TILEFISH FISHERY MANAGEMENT PLAN

(Includes Environmental Impact Statement and Regulatory Impact Review)

Volume I

November 2000

Mid-Atlantic Fishery Management Council

in cooperation with the

National Marine Fisheries Service

Draft adopted by Council: 25 May 1999
Final adopted by Council: 23 November 1999
Final approved by NOAA: 10 May 2001

A Publication of the Mid-Atlantic Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA57FC0002

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EXECUTIVE SUMMARY

The purpose of the proposed action is to initiate the management of golden tilefish (*Lopholatilus chamaeleonticeps*) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The lack of any regulations pertaining to the harvest of golden tilefish in the management unit led the Mid-Atlantic Fishery Management Council (Council) to develop a management plan for the species.

Fishery Management Plans (FMPs) and amendments must meet the requirements of a number of federal laws and regulations. In addition to MSFCMA, these laws and regulations include the National Environmental Policy Act, the Endangered Species Act, the Marine Mammal Protection Act, Executive Order 12866, and the Regulatory Flexibility Act. This document has been developed to meet all these federal requirements and contains all the elements of an FMP including the Environmental Impact Statement, Regulatory Flexibility Analysis, Regulatory Impact Review, and Fishery Impact Statement.

Results from the recently completed NMFS Northeast Fishery Science Center (NEFSC) stock assessment indicate that the tilefish stock (north of North Carolina) is at a low biomass level and is over exploited (Nitschke *et al.* 1999). Total biomass in 1998 was estimated to be 6.8 million pounds, which is about 35% of the biomass that would produce maximum sustainable yield (B_{MSY}). Biomass-based fishing mortality was estimated to be 0.45, which is about double the F_{MSY} of 0.22. Total landings in 1998 were 2.7 million pounds and significantly less than the estimated MSY(4.2 million pounds). Landings are somewhat seasonal, but do occur throughout the year. Current fishing mortality rates are unsustainable. There has been a shift in the exploitation pattern towards smaller fish. The SFA requires that a management program be developed immediately for this species and that targets and thresholds for stock size and fishing mortality be established.

The management unit for this FMP is defined as all golden tilefish (*Lopholatilus chamaeleonticeps*) under United States jurisdiction in the Atlantic ocean north of the Virginia/North Carolina border. Tilefish south of the Virginia/North Carolina border are currently managed as part of the Fishery Management Plan for the Snapper-Grouper Fishery managed by the South Atlantic Fishery Management Council.

The overall goal of this FMP is to rebuild tilefish so that the optimum yield can be obtained from this resource. To meet the overall goal, the following objectives are adopted:

1. Prevent overfishing and rebuild the resource to the biomass that would support MSY.
2. Prevent overcapitalization and limit new entrants.
3. Identify and describe essential tilefish habitat.
4. Collect necessary data to develop, monitor, and assess biological, economic, and social impacts of management measures designed to prevent overfishing and to reduce bycatch in all fisheries.

The fishing year for tilefish is the twelve (12) month period beginning with the implementation date of the FMP.

Management Strategy

The SFA, which reauthorized and amended the MSFCMA, made a number of changes to the existing National Standards. With respect to National Standard 1, the SFA imposed new requirements concerning definitions of overfishing in fishery management plans. To comply with National Standard 1, the SFA requires that each Council FMP define overfishing as a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis.

Each FMP must specify objective and measurable status determination criteria for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the requirements of the SFA, status determination criteria for tilefish are comprised of two components: 1) a maximum fishing mortality threshold and 2) a minimum stock size threshold. The maximum F threshold should be specified as F_{MSY} (or a suitable proxy) and the minimum biomass threshold should be specified as ½ B_{MSY} (or a suitable proxy).

For tilefish, MSY was specified from the surplus production model in the stock assessment at 4.2 million pounds (Nitschke *et al.* 1999). The Council adopted $F_{MSY} = 0.22$. The fishing mortality rate in 1998 is currently estimated to have been F = 0.45. The Council adopted B_{MSY} = 18.6 million pounds and ½ B_{MSY} = 9.3 million pounds. The 1998 biomass (at the beginning of 1998) is estimated to have been 6.8 million pounds or about 35% the B_{MSY} level.

The SFA also requires that a risk averse fishing mortality target and a biomass target be specified. For tilefish, the Council adopted a target fishing mortality rate, F_{target}, equal to the annual F determined from the selected rebuilding schedule. The Council choose a target stock biomass, B_{target}, equal to B_{MSY}.

An additional requirement of the SFA is that stocks which are identified as overfished must be rebuilt to the biomass level that will produce maximum sustainable yield (B_{MSY}). The SFA guidelines advise that, if a stock is overfished, management must specify a time period for rebuilding that is as short as possible. The rebuilding period is not to exceed 10 years, except where biology, environmental conditions or international agreements dictate otherwise.

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through a constant harvest strategy that would significantly reduce fishing mortality every year in the ten year rebuilding time frame. Fishing mortality will be reduced from an F of 0.45 (1998) to an F of roughly 0.30 in year 2000. The resource will be fully rebuilt to B_{MSY} in 10 years with 50% probability.

Proposed and Alternative Management Measures

Management Program for Tilefish

The Council adopted the following management program:

Preferred Management Measures

The Council adopted a number of preferred management measures to meet the objectives of the FMP (a complete description of these management measures is given in section 3.1). These

preferred alternatives are as follows:

1. Permit and reporting requirements for commercial vessels, operators and dealers.
2. The establishment of a Tilefish FMP Monitoring Committee.
3. The implementation of a framework adjustment process.
4. A 10 year stock rebuilding schedule with 50% probability of achieving the rebuilt B_{MSY} stock level.
5. A commercial quota divided into full-time (with two different tiers), part-time, and incidental categories.
6. A trip limit for the incidental category (non-longline).
7. Limited entry for the full-time (both tiers) and part-time quota categories.
8. Identification and description of essential tilefish habitat (EFH).

Alternatives to the Preferred Management Actions

A number of alternatives to the proposed management measures were identified by the Council for consideration by the public (a complete description of these management measures is given in section 3.1). These non-preferred alternatives include:
1. Take no action at this time.
2. Alternative rebuilding schedules.
3. Alternative limited entry criteria for full-time and part-time participation.
4. Coastwide trip limits.
5. Minimum size limit.
6. Hook size restrictions.
7. Effort reductions as in Days-at-sea measures.
8. Prohibition or restrictions on bottom tending mobile gear due to EFH damage.
9. Quarterly allocation of the quota for full-time and part-time participants.
10. Closure of the directed tilefish fishery for a one month calendar period from May through September.

It is important to note that the current Mid-Atlantic Council's policy is that landings after 1998 will not assure future access to or an allocation of the tilefish resource. The purpose of this policy is to prevent a rush to fish on this overfished resource, in the hopes of obtaining a larger future allocation.

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1.0 INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

1.1.1 History of FMP Development

The purpose of the proposed action is to initiate the management of golden tilefish (*Lopholatilus chamaeleonticeps*) pursuant to the MSFCMA of 1976 as amended by the SFA. The lack of any regulations pertaining to the harvest of golden tilefish in the management unit led the Mid-Atlantic Fishery Management Council (Council) to develop a management plan for the species.

FMPs and amendments must meet the requirements of a number of federal laws and regulations. In addition to MSFCMA, these laws and regulations include the National Environmental Policy Act, the Endangered Species Act, the Marine Mammal Protection Act, Executive Order 12866, and the Regulatory Flexibility Act. This document is being developed to meet these federal requirements and will contain all elements of the FMP including the Draft Environmental Impact Statement, Regulatory Flexibility Analysis, Regulatory Impact Review, and Fishery Impact Statement.

Tilefish fishing with longline gear, and to a lessor extent with otter trawls, has taken place off the mid Atlantic and southern New England coasts ever since the early 1900s. However, the fishery has been cyclical with the recent high interest beginning in the early 1970s. Most of the effort in the 1970s was concentrated in central New Jersey, but by the late 1970s and early 1980s a significant amount of landings were coming from eastern New York also.

The MAFMC became interested in management of tilefish in 1981 and began funding part of an individuals dissertation work on tilefish at Rutgers. That dissertation, *Population dynamics of and, impact of fishing on, tilefish in the middle Atlantic-southern New England region during the 1970's and early 1980's,* (Turner 1985) still is considered the seminal work on this species in this area.

While Turner was doing his research, Council staff began drafting a plan in 1982 and 1983. An industry advisor panel was created. There was significant scientific interest in the Council's efforts and the Science and Statistical Committee met numerous times to review and discuss the science with the Rutgers researchers and the industry advisors.

Council members were not heavily involved in the early stages of work in the early 1980s. Industry and staff were working on management measures and industry had nearly completely agreed to an ITQ approach based on historical landings. When Turner finally completed the population analyzes and industry realized they had to significantly reduce landings to get to the MSY level – industry backed away completely. The Council reprioritized its efforts and concentrated on a striped bass FMP.

In the early 1990s surfclam/ocean quahog ITQs, and the major summer flounder FMP were completed. Council again began focusing staff effort on tilefish. A SARC stock assessment was conducted in 1992 that indicated the resource was still overfished. Staff again began drafting an FMP and held numerous industry advisor meetings in 1993 and 1994. Industry disagreed with the assessment and questioned just about every piece of data that went into the analyses. There was no

mandate, such as the 1996 SFA, that required the Council to prevent overfishing for resources that were not under management. In 1994 the Council again switched its priorities away from tilefish.

October 1996 Congress passed the amended Magnuson-Stevens Act which requires rebuilding of all overfished resources under Council jurisdiction. The MAFMC spent 1997 and 1998 amending all its existing FMPs to comply with the SFA. NMFS declared tilefish overfished in the spring of 1998. The Council requested a new stock assessment from the NEFSC. The Council formed a Tilefish Committee which held its first meeting at the February 1999 Council meeting. A stock assessment was produced by the NEFSC and vetted through the Councils Science and Statistical Committee on 31 March 1999. The Tilefish Committee met 1 April with industry advisors.

In April a Tilefish Technical Team with Council staff and numerous NMFS personnel was formed to develop the analyses needed for FMP justification. A scoping document was developed (to initiate the NEPA process) and presented to the public on 27 April.

The Tilefish Committee and Advisors met 6 May. Council approved the FMP for public hearings at a special one day meeting on 25 May. The FMP was submitted to NMFS 28 May. The "Dear Reviewer" letter was issued on 16 July. Hearings were scheduled as quickly as possible and held on 23, 24, and 25 August in Rhode Island, New York, and New Jersey respectively. Public hearing comment period closed 7 September.

The Tilefish Committee and Advisors met 1 October. Public comments and other information was reviewed by the entire Council at the October Council meeting, but no decisions were made since the meeting was held in North Carolina which is outside the management unit of the FMP. Again, a special Council meeting for tilefish only was scheduled for 23 November. The Council recommended numerous changes and approved the FMP for submittal to NMFS. The Tilefish Technical Team conducted significant additional analyses with emphasis on the economic and social impacts of FMP. The FMP was redrafted and submitted to NMFS on15 March 2000. The entire effort took less than one year, from completion and peer-review of the stock assessment, to submission of the Council approved FMP. This rapid development of an FMP was attributable mainly to the extensive efforts of the Tilefish Technical Team, Industry Advisors, and the Tilefish Committee which pushed hard to meet the timetable imposed by the SFA for developing management measures and rebuilding overfished resources. The NMFS reviewed the15 March draft and responded 18 April requiring additional analyses in the Regulatory Impact Review (RIR) and Initial Regulatory Flexibility Analysis (IRFA) both of which are part of section 4. Also during the time of economic reanalyses for the above two sections, the Tilefish Technical Team reviewed the analyses of the fishing mortality that occurred in 1999. This draft incorporates all the above changes and was resubmitted on 22 November 2000.

1.1.2 Problems for Resolution

1.1.2.1 Overfishing Must End and the Stock Biomass Must be Rebuilt

Results from the recently completed NMFS Northeast Fishery Science Center (NEFSC) stock assessment indicate that the tilefish stock (north of North Carolina) is at a low biomass level and is over exploited (Nitschke *et al.* 1999). Total biomass at the beginning of 1998 was estimated to be 6.8 million pounds, which is about 35% of the biomass that would produce maximum sustainable yield (B_{MSY} of 18.6 million pounds). Biomass-based fishing mortality was estimated to be 0.45,

which is about double the F_{MSY} of 0.22. Total landings in 1998 were 2.7 million pounds (Table 1) and significantly less than the estimated MSY (4.2 million pounds). Current fishing mortality rates are unsustainable. There has been a shift in the exploitation pattern towards smaller fish. The SFA requires that a management program be developed immediately for this species and that targets and thresholds for stock size and fishing mortality be established.

1.1.2.2. Overcapitalization Should be Avoided

The tilefish fishery takes place year-round (Table 2). It is most intense from October to June when the market value and catch rates are the highest. Tilefish vessels are usually of steel construction and range in length from 50 to 100 feet. Although the number of vessels targeting tilefish has decreased since the peak in the early 1980's, the approximate dozen vessels currently in the fishery have more than adequate capacity to harvest the maximum economic yield level. Necessary reductions in fishing effort for most of the New England and Mid-Atlantic fisheries (i.e., groundfish, sea scallops, and summer flounder) could result in additional pressure on the tilefish resource if vessels exiting those fisheries enter this fishery.

1.1.2.3. Need for Better Data

National Standard 2 of MSFCMA states that "measures shall be based upon the best scientific information available." The 14th NEFSC Stock Assessment Workshop noted that the weighout interview coverage of the fishery was low and that other data which would allow for detection of changes in abundance would be useful to corroborate trends observed in the abundance indices. That workshop also called for the collection of size samples from landings. These data are necessary to assess the impact and effectiveness of management measures, as well as, monitor fishing mortality and changes in stock size to determine if additional management measures for the FMP may be necessary. The most recent stock assessment (Nitschke *et al.* 1999) and the habitat background document (Steimle *et al.* 1998) identified numerous problems with the need for better data that are included in section 6.

1.1.2.4 Identification and Description of Essential Fish Habitat

Pursuant to the 1996 requirements of the SFA, the Council is required to identify and describe essential habitat for tilefish in the western Atlantic ocean north of North Carolina.

1.1.2.5 Need to Understand and Address Bycatch

National Standard 9 requires that management plans minimize bycatch. There is currently insufficient data to determine the magnitude of this problem. Bycatch data needs to be collected especially in non directed fisheries.

1.1.3 Management Objectives

The overall goal of this FMP is to rebuild tilefish so that the optimum yield can be obtained from this resource.

To meet the overall goal, the following objectives are adopted:
1. Prevent overfishing and rebuild the resource to the biomass that would support MSY.

2. Prevent overcapitalization and limit new entrants.
3. Identify and describe essential tilefish habitat.
4. Collect necessary data to develop, monitor, and assess biological, economic, and social impacts of management measures designed to prevent overfishing and to reduce bycatch in all fisheries.

1.1.4 Management Unit

The management unit is all golden tilefish (*Lopholatilus chamaeleonticeps*) under United States jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish south of the Virginia/North Carolina border are currently managed as part of the Fishery Management Plan for the Snapper-Grouper Fishery managed by the South Atlantic Fishery Management Council (SAFMC). The current stock assessment covers all tilefish north and east of the Virginia/North Carolina boundary to the United States/Canada boundary (Shepherd pers. comm.). Katz *et al.* (1983) used significant differences in allelic frequencies to identify distinct stocks between mid-Atlantic and South Atlantic tilefish. Those authors also felt that certain aspects of golden tilefish distribution, life history and ocean circulation patterns supported their two stock hypothesis for the United States Atlantic.

Golden tilefish in the South Atlantic are also classified as overfished. The overfishing definition is based on SPR (spawning per recruit) with 1992 currently being the last time the resource was assessed. At that time, the SPR level was estimated at 21% with 30% being the overfishing level. Currently there is a TAL of 1 million pounds and south Atlantic tilefish landings in 1998 were estimated at 369,000 pounds. The SAFMC has a limited access transferable permit and an initial trip-limited, non-transferable permit. The landing of trawl caught tilefish is prohibited. Bottom longline gear is only allowed in depths of 50 fathoms or more.

Vessels landing tilefish from this management unit must land tilefish in the northeast/mid-Atlantic states of Maine through Virginia.

1.1.5 Management Strategy

The SFA, which reauthorized and amended the MSFCMA, made a number of changes to the existing National Standards. With respect to National Standard 1, the SFA imposed new requirements concerning definitions of overfishing in fishery management plans. To comply with National Standard 1, the SFA requires that each Council FMP define overfishing as a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis.

Each FMP must specify objective and measurable status determination criteria for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the requirements of the SFA, status determination criteria for tilefish are comprised of two components: 1) a maximum fishing mortality threshold and 2) a minimum stock size threshold. The maximum F threshold should be specified as F_{MSY} (or a suitable proxy) and the minimum biomass threshold should be specified as ½ B_{MSY} (or a suitable proxy).

For tilefish, MSY was specified from the surplus production model in the stock assessment at 4.2 million pounds (Nitschke *et al.* 1999). The Council adopted $F_{MSY} = 0.22$. The fishing mortality rate in 1998 is currently estimated to have been $F = 0.45$. The Council adopted $B_{MSY} = 18.6$ million

pounds and ½ B_{MSY} = 9.3 million pounds. The 1998 biomass (at the beginning of the year) is estimated to have been 6.8 million pounds or about 35% the B_{MSY} level.

The SFA also requires that a risk averse fishing mortality target and a biomass target be specified. For tilefish, the Council adopted a target fishing mortality rate, F_{target}, equal to the annual F determined from the selected rebuilding schedule. The Council choose a target stock biomass, B_{target}, equal to B_{MSY}.

An additional requirement of the SFA is that stocks which are identified as overfished must be rebuilt to the biomass level that will produce maximum sustainable yield (B_{MSY}). The SFA guidelines advise that, if a stock is overfished, management must specify a time period for rebuilding that is as short as possible. The rebuilding period is not to exceed 10 years, except where biology, environmental conditions or international agreements dictate otherwise.

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through a constant harvest strategy that would significantly reduce fishing mortality every year in the ten year rebuilding time frame (Table 3). Fishing mortality will be reduced from an F of 0.45 (1998) to an F of roughly 0.30 in year 2000. The resource will be fully rebuilt to B_{MSY} in 10 years with 50% probability. The 10-year rebuilding schedule with a constant harvest strategy has a projected total allowable annual catch of 1.995 million pounds (Table 3). In November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed.

1.2 PROPOSED AND ALTERNATIVE MANAGEMENT MEASURES

1.2.1 Proposed Management Measures

The Council adopted a number of preferred management measures to meet the objectives of the FMP (a complete description of these management measures is given in section 3.1). These preferred alternatives are as follows:

1.2.1.1 Permit and reporting requirements for commercial vessels, operators and dealers

Vessels landing tilefish for sale will be required to have Federal Vessel permits. A dealer permit is required for dealers purchasing tilefish harvested from the exclusive economic zone (EEZ) in addition to dealers purchasing tilefish from permitted vessels. Dealers issued a tilefish dealer permit must report all fish purchases along with information required at section 648.7 (l)(i).

Operators of commercial vessels (vessels with permits to sell tilefish) will be required to obtain Operator permits.

Vessels landing tilefish for sale would need to submit vessel logbook reports. Dealers would need

to submit dealer reports.

The current vessel logbook requires vessels to report everything they catch including bycatch.

These are the standard set of permits and reporting that the Council uses in most of their FMPs.

There is no within fishing year changes allowed among the various vessel permit categories.

1.2.1.2 The establishment of a Tilefish FMP Monitoring Committee

The Tilefish Monitoring Committee is a joint committee made up of staff representatives of the Mid-Atlantic Fishery Management Council, the Northeast Regional Office, the Northeast Fisheries Science Center, state representatives and a non-voting industry advisor. The state representatives may include any individual designated by an interested state from Maine to Virginia. There can be a maximum of three state representatives with the New England states having one representative and the mid-Atlantic states having a maximum of two representatives. There is also a non-voting industry advisor who is appointed by the Council Chairman. The Mid-Atlantic Council Executive Director or his designee will chair the Committee.

Under the preferred quota alternative (section 1.2.1.5), landings in the first fishing year would be set at 1.995 million pounds (Table 3). While the preferred alternative is a constant harvest strategy, there would be annual quota reductions for previous overages of the quota. There would also be a "benchmark" stock assessment conducted at the NEFSC sponsored SARC/SAW every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change which thus could warrant changes in the actual TAL. The strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used by the Committee and Council to get to the target.

The Tilefish Monitoring Committee is responsible only for establishing recommendations for the annual quotas and management measures to restrict fishing so as not to exceed the quotas. There are a wide variety of management measures that are frameworked (section 1.2.1.3) but the Council initiates and considers those measures. Thus, the Monitoring Committee actually considers only the annual quotas unless directed by the Council Chairman to evaluate those measures that are frameworked. The Monitoring Committee is convened after the completion of a "benchmark" stock assessment and/or at the direction of the Council Chairman. The Monitoring Committee should review landings data in its evaluation of the annual quotas. If directed by the Council Chairman to consider any frameworked management measures, the Committee can obviously consider any relevant available data. It is the Council's intent not to alter the annual quota if a benchmark stock assessment is not conducted prior to a certain fishing year. In the absence of a Council recommendation, the annual quotas will not change from one fishing year to the next except that the Regional Administrator may readjust the quotas to account for overages in the previous fishing year.

1.2.1.3 The implementation of a framework adjustment process.

The Council would like to be able to add or modify management measures through a framework adjustment procedure. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process. As such, management measures that have

been identified in the plan could be implemented or adjusted at any time during the year (with the exception of the quotas). This process could also be used for purposes of resolving gear conflicts.

Possible management measures for the fishery include:

- Minimum fish size
- Minimum hook size
- Closed seasons
- Closed areas
- Gear restrictions or prohibitions
- Permitting restrictions
- Gear limits
- Trip limits
- Overfishing definition and related thresholds and targets
- Annual specification quota setting process
- FMP Monitoring Committee composition and process
- Description and Identification of Essential Fish Habitat
- Fishing gear management measures that impact EFH
- Habitat areas of particular concern
- Set aside quota for scientific research

Any of these measures that could be implemented could be frameworked. That is, the Tilefish Monitoring Committee, made up of representatives of the Council and NMFS, could review the condition of the resource and fishery and recommend measures (e.g., trip limits, quota, etc.) to achieve the desired goals and rebuilding schedule.

1.2.1.4 A 10 year stock rebuilding schedule

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through a constant harvest strategy that would significantly reduce fishing mortality every year in the ten year rebuilding time frame (Table 3). Fishing mortality will be reduced from an F of 0.45 (1998) to an F of roughly 0.30 in year 2000. The resource will be fully rebuilt to B_{MSY} within 10 years of plan implementation with 50% probability.

Several other rebuilding schedules were evaluated as alternatives and are considered as part of section 3.1.2. The no fishing alternative allows the resource to be rebuilt to the B_{MSY} level in 5 years with 50% probability but in seven years with 100% probability. Rebuilding schedules for constant fishing mortality and constant harvest vary, but in all cases the landings need to be reduced significantly in order to rebuild to the B_{MSY} level. The status quo alternative (F = 0.45) will continue to rapidly reduce biomass, such that by year 2005 the total biomass (4.1 million pounds) is below the MSY equilibrium catch level of 4.2 million pounds (Table 4).

1.2.1.5 A commercial quota divided into full-time (with two subcategories), part-time, and incidental categories

All MAFMC FMPs are managed through quotas. Quota measures are generally effective in preventing overfishing and in rebuilding overfished stocks. The Council's two previous attempts at tilefish management (in the early 1980s and in the early 1990s) have also been based on quotas.

An overall quota, associated with a significant reduction in fishing mortality is the major management measure for this FMP at this time.

Under the preferred alternative, landings for each of the next 10 fishing years would be set at 1.995 million pounds (Table 3). In November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed.

While the preferred alternative is a constant harvest strategy, there would be annual quota reductions for previous overages of the quota. There would also be a "benchmark" stock assessment conducted every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change. Thus although the Council wishes to maintain a constant harvest strategy, there are at least two reasons that could warrant changes in the actual TAL for a specific fishing year. The strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used to get to the target.

There are three categories that the quota is divided among. The is an incidental, a part-time and a full-time category for division of the quota. The full-time category is also divided into two tiers for quota distribution. The selection criteria for the full-time and part-time categories determines any split in the quota based on the historical proportion of the catch. The "target" estimate of landings for the incidental category (5% of the TAL) is first subtracted from the TAL and then the remainder of the TAL is divided among the full-time tier 1 category which receives 66%, the full-time tier 2 category which receives 15%, and the part-time category which receives 19% (Table 80).

It is important to note that the current Council's policy is that landings after 1998 will not assure future access to or an allocation of the tilefish resource. The purpose of this policy is to prevent a rush to fish, on this overfished resource, in the hopes of obtaining a larger future allocation.

1.2.1.6 Trip limit for the incidental category

"Incidental" vessels (mostly otter trawls and a few gillnet vessels) will have trip limits imposed and will have a trip limit designed to achieve a "target" or soft quota which will have some reductions in the fishing mortality. The trip limit will continue for each fishing year and will not result in within year prohibitions of landings. The trip limit may be reduced from one fishing year to the next for overages in the target quota percentage. Five percent of the overall annual quota will be taken off the top of the quota (before it is distributed among the longline vessels) and will be provided to the incidental category for this "target" quota with a trip limit of 300 pounds set initially. The 300 pound limit was chosen because in 1997 and 1998, 99% of the incidental landings were 300 pounds and below with an average of 100 pounds. This average is highly skewed because of the large number of trips reporting landings averaging 28 to 30 pounds. Based on 1998 data (Table 85) only five non longline vessels made a total of 23 trips that landed more than 300 pounds of tilefish, and which will now be prohibited. The 300 pound trip limit is a compromise initially to balance the non directing fisheries' honest bycatch needs while trying to minimize the regulatory discards, but yet not have the limit provide incentive for anyone to direct on tilefish.

1.2.1.7 Limited entry for the full-time and part-time quota categories

NMFS (at the request of the MAFMC) published a control date (15 June 1993) for entry into the tilefish fishery**,** which means that commercial vessels that entered the tilefish fishery after 15 June 1993 "will not be assured of future access to or an allocation of the tilefish resource if a management regime is developed and implemented." NMFS' letter of 2 March 1999 to the Council states that "relatively new entrants into the fishery may have justly concluded that the Council did not intend to implement limit access provisions for the fishery based on a control date which is so outdated."

The history of the development of this FMP (both in the early 1980s and again in the early 1990s) has always included the concept of limited access as the preferred alternative. When Congress reauthorized the Magnuson Act in 1996, they placed a hiatus on ITQ/IFQ options until at least October of 2000. Thus, part of the previously considered alternative can not be considered until an Amendment is developed for the FMP. However, a limited access program can still be implemented.

Access limitation is a complicated issue. Most individuals who fished in the 1970s and early 1980s are no longer tilefish fishermen but believe that since they developed the fishery they should have some long-term privilege to the fishery. In 1996, nearly 75% (1,071 of 1,450) of the trips that caught some tilefish, had less than 10% of the trips landings as tilefish. However, in 1996, 20% of the trips that landed tilefish, landed at least 85% of their catch as tilefish. Fully 90% of all the tilefish landings in 1996 were landed on those trips where tilefish constituted at least 85% of the trips landings.

The Council considered four alternatives for the full-time vessel category for public hearings (Table 80). The first, as well as the public hearing preferred alternative (alternative 3), would specify that in order to qualify for a full-time permit, the vessel must have landed greater than 50,000 pounds in any one year between 1988 and 1993 as well as landed at least 25,000 pounds per year for any two years between 1994 and 1998. Under this alternative there would have been 8 vessels that qualify for full-time permits and the quota allocation to this category would have been 75% of the annual quota under option 1 and 65% under option 3. The division of the quota between the full-time and part- time vessel groups is the percentage of the TAL after the TAL has been reduced the 5% for the incidental category. Not one single commentor supported the preferred position of option 3 during the public hearings.

The Council also considered three alternatives for the part-time vessel category (Table 80). The first alternative, would be that in order to qualify for a part-time category permit, the vessel must have landed a minimum of 10,000 pounds per year in any one year between 1988 and 15 June1993, and at least 10,000 pounds in one year between 1994 and 1998. The preferred public hearing part-time requirements were that the vessel had to have landed at least 10,000 pounds in one year between 1988 and 15 June 1993. Vessels that have had landings in the "other gear" category of data analyses could obtain a part-time directed tilefish permit if they met the qualifying criteria for this category, but they would have to pursue the fishery by longline gear only in the future. Any gear other than longline gear would only qualify for an incidental permit. Under the option 1 alternative there would have been 10 part-time vessels, whereas under the preferred public hearing alternative there would have been 49 vessels that qualify for part-time permits. The quota allocation to the part-time category would have been 25% of the annual quota under option 1 and 35% of the quota under option 3. The preferred position was not supported during public hearings either.

Representatives of the two major factions of tilefish fishermen, the Historic Tilefish Coalition (mostly the historical New Jersey fishermen who fished mainly in the 1980s) and The Montauk Tilefish Association (mostly New York fishermen who have been very active during the past decade) met, discussed often, and worked very hard to develop a compromise that best represented their memberships. They presented this compromise position to the Council at the 23 November Council meeting and the Council adopted their position. The compromise limited entry position, option 6 (Table 80), is a combination of option 2 for the full-time vessels and an expansion of the time allowed for qualifying for the part-time vessels. Specifically, the compromise that the Council adopted is a two tier full-time category, where a vessel would have had to land at least 250,000 pounds per year for three years between 1993 and 1998 to be in tier 1. The vessels in this full-time tier 1 category would receive 66% of the annual quota. To be in the full-time tier 2 category, a vessel would have had to land at least 30,000 pounds per year for 3 years between 1993 and 1998 and this tier 2 category would receive 15% of the annual quota allocation. To be in the part-time category, a vessel would have had to land 10,000 pounds of tilefish in one year between 1988 and 1993 and 10,000 pounds in one year between 1994 and 1998, or have landed 28,000 pounds of tilefish in one year between 1984 and 1993. This part-time category will receive 19% of the annual quota allocation. Overharvests in one fishing year would be deducted specifically from the offending category in the subsequent fishing year. Under harvests remain in the ocean during the rebuilding period.

The compromise industry position that the Council also adopted is that when the tilefish fishery is rebuilt or at the end of the 10 year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered.

1.2.1.8 Identification and description of essential tilefish habitat

The SFA significantly affected FMPs regarding habitat issues. The SFA contains provisions for the identification and protection of habitat essential to the production of federally managed species. The Act requires FMPs to include identification and description of essential fish habitat (EFH), description of non-fishing and fishing threats, and suggest conservation and enhancement measures. These new habitat requirements are addressed in the FMP.

EFH is identified as all offshore waters over the Continental Shelf and Slope with water depths from 250 to 1200 feet, from the United States/Canadian boundary to the Virginia/North Carolina boundary (Figure 4).

Also the area included as EFH in the statistical areas 537 and 616 should be identified as Habitat Areas of Particular Concern (HAPC) since greater than 90% of the recent landings come from these areas (Figure 5).

Based upon some available scientific information (Auster and Langton 1998; DeAlteris 1998; Collie *et al.* 1996), it was inferred for the purposes of the public hearing document that trawling was causing long-term physical adverse impacts to tilefish EFH. It was further implied that in some

cases those adverse impacts could have been severe, at least locally. The basis of this conclusion was drawn from previous studies which show that in deep water, soft-bottomed sediments where environmental conditions are relatively stable, the impacts of trawling have resulted in destruction of benthic communities and habitat structure that was slow to recover following the cessation of fishing activity.

During the public hearing process, the Council received significant input from both the directed tilefish fishing industry and other fishing industry representatives that bottom-tending mobile gear was not significantly having an identifiable adverse effect on tilefish EFH. The environmental community strongly supported the association that bottom tending mobile gear can destroy bottom structures and that since tilefish are significantly dependent on bottom structure for their burrows, bottom tending mobile gear should be banned in tilefish HAPC.

On 30 September 1999, the Tilefish Technical Team consisting of Council staff, a Council member, NMFS (both NERO and NEFSC) personnel, academics and industry representatives were hosted in a workshop by Dr. Ken Able of Rutgers University to discuss the impacts of fishing gear to tilefish habitat. It was concluded that there is nothing definitively known about tilefish-mobile fishing gear interactions. There is nothing specifically described about the sensitivity of tilefish burrows in the scientific literature. Unquestionably, from submersible vessel research, there are trawl door patterns observed in areas with tilefish burrows, but how much of an impact the doors have and how quickly tilefish can reopen their burrows, if sediment closed, is completely unknown at this time. It is fully recognized that tilefish are extremely important to maintaining the habitat around their burrows and this is important for the entire demersal community around these burrows. Any short-term or long-term impacts of bottom tending mobile gear specifically to tilefish habitat are unquantifiable at this time. The scientists and industry representatives at this meeting concluded that a research program to answer these questions was the appropriate approach to take. On 23 November 1999 when the Council approved the FMP for Secretarial submittal , they passed the following motion to address this question: "that the MAFMC, NMFS, conservation organizations, and the fishing industry shall join together to design and implement within two years a scientific research program in order to determine if the use of mobile fishing gear is having a deleterious impact on tilefish habitat." The scientific research program will be developed within the near term.

1.2.2 Alternatives to the Preferred Management Actions

The Council has identified a number of alternatives to the proposed management measures have been identified by the Council for consideration by the public (a complete description of these management measures is given in section 3.1). These non-preferred alternatives include:

1. Take no action at this time.
2. Alternative rebuilding schedules.
3. Alternative limited entry criteria for full-time and part-time participation.
4. Coastwide trip limits.
5. Minimum size limit.
6. Hook size restrictions.
7. Effort reductions as in days-at-sea (DAS) measures.
8. Quarterly allocation of the quota for full-time and part-time categories.
9. Closure of the directed tilefish fishery for a one month period from May through September.
10. Prohibition or restrictions on bottom tending mobile gear because of EFH damage.

2.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 DESCRIPTION OF THE STOCK

2.1.1 Species Description and Distribution

Tilefish is the common name for *Lopholatilus chamaeleonticeps* (Figure 1). It is sometimes called the golden tilefish, colorful tilefish, or rainbow tilefish along the southeast coast to distinguish it from *Caulolatilus chrysops* (goldface tilefish), *C. cyanops* (blackline tilefish), *C. intermedius* (anchor tilefish), *C. microps* (blueline tilefish), and *Malacanthus plumieri* (sand tilefish; Freeman and Turner 1977).

Tilefish are found along the outer continental shelf from Nova Scotia, Canada to Surinam on the northern coast of South America (Dooley 1978 and Markle *et al.* 1980) in depths of 250 to 1500 feet (Figure 2). They are abundant in the southern New England/mid-Atlantic area, where a commercial fishery has existed since 1879; off southeastern Florida; and in the Gulf of Mexico. Over the range of tilefish, the distribution can be discontinuous with gaps occurring where benthic substrates are unsuitable for building and maintaining burrows (Steimle *et al.* 1998).

In the southern New England/mid-Atlantic area, tilefish generally occur at depths of 250 to 1200 feet and at temperatures from 48 - 62 ^{o} F (Nelson and Carpenter 1968, Low *et al.* 1983, and Grimes *et al.* 1986). Fish have been observed from Norfolk to Lydonia Canyons, but the majority of the fishery is concentrated between Hudson and Veatch Canyons (Figure 3).

Katz *et al.* (1983) studied stock structure of tilefish from off the Yucatan Peninsula in Mexico to the southern New England region using both biochemical and morphological information. They identified two stocks -- one in the mid-Atlantic/southern New England and the other in the Gulf of Mexico and the south of Cape Hatteras. Sulak and Ross (1996) reported that the ichthyofauna on the upper continental slope off Cape Hatteras was less diverse than on the upper slope off Virginia, and that individuals off Cape Hatteras were smaller and less active than their conspecifics off Virginia. This phenomenon (which they termed 'Lilliputian') was associated with low oxygen at the sediment surface and a high flux of particulate organic carbon from surface waters (Steimle *et al.* 1998). This upper slope, hypoxic area may be the cause of tilefish stock separation. Management of the stock south of the Virginia/North Carolina border is covered by the South Atlantic Fishery Management Council snapper grouper FMP.

Little is known of the distribution of the early life stages for tilefish. Fahay (1983) described the size of tilefish eggs with their single oil globule. Fahay and Berrien (1981) described the hatching of tilefish as well as the morphology of larvae and juveniles up to 2.5 inches.

Tilefish are shelter seeking and perhaps habitat limited. There are indications that at least some of the population is relatively nonmigratory (Turner 1986). Warme *et al.* (1977) first reported that tilefish occupied excavations in submarine canyon walls along with a variety of other fishes and invertebrates, and they referred to these areas as "pueblo villages." Valentine *et al.* (1980) described tilefish use of scour depressions around boulders for shelter. Able *et al.* (1982) observed tilefish use of vertical burrows in Pleistocene clay substrates in the Hudson Canyon area, and Grimes *et al.*

(1986) found vertical burrows to be the predominant type of shelter used by tilefish in the mid-Atlantic/southern New England region. Able *et al.* (1982) suggested that sediment type might control the distribution and abundance of the species, and the longline fishery for tilefish in the Hudson Canyon area is primarily restricted to areas with Pleistocene clay substrate (Turner 1986).

Movement patterns of tilefish are poorly understood. Tilefish are not thought to be schooling fishes, but they do aggregate in their preferred habitat (Freeman and Turner 1977). It is generally stated that as tilefish become increasingly larger, they tend to live in progressively deeper depths (Freeman and Turner 1977). There are some indications that tilefish remain in an area for long periods of time while other information suggests that at least some members of the population are relatively mobile (Turner 1986). Tagging studies suggest that tilefish do not migrate long distances (Grimes *et al.* 1980) while Freeman and Turner (1977) reported local movements of up to 1 or 2 miles per day. Repeated observations from a submersible of individual fish at specific sites over 24 hours, after 32 hours and after one year as well as limited tagging returns from fish at liberty between four and nineteen months indicated that some tilefish were long-term residents in an area (Grimes *et al.* 1983 and Grimes *et al.* 1986). In contrast, geographic and temporal changes in catch rates do indicate that tilefish concentrate in shallow depths inshore of Veatch Canyon in the late winter and spring in conjunction with decreasing bottom water temperatures both inshore and further east on Georges Bank (Grimes *et al*. 1980 and Grimes *et al*. 1986).

Apparently the balance between the physiological requirements of the tilefish and the water in which it lives is so delicate that it is susceptible to mass mortality (Freeman and Turner 1977). Such a condition existed only a few years after the species discovery. During the early spring of 1882, several vessels sailing offshore reported seeing great numbers of dead or dying fish floating at the surface of the sea between the latitudes of Cape May, New Jersey and Montauk, New York.

The mass mortality of tilefish of the mid-Atlantic Bight was so complete that exploratory fishing trips over the succeeding five years failed to catch a single specimen, and scientists of that time considered it to have been extinct (Lucas 1891). But 11 years after the disaster, several tilefish were caught, proving that, indeed, they were not extinct and within 16 years catches indicated that tilefish were once again becoming abundant (Bumpus 1899).

It is believed that the mass mortality of tilefish as well as other species of fishes and the rich fauna of invertebrates living in the narrow band of warm water lying along the edge of the continental shelf was due to a temporary offshore movement of normally cold shelf water (Freeman and Turner 1977). Since the warm water band is not only bordered on its inshore edge by the cold shelf water but underlain by cold water from inshore to the edge of the shelf and beyond caused a sudden lowering of the temperature within this band trapping the fishes living there and causing the mortality (Verrill 1882). Although no temperature measurements were made during the mass mortality, those made the following summer showed that the bottom water was considerably colder than the previous years and that the rich, warm-water fauna that normally lived there were absent. It had been replaced by sparsely occurring cold-water organisms (Verrill 1882).

2.1.2 Abundance and Present Condition

The tilefish stock is at low biomass and is over exploited (Nitschke *et al.* 1999). Current biomass levels are at about 35% of the level producing MSY and fishing mortality rates are about two times larger than the F_{MSY} level (Figure 6, Table 5, and Nitschke *et al.* 1999).

There has been a fishery for tilefish since 1915 (Figure 7). The initial fishery was apparently a longline fishery and within the first 10 months of 1916 the largest amount of tilefish ever landed in a year, 10 million pounds, was caught (Turner 1986). In the following years, up through World War II (WW II), when landings were recorded, they fluctuated between one and four million pounds After WW II, a trawl fishery developed in New England and accounted for most of the landings through the mid-1960's (Figure 8). A longline fishery which developed in the mid-Atlantic in the early 1970's has accounted for nearly all of the landings since then. Catches have generally been steadily declining since the late 1970's/early 1980's peak (Figure 7).

According to Nitschke *et al.* (1999), a commercial catch per unit effort (CPUE) series can be developed based on days absent from port. The CPUE can be used as an indicator of abundance. The assessment spends significant effort documenting the methodology of the approach and Tables 6 and 7, as well as, Figures 9 through 14 are included here for understanding of the stock assessment. The CPUE series is also critical for the development of the ASPIC surplus production model, from which all the biomass and fishing related parameters are generated.

Only a few tilefish per year are caught during NEFSC bottom trawl surveys and thus this time series is unlikely to be useful as an index of abundance for tilefish (Nitschke *et al.* 1999).

A recreational fishery occurred briefly during the 1970's (Figure 15). The recreational fishery since then has been insignificant, with little or no data available or useful for stock status evaluation (Nitschke *et al.* 1999).

2.1.3 Ecological Relationships and Stock Characteristics

2.1.3.1 Spawning and early life history

Grimes *et al.* (1988) indicate that tilefish are fractional spawners from about March through November, although most of the reproduction evidently occurs from May to September. This encompasses the July-August spawning period reported by Collins (1884), Bigelow and Schroeder (1953), Freeman and Turner (1977), and Morse (1981). Some females with free ova in the ovarian lumen (running ripe) were present in March through August and in October and November. From May through August, 89-98% of the females were ripe or running ripe (Grimes *et al.* 1988). Dooley (1978) observed "ripe" females in February-June (locations not stated, but possibly South Atlantic).

Running ripe or ripe males were not as frequently observed as were females in a similar reproductive state. In fact, only very large males (30 inches) were observed with a large creamy white swollen testicular mass. Ripe males were found in January, March, May through August, October, and November, but the highest proportions (23-46%) were present in May through August.

Freeman and Turner (1977) indicate that females spawn more than once during the spawning season, perhaps as many as three times. The rather long spawning period covering more than half of the year is unusual for temperate-water fishes such as found off the mid-Atlantic coast. However, the temperature regime of the bottom water at the edge of the continental shelf where tilefish live is characteristic of subtropical conditions. It is not at all uncommon for bottom dwelling fishes living under stable conditions within subtropical zones to have prolonged spawning periods (Freeman and Turner 1977).

Spawning behavior is unknown, but may be pair specific; pairs of females and males are often observed sharing a burrow and pair-bonding behavior was reported by Grimes *et al.* (1986). Pair-bonding would insure that a male was available to fertilize the eggs that are periodically released by the female. Mating may be socially mediated with dominant males controlling access to several females within a restricted area (Grimes *et al.* 1988) and may explain delayed maturity in some males. Idelberger (1985) suggested that the size and color of the dorsal head flap may play a role in females selecting a mate.

2.1.3.2 Age and growth

Aging work has only been performed on tilefish by Turner (1986). Lengths at age suggest that males grow faster than females, but the observed ages showed that females live longer. On average, tilefish (sexes combined) grow about 3.5 to 4 inches fork length (FL) per year for the first four years, and thereafter growth slows, especially for females. After age 3, mean last back-calculated lengths of males were larger than those of females. At age 4 males and females averaged 19.3 and 18.9 inches FL, respectively, and by the tenth year males averaged 32.3 while females averaged 26.4 inches FL.

Males achieved larger sizes than females, but they apparently did not live as long (Turner 1986). The largest male was 44.1 inches at 20 years old, and the largest female was 39 years at 40.2 inches FL. The oldest fish was a 46 year old female of 33.5 inches, while the oldest male was 41.3 inches and 29 years.

Annual growth increments of each sex were compared by Turner (1986), and males were found to grow more each year at most ages (Figure 16). Males achieved significant more growth than females at all ages between 4 and 16 and these differences exceeded 0.4 inches FL after age 5. At ages 17 to 25 growth increments were either not significantly different or not comparable because of small sample sizes (Turner 1986).

2.1.3.3. Catch at age

Limited catch at age data are available from 1996 and 1997 commercial landings (Figure 17). Prior to 1996 there were no recent age data or length data collected (USDC 1993a) from either the fishery or from any research vessel surveys. Turner (1986) collected otoliths from 1,990 tilefish during 1977 through 1982 and a section from either otolith of nearly every fish was readable for age. Turner's aging work is the only available information at the present time. However, tilefish otoliths are presently being collected by NMFS port agents, although the data are not yet available (Pellegrino pers. com.).

Turner (1986) aged fish from the fisheries that existed between 1977 and 1982 that he could sample (Figure 18). While the foreign trawl fishery no longer exists and the recreational fishery is at best minimal today, his efforts described the state of the resource fifteen years ago. His evaluation indicated that trawl caught fish were smaller at age than longline caught fish. Recreationally caught tilefish at age 4 averaged 18.1 inches while longline caught fish were 15.7 inches on average and trawl catches averaged 15.3 inches FL. By age 6 longline caught fish averaged nearly an inch larger than those caught in trawls**.**

Turner (1986) found that Von Bertalanffy growth models were significantly different between males

and females from 1978, between females from 1978 and 1982, and between all fish combined from 1978 and 1982 (Turner 1986, Table 8).

The length-weight regressions (Table 9) for whole weight were significantly different for males and females, but the regressions for eviscerated weights were not statistically different (Turner 1986). Overall, whole weights were 7% greater than eviscerated weights. Turner's analyses closely matches that of Freeman and Turner (1977).

The average weights in the catches by the longline, recreational and United States trawl fisheries generally declined throughout the periods for which length frequencies were recorded by Turner (1986), while the average weight in the foreign trawl catches fluctuated. The longline average weights per fish declined from 19.6 pounds to 7.7 pounds (71%) from 1974 to 1982 (Turner 1986). They fell about 45% from 1974 to 1977, and more gradually thereafter, only breaking the decreasing trend in 1981 (Turner 1986).

2.1.3.4 Sex ratio

Turner's (1986) research indicated three quite distinct patterns in sex ratios at age in the longline catches in 1978, 1979 and 1980, and 1982. The similarities among all years were that at age 5 (the youngest age at which sex could be reliably determined) sex ratios were about 1:1, when sample sizes were large, and that at ages 10 and above, sex ratios generally were skewed towards females. The differences among years usually occurred at ages 6 through 9 with females dominating some of those ages in 1978, males dominating all of those age in both 1979 and 1980 and nearly 1:1 sex ratios at ages 6 though 9 in 1982. To verify that the patterns were not artifacts of the seasons or areas sampled, Turner (1986) examined the sex ratios at age visually by area and season and found them to be relatively consistent when sample sizes were large.

Dooley (1978) suggested the possibility of sex change at a small size based on a high ratio of females to males among smaller individuals and the fact that the largest fish are mostly males. Idelberger (1985), Erickson and Grossman (1986), and Grimes *et al.* (1988) found weak histological evidence for such a change. Turner *et al.* (1983) suggested that the ratio is the product of differential growth and mortality rates between the sexes.

2.1.3.5 Maturity

Grimes *et al.* (1988) reported that the predorsal adipose flap size was a sign of maturity of males, and that the development of enlarged adipose flaps in males coincided with the size of 50% maturity. Grimes *et al.* (1988) was based on the same research as Turner's (1986) dissertation which was a period of rapid expansion of the commercial fishery. The size and age for females of the percent mature did not change for females. However, males show a higher percent mature for a specific size and age in 1982 than was noted in 1978. No maturity research has been performed on tilefish since 1982.

The size of sexual maturity of tilefish collected off New Jersey in 1971-73 was 24-26 inches TL in females and 26-28 inches TL in males (Morse 1981). Idelberger (1985) reported that 50% of females were mature at about 20 inches FL, a finding consistent with studies of the South Atlantic stock, where some males delayed participating in spawning for 2-3 years when they were 4-6 inches larger (Erickson and Grossman 1986). Grimes *et al.* (1988) reported that in the late 1970s and early

1980s, both sexes were sexually mature at about 19-26 inches FL and 5-7 years of age; the mean size at 50% maturity varied with the method used and between sexes. Grimes *et al.* (1986) estimated that 50% of the females were mature at about 19 inches FL using a visual method and about 23 inches FL using a histological method. For males, the visual method estimated 50% maturity at 24 inches FL while the histological method estimated 50% maturity at 21 inches FL. The visual method is consistent with NEFSC estimates for other species (O'Brien *et al.* 1993).

Grimes *et al.* (1988) reported that the mean size and age of maturity in males (but not females) was reduced after 4-5 years of heavy fishing effort. This may be evident in comparison of their findings (in late 1970s-early 1980s) with those of Morse (1981) for the early 1970s near the beginning of the renewed fishing effort for the species, which estimated maturity at a larger size. Although Morse used total length and Grimes used fork length, the shallow caudal indentation (forking) in tilefish probably does not account for all of the 2-4 inch difference in length for visually estimated maturity.

2.1.3.6 Fecundity and reproductive strategy

Turner (1986) reported that female tilefish produce from about 200,000 to ten million eggs annually. Freeman and Turner (1977) state the number of eggs produced increases with the size of the fish, probably in a curvilinear relationship to the fish's weight. It is estimated that from about 200,000 to 450,000 eggs are produced per pound of body weight. The authors reported the relation of gonad weight to body weight (x 100) of ripe females as ranging from about 1.2 to 5.5.

Turner (1986) reported that during his study they observed that the age at maturity of 50% of the male tilefish, as determined from gross visual inspection of the gonads, had declined to about 5 years old by 1982. Noting that the population size had declined apparently as a result of fishing, it was suggested that the participation of young males in reproduction was socially mediated. Katz *et al.* (1983) found that adult tilefish had several sexually distinct characteristics, including differences in the predorsal adipose flap size between large (28 inch) males and females. It was suggested that these sexual differences in predorsal adipose flap size among adults was an ecologically valuable trait that might play a role in the mating system.

The reproductive strategy of tilefish warrants caution in evaluating impacts on this resource. Tilefish are long-lived and the age structure of the population may induce lags in the response to fishing mortality (USDC 1993a). Little is known about the variability of tilefish recruitment, but the non-equilibrium surplus production model suggests a maximum instantaneous rate of population biomass increase (r) on the order of 0.45 per year (Nitschke *et al.* 1999). This calculation of the "r" rate is very useful since sustainable levels of fishing are half the "r".

Grimes *et al.* (1988) estimated that females 21-36 inches produce 195,000 to 10,000,000 eggs; the mean fecundity for 49 fish was 2,280,000. This fecundity range is consistent with estimates by Morse (1981) and Erickson and Grossman (1986). However, these authors noted that with serial or fractional spawners there is some doubt whether all of the eggs in the ovaries are released during a seasonal spawning cycle. Residual eggs could be resorbed during the winter.

2.1.3.7 Natural mortality

Turner (1986) estimated natural mortality (M) by several methods using various combinations of his data. His most reasonable estimates fell between 0.1 and 0.22. He concluded that M is around

0.15. Turner also examined the M's of several other longlived fishes and of the longevity of species with reported M's below 0.2 which showed that a range of 0.1 to 0.2 is very reasonable for tilefish.

Very few males and females have been aged at over 30 and 40 years old respectively. The possibility that male tilefish have a higher M than females exists, and has been speculated, but can not be resolved with the available data (Turner 1986).

Hoenig (1983) used longevity estimates of 40-50 years for "unexploited" tilefish population in a regression model to predict total annual mortality M = 0.09-0.11.

The 1999 stock assessment (Nitschke *et al.* 1999) used an M = 0.1 and this estimate was approved by the peer reviewed MAFMC Science and Statistical Committee.

2.1.3.8 Fishing mortality

Fishing mortality (F) has been very high relative to the level that would produce MSY (Nitschke *et al.* 1999). The 1998 estimate (0.45 as estimated with the surplus production model) was 2 times larger than the fishing mortality level for MSY. This relative level of current fishing mortality is more reliably estimated than absolute levels of F and F_{MSY}.

Turner's (1986) estimate of fishing mortality using a virtual population analysis (VPA) for fully recruited fish showed that it increased rapidly during his research to levels that were 3 to 5 times higher than the preferred estimates of the natural mortality. The annual weighted mean fishing mortality for fully recruited ages at a natural mortality of 0.15 in 1977 was 0.2. By 1981, it was estimated to have increased to 0.74.

The 1999 stock assessment (Nitschke *et al.* 1999) used an M = 0.1, and identified that the annual Fs have been significantly above the F_{MSY} level in nearly all years since the late 1970s (Figure 19).

2.1.3.9 Recruitment

No stock-recruitment relationship has been defined, but since the intrinsic rate of increase is low, a fairly strong stock-recruitment relationship may exist (USDC 1993a).

2.1.3.10 Yield and Spawning Stock Biomass per Recruit

Biological reference points from the Thompson-Bell yield-per-recruit model (Thompson and Bell 1934) were calculated. The proportions mature-at-age were derived from estimates of maturity in 1978 and 1982 provided by Grimes et al. (1988). The partial recruitment and weight at age was taken from Turner's (1986) yield-per-recruit analysis (Ricker model). In calculating weight at age, Turner accounted for dimorphic growth using samples weighted by the sex ratio at age. Estimated weight for the 20+ age group was calculated from the average weight of ages 20-30 using the von Bertalanffy and length-weight equations (Turner 1986). A natural mortality rate of 0.1 was assumed for all ages, given the potential maximum age of 35 years. The proportion of natural mortality which occurs prior to spawning was estimated at 50% of the annual total, since spawning occurs from May through August (Grimes et al. 1988). The proportion of fishing which occurs prior to spawning was estimated as 55% (Figure 20). This estimate was calculated from the proportion of

landings which occurred in the first half of 1997 (January to June). The yield-per-recruit analysis provided estimates of F_{max} = 0.143 and $F_{0.1}$ = 0.081 (Figure 21).

Turner (1986) observed a decrease in mean lengths at age between the period 1979-1981 and 1982. However this change in mean lengths at age produced only a slight decrease in the estimated F_{max} and $F_{0.1}$ reference points; F_{max}=0.22 and $F_{0.1}$=0.14 with m=0.1 for 1982 (Turner 1986). The uncertainty Turner points out in the yield per recruit analysis due to life history changes still exists. The decrease in the population abundance (based on CPUE) since 1982 may also be associated with changes in life history parameters in recent years, but no analysis has been conducted linking abundance to demographics.

The yield-per-recruit analysis assumes that weights at age and partial recruitment pattern has not changed since Turner's calculation in the early 1980s. However, the size composition of the commercial catch suggests a change in the partial recruitment may have occurred. When the expanded commercial length frequency from the length based analysis in 1996 and 1997 is converted to the proportion at age using Turner's (1986) age length key, 73% of the catch is comprised of age 4 and 5 (Figure 17). These ages had a partial recruitments of 26% and 54% respectively in Turner's study (Nitschke *et al.* 1999). This change might also be due to incoming strong recruitment, or any of the other factors that influence the estimation of the length frequency distribution, as noted in the previous section. Turner (1986) also suggests that 5 and 6 year old fish were becoming increasingly vulnerable to fishing in 1980-1981. Caution should be taken in interpreting the yield per recruit analysis since a shift in the fishery mortality pattern to younger/smaller fish will result in a reduction of the values of the yield per recruit reference points i.e., F_{max}.

2.1.3.11 Social structure and behavior

Several lines of evidence indicate that social structure may be important in tilefish ecology (Turner 1986). The habitat limitation, long term residency of some fish in particular areas and the observation by Grimes *et al.* (1986) that tilefish burrows were contagiously distributed, provide the framework within which social interactions could be important. That males grow far larger than females, that they are sexual dimorphic, particularly the pronounced differences in predorsal adipose flap size (Katz *et al*. 1983), and that participation in reproduction by young males appears to be density dependent strongly suggests that the population is socially structured (Turner 1986).

Tilefish do not school in such a way as do cod (Freeman and Turner 1977). Rather, tilefish seem to occur in clusters or pods, often with similar size fish occurring in close association; dissimilar size ones more spread out.

When tilefish are frightened, they inevitably swim very rapidly into nearby burrows (Cooper 1974). It may be the location and abundance of these burrows that governs the clustering of the tilefish (Freeman and Turner 1977).

Based on a few tagging studies and the decade or so needed to re-colonize the southern New England grounds after the great mortality of 1882, tilefish make little or no migration (Freeman and Turner 1977; Grimes *et al.* 1983 and 1986). However, the seasonal variability in the presence of a band of warm water near Nantucket Shoal and southern Georges Bank during the winter/spring suggest that there is some migration along the outer shelf within the preferred habitat or, alternatively, that tilefish reduce their activity or hibernate in their burrows at low water temperatures.

2.1.3.12 Predator/prey and species coexistence

Tilefish burrows provide habitat for numerous other species of fish and invertebrates (Able *et al.* 1982 and Grimes *et al.* 1986) and in this respect they are similar to "pueblo villages" (Warme *et al.* 1977). Conger eels has been observed sharing burrows with tilefish, though this varied geographically (Turner 1986). There were high rates of co-occurrence of tilefish and conger eels in the Hudson Canyon area and lower rates in the southern New England area (Grimes *et al.* 1986). Several other species are more abundant in areas adjacent to burrows and less abundant away from them (Able *et al.* 1982 and Grimes *et al.* 1986). Many of these species occupy secondary excavations in the sides of tilefish burrows. Among the fish observed near burrows both *Anthias nicholsi* (yellowfin bass) and *Urophycis* sp. (hake) have been seen occupying secondary excavations (Grimes *et al.* 1986). Quite frequently *Helicolenus dactylopterus* (blackbelly rosefish) and less often *Sebastes* sp. (rockfish) are found around tilefish burrows but apparently have not been observed occupying excavations (Able *et al.* 1982). From fishes that are caught with tilefish, Freeman and Turner (1977) speculated that additional competitors may be *Peristedion miniatum* (armored searobin), *Lophius americanus* (goosefish), *Squalus acanthias* (spiny dogfish), *Carcharhinus obscurus* (dusky shark), *Carcharhinus plumbeus* (sandbar shark), and *Galeocerdo cuvier* (tiger shark).

Galatheid (Able *et al.* 1982 and Grimes *et al.* 1986) and goneplacid (Grimes *et al*. 1986) crabs are abundant near tilefish burrows where they occupy secondary burrows as do other less abundant crustaceans (*Cancer* sp., *Acantocarpus alerandri,* and *Homarus americanus*). Grimes *et al.* (1986) suggested that tilefish burrows provide access to clay for excavation for many of these species, and that the energy costs to these secondary burrows may be lower there than on flat substrates in the same area. They also suggested that tilefish feeding and excretion might provide a nutrient rich environment for these associates. A number of these species are important in the diet of tilefish (Turner 1986); apparently, the benefits of living close to tilefish outweigh the dangers.

Able *et al.* (1982) and Grimes *et al.* (1986) concluded that a primary function of tilefish burrows was predator avoidance. The NEFSC database only notes goosefish as a predator. While tilefish are sometimes preyed upon by spiny dogfish and conger eels, by far the most important predator of tilefish is other tilefish (Freeman and Turner 1977). Quite a few of the smallest specimens have been taken from the stomachs of tilefish. Nonetheless, large tilefish appear to be selective in the size of tilefish they eat, for Freeman and Turner (1977) never found any in their stomachs longer than 12 inches, with most being less than 8 inches. At the same time, large tilefish often have in their stomachs *Scomber scombrus* (Atlantic mackerel), *Clupea harengus* (sea herring) and *Merluccius bilinearis* (silver hake) measuring 14 inches and more.

It is also probable that large bottom-dwelling sharks of the genus *Carcharhinus,* especially the dusky and sandbar, prey upon free swimming tilefish. During the summer months, these species of sharks are reported to attack tilefish that are hooked on longlines and at times eat and mutilate enough of them to cause considerable loss to fishermen (Freeman and Turner 1977). Stillwell and Kohler (1992) did not find tilefish in the stomachs of sandbar shark (*C. plumbeus*) collected offshore in the Middle Atlantic Bight. *Prionace glauca* (blue shark) and *Sphyrna* sp. (hammerheads) at times attack tilefish as fishermen bring them to the surface, but these species of sharks when occurring at the edge of the continental shelf always seem to be at or near the surface. Thus, they probably are not natural predators of the bottom-dwelling fish (Freeman and Turner 1977).

Nothing is known about the diets and feeding habits of tilefish larvae, but they probably prey on zooplankton. The examination of stomach and intestinal contents by various investigators reveal that tilefish feed on a great variety of food items (Collins 1884, Linton 1901a and 1901b, and Bigelow and Schroeder 1953). Among those items identified by Linton (1901a and 1901b) were several species of crabs, mollusks, annelid worms, polychaetes, sea cucumbers, anemones, tunicates and fish bones (Table 10). Bigelow and Schroeder (1953) identified shrimp, sea urchins and several species of fishes in tilefish stomachs. Freeman and Turner (1977) reported examining nearly 150 tilefish ranging in length from 11.5 to 41.5 inches. Crustaceans were the principal food items of tilefish with the squat lobster (*Munida*) and spider crabs (*Euprognatha*) were by far the most important crustaceans. The authors report that crustaceans were the most important food item regardless of the size of tilefish, but that small tilefish fed more on mollusks and echinoderms than larger tilefish. Dooley (1978) terms the post-larval stage omnivorous, because of these reports. The presence of fish parts in all sizes of tilefish indicate that they are capable of capturing rapidly swimming organisms, though this ability progressively increases as the tilefish become larger. Besides naturally occurring organisms, tilefish will seek out and devour nearly anything along the bottom that resembles their usual food (Freeman and Turner 1977).

They also eat near-bottom or pelagic prey such as salps (*Salpa zonaria*), squid, hyperiid amphipods, small spiny dogfish (*Squalus acanthias*), Atlantic mackerel (*Scomber scombrus*), sea herring (*Clupea harengus*), and silver hake (*Merluccius bilinearis*). Human trash (potato peels, meat bones, and shiny hardware) were also eaten (Collins 1884; Freeman and Turner 1977). Tilefish stomachs examined off Georgia also contained non-benthic myctophid fish, butterfish (*Peprilus triacanthus*), deep-sea shrimp, and spotted hake (Urophycis *regia*) (Dooley 1978). The NEFSC food habits data base included data from nine juvenile tilefish, which ate primarily brittlestar echinoderms, and unidentified crustaceans (Figure 22; Steimle *et al.* 1998). Cooper, Valentine *et al.* (1987) called tilefish the apex predator of the "pueblo village" canyon community.

Freeman and Turner (1977) and Low *et al.* (1983) reported that tilefish are visual daytime feeders, but Grimes *et al.* (1986, 1987) reported that tilefish were most active at night (~2000-0800 hrs). Tilefish appear to be attracted to the bait on longline hooks at some distance from their shelters (Grimes *et al.* 1982), suggesting that food detection is more than visual and tilefish may be effective scavengers on fresh material like many deep-sea megafauna. Freeman and Turner (1977) noted that there was no evidence that feeding is inhibited during spawning, which is consistent with an extended, serial spawning strategy.

2.1.3.13 Parasites, diseases, injuries and abnormalities

Linton (1901a and b) examined stomachs and intestines of several tilefish caught off southern New England and found them to contain cestodes, trematodes, nematodes, and acanthocephala. Freeman and Turner (1977) found upon examining nearly 150 specimens of tilefish taken at different times throughout the year that three quarters of them contained nematodes. While nematodes were found in all size tilefish, their numbers generally increased as the size of the tilefish increased.

Tilefish are also parasitized by *Petromyzon marinus* (sea lamprey)**.** Infestation occurs mostly during late winter and spring and seems to be only by young lampreys, always by those measuring less than 12 inches (Freeman and Turner 1977). The greatest infestation they reported occurred in February 1974 when 15 tilefish, out of a catch of 470, had sea lampreys attached to their bodies or had open

wounds recently caused by these parasites.

Low levels of toxic metal and organic contaminants have been found in several tissues of individuals from the Middle Atlantic Bight population, although the source of the contaminants is unknown (Steimle *et al.* 1996).

2.1.4 Maximum Sustainable Yield

Based on the estimated parameters from the surplus production model (CPUE series development described in section 2.1.2 and Nitschke *et al.* 1999), maximum sustainable yield is estimated at around 4.2 million pounds (Nitschke *et al.* 1999). The fishing mortality rate at the MSY level was estimated to be approximately 0.22 (Table 5).

The best current estimate of 4.2 million pounds is between the 2.5 million pounds estimated by the 1993 SARC (USDC 1993a) and the 5.5 million pound estimate of Turner (1986).

The non-equilibrium surplus production model for tilefish is the best method of assessing tilefish at present (MAFMC Science and Statistical Committee conclusion of 31 March 1999). No adequate fishery independent sources of information exist. Fishery independent surveys, routinely conducted by NEFSC since 1963, fail to sample the deep offshore regions where tilefish are caught by commercial longline gear, due to survey trawl gear configuration, including roller gear. Despite the high total landings of tilefish in the last two decades, sampling of the commercial fishery is intermittent and suitable length or age composition data do not exist. Reliable estimates of the days at sea for trips catching tilefish are available from vessel trip reports, and these data are used with reported landings to calculate landings per unit effort indices of abundance.

2.1.5 Probable Future Condition

The stock is at low biomass and is overfished. The MSY level is estimated at around 4.2 million pounds with fishing mortality associated with the maximum sustainable yield level of approximately 0.22 (Table 5). Current biomass levels are at about 35% of the level producing MSY and fishing mortality rates are about two times larger than F_{MSY} (Nitschke *et al* 1999). Current F levels can not be sustained. There has been a shift in the exploitation pattern to smaller fish. Management measures must reduce current fishing mortality and rebuild spawning stock biomass.

Numerous forecasts were performed by Nitschke (pers. comm.) after the Nitschke *et al.* (1999) document was peer reviewed by the MAFMC Science and Statistical Committee (Tables 3, 4, and 11 through 21). It is obvious that catches can not continue at current levels without jeopardizing the fishery and the resource.

Under the preferred Council alternative (Table 3) the tilefish resource will be rebuilt to the B_{MSY} in ten years with 50% probability.

Rebuilding the stock biomass will require a significant reduction in fishing mortality. Even when the fishing mortality is reduced below the F_{MSY} level, there will be a lag until the biomass is rebuilt to the biomass associated with the maximum sustainable yield level. This lag is at least five years because of the long-lived/late-maturity life history strategy of tilefish.

2.2 DESCRIPTION OF HABITAT

Tilefish habitat is restricted to the continental shelf break south of the Gulf of Maine. The following description is taken from the Tilefish EFH source document (Steimle *et al.* 1998), and is based largely on Warner (1986). This description applies to juveniles and adults. The outer continental shelf, shelf break, and upper slope (300-1650 ft) that contain suitable habitat for tilefish are the product of several processes. The topography developed during repeated cycles of glacial advance and retreat that caused major changes in sea levels. The outer shelf of the Middle Atlantic Bight slopes gently (1-2 degrees) and is generally flat except for relict submerged river valleys (e.g., Hudson Shelf Valley), submerged beach fronts, and submarine canyons. At the edge of the continental shelf, the slope increases to 5-7 degrees and greater in the current-washed canyons, where there are near vertical walls. Sediments on the outer shelf-upper slope in the area used by tilefish are medium to fine sands and silt, with isolated areas of exposed clays and other consolidated sediment near the heads or within the submarine canyons. Off New England, glacial erratic boulders randomly occur and coarser sediments are found in the current-washed channels of many canyons. The topography on either side of Hudson Canyon is irregular and hummocky (Twichell *et al.* 1995).

Current patterns and water mass dynamics at the shelf break are partially affected by wind, Rossby waves moving up slope, and lateral variation in the location of the Gulf Stream and its loops and gyres. Residual water mass movement on the shelf and upper slope is to the southwest. A "warm belt" (48-57 °F) occurs at the shelf break where shelf and slope water meet. The width and linear extent of this band varies seasonally; it extends beyond Nantucket Shoal and along southern Georges Bank in the summer and fall, but retreats to Long Island in the winter and spring (Colton and Stoddard 1973).

Flagg (1987) summarized the hydrography of the shelf for southern Georges Bank and his description applies south to Virginia (Schmitz *et al.* 1987). Seasonal fluctuations in bottom temperatures affect the water column down to about 650 feet on the continental shelf (including shallow parts of Georges Bank) and shelf break. There is a persistent cold pool or band of residual winter bottom water (usually <50 °F) along the mid-outer shelf that parallels the shelf break. Beyond the warm band at the shelf break (1650 ft), the bottom temperature on the slope declines gradually to about 39 °F. There is a seasonally variable pycnocline on the outer shelf at about 165 ft that deepens to 250-350 ft at the shelf break; salinities above the pycnocline tend to be <35 ppt and below the pycnocline, in the tilefish warm band, they are about 35-36 ppt. Dissolved oxygen (DO) at the shelf break varies seasonally between 3-7 ppm in the winter and 3-5 ppm in the summer; the lowest values occur in the oxygen minimum zone around 650-1300 feet. Movement of Gulf Stream gyres and meandering loops over the slope temporarily affect hydrographic conditions and biological communities at the shelf break.

The oceanographic, geological, and biological changes that occur at the shelf break, and the specialized community that exists in this zone, has been described as a unique ecotone with the characteristics of an edge effect (enhanced productivity and diversity), although the boundaries and environmental sensitivity of this zone/community are still in question (Church *et al.* 1984; Warner 1986). Warner *et al.* (1983) considered tilefish a good indicator species for delineating the shelf break "warm belt" community and for monitoring the sensitivity of this ecosystem to disturbance (e.g., oil and gas development). In the winter, the shelf edge south of New Jersey supports several populations of wintering fish (e.g., black sea bass (*Centropristis striata*), scup (*Stenotomus chrysops*), butterfish (*Peprilus triacanthus*), spotted hake (*Urophycis regius*), summer flounder

(*Paralichthys dentatus*), small pelagic fishes, and squid (Pearson 1932) that may be a seasonal source of prey for tilefish.

2.2.1 Habitat Requirements by Life History Stage

According to section 600.815 (a)(2)(I)(A) an initial inventory of available environmental and fisheries data sources relevant to the managed species should be used in describing and identifying essential fish habitat (EFH).

In section 600.815 (a)(2)(I)(B) in order to identify EFH, basic information is needed on current and historic stock size, the geographic range of the managed species, the habitat requirements by life history stage, and the distribution and characteristics of those habitats.

The majority of the following information in this section is taken from the Tilefish EFH source document Steimle *et al.* (1998) prepared by researchers at the Sandy Hook Laboratory of NMFS.

2.2.1.1 Eggs

Tilefish eggs are non-adhesive and buoyant (Bigelow and Schroeder 1953; Freeman and Turner 1977). Eggs that were artificially fertilized and reared at 72-76 °F hatched in 40 hours (Fahay and Berrien 1981).

Tilefish eggs collected during the NEFSC Marine Resources Monitoring, Assessment and Prediction (MARMAP) program surveys [see Reid *et al.* (1998) for methods] were associated with mean water column (to 650 ft) temperatures of 46-66 °F with a trend following the seasonal rise in temperatures (Figure 23). The egg-temperature distribution suggests that Fahay and Berrien (1981) hatched eggs at a slightly higher than normal temperature (72-76 °F vs. <66 °F). The hatching time they measured (40 hrs) may be longer under cooler conditions.

The depth at which the eggs were collected during the MARMAP surveys ranged from 260-4100 ft; most eggs were collected between 260-2600 ft (Figure 23). The November data was one tow in deep water off Chesapeake Bay and suggests an unusual situation.

Based on the MARMAP ichthyoplankton surveys (1978-87) tilefish eggs were collected from March to November on the outer continental shelf from North Carolina to southern Georges Bank; the highest densities were found from Hudson to Block canyons. In March, a few eggs were collected between these canyons. From April to October, eggs were collected broadly on the outer shelf. In November, eggs were only collected off Chesapeake Bay (Berrien and Sibunka, in press).

2.2.1.2 Larvae

The larvae were not identified in ichthyoplankton samples until recently. Newly hatched larvae are 0.10 inches long and well formed at 0.19 inches; the largest pelagic larva was 0.34 inches. Larvae occur in the plankton from July to September over the outer continental shelf in the Middle Atlantic Bight. The center of abundance lies between Hudson and Baltimore canyons (Fahay and Berrien 1981).

If post-larval tilefish are primarily sedentary and non-migratory, except perhaps seasonally off New

England (Freeman and Turner 1977; Grimes *et al.* 1987), then the recruitment of tilefish to support or re-establish local populations is dependent on larval settlement (Bumpus 1899). The habitat criteria for larval tilefish settlement and the transition to juveniles are unknown. If transitional tilefish larvae and early juveniles are unable to excavate burrows, they may be dependent on other sources of shelter.

Tilefish larvae were rarely collected during the MARMAP surveys. The data suggest that larvae prefer a narrow range of fairly warm water and relatively shallow depths (Steimle *et al.* 1998, Figure 24).

2.2.1.3 Juveniles

The smallest juveniles collected in bottom trawls were 0.6 inches (Fahay and Berrien 1981). Early juveniles 2.5-3.3 inches were collected at 300-650 ft during April-July along the outer edge of the Middle Atlantic shelf (Bigelow and Schroeder 1953; Dooley 1978). The smallest fish collected in the Northeast Fisheries Science Center (NEFSC) bottom trawl survey was 5.5 inches [see Reid *et al.* (1998) for a description of methods]. Bigelow and Schroeder (1953) reported that 3.5 inch specimens were collected off New England in April and 3.9-4.1 inches specimens were collected in July. Freeman and Turner (1977) suggested that particular juvenile size classes favor certain areas; some of these areas were avoided by longliners because of the low market value of small fish.

Juveniles often occupy simple vertical shaft burrows in semi-lithified clay (Able *et al.* 1982). According to Freeman and Turner (1977), divers observed tilefish using lobster pots as shelter; in deeper waters, red crab traps may also be used. Anthropogenic material, such as ship wrecks and other solid structures, are also used (e.g., Cooper, Valentine *et al.* 1987), possibly by juveniles that have not found or excavated burrows.

The characteristic dorsal adipose flap behind the eye develops at about 3.1 inches, which may be an age of 1 year (Bigelow and Schroeder 1953). Tilefish are sexually dimorphic and the flap grows larger in males (Katz *et al.*1983).

The NEFSC groundfish survey collected few juvenile tilefish in more than 30 years of operation. Spring trawl collections contained the highest number of samples (91). Approximately 24% of the collections occurred at bottom temperatures below the limit (>46 °F) reported in previous studies; most of these low temperature data came from surveys in the 1970s. The maximum temperature of occurrence in the NEFSC trawl survey (~59 °F) was also lower than the preferred maximum (~ 64 °F) reported in previous studies (Figure 25; Table 22). Temperature data from other seasons were within the range of the spring collections with a weak mode at 48-52 °F. This suggests that juveniles are more tolerant of low temperatures than adults, which could help recruits survive in marginal habitat conditions.

The depth range of juveniles collected in the spring during NEFSC bottom trawl surveys was 300-900 ft; most were collected at 550 ft; the maximum depth of the NEFSC trawl surveys was 1200 ft (Reid *et al.*1998). The juvenile tilefish depth of capture in other seasons was similar to that for spring.

2.2.1.4 Adults

Tilefish are shelter-seeking and adults have been observed and photographed using rocks, boulders, and the scour depressions beneath them, exposed rocky ledges, and horizontal and vertical burrows in semi-lithified clay outcrops on the upper slopes, flanks, and shoulders of submarine canyons, such as Oceanographer Canyon (southern Georges Bank) and Hudson Canyon (Valentine *et al.* 1980; Able *et al.*1982, 1987). Tilefish burrows can be tubular or funnel-shaped, up to 15 feet wide at the mouth, and several meters deep. The main burrow often contains a complex of smaller burrows created and used by decapod crustaceans (Able *et al.* 1982; Grimes *et al.* 1986). The hydrographic, geological, and biological characteristics of this habitat were described by Valentine *et al.* (1980). The complex of burrows in clay outcrops along the slopes and walls of submarine canyons, and elsewhere on the outer continental shelf, has been called "pueblo" habitat, because of its similarity to human structures in the southwestern United States (Cooper and Uzmann 1977).

Twichell *et al.* (1985) speculated that the largest burrows are the product of a lifetime of the activities of individual tilefish. They gradually widen and deepen the burrows as they grow. Burrows are modified by decapod crustaceans, which sometimes join adjacent burrows with their activities, or collapse part or all of a burrow complex (Able *et al.*1982; Twichell *et al.*1985; Grimes *et al.* 1986). Able *et al.* (1987) suggested that sidescan sonar could be used to assess the occurrence and density of burrows and other shelter on the seafloor (and possibly to estimate tilefish density). Using sidescan imagery, Grimes *et al.* (1986) estimated that the density of burrows was about 6,500/mi^2 near Hudson Canyon and as high as 34,000/mi^2 ; Barans and Stender 1993), but lower (~4,100/mi^2) in the Gulf of Mexico (Matlock *et al.* 1991). Able *et al.* (1987) reported that the density of burrows varied more than ten-fold among different areas inhabited by tilefish.

Tilefish are important modifiers or creators of habitat on the outer continental shelf (Able *et al.*1982). Twichell *et al.* (1985) suggest that the burrowing habitats of tilefish and their associated crustaceans significantly alter the topography and that the irregular, hummocky topography found on either side of Hudson Canyon may be the product of tilefish activity. They also discuss how creation, expansion, and use of burrows, vertical pits, and horizontal pueblos, in the semi-lithified clay enhances the erosion of the exposed clay. Grimes *et al.* (1987) suggest that since each generation of tilefish may excavate a new burrow, the habitat modification and erosion caused by tilefish is significant. It is reasonable to assume that small tilefish will use an existing burrow if it is in good shape and unoccupied. The current relatively high fishing levels and low adult population levels may have reduced the need of recruiting tilefish to create new burrows and reduced erosion rates.

The organisms that create the burrows and their excavation methods are not completely known, although several hypotheses have been proposed, including the activities of galatheid crabs and tilefish (Grimes *et al.* 1986, 1987). According to Cooper, Shepherd *et al.* (1987), tilefish are a "tertiary borer and nestler that further enlarge excavations and occupy existing burrows," they believe the burrows are started by smaller crustaceans. Grimes *et al.* (1986) and Able *et al.* (1993) conclude that tilefish maintain the burrows and burrow associates. The use of burrow, pueblo, and intermixed habitats was described by Able *et al.* (1982) and Grimes *et al.* (1986). Tilefish are relatively inactive and usually only one tilefish occurs in a burrow (Able *et al.*1982), although several tilefish were observed using boulders off New England (Grimes *et al.* 1987). There seems to be no preference for shelter size or shape. Some fish appear to be residents of certain burrows or shelter sites and retreated to these shelters when disturbed by researchers (Grimes *et al.* 1983, 1986). Tilefish may move away from their shelter to feed and their feeding activity may organize the activity of other species in the habitat; thus tilefish fit the definition of a "keystone" species (Grimes *et al.* 1986).

Tilefish are not unique fish in their modification of sediments. Stanley (1971) and Auster *et al.* (1995) reported depressions in sediments made by fish (e.g., red hake, *Urophycis chuss*) and crustaceans on the outer continental shelf that were used by other species for shelter.

Tilefish habitat in the Middle Atlantic Bight (Georges Bank to just south of Hudson Canyon) occurs on the shelf between 350-650 ft, at 48-57 °F, and contains rock or clay boulders, or clay outcrops with burrows (Grimes *et al.*1986). Levy *et al.* (1988) found tilefish using rocky ledge or burrow shelter south to Norfolk Canyon off Virginia. And some of the biogenic habitat (cavernous hollows in clay) and poorly identified fish noted by Stanley (1971) in early video explorations in Wilmington Canyon may include tilefish and their burrows. Tilefish were collected by trawl southwest of Norfolk Canyon in March during the winter fishery off Virginia and North Carolina in the early 1930s (Pearson 1932). The shelf area off southern New England and on Georges Bank may be used seasonally or if suitable temperatures persist through the coolest hydrographic periods (Grimes *et al.*1986).

Tilefish habitat is used by other fish and invertebrates, especially crustaceans, including rare species (Williams 1988), those new to science (Bowman 1986), and those whose known range may extend in this habitat [e.g., crimson/yellowfin bass, *Anthias nicholsi* (Grimes *et al.*1986; Bowman 1986; Cooper, Valentine *et al.* 1987)]. Several of these community members are of interest to fisheries, including American lobster (*Homarus americanus*), conger eel (*Conger oceanicus*), ocean pout (*Macrozoarces americanus*), cusk (*Brosme brosme*), redfish (*Sebastes spp.*), and hake (*Urophycis spp.*) (Grimes *et al.* 1986; Hood *et al.* 1988). Near Norfolk Canyon, tilefish overlap with the smaller blueline or blackline tilefish *Caulolatilus sp.* (Pearson 1932), with which it may share burrows (Able *et al.* 1987). Some of the larger fish and lobster that co-exist with tilefish in their burrows compete with tilefish for food, e.g., conger eel (Freeman and Turner 1977; Levy *et al.* 1988).

The relatively flat seafloor among the tilefish burrows and in submarine canyons can be inhabited by species typical of unstructured, open bottom, such as Jonah crab (*Cancer borealis*), red crabs [*Geryon (Chaceon) quinqueidens*], skates (*Raja spp.*), dogfish (*Squalus* sp.), witch flounder (*Glyptocephalus cynoglossus*), Gulf Stream flounder (*Citharichthys arctifrons*), goosefish (*Lophius americanus*), greeneye (*Chlorophthalmus agassizi*), armored sea robin (*Peristedion miniatum*) and faun cusk-eel (*Lepophidium cervinum*). These species are caught on longlines with tilefish and have been trawled, dredged, and observed during surveys (Goode, 1881; Collins, 1884; Bumpus, 1899; Haedrich *et al.*, 1975, 1980; Cooper, Shepard *et al.*, 1987). The armored sea robin may be confined to the same Middle Atlantic Bight shelf break "warm zone" as tilefish; it was found during the great tilefish mortality event of 1882 (Collins 1884; Bigelow and Schroeder 1953).

Middle Atlantic Bight tilefish of both sexes grow about 2.5 inches/yr to age 4 after which growth rates slow and males grow faster than females (Turner *et al.* 1983; Turner 1986). Males grow larger than females (Freeman and Turner 1977; Morse 1981; Turner *et al.* 1983); the maximum size of females was 39 inches FL (100 cm) and the maximum size of males was 44 inches FL (112 cm), but females tended to be older than males (Turner *et al.* 1983).

Except for the spring, there are insufficient data on adult tilefish in the NEFSC bottom trawl surveys to determine their bottom temperature and depth preferences. One adult (2% of total) was collected at 44 °F which is below the published temperature preference range (~46-64 °F). The maximum temperature at which adult tilefish were collected during the NEFSC bottom trawl surveys was lower (~57 °F) than the maximum reported in previous studies (Table 22). The association of adult

tilefish with temperature was similar to juveniles with a weak mode at 50-52 °F.

In the spring of 1882, an estimated 1.5 billion tilefish weighing over 7 million tons were found dead and dying at the surface offshore between Nantucket Shoal and Maryland. This was followed by a collapse of the fishery and the population (Collins 1884; Bumpus 1899; Bigelow and Schroeder 1953; Dooley 1978). Many other organisms associated with the tilefish habitat also died (Bigelow and Schroeder, 1953), including armored sea robin (*Peristedion miniatum*), "red snappers," galatheid crabs, and deep-water spider and hermit crabs (Collins 1884). The mortality is presumed due to thermal shock from a rapid drop in temperature, which may have been caused by meanders of the Gulf Stream or unusually heavy sea ice off Nova Scotia associated with upwelling of the deep, cold Labrador Current; undersea volcanism was also suggested (Collins 1884; Bumpus 1899; Bigelow and Schroeder 1953; Dooley 1978). Collins (1884) reported no evidence of disease or excessive parasite infestations; most freshly dead or dying fish had empty stomachs and their air bladders extruding from their mouths. Some fish found at the surface off southern New England during the event were identified by seamen as cod and hake (Collins 1884), which are moderately cold tolerant. This observation suggests that if temperature change was the cause, it was probably rapid.

The depth range of adults collected in the spring was 350-900 ft with a weak mode at about 450 feet most fish were collected shallower than 700 feet. Data for adult tilefish from other seasons were consistent with the spring with a mode at 525-550 ft, which is consistent with previous studies, although tilefish have been collected to 1800 ft (Table 22).

The NEFSC bottom trawl surveys collected few adult tilefish. Those that were caught occurred along the continental shelf break between Nantucket Shoals and Hudson Canyon primarily in spring (Figure 26).

Warner (1986) generated a series of relative CPUE maps for the fishery from Toms Canyon (south of Hudson Canyon) to Hydrographer Canyon on western Georges Bank for 1973-82 (Steimle *et al.* 1998). Because the fishery concentrated on areas with the highest catches (apparent abundance), the resulting data are biased and probably underestimate the distribution of the stock. At the time of this analysis, the fishery was still expanding and all areas of tilefish abundance may have not been located. The eastern expansion noted in this time series was due mostly to the expansion of the fishery and not the tilefish stock. Effort in the fishery (used here as a surrogate for tilefish relative abundance) is associated with topographically rough bottom. Chang (1990) examined commercial landings data for 1977-88 when the tilefish fishery was mature and found that tilefish were more widely distributed than during the early period of the fishery analyzed by Warner (1986). The highest landings in the mature fish were concentrated south of Martha's Vineyard and near Hudson Canyon, especially in the winter and spring.

2.2.2 Description and Identification of EFH (Includes Habitat Areas of Particular Concern)

2.2.2.1 Methodology for description and identification

According to section 600.815 (a)(1), FMPs must describe EFH in text and with tables that provide information on the biological requirements for each life history stage of the species. These tables should summarize all available information on environmental and habitat variables that control or limit distribution, abundance, reproduction, growth, survival, and productivity of the managed species. The tilefish EFH background document (Steimle *et al.* 1998) is considered the best

scientific information available in order to meet National Standard 2 of the MSFCMA and will be relied upon heavily throughout this section.

As defined in section 3 (10) of the MSFCMA, essential fish habitat is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." NMFS interprets "waters" to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

A matrix of habitat parameters (i.e. temperature, salinity, light, etc.) for eggs, larvae, pelagic-juveniles, and juveniles and older, was developed in the tilefish EFH background document and included in this FMP as Table 22.

In section 600.815 (a)(2)(ii)(A), the Councils are directed to "interpret this information in a risk-averse fashion." In the next section, (B) it states "if a species is overfished, and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species should be considered essential in addition to certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible."

The Council has interpreted the above direction of interpreting the information in a "risk-averse" fashion as the same as the NMFS policy on risk aversion as expressed by Schaefer (1995). Schaefer (1995) states that, although there is no formal agency (NMFS) definition of risk-averse decision making, it is discussed in several NMFS publications. A succinct agency statement regarding the rationale and objectives of this type of decision making was presented publicly in the *Strategic Plan of the National Marine Fisheries Service -- Goals and Objectives* dated 10 June 1991. This statement, according to Schaefer (1995), still represents the formal agency position on this issue. Under Goal 2 -- Maintain Currently Productive Fisheries, there is a discussion of risk-prone and risk-averse decision making. This clearly explains that the agency advocates risk-averse fishery management decisions because they reduce the risk of overfishing and give the benefit of the doubt to conservation, particularly in the face of uncertainty about the effects of management actions on the managed fishery resources. Also, in *Our Living Oceans*, December 1993, page 24, NMFS indicates that risk-averse decision making is a key element in the development of any improved management system, and that this policy means that managers should err on the side of caution with respect to long-term resource health when making fishery management decisions. Making such decisions based on short-term objectives often places the resource's long-term health at risk.

Currently, only two data sets are available for determining tilefish EFH. These data sets are at best, Level 2 data. The data sets are: 1) MARMAP ichthyoplankton survey (Level 2); 2) NEFSC bottom trawl survey data (barely Level 2). Tilefish are located offshore, therefore state data and ELMR data are not needed to determine tilefish EFH. In addition to these surveys commercial landings provide presence/absence data (level 1) by statistical area. These data provide the best index of abundance for tilefish (Nitschke *et al.* 1999).

To identify and describe EFH offshore, the Mid-Atlantic Council is relying on data and information

derived from the NMFS ichthyoplankton, bottom trawl surveys, and commercial landings data. These surveys provide the best available information on the distribution and relative abundance of Council-managed species in offshore waters. The Council does acknowledge that the NEFSC trawl survey Level 1 and 2 data for tilefish may not accurately represent tilefish relative abundance and distribution because 1) the fish can avoid trawls if they are in their burrows or other shelter (e.g., submarine canyons), and 2) the fish occur beyond the lower depth limits of the NEFSC trawl survey. Additionally, commercial longline catch location data can be biased toward areas with a certain harvest rate of a preferred size range and away from areas where the bycatch of nuisance species, such as dogfish, reduces the tilefish catch.

Reid *et al.* (1998) produced an appendix that is useful for all the species' habitat background documents produced by Sandy Hook Laboratory of NMFS. Reid *et al.* (1998) describes the methods used in NEFSC, state, and other surveys. Data were collected in these surveys on distribution and abundance of all life stages and environmental variables.

The NEFSC ran the MARMAP (Marine Resources Monitoring, Assessment and Prediction) program that sampled fish eggs and larvae on monthly to bimonthly surveys covering the continental shelf from Cape Hatteras, NC to Cape Sable, Nova Scotia from 1977 through 1987 (Reid *et al.* 1998). A total of 81 surveys were made, and Reid *et al.* (1998) documents all the dates and numbers of tows for each survey where eggs and larvae were collected.

The NEFSC bottom trawl surveys have been conducted in the fall since 1963 and in the spring since 1968, with season surveys also being conducted in summer and winter on an intermittent basis. Distribution of juvenile and adult fish have been identified through trawl stations that were selected in a stratified random design that provides unbiased estimates of fish availability to the trawl gear in relation to the distribution of the species. Strata were defined based on water depth, latitude, and historical fishing patterns. Station allotments were approximately one station per 200 square nautical miles. At each station, the total catch was sorted by species, and the catch of each species was weighed and measured; very large catches were subsampled. Geographic range extends throughout the United States Atlantic EEZ north of Cape Hatteras. Full details of this survey are described in Reid *et al.* (1998).

2.2.2.1.1 Four alternative approaches for describing EFH considered by the Mid-Atlantic Technical Team

One of the tasks of the Mid-Atlantic EFH Technical Team was to develop alternatives to designate EFH for consideration by the Council. These alternatives were derived from a set of alternatives that were developed at a meeting with several ecologists at the Sandy Hook Laboratory in February 1998. The alternatives were initially developed for bluefish, because the Bluefish Fishery Management Plan was the first plan to be amended with the EFH requirements of the reauthorized Magnuson-Stevens Act. At this meeting, five alternatives for EFH identification recommendations were discussed for bluefish. These alternatives provide the basis for evaluation of the other Council managed species. These five bluefish alternatives were: 1) no action (NEPA requirement); 2) 100% of area where overfished resources occur; 3) the “bottleneck” concept as identified in the bluefish EFH background document where a critical area may restrict recruitment; 4) identification of EFH based on temperature or other key environmental requirement; and 5) a threshold or cutoff point using some percentage of the distribution, i.e. 50%, 75%, 90%, or 100% (Reid *et al.* 1998). In actuality, the second alternative is an option under the fifth alternative and will be treated as such

in this FMP. The following is a discussion for tilefish of the various alternatives and how they were approached with the limited, Level 1 and Level 2 data.

1. The "no action" alternative is included in the FMP because it is required by NEPA (National Environmental Policy Act) but it is not viewed by the Council as defensible. This alternative, or no EFH designation, could not meet the Congressional mandate identified in the 1996 reauthorized Magnuson-Stevens Act. This alternative would not allow stock improvement associated with the conservation of essential fish habitat.

2. The second alternative is to identify bottlenecks to tilefish recruitment. No bottlenecks to tilefish recruitment were identified in the EFH background document.

3. Alternative 3 is to identify EFH based on temperature regimes or some other critical environmental factor. This approach is the preferred alternative because of the wide amount of information on the habitat preference of tilefish that is available from the literature and which was summarized nicely in the EFH background document. In addition, the trawl survey data are likely biased low because tilefish are found in deeper depths than what is sampled in the trawl survey.

4. The use of some objective criteria, e.g. identifying some distributional percentage of the catches by area is not the preferred alternative for tilefish, because of the inadequacy of the NEFSC otter trawl to sample tilefish. For EFH designations based on Level 2 data, it is assumed that high value areas are those that support the highest density or relative abundance. This approach is supported by the technical guidance manual when Level 2 data (e.g., MARMAP ichthyoplankton data and the NEFSC trawl survey) are available (USDC 1998). However, in reality only level 1 data are available for tilefish at this time. Limitations, assumptions, and qualifying terms for EFH data and information sources were thoroughly addressed by the NEFMC in their omnibus EFH Amendment and is summarized in Appendix 4.

2.2.2.1.2 Viable alternatives from the four alternatives identified above

Alternatives 1 and 2 were eliminated by the Council from consideration. Alternative 1 simply because the no action alternative would not meet the Congressional mandate. Alternative 2 was eliminated because no recruitment bottlenecks have been identified yet for tilefish (Steimle *et al.* 1998). Public comment was solicited on any of the above considered four alternatives, or any other means of identifying EFH; however, the Council considered only alternatives 3 and 4 viable.

The Council seriously considered using alternative 4 -- with identifying100% of the NEFSC trawl survey catch distribution as EFH -- because tilefish are currently considered overfished. When the initial EFH guidelines were proposed in 1997, EFH for overfished species was to be identified as wherever the resource occurred. The Council, commenting on those guidelines in 1997, suggested that the Secretary should establish rules on how much of the total habitat should really be declared EFH. The Council also considered using 100% because of the language in section 600.815 (a)(2)(ii)(B) where it states "if a species is overfished, and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species

should be considered essential in addition to certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible."

Alternative 4 was not recommended because MARMAP and NEFSC trawl surveys do not sample tilefish well, and tilefish are found in very few ten minute squares. These surveys are not representative of tilefish. As stated above (section 2.2.2.1), the Council acknowledges that the NEFSC trawl survey Level 1 and 2 data for tilefish may not accurately represent tilefish relative abundance and distribution because 1) the fish can avoid trawls if they are in their burrows or other shelter (e.g., submarine canyons), and 2) the fish occur beyond the lower depth limits of the NEFSC trawl and MARMAP surveys. Options under alternative 4 are based on the relative densities and areas of higher concentrations of fish. Maps of EFH designation options are provided for each life history stage (Figures 27 through 30). Maps presented display the distribution and abundance data by ten minute squares, a spatial scale that is easily compared to other data sets, information from the fishing industry, and existing management analyses.

2.2.2.1.3 Options for identifying EFH under environmental factor alternative - alternative 3

The Mid-Atlantic EFH Technical Team recommendation is that environmental variables, depth and temperature regimes, should be used to delineate tilefish essential fish habitat. This approach was chosen over the use of objective criteria that delineates tilefish distribution and abundance as was done in other MAFMC FMPs. The Guidelines instruct that when using Level 1 data (which is truly all that is available for tilefish), “EFH can be inferred on the basis of distributions among habitats where the species has been found and on information on its habitat requirements and behavior.”

While the Mid-Atlantic EFH Technical Team recommendation was that the environmental variables of depth and temperature were used to delineate tilefish EFH, it is clear that the Team would have preferred to also factor in sediment type. Tilefish are clearly shelter-oriented fishes and certain types of sediments (firm clay) in which their burrows can be created and maintained seem essential to tilefish well-being. Ready access to detailed oceanic fine-scale sediment types was not available to the EFH Technical Team during the development of the FMP. It is possible that suitable substrate may not exist continuously throughout the depth-temperature sone favored by tilefish, or even may exist just outside this zone, or may be temporarily unavailable when covered by sand or silt. All of these issues are complicated and difficult to fully address at this time with the limited information available for this species. However, with implementation of the FMP, more research should be focused on tilefish, and with the identification and description of EFH frameworked, the refinement of EFH can proceed efficiently in the future.

The recommendation on the designation of EFH under alternative 3 is due to their overfished status (the biomass is currently at about 35% of the biomass that is needed to support MSY) and the fact that the NEFSC trawl and MARMAP ichthyoplankton surveys are not representative of the habitat that support tilefish. This approach should be used for all life stages since there were no readily apparent significant differences in distribution by life stage. Current information does not demonstrate any life stage is limiting, in terms of an ecological bottleneck-type habitat association.

It is important to remember that this is not the last step in the process, but that the public, Habitat Advisors, Habitat Committee, and the Council will have the opportunity to review and if necessary, modify these EFH designations in the future through the framework process. During the public hearing process, the public was asked to comment on these designations and was able to provide

additional available information. Following public review, the Council had the opportunity to modify the EFH designations based on input gathered during this process.

2.2.2.2 Specific description and identification of tilefish essential fish habitat

Eggs and Larvae: Tilefish eggs and larvae have EFH identified as the water column between the 250 and 1200 foot isobath, from United States/ Canadian boundary to the Virginia/North Carolina boundary (Figure 4). Tilefish eggs and larvae are generally found in water temperatures from 46-66°F.

Juveniles and Adults: Tilefish juveniles and adults have EFH identified as benthic waters and substrate between the 250 and 1200 ft isobath, from United States/ Canadian boundary to the Virginia/North Carolina boundary (Figure 4). Tilefish are generally found in rough bottom, small burrows and sheltered areas in water temperatures from 46-64°F.

Finally, the MAFMC solicited input from the public during the public hearing process on Figure 31, on where they perceived EFH for tilefish should be designated. No comments on the specific description and identification of tilefish EFH were received.

The Council continues its support of the Mid-Atlantic EFH Technical Team recommendation for the specific description and identification of tilefish EFH. Tilefish EFH for all life stages is identified as occurring between 250 and 1200 foot isobaths. Cited research and Table 22 show different depth ranges by life stage than the above described EFH depths. Table 22 identifies that eggs are found to roughly 2500 feet, larvae have been found in as little as 150 feet and juveniles and adults have been collected in depths to roughly 1650 feet. The citations in Table 22 are the limits, both maximum and minimal where specific life stages have been collected. The Technical Team's recommendation was not based on the absolute limits of individual collections and this approach was strongly supported by the industry position during the discussions of fishing gear impacts to tilefish habitats. Based on tilefish industry recommendations as to where fishing actually occurred, the Council considered implementing fishing gear restrictions within the subset of EFH of depths between the 300 and 850 foot isobaths. The Council is confident that based on the existing knowledge of tilefish, that the identification and description of tilefish EFH, as between the 250 and 1200 foot isobaths, will be a good first step in delineating and protecting tilefish EFH. As better knowledge becomes available the identification and description of EFH and HAPC is frameworked so the refinement can proceed efficiently in the future.

2.2.2.2.1 Identification of Habitat Areas of Particular Concern

According to section 600.815 (a)(9), FMPs should identify habitat areas of particular concern (HAPC) within EFH where one or more of the following criteria must be met: (i) ecological function, (ii) sensitive to human-induced environmental degradation, (iii) development activities stressing, or (iv) rarity of habitat.

Tilefish are "shelter-seeking and habitat limited." Tilefish habitat meets three of these four criteria, these are ecological function, sensitive to human-induced environmental degradation, and rarity of habitat. As previously stated, the NEFSC trawl survey is not a good indicator of tilefish abundance. In recent years 90% of the tilefish landings have occurred from two different statistical areas, areas

537 and 616. EFH that occurs within these two statistical areas is designated as HAPC for EFH. Specifically, the definition for tilefish HAPC is as follows:

HAPC for juvenile and adult tilefish is substrate between the 250 and 1200 ft isobath within statistical areas 616 and 537.

The Council concluded that with the current level of overfishing this resource is experiencing, that the areas where the vast amount of landings are occurring is where tilefish are likely to be presently concentrated. It is the Council's desire to identify as HAPC the areas of apparent current concentration of the resource. It is hoped that as the resource is rebuilt it will become less geographically concentrated. The Council is not choosing to afford additional protection to the areas identified as HAPC at this time, however, the Council is very sensitive to the possibility that as additional information on the supposed impact from mobile gear to tilefish habitat is better evaluated, that protection of specific habitats may be warranted. Without an attempt to prejudge either future information or the Council decisions, it is logical to note at this time that if specific habitats warranted protection in the future, that the HAPC areas may be the likely candidate areas. It is possible that tilefish habitat outside these statistical areas also serve important ecological functions, is rare and sensitive to human-induced environmental degradation. However at this time the Council decided to focus its identification of the HAPC on where the vast majority of current landings are occurring. As the resource is rebuilt, it will be likely that the areas of landings become more widespread. As the resource is rebuilt, better information on the possible effects of mobile gear impacts to tilefish burrows will be better understood, and then the Council will be able to refine its identification and description of HAPC, as well as re-evaluate the need for fishing gear management measures within the framework process. Frameworking in this FMP is designed to allow rapid response as the level of knowledge improves, which will almost certainly occur as this resource is brought under federal management.

2.2.3 Fishing Activities that May Adversely Affect EFH

2.2.3.1 Background

The Magnuson-Stevens Act requires any FMP prepared by the Councils to identify and minimize, to the extent practicable, adverse effects on EFH caused by fishing (Section 303 (a)(7)). The Act defines fishing as "any activity, other than scientific research conducted by a scientific research vessel, that involves (1) the catching, taking, or harvesting of fish, (2) the attempted catching, taking, or harvesting of fish; (3) any other activity that can reasonably be expected to result in catching, taking, or harvesting of fish; (4) an operation at sea in support of, or preparation for, any activity described in paragraphs (1), (2), or (3) of this definition" (50 CFR 600.10).

Pursuant to 50 CFR 600.815 (a)(3), adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. Examples of adverse impacts include activities that damage or destroy bathymetric structure, degrade substrates thereby reducing habitat quality or limiting quantities of suitable substrate, or remove benthic organisms or whole biological communities. FMPs must include management measures that minimize adverse effects on EFH from fishing, to the extent practicable, and identify conservation and enhancement measures.

Councils must act to prevent, mitigate, or minimize any effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH.

In order to determine the fishing activities that may adversely affect EFH as required by 50 CFR 600.815(a)(3), six factors will be addressed by the Council in its analysis of fishing activities and their potential effects to tilefish EFH: (1) Identification of all fishing gears used in and around EFH of the managed species, as well as those gears used for harvesting other species in the same vicinity; (2) characterize the identified gears by function, size, and use; (3) using best available information, provide a detailed description of the potential impacts to benthic habitats, including physical, chemical, and biological alterations to the substrate, loss and/or injury of benthic organisms, prey species, as well as other components of the ecosystem; (4) assess the impacts from fishing related marine debris and "ghost" gear on EFH of the managed species; (5) determine cumulative impacts of multiple fishing practices on EFH of the managed species; and (6) identify fishing activities that have an adverse effect on the EFH of the managed species based on the conclusions reached in the gear assessment.

2.2.3.2 Fishing Gear Used in the Tilefish Fishery

The directed commercial fishery for tilefish is largely by longline. Otter trawls may also be used, but have limited utility because of the habitat preferred by tilefish. Otter trawls are only effective where the bottom is firm, flat, and free of obstructions. Soft mud bottom, rough or irregular bottom, or areas with obstructions, which are those areas most frequented by tilefish, are not conducive to bottom trawling. However, tilefish are often taken incidental to other directed fisheries, such as the trawl fisheries for lobster and flounder (Freeman and Turner 1977) and hake, squid, mackerel and butterfish (NMFS, unpublished landings data).

Landings data compiled by NMFS indicate that in the 10-year interval of 1988-1997, the average tilefish catch by weight was 93 % by longline and only 7 % by otter trawl (Table 23). Minimal catches were also recorded for offshore lobster pots and sink gill nets.

2.2.3.3 Characterization of Fishing Gears Used in Tilefish EFH

Longline: The general design of the longline is simple, consisting of a main line with a number hooks attached. Main lines are coiled without hooks on a drum until deployed; each end of the main line is attached to an anchor line and fitted with a surface float when deployed. Longlines may be fished at the surface, bottom, or intermediate depths. An advantage of longlines is that few men are needed to work a large number of hooks that can be fished over a wide geographic area (Stansby1963). Tilefish longlines are typically coiled on a drum. The longline is fair-led off the drum and the hooks are snapped onto the line at specified intervals depending upon fishing conditions. During haul-back, the longline is fair-led back to the drum as the hooks are unsnapped (Nolan pers. comm.)

Hook and Handline: Rod and reel is the typical gear used in the recreational fishery. Because tilefish are found in relatively deep waters, electric reels may be used to facilitate landing (Freeman and Turner 1977).

Sink/Anchor Gillnets: Gillnets operate principally by wedging and gilling fish, and secondarily by entangling. The webbing is usually monofilament nylon due to its transparency, but other fibers or

multi-filaments may also used. Anchored sink gillnets are rigged so that the weight of the leadline exceeds the buoyancy of the floatline causing the net to sink to the bottom. Anchors are attached to each end to fix the gear in place. Nets vary in length from 300 to 600 feet, and are typically fished in 10 to 60 feet depths. (DeAlteris 1998).

Pots: A pot is a small, portable, 3-dimensional device that allows the animal to enter the gear voluntarily, but makes escape difficult, if not impossible. The principle of operation of pot gear is that animals enter the device seeking food, shelter, or both. The holding area restricts the animal until the gear is retrieved. Bait is placed in a bag or cage within the pot. Culling rings or escape vents are added to the exterior wall of the pot to allow for the release of undersize sub-legal animals. Finfish, shellfish and crustaceans are all harvested with pots in the estuarine, coastal and offshore waters of the United States.

Clawed lobsters are harvested with pots in the waters of the northwest Atlantic. The pots were previously constructed of wood lath over steam bent frames, but because wood boring bivalves destroy wood, vinyl coated wire pots have replaced them in most cases due to cost factors. The pots are typically divided into two sections. Lobsters enter the pot into the "kitchen area," via either of two funnels in response to the bait, then move into the "parlor" area via a second funnel. Escape vents, sized to minimize the retention of sub-legal lobsters are occasionally installed in both areas of the pot, The pots are fished individually or in "trawls" attached to a mainline in shallow water, and only in trawls of 20-50 pots in deep water. Buoys and lines mark both the single pots, and the ends of the trawls of pots. Fishermen haul pots either by hand in shallow water, or use an hydraulically powered pot hauler in both shallow and deep water, The pot hauler was a significant mechanization introduced into the pot fishery, that allowed for the development of deep water fisheries (DeAlteris 1998).

Bottom Otter Trawl (fish): Otter trawls (a bottom-tending mobile gear) developed as fishermen sought to increase the horizontal opening of the trawl mouth beyond that possible with cumbersome rigid beam trawls. In the late 1880s, Musgrave invented the otter board, a water-plane device that when used in pairs, each towed from a separate wire, served to open the net mouth horizontally and hold the net on the bottom. Initially, all otter boards were connected to the wing ends of the trawl, as they are today in the shrimp trawl fishery. In the 1930s, the Dan Leno gear was developed by Frenchmen, Vigarnon and Dahl, that allowed the otter boards (doors) to be separated from the trawl wing ends using cables or "ground gear." This technology increased the effective area swept by trawl from the distance between the net wings to the distance between the doors. The ground gear can be as long as 600 feet, thus increasing the area swept by the trawl by as much as three fold. It is the spreading action of the doors resulting from the angle at which they are mounted that creates the hydrodynamic forces needed to push them apart. These forces also push them down towards the sea floor. On fine-grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the trawl net (Carr and Milliken 1998).

The bottom trawl net is a funnel-shaped net composed of upper and lower sections joined at seams referred to as "gores". Some bottom trawls also have side panels to increase the vertical opening, and therefore have four seams. The mouth of the trawl net consists of jib and wing sections in both the upper and lower panels. A "square" section forms a roof over the net mouth. The body of the trawl net includes belly sections, leading to the cod-end where the catch is collected. The webbing is attached to a rope frame consisting of a headrope, along the upper panel leading edge, and a footrope, along the lower panel leading edge. The sweep, which tends bottom as the net is towed,

is attached to the footrope. The headrope is equipped with floats that provide buoyancy to open the net mouth vertically, The headrope and footrope/sweep are attached to bridles (also referred to as legs) at the wing ends, that lead to the ground wires and the trawl doors, The sweep also comes in contact with the bottom as it acts to collect fish that lie or congregate before it. The configuration of the sweep can vary considerably and is dependent upon both the bottom type and species of fish targeted (Carr and Milliken 1998).

On smooth bottoms, the footrope may be weighted with chain or leadline, or may be rope wrapped with wire. This is the simplest and lightest sweep, known as a chain sweep. On soft or slightly irregular bottoms, rubber discs (known as "cookies") stamped from automobile tires can be strung along the sweep (Carr and Milliken 1998). On rougher bottoms, rubber rollers or steel bobbins are rigged to the footrope to assist the trawl's passage over the bottom. Both the rollers and the bobbins use small steel or rubber spacers between the much larger roller and bobbins. In New England, the rollers have been largely replaced with "rockhopper" gear, that uses larger rollers that are actually fixed in place, spaced with the smaller rubber discs (Carr and Milliken 1998). This setup enables the trawl to pass over, yet still effectively fish, areas with large rocks and boulders.

A newly developed gear known as "street-sweeper" trawl gear, is constructed of a series of rubber disc spacers and bristle brushes, as found in actual street sweepers. The distinguishing component of this sweep is the brushes made of stiff bristles mounted on a cylinder core, The brush cylinders are up to 31 inches in diameter have smaller diameter rubber disc(s) placed between them. The discs are strung on a cable or chain and aligned in series forming the sweep of the trawl net. This innovation probably allows the trawl to be fished on rougher bottom than any other design and it is lighter than the rockhopper (Carr and Milliken 1998).

The raised-footrope trawl was designed especially for fishing for whiting, red hake, and dogfish. It was designed to provide vessels with a means of continuing to fish for small mesh species without catching groundfish. The configuration consists of a 42 inch long chain connecting the sweep to the footrope, which results in the trawl fishing about 18 - 24 inches above the bottom (Carr and Milliken 1998). The raised footrope keeps the net slightly above the bottom, allowing complete flatfish escapement, and theoretically it is supposed to travel over codfish and other roundfish (whiting and red hake tend to swim slightly above the other groundfish). Carr and Milliken (1998) report that studies have confirmed that the raised footrope sweep has much less contact with the sea floor than does the traditional cookie sweep that it replaces.

Bottom trawl vessels are classified as to the location of the pilothouse, and manner in which the net is set and hauled. Eastern rig vessels handle the trawl gear from the side of the vessel and the pilothouse is located aft of the working deck. Western rig vessels handle the trawl gear over the stern of the vessel and the pilothouse is forward of the working deck. Most western rig or stern trawlers stow the trawl net on a reel located at the stern of the vessel.

Bottom trawl fisheries are directed for demersal species on all coasts of the United States. In the northeast, vessels from 50 to 150 feet in length fish in waters ranging from 30 to 1200 feet in depth. Small mesh nets are used to capture northern shrimp, whiting, butterfish and squid. Large mesh trawls are used to harvest cod, haddock, flounder and other large species, These trawls are typically rigged with long ground wires that create sand clouds on the seabed, herding the fish into the trawl mouth. The largest trawlers, from 150-300 feet in length, catch, process and freeze their products onboard, and are referred to as factory, catcher, and processor trawlers, (DeAlteris 1998).

Otter trawls may be modified to harvest shellfish, such as lobster, crab, and scallop. The characteristics and operation of these trawls are similar to those designed for finfish.

2.2.3.4 Potential Impact of Fishing Activities on Tilefish EFH

One of the most difficult aspects of estimating the extent of impacts on EFH is the lack of high resolution data on the distribution of fishing effort. Fishers are often resistant to reporting effort based on locations of individual tow or sets (for the obvious reason of divulging productive locations to competitors and regulators). Moreover, effort data are required to be reported as one location or statistical area for a trip or each time a vessel changes statistical areas, as opposed to reporting tow-by-tow or set information. Thus, data indicating a vessel's effort and locations may represent a large geographical area (Colosi pers. comm.). However, using this type of data, it has been possible to obtain averages of effort, and subsequent extrapolations of area impacted, for larger regions (Auster and Langton 1998).

Trawling effort in the Middle Atlantic Bight off the northeast United States was summarized by Churchill (1989). Trawled area estimates were extrapolated from fishing effort data in 30 minute latitude x 30 minute longitude grids. The range of effort was quite variable, but the percent area impacted in some blocks off southern New England was over 200% with one block reaching 413%. Estimating the spatial impact of fixed gears is even more problematic. For example, during 1996 there were 2,690,856 lobster traps fished in the state of Maine (Maine Department of Marine Resources, unpublished data). These traps were hauled on average every 4.5 d, or 81.4 times/year. Assuming an 11 ft^2 footprint for each trap, the area impacted was 88 square miles. A lack of data on the extent of the area actually fished makes analysis of the impacts of fishing on EFH in those fisheries difficult (Auster and Langton1998).

Fishery harvest has a range of effects on the benthic habitat and biotic community. Auster and Langton (1998) summarize and interpret the current scientific literature on fishing impacts as they relate to fish habitat. These studies are discussed within three broad subject areas: (1) effects on structural components of habitat; (2) effects on community structure; (3) effects on ecosystem processes. Each type of gear used in tilefish EFH will be evaluated in light of these three potential effects.

Longline: This gear is the principal commercial harvest method accounting for approximately 24.1 million pounds (Table 1), or 93 % of the tilefish catch (Table 23), during the 10-year period, 1988-1997. This gear has minimal detectable impacts to marine habitats. Longlines modify the structural component of the habitat, but the impacts are short-term and temporary. Additionally, deployment and retrieval of anchors result in minimal disturbance to bottom sediments; effects (e.g., increased turbidity) are minimal and ephemeral. Because of the limited length of time this gear is deployed, effects at the community and ecosystem levels are not detectable.

Hook and line: This gear is the principal recreational harvest method for tilefish. Additionally, approximately 1000 pounds of tilefish were landed commercially by hook and line in the 10-year period, 1988-1997. The impacts are more innocuous than longlines (e.g., deployed for shorter periods of time; no anchors).

Sink/Anchor Gillnet: This gear generally is not used in waters deeper than 60 feet (DeAteris1998). However, NMFS documented that approximately 2000 pounds of tilefish were landed commercially

in the 10-year period, 1988-1997 (Table 24), by anchor gillnets. The impacts, similar to those associated with longlines (e.g., minor structural modification; sediment disturbance during deployment and retrieval of anchors), are short-term and temporary.

Lobster pots: An incidental catch of tilefish by pots of less than 1000 pounds was documented for the 10-year period, 1988-1997 (Table 24). Pots produce only minor detectable impacts to the marine environment. Pots modify the structural component of the habitat, but the impacts are short-term and temporary. Sessile and sedentary benthic invertebrates occluded by the footprint of the pot may be suffocated or suffer mechanical damage, thereby resulting in minor decreases in the forage base locally. Additionally, deployment and retrieval of pots result in minor disturbance to bottom sediments; effects (e.g., increased turbidity) are minimal and ephemeral. To put the relative extent of these impacts in perspective, Auster and Langton (1998) estimated that the footprint of a lobster pot occupies approximately 11 feet^2 of bottom, while bottom scraping associated with pot retrieval may affect approximately 33 ft^2/pot. Spatially, the affected area is not significant when compared with that affected by mobile gear, such as described below for otter trawls. Because of the limited length of time this gear is deployed, effects at the community and ecosystem levels are not detectable.

Otter trawls: Bottom-tending otter trawls harvested approximately 2.0 million pounds of tilefish (Table 23), or 7 % of the catch, during the 10-year period, 1988-1997. A directed otter trawl fishery for tilefish was initiated in the late 1940s, but competition and market conditions caused this fishery to cease by the late 1960s (Freeman and Turner 1977). Today, trawl-netted tilefish are harvested primarily as bycatch. Rhode Island and Connecticut are the only states that catch tilefish primarily with the otter trawl. This represents 77.6% and 70.9% of Rhode Island and Connecticut tilefish landings, respectively, from 1988-1997 (Table 25). Tilefish are also an important component of the bycatch in the groundfish fishery, particularly for offshore hake, as well as the squid, mackerel, butterfish fisheries. According to a NMFS port agent in Rhode Island (Chiarella pers. comm.), most of the Rhode Island's tilefish commercial landings are a bycatch from the squid fishery in the Hudson Canyon.

As described previously, the ground gear of otter trawls is designed to increase sweep and create turbidity clouds to aid in herding fish into the net. As a result, the area affected by a single tow of an otter trawl is much larger than the mouth of the net. For example, Carr and Milliken (1998) state, " The ground gear can be as long as 600 feet, thus increasing the area swept by the trawl by as much as three fold." In their study, DeAlteris *et al.* (1998) estimated that the scars left in Narragansett Bay by mobile fishing gear averaged 4 miles in length. Multiplying the swath circumscribed by the trawl's ground gear (width from door to door) times the length of the tow results in an area of impact of approximately 1 mile^2 per tow.

A review of 22 studies all show measurable impacts of bottom-tending mobile fishing gear on the structural components of habitat (e.g., sand waves, emergent epifauna, sponges, coral), when defining habitat at this spatial scale. Results of each of the studies show similar classes of impacts despite the wide geographic range of the studies (i.e., tropical to boreal). In summary, mobile fishing gear reduced habitat complexity by: (1) directly removing epifauna or damaging epifauna leading to mortality, (2) smoothing sedimentary bedforms and reducing bottom roughness, and (3) removing taxa which produce structure (i.e., taxa which produce burrows). Studies which have addressed both acute and chronic impacts have shown these types of effects (Auster and Langton 1998).

Lack of information on the small scale distribution and timing of fishing makes it difficult to ascribe the patterns of impacts observed in field studies to specific levels of fishing effort. Auster *et al.* (1996) estimated that between 1976 and 1991, Georges Bank was impacted by mobile gear (i.e., otter trawl, roller-rigged trawl, scallop dredge) on average between 200-400% of its area on an annual basis, and the sampling data from NMFS observer coverage demonstrated that the distribution of tows was nonrandom. While these data represent less than 5% of overall fishing effort, they illustrated that the distribution of fishing gear impacts is quite variable (Auster and Langton 1998).

Recovery of the habitat following trawling is difficult to predict as well. Timing, severity, and frequency of the impacts all interact to mediate processes which lead to recovery (Watling and Norse 1997). For example, sand waves may not be reformed until storm energy is sufficient to produce bedform transport of coarse sand grains (Valentine and Schmuck 1995), and storms may not be common until a particular time of year or may infrequently reach a particular depth, perhaps only on decadal time scales. DeAlteris *et al.* (1998) studied the impacts of mobile gear in Narragansett Bay, RI, and found that recovery time was influenced by depth and substrate. Sand substrates in shallow water recovered more quickly than mud substrates in deep water, where gear scars were detectable by side-scan sonar for much longer periods of time.

Habitat recovery also depends on the natural history of the affected epibenthic fauna. Sponges are particularly sensitive to disturbance because they recruit aperiodically and are slow growing in deeper waters (Reiswig 1973; Witman and Sebens 1985; Witman *et al.* 1993). In the outer shelf-upper slope waters south of New England where tilefish occur, patches of branching soft corals, such as *Paragorgia arborea, Primnoa resedaeformis, and Pennatula aculeata* (Wigley and Theroux 1981 and Theroux and Wigley 1998), are capable of providing biogenic structure; the first two species can grow relatively large. These branching soft corals are also relatively fragile (and probably slow growing in this plankton-poor environment) and may thus be easily damaged by mobile gear. Many species, such as hydroids and ampelescid amphipods, reproduce once or more annually, and their stalks and tubes provide cover for the early benthic phases of many fish species and their prey (e.g., Auster *et al.* (1996, 1997b). Where fishing effort is constrained within particular fishing grounds, and where data on fishing effort is available, studies which compare similar sites along a gradient of effort have produced the types of information on effort-impact that will be required for effective habitat management (e.g., Collie *et al.* 1996, 1997; Thrush *et al.* in press). Unfortunately, this type of analysis is not available within tilefish habitat.

The role these habitat impacts have on harvested populations is unknown in most cases. However, a growing body of empirical observations and modeling demonstrate that effect can be seen in population responses at particular population levels. For example, Lindolm *et al.* (1998) have modeled the effects of habitat alteration on the survival of 0-year cohorts of Atlantic cod. The model results indicate that a reduction in habitat complexity has measurable effects on population dynamics when the adult stock is at low levels (i.e., when spawning and larval survivorship does not produce sufficient recruits to saturate available habitats). At high adult population levels, when larval abundance may be mediated by habitat, no effect in the response of the adult population to habitat change was found.

The long-term effects of fishing on benthic community structure are not easily characterized. The pattern that does appear to be emerging from the available literature is that communities that are subject to variable environments, and are dominated by short-lived species, are fairly resilient. Depending on the intensity and frequency of fishing, the impact of such activity may well fall within

the range of natural perturbations. In communities which are dominated by long-lived species in more stable environments, the impact of fishing can be substantial and longer term. In cases such as described in Auster and Langton (1998) for Strangford Loch and the Australian shelf, recovery from trawling will be on the order of decades. In many areas, these patterns correlate with shallow and deep, more stable environments. However, water depth is not the only variable that can be used to characterize trawling impacts.

There are few studies that describe fishing impacts on soft muddy bottom communities or deep areas at the edge of the Continental Shelf. Such sites would be expected to be relatively low energy zones, similar to Strangford Loch, and might not recover rapidly from fishing disturbance. Studies in these relatively stable environments are required to pattern fishing impacts over the entire environmental range, but, in anticipation of such results, Auster and Langton (1998) suggested that one should expect a tighter coupling between fish production and benthic community structure in the more stable marine environments . Tilefish are a long-lived species that are found in deep stable environments and are heavily dependent upon complex burrows. These burrow habitats may be more vulnerable to disturbances than shallower less complex habitats.

A number of studies in shallow, semi-closed systems, such as bays and estuaries, have demonstrated measurable impacts to ecosystem processes from mobile gear. Open coastal and outer continental shelf systems can also experience perturbations in these processes. However, the relative rates of other processes may minimize the effects of such disturbances, depending upon the level of fishing effort (Langton and Auster 1998).

Mayer *et al.* (1991) discussed the implications of organic matter burial patterns in sediments versus soils. Their results are similar to organic matter patterns found in terrestrial soils. Sediments are essentially part of a burial system while soils are erosional. While gear disturbance can enhance remineralization rates by shifting from surficial fungal dominated communities to subsurface communities with dominant bacterial decomposition processes, burial caused by gear disturbance might also enhance preservation, if material is sequestered in anaerobic systems. Given the importance of the carbon cycling in estuaries and on continental shelves to the global carbon budget, understanding the magnitude of effects caused by human disturbances on primary production and organic matter decomposition will require long-term studies as have been conducted on land (Auster and Langton 1998).

Another ecosystem impact associated with trawling is alteration of marine food webs. Injured and displaced benthic invertebrates provide short-term increases in available forage for predators not taken in nets, while reduced numbers of predators resulting from harvesting provide an opportunity for the proliferation of prey species in the longer term (Auster and Langton 1998).

Although many of the studies show adverse effects on benthic and epibenthic community structure from bottom tending mobile fishing gears, none of the existing literature discusses or documents specific impacts to subterranean burrow communities such as those utilized by tilefish.

2.2.3.5 Potential Impact of Debris and Ghost Gear on Tilefish EFH

Stationary gear may also cause adverse impacts to fish habitat by becoming ghost fishing gear. This occurs when storms, mobile gear, or boats rip traps, gill nets, and pots from their lines. This lost gear cannot be retrieved and may continue to fish for years (Rhodes 1995). In addition, ghost gill

nets, traps, and pots change the structural component of the habitat. This can be a problem with both commercial and recreational gear. This problem is currently impossible to quantify and the ecosystem effects are difficult to predict. With respect to tilefish, which is a structure-oriented species, ghost gear and other debris of anthropogenic origin may serve to enhance habitat in a similar nature as artificial reefs. Divers have observed tilefish using lobster pots and wrecks as shelter (Steimle *et al.* 1998). Additionally, the hard surfaces provided by such debris provide substrate for the attachment of epibenthic invertebrates, which contribute to local forage bases.

2.2.3.6 Cumulative Impacts of Fishing Activities on Tilefish EFH

Several fishing gears, both fixed and mobile, are used in tilefish EFH. The principal fixed gears are longlines for commercial harvest, and rod and reel for recreational harvest. Incidental fixed gear harvest methods include lobster pots and sink/anchor gill nets. Impacts associated with these gears are considered temporary and short-term. The otter trawl is the documented mobile gear that potentially could affect tilefish EFH most significantly. Its use is directed primarily towards groundfish, squid, and butterfish, with tilefish taken as bycatch. Adverse impacts associated with trawling have been documented for some marine habitats, but not specifically for tilefish EFH.

Based upon some available scientific information (Auster and Langton 1998; DeAlteris 1998; Collie *et al.* 1996), it was inferred for the purposes of the public hearing document that trawling was causing long-term physical adverse impacts to tilefish EFH. It was further implied that in some cases those adverse impacts could have been severe, at least locally. The basis of this conclusion was drawn from previous studies which show that in deep water, soft-bottomed sediments where environmental conditions are relatively stable, the impacts of trawling have resulted in destruction of benthic communities and habitat structure that was slow to recover following the cessation of fishing activity.

The spatial significance of these adverse impacts is not known. In the 3-year period 1996-98, tilefish were landed in 238 trawl vessel-trips, or an average of 80 trips per year. Nevertheless, 90% of this commercial catch was concentrated in statistical areas 616 and 537 in depths at or greater than 600 feet, 100 fathoms (NMFS, unpublished VTR data). Although the number of vessel trips appears low, effort is concentrated in a small area. Unfortunately, the number of tows per trip and the area of bottom habitat affected by each tow is unknown. Insufficient information is currently available to adequately or accurately assess the cumulative impacts of trawl fishing in tilefish EFH.

During the public hearing process, the Council received significant input from both the directed tilefish fishing industry and other fishing industry representatives that bottom-tending mobile gear was not significantly having an identifiable adverse effect on tilefish EFH. The environmental community strongly supported the association that bottom tending mobile gear can destroy bottom structures and that since tilefish are significantly dependent on bottom structure for their burrows, bottom tending mobile gear should be banned in tilefish HAPC.

On 30 September 1999, the Tilefish Technical Team consisting of Council staff, a Council member, NMFS (both NERO and NEFSC) personnel, academics and industry representatives were hosted in a workshop by Dr. Ken Able of Rutgers University to discuss the impacts of fishing gear to tilefish habitat. It was concluded that there is nothing definitively known about tilefish-mobile fishing gear interactions. There is nothing specifically described about the sensitivity of tilefish burrows in the scientific literature. Unquestionably, from submersible vessel research, there are

trawl door patterns observed in areas with tilefish burrows, but how much of an impact the doors have and how quickly tilefish can reopen their burrows, if sediment closed, is completely unknown at this time. It is fully recognized that tilefish are extremely important to maintaining the habitat around their burrows and this is important for the entire demersal community around these burrows. Any short-term or long-term impacts of bottom tending mobile gear specifically to tilefish habitat are unquantifiable at this time. The scientists and industry representatives at this meeting concluded that a research program to answer these questions was the appropriate approach to take. On 23 November 1999 when the Council approved the FMP for Secretarial submittal , they passed the following motion to address this question: "that the MAFMC, NMFS, conservation organizations, and the fishing industry shall join together to design and implement within two years a scientific research program in order to determine if the use of mobile fishing gear is having a deleterious impact on tilefish habitat." The scientific research program will be developed within the near term.

2.2.3.7 Fishing Activities that Adversely Affect Tilefish EFH

As discussed previously, it was inferred through association that the commercial trawl fishery was adversely affecting tilefish EFH based upon studies in somewhat similar habitats. However, insufficient information currently exists to adequately or accurately assess the severity or extent of those adverse impacts upon burrow habitat. It should be noted that tilefish EFH also provides EFH for one or more life stages of 17 other managed species. Of these species, offshore hake, butterfish, squid, and Atlantic mackerel, have narrowly defined EFH in the North and Mid-Atlantic area, most of which overlap with tilefish. Any future management measures implemented to protect tilefish EFH will protect EFH for these species, as well.

2.2.4 Options for Managing Adverse Effects from Fishing

According to section 600.815 (a)(3) Councils must act to prevent, mitigate, or minimize adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH.

Section 600.815 (a)(4) states that, fishery management options may include, but are not limited to: (i) fishing equipment restrictions, (ii) time/area closures, and (iii) harvest limits.

The requirement concerning gear impact management is to the extent practicable given the evidence that the fishing practice is having an identifiable adverse effect. For purposes of the public hearings, the Council concluded that the commercial trawl fishery was adversely affecting tilefish EFH. However, the effort of these bottom tending gears was largely unquantified from data that are presently collected by the NEFSC, as summarized by Auster and Langton (1998). After reviewing the results of the 30 September Tilefish Technical Team meeting at Rutgers, as well as the information provided during the public hearing process, the Council determined that bottom tending gear is not adequately identified as having an adverse effect on tilefish EFH and concurred with the research recommendation. Since no adverse impact has been identified, the Council is not proposing any management measures to minimize the effects of fishing on tilefish EFH. The Council emphasized that while they were not recommending any fishing gear restrictions, or not recommending any management measures *at this time*, they are serious about making appropriate recommendations based upon scientific research designed to address the issue of mobile gear impacts directly to tilefish EFH.

The sensitivity of tilefish EFH to bottom tending gear is the crux of the issue. If bottom tending

mobile gear are destroying the bottom structure of the vertical or possibly horizontal burrows, then these gear should not exist in tilefish EFH.

Tilefish in the South Atlantic (south of the Virginia/North Carolina border) are prohibited from being landed by anything but hook and line gear, spear fishing gear, and sea bass pots.

2.2.5 Identification of Non-Fishing Activities and Associated Conservation and Enhancement Recommendations

NOTE: Sections 600.815(a)(5), 600.815(a)(6), and 600.815(a)(7) are all combined here, in order to better clarify the cause and effect association of actions.

According to section 600.815 (a)(5), FMPs must identify activities that have the potential to adversely affect EFH quantity or quality, or both. Broad categories of activities which can adversely affect EFH include, but are not limited to: dredging, fill, excavation, mining, impoundment, discharge, water diversions, thermal additions, actions that contribute to non-point source pollution and sedimentation, introduction of potentially hazardous materials, introduction of exotic species, and the conversion of aquatic habitat that may eliminate, diminish, or disrupt the functions of EFH.

Multiple-use issues are constantly changing, as are the impacts of certain activities on living marine resources (USDC 1985a). Activities that occur on estuarine and coastal lands and waters and offshore waters may affect living marine resources directly and/or indirectly through habitat loss and/or modification. These effects, combined with cumulative effects from other activities in the ecosystem, may contribute to the decline of some species (USDC 1997a). The following discussion identifies and describes each multiple use issue and the potential threats associated with that issue. The adverse effects to marine organisms and their habitats resulting from any given threat are demonstrable, but usually not presently completely quantifiable. Environmental and socio-economic issues remain to be satisfactorily resolved with regard to impacts on marine organisms and their habitats.

The threats addressed in this section are germane to the entire Atlantic coast. All Council managed species exist outside the geographic boundaries of Mid-Atlantic Council. Knowledgeable NMFS/Council individuals were asked to identify and prioritize non-fishing "perceived" threats. Once this list was complete, the resulting paper was distributed for review via mail, workshops, and conferences. The list is prioritized in regards to (1) perceived threats of habitat managers and others in the environmental community and (2) potential impact to tilefish EFH (Table 26). Information from the ASMFC workshop (Stephan and Beidler 1997) for habitat managers, which included a broad spectrum of constituents, was also used to identify threats.

Measures for conservation and enhancement of EFH

According to section 600.815 (a)(7), FMPs must describe options to avoid, minimize, or compensate for the adverse effects identified in the non-fishing threats section including cumulative impacts (section 2.2.5.6). The Councils are deeply concerned about the effects of marine and estuarine habitat degradation on fishery resources.

The MSFCMA provides for the conservation and management of living marine resources (which by definition includes habitat), principally within the EEZ, although there is concern for manage-

ment throughout the range of the resource. Additionally, the MSFCMA provides [305(b)(3)(A)] that "Each Council may comment on, and make recommendations to the Secretary and any federal agency concerning, any activity authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by any federal or state agency that, in the view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority." [305(b)(4)(B)] "Within 30 days after receiving a comment under subparagraph (A), a federal agency shall provide a detailed response in writing to the Council commenting under paragraph (3)."

The Councils have a responsibility under the MSFCMA to consider the impact of habitat degradation on tilefish. The following recommendations are made in light of that responsibility.

The goal of the Council is to preserve all available or potential natural habitat for tilefish by encouraging management of conflicting uses to assure access by tilefish and maintenance of high water quality to protect tilefish migration, spawning, nursery, overwintering, and feeding areas. Non-water dependent actions are not a concern in tilefish EFH because they are an offshore species. Water dependent activities that may adversely affect tilefish EFH, should be designed using environmentally sound engineering and best management practices to avoid or minimize those impacts. Regardless, the least environmentally damaging alternatives available should be employed to reduce impacts, both individually and cumulatively to tilefish EFH. Finally, compensatory mitigation should be provided for all unavoidable impacts to tilefish EFH.

Also, in general, the USEPA (US Environmental Protection Agency) and states should review their water quality standards relative to tilefish EFH areas and make changes as needed in estuarine and coastal areas. The USEPA should establish water quality standards for the EEZ sufficient to maintain edible tilefish. Finally, water quality standards in tilefish EFH should be enforced rigidly by state or local water quality management agencies, whose actions should be carefully monitored by the USEPA. Where state or local management efforts (standards/enforcement) are deemed inadequate, USEPA should take steps to assure improvement; if these efforts continue to be inadequate, USEPA should assume authority, as necessary.

Specific recommendations for the conservation and enhancement of tilefish EFH are found following discussion of individual habitat threats. The permitting/licensing authority should ensure that the project proponents adhere to the following recommendations.

2.2.5.1 Habitat threats prioritized for tilefish EFH

Many anthropogenic (caused by man) actions threaten the integrity of tilefish EFH. These threats have been prioritized based on the following:

Tilefish are benthic species found in deep waters on the Continental Shelf (Steimle *et al.* 1998). They are opportunistic feeders, and few of their prey items are estuarine dependent (section 2.1.3.12). Tilefish are not found in estuaries, and no estuaries are designated as EFH for tilefish. However, cumulative impacts from estuarine and land-based activities can have negative effects on tilefish EFH in offshore waters.

Based on these considerations, threats that impact water quality and substrate in offshore waters are priority concerns in tilefish EFH (Table 26). The threats may be primary, direct (e.g., physically removing habitat by dredging or filling) or secondary, indirect (e.g., water quality degradation

caused by urban or agricultural runoff). Many of the threats associated with tilefish EFH result in both primary and secondary impacts (e.g., coastal development, dredging and spoil disposal). Collectively, these impacts are "cumulative," which are often synergistic (i.e., the whole is greater than the sum of its parts). Some of the more challenging cumulative impacts are discussed in section 2.2.5.6.

A more detailed discussion of the habitat threats affecting tilefish EFH and other coastal habitats follows. The described threats, and associated enhancement or mitigative recommendations, are related to both direct and indirect impacts. Again, their priority with respect to tilefish EFH is identified in Table 26.

2.2.5.1.1 Energy production and transport

Energy production facilities are widespread along Atlantic coastal areas, and although there is currently no offshore production of oil, there is the threat of future oil production and always the potential for fossil fuel spill during transport.

Coal and oil-fired plants and shore based refineries are served by various sized vessels, which transport the fuels. Transportation of fuels may risk the chance of major oil spills or release of other hazardous materials, increases in automotive emissions, and habitat loss from construction of pipelines (Hill 1996). The excavation of fossil fuels may have adverse effects on biota (Hill 1996).

Exploratory and production drilling and transport of oil and gas resources on the Outer Continental Shelf (OCS) may affect biota and their habitats through the deposition of drilling muds and cuttings. Oil spills resulting from well blowouts, pipeline breaks, and tanker accidents are of major concern. Seismic testing operations can interfere with fishing operations and damage or destroy fishing gear. Contaminants from oil exploration include mostly petroleum hydrocarbons and heavy metals. Effects of hydrocarbon contamination in the water column and sediments may include: mortality of larval fish; mortality from predation due to slower avoidance behavior; bioaccumulation in fish; migration interference for salmon and other anadromous species; and slower maturation of larvae (Howarth 1991). Sublethal effects can cause a decrease in recruitment, as well as complex ecological interactions (Howarth 1991). Cumulative effects of oil on ecosystems include changes in benthic community structure and possible changes in planktonic community structure (Howarth 1991). Oil and gas exploration in the Mineral Management Service's (MMS) Mid-Atlantic, North Atlantic, and South Atlantic lease areas may result in loss or degradation of benthic habitat from the deposition of discharged drilling muds and cuttings. Should production of oil and gas occur in these areas, the transport of the products to onshore storage and processing facilities would pose additional threats to coastal zone and estuarine ecosystems (USDC 1985a).

Measures for conservation and enhancement

A). All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill. Dispersants shall not be used to clean up fuels and hazardous materials unless approved by the USEPA/Coast Guard and fishery agencies.

B). Offshore oil and gas leasing, exploration, and production should be strictly limited and controlled, so as not to degrade tilefish EFH. Onshore facilities assisting offshore oil and gas exploration and development, and secondary development stimulated by OCS development, should not

degrade tilefish EFH.

2.2.5.1.2 Ocean disposal and dredge spoil placement

Ocean disposal of industrial waste products, dredged material, and radioactive wastes degrades water quality and associated habitats. Concentrations of heavy metals, pesticides, insecticides, petroleum products, and other toxic contaminants contribute significantly to degradation of waters off the Atlantic coast. Changes in biological components are a consequence of long-term ocean disposal. Harmful human pathogens and parasites can be found in biota and sediments in the vicinity of ocean dump sites. In addition, shellfish harvesting grounds have been closed because of excessive concentrations of pathogenic and indicator species of bacteria.

Many of the above issues and concerns may also be germane to the dumping of fish and shellfish waste in the ocean. The closure of land based processing plants because of the inability to meet NPDES/SPDES effluent requirements encourages the attempts for at sea disposal. While fishery byproducts may be nutritive in value at certain levels, problems of biological oxygen demand (BOD) increase excessive algal blooms, and concentrations of pathogenic bacteria, may be associated with ocean disposal of fisheries products. Although these impacts may not have a direct impact on tilefish, there may be indirect or synergistic effects that would impact the fragile pueblo village ecosystem.

Disposal of dredged material can create significant impacts in aquatic ecosystems. Historically, dredged material was disposed of by being discharged in designated open-water disposal areas near the dredging site. Because of concern about environmental damage, disposal of dredged material has begun to be tightly regulated (Chytalo 1996).

Excluding the potential of new work being authorized in sensitive habitats, the major problem associated with dredging is disposal of dredged material (spoil). Almost 60 per cent of the spoil generated nationally (approximately 310 thousand metric wet tons) is discharged into estuarine and marine habitats (OTA 1987). This volume can be anticipated to increase as the trend for deeper channels and port expansions escalate.

Although alternatives to in-water disposal have been proposed, such as transporting spoil to inland areas to reclaim strip mines and use as a raw material for manufacturing bricks, only upland disposal in adjacent coastal areas has proven to be practicable. However, as the demand for coastal development increases, the amount of available uplands is diminishing, while the cost of those lands is increasing. Additionally, mounting evidence indicates that long-term use of upland spoil sites cause adverse impacts, such as salinity intrusion in shallow aquifers.

Diked containment islands in estuaries have been effective, cost efficient methods to dispose of dredged material. However, these islands, such as Craney Island in Virginia and Hart-Miller Island in Maryland, require hundreds of acres each for construction. This is an irreversible commitment of estuarine habitat. Consequently, sensitive areas must be identified and avoided. Construction of spoil islands must be restricted to those areas that will have the least impact on estuarine and marine ecosystems. Compensatory mitigation to increase the carrying capacity within the affected estuaries to offset these impacts must also be a requirement of island construction.

More recently, there has been a trend toward the "beneficial use" of dredged material. Some uses

of dredged material can be truly beneficial, while some are merely a trade-off of one habitat type for another, usually at the expense of living marine resources. Some examples of true beneficial uses are by-passing sediments removed from natural littoral processes to down-drift, starved beaches, restoration of structure to depleted oyster reefs, and restoration of eroded wetlands to abate erosion. However, other proposed beneficial uses, such as creating bird breeding islands in shallow water habitats, only deplete valuable fish habitats (Goodger pers. comm.).

Measures for conservation and enhancement

Note: Ocean disposal was a major concern to NMFS habitat researchers and the Council members in the mid to the late 1980s. Through concerted efforts of numerous individuals and agencies, ocean disposal has presently ceased; however, discussions still persist relative to resuming dumping. Should ocean disposal ever become viable again, the Council policy (MAFMC 1990b) should be reviewed.

A). Under no circumstances should there be disposal of contaminated material in tilefish EFH (section 2.2.5.4.D).

B). Ocean disposal of fresh fish waste (i.e., scallop shells and bodies, fish racks, etc.) shall be permitted in areas that are not environmentally at risk. Monitoring of the disposal area will be the responsibility of the discharger if there is credible scientific information that suggest the area is being negatively impacted by the discharge.

C). No dredge spoil placement should take place in tilefish EFH.

D). Construction of spoil containment islands should be avoided in tilefish EFH, except when no practicable alternatives are available. In those exceptional cases when island construction is necessary, sites should be selected that result in the least damaging impacts to tilefish EFH.

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

E). When projects are considered and in review for open water disposal permits for dredged material, state and federal permitting agencies should identify the direct and indirect impacts such projects may have on tilefish EFH.

F). No unconfined disposal of contaminated dredge material, sewage sludge, or industrial waste should ever be allowed in tilefish EFH.

G). Disposal sites should be located in uplands when possible.

2.2.5.1.3 Nonpoint source (NPS) contamination

Nonpoint pollution generally results from land runoff, atmospheric deposition, drainage, groundwater seepage, or hydrologic modification (USEPA 1993). Technically, the term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of “point source” in section 502(14) (40 CFR 122.2) of the Clean Water Act. That definition states:

> The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Nonpoint pollution is the pollution of our nation's waters caused by rainfall or snowmelt moving over and through the ground. Ground water is an important source of surface water and nutrients. The United States Geologic Survey (USGS) has determined that 50% of the water in streams comes from ground water. The amount of ground water varies according to the type of rock and sediment beneath the land surface (USGS 1997). Up to one-half of the nitrogen entering the Chesapeake Bay travels through the ground water (USGS 1997). It is possible that about 10% to 20% of the phosphorous entering the Chesapeake Bay also travels through ground water (USGS 1998). Atmospheric deposition transports about 9% of the nitrogen and 5% of the phosphorous loads to the Chesapeake Bay (Alliance for Chesapeake Bay 1993).

As the runoff moves, it picks up and transports natural and anthropogenic pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters. Major pollutants in runoff include pathogens, nutrients, sediments, heavy metals, oxygen demanding substances, road salts, hydrocarbons, and toxics. Acid precipitation from nonpoint sources are demonstrable problems in Atlantic coastal and estuarine waters (USEPA 1993 and USDC 1985a). In addition, hydrologic modification is a form of nonpoint source pollution that often adversely affects the biological, physical and chemical integrity of surface waters (USEPA 1993). The alteration of natural hydrology due to urbanization, and the accompanying runoff diversion, channelization, and destruction of natural drainage systems, have resulted in riparian and tidal wetland degradation or destruction. Temperature changes result from increased flows, removal of vegetative cover, and increases in impervious surfaces. NPS can be divided into three components, each of which will be discussed separately. Conservation measures will be offered for each component. Tilefish contamination, reported by Steimle *et al.* (1996) is most likely from non-point sources.

2.2.5.1.3.1 Urban NPS

Urban construction is not limited to the shore but also includes inland development that can adversely impact aquatic areas. One of the major problems arising from urban development is the increase in nonpoint source contamination of estuarine and coastal waters. Highways, parking lots, and the reduction of terrestrial and wetland vegetation facilitate runoff loaded with soil particles, fertilizers, biocides, heavy metals, oil products, polychlorinated biphenyls (PCBs), and other material deleterious to aquatic biota and their habitats. Atmospheric emissions resulting from certain industrial processes contain sulphurous and nitrogenous compounds that contribute to acid precipitation, a growing source of concern in some anadromous and fresh water sections of tidal streams.

Nonpoint pollution is incorporated in water, sediments, and living marine resources (USDC 1985a).

Cumulatively, the effects of this environmental insult may have far reaching implications for fisheries resources. Estuarine and riverine plumes entering coastal waters are influenced by global and other dynamic forces. These plumes may remain as discrete water masses flowing close to the coast for hundreds of miles.

The purpose of vegetated filter strips is to remove sediment and other pollutants from runoff and wastewater by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing the amount of pollution entering adjacent waterbodies. The ability of a wetland to act as a sink for phosphorus and the ability to convert nitrate to nitrogen gas through de-nitrification are two examples of the important nonpoint source pollution abatement functions performed by constructed wetlands.

Measures for conservation and enhancement

A). Watershed protection/site development should be encouraged. Comprehensive planning for development on a watershed scale and for small-scale site development, including planning and designing to protect sensitive ecological areas, minimize land disturbances and retain natural drainage and vegetation whenever possible.

B). Pollution prevention activities, including techniques and activities to prevent nonpoint source pollutants from entering surface waters, should be implemented. Primary emphasis should be placed on public education to promote methods for proper disposal and/or recycling of hazardous chemicals, pet waste management strategies, management practices for lawns and gardens, onsite disposal systems (OSDSs), and commercial enterprises such as service stations and parking lots.

C). Watershed management programs of existing developments should be developed that identify the sources, specify appropriate controls, such as retrofitting or the establishment of buffer strips, and provide a schedule by which these controls are to be implemented.

D). Best Management Practices (BMPs) should be employed during urban construction to minimize impacts to tilefish EFH.

E). The release of harmful chemical contaminants should be sequestered at their source thereby preventing their entering the atmosphere and subsequently being deposited in coastal waters.

F). BMPs should be implemented to manage stormwater to minimize the discharge of contaminants that degrade coastal waters or waters flowing into coastal waters. Stormwater should not be allowed to mix with sewage effluents (i.e., combined sewage/stormwater outfalls or CSOs). Where CSOs exist, the systems should be retrofitted to separate the two discharges.

2.2.5.1.3.2 Agricultural NPS

Agricultural development can affect fisheries habitat directly through physical alteration and indirectly through nutrient enrichment and chemical contamination. Fertilizers, herbicides, insecticides, and other chemicals are washed into the aquatic environment via uncontrolled nonpoint source runoff draining agricultural lands. These nutrients and chemicals can affect the growth of aquatic plants, which in turn affects fish, invertebrates, and the general ecological balance of the water body. Additionally, agricultural runoff transports animal wastes and sediments that can affect spawning areas, and degrade water quality and benthic substrate. One of the most serious consequences of erosional runoff is that the frequent dredging of navigational channels results in dredged material that requires disposal, often in areas important to living marine resources (USDC 1985a). Excessive uncontrolled or improper irrigation practices also contribute to nonpoint source pollution and often exacerbate the contaminant flushing, as well as deplete and contaminate ground water.

Agricultural development can significantly affect wetlands. Common flood control measures in low lying coastal areas include: dikes, ditches, and stream channelization. Wetland drainage is practiced to increase tillable land acreage. Wildlife management techniques that also destroy or modify wetland habitat include the construction of dredged ponds, low level impoundments, and muskrat ditches and dikes (USDC 1985a).

Animal waste (manure) includes fecal and urinary waste of livestock and poultry; process water (e.g., from a milking parlor); excess feed, bedding, litter, and soil (USEPA 1993). Pollutants associated with animal wastes include: oxygen-demanding substances; nitrogen, phosphorous, and other nutrients; organic solids; bacteria, viruses, and other microorganisms; and sediments (USEPA 1993). Runoff transporting these wastes and pollutants may result in fish kills; dissolves oxygen depletion; unpleasant odors and appearance; eutrophication; and shellfish contamination (USEPA 1993).

Another source of nonpoint source pollution from livestock is atmospheric deposition. Recent analyses by Rudek (1998 in Rader pers. com.) clearly demonstrate that more than two-thirds (65-90%) of nitrogen excreted by the huge swine concentration in coastal North Carolina is evaporated as ammonia and redeposited within about 65 miles maximum – typically into nutrient sensitive waters, including the Neuse River and Tar-Pamlico Sounds.

Many agricultural fields are poorly drained. To facilitate crop planting and cultivation, elaborate systems of drainage ditches are excavated. These drainage systems are frequently excavated through wetlands and ultimately discharged into natural waterways. Drainage systems serve as conduits transporting fertilizers, pesticides, sediment, and other contaminants that degrade habitat and water quality.

Measures for conservation and enhancement

A). USEPA and appropriate agencies should establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to coastal waters to minimize pesticide, fertilizer, and sediment loads to coastal waters. The effective width of these vegetated buffer strips should vary with slope of terrain and soil permeability.

B). The Natural Resources Conservation Service and other concerned federal and state agencies should conduct programs and demonstration projects to educate farmers on improved agricultural practices that would minimize the wastage of pesticides, fertilizers, and top soil and reduce the adverse effects of these materials on coastal waters (MAFMC 1990a).

The following measures were taken mainly from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

C). Delivery of sediment from agricultural lands to receiving waters should be minimized. Land owners have a choice of one of two approaches: (1) apply the erosion component of the United States Department of Agricultures Conservation Management System through such practices as conservation tillage, strip cropping, contour farming, and terracing, or (2) design and install a combination of practices to remove settleable solids and associated pollutants in runoff for all but the larger storms.

D). New confined animal facilities and existing confined animal facilities over a certain size should be designed to limit discharges to waters of the United States by storing wastewater and runoff caused by all storms up to and including the 25-year frequency storms. For smaller existing facilities, the management systems that collect solids, reduce contaminant concentrations, and reduce runoff should be designed and implemented to minimize the discharge of contaminants in both facility wastewater and runoff caused by all storms up to and including 25-year frequency storms.

E). Stored runoff and solids should be managed through proper waste utilization and use of disposal methods which minimize impacts to surface/ground water. Confined animal facilities required to obtain a discharge permit under the National Pollutant Discharge Elimination System (NPDES) permit program should not be subject to these recommendations.

F). Development and implementation of comprehensive nutrient management plans should occur. The fundamentals of a comprehensive nutrient management plan include a nutrient budget for the crop, identification of the types and amounts of nutrients necessary to produce a crop based on realistic crop yield expectations, and an identification of the environmental hazards of the site. Other items include soil tests and other tests to determine crop nutrient needs and proper calibration of nutrient equipment.

G). Pesticide and herbicide management should minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow of pesticides into water supplies, and improving calibration of pesticide spray equipment. Strategies such as integrated pest management (IPM) should be used. IPM strategies include evaluating current pest problems in relation to the cropping history, previous pest control measures, and applying pesticides only when an economic benefit to the producer will be achieved, i.e., application based on economic thresholds. If pesticide applications are necessary, pesticides should be selected based on consideration of their environmental impacts such as persistence, toxicity, and leaching potential.

H). Livestock grazing should protect sensitive areas, including streambanks, wetlands, estuaries, ponds, lake shores, and riparian zones. Protection is to be achieved with improved grazing management that reduces the physical distance and direct loading of animal waste and sediment caused by livestock by restricting livestock access to sensitive areas through a range of options.

I). Upland erosion is to be reduced by either: (1) applying the range and pasture components of a Conservation Management System, or (2) maintaining the land in accordance with the activity plans established by either the Bureau of Land Management or the Forest Service. Such techniques include the restriction of livestock from sensitive areas through locating salt, shade, and alternative drinking sources away from sensitive areas, and providing livestock stream crossings.

J). Irrigation systems that deliver necessary quantities of water, yet reduce nonpoint pollution to surface waters and groundwater, should be developed and implemented. To achieve this, uniform application of water based upon an accurate measurement of cropwater needs and the volume of irrigation water applied should be calculated. When applying chemicals through irrigation (a process known as chemigation), special additional precautions apply. In state waters, conflicting laws may take precedence. In no case should irrigation be practiced to the point that runoff occurs from the field.

K). Best Management Practices should be implemented to minimize habitat impacts when agricultural ditches are excavated through wetlands that drain to coastal waters.

L). NPDES/ State Pollutant Discharge Elimination System (SPDES) permits in consultation with state fishery agency should be required for agricultural ditch systems that discharge into coastal waters.

M). Acceptable swine waste treatment technologies should be developed to replace current practices which rely upon evaporation or movement through groundwater to dispose of nitrogen (Rader pers. comm.).

N). Nitrogen reduction programs should account for airborne delivery (Rader pers. comm.).

2.2.5.1.3.3 Silvicultural NPS

Federal land management has allowed activities to occur which have degraded riparian and riverine habitat in the national forests, thereby contributing to the decline of marine and anadromous fishes (USDC 1997a). The impacts of forest activities conducted within the framework of these land use plans include effects on marine and anadromous species and significant habitat degradation from timber harvest, road construction, grazing, mining, outdoor recreation, small hydropower development, and water conveyance permitting. These actions have: reduced physical, biological and channel connectivity between streams and riparian areas, floodplains, and uplands; increased sediment yields (leading to pool filling and elimination of spawning and rearing habitat); reduced or eliminated large woody debris; reduced or eliminated the vegetative canopy (leading to increased temperature fluctuations); altered peak flow timing; increased water temperature; decreased dissolved oxygen; caused streams to become straighter, wider, and shallower; and degraded water quality by adding toxic chemicals through mining and pest control. These effects, combined with cumulative effects from activities on nonfederal lands, have contributed to the decline of marine and anadromous fish species (USDC 1997a).

Silvicultural contributions to water pollution has been recognized by all states with significant forestry activities (USEPA 1993). On a national level, silviculture contributes approximately 3% to 9% of nonpoint source pollution to the nation's waters (USEPA 1993). Local impacts of timber harvesting and road construction on water quality can be severe, especially in smaller headwater streams. Studies on forest land erosion have concluded that surface erosion rates on roads often equaled or exceeded rates reported for severely eroding agricultural lands (USEPA 1993). These effects are of greatest concern where silvicultural activity occurs in high-quality watershed areas that provide municipal water supplies or support cold-water fisheries. The USEPA (1993) reported that 24 states have identified silviculture as a problem source contributing to nonpoint source pollution. Some states report up to 19% of their river miles impacted by silviculture. On federal lands, such as national forests, many water quality problems can be attributed to the effects of timber harvesting and related activities (USEPA 1993).

Measures for conservation and enhancement

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

A). Preharvest planning should ensure that silvicultural activities take into account potential nonpoint source pollutant delivery to surface waters. Key aspects of forestry operations relevant to water quality protection that should be addressed include: the timing, location, and design of harvesting and road construction; the identification of sensitive areas or high-erosion-hazard areas; and the potential for additional cumulative contributions to existing water quality impairments.

B). Streamside management areas (SMA) should be established along tilefish EFH and should be managed to protect the water quality of the adjacent waterbody.

C). Delivery of sediment from road construction or reconstruction should be reduced. This is to be accomplished by following the preharvest plan layouts.

D). Existing roads should be managed to prevent sedimentation and pollution from run-off-transported materials. Measures taken can include the use of inspections and maintenance actions to prevent erosion of road surfaces and ensure the continued effectiveness of stream crossing structures. Appropriate actions for closing roads that are no longer in use should also be taken.

E). NPS pollution resulting from timber harvesting operations should be reduced by taking into account the location of landings, the operation of ground-skidding and cable yarding equipment, and preventing of pollution from petroleum products. Harvesting practices that protect water quality and soil productivity can also reduce total mileage of roads and skid trails, lower equipment maintenance costs, and provide better road protection and reduce road maintenance. Appropriate skid trail location and drainage, and proper harvesting in SMAs should be addressed.

F). Impacts of mechanical site preparation and regeneration operations should be reduced, and on-site potential nonpoint source pollution should be confined. Measures such as keeping slash materials out of drainages, operating machinery on the contour, and protecting the ground cover in ephemeral drainages and SMAs should be implemented.

G). Potential nonpoint source pollution and erosion resulting from prescribed fire for site preparation and from methods for suppression of wildfire should be reduced. Prescribed fires should be conducted under conditions to avoid the loss of litter and incorporated soil organic matter. Bladed firelines should be stabilized to prevent erosion, or practices such as handlines, firebreaks, or hose lays should be used where possible.

H). Erosion and sedimentation by the rapid revegetation of areas of soil disturbance from harvesting and road construction should be reduced. The disturbed areas to be revegetated are those localized areas within harvest units or road systems where mineral soil is exposed or agitated such as road cuts, fill slopes, landing surfaces, cable corridors, or skid trails.

I). Pesticide and herbicides should be managed to minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow into water supplies, and improving calibration of spray equipment.

The following recommendations are taken from Murphy (1995):

J). Riparian buffer zones of appropriate size and design should be required on any forested land

adjacent to waterways that include EFH. The buffers should provide all processes that create and maintain fish habitat, particularly shade, stream bank integrity, and recruitment of large woody debris.

K). Enforcement of best forestry management practices for ensuring water quality standards at state and federal levels should be strongly encouraged.

L). Watershed analysis and subsequent watershed planning at the local and state levels should be strongly encouraged.

M). Upland habitat restoration should be encouraged. Restoration of upland habitat should include measures to control erosion, stabilize roads, upgrade culverts for fish passage, and manage watershed uses.

N). Restoration of riparian areas should be encouraged. Restoration goals should restore functions of riparian vegetation by reestablishing mature conifers or other appropriate vegetation.

O). Riparian areas should be revegetated with stable vegetation.

2.2.5.1.4 Shipping

Major ports along the Atlantic coast include those at Miami, Florida; Jacksonville, Florida; Savannah, Georgia; Charleston, South Carolina; Wilmington, North Carolina; Norfolk, Virginia; Baltimore, Maryland; Wilmington, Delaware; Philadelphia, Pennsylvania; New York, New York; Providence, Rhode Island; Boston, Massachusetts; Portsmouth, New Hampshire; and Portland, Maine. These ports handle primarily grains, coal, ores, and manufactured commodities. Some of these ports and many other ports along the Atlantic seaboard (e.g. Gloucester and New Bedford Massachusetts, Rockland Maine, Newport and Point Judith Rhode Island, Hampton-Norfolk Virginia, Ocean City Maryland) also support major commercial and recreational fisheries (USDC 1985a).

The introduction of exotic species and contaminated materials through ballast water release and exchange is an impact of port utilization. Ballast water is used by most ships for stability and maneuverability (Moyle 1991). The water is typically pumped into separate tanks used just for ballast or in empty cargo tanks when departing from port, and discharged when the ship takes on a cargo at another port. Evidence shows that hundreds of species of invertebrates have become established in exotic locales after being transported in ballast water (Moyle 1991). An infamous Atlantic coast example of a ballast water introduction is the zebra mussel (*Orreissena polymorha*).

Another hazard of port utilization is the potential for shipping accidents. Transportation of fossil fuels and other materials may result in major spills of oils and other hazardous materials (Hill 1996). Tributyl-tin, used in commercial anti-fouling paints, was formerly a major concern and has been largely banned, with the notable exception of aluminum hulled vessels (Foerster pers. comm.).

Measures for conservation and enhancement

A). To avoid introducing exotic species and toxic materials, ballast water should be exchanged beyond 200 miles or treated with chlorine or other toxicants. Procedures should be developed for

monitoring ballast water. Factors controlling introduced species should be studied in species' native ecosystems (Moyle 1991).

B). All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill.

C). Dispersants should not be used to clean up fuels and hazardous materials unless approved by the USEPA/Coast Guard after consultation with fisheries agencies.

2.2.5.1.5 Marine mining

Deep ocean extraction of mineral nodules is a possibility for some non-renewable minerals now facing depletion on land. Such operations are proposed for the deep ocean proper, where nodules are bedded on oceanic oozes. Resuspension of these oceanic oozes can affect water clarity over wide areas and, if roiled to the near-surface, could also affect photosynthetic activity. Nodule concentrations have been located along the slope/ocean deep zone in Georgia and the Carolinas (Ludwig and Gould 1988). Such mining activities could potentially affect benthic organisms and their habitats, as well as pelagic eggs and larvae (USDC 1985a).

Marine mining elevates suspended materials at mining sites and turbidity plumes may move several miles from individual sites. Resuspended sediments may contain contaminants such as heavy metals, pesticides, herbicides, and other toxins. Mining also results in changes in sediment type or sediment quality, often over areas measurable in square miles. Deep borrow pits created by mining may become seasonally or permanently anaerobic. Finfish appear to seek out these warmer pockets in the late fall, possibly as a result of declining water temperatures in surrounding area (Ludwig and Gould 1988). It may be important for beach nourishment projects to avoid areas that are rich in clam shells or near other "reef" habitats (Steimle pers. comm.).

Measures for conservation and enhancement

The following are applicable to freshwater situations and are recommendations taken from the NMFS National Gravel Extraction Policy (1996).

A). An integrated environmental assessment, management, and monitoring program should be a part of any marine mining operation, and encouraged at federal and state levels.

B). Plan and design mining activities to avoid significant resource areas (such as consolidated sand ledges and pueblo villages).

C). Plan and design mining activities with minimum area and depth to minimize recolonization times (deep holes should be avoided).

D). Remove material from areas where accumulation is caused by human activities.

2.2.5.1.6 Cumulative impact analysis

According to section 600.815 (a)(6), to the extent feasible and practicable, FMPs should analyze how fishing and non-fishing activities influence habitat function on an ecosystem or watershed scale.

"Cumulative impacts to the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such actions." Several examples of cumulative impacts from non-fishing and fishing threats include wetland losses, nutrient enrichment, eutrophication, toxic algal blooms, and global climate change. These cumulative impacts generally occur in estuarine and inshore areas but these multiple effects can result in adverse impacts to tilefish EFH.

2.2.5.1.6.1 Nutrient Loading

Land use intensification threatens efficient nutrient cycling in many watersheds. Excess nutrients from land based activities accumulate in the soil, pollute the atmosphere, pollute ground water, or move into streams. Healthy watersheds have a reasonable balance of nutrient imports and exports (Aschman *et al.* 1997). Physical characteristics and nutrient loadings of eight of the major mid-Atlantic estuaries are summarized in Table 27. Five of eight of these estuaries have medium to high nutrient loadings. Nutrient inputs include a combination of urban and industrial sources (Mid-Atlantic Regional Research Program 1994). Nutrient to these mid-Atlantic estuaries include sewage input (septic systems and wastewater treatment), industrial wastewater, urban input, agricultural sources, and atmospheric inputs.

Of course while nutrient overloading is a significant problem in many areas, nutrients are necessary for overall productivity. It is speculated by some that chemosynthesis from deep sea trenches is perhaps the largest input of nutrients into the marine system. (Fletcher pers. com.). While world-wide, chemosynthesis may be very important in the oceans' productivity, it does not appear that significant nutrients are contributed from deep sea trenches to areas currently designated as tilefish EFH.

Measures for conservation and enhancement

Nutrient loading is a cumulative impact that results from the individual threats of coastal development, nonpoint source pollution, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid wastes, ocean disposal and aquaculture. Please refer to the above sections for individual measures for conservation and enhancement.

2.2.5.1.6.2 Harmful algal blooms

It is believed that nutrient enrichment of estuarine waters has lead to blooms of noxious dinoflagellates and algae (Mid-Atlantic Regional Marine Research Program 1994). Examples of such dinoflagellates or algae include *Gynodinium breve*, the dinoflagellate that causes neurotoxic shellfish poisoning, dinoflagellates of the genus *Alexandrium*, which cause paralytic shellfish poisoning, *Aureococcus anophagefferens*, the algae which causes "Brown tide", and diatoms of the genus *Pseudo-nitzschia*, which cause amnesic shellfish poisoning (Boesch *et al.* 1997).

Brown tide has been a recurrent problem in Peconic/Flanders and South Shore Bays of Long Island, since 1985 (Suffolk County DOHS 1997). It has also occurred in Narragansett Bay, Rhode Island and Barnegat Bay, New Jersey. Among finfish and shellfish that have been impacted by brown tide, the scallop population in the Peconic Estuary has virtually eradicated (Suffolk County DOHS 1997). The causes of the impact of brown tide are still unknown and may be attributed to toxic, mechanical, and/or nutritional aspects of the organism. However, when brown tide blooms exist at concentra-

tions greater than 200,000 to 250,000 cells per 0.06 cu. in. (1 ml), it reduces light penetration, adversely impacting eelgrass beds which are of critical importance to finfish and shellfish (Suffolk County DOHS 1997). Although macro-nutrients do not cause blooms, they may provide optimum conditions for it.

2.2.5.1.6.3 Global climate change

Global warming, an indirect impact of population growth, is an increased accumulation of carbon dioxide and other gases, such as methane, that trap solar infrared light in the atmosphere causing a warming trend. Although these gases also result from natural processes, excesses originate from industrial and residential sources. Although the issue of global warming is controversial, all models predict some warming, especially in the higher latitudes in the northern hemisphere (Thorne-Miller and Catena 1991).

While the rise of the ocean temperature may not be as dramatic or as fast as the atmosphere, only a degree or two can have a dramatic effect on biological communities (Thorne-Miller and Catena 1991). Another potential affect will be sea level rise caused by the melting of the Arctic tundra and ice cap. Among the possible effects on sea life are: (1) a significant loss of coral reefs, salt marshes, and mangrove swamps unable to keep up with a rapid rise in sea level; (2) loss of species whose temperature tolerance range is exceeded (perhaps an even greater threat to corals than sea-level rise); (3) effects from Tundra runoff including runoff of nutrients and suspended sediments; and (4) saltwater intrusion that wreaks havoc with freshwater ecosystems, including rivers, freshwater marshes, and coastal lowland farm acreage (Thorne-Miller and Catena 1991). Other effects that may result from the melting of the Arctic tundra, include: (1) warmer water species would invade formerly cooler habitats confining cooler habitat species farther north; and (2) physical changes in the Arctic Seas that may have repercussions through oceans worldwide by altering the patterns of circulation, food chains that include valuable fisheries, and climate in other part of the world (Thorne-Miller and Catena 1991).

The Department of Commerce reports that human-generated increases in greenhouse gas concentrations have combined with natural forces to cause unprecedented warming in the Arctic in the 20th century, a phenomenon that could lead to significant changes in the earth's natural environment (USDC 1997b). Between 1840 and the mid-20th century, the Arctic warmed to the highest levels of the past four centuries, causing dramatic retreats of glaciers, thawing of permafrost and sea ice, and changes in terrestrial and lake ecosystems (USDC 1997b). Significant warming in the Arctic, particularly after 1920, may also be related to increased solar irradiance, decreased volcanic activity, and factors internal to the climate system (USDC 1997b).

As a result of changing meteorological conditions and sea level rise, fish habitats, fishery yields, and the industry's shoreline infrastructure could change dramatically (Bigford 1991). The projected average range of global sea level rise over the next century has been adjusted down since the mid-1980's, but still ranges from about 20 to 78 inches (50 to 200 cm). At least three factors will determine the severity of impacts from sea-level rise on natural resources and their habitat: (1) physical obstruction to inland habitat shifts from natural or human barriers; (2) resilience of species to withstand new environmental conditions during periods of erosion-induced transition; and (3) the rate of environmental change (Bigford 1991). Also sea-level rise could affect species distributions and abundance, particularly for estuarine-dependent or wetland dependent species.

2.2.5.7 Legislation and regulations that currently address habitat issues

Many federal laws are designed to regulate activities that have the potential to adversely affect the environment. Frequently, state programs complement those of the federal government. However, it is not the intent of this discussion to provide a comprehensive description of all these programs, but rather focus attention on those that most directly affect fisheries resources and their associated habitats. Those programs in which NMFS participate are emphasized because NMFS is specifically charged with conserving, enhancing, and managing living marine resources and, in concert with the Councils, implementing provisions of the MSFCMA.

Consultative authority is conferred to NMFS by several laws [e.g., Fish and Wildlife Coordination Act (FWCA), the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA)]. These laws require federal agencies to consult with NMFS when proposing to construct, operate, authorize, or fund any activity that may affect resources within the purview of NMFS (e.g., fisheries resources, some marine mammals and endangered species, and their respective habitats). These mandates are essential to NMFS when reviewing proposals requiring permits to modify estuarine and marine habitats, such as those regulated by the Rivers and Harbors Act Section 10/Clean Water Act Section 404 program.

Section 10 of the River and Harbor Act of 1899 authorizes the Army Corps of Engineers (COE) to regulate activities in navigable waters (to mean high water shoreline). Section 404 of the Clean Water Act (CWA), as amended, authorizes COE to regulate the discharge of dredged or fill materials in waters of the United States, including wetlands. USEPA exercises oversight of the corps through establishment of guidelines under Section 404(b)(1) and the ability to veto permit decisions under Section 404(c). The COE must consult with NMFS, and consider any recommendation made by them, before making a permit decision. It is through these recommendations that NMFS has the opportunity to alleviate potential adverse impacts associated with project implementation.

NMFS may also use its consultative authorities when reviewing other activities that can affect aquatic habitats. For example, Section 402 of CWA authorizes USEPA, or delegated states with approved programs, to regulate the discharge of all industrial and municipal wastes (i.e., point source discharges). The USEPA and COE also share regulatory responsibilities under the Marine Protection, Research, and Sanctuaries Act (MPRSA) for the discharge of wastes into ocean waters. The COE specifically regulates the discharge of dredged materials, while USEPA regulates other discharges (e.g., municipal sewage sludge, industrial wastes). MPRSA also directs NOAA to conduct research and establish marine sanctuaries, which have habitat applications, as do elements of the Coastal Zone Management Act (CZMA).

Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requires states with approved Coastal Zone Management Programs to address nonpoint pollution in coastal waters. States must submit Coastal Nonpoint Pollution Control Programs for approval to both the USEPA and the NOAA. USEPA published "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters" to assist states to achieve compliance with CZARA. States failing to comply with Section 6217 may lose part of their federal funding under Section 306 of CZMA and Section 319 of CWA.

Other provisions of CWA enable NMFS to exercise its consultative authorities to conserve and enhance living marine resources and habitat. For example, Section 316 (a) and (b) require power

plants to address and abate thermal pollution, and entrainment and impingement of organisms, respectively, and Section 303 requires states to address water quality holistically by watershed. Total Maximum Daily Loads (TMDLs) are being established for some key pollutants (e.g., some heavy metals, nutrients), however, in most cases have not been established under Section 303. Stream segments within each watershed are then monitored, and abatement plans are developed so that each watershed can be brought into compliance with TMDLs.

Section 320 of the CWA authorizes the National Estuary Program (NEP). Currently, 28 estuaries are included in the NEP nationally; 8 in the Mid-Atlantic. Habitat loss and modification and eutrophication have been identified as major problems affecting Mid-Atlantic estuaries. Comprehensive Conservation and Management Plans (CCMPs) have been developed that address the problems affecting these estuaries, describe measures needed to resolve these problems, and provide implementation strategies. Plans are also developed to monitor the success of plan implementation. NMFS participates on the Scientific and Technical Committees (STACs) and Living Resources Subcommittees (LRSCs) of many of these estuaries recommending research needed to understand estuarine processes and problems, assisting in the development of CCMPs, and facilitating their implementation.

Some laws, such as the Federal Power Act, as amended, provide NMFS with the authority to prescribe mitigative measures (e.g., construction of fish passage facilities) for projects licensed by the Federal Energy Regulatory Commission. In the northeast, prescriptive authority is primarily used to retrofit facilities that injured resources resulting from past actions, such as requiring construction of fishways on existing hydroelectric plants during relicensing evaluations. Other legislation mandating NMFS to mitigate resource injuries through restoration or replacement of equivalent services are found in the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) and Oil Pollution Act.

Additionally, NMFS is involved in programs (e.g., Saltonstall-Kennedy, Anadromous Fish Act) that provide grants for the implementation of studies that contribute to the conservation of fish and habitats, or improve fisheries management.

The MSFCMA interim final rule requires consultation between NMFS and other state and federal agencies regarding EFH. Federal agencies are required to respond to NMFS and Council comments on federal activities, including those that are federally authorized or funded. State and federal agencies are encouraged to coordinate with NMFS and the Council in the early stages of actions to identify potential impacts to EFH.

Other pertinent legislation affecting the protection, conservation, enhancement, and management of living marine resources and habitat can be found in *A Plan to Strengthen the National Marine Fisheries Service's National Habitat Program* (USDC 1996b).

2.2.6 Prey Species

This issue is fully discussed in the ecological relationships section 2.1.3.12.

2.2.7 Research and Information Needs

These seventeen habitat research recommendations are from the Steimle *et al.* (1998) habitat

background document. The Council did not prioritize these seventeen research recommendations relative to tilefish habitat at this time. These habitat research recommendations have been incorporated with the stock assessment research recommendations (section 6) and other identified data and information needs. After implementation of the FMP, the Council looks forward to working with NEFSC and NERO personnel, in addition to academics, to begin addressing the most pressing issues for tilefish management. The Council is however extremely interested in the issue of mobile fishing gear having a potential deleterious impact on tilefish habitat. To this end, the Council actually unanimously passed a motion (November 23, 1999) that stated that: "the MAFMC, NMFS, conservation organizations, and the fishing industry shall join together to design and implement, within two years, a scientific research program in order to determine if the use of mobile fishing gear is having a deleterious impact on tilefish habitat". The Council is seriously interested in tilefish research and has incorporated a set aside quota for scientific research as part of the framework adjustment process (section 3.1.1.7).

1. Are tilefish protogynous (size-related sex change from female to male) at pre-maturation (Dooley 1978; Idelberger 1985; Grimes *et al.* 1988)? If so, how is it affected by the social structure of a local population (sex ratio of mature fish) and how is that affected by fishing?

2. Do tilefish off southern New England leave suitable habitats during the winter and where do they go (Grimes *et al.* 1986)?

3. Assume that the boundaries of tilefish habitat are flexible and dictated by physical (sediments, shelter, temperature), biological (burrow builders, prey, competition, recruitment), and fishery (stock size, harvest intensity, and population size structure) processes. Can a probabilistic model be developed that identifies the size and shape of suitable habitat (after Warner 1986)?

4. Are adult male tilefish territorial? If so, how does the removal by the fishery of large, dominant males effect the social structure of a local population (Grimes *et al.* 1988)?

5. If vertical burrows, the primary habitat of tilefish according to Able *et al.* (1982) and Grimes *et al.* (1986), are filled with loose sediments because of intensive trawling (Churchill 1989), offshore sediment disposal, or a major storm, can the burrows be cleared and reused by the tilefish? By other organisms?

6. What degree of symbiosis or mutualism exists between tilefish and other developers/users of burrow habitats (e.g., galatheid crabs) (Grimes *et al.* 1987)?

7. Do tilefish form long-term associations with individuals of the opposite sex (pair bonds) (Grimes *et al.* 1986)? How does harvesting affect the social structure and breeding potential of the population?

8. Peak activity and feeding in tilefish has been reported to be day (Freeman and Turner 1977) and night (Grimes *et al.* 1987). Peak activity and feeding are usually coincident (for energetic reasons) unless feeding grounds are well away from resting grounds; why the difference in conclusions?

9. The Katz *et al.* (1983) study of stock identification between the Middle and South Atlantic bights did not examine tilefish between Toms Canyon (south of Hudson Canyon) and the border between North Carolina and South Carolina. Do tilefish from Cape Hatteras (e.g., Norfolk Canyon) support

separating the population into two biologically distinct stocks?

10. More information on the age structure of the population in different years are needed to improve estimates of mortality rate and to determine sexual differences in mortality rate (Turner *et al.* 1983).

11. The attributes of habitat that trigger larval tilefish settlement and juvenile transition are unknown. These are especially important for recruitment and maintenance of local, non-migratory populations.

12. The range of environmental parameters for tilefish egg survival and development are unknown.

13. Are tilefish affected by the relatively low levels of anthropogenic contaminants that are in their tissues (Steimle *et al.* 1996)?

14. Do juvenile tilefish aggregate in certain areas? If so, where and what are their characteristics (Freeman and Turner 1977)?

15. Does the oxygen minimum band on the upper slope affect tilefish distribution?

16. Is tilefish cannibalism caused by inadequate shelter habitat for small juveniles or the territoriality of adults? If so, can juvenile shelter and survival be increased artificially?

17. Do juveniles tolerate lower temperatures than adults?

2.2.8 Review and Revision of EFH Components of FMP

In section 600.815 (a)(11), it states that Councils and NMFS should periodically review the EFH components of FMPs, including an update of the fishing equipment assessment. Each EFH FMP Amendment should include a provision requiring review and update of EFH information and preparation of a revised FMP Amendment if new information becomes available.

The Council will amend its FMPs at least every five years as called for in this section, but is also including a habitat framework adjustment provision that can be included in each FMP. Due to the very rapid time constraints of meeting the October-MSFMCA deadline mandated by Congress (with very limited additional funds), it was impossible to include much of the state survey data that will be available in the future, as well as, much of the unpublished literature on contaminants etc. It is important to understand that this EFH is a "work in progress" and that the process will evolve. This framework provision is envisioned to work along the existing framework provisions established for the New England Multispecies FMP by the NEFMC. A similar process is proposed in this FMP for other non-EFH management measures.

The FMP contains identification and descriptions of essential fish habitat and habitat areas of particular concern, estimates of gear impacts on essential fish habitat, and contains recommendations that describe options to avoid, minimize, or compensate for the adverse effects and promote the conservation and enhancement of EFH. In some cases those definitions, estimates, and recommendations are made in general terms because the necessary work on, for example, the specific content and concentrations of organic and inorganic (nutrient) compounds have not as yet been compiled and/or specified by regulatory agencies. The purpose of this framework provision is to incorporate

such specifics into the definitions, estimates, and recommendations as specifics are developed via existing data not available when the FMP was adopted. The framework provision is not to be used to add or delete the conservation and enhancement recommendations, but only to adjust descriptions of EFH (boundaries), habitat areas of particular concern, and revise gear management measures (such as degradable panels and lines).

The Council envisions creating a Habitat Monitoring Committee (HMC) made up of at least staff representatives from the NMFS Northeast Fisheries Science Center, the Northeast Regional Office Management and Habitat sections, the Atlantic States Marine Fisheries Commission, and Chaired by the Council Executive Director or his/her designee. The HMC will meet at the call of the HMC Chair, to develop options for MAFMC consideration on any adjustment or elaboration of any FMP EFH definition or gear impacts of EFH recommendations necessary to achieve the habitat goals and objectives. Based on this review, the HMC will recommend specific measures to revise EFH definitions, revise gear specifications.

The MAFMC, through its Habitat Committee, will review the recommendations of the HMC and all of the options developed by the HMC and other relevant information, consider public comment, and develop a recommendation to meet the FMP's habitat goals and objectives. If the MAFMC does not submit a recommendation that meets the FMP's habitat goals and objectives and is consistent with other applicable law, the Regional Administrator may adopt by regulatory change any option developed by the HMC, unless rejected by the MAFMC or tabled by the MAFMC for additional consideration, provided the option meets the FMP's habitat goals and objective and is consistent with other applicable law. The frameworked process for developing EFH and/or gear impacts will follow the same overall process as that for other non-EFH management measures.

2.3 DESCRIPTION OF FISHING ACTIVITIES

2.3.1. History of Exploitation

The tilefish fishery began in 1879, but collapsed shortly thereafter, with mass mortalities in 1882 (Steimle *et al.* 1998). The stock began to recover in the late 1890s with an abundance of young fish (Bumpus 1899; Steimle *et al.* 1998). The species was again being fished and promoted by the United States Bureau of Commercial Fisheries when catches were first recorded in 1915 (325,000 pounds). A total of 10 million pounds were taken in 1916, which is the largest annual catch to date, but only 10,000 pounds were reported landed in 1920 (USDC 1993a; Figure 7). Freeman and Turner (1977) state that it was the market conditions that dictated the amount of fishing in the early years and not the abundance of tilefish. Landings were low during WW II but then rose during the 1950s to between 3 and 4 million pounds, followed by a decline in the late 1960s to less than 100,000 pounds (Figure 7). Landings immediately after WW II were mainly by otter trawls. Poor prices in the market and increased competition for the available fish on the southern New England grounds from foreign vessels led fishermen away from fishing for tilefish. By the late 1960's tilefish were taken only incidentally with other, more sought after species of fish (Freeman and Turner 1977). Landings increased during the 1970's as the longline fleet developed and peaked in 1979 at 8.7 million pounds (Figure 7). Through the mid 1980's landings were around 4 million pounds, but jumped significantly to 7 million in 1987 and then plummeted to only 1 million pounds in 1989 (Figure 7). In the late 1990's, landings have increased from a low of less than 1.5 million pounds in 1994 to 2.7 million pounds in 1998 (Table 1; Figure 7).

2.3.1.1 Commercial Fishery

2.3.1.1.1 Landings by region

Tilefish landings in 1997 accounted for 0.2% of the total commercial landings from Maine to Virginia (USDC 1998). On average, from 1985-1994, 89.7% of the total commercial tilefish landings came from mid-Atlantic region and only 9.3% from the New England region (Table 28). The percentage of coastal landings by the New England region dropped from 21% in 1985 to a low of 2% in 1991 then rose again to a peak of 19% in 1993. Due to a change in reporting system, commercial landings are not available by region by area for 1995-1998.

At least 99% of all commercial tilefish landings for the States from Maine through Virginia between 1985 and 1994 were caught in the EEZ (Table 28). Only in 1988 and 1993 were more than 1,000 pounds of tilefish recorded as being landed from state controlled waters. However, it is likely that these are misreported landings.

2.3.1.1.2 Landings by state

Available data over the past 50 years indicates that New York had the highest percentage (38%) of the total commercial landings from Maine through Virginia, with New Jersey having the second most (36%, Table 1) . NMFS Unpublished General Canvass (Table 29) data indicates that during the past decade, New York has landed nearly 68%, New Jersey 22%, Rhode Island 8%, and Maine 1% of tilefish from Maine through Virginia (Table 1). No other state during the past decade averaged more than one percent of the total tilefish landings.

2.3.1.1.3 Commercial landings by gear

Tilefish are primarily caught by longline and otter trawl. Ninety-three percent of the tilefish landings during the past decade have been made with longline gear (Table 23). Bottom trawls have landed seven percent of the total over the past ten years. No other gear had any significant commercial landings. During the past decade, the percentage of otter trawl landings for tilefish were the highest in 1993 at 13.1% of the total landings (Table 24).

Rhode Island and Connecticut were the only states whose primary gear for tilefish was otter trawl with 69.8% and 70.7% of their landings, respectively, by that gear during the past decade (Table 25). Longline landings for the two states with the greatest landings were 98.2% of New York's total landings and 99.3% of New Jersey's total landings, during the past decade.

2.3.1.1.4 Commercial landings by statistical area

Nearly three-quarters of the most recent landings were caught in statistical area 537 (Table 30), which includes Atlantis, Alvin, and Block Canyons (Figures 3 and 5). The second most landings occurred in statistical area 616, which includes Hudson Canyon. The third most landings were caught in statistical area 526, which includes Veatch Canyon (Figures 3 and 5). Less than 5% of the total landings were caught in statistical areas 525, 533, 534, and 636 which also include canyons.

2.3.1.1.5 Commercial landings by season

Seasonally, the highest landings of tilefish occur in January through June, with a peak of 3.01 million pounds in March during the past decade. New York, New Jersey, and Rhode Island (states with the three highest landings) show a similar trend in landings throughout the year. The average monthly commercial landing over the past ten years is 2.15 million pounds (Table 2).

2.3.1.2 Recreational fishery

During the fall of 1902, several men sailing out of Stonington, Connecticut, on a pleasure yacht fished the Block Canyon area and caught tilefish (Freeman and Turner 1977). At first they used handlines and caught fish as fast as the bait reached bottom. Later, they used a short piece of longline and also caught a number of tilefish. These men had sailed offshore to verify information on the whereabouts and the abundance of tilefish and the fish they caught were given away (Smith 1905).

The next record of tilefish being caught for recreation or sport was more than 60 years later, in the summer of 1963. The catch was made in the Hudson Canyon area off New Jersey when five anglers caught over 300 pounds in less than a half hour of fishing (Dixon 1974). Except for a few more catches that year and the next, it remained until 1969 before another tilefish was caught by recreational fishermen (Freeman and Turner 1977). Then, a party boat sailing some 90 miles out of Atlantic City, New Jersey, by chance fished a spot along the edge of the continental shelf and caught several specimens. This unusual catch at the time led other party and charter boat captains to try for tilefish. Within less than a year, scores of boats were fishing out of ports from New York and New Jersey. Peak catches (220,000 pounds) were assumed to have occurred in 1974 (Turner 1986) with estimated catch rates for party boats of about 2000 pounds per trip.

Turner (1986) reports steadily decreasing estimated catches by the recreational fishery from 125,00 pounds in 1975 to a low of 6,000 pounds in 1982 (Figure 15). In 1997 (the most recent MRFSS data) there were 3 intercepted trips which stated that tilefish was the primary species being targeted. This suggests that there is not a substantial directed recreational fishery for tilefish. The Council expended extensive efforts (Freeman pers. comm.) to generate interest among former recreational tilefish fishermen to become advisors to no avail.

2.3.1.3 Foreign fishing activities

Turner (1986) reported foreign trawl landings of 11,000 pounds in 1975, peaking at 326,000 pounds in 1978 and decreasing to 26,000 pounds in 1982 (Figure 32). Freeman and Turner (1977) report foreign fishery landings prior to those Turner's landings that begin in 1975. Foreign fishery landings were reduced to zero by the mid 1980s.

2.3.1.4 Length frequencies

Length frequency (Figure 33) of the commercial catch from 1996 and 1997 peaked between 16 and 18 inches (40 - 45 cm). Length frequency from the 1898 longline survey showed a much wider distribution and peaked around 26 to 28 inches (Figure 34). Turner *et al.* (1983) found the proportion of fish in the landings of greater than 28 inches length declined from 71% in 1974 to 16 - 21% in 1980, during which time the longline tilefish fleet was growing and effort was increasing. The current estimate of 3% of the 1996 - 97 landings at lengths of greater than 29 inches is substantially lower than the findings of Turner *et al.* (1983), suggesting a higher current mortality rate.

2.3.2 Economic Characteristics of the Fishery

Commercial landings had a net increase of 260% from 1989 to 1998 (Table 1). Through this period, price showed a slight net increase from $1.75/lb (1998 adjusted) in 1989 to $1.80 in 1998 (Table 31). Exvessel value of United States commercial tilefish landings shows the same trend as the landings (Figure 35). Exvessel value of tilefish neared $4.8 million in 1998 and accounted for 0.5% of the total value of the New England and mid-Atlantic regions combined landings (USDC 1998; Table 31). The highest recorded exvessel value of tilefish was $8 million in 1987 (USDC 1993) when landings were the 6th highest recorded since 1915 (Freeman and Turner 1977; NMFS Unpublished General Canvass data). The mean price in 1998 was $1.80/lb. Peak price over the past decade was $1.91 in 1994 and 1995 (adjusted for 1998; Table 31).

Total exvessel value by state shows the same trends as total commercial landings (Table 32). In 1998, New York had the highest exvessel value at $3.3 million, with a median price of $1.85/lb (Table 32). Maryland fish brought the highest price ($2.07/lb) while Rhode Island fish were the lowest, valued only at $0.61/lb (Table 32).

Seasonally, the months with the highest landings (January through June) had the highest exvessel value, with a peak value of $4.5 million in March. Monthly exvessel value averaged $3.4 million (Table 33).

2.3.3 Port and Community Description

2.3.3.1 Defining What Constitutes a Community

Before beginning with the profiles of the port and community descriptions, a few words are necessary about how community is defined in this FMP. By National Standard 8 requirements, a fishing community must be a geographic entity. This could be either a port/town or a county or some other small geographic division. In this FMP the port/town is the basic unit of analysis. Because in some cases there is a port which serves as the base for fishing activity but most fishermen do not reside directly in that port/town, both owner's home address and primary port of landing for a vessel are discussed. Further, many small towns within the same county share social and economic networks as well as cultural characteristics, making it useful to discuss them as a unit. Thus relevant county and state data will also being highlighted.

In determining who would be examined for impacts two main groups were assumed to be affected: those who are currently commercially landing tilefish (for purposes of these analyses those who landed tilefish in 1998) and those who are obviously affected by the regulations as evidenced by their standing in either the full-time or part-time limited entry category. The first group (those who landed tilefish in 1998) contains 215 vessels. The second group (those who qualified for limited access) contains 50 vessels. Because some vessels both landed tilefish in 1998 and qualified for limited access, when the two groups are combined a total of 250 vessels results. Those who may have caught tilefish in the past but are not currently landing tilefish and did not qualify are not included.

Within the Social Impact Assessment (SIA: section 5) these 250 vessels will be broken out by a variety of categories, including qualification status. For purposes of the community profiles, however, they are broken out only by community. The universe examined in this FMP is all those

who qualified for limited access (50 vessels) plus any additional vessels which landed tilefish in 1998 but did not qualify for limited access (215 vessels). This yields a total of 250 vessels.

The relationship of primary landing port to owner's home town for these 250 vessels is as presented in Table 34).

2.3.3.2 Dependence of Individual Communities on Tilefish as a Percentage of All Fish

There are 31 northeast or North Carolina ports (located in 19 counties) in the NMFS databases which show at least 1 pound of tilefish landed in 1998. These are: Stonington and New London, Connecticut (both in New London County) and the unspecified port of "Other Connecticut; Gloucester (Essex County), and New Bedford (Bristol County), Massachusetts; Ocean City, Maryland (Worcester County); Portland, Maine (Cumberland County); in North Carolina -- Wanchese, Avon, and the combined small ports under "Other Dare -- Stumpy Point, Oregon Inlet, Manteo, Hatteras (Dare County), Morehead City and Beaufort (Carteret County), and Engelhard (Hyde County); Belford (Monmouth County), Long Beach/Barnegat Light and Point Pleasant plus the combined small ports under "Other Ocean -- such as Ship Bottom and Little Egg Harbor (all Ocean County) and Cape May (Cape May County) in New Jersey; Freeport (Nassau County), Montauk, Hampton Bay, Greenport and Mattituck (all Suffolk County) and the unspecified "Other Suffolk in New York; Newport and Tiverton (Newport County) and Point Judith (Washington County) in Rhode Island; and Newport News (City of Newport News County), Virginia Beach (City of Virginia Beach County), Hampton (City of Hampton County) and Chincoteague (Accomac County) in Virginia.

Of these 31, there are 17 ports (located in 9 counties) which show a 0.01% or greater dependence on tilefish either as a percentage of total pounds landed or as a percentage of total revenue from all landings (fishing revenue dependence). All these ports and counties are described at least briefly below in the community profiles.

Only 5 ports, however, have at least a 1.0% fishing revenue dependence on tilefish: Montauk, NY (Suffolk County); Long Beach/Barnegat Light, NJ (Ocean County); Hampton Bay, NY (Suffolk County); the combined ports under "Other Ocean (Ocean County) in New Jersey; and Point Judith (Washington County) in Rhode Island. These are also 5 of the 6 ports with at least a 1.0% poundage dependence on tilefish (though "Other Ocean and Point Judith trade places). The sixth port is Avon (Dare County) in North Carolina. (Avon has less than a 1.0% poundage dependence.)

The description of the North Carolina ports and communities is included here for completeness of the description of the NEFSC data base, however it is assumed that the North Carolina ports are landing tilefish managed under the SAFMC Snapper/Grouper FMP. It is a requirement of this FMP that vessels landing tilefish from this management unit must land tilefish in the northeast/mid-Atlantic states of Maine through Virginia.

It should be noted that only one port (Montauk, NY) has at least a 10% dependence by either poundage or fishing revenue. By revenue it has over a 20% dependence, in fact. Suffolk County overall (where Montauk is located) has a 5-7% dependence, according to whether pounds or dollars are measured (Tables 35 and 36). Ports having 2-10% dependence (either dollars or poundage) are: Hampton Bay, NY; Barnegat Light, NJ and Point Judith, RI.

By county, 9 counties have at least a 0.1% poundage or revenue dependence on tilefish as a percentage of all fish (Table 37). But only 3 counties have at least a 1.0% poundage or revenue dependence

on tilefish. Further, the order of most to least dependence is different depending on whether pounds or dollars are used as the measuring stick. By poundage, Suffolk County in New York is most dependent, followed by Ocean County in New Jersey, and Washington County in Rhode Island. By revenue, the same three appear, but Ocean and Washington switch their order of precedence. Counties showing dependence below the top three but greater than 0.1% are: New London, CT and Newport, RI by poundage -- and Dare, NC; Newport, RI; and New London, CT by revenue.

2.3.3.3 Dependence of Individual Communities on Fishing as a Percentage of All Industries

The dependency levels above are only within the fishing industry. If we look at the total dependence of these communities on fishing in relation to other industries, then a different pattern emerges. We should remember, however, that the fishing dependence numbers above are based on 1998 data while the broader dependence numbers below are based on 1995 data. The counties described below are only those where either the county as a whole or some port within the county has at least a 0.01% dependence on tilefish.

Using IMPLAN (Clay pers. comm.) input-output software, when comparing the total value of commercial fishing sales to the value of all goods and services sold within the county (including fishing), in 1995 only Newport and Washington counties in Rhode Island were as much as 1% dependent on commercial fishing sales (Table 38). Suffolk and Nassau (both NY), and Ocean (NJ) counties are only 0.040%, 0.005% and 0.029% dependent on commercial fishing sales, respectively. Dare County in NC is 0.053% dependent on commercial fishing sales. Of course, these percentages are only for exvessel sales of fish and do not include processors, bait and tackle shops, marine hardware stores, etc. When some of these are added in, the percentages rise.

Table 39 (also based on IMPLAN) adds in fresh and frozen seafood processing, and canned and cured seafood processing. Other sectors such as ice manufacturing, boat building, retail sales, grocery sales are also fishing dependent to some degree but have substantial non-fishing sales as well and thus were not included. However, because there is some degree of fishing dependence associated with these non-included components, all the percentages below in the table 39 should be assumed to be lower bound estimates. Washington County in Rhode Island is 3% dependent, followed by Newport County, RI and Cumberland County, ME at 1%. Dare County in NC is 0.4% dependent, while Suffolk (NY), Ocean (NJ) and Nassau (NY) counties are still very low with 0.02-0.04% dependence.

Using County Business Pattern (CBP) Data from the US Census site, we are only able to look at numbers of employees, numbers of establishments, and annual payroll. However, the payroll numbers for many of the industry sectors in question are confidential at this level -- meaning only partial data are available. Further, even the numbers of employees and establishments is reported as a range for some sectors. Thus, only data on numbers of establishments were used. In this case, if all possible sectors are included, then we see another pattern emerge. (See County profiles below for specific sectors included for each county.)

Carteret County, North Carolina jumps to the top, followed by Newport and Washington counties in Rhode Island (Table 40). Cumberland County, Maine and Dare County, North Carolina drop below New London County, Connecticut. Suffolk, Nassau (NY) and Ocean (NJ) counties remain at the bottom of the list.

Further, absolute economic dependence is not the sole appropriate measure of dependence on fishing. Sometimes, fishing occupies a small but essential place in a portfolio of economic activities occurring in a community. Those involved in fishing often have few other options which will provide them with equivalent remuneration. Further, certain communities have a strong historical and cultural association with fishing which they seek to maintain. To remove or deteriorate this sector would thus have a strong deleterious impact on the social structure of the community, demonstrating its dependence on fishing.

Looking at individual port level dependence (Table 41), Wanchese, NC (Dare County) jumps to the top, followed by Montauk, NY (Suffolk County), Barnegat Light, NJ (Ocean County), Hatteras, NC (Dare County) and then two more Suffolk County ports - Mattituck and Greenport.

2.3.3.3.1 Suffolk County, New York

Suffolk is one of the 62 counties in New York. It is part of the Nassau-Suffolk Metropolitan Area. Its 1997 population of 1,361,138 ranked 4th in the State. [* All income estimates, with the exception of per capita personal income, PCPI, are in thousands of dollars.]

PER CAPITA PERSONAL INCOME

In 1997, Suffolk had a per capita personal income (PCPI) of $30,330. This PCPI ranked 6th in the State, and was 100 percent of the State average, $30,250, and 120 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 4.0 percent from 1996. The 1996-97 State change was 4.3 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Suffolk had a total personal income (TPI) of $41,282,942*. This TPI ranked 5th in the State and accounted for 7.5 percent of the State total. The 1997 TPI reflected an increase of 4.5 percent from 1996. The 1996-97 State change was 4.3 and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Suffolk. In 1997, earnings were 67.2 percent of TPI; dividends, interest, and rent were 17.3 percent; and transfer payments were 15.5 percent. From 1996 to 1997, earnings increased 5.0 percent; dividends, interest, and rent increased 3.3 percent; and transfer payments increased 3.9 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Suffolk increased from $20,897,961* in 1996 to $22,116,323* in 1997, an increase of 5.8 percent. The largest industries in 1997 were services, 28.6 percent of earnings; state and local government, 17.2 percent; and retail trade, 9.3 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing industry from 1996 to 1997 was durable goods manufacturing (8.5 percent of earnings in 1997), which increased 0.7 percent; the fastest was construction (6.1 percent of earnings in 1997), which increased 9.6 percent. (Regional Economic Information Systems, Bearfacts – http://govinfo.library.orst.edu/bfact?9_9_30-

103.nyc).

In 1990 Suffolk County had 1,321,864 residents, allocated among 343,611 families (average family size was 3.4) and 424,623 households. By 1995 the population was estimated to be 1,353,704 and by 1998 to be 1,371,269. According to 1990 Census data in Suffolk County there were 8573 persons employed in agricultural services, forestry and fishing (1% of all employed persons 16 or over). Of these, 101 were captains or other officers of fishing vessels (all white, non-Hispanic males), and 654 were fishers (all male, 650 non-Hispanic white and 4 non-Hispanic black).

According to a 1997-98 survey of private sector firms in the county, conducted by the Suffolk County Department of Labor (DOL) and the Private Industry Council, 96.8% of firms responding (response rate was 45.5%) expected their employment to remain stable or expand over the following year. Manufacturing and finance, insurance and real estate were the most optimistic sectors. The largest industry in the county is services, with 35.9% of private sector jobs. In agriculture, forestry and fishing 96.8% of firms expected increasing or stable employment, while 3.2% expected decreases (http://www.co.suffolk.ny.us/labor/EmployerSurvey97-98.html).

Occupations expected to be in demand were: sales representative-agent, truck driver, auto-truck mechanic, engineers, carpenters (144 jobs), construction laborers (141 jobs), HVAC mechanics, plumbers, electricians, dental assistants, physical therapists, registered nurses, and home health aides. Three percent of needed employees (293 persons) were in agriculture, forestry and fishing, but only 4 fishermen, 1 fish packer/cutter, 13 marina workers, and 9 boat/marine mechanics were listed. The industry with the most difficulty in finding qualified personnel was the services industry, followed by retail trade and then manufacturing. Average hourly wages in agriculture, forestry and fishing were reported to be $9.84 per hour. Construction jobs averaged $12.19 per hour and manufacturing $11.96 per hour. Retail trade averaged only $7.96 per hour. However for the one firm reporting as employing fishermen, average wages per fisherman were $24 per hour and for the one firm employing licensed seamen wages averaged $29 per hour. This is considerably higher than plumbers who received $13.73 per hour, carpenters who received $13.26 per hour, machinists $13.29 per hour, boat/marine mechanic $11.83 per hour, truck-van drivers $9.87 per hour, construction laborers $9.60 per hour or marina workers $8.29 per hour. By employer zip code, 53 of the needed jobs (based in 27 firms) were located in Hampton Bay and 27 jobs (in 16 firms) were in Montauk.

According to CBP data for 1997, agricultural services, forestry and fishing account for 1% of employees, 3% of establishments and 1% of annual payroll (Table 42). When fishery-dependent industries are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data (see footnote on Table 43). Overall, 90% of establishments in Suffolk County employ only 1-19 employees; within agricultural services, forestry and fishing this ratio is 97%.

Of the 481,317 housing units in the county, 12% were empty in 1990 -- 7% because they are primarily used for seasonal, recreational or occasional use. Of the occupied units, 20% were rentals.

In 1990, 81% of all residents had been born in the state of New York and the next largest group (4%) were born in the northeast United States. Further 68% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 20% were living in a different house in 1985 but still within Suffolk County, and 9% were living in a different house but still in

New York.

In 1990, the racial composition of Suffolk County was 90% white, 6% black and 4% other groups. Of those other groups the largest number were Chinese and then Asian Indian. Further, 7% of all persons were of Hispanic origin. When reporting first ancestry, Italian was the largest group (24%); this was followed by German (16%) and Irish (16%), and then "Race or Hispanic origin groups"(10%). The vast majority of persons age 5 years and over speak only English (92%), and only 2% of households are classified as linguistically isolated.

In 1990, 33% of county residents aged 25 and over were only high school graduates and 13% held only a bachelor's degree. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 685,482 -- with a 6.2% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 447,152. According to the 1997 CBP, there were 478,793 employees and 41,084 establishments. According to the Bureau of Economic Analysis, Regional Economic Information System, in 1997 there were 672,001 total employees in the county including both full- and part-time employees, and 111,932 proprietors.

In 1989 the median *household* income was $49,128 with the median family income at $53,247 and the median non-family income at $24,016. The *per capita* income in 1989 was $18,481. Only 5% percent of persons for whom poverty status was determined (98% of all residents) had 1989 income below the poverty line. In 1996 the median *household* income was estimated to be $52,080, and 7.4% of the county's population was estimated to be living in poverty.

Port of Montauk

In 1990 Montauk CDP had 3,001 residents, allocated among 817 families (average family size was 2.87) and 1,284 households. According to 1990 Census data there were 151 persons employed in occupations of agricultural services, forestry and fishing (9% of all employed persons 16 or over), though only 139 persons are listed within the industry category of agriculture, forestry and fishing.

Of the 3,984 housing units in Montauk, 69% were empty in 1990 -- 91% because they are primarily used for seasonal, recreational or occasional use. Of the occupied units, 29% were rental units.

In 1990, 70% of all residents had been born in the state of New York and the next largest group (14%) were foreign born. Of persons age 5 and over 58% were living in the same house in 1990 that they had occupied in 1985. An additional 25% were living in a different house in 1985 but still within Suffolk County, and 9% were living in a different house but still in New York. In addition, 65% of all workers 16 and over worked in their place of residence, while 90% worked in their county of residence.

In 1990, the racial composition of Montauk was 98% white, 1% black and less than 1% of any other group. Further, 7% of all persons were of Hispanic origin. When reporting first ancestry, German was the largest group (20%); this was followed by Irish (17%) and Italian (10%), and then "race or Hispanic origin groups" (8%). The majority of persons age 5 years and over speak only English (82%), and only 1% of households are classified as linguistically isolated.

In 1990, 35% of port residents aged 25 and over were only high school graduates and 13% held only

a bachelor's degree. In 1989 the median *household* income was $31,849 (almost a third lower than the Suffolk County average) -- with the median family income at $39,292 (almost a quarter below the county average) and the median non-family income at $22,417 (only 7% lower than the county average). The *per capita* income in 1989 was $20,502 (11% higher than the county average). Only 3% percent of persons for whom poverty status was determined (98% of all residents) had 1989 income below the poverty line.

Montauk is an isolated community at the tip of Long Island, New York. Dyer & Griffith (1996) classify it as a "Small Scale Natural Resource Community" because of its limited industrial base. According to the 1990 census (Table 44), the largest employment sector is retail trade, followed by personal services, construction and "Other professional and related services."

In Montauk, baymen originally fished for subsistence and barter using weirs and inshore seine nets. The vessel of choice was the piragua, a small sail- powered craft for fishing in nearshore bays and inlets. Shellfish fishing was also important and remains a seasonal summer activity. Although baymen have disappeared in Montauk, some still follow this simple lifestyle in nearby Shelter Island, Snug Harbor and Freeport.

Shore seining for menhaden ("bunkers") was an early commercial activity that supported over thirty "seine gangs" in the early 1800s. Shore gangs were replaced at the turn of the century by menhaden steamers using haul seines. Women used to play an important part in the fishery by helping out with the beach (seining for alewives). They also worked in marketing and processing of bunkers. Bunker factories made millions for their owners, and fish were converted into fish meal, fertilizer, and oil. Local menhaden stocks were eventually depleted, and the bunker industry lasted until 1968 when the last fish factory -- the Promise Land, closed.

Despite the closure of the bunker factories and a small groundfish fleet, Montauk remains New York state's most important commercial fishing port. A large portion of the catch, which also includes 10 percent of the *Illex* and *Loligo* squid landings in the northeast, is sold for export (Dyer and Griffith 1996).

Commercial and recreational fishing are the primary activities in Montauk, with the community business sector being geared to servicing these two fishing sectors. The summer season is also important for tourists, and summer rates for hotels and other seasonal housing reflect this.

A local community leader in the recreational sector estimated that 100 resident families make their living in recreational fishing services (Clay pers. comm.). With 24 estimated commercial vessels averaging three crew each, there are approximately 72 families that are directly dependent on the production side of commercial fishing. (Seventy two fishermen does not necessarily mean 72 separate families.) This does not include those in the processing, transportation, and infrastructure support sector (e.g., fish market owners/operators, dock workers, welders, fish processors, carpenters: Dyer and Griffith 1996).

"The winter community is small and insular, consisting of commercial fishers and their families, small businesses, and local charter boat owners/operators. Some of the recreational fishers will overwinter in Montauk or nearby East Hampton. Many others will drydock their vessels and spend the winter months elsewhere. The height of the fishing season begins around mid-March after Saint Patrick's Day, which is marked by a celebration of the rites of spring and the renewal of fishing.

Fishing is most active June to September, and least active December to February. The winter fishery targets tilefish, pollock and cod along the shelf. In the summer, a large charter boat fleet goes after tuna. A summer fishery for yellowfin, bluefin, and big eye tuna is conducted by a day and charter boat fleet (Table 45). The importance of the recreational sector has been steadily growing as recreational fishing pressure increases and as some commercial fishers convert their boats for charter fishing and whale watching (Dyer and Griffith 1996).

Montauk is also home of a productive tilefish fleet. Tilefish are caught during the fall and winter months by longline in deep water at the edge of the continental shelf. Montauk led the northeast in tilefish landings in 1993 with 2,200,000 pounds valued at $2.75 million. Tilefish are sold in restaurants in New York or bought by the Japanese to make sashimi. One tilefish operation consisted of three boats owned by two brothers. Each boat had two crews of three deckhands and a captain. They would fish the deep water valleys off of New Jersey for ten days, return, and rotate out with another crew (Dyer and Griffith 1996). In 1998 tilefish landings in Montauk were again the highest in the northeast, with landings of 1,388,905 valued at $2,569,783. Montauk has three docks run by three fish houses, of which one primarily handles tilefish, one handles groundfish and lobster boats in the summer, and one handles draggers (McCay *et al.* 1993).

The docks are a couple of miles away from the town's main street. Around the docks are a number of associated industries such as restaurants, fish markets and marinas, with most of these businesses closed for the winter season. There are four marinas, three party boats and eight charter boats with posted telephone numbers at the Chamber of Commerce. Marinas which cater to the recreational sector include the Montauk Marine Basin, the Montauk Yacht Club, Uihlien's Marina and Boat Rental, and West Lake Fishing Lodge. Commercial vessels are located at two city docks opposite each other on the harbor. One is located near two fish markets and one next to the Coast Guard station.

Most of Montauk's fish are packed out at four commercial facilities: Inlet Seafood, a fishing cooperative; Gosman's Dock; Montauk Fish Dock; and Deep Water Seafood. Except for Inlet Seafood, which opens after Saint Patrick's Day for the spring-summer season, there is little local processing and sale of fish. Some fish does go to local restaurants during the summer. The commercial catch is shipped to Fulton's Fish Market in New York City. Fish are generally shipped whole frozen. In the past, there have been problems with the legitimacy of the market. Although a precise number of boxes (of fish) were sent to Fulton, Fulton claimed to receive a lesser amount in many instances. One key respondent noted: "those practices have changed since the government take-over of the market. There are few marketing alternatives for fishers, and Fulton's continues to be the primary destination.

Areas previously dominated by baiting shanties near the state docks are taken over by whale watching and charter boat operations. Baiting longlines is now carried out on board by deckhands.

“Fifteen years ago there used to be bait shanties here, but now they are all gone. You can see the whale watching and charter boats all along the docks where the bait shanties used to be. We used the bait to fish longlines. Now, we fish for squid and bait our hooks by hand on board. We fish deep water for squid and tilefish, because the other species such as flounder are played out. Most of the inshore fish are gone." --Commercial Fisher (Clay pers. comm.).

In February of 1996, a total of 18 of the commercial fleet of medium to large scale vessels ranging

from 32 to 90 feet were counted at the dock, and another six reported out fishing. All commercial vessels observed were trawlers with the exception of two lobster vessels. Party boats, tuna head boats, and whale watching boats dominated the drydock area. In 1998, there were 188 vessels which landed fish or shellfish in Montauk according to the NMFS Commercial Landings database.

Fishing effort off Montauk and on commercial stocks targeted by Montauk fishers (e.g., *Loligo*) is increasing somewhat from migration of vessels from other ports since the closure of portions of the Georges Bank. This has caused some concern and conflict between local fishers and these "outsiders" (key respondents -- two commercial fishers). A key respondent reported that the large boats from the New England fishery now fishing out of Ocean City, Maryland are directly competing with the Montauk fleet for whiting, squid and other species.

There has been a transition from commercial to charter boat/recreational fishing with the decline of local fishery stocks. Part of this conversion includes a shift of effort into tuna fishing, which is seen as a viable alternative as groundfish fishing has become less lucrative in the Long Island Sound.

"I switched over to tuna because it is easier to make money. You can make a lot of money catching tuna, and you don't have the same overhead as with groundfish. Also, if you take out guests on charter, they don't have to catch a fish to be happy." -- Former Captain of Groundfish Fishing Vessel (Dyer and Griffith 1996).

Avoiding pollution and abiding by nearshore restrictions means longer trips at greater distances offshore. Fishing farther offshore has increased risk for those who traditionally fished the Sound, and two local baymen died at sea in 1993 while fishing far from shore. Traditional fishing cycles of 2-4 days were tied into "making market". With trip lengths increasing to 5 days or more, including greater transit distance and costs to reach the grounds, it has made earning an income more unpredictable. A local crewman explains: "We have to fish with the cycles - when markets open up to buy fish -- if we can't do this it makes it difficult to make a living - your income becomes very erratic".

In response to such events and economic concerns over fishing families, the Montauk Emergency Fishermen's Fund was initiated in 1993. The purpose of this fund is "to take care of fishermen and their immediate families who experience loss of life at sea, medical hardship, or severe economic hardship"(Dyer and Griffith 1996).

Communication with management was expressed as a lack of understanding of what fishers and fishing was all about. Interviews with local commercial fishers indicated a frustration with the management process, and that fishers felt their concerns were ignored even when they did have a chance to speak (Clay pers. comm.).

"We hold our local meetings in a room above the firehouse. When the state reps come by to listen to us, they nod their heads a lot but nothing is ever done about our concerns. We don't see the situation the same- there are more fish out there than they say. Those public hearings are just a rubber stamp so they can go ahead and do whatever they want anyway (Dyer and Griffith 1996).

Given the isolation of Montauk, with few options other than marine resource utilization, this community is highly dependent on sustaining its commercial fishing enterprise. As in other secondary ports in this study, the commercial groundfish fishing sector in Montauk does not appear

to be expanding, nor does it appear to be reproducing itself through replacement of old vessels with new, increased processing capacity, or increasing social yield (the number of fishers who sustainably participate). Declines in all of these areas are being hastened by the growth of the recreational sector, increasing fishing costs, pollution impacts on stocks, and regulatory restrictions. Yet, the expansion of fishers into new fisheries such as tilefish, and switching to tuna fishing and other strategies (e.g., whale watching) has given the commercial fishing community more flexibility than in larger ports such as Gloucester (Dyer and Griffith 1996).

Port of Hampton Bay

In 1990 Hampton Bay CDP had 7,893 residents, allocated among 2,095 families (average family size was 2.94) and 3,243 households. According to 1990 Census data there were 116 persons employed in occupations of agricultural services, forestry and fishing (3% of all employed persons 16 or over), though there were 133 employed in agriculture, forestry and fishing industries (Table 46).

Of the 5,227 housing units in the port, 37% were empty in 1990 -- 82% because they are primarily used for seasonal, recreational or occasional use. Of the occupied units, 28% were rental units.

In 1990, 81% of all residents had been born in the state of New York and the next largest group (7%) were born in the northeastern United States Of persons age 5 and over, 62% were living in the same house in 1990 that they had occupied in 1985. An additional 23% were living in a different house in 1985 but still within Suffolk County, and 9% were living in a different house but still in New York. In addition, 30% of all workers 16 and over worked in their place of residence, while 90% worked in their county of residence.

In 1990, the racial composition of Hampton Bay was 98% white, 1% black and less than 1% of any other group. Further, 2% of all persons were of Hispanic origin. When reporting first ancestry, Irish was the largest group (20%); this was followed by German (17%), Italian (16%), and English (9%). The vast majority of persons age 5 years and over speak only English (93%), and only 2% of households are classified as linguistically isolated.

In 1990, 34% of port residents aged 25 and over were only high school graduates and 12% held only a bachelor's degree. In 1989 the median *household* income was $35,736 (almost a quarter lower than the Suffolk County average) with the median family income at $41,676 (over 20% below the county average) and the median non-family income at $21,023 (only 7% lower than the county average). The *per capita* income in 1989 was $18,249 (almost exactly the county average). Only 6% percent of persons for whom poverty status was determined (98% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by educational services and public administration.

Port of Greenport

In 1990 Greenport village had 2,070 residents, allocated among 542 families (average family size was 2.97) and 875 households. According to 1990 Census data in Greenport there were 54 persons employed in occupations of agricultural services, forestry and fishing (5% of all employed persons

16 or over), though there were 39 employed in agriculture, forestry and fishing industries (Table 47).

Of the 1,134 housing units in the village, 24% were empty in 1990 -- 62% because they are primarily used for seasonal, recreational or occasional use. Of the occupied units, 44% were rental units.

In 1990, 77% of all residents had been born in the state of New York and the next largest group (8%) were born in the Southern United States. Of persons age 5 and over, 61% were living in the same house in 1990 that they had occupied in 1985. An additional 25% were living in a different house in 1985 but still within Suffolk County, and 6% were living in a different house but still in New York. In addition, 47% of all workers 16 and over worked in their place of residence, while 96% worked in their county of residence.

In 1990, the racial composition of Greenport village was 84% white, 16% black and less than 1% of any other group. Further, 4% of all persons were of Hispanic origin. When reporting first ancestry, "race or Hispanic origin groups" was the largest group (16%); this was followed by Irish (15%), then German and English (14% each). The vast majority of persons age 5 years and over speak only English (94%), and only 2% of households are classified as linguistically isolated.

In 1990, 36% of village residents aged 25 and over were only high school graduates and 9% held only a bachelor's degree. In 1989 the median *household* income was $25,562 only half the Suffolk County average with the median family income at $29,643 (44% below the county average) and the median non-family income at $17,961 (a quarter lower than the county average). The *per capita* income in 1989 was $14,002 (A quarter lower than the county average). Nearly 12% percent of persons for whom poverty status was determined (99.8% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by health services and construction.

Port of Mattituck

In 1990 Mattituck had 3,849 residents, allocated among 1,126 families (average family size was 3.08) and 1,519 households. According to 1990 Census data in Mattituck there were 103 persons employed in industries of agricultural services, forestry and fishing (6% of all employed persons 16 or over), though there were only 80 employed in agriculture, forestry and fishing occupations (Table 48).

Of the 2,191 housing units in the town, 33% were empty in 1990 -- 86% because they are primarily used for seasonal, recreational or occasional use. Of the occupied units, 16% were rental units.

In 1990, 85% of all residents had been born in the state of New York and the next largest group (5%) were born in the northeastern United States. Of persons age 5 and over, 64% were living in the same house in 1990 that they had occupied in 1985. An additional 20% were living in a different house in 1985 but still within Suffolk County, and 5% were living in a different house but still in New York. In addition, 26% of all workers 16 and over worked in their place of residence, while 96% worked in their county of residence.

In 1990, the racial composition of Mattituck was 98% white and less than 1% of any other group.

Further, under 1% of all persons were of Hispanic origin. When reporting first ancestry, German was the largest group (24%); this was followed by Polish (20%), Irish (17%) and English (11%). The vast majority of persons age 5 years and over speak only English (93%), and only 3% of households are classified as linguistically isolated.

In 1990, 38% of village residents aged 25 and over were only high school graduates and 2% held only a bachelor's degree. Another 24% had some college. In 1989 the median *household* income was $36,415 (only 74% of the Suffolk County average) with the median family income at $44,688 (84% of the county average) and the median non-family income at $22,159 (92% of the county average). The *per capita* income in 1989 was $17,511 (95% of the county average). Four percent of persons for whom poverty status was determined (99.6% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by education al services and health services.

2.3.3.3.2 Nassau County, New York

Nassau is one of the 62 counties in New York. It is part of the Nassau-Suffolk Metropolitan Area. The 1997 population of 1,299,485 ranked 5th in the State.

PER CAPITA PERSONAL INCOME

In 1997, Nassau had a per capita personal income (PCPI) of $39,691. This PCPI ranked 3rd in the State, and was 131 percent of the State average, $30,250, and 157 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 4.2 percent from 1996. The 1996-97 State change was 4.3 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Nassau had a total personal income (TPI) of $51,578,265*. This TPI ranked 3rd in the State and accounted for 9.4 percent of the State total. The 1997 TPI reflected an increase of 4.2 percent from 1996. The 1996-97 State change was 4.3 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Nassau. In 1997, earnings were 62.9 percent of TPI; dividends, interest, and rent were 23.6 percent; and transfer payments were 13.6 percent. From 1996 to 1997, earnings increased 4.6 percent; dividends, interest, and rent increased 3.1 percent; and transfer payments increased 3.9 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Nassau increased from $25,386,409 (All income estimates with the exception of PCPI are in thousands of dollars.) in 1996 to $26,642,198 in 1997, an increase of 4.9 percent. The largest industries in 1997 were services, 37.4 percent of earnings; state and local

government, 12.1 percent; and finance, insurance, and real estate, 11.5 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was finance, insurance, and real estate, which increased 1.5 percent; the fastest was wholesale trade (8.3 percent of earnings in 1997), which increased 5.8 percent. (Regional Economic Information Systems, BEA, Bearfacts http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/36/36059.htm)"

In 1990 Nassau County had 1,287,348 residents, allocated among 346,790 families (average family size 3.3) and 431,148 households. By 1995 the population was estimated to be 1,305,772 but by 1998 to be only 1,302,220. According to 1990 Census data in Nassau County there were 5,202 workers employed in farming, forestry and fishing; of these there were 14 captains or other officers of fishing vessels (all white, non-Hispanic males), and 57 fishers (all male, 40 non-Hispanic white and 17 non-Hispanic black).

Agricultural services, forestry and fishing account for 1% of employees, 2% of establishments and 1% of annual payroll (Table 49). When fishery-dependent industries (Table 50) are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 90% of establishments in Nassau County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 97%.

Of the 446,292 housing units in the county, only 3% were empty in 1990. Of the occupied units, 20% were rental units.

In 1990, 77% of all residents had been born in the state of New York and the next largest group (13%) were foreign born. Further 72% of persons 5 age and over were living in the same house in 1990 that they had occupied in 1985. An additional 15% were living in a different house in 1985 but still within Nassau County. In addition, 14% of all workers 16 and over worked in their place of residence, while 60% worked in their county of residence.

In 1990, the racial composition of Nassau County was 87% white, 9% black and 3% Asian (primarily Asian Indian and Chinese) and less than 1% other groups. Further, only 6% of all persons were of Hispanic origin. When reporting first ancestry, Italian was the largest group (21%); followed by Irish (14%), German (12%), "Race or Hispanic origin groups" (10%), and Russian (6%). The vast majority of persons age 5 years and over speak only English (83%), and only 3% of households are classified as linguistically isolated.

In 1990, 84% of county residents were only high school graduates and 30% were only college graduates. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 672,423 with a 5% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 523,126. According to the 1997 CBP, there were 525,084 employees and 45,981 establishments.

In 1989 the median *household* income was $54,283 with the median family income at $60,619 and the median non-family income at $25,062. The *per capita* income in 1989 was $23,352. In 1996 the median *household* income was estimated to be $58,155, and 5.1% of the county's population was estimated to be living in poverty.

Port of Freeport

In 1990 Freeport village had 39,894 residents, allocated among 9,717 families (average family size was 3.51) and 13,230 households. According to 1990 Census data there were 247 persons employed in occupations of agricultural services, forestry and fishing (1% of all employed persons 16 or over), though there were only 241 employed in agriculture, forestry and fishing industries (Table 51).

Of the 13,660 housing units in the village, only 3% were empty in 1990. Of the occupied units, 35% were rental units.

In 1990, 64% of all residents had been born in the state of New York and the next largest group (22%) were foreign born followed by born in the Southern United States. (8%). Of persons age 5 and over, 62% were living in the same house in 1990 that they had occupied in 1985. An additional 24% were living in a different house in 1985 but still within Nassau County, and 8% were living in a different house but still in New York. In addition, 23% of all workers 16 and over worked in their place of residence, while 69% worked in their county of residence.

In 1990, the racial composition of Freeport village was 57% white, 32% black, 2% Asian or Pacific Islander (especially Filipino, Asian Indian and Chinese) and less than 1% of any other group. Further, 20% of all persons were of Hispanic origin. When reporting first ancestry, "race or Hispanic origin groups" was the largest group (36%); followed by Irish and Italian (9% each), German (8%) and West Indian (excluding Hispanic origin groups) (6%). The majority of persons age 5 years and over speak only English (74%), and only 7% of households are classified as linguistically isolated.

In 1990, 30% of village residents aged 25 and over were only high school graduates and 12% held only a bachelor's degree. In 1989 the median *household* income was $43,948 (81% of the Nassau County average) with the median family income at $49,829 (82% of the county average) and the median non-family income at $27,272 (9% above the county average). The *per capita* income in 1989 was $17,018 (73% of the county average). Just over 7% percent of persons for whom poverty status was determined (99% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by health services, educational services and durable goods manufacturing. Freeport ranks second in the list of top ten places in Nassau County in the 1992 Economic Census, based on population, number of establishments and sales. In 1992, there were 241 retail establishments with total sales of $305 million, 137 wholesale establishments with total sales of $463 million and 315 services establishments with total sales of $134 million.

2.3.3.3.3 Ocean County, New Jersey

Ocean is one of the 21 counties in New Jersey. It is part of the Monmouth-Ocean Metropolitan Area. The 1997 population of 482,421 ranked 9th in the State.

PER CAPITA PERSONAL INCOME

In 1997, Ocean had a per capita personal income (PCPI) of $25,725. This PCPI ranked 16th in the State, and was 80 percent of the State average, $32,356, and 102 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 2.4 percent from 1996. The 1996-97 State change

was 4.7 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Ocean had a total personal income (TPI) of $12,410,502*. This TPI ranked 10th in the State and accounted for 4.8 percent of the State total. The 1997 TPI reflected an increase of 4.0 percent from 1996. The 1996-97 State change was 5.4 percent and the national change was 5.7 percent. (* All income estimates, with the exception of PCPI, are in thousands of dollars.)

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Ocean. In 1997, earnings were 54.7 percent of TPI; dividends, interest, and rent were 25.3 percent; and transfer payments were 20.0 percent. From 1996 to 1997, earnings increased 3.7 percent; dividends, interest, and rent increased 3.5 percent; and transfer payments increased 5.2 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Ocean increased from $4,327,938* in 1996 to $4,474,328* in 1997, an increase of 3.4 percent. The largest industries in 1997 were services, 32.4 percent of earnings; state and local government, 16.5 percent; and retail trade, 15.9 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was transportation and public utilities (5.5 percent of earnings in 1997), which decreased 8.1 percent; the fastest was retail trade, which increased 11.2 percent. (Regional Economic Information System, Bureau of Economic Analysis http://govinfo.library.orst.edu/cgi-bin/bfact?9_05-029.njc)"

In 1990 Ocean County had 433,203 residents, allocated among 121,382 families and 168,312 households. By 1995 the population was estimated to be 464,822 and by 1998 to be 489,819. According to 1990 Census data in Ocean County there were 2,321 persons employed in farming, forestry and fishing occupations; of these, there were 36 captains or other officers of fishing vessels (all white, non-Hispanic males), and 268 fishers (267 male, 261 non-Hispanic white, 6 Hispanic white, 1 white female).

Agricultural services, forestry and fishing account for 1% of employees, 3% of establishments and 1% of annual payroll (Table 52). When fishery-dependent industries (Table 53) are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 91% of establishments in Ocean County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 97%.

Of the 219,863 housing units in the county, 24% were empty in 1990. Of the occupied units, 13% were rental units. Of the vacant units, 68% were for seasonal, recreational or occasional use, and 30% of all vacant units were classified as "usual home elsewhere."

In 1990, 64% of all residents had been born in the state of New Jersey and the next largest group (22%) were born in the northeast United States. Further 58% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 18% were living in a different house in 1985 but still within Ocean County, and 16% were living in a different house but

still in New Jersey.

In 1990, the racial composition of Ocean County was 95% white, 3% black and less than 1% other groups. Further, under 3% of all persons were of Hispanic origin. When reporting first ancestry, Italian was the largest group (19%); followed by German (18%), Irish (17%), and Polish (7%). The vast majority of persons age 5 years and over speak only English (90%), and only 2% of households are classified as linguistically isolated.

In 1990, 37% of county residents were only high school graduates and 10% were only college graduates. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 195,254 with a 6.7% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 92,111. According to the 1997 CBP, there were 101,619 employees and 10,578 establishments. According to the Bureau of Economic Analysis, Regional Economic Information System, in 1997 there were 173,217 total employees in the county including both full- and part-time employees, and 38,541 proprietors.

In 1989 the median *household* income was $33,110 with the median family income at $39,797 and the median non-family income at $16,600. The *per capita* income in 1989 was $15,598. In 1996 the median *household* income was estimated to be $40,474, and 7.3% of the county's population was estimated to be living in poverty.

Port of Barnegat Light/Long Beach

In 1990 Barnegat Light Borough had 675 residents, allocated among 198 families (average family size was 2.55) and 330 households. According to 1990 Census data in Barnegat Light Borough there were 32 persons employed in occupations of agricultural services, forestry and fishing (8% of all employed persons 16 or over), though there were 39 employed in agriculture, forestry and fishing industries (Table 54).

Of the 1,187 housing units in the borough, 72% were empty in 1990. Of the occupied units, 18% were rental units. Of the vacant units, 86% were classified as for seasonal, recreational or occasional use only, and 28% were usual home elsewhere.

In 1990, 51% of all residents had been born in the state of New Jersey and the next largest group (38%) were born in the northeastern United States. Of persons age 5 and over, 62% were living in the same house in 1990 that they had occupied in 1985. An additional 13% were living in a different house in 1985 but still within Ocean County, and 14% were living in a different house but still in New Jersey. In addition, 36% of all workers 16 and over worked in their place of residence, while 60% worked in their county of residence.

In 1990, the racial composition of Barnegat Light Borough was 99.6% white, and less than 1% of all persons were of Hispanic origin. When reporting first ancestry, German was the largest group (27%), followed by Irish (16%), then English (12%). The majority of persons age 5 years and over speak only English (99%), and only 2% of households are classified as linguistically isolated.

In 1990, 36% of borough's residents aged 25 and over were only high school graduates and 13% held only a bachelor's degree. An additional 14% had some college. In 1989 the median *household* income was $37,955 (15% above the Ocean County average) with the median family income at

$44,643 (12% above the county average) and the median non-family income at $26,000 (57% above the county average). The *per capita* income in 1989 was $25,975 (66% above the county average). Just under 7% percent of persons for whom poverty status was determined (99.9% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by finance, insurance and real estate; and other professional services.

The community of Barnegat Light is located on Long Beach Island, a barrier island along the New Jersey shore. The northern tip of Long Beach Island has been occupied for several hundred years by native Americans, the Military, commercial fishermen, summer visitors, and permanent residents. Its current history goes back to 1609 when Barnegat Inlet, from which the town gets its name, was first sighted by Henry Hudson. The area that is now known as Barnegat Light was described in a deed from the English Crown in 1692.

In 1881 Barnegat City was an outpost of Long Beach Township. In 1904 the community seceded from the Township and became independent. The town was incorporated as a separate political entity in 1904. The name Barnegat City held for another 44 years when, in November of 1948, the community, by referendum, elected to identify with its major landmark by officially taking the name Barnegat Light.

Today Barnegat Light has a winter population of about 800, with about 50% retirees. Generally, these folks had maintained a summer residence in Barnegat Light during their working years. The remaining 50% are younger, working families, engaged in the commercial fishing industry, construction, banking, real estate, small retail businesses, restaurants, and health care services. There are about 1,100 residences, many used as second home (http://www.barnlight.com/past.html).

In looking at the small town of Barnegat Light, it becomes apparent that the small businesses are very reliant on the summer tourist economy and the year round fishing industry. This is apparent with all of the summer and beach houses, the seashore shops and convenience stores along the main boulevard to and through Barnegat Light. The tourist surf shops, souvenir shops, small grocery and convenience stores, fish markets, and even the electronics and repair shops advertise goods and service catering to the needs of their consumers. It also becomes apparent that the town relies fixedly on its commercial fishing industry year round. According to a resident, the commercial fishing becomes the stalwart economic sector for the town in the winter through employing as many as 150 local people to work at the marinas (Wilson *et al.*1999).

The island up to and including Barnegat Light is intensely developed with summer and beach/boarding houses, and much of the community is heavily geared toward the summer beach economy. During the winter, Barnegat Light's economy slows significantly, and one of the major forms of employment becomes commercial fishing. Commercial fishing employs 150 people working on docks and is one of the biggest income generating businesses on the island during the winter.

Barnegat Light is located “adjacent to what was the infamous Barnegat Inlet before a multimillion dollar Corps of Engineers project brought its fierce currents somewhat under control (http://www.fishingnj.org/portbl.htm). Commercial and recreational fishing have a long tradition here, as they once did in the community of Beach Haven on Long Beach Island, which is now only

private boat marinas and residential condominiums.

The Borough of Barnegat Light has 50 boat slips available for lease by permit. The slips run between 7th and 10th Streets. These slips can accommodate 23 foot vessels and several can accommodate boats up to 25 feet. The Mayor and Council has introduced an Ordinance that will change the current leasing system to a permit. Current slip holders that wish to stay with their slips will have to renew with payment in full by January 1. A fee of $1,100 will be charged for a permit for the use of a municipal boat slip for the entire season (April 1 through December 1). All unleased slips will become available to the public on January 1. Private slips are available from local marinas on a seasonal or short term basis (http://www.barnlight.com/boating.html).

Barnegat Light's two commercial docks service a fleet that ranges from small, local day boats to globe spanning longliners. Several fishermen in Barnegat Light pioneered the deep water tilefish fishery back in the 1970s and through a successful marketing campaign turned the fishery into the consumer's "poor man's lobster." Along with Montauk, on the Eastern end of Long Island, Barnegat Light is still the center of this valuable fishery.

Barnegat Light is the home port of many members of the East Coast's longline fleet. Targeting several species of tuna as well as swordfish, on their several week or longer trips Barnegat Light longliners routinely fish from the high seas from hundreds to thousands of miles away. Barnegat Light is also home to several state-of-the-art scallop vessels and a fleet of smaller, inshore gillnetters (http://www.fishingnj.org/portbl.htm).

There are approximately 25 gillnetters, 8 scallopers, and 15 longliners. These numbers do not include party boats serving the recreational fishing market. These vessels are busy year round, shipping seafood to markets and restaurants all over the eastern United States and internationally as far away as Japan (http://www.barnlight.com/comfishnewssub1.html).

Each year over 4 million pounds of seafood are packed out over the commercial dock of Viking Village and shipped not only locally, but to many parts of the world. Viking Village is home port to seven scallopers, 10 longliners and about nine inshore-fishing net boats. Each boat is independently owned and uses Viking Village for pack-out, marketing and sale of the catch.

A group of Scandinavians who immigrated here in the 1920s originally named it Independent Dock. They chose the Barnegat Light area because it reminded them so much of their homeland, where they were fishermen. Over the years, many types of seafood have been brought in. Today, the majority of the catch consists of scallops, tuna, swordfish, tilefish and different kinds of inshore fish, such as weakfish, monkfish, bluefish, shad and dogfish. Codfish, once a major catch, have been virtually fished out of local fishing grounds.

The scallopers bring in about 555,500 pounds per year. The boats are out for eight to ten days at a stretch with an average crew of seven. The boats tow the ocean floor with a chain mesh for a period of time after which the chain mesh is winched on board; the crew removes the meat from the scallop shells. Recently, a market has been found for the red roe of the scallop. It is carefully boxed and iced at sea, and most of it is shipped to France.

Longlining, as the name implies, involves the use of a "long line" and a series of baited hooks. Longliners bring in many types of fish, including bigeye and yellowfin tuna, tilefish, and swordfish.

At Viking Village alone they account for about 174,000 pounds per year. The bigeye tuna, sometimes weighing in over 250 pounds, can bring up to $20 per pound wholesale in the Japanese markets. It is considered a delicacy because of its high fat content, which the yellowfin cannot equal. Tilefish were once considered extinct in the 1950s but had made a come back in the 1970s.

The net boats are smaller vessels used to catch bluefish, weakfish, monkfish, dogfish and shad. Unlike longliners and scallopers, net boats return to port after a day's catch. Dogfish is a relatively new commodity to pass over Viking Village's docks. Once considered only a trash fish, they now are caught and shipped to Europe and China. The fins are used by the Chinese, and the body of the fish is shipped to France and England to be processed into what is know there as "Fish 'n Chips."

Since new markets have opened up, now only 40 percent of Viking Village's catch is shipped to the Fulton Fish Marker in New York City. The remainder is shipped up and down the East Coast with a good percentage going over seas. Some local restaurants and seafood dealers, such as Wida's, Surf City Fishery, Beach Haven Fishery and Cassidy's Fish Market, are direct purchasers of Viking Village's products.

Viking Village and the boats docked there employ about 200 people, making it one of Long Beach Island's larger businesses (http://www.fishingnj.org/bizzvik.htm).

Throughout the interviews and meetings conducted by Doug Wilson of Rutgers University (Clay pers. comm.), several citizens and business owners from the Barnegat Light community emphasized the role the fishing industry has in sustaining and preserving their community. The marinas are the major source of taxes for the community, according to representatives of the community's taxpayers association. Two of the five marinas are primarily dependent on the commercial fisheries. An owner of one of the marinas said that 80% of their overall income comes from the commercial fishing industry, for fuel and other services. Although there is a lot of recreational fishing, the amount of fuel and other services sold to recreational fishermen is tiny compared with what is sold to commercial fishers. One marina owner said that for fuel, the ratio is about 40 or 50 commercial to one recreational. In addition, small businesses are able to stay open all year because of the fishing industry, and this has stabilized the community so that it has the lowest crime rate on the island.

According to another respondent, the fishing industry is an integral part of the social and economic livelihood of Barnegat Light. In examining the fishing industry of the town, Barnegat Light is one of Ocean County’s most important ports. Of the 1993 Ocean County Landings totaling 28.5 million tons, the port totaled 3.8 million but the value of these landings was $9.1 million dollars, which calculates to be 39% of the Ocean County landings value (New Jersey Department of Agriculture 1995). Many members of the East Coast’s longline fleet, scallop vessels, and a fleet of inshore gillnetters reside at this port (NJ Fish Net, NJ Seafood Association). Recreational and charter boats also utilize and work from this port. The recreational and charter boat fishing industries landings, percentages, and values were not available for the port or county level. New Jersey’s statewide estimates for the marine recreational fishing are available in the State Profile section.

There are five marinas in Barnegat Light. The two largest docks have 36 full-time resident commercial boats, approximately 40 recreational and charter boats, and some transients. Commercial fishing boats work out of these docks year round. The three remaining docks can each accommodate approximately 30 to 35 boats, most of which are recreational boats and charter/party boats, with a

few headboats. Most of the recreational and sportfishing fishing boats that utilize this port are here for part of the year, usually from May or June through early October.

One dock is completely occupied by commercial boats, the owners are also commercial fishermen. These commercial boats include seven scallopers, ten longliners that fish for tuna, swordfish, and tilefish, and about nine inshore-fishing net boats. All the boats are privately owned (New Jersey Fishing, New Jersey FishNet). Three offloading stations are part of this dock. During the slow to steady seasons, five or six locally hired full-time employees, the boat captain and crew perform the offloading. Additionally, dock hands are hired locally for the busy season. The choice for marketing and sale of the fresh fish can either be done by the captain or by the owners of the dock. The owners of the dock sell some of the catch to fresh fish markets in Boston, Philadelphia, Maryland, and New York with the remaining being sold to local restaurants, retailers, wholesalers or at their own fish market, which is open from April to October (McCay 1993).

The second of the largest docks accommodates ten commercial boats, fifteen charter boats, and twenty-five recreational vessels. This dock is primarily an offloading facility and can accommodate up to five vessels for offloading. During offloading, there are two people working the docks to help the captain and crew. The marketing and sale of the fish is done by the boat captain, who sells the fresh fish to local fish markets (McCay 1993).

The Barnegat Light port is known for its offshore longline fishery. Today it focuses on the tunas (yellowfin, bigeye) for most of the year and swordfish part of the year. A few continue bottom longlining, for tilefish, caught in deep waters of the outer continental shelf and canyons. The longlining tradition derives from a winter handline and longline fishery for cod, which lasted through the first part of this century and was prosecuted by Scandinavian immigrants among others. Tilefish were well known by the old-timers of Barnegat Light but markets were poor. In 1969 a captain began tilefishing again. In the early 1970s he and others cooperated in successfully creating a domestic market for tilefish, and this soon emerged as a major focus of the longliners of Barnegat Light, as well as Montauk, New York and, more recently, Point Judith, Rhode Island. The fleets developed rapidly, attracting even some of the charter boat fishermen. They diversified into pelagic longlining, for swordfish and tunas, as tilefish catch rates diminished. Others moved into sea scalloping.

Although Barnegat Light is mainly a longline fishing community, there is also a small group of coastal gill-netters plus seven large sea scallopers. And like all ports in the region, it has a significant recreational fishery, with an equally long tradition. The longliner fleet is side by side with the party boats at one of the docks. Indeed, one of the families is involved in both commercial and party boat fishing, including offshore "canyon" fishing for highly migratory species (HMS). The HMS longline fishery and the scallop fishery are the most important in economic and social terms. Consequently, declines in allowable catches, seasons, trip limits, and, for the scallopers, days-at-sea are threatening the fishing community. There are few viable options (Wilson *et al.* 1999).

Ports of “Other Ocean”

Ship Bottom Borough

In 1990 Ship Bottom Borough had 1,352 residents, allocated among 397 families (average family size was 2.64) and 649 households. In 1995 the population was estimated to be 1,350. According

to 1990 Census data in Ship Bottom Borough there were 9 persons (Table 55) employed in occupations of agricultural services, forestry and fishing (2% of all employed persons 16 or over), though there were 11 employed in agriculture, forestry and fishing industries.

Of the 2,084 housing units in the borough, 69% were empty in 1990. Of the occupied units, 26% were rental units. Of the vacant units, 69% were classified as for seasonal, recreational or occasional use only, and 35% were "usual home elsewhere."

In 1990, 51% of all residents had been born in the state of New Jersey and the next largest group (37%) were born in the northeastern United States. Of persons age 5 and over, 61% were living in the same house in 1990 that they had occupied in 1985. An additional 18% were living in a different house in 1985 but still within Ocean County, and 10% were living in a different house but still in New Jersey. In addition, 28% of all workers 16 and over worked in their place of residence, while 76% worked in their county of residence.

In 1990, the racial composition of Ship Bottom Borough was 97% white, and 2% "Other races". Only 4% of all persons were of Hispanic origin. When reporting first ancestry, German was the largest group (21%), followed by Irish (19%), Italian (15%), and English (12%). The majority of persons age 5 years and over speak only English (97%), and only 1% of households are classified as linguistically isolated.

In 1990, 34% of borough's residents aged 25 and over were only high school graduates and 7% held a only bachelor's degree. An additional 13% had some college, and 9% had 9th through 12th grade but no diploma. In 1989 the median *household* income was $29,205 (88% of the Ocean County average) with the median family income at $35,268 (89% of the county average) and the median non-family income at $17,969 (8% above the county average). The *per capita* income in 1989 was $17,782 (14% above the county average). Just under 9% percent of persons for whom poverty status was determined (99.5% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by construction and educational services.

In 1817, during a heavy March fog, a schooner captain rescued a woman trapped in the hull of an overturned ship offshore, and the area became known as Ship Bottom. In 1872, a lifesaving station was established there. In April 1925, the area of Ship Bottom and Beach Arlington separated from Long Beach Township and became one town.

Ship Bottom also has a public boat ramp at 10th Street near the entrance to the Island.

The Long Beach Island Grade School, one of two schools in the Long Beach Island School District, is on 21st Street and is the public school for children in grades three through six in all Island towns except Beach Haven, which has a separate school district.

The other school in the Long Beach Island School District is the Ethel A. Jacobsen School in neighboring Surf City for children in kindergarten through second grade. Children in seventh grade and above attend classes on the mainland in Southern Regional School District (Southern Ocean Community Guide 9/23-24/98, Times-Beacon Newspapers).

Little Egg Harbor
Originally part of Burlington County, Little Egg Harbor took its name from the portion of the bay called Egg Harbor by Dutch sailors because of the great quantities of sea gull eggs found in nests along the shore.

Little Egg had its share of privateers, smugglers, pirates and other ruffians that were part of early Jersey Shore history.

Henry Jacobs Falkinburg Sr. was the first white man to settle in the township. He arrived sometime prior to 1698 and began trading merchandise with the local Indians, securing the properties later known as Osborn and Wills Islands and a number of farmlands.

Early settlers in Little Egg who did not farm began building boats, getting timber from the surrounding forest for hulls. One of the first recorded ships of the township was a sloop belonging to Thomas Ridgway Sr. John Mathis Sr. was also an early ship owner. His vessel was commanded by his son Daniel and sailed the West Indies routes.

The gathering of clams and oysters was also profitable and it was not long before Philadelphians and New Yorkers were dining on shellfish harvested in Little Egg Harbor.

The township eventually broke from Burlington County and became part of Ocean County, and the Tuckerton section of Little Egg became an entity unto itself.

Today, Little Egg Harbor Township surrounds Tuckerton on three sides with a land area of 45 square miles. It includes West Tuckerton, Parkertown, Osborn Island, and large developments like Atlantis, Mystic Island, Holly Lake Harbor, Deerfield Park, Tuckerton Gardens, Spring Valley Lakes, as well as a part of Warren Grove.

The Little Egg Harbor township has an elementary school and intermediate school and is home to Pinelands Regional High School and Middle School, which also accept students from Tuckerton, Eagleswood and Bass River (Southern Ocean Community Guide 9/23-24/98, Times-Beacon Newspapers).

2.3.3.3.4 Dare County, North Carolina

Dare is one of the 100 counties in North Carolina. It is not part of a Metropolitan Area. The 1997 population of 27,935 ranked 68th in the State.

PER CAPITA PERSONAL INCOME

In 1997, Dare had a per capita personal income (PCPI) of $21,624. This PCPI ranked 25th in the State, and was 93 percent of the State average, $23,168, and 86 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 4.1 percent from 1996. The 1996-97 State change was 5.1 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Dare had a total personal income (TPI) of $604,066*. (* All income estimates with the

exception of PCPI are in thousands of dollars.) This TPI ranked 67th in the State and accounted for 0.4 percent of the State total. The 1997 TPI reflected an increase of 8.4 percent from 1996. The 1996-97 State change was 6.8 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Dare. In 1997, earnings were 60.9 percent of TPI; dividends, interest, and rent were 20.5 percent; and transfer payments were 18.6 percent. From 1996 to 1997, earnings increased 9.4 percent; dividends, interest, and rent increased 6.4 percent; and transfer payments increased 7.4 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Dare increased from $374,509* in 1996 to $411,465* in 1997, an increase of 9.9 percent. The largest industries in 1997 were retail trade, 24.1 percent of earnings; services, 22.0 percent; and construction, 14.4 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was state and local government (14.3 percent of earnings in 1997), which increased 7.8 percent; the fastest was finance, insurance, and real estate (10.7 percent of earnings in 1997), which increased 11.1 percent (Regional Economic Information System, Bureau of Economic Analysis (http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/37/37055.htm).

In 1990 Dare County had 22,746 residents, allocated among 6,469 families (average family size 2.88) and 9,359 households. By 1995 the population was estimated to be 26,847 and by 1998 to be 28,953. According to 1990 Census data in Dare County there were 30 captains or other officers of fishing vessels (all white, non-Hispanic males), and 440 fishers (391 male non-Hispanic white, and 49 female non-Hispanic white).

Agricultural services, forestry and fishing account for 1% of employees and 2% of establishments (Table 56). When fishery-dependent industries are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data (Table 57). Overall, 93% of establishments in Dare County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 100%.

Of the 21,567 housing units in the county, 57% were empty in 1990. Of the occupied units, 29% were rental units. Of vacant units, 53% are for seasonal, recreational or occasional use.

In 1990, 41% of all residents had been born in the state of North Carolina and the next largest group (36%) were born in the northeast United States. Further 35% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 24% were living in a different house in 1985 but still within Dare County, and 8% were living in a different house but still in North Carolina.

In 1990, the racial composition of Dare County was 95% white, 4% black and 1% other groups. Further, under 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group (23%), followed by German (15%), then "United States or American" (11%) and Irish (9%). The vast majority of persons age 5 years and over speak only English (97%), and

less than 1% of households are classified as linguistically isolated.

In 1990, 36% of county residents were only high school graduates and 21% were only college graduates. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 14,331 with a 5.6% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 9,452. According to the 1997 CBP, there were 10,473 employees and 1,605 establishments. In 1989 the median *household* income was $29,322 with the median family income at $34,891 and the median non-family income at $16,858. The *per capita* income in 1989 was $15,107. In 1996 the median *household* income was estimated to be $33,617, and 8% of the county's population was estimated to be living in poverty.

Recreational fishing by small boat (private, rental, charter) is popular in the Pamlico, Croatan, Albemarle and Roanoke Sounds. Anglers can expect to catch a wide variety of fish including trout, spot, croaker, summer flounder, sheepshead and at night, even red drum. Also popular is cobia, which hits its peak in late May or early June. In recent years, there have been good catches of striped bass during the fall and winter and spring.

There are public boat ramps located at numerous places including the Manteo waterfront, Oregon Inlet, Pirate's Cove, Kill Devil Hills on Durham St. and on Hatteras Island.

In addition, headboats, which carry 40-50 people, run half-day trips and stay in the sound and inlet waters. Depending on the season, the catch is usually spot, sea trout, summer flounder, croaker, and black sea bass.

In the summer, summer flounder, croaker and small bluefish are the mainstay, though spot, croaker and grey trout can also be caught. Surf fishing really takes off by Outer Banks standards in August when pompano and Spanish mackerel begin to make a showing and a few tarpon are hooked. September is the best month for all three (http://www.outerbanks.org/fishing.htm).

Port of Wanchese

In 1990 Wanchese had 1,380 residents, allocated among 371 families (average family size was 3.22) and 513 households. According to 1990 Census data in Wanchese there were 137 persons employed in occupations of agricultural services, forestry and fishing (20% of all employed persons 16 or over), though there were 131 employed in agriculture, forestry and fishing industries.

Of the 583 housing units in the port, 12% were empty in 1990. Of the occupied units, 25% were rental units. Of the vacant units, 14% were classified as for seasonal, recreational or occasional use only, and 11% were "usual home elsewhere."

In 1990, 61% of all residents had been born in the state of North Carolina and the next largest group (23%) were born in the southern United States. Of persons age 5 and over, 53% were living in the same house in 1990 that they had occupied in 1985. An additional 27% were living in a different house in 1985 but still within Dare County, and 4% were living in a different house but still in North Carolina. In addition, 38% of all workers 16 and over worked in their place of residence, while 97% worked in their county of residence.

In 1990, the racial composition of Wanchese was 99% white. Only 1% of all persons were of

Hispanic origin. When reporting first ancestry, United States or American was the largest group (28%), followed by English (14%), and German (10%). The majority of persons age 5 years and over speak only English (98%), and no households are classified as linguistically isolated.

In 1990, 31% of port's residents aged 25 and over were only high school graduates and 5% held a only bachelor's degree. An additional 20% had some college, and another 20% had 9th through 12th grade but no diploma. In 1989 the median *household* income was $25,977 (89% of the Dare County average) -- with the median family income at $28,828 (83% of the county average) and the median non-family income at $13,015 (77% of the county average). The *per capita* income in 1989 was $10,830 (72% of the county average). Nine percent of persons for whom poverty status was determined (99% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is agriculture, forestry and fishing, followed by retail trade (Table 58).

Wanchese is located on the southern part of Roanoke Island, located in the northern Outer Banks. This small fishing village is said to have changed as little as those who have lived here for generations (Cutchin 1997). The village actually received its name from a Native American leader named Wanchese who greeted these first English settlers in 1584; Wanchese was officially named when the federal postal system was established in 1886 (Cutchin 1997, Wilson *et al.* 1999).

Fishing has long been important to the town. Today the village still revolves around fishing, but has expanded to include processing plants. Through traditionally a commercial fishing community, recent growth in tourism and recreational fishing has sparked competition between the new and the old for a restricted resource (Wilson *et al.* 1999).

Wanchese's first fish house was begun in 1936 by the grandfather of the current generation that still runs two fish houses in the community, one of which related this history. His son fished the first trawler in Wanchese in the 1950s. He took a little 65 foot wooden boat and converted it into a fishing trawler. The grandfather stayed and helped packing boats but he was a gillnetter at heart and would rather be catching fish. In those days they were fishing more in Pamlico and Albemarle Sounds than in the ocean. They beach fished for sea mollusks, trout, croakers, spots, striped bass, and bluefish. In the Sounds they fished croakers, butterfish, Spanish mackerel, spots, and pigfishes. With the trawler they began flounder fishing in the winter. Then they would go offshore and catch some black sea bass later in the year. They bought another similar boat and then a WWI converted subchaser. The subchaser was the first boat to try scalloping. The owner of a third fish house built the first flynet in 1971 (Wilson *et al.*1999).

Fishers along the Outer Banks and from Wanchese are especially sensitive to the historical importance of their fisheries and related marine lifestyles, beginning with the shore-based whaling fisheries of the early colonial period and going through subsequent periods where fishing families provided life-saving services to hundreds of ships that make up the "Ghost Fleet" of the Outer Banks. Fishers mentioned the importance of this history in terms of the memories of old fishers. One claimed, for example, that there have been periods in local fishers' pasts that they had to migrate to Florida because of declines in local fish stocks, making the argument that regulations need to consider extreme fluctuations in fish stocks as part of the economic hazards of commercial fishing. This same fisher noted the importance of life-time experience in fishing and of the difference

between knowledge gained through direct experience and knowledge gained through scientific methods; the latter, of course, may suffer from sampling biases, while the former may suffer from other kinds of biases (economic, political, religious, etc.), yet combining the two could far better inform the regulatory community than sole reliance on one or the other.

The heavy dependence on Wanchese as a fishing community demands special attention in this section, even though tilefish landings in North Carolina are governed by the SAFMC Snapper Grouper FMP. Seven principal families of seafood dealers ring the seafood industrial park and serve as the central locations of the estimated 200 fishing families who live in Wanchese as well as anchor the southern marketing behaviors of fishers from as far away as New Bedford, Massachusetts and Portland, Maine. The fleets that originate from here, and the fishing activity focused by the seafood dealers and the ports, concentrate around the seafood industrial park and fleets of trawlers organized or encouraged by seafood dealers. The large, greater than100 foot vessels, as is occurring elsewhere, have been less active recently, their captains and crews now fishing from smaller crafts.

These arrangements have been replicated in the Newport News/Hampton area. As one leaves either Wanchese or migrates across the Chesapeake, to Virginia's Eastern Shore and the other parts of the Delmarva Peninsula, more independent, owner-operator fishing operations prevail, with some long-time loyalties between fishers and fish dealers that hinge on the questions of slip space and access. In recent years, fishers in this region have become increasingly concerned that real estate development will entice dealers to sell their space to developers less interested in commercial fishing than in providing marinas and condominiums for recreational boating traffic (Dyer and Griffith 1996).

Ports of "Other Dare"

Roanoke Island/Dare Mainland, home to the first English speaking settlement, runs East to West on Highway 64/264, and is made up of Manteo, Wanchese, Manns Harbor and Stumpy Point. This island is not bordered by the Atlantic, but instead is situated on the Roanoke and Croatan Sounds.

Manteo

In 1990 Manteo town had 997 residents, allocated among 254 families (average family size was 2.86) and 472 households. According to 1990 Census data in Manteo town there were 20 persons employed in occupations of agricultural services, forestry and fishing (4% of all employed persons 16 or over), though there were 21 employed in agriculture, forestry and fishing industries (Table 59).

Of the 684 housing units in the town, 35% were empty in 1990. Of the occupied units, 43% were rental units. Of the vacant units, 37% were classified as for seasonal, recreational or occasional use only, and 18% were "usual home elsewhere."

In 1990, 66% of all residents had been born in the state of North Carolina and the next largest group (21%) were born in the southern United States. Of persons age 5 and over, 53% were living in the same house in 1990 that they had occupied in 1985. An additional 16% were living in a different house in 1985 but still within Dare County, and 11% were living in a different house but still in North Carolina. In addition, 41% of all workers 16 and over worked in their place of residence, while 97% worked in their county of residence.

In 1990, the racial composition of Manteo town was 87% white and 13% black. Less than 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group

(24%), followed by "Race or Hispanic Origin Groups" (15%), then "United States or American" (11%) and Irish (10%). The majority of persons age 5 years and over speak only English (96%), and less than 1% of households are classified as linguistically isolated.

In 1990, 27% of town's residents aged 25 and over were only high school graduates and 11% held a only bachelor's degree. An additional 27% had some college, and 17% had 9th through 12th grade but no diploma. In 1989 the median *household* income was $23,403 (80% of the Dare County average) with the median family income at $30,326 (87% of the county average) and the median non-family income at $14,500 (86% of the county average). The *per capita* income in 1989 was $13,068 (87% of the county average). Eleven percent of persons for whom poverty status was determined (97% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by educational services and construction.

Manteo is the site where the English first settled in America (http://www.outer-banks.com/visitor-info/roanokeisle.html).

Stumpy Point
The fishing village of Stumpy Point, which lies along the swampy coastline of a Pamlico Sound bay on the Dare County mainland, has a population of 270 (outer-banks.nc.us/Sentinel/feature30.htm).

Hatteras
Hatteras Island runs North to South along Highway 12, and is accessible by crossing over the Oregon Inlet Bridge, or by taking a short ferry trip from Ocracoke, North to Cape Hatteras. Consisting of Rodanthe, Waves, Salvo, Avon, Buxton, Frisco and Hatteras, this island is surrounded by water with the Pamlico Sound on the West and the Atlantic Ocean on the East (http://www.outerbanks.org/accommodationsintro.htm).

In 1990 Hatteras Township had 2,675 residents, allocated among 751 families (average family size was 2.9) and 1,078 households. According to 1990 Census data in Hatteras Township there were 88 persons employed in occupations of agricultural services, forestry and fishing (6% of all employed persons 16 or over), though there were 77 employed in agriculture, forestry and fishing industries.

Of the 1,861 housing units in the township, 42% were empty in 1990. Of the occupied units, 26% were rental units. Of the vacant units, 63% were classified as for seasonal, recreational or occasional use only, and 18% were "usual home elsewhere".

In 1990, 46% of all residents had been born in the state of North Carolina and the next largest group (22%) were born in the southern United States. Another 18% were born in the northeastern United States. Of persons age 5 and over, 43% were living in the same house in 1990 that they had occupied in 1985. An additional 20% were living in a different house in 1985 but still within Dare County, and 9% were living in a different house but still in North Carolina. In addition, 96% of all workers 16 and over worked in their county of residence.

In 1990, the racial composition of Hatteras Township was 99% white. Only 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group (34%) followed by German (14%), United States or American (12%) and Irish (9%). The majority of persons age 5

years and over speak only English (98%), and no households are classified as linguistically isolated.

In 1990, 34% of township's residents aged 25 and over were only high school graduates and 15% held a only bachelor's degree. An additional 17% had some college, and 19% had 9th through 12th grade but no diploma. In 1989 the median *household* income was $24,667 (84% of the Dare County average) with the median family income at $31,915 (92% of the county average) and the median non-family income at $15,065 (89% of the county average). The *per capita* income in 1989 was $12,796 (85% of the county average). Just over 6% of persons for whom poverty status was determined (99.7% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by construction and personal services (Table 60).

Hatteras Village is located on Hatteras Island, part of North Carolina's outer banks. Geographic isolation adds to the local character of Hatteras. Respondents said that it is a place where people feel safe. Some people leave their houses unlocked. It feels safer because it is an isolated island community. It feels safer because it is an isolated island community. A ferry leaves Hatteras to go to neighboring Ocracoke Island. Usage of the ferry is very frequent in the summer when you can get cars backed up for a half a mile. The village is quite and insular and "made up of a lot of people who came here to get away from something" (Wilson *et al.* 1999).

Since World War II, the economy of the Hatteras community has depended on charter and commercial fishing as the major sources of local income; tourism also serves as an important economic activity (Wilson *et al.* 1999).

Hatteras Village is almost totally dependent on fishing. While non-fishing tourists, especially windsurfers, are attracted to beaches elsewhere on the island, Hatteras Village's own beaches are less appealing. Tourists come to Hatteras because they want to fish. Our oldest respondent told us that when he was growing up the only thing to do was fish. He remembers one morning, fifty years ago, counting some 260 boats going out of the harbor. They were gillnetting for trout and croakers and caught a lot more fish than is being caught now. The recreational and charter fishing industry's history is just as proud. The wall of one charter boat office is covered with captioned pictures displaying the history of the Albatross Fleet. In 1937, the four sons of a commercial fisherman went into the charter business. Their first sailfish was caught in 1940. Tarpon and dolphin began in 1940. They hired a publicist to spread the word about big game fishing in Hatteras. They caught their first marlin in 1951. In 1952, the first blue marlin was caught by a lady. In 1962, The Albatross III caught a world record, 810 pound blue marlin. The headline on a yellowing copy of a 1958 New York City newspaper article proclaims the shocking news of an "Angler Deliberately Releasing a Blue Marlin!" (Hurley 1958). The angler was Jack Cleveland of Greenwich CT fishing on the Albatross.

A charter boat captain related that newcomers are amazed at how good the fishing is. Ditton *et al.* (1998) did a survey of both private and charter boat anglers in Hatteras in the winter of 1997. Their results support the captain's assertion. They found that of 644 anglers, 46 percent agreed with the statement: "I caught more fish than I expected on this trip" and 42 percent agreed that they "could not imaging a better fishing trip." The winter season is bluefin tuna. In early spring they get puppy drum on the beach, and offshore yellowfin tuna, dolphin, wahoo and marlin. Sailfish come in June. In the summer with the warm water they get "all fish": summer flounder, cobia, speckled trout,

drum, wahoo, marlin and sailfish. In the fall are flounders, king mackerel and rockfish.

The marinas are 100 percent fishing related. Over the course of the year most people come to fish with their boats, both trailer boats and over water boats. A marina owner estimates that half of the parties are all men and about half families. The families go to the beach, the shops, and amusements such as go cart tracks. The winter bluefin tuna fishing brings a greater percentage of the trips to the charter fleet. In their census of fishing trips during the bulk of the 1997 winter season, Ditton *et al.* (1998) found only 27 percent of bluefin tuna fishing trips were in private boats and the rest in charter boats. Ditton *et al.* (1998) found 51 charter boats in Hatteras in January.

Make up charters, where marinas organize the parties, are becoming more and more common. A captain estimated that his marina did 140 make up charters in the past year. The majority of the charter customers are after a good experience with offshore fishing. One captain, who has been chartering for many years, believes that the motivations of the charter customers are changing. He describes the current group as people who want to get way from city jobs and have fun with something really different. A lot of them are outdoorsmen in other areas. The fishing puts them in touch with wild creatures. The "game hogs," meaning those primarily interested in getting a lot of "meat," have dwindled. He sees the customers as willing to accept limits when they are imposed. Often they are more willing to accept limits than people who have fished all their lives. Meat, however, is still an important motivation for all anglers except for billfish anglers. In fact, another captain, who does about a quarter of his business on billfish, sees the growing catch and release ethic as having reduced angler interest in marlins.

Captains say it is very hard to find a year round mate. The college students who work in the summer can make more money when they graduate. It is a good lifestyle for a college student, but to find someone year round they have to like to fish. These are more skilled fishers and they want their own boats. One captain said that "of the boats that are fishing year round, you can bet that the mates that they have are looking for a boat to fish in the future." He estimates that about one in five mates are married and supporting a family.

Changes in fishing affect charter bookings almost instantly. Within a couple of weeks after a fish species is gone the marinas will start to get cancellations. Charter customers show little loyalty to North Carolina as a place to fish. Ditton *et al.* (1998) found that less than a majority of charter boat anglers (44 percent) opposed restricting NC fishing to benefit other parts of the coast, while a majority of the private anglers (57 percent) opposed the measure. They also found that anglers from NC were more likely to oppose the measure.

Because Hatteras attracts top sport fishers from around the world, the issues of minimum sizes and trophy fish take on special significance. One captain, by his account and that of others, attracts people who come specifically to fish for world records. They are interested in setting records by catching smaller bluefin tuna on fly rods. In 1997 fishing for fish between 27" and 73" was closed on March 2nd. Between, March 5th to March 18th, he had four different groups of people coming to fish for bluefin tuna for world records; and they all canceled because they could not keep a world record fish even if they caught it. Few anglers want to release bluefin tuna. Ditton *et al.* (1998) found that 60 percent opposed catch and release only for bluefin tuna. Keeping trophy fish "means a lot to someone who has paid a thousand dollars to go out fishing" the marina owner said.

The "charter business is not native sons any more" said one respondent. A captain estimated that

where the village had 15 charter boats ten years ago there are now 40. These are the charter boats that stay here all year round. Transient charters come for the "cream of the crop," particularly the bluefin season. Ditton *et al.* (1998) found 51 charter boats in the village during the 1997 bluefin season. There is tension between the local charter boats and the transient charters because of increased competition for both fish and customers. One new charter boat is a state-of-the-art luxury boat with fish finding electronics, a stereo, a microwave and air conditioning. The locals argue that he could get $1,500 a day but instead charges but a little more than the going rate. He has announced that he intends to take business from people. However, they say that the charter fleet has not reached a saturation point and that the customers are still happy. The charter captains say they generally work well together. There is also tension with private recreational fishers who following the charter boats to see where they fish.

Another long-time, local fisherman is running two party boats. He is finding more and more ways to make the party boat a family excursion. He does pirate trips and other special off shore trips. He also does birding trips.

The Hatteras Village Civic Association holds three tournaments a year. Tournaments attract people for the prize money and the social events that surround them. The biggest in the area is the Big Rock tournament the first week in June. The present tournament is three days and many boats fish out of Hatteras. One marina manager, interviewed just after a tournament in May, reported that the tournament attracted 9 boats. This was an increase of a third over the year round boats. Also in May is a tournament at another marina and one at a private club. Tournaments are in May because it is otherwise a slow month. There is also a king mackerel tournament in the fall,

Recreational billfishing in Hatteras is described by respondents as totally catch and release. The only exception, and it is an important one, is large tournaments. There are seven such tournaments in North Carolina that are too large and if these tournaments were not allowed to kill fish it would have a negative impact on all businesses related to recreational fishing. The biggest tournament directly affecting Hatteras is the Big Rock in Morehead City. Many boats in this tournament fish out of Hatteras. The blue marlins being killed in tournaments are 110 inches. Respondents disagree about the affect of a 113 inch size limit on these tournaments, but 113 inches is tending toward a rare event. It would make it possible that a tournaments would not catch any fish. The tournament at the private club in Hatteras is a total release tournament and has been for five years. However, it is for a trophy only. The organizer says that they lost a few people when they shifted to total release, but they picked up even more. In his estimation, more people don't want to kill than do. The scales at the club are rusted out, they could not weigh fish in any case (Wilson *et al.*1999).

Commercial fishing in Hatteras is very similar to the small scale fishery described in the Wanchese profile. The only active commercial fishing organization is the Hatteras-Ocracoke Auxiliary of the North Carolina Fishermen's Association, which has been organized since 1992. In the current Hatteras fleet there are 5 boats of the 35 or so small gill net boats that go shark longlining during the shark season. They lost income through shark closings and quotas. Some have incidental permits for the bluefin tuna but they cannot reach the incidental matching ratio. Others have general category permits, but that season opens after the fish have passed. These small boat fishers are dependent on a very diverse fishery. They fish five or six species a year but do not always fish the same ones every year. What scares them is that they will not be fishing sometime when landings are counted for some system based on current participation (Wilson *et al.* 1999).

Port of Avon

Avon is situated on the Outer Banks of North Carolina, just to the north of Cape Hatteras. Avon has beach access, sometimes more than it wants. Much of NC 12 on Hatteras Island is in a precarious position. It often gets washed over in major storms. One of those areas is just south of Avon, where it can cut the southern part of the island off from traffic. Otherwise, Avon has vacation homes and stores with the necessities (http://www.ego.net/us/nc/ob/buxton.htm).

The original village is situated on a picturesque harbor, and still retains some of the old-style island homes. Fishing boats still frequent the harbor. Like the majority of the villages on Hatteras Island, Avon was "assigned" its current name by the U. S. Postal Service, presumably because the Indian names were too hard to pronounce and spell. Prior to the post office arriving in 1883, Avon's original name was Kinnakeet, and is used today by some native islanders.

This soundside fishing village is home to the Little Kinnakeet Lifesaving Station, one of seven built on the Outer Banks to aid crews caught in the rough, treacherous waters offshore. Little Kinnakeet, built in 1874, is being restored by the National Park Service to depict the small community of lifesavers and their families that served here. Big Kinnakeet Lifesaving Station, built in 1879, was located a few miles to the south. This is an area filled with the tradition of the surfmen.

Like many of North Carolina's barrier islands prior to the 1800s, the area around Avon had large maritime forests. But these were felled for the ship-building trades or encroachment by the villagers' feral animals. With the loss of the forests, the dunes began to migrate, pushed by the nearly ever-present winds. The dunes suffocated much of the remaining forest. Today, dune stabilization is a constant task (http://www.hatteras-nc.com/avon/).

2.3.3.3.5 Carteret County, North Carolina

Carteret is one of the 100 counties in North Carolina. It is not part of a Metropolitan Area. These 1997 population of 59,560 ranked 38th in the State.

PER CAPITA PERSONAL INCOME

In 1997, Carteret had a per capita personal income (PCPI) of $20,798. This PCPI ranked 31st in the State, and was 90 percent of the State average, $23,168, and 82 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 5.1 percent from 1996. The 1996-97 State change was 5.1 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Carteret had a total personal income (TPI) of $1,238,751*. This TPI ranked 36th in the State and accounted for 0.7 percent of the State total. The 1997 TPI reflected an increase of 6.8 percent from 1996. The 1996-97 State change was 6.8 and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, propri-

etors' income); dividends, interest, and rent; and transfer payments received by the residents of Carteret. In 1997, earnings were 56.6 percent of TPI; dividends, interest, and rent were 19.8 percent; and transfer payments were 23.6 percent. From 1996 to 1997, earnings increased 7.5 percent; dividends, interest, and rent increased 6.3 percent; and transfer payments increased 5.5 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Carteret increased from $504,266* in 1996 to $552,679* in 1997, an increase of 9.6 percent. The largest industries in 1997 were services, 22.2 percent of earnings; retail trade, 19.1 percent; and state and local government, 18.2 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was transportation and public utilities (5.3 percent of earnings in 1997), which increased 5.6 percent; the fastest was construction (11.4 percent of earnings in 1997), which increased 26.8 percent.

(*All income estimates with the exception of PCPI are in thousands of dollars http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/37/37031.htm).

In 1990 Carteret County had 52,556 residents, allocated among 15,351 families (average size 2.88) and 21,221 households. By 1995 the population was 57,880 and by 1998 to be 60,054. According to 1990 Census data in Carteret County there were 27 captains or other officers of fishing vessels (19 white non-Hispanic males and 8 American Indian or Alaskan native male), and 333 fishers (all male, 302 non-Hispanic white, 5 Hispanic white, 8 non-Hispanic black and 18 “Other races”).

Agricultural services, forestry and fishing account for 1% of employees, 2% of establishments and 2% of annual payroll (Table 61). When fishery-dependent industries (Table 62) are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 91% of establishments in Carteret County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 92% and within hunting, trapping and fishing it is 100%.

Of the 34,567 housing units in the county, 39% were empty in 1990. Of the occupied units, 26% were rental units. Of the vacant units, 76% were for seasonal, recreational or occasional use, and 9% were “usual home elsewhere.”

In 1990, 64% of all residents had been born in the state North Carolina and an additional 11% were born in the southern United States. Further 49% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 20% were living in a different house in 1985 but still within Carteret County, and 11% were living in a different house but still in North Carolina. Three percent of all workers age 16 or over who reside in the county also work within the county.

In 1990, the racial composition of Carteret County was 91% white, 8% black and 1% other groups. Less than 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group (24%), followed by German (13%), Irish, United States or American, and Race or Hispanic Origin Groups (10% each). The vast majority of persons age 5 years and over speak only English (97%), and under 1% of households are classified as linguistically isolated.

In 1990, 31% of county residents were only high school graduates and 11% were only college graduates. Another 21% had some college, and 15% had 9th through 12th grade but no diploma. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 26,406 - with a 5.4% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 13,990. According to the 1997 CBP, there were 16,957 employees and 1,869 establishments. In 1989 the median *household* income was $25,811 - with the median family income at $30,241 and the median non-family income at $14,038. The *per capita* income in 1989 was $13,227. In 1996 the median *household* income was estimated to be $31,746, and 12.7% of the county's population was estimated to be living in poverty.

Carteret County provides a good example of the significance of the fishing industry to local communities in North Carolina. Centrally located along North Carolina's coast, it is one of the state's most important commercial and recreational fishing destinations. A study by the Carteret County Economic Development Council concluded that about 20 percent of the civilian labor force in that county is directly or indirectly employed in commercial fishing. The study further concluded that without commercial fishing, the county's economy would suffer. Although recreational fishing was not analyzed in this study, it undoubtedly also supports a significant number of jobs in Carteret County (http://www.nmfs.gov/habitat/publications/habitatconections/num2.htm).

Port of Morehead City

In 1990 Morehead City had 6,046 residents, allocated among 1,572 families (average family size was 2.82) and 2,692 households. According to 1990 Census data in Morehead City there were 86 persons employed in occupations of agricultural services, forestry and fishing (3% of all employed persons 16 or over), though there were 77 employed in agriculture, forestry and fishing industries (Table 63).

Of the 3,206 housing units in the town, 17% were empty in 1990. Of the occupied units, 45% were rental units. Of the vacant units, 52% were classified as for seasonal, recreational or occasional use only, and 9% were "usual home elsewhere."

In 1990, 68% of all residents had been born in the state of North Carolina and the next largest group (18%) were born in the southern United States. Of persons age 5 and over, 42% were living in the same house in 1990 that they had occupied in 1985. An additional 28% were living in a different house in 1985 but still within Carteret County, and 8% were living in a different house but still in North Carolina. In addition, 89% of all workers 16 and over worked in their county of residence, and 50% work in their town of residence.

In 1990, the racial composition of Morehead City was 82% white and 18% black. Only 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group (20%), followed by Race or Hispanic Origin groups (18%), German (13%) and Irish (10%). The majority of persons age 5 years and over speak only English (96%), and less than 1% of households are classified as linguistically isolated.

In 1990, 30% of town's residents aged 25 and over were only high school graduates and 10% held a only bachelor's degree. An additional 12% had some college, and 18% had 9th through 12th grade but no diploma. In 1989 the median *household* income was $22,041 (85% of the Carteret County average) with the median family income at $26,673 (88% of the county average) and the median

non-family income at $10,794 (77% of the county average). The *per capita* income in 1989 was $11,410 (86% of the county average). Just over 19% of persons for whom poverty status was determined (95% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by public administration and construction.

This area of North Carolina's "Crystal Coast" was the product of extensive planning by John Motley Morehead, governor of North Carolina from 1841 to 1845. He envisioned "a great commercial city" where Shepherd's Point intersected with the Newport River and Beaufort Inlet. Plans were developed to extend the North Carolina Railroad from Goldsboro to Shepherd's Point.

The first lots were sold at public auction in 1857. When the railroad was completed a year later, the area seemed destined for rapid development as a major port. However, Morehead City's continued development as a port was interrupted by The Civil War. Following the war, the shipping terminal deteriorated, but the railroad continued hauling vast quantities of seafood to the state's inland sections.

The section of the city known as the "Promised Land," - along Bridges Street - was settled by refugees from the whaling communities on Shackleford Banks. These communities, approximately six miles east of Morehead City by boat, were utterly destroyed by the great hurricane of 1899.

In recent years, a large charter-fishing fleet has developed. The town has regained its commercial viability as a modern port terminal as well as a being the "sound-side" of the Atlantic Beach resort trade (http://www.morehead.com/history/).

2.3.3.3.6 Newport County, Rhode Island

Newport is one of the 5 counties in Rhode Island. It is not part of a Metropolitan Area. The 1997 population of 82,962 ranked 4th in the State.

PER CAPITA PERSONAL INCOME

In 1997, Newport had a per capita personal income (PCPI) of $27,558. This PCPI ranked 2nd in the State, and was 107 percent of the State average, $25,667, and 109 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 6.0 percent from 1996. The 1996-97 State change was 5.4 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Newport had a total personal income (TPI) of $2,286,246*. (* All income estimates with the exception of PCPI are in thousands of dollars.) This TPI ranked 4th in the State and accounted for 9 percent of the State total. The 1997 TPI reflected an increase of 6.2 percent from 1996. The 1996-97 State change was 5.3 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, propri-

etors' income); dividends, interest, and rent; and transfer payments received by the residents of Newport. In 1997, earnings were 60.8 percent of TPI; dividends, interest, and rent were 20.9 percent; and transfer payments were 18.2 percent. From 1996 to 1997, earnings increased 7.3 percent; dividends, interest, and rent increased 2.8 percent; and transfer payments increased 6.6 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Newport increased from $1,343,651* in 1996 to $1,445,178* in 1997, an increase of 7.6 percent. The largest industries in 1997 were services, 32.4 percent of earnings; federal civilian government, 17.0 percent; and military, 11.6 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was state and local government (8.2 percent of earnings in 1997), which increased 0.8 percent; the fastest was services, which increased 13.1 percent (Regional Economic Information System, Bureau of Economic Analysis http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/44/44005.htm).

In 1990 Newport County had 87,194 residents, allocated among 22,684 families (average size 3.07) and 32,731 households. By 1995 the population was estimated to be 81,933 and by 1998 to be 82,868. According to 1990 Census data in Newport County there were 27 captains or other officers of fishing vessels (19 white non-Hispanic males and 8 American Indian or Alaskan native male), and 333 fishers (all male, 302 non-Hispanic white, 5 Hispanic white, 8 non-Hispanic black and 18 “Other races”).

Agricultural services, forestry and fishing account for 1% of employees, 3% of establishments and 1% of annual payroll (Table 64). When fishery-dependent industries (Table 65) are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 91% of establishments in Newport County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 99%.

Of the 37,475 housing units in the county, 13% were empty in 1990. Of the occupied units, 41% were rental units. Of the vacant units, 46% were for seasonal, recreational or occasional use.

In 1990, 38% of all residents had been born in the state of Rhode Island another 38% were born in the northeast United States. Further 51% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 21% were living in a different house in 1985 but still within Newport County, and 3% were living in a different house but still in Rhode Island.

In 1990, the racial composition of Newport County was 94% white, 4% black and 2% other groups. Of those other groups the largest number were Filipino and then American Indian. Further, 2% of all persons were of Hispanic origin. When reporting first ancestry, Irish was the largest group (19%) followed by English (14%), then Portuguese (13%). The vast majority of persons age 5 years and over speak only English (92%), and only 1% of households are classified as linguistically isolated.

In 1990, 29% of county residents were high school graduates and 19% were college graduates. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 39,876 - with a 7.3% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 23,027. According to the 1997 CBP, there were 25,988 employees and 2,657 establishments. In 1989 the median *household* income was $35,829 -

with the median family income at $41,424 and the median non-family income at $20,929. The *per capita* income in 1989 was $16,819. In 1996 the median *household* income was estimated to be $40,058, and 8.3% of the county's population was estimated to be living in poverty.

Port of Newport

In 1990 Newport city had 28,227 residents, allocated among 6,422 families (average family size was 3.0) and 2,692 households. According to 1990 Census data in Newport there were 316 persons employed in occupations of agricultural services, forestry and fishing (2% of all employed persons 16 or over), though there were 291 employed in agriculture, forestry and fishing industries.

Of the 13,094 housing units in the town, 15% were empty in 1990. Of the occupied units, 58% were rental units. Of the vacant units, 34% were classified as for seasonal, recreational or occasional use only, and 13% were "usual home elsewhere".

In 1990, 44% of all residents had been born in the state of Rhode Island and the next largest group (28%) were born in the northeastern United States. Of persons age 5 and over, 42% were living in the same house in 1990 that they had occupied in 1985. An additional 24% were living in a different house in 1985 but still within Newport County, and less than 1% were living in a different house but still in Rhode Island. In addition, 88% of all workers 16 and over worked in their county of residence, and 67% work in their town of residence.

In 1990, the racial composition of Newport was 89% white, 8% black and 3% other groups - especially American Indian and Filipino. Only 3% of all persons were of Hispanic origin. When reporting first ancestry, Irish was the largest group (25%), followed by English (12%) and German (9%). The majority of persons age 5 years and over speak only English (92%), and less than 3% of households are classified as linguistically isolated.

In 1990, 28% of the town's residents aged 25 and over were only high school graduates and 20% held a only bachelor's degree. An additional 18% had some college. In 1989 the median *household* income was $30,534 (85% of the Newport County average) with the median family income at $37,427 (90% of the county average) and the median non-family income at $20,629 (99% of the county average). The *per capita* income in 1989 was $16,358 (97% of the county average). Just over 11% of persons for whom poverty status was determined (90% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by other professional and related services and educational services (Table 66).

According to updated figures from the city government (Table 67), Newport's economy is improved over 1990. Unemployment is down and commercial construction is up.

The town of Newport was settled in 1639, and was incorporated as a city in 1784. Rhode Island was founded on the basis of complete religious and political freedom, and in Newport, Quakers and Jews found a comfortable haven shortly after its founding. By the early 1700's, commerce, combined with a successful farming and fishing industry, brought great wealth to the community. Newport ships probably developed what became the first resort in British North America when, during the 1720's, sea captains brought passengers from the Carolinas and Caribbean who wished to get away from the

heat, fever and humidity of their plantations.

Newport was one of the five most important settlements in the 13 colonies, sharing that distinction with Boston, New York, Philadelphia and Charlestown. Newport was the "Birthplace of the Navy", and with private and naval shipping combined, added to the cosmopolitan atmosphere of the community. The finest craftsmen in furniture and silver worked here before the Revolution. Summer visitors enjoyed an advanced cultural society that has continued to this day.

Newport combines three communities in one -- the settled community, the Navy (which bases its Naval Education and Training Center here), and the "summer colony." All work in harmony to produce and sponsor events of international importance such as topera and music festivals; the opening of the opulent Vanderbilt, Astor, and Belmont mansions to visitors; and outstanding exhibits and performances of the visual and performing arts.

The city claims more standing buildings built before 1830, than any American community. Many are open to visitors, such as the Old Colony House, the nation's second oldest capitol building; the Redwood Library, the oldest library building in continuous use; the Touro Synagogue, America's oldest Jewish house of worship; the armory of the Artillery Company of Newport, the oldest, active military organization in the country; and several examples of Colonial residential architecture such as the Hunter House, which experts agree rates with the nation's top ten.

Contemporary Newport has a variety of museum attractions, including the International Tennis Hall of Fame, the Newport Auto Museum, and replicas of two ships recalling the port's part in the Revolutionary War, the colonial Sloop-of-War Providence. There are windjammer cruises out of the port, excursion boats, harbor and city bus tours, a New York style disco, scuba diving, surfing, spearfishing, summer theater, golf, pari-mutual jai alai, tennis and fishing along with numerous yacht races for international, national, regional, or Olympic championships. Its numerous restaurants serve up the best in Rhode Island seafood, and several are known for their continental cuisine (http://www.riedc.com/mcds/Newport.html#introduction).

Newport is an historical port dedicated to tourism and recreational boating but with a long and persistent commercial fishing presence. Before the development of the docking facilities at Point Judith, Newport was the center for fishing and shipping in the state. In 1971, 57 percent of all Rhode Island commercial fisheries landings were in Newport, but Point Judith surpassed Newport in importance by 1973, and now is the dominant commercial port in the state.

Tourism in Newport started as far back as the 1700s. Visitors included southern plantation owners who stayed in Newport to escape the heat of the summer. By the 1830s, tourist hotels began to dominate the shore side landscape. The famous "cottages" of Newport where built by industrialists seeking to outdo each other in displays of ostentatiousness. The present tourist economy is centered on year round activities with the highlights being summer and sailing events. The Americas Cup races are regularly held in the area, attesting to the importance of the pleasure boating industry.

Besides tourism, the East Bay Navy base has a major economic impact in the area. The base employees thousands of local civilians in service roles. The service industry also caters to a large retirement community. Many naval personnel familiar with the area from periods at the local War College or at the command schools select Newport for retirement. They bring money into the community as retirement pensions and contribute to the support of many service-oriented businesses

as significant consumers.

The history of the fishery and its present state up to 1980 have been thoroughly described by Bort (1980). We give an overview of the fishing history and infrastructure here, and then focus on the fishery as it now exists.

Fishing has always been an integral part of the local economy, although not of the stature of tourism and other components. It does not make much sense to talk of the degree of community "dependency" on fishing in Newport, for the existing 'community' could do quite well if commercial fishing disappeared altogether. A different perspective is to think of the fishing "community" as a regional contributor to the commerce of the groundfish fishery, and as a means of providing support to approximately 200 families with a sustainable livelihood while they contribute a high-quality food product to the commerce of the region and nation.

During the 1700s to early 1800s, fishing was an important part of the local economy. Historical records mention fish drying stations and fisheries. The quantities of fish are not mentioned, and fisheries as an activity declined by the 1700s with the rapid development of Newport as a slave trading and shipping center.

Whaling was practiced for several decades in the 1770s, but was never as important as it was in ports such as New Bedford and Nantucket. By 1785, the whaling fleet consisted of 50 craft. However, by the late 1850s, most of the craft had either moved to New Bedford or entered other pursuits (Field 1902).

The period from 1800 to 1930 saw the development of the indigenous (bay and inshore) fleet. Fishing effort was concentrated on groundfish stocks that could be reached in a day, fished, and then landed on the dock. Most fish, with the exception of menhaden, were taken in staked and floating fish traps and weirs. This was also the period when industrial fish was a major component of the economy. For example, in 1889 in Newport and other Rhode Island ports, fish reduction plants for menhaden, and fish drying operations for cod and other groundfish processed 127 million pounds of fish, 89 percent of which were menhaden (Olsen and Stevenson 1975). This fishery collapsed in the 1930s, and the fishery transitioned towards groundfish trawling. During the 1920s, marine diesel engines effectively extended the range and fishing time of commercial groundfishing vessels using otter trawls.

Newport has one of the best natural harbors on the northeast. It provides excellent protection from rough weather, and is deep enough to provide berthing for US naval vessels. There is only one wharf area that is presently used by fishers. It is leased by the state to the Newport Shipyard Company. In 1981, major fish buyers included Anthony's Seafood, Aquidnick Lobster Company, and Parascandolo and Sons. Anthony's is no longer in business, and Parascandolo markets all groundfish landings that come into Newport. Fish are not sold or processed locally, but ice packed in trucks to Boston, New York, New Bedford, and markets south. Decisions are made on where to ship the fish based on equitable pricing and demand. Ice is supplied to these firms by the Eastern Ice Company located in Newport. The Tallman and Mack Company, a private firm reported by Bort (1981) to operate fish traps between April and November out of Newport, is no longer in business.

Newport's fishing fleet has dramatically declined over the last twenty years. The decline has been spurred by increasing property values restricting fishing industry infrastructure and competition with

recreational vessels constricting wharf space. No new boats or new shore side fishing businesses have come into the fishery in the last twenty years. The local waters of Narragansett Bay are overfished, and nearshore grounds off the coast and nearby Block Island have experienced significant declines in groundfish. Factors forcing a decline in groundfishing are not recent, but has been ongoing for some time. Bort (1981) wrote: "The general direction of the community's development does not bode well for the future of fishing. Neither tourists nor pleasure boaters are typically enthusiastic about sharing a harbor with commercial fishermen. The stereotypic grizzled old man handlining from a dory is romanticized. The modern steel trawler is viewed as a source of odor and noise and as competition for space. The fishing industry is far down on the list of economic inputs to Newport, and probably also on the community's list of priorities".

Bort (1981) was correct in this prediction. There is still a degree of prejudice by the Newport community against commercial fishers (key respondent, Office of the Harbor Master), and the fleet has declined dramatically. In 1977, 164 boats made landings in Newport. Of these 49 were from Newport, 45 from New Bedford, and the remainder from as far north as Gloucester and as far south as Virginia (Murphy pers. comm.). In 1978, only 91 of these vessels had returned to Newport.

The greatest decline has been in the indigenous, or bay and inshore fleet. After WWII, the indigenous Newport fleet consisted of 20 vessels. In 1981, this number was down to only eight, and in 1996, only four. Declines in nearshore stocks, pollution impacts, competition with stationary gear, and area closures have made inshore groundfishing more difficult. Overall, the Newport fleet is more dependent proportionately on groundfish than the more diversified fleet fishing out of Point Judith. All of the vessels are essentially groundfish fishing, with some having the capacity and permits to fish squid (*Loligo*) as needed in order to maximize the benefit of days at sea limits.

Despite these difficulties, local fishers and fish marketers feel that the remaining fleet represents a stabilized situation. "These guys that fish out of here, they are doing OK - they're holding their own. Prices are down right now with all the foreign fish being shipped in, and its rough. But they're going to make out OK and survive. When they have to, they can switch over to fishing for squid, and that gives them some flexibility" (key respondent, Newport fish marketer as cited by Clay pers. comm.).

However, as in other ports, it does not appear that the social, economic, and cultural capital which comprise the fishery are being reproduced. Multispecies Groundfish permit holders in Newport will eventually have to make the decision to retire their permits to or pass them on to others as vessels age and new recruits do not take up the occupation (a decline in the social yield). The questions that remains for Newport are (1) will the community support the presence of a new generation of fishers, (2) will a support infrastructure survive to allow them to fish, and (3) will anyone be interested in joining a profession that is both dangerous and increasingly economically risky? (Dyer and Griffiths, 1996).

2.3.3.3.7 Washington County, Rhode Island

Washington is one of the 5 counties in Rhode Island. It is part of the Providence-Warwick-Pawtucket Metropolitan Area. The 1997 population of 119,243 ranked 3rd in the State.

PER CAPITA PERSONAL INCOME

In 1997, Washington had a per capita personal income (PCPI) of $27,198. This PCPI ranked 3rd

in the State, and was 106 percent of the State average, $25,667, and 108 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 5.7 percent from 1996. The 1996-97 State change was 5.4 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Washington had a total personal income (TPI) of $3,243,118*. (* All income estimates with the exception of PCPI are in thousands of dollars.) This TPI ranked 3rd in the State and accounted for 12.8 percent of the State total. The 1997 TPI reflected an increase of 6.9 percent from 1996. The 1996-97 State change was 5.3 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Washington. In 1997, earnings were 66.6 percent of TPI; dividends, interest, and rent were 18.2 percent; and transfer payments were 15.2 percent. From 1996 to 1997, earnings increased 8.1 percent; dividends, interest, and rent increased 2.8 percent; and transfer payments increased 7.1 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Washington increased from $1,369,415* in 1996 to $1,439,275* in 1997, an increase of 5.1 percent. The largest industries in 1997 were services, 25.1 percent of earnings; state and local government, 19.6 percent; and retail trade, 12.6 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was state and local government, which increased 0.4 percent; the fastest was nondurable goods manufacturing (8.2 percent of earnings in 1997). (Regional Economic Information System, Bureau of Economic Analysis -- http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/44/44009.htm).

In 1990 Washington County had 110,006 residents, allocated among 28,309 families (average size 3.10) and 39,272 households. By 1995 the population was estimated to be 116,862 and by 1998 to be 120,699. According to 1990 Census data in Washington County there were 131 captains or other officers of fishing vessels (122 white non-Hispanic males and 9 males of “Other races” and 566 fishers (559 non-Hispanic white male, 7 male of “Other races” and 46 white non-Hispanic female).

Agricultural services, forestry and fishing account for 1% of employees, 4% of establishments and 1% of annual payroll (Table 68). When fishery-dependent industries (Table 69) are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 91% of establishments in Washington County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 97%, and within hunting, trapping and fishing it is 100%.

Of the 49,856 housing units in the county, 21% were empty in 1990. Of the occupied units, 31% were rental units. Of the vacant units, 65% were for seasonal, recreational, or occasional use and 6% were “usual home elsewhere.”

In 1990, 61% of all residents had been born in the state of Rhode Island and the next largest group

(25%) were born in the northeast United States. Further 53% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 18% were living in a different house in 1985 but still within Washington County, and 10% were living in a different house but still in Rhode Island. Of workers age 16 and up, 56% work in the county.

In 1990, the racial composition of Washington County was 97% white, 1% black and 1% American Indian, Eskimo, or Aleut. Further, under 1% of all persons were of Hispanic origin. When reporting first ancestry, Irish and English were the highest groups (17% each), followed by Italian (16%), and German (8%). The vast majority of persons age 5 years and over speak only English (93%), and only 1% of households are classified as linguistically isolated.

In 1990, 29% of county residents were only high school graduates and 18% were only college graduates. An addition 18% had some college. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 59,130 -- with a 5.4% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 30,887. According to the 1997 CBP, there were 31,915 employees and 3,381 establishments. In 1989 the median *household* income was $36,948 -- with the median family income at $42,343 and the median non-family income at $20,234. The *per capita* income in 1989 was $16,182. In 1996 the median *household* income was estimated to be $44,397, and 6.7% of the county's population was estimated to be living in poverty.

Port of Point Judith

While Point Judith is not an incorporated place and as such is not available in the general census files, both Point Judith and nearby Narragansett are included in the county subdivision of South Kingstown. Census data for that entity are therefore included here.

In 1990 South Kingstown had 24,631 residents, allocated among 5,243 families (average family size was 3.11) and 7,456 households. According to 1990 Census data in south Kingstown there were 423 persons employed in occupations of agricultural services, forestry and fishing (4% of all employed persons 16 or over), though there were 448 employed in agriculture, forestry and fishing industries.

Of the 9,806 housing units in the town, 24% were empty in 1990. Of the occupied units, 90% were rental units. Of the vacant units, 84% were classified as for seasonal, recreational or occasional use only, and 11% were "usual home elsewhere".

In 1990, 45% of all residents had been born in the state of Rhode Island and the next largest group (28%) were born in the northeastern United States. Of persons age 5 and over, 46% were living in the same house in 1990 that they had occupied in 1985. An additional 18% were living in a different house in 1985 but still within Washington County, and 14% were living in a different house but still in Rhode Island. In addition, 65% of all workers 16 and over worked in their county of residence.

In 1990, the racial composition of South Kingstown was 93% white, 2% black and 2% American Indian, Eskimo or Aleut and 3% Asian or Pacific Islander. Only 1% of all persons were of Hispanic origin. When reporting first ancestry, English and Irish were the largest groups (16% each) followed by Italian (13%). The majority of persons age 5 years and over speak only English (92%), and less than 1% of households are classified as linguistically isolated.

In 1990, 24% of the town's residents aged 25 and over were only high school graduates and 20% held a only bachelor's degree. An additional 17% had some college. In 1989 the median *household* income was $36,481 (99% of the Washington County average) with the median family income at $41,895 (99% of the county average) and the median non-family income at $21,523 (6% above the county average). The *per capita* income in 1989 was $14,325 (89% of the county average). Just over 7% of persons for whom poverty status was determined (74% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by educational services and other professional and related services.

Updated data are available for Narragansett only (Table 69). These indicate that employment in agriculture, forestry and fisheries has more than doubled between 1990 and 1998. However, some of this may simply be movement within the general Point Judith area rather than actual increases. Employment in retail trade and services are also up considerably. Unemployment overall is down.

Commercial fishing in Point Judith is an historically recent activity. The port lacks the complex fishing traditions and infrastructure of the larger ports such as Gloucester and New Bedford. Here, a fleet consisting of offshore and inshore vessels follow a cyclic, shifting pattern of resource use that sets Point Judith apart from the northern New England ports. Point Judith boats are diverse in their annual round and approach to the fisheries as opposed to New Bedford boats which only go after groundfish. Fishers are employed full-time as they switch fisheries and boats during the year. The port most similar to Point Judith is Chatham, although Chatham has no large offshore vessels in its fleet.

Beginning in the 17th century and through most of the 18th, the region of southern Rhode Island surrounding Point Judith was a farming community. Pictures from the turn of the century show plowed fields and farm settlements where there are now secondary growth forest and housing developments. The textile industry started in 1802, became prominent in the late 19th century, and then collapsed. The 20th century has seen the decline of agriculture and mill manufacturing, and their replacement with the tertiary services sector, including retail trade, health care, education, and tourism. Commercial fishing is a secondary industry that came to prominence in the 1930s. Unlike other primary sector industries such as agriculture which have declined, fishing advanced in importance.

Seining was carried out by 'fishing gangs', characterized by fish houses along the beach with bunks in which they slept until it was time to fish. Gangs were equipped with two boats and a seine, and this fishing practice continued until about 1940. Trap fishing and lobstering were also important early fishing methods in the area.

After WWII, the fishing fleet expanded and a cooperative was formed (The Point Judith Fishermen's Cooperative Association, locally known as "the Coop"). This included most all inshore groundfishers in the port. As of 1978, Point Judith's landings made up 61 percent of Rhode Island's total catch. In 1992, the total value of fish landed in Point Judith was $36.2 million.

With enactment of the 200 mile limit in 1976, fishing strategies began to diversify as lobster, shellfish, and swordfishing became important. These new fisheries did not require the same

precision, or knowledge of the grounds as groundfishing. It encouraged a whole new generation of fisher who worked outside the established Coop. Many of these newcomers had never fished before, but were making a lot of money. New entrants were also encouraged by inexpensive boat loans made available through the US Department of Commerce. The expansion of the industry in the late 1970 pressured the Coop to put a moratorium on memberships. This was extended until 1986-87 when the Coop increased its processing capacity by moving into a new larger building. Yet during the Coop moratorium, other companies filled the niche created by the expanding industry, and by the time the Coop could accommodate the influx, there was little incentive for fishers to join. The expansion of the Coop increased operating costs, and along with pressures from local and external (main market) competitors, contributed to its collapse in 1994.

The social cohesiveness of the Point Judith community was based on sharing the common occupation and traditions of the fishing lifestyle. Twenty years ago, there was a different atmosphere to the community. Bait processing and related jobs brought locals with no prior experience into contact with established fishers to share in the development of the industry. An event that represented this shared lifestyle was the blessing of the fleet. The blessing was marked with food, games, parades, and other festivities. Commercial fishing boats would be cleaned and decorated for the celebration to symbolically demonstrate their central value in the social and economic life pattern of the community (Dyer and Griffith 1996).

Tourism, however, has continued to gain in importance in Point Judith in recent years. A similar process typifies nearby Newport, where fishing has been overshadowed and incrementally reduced by more than a hundred years of touristic development (Bort 1980). For example, with the increasing costs of boat insurance, insurance companies refused to cover anyone hurt during the Blessing of the Fleet celebration: "They went so far as to say, anyone participating, such as boat owners letting people on their vessels, would have their entire insurance canceled" (Clay pers. comm.). Such insurance blackmail effectively ended the blessing, and the town officials never fought to keep this significant marker of the local fishing culture alive (personal communication, key respondent). This change represented a shift in social and economic alliances away from fishing towards tourism.

Areas where fishers used to park before setting out to sea are now lots for tourists. All but one of the social gathering spots for fishers have been converted into tourist attractions such as ice cream shops and restaurants. Weakening of the communal identity of fishers has had a negative social impact. A symptom of this is the changing role of the Point Judith Mission. The Mission initially helped fisher families in crisis with food and small loans. Over the years the emphasis moved towards helping fishers with drug and alcohol addiction problems. Today, some key respondents feel the Mission has lost its community orientation as a support resource for fishing families.

Despite these changes, as one respondent put it, "there is still a distinct community of fishermen here". Fishers comprise a social and occupational network. People know each other. The small town atmosphere is punctuated by functions such as the Fishermen's Scholarship fund, that recently had its annual game feast where $6,000 were raised for the sons and daughters of fishers.

Port facilities, although small scale compared to New Bedford or Gloucester, are adequate for the size of the local fleet. There are approximately 230 vessels of all types berthed in Point Judith (McGovern pers. comm.). The area is not much bigger than 3 city blocks, but all the activity in the area is associated with some aspect of the fishing industry. Vessels are located at a number of docks which extend perpendicular to the main street. Another set of docks extend off a large industrial

area. Across from the harbor are a number of empty docks for seasonal recreational boaters.

There are numerous support industries along the water. The large industrial area at the North end of the street is where most fish processing is done. It has six processing plants including the former Point Judith Coop (now owned by an independent operator) and the Town Dock. Facilities include dockside fuel pumps, a single restaurant/store, bait shops, commercial marine suppliers, recreational suppliers, and vessel repair shops. Along the adjoining streets are several other restaurants devoted to seafood. The Block Island Ferry also leaves from this port and promotes a large seasonal population of people passing through town.

The main docking facility is the Town Dock. It employs 50 people and hires between 20-50 part-timers as needed. Temporary employees work at the dock on a seasonal basis depending on the species. Permanent employees all live in the area, while part-timers live as far away as Providence.

Town Dock handles 12 permanent vessels in the 60-70 foot range. They do handle some vessels from other ports, but primarily deal with the 12 Point Judith vessels. Dock space does not appear to be a problem in Point Judith, as long as boats are out at sea. During storms the boats have to 'raft-out' which means they tie up to one another along the docks. Boats are charged a docking fee which is handled by the state. There are more docks than processing places in town with a dozen different places to tie up.

At one time, the dock served as a cutting dock for yellowtail and summer flounder, and cod. About seven years ago it shifted its focus because of a decrease in landings for these species. Now they process little groundfish and deal primarily with squid, herring and mackerel. Other important species include butterfish, scup, and summer flounder. Fish product from Point Judith is considered to be of very high quality. It commands high prices in Fulton's and the Boston Fish Market.

Squid, herring, mackerel and whiting are predominantly offshore midwater species caught by large (70 foot) vessels. Groundfish such as cod, flounder and haddock are primarily targeted by inshore medium length vessels but by no offshore vessels.

An ecological advantage for Point Judith fishers is that they are close to many of their primary stocks, including relatively new target species such as squid. Another advantage is that Point Judith fishers have access to mid-Atlantic stocks such as butterfish, which are approaching the northern most point for many species, as well as access to northern traditional groundfish areas and stocks. An important key to adaptability of Point Judith fishers is stock and gear switching. This adaptability is attuned to the mixing of Mid-Atlantic and New England marine ecozones.

In a telephone survey, the total number of suppliers of fisheries equipment was noted as eleven, with 32 wholesale fish and seafood buyers, four seafood brokers, and 2 packers. Fish product from Point Judith has the reputation for being fresh and of high quality. It brings good prices in major markets.

The Point Judith fisheries have been dominated by otter-trawl dragging and lobster pot fishing, which together regularly make up 90-95 percent of the catch.

The fleet in Point Judith is very unlike those in Gloucester and New Bedford, and most similar to the Chatham fishing fleet. It differs from Chatham in having an offshore fleet (17 compared to none for Chatham). The industry and the local fisher families, with the possible exception of lobster

fishers and shellfishers victimized by the Cape North oil spill, are under less stress than those in ports such as Gloucester and New Bedford. Adaptability is a trademark of the Point Judith fleet, and local respondents say they have enjoyed six successful consecutive fishing seasons. As a major gear supplier notes (Clay pers. comm.):

"The fishermen have had the best year they have had in a long time last year -- and that's true in both the Gulf of Maine and south of Cape Cod. It's not true in the traditional New Bedford, Gloucester, and Boston fisheries. But the other fisheries -- the Mid-Atlantic fisheries -- have grown, and good fishermen in the Gulf of Maine have had a good year despite reduced effort. And I think a lot of fishermen are optimistic for the future. They see things coming along much faster than management, I think, sees them coming."

Like Chatham, Point Judith fishers have the capacity and willingness to innovate and spread their efforts across different gear types and fishery stocks (key respondent, local fishing community leader). For example, recent increases in local landings result from targeting herring, which involves a gear conversion costing $125,000. Such success and economic flexibility is mirrored in a fleet that is fairly modern and in good repair.

The number of commercial vessels in port in 1996 were 134. Vessels range from 45-90 feet, with most being ground trawlers. Of these, 55 are between 45 and 75 feet, and 17 over 75 feet. The smaller vessels have 1-2 person crews, with larger vessels manned by 4-5 crew. Most larger vessels fish for squid, herring and whiting. Some smaller inshore boats are still targeting groundfish, but no boats over 70 feet are.

Some larger vessels from Gloucester and other ports may join the local fleet. One fisher from Gloucester recently fished for squid off of Rhode Island. His motivation was to establish a history in the squid fishery (a form of future 'fishing investment'), although he actually lost money on the initial venture.

As in Gloucester, there is an external market for seafood products, including processing of non-local seafood products. For example, the Mitsubishi corporation has an arrangement with Sea Fresh Corporation. Mitsubishi Fresh, Inc. contracts 16 Taiwanese longliners to fish for big eye and yellowfin tuna off of Brazil and Trinidad. These vessels stay out for six months at a time, unloading their catch onto carrier vessels in exchange for fuel and food, and then return to Trinidad where the main plant is located. Fish are handled and shipped from Trinidad to Miami and New York for distribution in the United States markets. Most of the harvest is sold domestically. All sales and business are conducted out of Narragansett. The involvement of foreign investors in local seafood processing is a pattern that is begin repeated in many ports.

The original inhabitants of the region where Algonquin Indians, who hunted, trapped and cultivated until being replaced by European colonists. Indian displacement began with the Pettaquamscutt Purchase in 1658, followed by other transactions in 1660 and 1662. White settlers practiced agriculture using slaves and indentured servants for the next 200 years. The industrial sector boomed in the early 1800s with the growth of textile mills, while the agricultural sector experienced declines with gentrification of the area and shifts in labor to mill jobs. Details of demographic transition and economic history from these early years up to 1970 can be found in Poggie and Gersuny (1978). The primary trend has been towards an increase in the services sector away from primary and secondary sectors. In 1970, only 1.1 percent of workers were engaged in agriculture

(93 people), 903 in manufacturing (including 244 in textiles), 24.2 percent in material goods-producing occupations, with the majority (74.7%) involved in various professional, white collar, and service pursuits.

As of 1996, the labor force remains skewed towards the service industry, with fishers' numbers remaining fairly constant. Few new fishers are coming into the industry from local communities, but sons of fishers are inheriting operating vessels and permits (key respondent, Point Judith as cited by Clay pers. comm.). Tourism has also become a competing industry, as described below. Although fishers are holding their own, access to prime docking space and 'social space' is being lost to tourism development.

Most fishers from this port live in a 20 mile radius. There is little residential housing in the immediate vicinity. Thus, there is no communal enclave of fishers' residences, and fishing families are scattered throughout the small local communities of Southern Rhode Island, including Snug Harbor, Wakefield, and Narragansett. Although Point Judith does have a tradition in the fisheries, most of the people here have little family connection to the fishing industry. The typical Point Judith fisher is around 40 years old, has college or masters degrees, and came into the fisheries during the 60's primarily for the lifestyle and financial independence afforded by the occupation.

The majority of fishers are first generation and lack historical ties to the industry. There is also little ethnic diversity in a population characterized as highly adaptive. The more ethnically rooted a fishing community is, the more difficult it is for them to change. There is a good side to lack of tradition.

The overwhelming majority of fishers are white males. Older fishermen refer to themselves as "Swamp Yankees." On the other hand, a majority of fish processing workers are ethnic minorities. The former Coop contracts a company to bus in Asians and Puerto Ricans from Providence to work in the fish houses.

Several local organizations represent fishers and their issues. Until 1994, the Point Judith Fisherman's Coop was a viable organization which provided marketing support to members. The marketing-purchasing organization of the Coop made it "one of the most effective fishing cooperatives in the United States." Overcapitalization has been cited as the major factor in the failure of the cooperative, but other conditions such as poor prices and market conditions could have contributed to its demise (key respondent, Point Judith as cited by Clay pers. comm.). The Coop has been purchased, and is now run as an independent fish marketing organization.

An important fishing organization based out of Point Judith is the East Coast Fisheries Federation (ECFF). It is mainly a large boat organization extending from New Bedford to New Jersey. ECFF is partially supported by funding from local processors, and functions to keep fishers abreast of important management issues. Funds are taken from fuel costs, with 3 cents from every gallon going to the organization, which ensures its existence even if there is a lack of interest.

According to the organization president "most fishermen are issue orientated when it comes to joining organizations...so when the crisis is handled, the organization usually goes down the drain. Because there is a no hassle membership subscription with our organization, these vessels are ensured consistent representation and information from the stability of the organization funds." The president claims he has never lost a member by default and sees a continuing solid base of participa-

tion.

The primary issues in this port are distilled from interviews with key informants as the most often mentioned critical issues. They reflect the focus and concern of Point Judith fishers in maintaining flexibility and adaptability: being able to change fisheries, versatility, but dampened by the hassle of numerous new permits for the different fisheries and not knowing the control dates until after the fact; being on the margins of management decision making; restrictions on the mesh size you can have onboard your vessel with what fish, the need for these fisheries to be able to switch mesh sizes mid-tow; gear conflict offshore between draggers and offshore lobster pots as well as inshore between draggers and gillnetters; fear of ITQs; positive attitudes towards the buyout program; inability to improve your business by increasing your vessel size and/or horsepower (Certain fisheries, such as groundfish and scallops, have vessel upgrade limits on length, tonnage, and horsepower as a form of effort control.); distrust of the political process of developing FMPs; discouragement at the time lapse between the gathering of scientific data and the proper use of that data; insulted by the way they are perceived and publicly portrayed by fishery scientists (no perceived respect for their knowledge or experience as fishers by those managing the resource); pollution impacts on nearshore waters; interference in commercial fishing by the developing tourist (recreational boating) sector; including loss of dock space for nearshore draggers; poor prices because of the influx of foreign fisheries products driving down exvessel value of domestic fresh-caught fish; and no control over the marketing end of the industry (loss of any control over prices when the Coop went bankrupt).

The development of tourism in south Kingston and a focus on offshore trawling has also created problems for the few inshore draggers who wish to continue groundfishing. Dock space is expensive, and supporting commercial infrastructure cannot be expanded upon, since it is in competition with a growing recreational boat sector. The trend has been towards consolidation of infrastructure and loss of 'social' space as the surrounding area becomes gentrified.

The kinds of impacts being felt by families of large draggers in places such as New Bedford and Gloucester is not apparent in Point Judith. Fishers are still under stress because of the constantly changing regulatory climate, but appear to be coping by maintaining flexible fishing strategies. The oil spill has also stressed local fishing families, particularly those that rely on shellfishing and lobstering for all or part of their fishing income (Dyer and Burroughs 1996).

As in all of the primary ports surveyed, there is no evidence that the industry is replicating itself or expanding through the introduction of new vessels and support businesses. However, Point Judith fishers are, overall, being able to sustain their level of social yield in the fishery by maintaining a great degree of adaptability to changing regulatory and economic conditions.

The social reproduction of the fishery follows a father-son progression, and fishers are related to each other patrilineally. This is predicted by the Natural Resource Community model, in which relationships to utilization of local resources, whether they be extracted through commercial fishing, farming, or for subsistence purposed, tie individuals to a location through the social and cultural value of a renewable natural resource extraction lifestyle.

Thus, patrilineal kinship ties have defined the social and occupational networks of local fishers for generations. A recent dockside intercept survey of seven boat captains found them working with

a son and/or one other male relative as part of the crew.

One significant change is that women are involved more as crew a dockside support than they have been in the past, with at least one woman boat owner in the port. Another difference with the present fishing populations from the early 1970s is that there has been an influx of first time fishers from URI and nearby communities that have no family history in the industry, and got into fishing because it was an available option. Present recruitment, however, is at a standstill as limits on permits, well established occupational networks, and high start-up costs inhibit new entrants to the fishery.

Other issues include gear conflicts, area restrictions, and competition for resources with the recreational sector.

Social conflicts noted by Poggie and Gersuny (1978) have only worsened since, and their description is apt: "Although they are circumspect in talking about them, commercial fishermen also have to contend with sports fishermen and pleasure boating enthusiasts as competitors in the social environment. Inshore pot lobstermen in particular view these groups as their enemies, as human predators who interfere with their livelihood. Pleasure boaters frequently violate the rules of the road and damage fishing gear, as well as compete for scarce dock space".

Fishers of Point Judith are maintaining their economic viability by taking advantage of a good mix of mid and north Atlantic fish stocks, and by maintaining diversity in seasonal fishing patterns, gear types, and permits held. The result is a relatively economically healthy fishing fleet, but with few new recruits and no new vessels coming into the system. Ties to international markets have kept the inshore processing sector viable even with the declines in groundfish landings. Offshore midwater draggers have also made up for local declines in groundfish landing by targeting high biomass midwater species such as whiting, herring and squid. The immediate future of the fishery in Point Judith looks good, but the lack of recruitment and loss of social and cultural capital through gentrification prevents the industry from expanding. There is evidence that this is occurring, since the south Kingston area is experiencing a population growth due to high quality of living and benefits of a good school system which is driving rapid land development. As values of local dock space and land increase, further declines in fishing infrastructure may follow (Dyer and Griffiths 1996).

2.3.3.3.8 New London County, Connecticut

New London is one of the 8 counties in Connecticut. It is part of the New London-Norwich Metropolitan Area. The 1997 population of 248,838 ranked 4th in the State.

PER CAPITA PERSONAL INCOME

In 1997, New London had a per capita personal income (PCPI) of $28,466. This PCPI ranked 6th in the State, and was 79 percent of the State average, $35,863, and 113 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 3.7 percent from 1996. The 1996-97 State change was 5.5 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, New London had a total personal income (TPI) of $7,083,512*. (* All income estimates with the exception of PCPI are in thousands of dollars.) This TPI ranked 4th in the State and accounted for 6 percent of the State total. The 1997 TPI reflected an increase of 3.6 percent from 1996. The 1996-97 State change was 5.7 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of New London. In 1997, earnings were 66.1 percent of TPI; dividends, interest, and rent were 17.5 percent; and transfer payments were 16.4 percent. From 1996 to 1997, earnings increased 3.0 percent; dividends, interest, and rent increased 4.3 percent; and transfer payments increased 4.9 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in New London increased from $4,983,674* in 1996 to $5,286,511* in 1997, an increase of 6.1 percent. The largest industries in 1997 were services, 34.4 percent of earnings; durable goods manufacturing, 12.6 percent; and nondurable goods manufacturing, 9.9 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was durable goods manufacturing, which decreased 7.9 percent; the fastest was construction (5.2 percent of earnings in 1997), which increased 23.6 percent (Regional Economic Information System, Bureau of Economic Analysis http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/09/09011.htm).

In 1990 New London County had 254,957 residents, allocated among 67,291 families (average size 3.07) and 93,542 households. By 1995 the population was estimated to have dropped to 250,404 and by 1998 to 245,740. According to 1990 Census data in New London County there were 19 captains or other officers of fishing vessels (all white non-Hispanic males), and 85 fishers (all non-Hispanic white, 67 male and 18 female).

Agricultural services, forestry and fishing account for an undisclosed percent of employees, 2% of establishments and an undisclosed percent of annual payroll . When fishery-dependent industries are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 88% of establishments in New London County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 98% and within hunting, trapping and fishing it is 100%.

Of the 104,461 housing units in the county, 11% were empty in 1990. Of the occupied units, 35% were rental units. Of the vacant units, 43% were for seasonal, recreational or occasional use, and 13% were “usual home elsewhere”.

In 1990, 52% of all residents had been born in the state of Connecticut and 24% were born in the northeast United States. Further 53% of persons age 5 and over were living in the same house in 1990 that they had occupied in 1985. An additional 25% were living in a different house in 1985 but still within New London County, and 6% were living in a different house but still in Connecticut.

In 1990, the racial composition of New London County was 92% white, 5% black and 3% other groups. Of those other groups the largest number were Filipino and then American Indian. Further,

3% of all persons were of Hispanic origin. When reporting first ancestry, Irish, English and German were the largest groups with 12% each. The majority of persons age 5 years and over speak only English (91%), and only 2% of households are classified as linguistically isolated.

In 1990, 33% of county residents were only high school graduates and 13% were only college graduates. Another 19% had some college and 12% had 9th through 12th grade but no diploma. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 129,725 - with a 5.3% unemployment rate. The number of employees in the county for 1994 was 87,469. According to the 1997 CBP, there were 102,722 employees and 5,801 establishments. In 1989 the median *household* income was $37,488 - with the median family income at $43,256 and the median non-family income at $22,457. The *per capita* income in 1989 was $16,702. In 1996 the median *household* income was $43,725, and 7.3% of the county population was estimated living in poverty.

Port of Stonington

In 1990 Stonington borough had 1,100 residents, allocated among 293 families (average family size was 2.67) and 576 households. According to 1990 Census data in Stonington there were 17 persons employed in occupations of agricultural services, forestry and fishing (3% of all employed persons 16 or over), though there were 18 employed in agriculture, forestry and fishing industries (Table 70).

Of the 713 housing units in the town, 20% were empty in 1990. Of the occupied units, 48% were rental units. Of the vacant units, 56% were classified as for seasonal, recreational or occasional use only, and 43% were "usual home elsewhere".

In 1990, 33% of all residents had been born in the state of Connecticut and 43% were born in the northeastern United States. Of persons age 5 and over, 60% were living in the same house in 1990 that they had occupied in 1985. An additional 18% were living in a different house in 1985 but still within New London County, and 5% were living in a different house but still in Connecticut. In addition, 87% of all workers 16 and over worked in their county of residence and 23% worked in Stonington.

In 1990, the racial composition of Stonington was 99.7% white. Only 2% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group (22% each) followed by Irish (13%) and Italian and German (11% each). The majority of persons age 5 years and over speak only English (84%), and 5% of households are classified as linguistically isolated.

In 1990, 20% of the town's residents aged 25 and over were only high school graduates and 23% held a only bachelor's degree. An additional 19% had some college. In 1989 the median *household* income was $38,654 with the median family income at $50,880 and the median non-family income at $26,641. The *per capita* income in 1989 was $27,965. Just over 5% of persons for whom poverty status was determined (99.8% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is manufacturing, durable goods, followed by retail trade.

Port of New London

In 1990 New London city had 28,540 residents, allocated among 6,113 families (average family size

was 3.0) and 10,736 households. According to 1990 Census data in New London city there were 423 persons employed in occupations of agricultural services, forestry and fishing (4% of all employed persons 16 or over), though there were 448 employed in agriculture, forestry and fishing industries.

Of the 11,970 housing units in the town, 11% were empty in 1990. Of the occupied units, 63% were rental units. Of the vacant units, 10% were classified as for seasonal, recreational or occasional use only, and 9% were "usual home elsewhere".

In 1990, 45% of all residents had been born in the state of Connecticut and the next largest group (23%) were born in the northeastern United States. Of persons age 5 and over, 42% were living in the same house in 1990 that they had occupied in 1985. An additional 27% were living in a different house in 1985 but still within New London County, and 5% were living in a different house but still in Connecticut. In addition, 94% of all workers 16 and over worked in their county of residence, and 50% worked in New London city.

In 1990, the racial composition of New London city was 73% white, 17% black, 7% "other race" and 3% other groups - primarily Filipino. Nearly 12% of all persons were of Hispanic origin. When reporting first ancestry, "race of Hispanic origins" (24.1%) was the largest group, followed by Irish (12%), and Italian (11%). The majority of persons age 5 years and over speak only English (81%), and 5% of households are classified as linguistically isolated.

In 1990, 32% of the town's residents aged 25 and over were only high school graduates and 11% held a only bachelor's degree. An additional 6% had some college. In 1989 the median *household* income was $26,336 (70% of the New London County average) with the median family income at $31,274 (73% of the county average) and the median non-family income at $20,024 (89% of the county average). The *per capita* income in 1989 was $12,971 (78% of the county average). Just over 15% of persons for whom poverty status was determined (86% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by educational services and other professional and related services (Table 71).

New London city is also actively seeking to enhance its economic development - including its port areas, as seen in the following excerpt from the city web page:

ENTERPRISE ZONE: The City of New London's Enterprise Zone, expanded in 1993, encompasses a majority of the waterfront, commercial and industrial property that lies within the City of New London. The Enterprise Zone provides both real estate and personal property tax abatements for manufacturers and provides real estate property tax abatements for commercial expansion of property located within the Zone. It is anticipated that the Enterprise Zone will compliment the incentives provided through the Foreign Trade Zone and will stimulate the economic development of the State Pier Industrial Area.

FOREIGN TRADE ZONE: Located near the State Pier, the City of New London's Foreign Trade Zone encompasses 140 acres of industrial public and private property with direct transportation access by water (via State Pier), overland by rail (Railtex) and road (via I-95). The Foreign Trade Zone allows for large importers/exporters to take advantage of tariff reductions through the manu-

facture, storage and distribution of raw materials and goods assembled and transported through the Zone.

PORT DEVELOPMENT: A $25 million renovation has been completed at State Pier and the Port is now ready to accept cargo. Logistec, Inc. of Montreal has been hired by the State of Connecticut to act as the Port operator and has been aggressively and actively marketing the Port.

OTHER NEIGHBORHOOD REVITALIZATION EFFORTS: State enabling legislation, PA 95-340, enacted in 1995, provides for the "Establishment of Neighborhood Revitalization Zones" in communities where there are a significant number of properties which are foreclosed, vacant, abandoned, blighted, substandard and pose a public safety hazard. The legislation establishes a new model for economic revitalization of neighborhoods on the local level through the inclusion of the private sector and participation of neighborhood residents with the local government. The City adopted a local resolution to establish such Neighborhood Revitalization Zone(s) as an additional means of pursuing its efforts at neighborhood revitalization. The City has begun the planning process from which a strategic plan will be developed. In conjunction with this effort, the City has funded the following program through the Community Development Block Grant Program.

NEIGHBORHOOD ENHANCEMENT PROGRAM: Provides funds for administration and operating costs to implement a comprehensive program, the aim of which is to preserve and strengthen New London's neighborhoods by ridding them of abandoned and deteriorated buildings, putting vacant and overgrown lots to better use, improving substandard housing, increasing the number of lead safe housing units and providing for infrastructure improvements. The plan is to approach the problem by targeting specific geographic areas and involving the residents of those areas in the improvement of their neighborhoods. This strategy includes designating "Neighborhood Revitalization Zones" (NRZ) and assisting NRZ committees in preparing strategic plans for their particular area. Another component of the program involves the disposition of City owned property that has been acquired through the tax sale process. Additionally, a component which addresses the problem of lead detection and poisoning prevention will be an important aspect to increase the habitability of our housing stock and strengthen the fabric of the neighborhoods. Funds for this are provided through the City's "Housing Conservation Program" that provides loans to property owners for rehabilitation. The "Neighborhood Infrastructure Improvement Program" provides funds for self-directed neighborhood improvements such as safe street lighting, sidewalks, permanent landscaping, and signs. This program is administered in conjunction with the Neighborhood Alliance organization established as a result of the "Safe Neighborhoods Program," a state funded program designed to offer a comprehensive enforcement, crime prevention, and security enhancement program (http://www.NewLondon-CT.com/developmentmenu.htm).

2.3.3.3.9 Cumberland County, Maine

Cumberland is one of the 16 counties in Maine. It is part of the Portland Metropolitan Area. The 1997 population of 251,368 ranked 1st in the State.

PER CAPITA PERSONAL INCOME

In 1997, Cumberland had a per capita personal income (PCPI) of $28,044. This PCPI ranked 1st in the State, and was 128 percent of the State average, $21,937, and 111 percent of the national average, $25,288. The 1997 PCPI reflected an increase of 6.2 percent from 1996. The 1996-97

State change was 4.7 percent and the national change was 4.7 percent.

TOTAL PERSONAL INCOME

In 1997, Cumberland had a total personal income (TPI) of $7,049,478*. (* All income estimates with the exception of PCPI are in thousands of dollars.) This TPI ranked 1st in the State and accounted for 25.9 percent of the State total. The 1997 TPI reflected an increase of 7.0 percent from 1996. The 1996-97 State change was 5.0 percent and the national change was 5.7 percent.

COMPONENTS OF TOTAL PERSONAL INCOME

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Cumberland. In 1997, earnings were 64.8 percent of TPI; dividends, interest, and rent were 19.8 percent; and transfer payments were 15.4 percent. From 1996 to 1997, earnings increased 8.5 percent; dividends, interest, and rent increased 3.4 percent; and transfer payments increased 5.3 percent.

EARNINGS BY INDUSTRY

Earnings by persons employed in Cumberland increased from $5,174,190* in 1996 to $5,607,859* in 1997, an increase of 8.4 percent. The largest industries in 1997 were services, 31.0 percent of earnings; finance, insurance, and real estate, 12.4 percent; and retail trade, 12.2 percent. Of the industries that accounted for at least 5 percent of earnings in 1997, the slowest growing from 1996 to 1997 was wholesale trade (7.8 percent of earnings in 1997), which increased 3.7 percent; the fastest was durable goods manufacturing (6.2 percent of earnings in 1997), which increased 23.6 percent (Regional Economic Information System, Bureau of Economic Analysis http://www.bea.doc.gov/bea/regional/bearfacts/bf9697/23/23005.htm).

In 1990 Cumberland County had 243,135 residents, allocated among 63,593 families (average size 3.01) and 94,607 households. By 1995 the population was estimated to be 248,526 and by 1998 to be 253,582. According to 1990 Census data in Cumberland County there were 124 captains or other officers of fishing vessels (all white non-Hispanic males), and 614 fishers (all non-Hispanic white, 587 male and 27 female).

Agricultural services, forestry and fishing account for 1% of employees, 2% of establishments and 1% of annual payroll. When fishery-dependent industries are added in the level of dependence increases, but is difficult to calculate due to data reporting restrictions in the County Business Pattern data. Overall, 87% of establishments in New London County employ 1-19 employees; within agricultural services, forestry and fishing this percentage is 98% and within hunting, trapping and fishing it is 100%.

Of the 109,890 housing units in the county, 14% were empty in 1990. Of the occupied units, 36% were rental units. Of the vacant units, 67% were for seasonal, recreational or occasional use, and 3% were “usual home elsewhere”.

In 1990, 65% of all residents had been born in the state of Maine and 21% were born in the northeast United States. Further 52% of persons age 5 and over were living in the same house in 1990 that

they had occupied in 1985. An additional 26% were living in a different house in 1985 but still within Cumberland County, and 8% were living in a different house but still in Maine. Of resident workers age 16 and over, 90% work within the county.

In 1990, the racial composition of Cumberland County was 98% white and less than 1% any other groups. Further, under 1% of all persons were of Hispanic origin. When reporting first ancestry, English was the largest group with 22%, followed by Irish (14%) and French (10%). The majority of persons age 5 years and over speak only English (94%), and only 1% of households are classified as linguistically isolated.

In 1990, 32% of county residents were only high school graduates and 18% were only college graduates. Another 18% had some college. The civilian labor force in 1994, according to the Bureau of Labor Statistics, was 125,102 - with a 5.1% unemployment rate. The number of employees in the county for 1994, according to County Business Pattern (CBP) data from the Census, was 122,974. According to the 1997 CBP, there were 136,988 employees and 9,793 establishments. In 1989 the median *household* income was $32,286 - with the median family income at $38,882 and the median non-family income at $19,490. The *per capita* income in 1989 was $15,816. In 1996 the median *household* income was estimated to be $38,190 and 9.2% of the county's population was estimated to be living in poverty.

The County of Cumberland was incorporated in 1760 and was named after William, Duke of Cumberland, son of George II. The county is comprised of three cities and twenty-four towns, with the city of Portland as the county seat. In July 1998, the newest municipality was added to the county, the Town of Frye Island, whose residents voted to leave the Town of Standish, and form their own municipality. The area of the county is 853 square miles (http://www.cumberlandcounty.org/geninfo.html).

Port of Portland

In 1990 Portland city had 64,358 residents, allocated among 14,819 families (average family size was 2.91) and 28,230 households. According to 1990 Census data in Portland there were 449 persons employed in agricultural services, forestry and fishing industries (1% of all employed persons 16 or over), though there were 335 employed in agriculture, forestry and fishing occupations. According to 1990 Census data in the city of Portland there were 41 captains or other officers of fishing vessels (all white, non-Hispanic males), and 89 fishers (all non-Hispanic white, 75 male and 14 female).

Of the 31,293 housing units in the town, 10% were empty in 1990. Of the occupied units, 58% were rental units. Of the vacant units, 33% were classified as for seasonal, recreational or occasional use only, and 6% were "usual home elsewhere".

In 1990, 64% of all residents had been born in the state of Maine and the next largest group (21%) were born in the northeastern United States. Of persons age 5 and over, 45% were living in the same house in 1990 that they had occupied in 1985. An additional 31% were living in a different house in 1985 but still within Cumberland County, and 8% were living in a different house but still in Maine. In addition, 93% of all workers 16 and over worked in their county of residence, and 69% worked in Portland.

In 1990, the racial composition of Portland was 97% white, 1% black and 2% Asian or Pacific Islander - especially Cambodian. Less than 1% of all persons were of Hispanic origin. When reporting first ancestry, Irish and English were the largest groups (18% each) followed by French (10%). The majority of persons age 5 years and over speak only English (93%), and less than 2% of households are classified as linguistically isolated.

In 1990, 28% of the town's residents aged 25 and over were only high school graduates and 20% held a only bachelor's degree. An additional 17% had some college. In 1989 the median *household* income was $26,576 (82% of the Cumberland County average)with the median family income at $34,837 (90% of the county average) and the median non-family income at $18,357 (94% of the county average). The *per capita* income in 1989 was $14,914 (94% of the county average). Just over 14% of persons for whom poverty status was determined (97% of all residents) had 1989 income below the poverty line.

According to the 1990 census, the largest employment sector is retail trade, followed by health services and finance, insurance and real estate (Table 72).

Natives of Maine draw much of their identity and trace their ancestry to traditions based on coastal and marine resources and other interactions with the natural environment (Duncan 1995). Maine fisheries are best known for lobstering which has been a lucrative fishery in recent years. However, overcrowding and territorial disputes have also emerged as problems.

Portland itself is a diversified community with a complex economy, the center of a county that boasts the second lowest unemployment rate (between 4% and 7%) in the state (Maine Department of Labor 1994). The civilian labor force in the Portland Metropolitan Area averages 132,290 for the year, reaching lows of 126,050 during the month of September and reaching a high of 138,100 during December, when the unemployment rate drops to 4.3%, largely, of course, because of increases in retail trade around Christmas. Generally, however, the summer months suffer lower unemployment rates than the winter months. Seasonal fluctuations such as these are common throughout the state of Maine, if more exaggerated in smaller, isolated communities that are more heavily dependent on fishing. Stonington's unemployment rate, for example, fluctuates between a low of 3.1 percent in August to a high of 10.5 percent in February. Portland's economy, by comparison, is much more stable seasonally.

Distributions of the Portland industrial sector indicate an economy with a strong (but no longer central) manufacturing base and a growing service sector, reflecting national economic restructuring trends. Average wages in the Portland MSA are around $10.00/hour, or around half of what crew on groundfishing vessels can make (or were used to making prior to the current crisis), and as little as a fifth of what captains were making. Median family incomes in the city were $25,600 in 1983 and $38,511 in 1990, or an increase of 6.5 percent, indicating a relatively robust economy.

Commercial fishing, of course, is but one of several industries and cannot be said to be the leading industry in the city, although the port itself occupies a central place in the city's economy and its quality of life. Two waterfront surveys compiled by the Council of Governments in Portland reported that during the recession of the late 1980s and early 1990s, Portland's waterfront businesses expanded and hired more employees, indicating the port's overall importance in the city's economic health (Greater Portland Council of Governments 1991a and 1991) "good fishing harvests" were mentioned by the Council as primary in keeping waterfront businesses active during these years of

economic downturn.

Casco Bay is a deep water port, extremely sheltered and located only three and one half miles from open ocean. Through the year it remains free of ice, which makes for easy navigation not only for the commercial fishing fleet but also for growing marine traffic related to imports, transportation, and recreation. Much of the development of the harbor in the past ten years has been the growth of condominiums and other real estate development that often competes with commercial fishing for space and aesthetics. Despite these changes, commercial fishing in Portland remains a core industrial segment, important in the city's identity and history. Indeed, those responsible for monitoring waterfront development see non-marine related uses of space along the waterfront as directly tied to marine related uses in positive ways.

Land owners are clearly a small number of the actual 'firms' which are located on the waterfront, yet they have some specific concerns about the amount of underutilized space along the waterfront. There continues to be a strong call for reviewing the current zoning restrictions from such owners and from some of the renters. Some renters have suggested that the waterfront users could be paying less in rent if the buildings were occupied more fully. In other words, nonmarine related uses could subsidize marine related uses (Greater Portland Council of Governments 1991a)

Official publications of Portland's city government often highlight the central role of commercial fishing, and clearly the Portland Fish Exchange is among the city's proud accomplishments, being unique in the northeast and attracting the attention of seafood dealers and brokers in ports such as Gloucester and New Bedford.

At the heart of the Portland fishing fleet stands the Portland Fish Exchange (PFE), a display auction founded in 1987 on the Portland waterfront. The auction has acquired a reputation for fairness and accuracy of weighing in a region long known for difficulties between seafood dealers and fishers. Some fishers we interviewed while landing fish in Portland had recently moved from selling their fish in Boston and New York markets, saying that those markets were far too prone to rounding weights downward, arguing over quality and other characteristics of the catch, and sometimes taking days or weeks to pay for fish. The Portland Exchange, by contrast, provides a setting where fishers or their representatives (brokers) come together with buyers, every Sunday through Thursday noon, to bid on various lots of fish.

Another fisher interviewed suggested that the auction's reputation for accuracy has been responsible for fewer disputes between fishers and buyers that have led to marketing boycotts or protests over what seemed to fishers to be price-fixing.

We had a few minor tie-ups because the price wasn't any good; those didn't last very long. Well, the dealer will come down and talk about it, and then they settled it, and then we'd go out. That was years ago when it used to work that way. And now with the auction, it doesn't work that way. This auction has been the best thing that ever happened to us. We used to give -- if we caught a hundred pounds of fish, we got paid for 100, but there was 112 or so in the box. Now we auction, and there's about 112 in there.

Typically, fish are landed at the auction early in the morning, between four and six, separated and weighed, and auctioned off at noon. During the shrimp season, shrimp auctions also take place in the evening. The Exchange employs between 35 and 55 individuals, fluctuating through the year

based on weather conditions and the availability of groundfish. With the exception of shrimp, most of the species they land are groundfish species. The Exchange also assembles daily price reports and lists of species landed by vessel, pounds, sizes, and other information, serving as an excellent data source for National Marine Fisheries Service's efforts to monitor the conditions of the resource on a daily, weekly, or annual basis.

The Exchange is the center of the northern shore of Casco Bay, sitting among several seafood brokering establishments and the Marine Trade Center, a building that is conspicuously businesslike in appearance, reflecting the self-professed entrepreneurial spirit of the Portland fleet. The Center houses the National Marine Fisheries Service offices, the Maine Department of Labor's Fishing Family Assistance Center, Maine Fishermen's Wives Association, and several other marine related businesses or assistance organizations. Dock space along the waterfront, like most heavily commercialized ports, is at a premium. The city of Portland rents space to 22 boats and maintains a transient pier where boats may tie up for three days at a time; this is 100 foot long and boats can tie up three deep, similar to the vessel stacking in New Bedford. They have eight more slips in May of 1996, and rarely does a permanent slip tenant relinquish his right to harbor space. This indication of a high demand for slip space is another indication of the tenacity of the Portland fleet and its resilience in the face of proposed restrictions and probable economic declines.

In addition to the complex that includes the Fish Exchange, seafood dealers, and the Marine Trade Center, the active space of commerce between Commercial Boulevard and the waterfront, as well as the waterfront across the bay, includes several seafood dealers, gear manufacturers, and other businesses that service the fleet and its personnel in a variety of capacities.

Within the Portland fishing community, it is not uncommon for fishers born into fishing families or those who eventually become crew to try out nonfishing jobs during their younger years, usually in and around the water. This would include operating ferries, building or maintaining boats, or performing other shore side tasks. A few fishers we interviewed, especially those operating smaller vessels, moved between fishing and shore-based employment on and off over the course of their professional careers; we may think of this as yet another extension of moving between fisheries through the course of several seasons or from year to year, adapting vessels, modifying gears, and targeting different species based on stocks, regulations, and crowding problems.

In the process of moving between shore, water-related occupations and fishing, either as crew or as part-time fishers/captains themselves, fishers gradually gain the trust of the established fishing community and slowly become accepted into its ranks. Because there is a history of regulatory pressure, persistent perceptions that the fishing way of life is being criminalized, untrustworthy marketing relationships, and the necessities of interdependence between captains and crew at sea, developing trusting relationships is a slow and often painstaking process that permeates the fishing community. By the same token, the difficulties of forming long-term and trusting relationships make those that have been formed all the more important as components of the overall social infrastructure of fishing.

Considered as part of the economic health of fishing, working in and around the water, moving between fishing and shore-based employment, and occupying different positions on different kinds of fishing vessels has been important to the ways in which the social capital of fishing develops and becomes available for investment in a productive fishing enterprise. By social capital we refer to those network relationships -- between captains and crew, captains and suppliers, among crew or

among captains, and between captains, owners, and creditors, and so forth -- that enable partnerships designed to generate incomes. In fishing, the development of fishing skills and knowledge about fishing grounds, the willingness to adhere to captains' safety standards, the ability to remain at sea for extended periods, etc. are all attributes we normally consider human capital. Yet human capital in fishing is useless without the weblike partnerships that link fishing vessels to credit systems for financing, fuel, ice, trip food, etc. -- without, that is, social capital, and the trust upon which the mobilization and investment of social capital depend. Comments from one of our respondents show how extensively entrenched are relationships based on trust and credit and how they may be negatively impacted by negative publicity about the fishery.

Well, you have to see ramifications of this whole publicity thing. Like I've had an account with Shaw Supermarket, a charge account, for a long time. And when I got the second boat, I called them up and I asked them for another charge account for the other boat, and they wouldn't give me one. I said, 'Why?' and they said they were phasing out their fishing boats because their credit and liability wasn't too good. I says, 'Have I ever missed a payment?,' and they said, 'No, your credit's very good.' As a matter of fact, they asked me to stop paying like I was paying, wanted me to go on paying them every 30 days. Basically what I do is when a boat comes in and I do a settlement sheet and I pay them and then I get all the bills and I pay all the bills and I put it in the mail and send it to them. So if I had a bill from Shaw's for $257, I sent them a check for $257 with the account number on it. Well, they didn't want me to do that anymore. They wanted me to wait til they sent me a statement and then pay the statement, because it was confusing the bookkeepers, I guess. But they wouldn't give me another charge account, because they felt the fishing industry was going down. There are a few places like that. A year ago I put a new winch engine into one boat, and I really had to get a great recommendation from the Caterpillar Company to the guy who would come down and wrap the exhaust pipe with insulation, because he said, 'I've been stiffed by fishermen. I don't even want to touch you guys (Clay pers. comm.).

If credit relations in the fishing industry are enhanced by trust, so too are they particularly susceptible to pieces of information that chip away at that trust. This occurs, moreover, within an industry whose participants have been prone to considering attacks on their ways of life as stemming from a conspiracy of environmentalists, government personnel, and recreational fishing and tourist interests. While these sentiments are widespread throughout the fishing industry of the United States (Fritchey 1993), the ways fishers act on them, responding to what they perceive as crises and to very real restrictions of their fishing activity, vary from port to port.

Maine fishers are adapting to new developments in fishing regulations in ways that are in line with their historical participation in the fisheries: by resisting regulations through legal and illegal means while experimenting with new gears, new species, and new on-shore economic opportunities. The concentration of the fleet around the PFE has meant that those fishers based in and around Portland are likely to be more heavily impacted by further groundfishing restrictions than those in other, smaller ports, where lobster fishing prevails. Although the Greater Portland economy has a broad and diverse base, groundfishermen in this area will be unlikely to find comparable work with comparable incomes outside groundfishing; in addition, of course, they face the loss of large investments in fishing vessels and gears with the collapse of the industry. (Dyer and Griffiths 1996).

3.0 ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

3.1 MANAGEMENT ALTERNATIVES

3.1.1 Preferred Measures to Attain Management Objectives

The management measures are described in this section and analyzed in section 3.1.5.

3.1.1.1 Specification of OY, DAH, DAP, JVP, and TALFF

Section 600.310 (b) states that the determination of OY is a decisional mechanism for resolving the MSFCMA's multiple purposes and policies, implementing an FMP's objectives, and balancing the various interests that comprise the national welfare. OY is to be based on MSY, or on MSY as it may be reduced for social, economic, or ecological reasons. The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing.

OY is all tilefish harvested pursuant to this FMP as determined by the overfishing definition and rebuilding schedule detailed in this FMP. OY could change after a benchmark stock assessment if the fishing mortality rate target or any other biological reference point changes and is dependent on the level of stock biomass.

The Council has concluded that United States vessels have the capacity to, and will, harvest the OY on an annual basis, so DAH equals OY. The Council has also concluded that United States fish processors, on an annual basis, will process that portion of the OY that will be harvested by United States commercial fishing vessels, so DAP equals DAH and JVP equals zero. Since United States fishing vessels have the capacity and intent to harvest the entire OY, there is no portion of the OY that can be made available for foreign fishing, so TALFF also equals zero.

3.1.1.2. Permit requirements for commercial vessels

Any owner of a vessel desiring to fish for tilefish within the United States EEZ with the intent to sell, or transport or deliver for sale, any tilefish taken within the EEZ must obtain a federal commercial vessel permit from NMFS for that purpose. This includes all vessels that intend to land tilefish in the incidental, part-time category, full-time tier 1, or full-time tier 2 categories.

An applicant must apply for a federal vessel permit in writing to the Regional Administrator. The application must be signed by the applicant and submitted to the Regional Administrator at least 30 days before the date upon which the applicant desires to have the permit made effective. Applications must contain the name, principal place of business, mailing address and telephone number of the applicant. The Regional Administrator will notify the applicant of any deficiency in the application. If the applicant fails to correct the deficiency within 15 days following the date of notification, the application will be considered abandoned. Except as provided in Subpart D of 15 CFR Part 904, the Regional Administrator will issue a permit within 30 days of the receipt of a completed application.

Any permit issued under this section remains valid until it expires, is suspended, is revoked, or ownership changes. Any permit which is altered, erased, or mutilated is invalid. The Regional Administrator may issue replacement permits. Any application for a replacement permit shall be considered a new permit. The majority of FMPs administered in the Northeast Region end on April 30 annually. It is the Council's intent to give the Regional Administrator the administrative prerogative to standardize the issuance and renewal of permits.

A permit is not transferable or assignable. It is valid only for the vessel to whom it is issued.

The permit must be displayed for inspection upon request by an authorized officer or any employee of NMFS designated by the Regional Administrator.

The Regional Administrator may suspend, revoke, or modify, any permit issued or sought under this section. Procedures governing permit sanctions or denials are found at Subpart D of 15 CFR Part 904. The Regional Administrator may, after publication of a notice in the *Federal Register*, charge a permit fee. Within 15 days after the change in the information contained in an application submitted under this section, the vessel issued the permit must report the change in writing to the Regional Administrator.

The federal costs of implementing an annual permit system for the sale of tilefish can be charged to permit holders as authorized by section 303(b)(1) of the Magnuson-Stevens Act. In establishing the annual fee, the NMFS Regional Administrator will ensure that the fee does not exceed the administrative costs incurred in issuing the permit, as required by section 304(d) of the Magnuson-Stevens Act.

Eligibility must be established during the first year of the FMP. In other words, the limited entry permits for the part-time, full-time tier 1, and full-time tier 2 categories may not be applied for more than twelve months following the effective date of the final regulations or if a vessel is retired from the fishery. This does not effect annual permit renewals. Vessels may qualify for only one limited access permit.

Applicants for limited entry permits shall provide information with the application sufficient for the Regional Administrator to determine if the vessel meets the eligibility requirements. Sales receipts or dealer weighout forms signed by the dealer may be considered acceptable forms of proof. The Regional Administrator may also consider tax returns for additional documentation of landings.

Most of the above issues that deal with commercial tilefish permits are similar to those for other commercial vessels for other fisheries of the Northeastern United States that are described in section 648.4 of 50 CFR. The Council's intent regarding the eligibility, application/renewal and the qualification restrictions are detailed above. The Council's intent on other issues is not to change those regulations that are also addressed in various sections of 648.4. As such the regulations regarding the following issues are found in the associated sections: changes in ownership (648.4 (D), replacement and upgrade provisions (648.4 (E) and (F)), consolidation restrictions (648.4 (G)), vessel baseline specifications (648.4 9H)), limited access permit restrictions (648.4 (I)), confirmation of permit histories (648.4 (J)), abandonment or voluntary relinquishment of permits (648.4 (K)), and a restriction on permit splitting (648.4 (L)).

3.1.1.3 Dealer permits and fees

A dealer permit is required for dealers purchasing tilefish harvested from the exclusive economic zone (EEZ) in addition to dealers purchasing tilefish from permitted vessels. Dealers issued a tilefish dealer permit must report all fish purchases along with information required at section 648.7 (l)(i). A dealer of tilefish is defined as a person or firm that receives tilefish for a commercial purpose from a vessel possessing a commercial tilefish permit pursuant to this FMP for other than transport.

An applicant must apply for a federal dealer permit in writing to the Regional Administrator. The application must be signed by the applicant and submitted to the Regional Administrator at least 30 days before the date upon which the applicant desires to have the permit made effective. Applications must contain the name, principal place of business, mailing address and telephone number of the applicant. The Regional Administrator will notify the applicant of any deficiency in the application. If the applicant fails to correct the deficiency within 15 days following the date of notification, the application will be considered abandoned. Except as provided in Subpart D of 15 CFR Part 904, the Regional Administrator will issue a permit within 30 days of the receipt of a completed application.

Any permit issued under this section remains valid until it expires, is suspended, is revoked, or ownership changes. Any permit which is altered, erased, or mutilated is invalid. The Regional Administrator may issue replacement permits. Any application for a replacement permit shall be considered a new permit. It is the Council's intent to give the Regional Administrator the administrative prerogative to standardize the issuance and renewal of permits.

A permit is not transferable or assignable. It is valid only for the dealer to whom it is issued.

The permit must be displayed for inspection upon request by an authorized officer or any employee of NMFS designated by the Regional Administrator.

The Regional Administrator may suspend, revoke, or modify, any permit issued or sought under this section. Procedures governing permit sanctions or denials are found at Subpart D of 15 CFR Part 904. The Regional Administrator may, after publication of a notice in the *Federal Register*, charge a permit fee. Within 15 days after the change in the information contained in an application submitted under this section, the dealer issued the permit must report the change in writing to the Regional Administrator.

3.1.1.4 Operator permit and fees

Any individual who operates a vessel for the purpose of fishing commercially for tilefish (i.e., possesses a valid commercial vessel permit tilefish) must obtain an operators permit. Any vessel fishing commercially for tilefish must have on board at least one operator who holds an operators permit. That operator may be held accountable for violations of the fishing regulations and may be subject to a permit sanction. During the permit sanction period, the individual operator may not work in any capacity aboard a federally permitted fishing vessel.

The federal permit program has the following requirements:

1. Any operator of a commercial vessel fishing for tilefish must have an operator's permit issued by

the NMFS Regional Administrator.

2. An operator is defined as the master or other individual on board a vessel who is in charge of that vessel (see 50 CFR 620.2).

3. The operator is required to submit an application, supplied by the Regional Administrator, for an Operator's Permit. The permit will be issued for a period of up to three years.

4. The applicant would provide his/her name, mailing address, telephone number, date of birth and physical characteristics (height, weight, hair and eye color, etc.) on the application. In addition to this information, the applicant must provide two passport-size color photos.

5. The permit is not transferable.

6. Permit holders would be required to carry their permit aboard the fishing vessel during fishing and off-loading operations and must have it available for inspection upon request by an authorized officer.

7. The Regional Administrator may, after publication in the *Federal Register*, charge a permit fee not to exceed the administrative costs incurred in issuing the permit.

3.1.1.5 Specification and sources of pertinent fishery data

3.1.1.5.1 Domestic and foreign fisheries

Section 303(a)(5) of the MSFCMA requires that the Councils specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter/party fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls and the estimated processing capacity of, and actual processing capacity utilized by, United States fish processors. In order to achieve the objectives of this FMP and to manage the fishery for the maximum benefit of the United States (as specified in the MSFCMA), it is necessary that, at a minimum, the Secretary collect on a continuing basis and make available to the Council: (1) tilefish catch, effort, and exvessel value and the catch and exvessel value of those species caught in conjunction with tilefish (as well as all discard information) for the commercial fishery provided in a form that analysis can be performed at the trip, water area, gear, month, year, principal (normal) landing port, landing port for trip, and state levels of aggregation; (2) catch, effort and discards for any recreational fishery; (3) biological (e.g., length, weight, age, and sex) samples from both the commercial and recreational fisheries; and (4) annual and fully comparable NMFS bottom trawl surveys for analyses of both CPUE and age/size frequency. The Secretary may implement necessary data collection procedures through amendments to the regulations. It is mandatory that these data be collected for the entire management unit on a compatible and comparable basis.

Commercial logbooks must be submitted by federal commercial permit holders in order to monitor the fishery. The current vessel logbook requires vessels to report everything they catch including bycatch. Vessel owners must submit logbooks within 15 days of the end of the reporting month.

It is intended that the reports required by this section are the same as the reports required by the Summer Flounder FMP, the Multispecies FMP, Dogfish FMP, and the Atlantic Sea Scallop FMP. That is, fishermen need to submit one logbook report, not one report for each FMP. Federal tilefish vessel permit holders can sell tilefish only to Federal dealer permit holders.

Foreign fishermen are subject to the reporting and record keeping requirements in 50 CFR 611.

3.1.1.5.2 Dealers

In order to monitor the fishery and enable the Regional Administrator to forecast when a closure will be needed, dealers with permits issued pursuant to this FMP must submit weekly reports showing at least the quantity of tilefish purchased (in pounds), and the name and permit number of the individuals from whom the tilefish was purchased.

Buyers that do not purchase directly from vessels are not required to submit reports under this provision. Dealers should report only those purchases from vessels with commercial permits for tilefish.

3.1.1.5.3 Processors

The processing sector must submit the Processed Product Report, as is required in all MAFMC FMPs. The submission of the report is now mandatory for all information requested. Dealers are required to come under NMFS current interactive voice response (IVR) reporting system since this is a quota managed species. The NMFS could also require vessel owners to report via the IVR system although currently only dealers are required to do so. Quotas will be monitored by the Regional Office as is for other MAFMC FMPs. The Regional Administrator may waive this requirement. Dealers and vessels must each report (weekly for dealers and within 15 days of the end of the reporting month for vessels) and when the part-time and two full-time categories' quotas are filled those respective categories will be closed for the remainder of the fishing year. Any overages will be subtracted from the following year's offending category (i.e. if fishermen in the part-time category exceed their quota in the second fishing year, then the part-time category will be reduced in the third fishing year). Any quota not caught by a specific category during a specific fishing year will remain in the ocean.

3.1.1.5.4 Limited entry permits and the appeal of denial of permit

Section 3.1.1.9 details the limited entry requirements for the full-time and part-time quota categories. Upon approval of this FMP, NMFS will attempt to notify all owners of vessels for which NMFS has credible evidence available that they meet the qualification criteria described for each category. Vessel owners must still apply within 12 months of the effective date of these regulations to complete the qualification requirements. If a vessel owner has not been notified that the vessel is eligible to be issued a limited access tilefish permit, and the vessel owner believes that there is credible evidence that the vessel does qualify under the pertinent criteria, the vessel owner may apply for a limited access tilefish permit within 12 months of the effective date of these regulations by submitting evidence that the vessel meets the requirements. In the event the applicant is denied, the applicant may appeal. Any applicant denied a limited tilefish permit may appeal to the Regional Administrator within 30 days of the notice of denial. Any such appeal shall be in writing. The only grounds for appeal is that the Regional Administrator erred in concluding that the vessel did not

meet the limited entry criteria. The appeal shall set forth the basis for the applicant's belief that the Regional Administrator's decision was made in error. The appeal may be presented, at the option of the applicant, at a hearing before an officer appointed by the Regional Administrator. The hearing officer shall make a recommendation to the Regional Administrator. The Regional Administrator's decision on the appeal is the final decision of the Department of Commerce.

3.1.1.6 Tilefish FMP Monitoring Committee

The Tilefish Monitoring Committee is a joint committee made up of staff representatives of the Mid-Atlantic Fishery Management Council, the Northeast Regional Office, the Northeast Fisheries Science Center, state representatives and an industry member. The state representatives may include any individual designated by an interested state from Maine to Virginia. There can be a maximum of three state representatives with the New England states having one and the mid-Atlantic states having a maximum of two. There is also a non-voting industry advisor who is appointed by the Council Chairman. The Mid-Atlantic Council Executive Director or his designee will chair the Committee. The Tilefish Monitoring Committee provides its report to the MAFMC Tilefish Committee.

Under the preferred quota alternative, landings in the first fishing year would be set at 1.995 million pounds (Table 3). While the preferred alternative is a constant harvest strategy, there would be annual quota reductions for previous overages of the quota. There would also be a "benchmark" stock assessment conducted at the NEFSC sponsored SARC/SAW every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change which thus could warrant changes in the actual TAL. The strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used by the Committee and Council to get to the target.

The Tilefish Monitoring Committee is responsible only for establishing recommendations for the annual quotas and management measures to restrict fishing so as not to exceed the quotas. There are a wide variety of management measures that are frameworked (section 3.1.1.7) but the Council initiates and considers those measures. Thus, the Monitoring Committee actually considers only the annual quotas unless directed by the Council Chairman to consider and evaluate those measures that are frameworked. The Monitoring Committee is convened after the completion of a "benchmark" stock assessment and/or at the direction of the Council Chairman. The Monitoring Committee should review landings data in its evaluation of the annual quotas. If directed by the Council Chairman to consider any frameworked management measures, the Committee can obviously consider any relevant available data. It is the Council's intent not to alter the annual quota if a benchmark stock assessment is not conducted prior to a certain fishing year. In the absence of a Council recommendation, the annual quotas will not change from one fishing year to the next except that the Regional Administrator may readjust the quotas to account for overages in the previous fishing year.

The Council will receive the report of the Tilefish Committee as well as appropriate public input. The Council will consider this information and jointly determine any adjustments. Next, the Council will make its recommendations to the Regional Administrator. The Regional Administrator will receive the report of the Council and publish a report in the *Federal Register* for public comment by the date specified in the regulations, which provides the Council sufficient time to implement quotas and other management measures. Following the review period, the Regional Administrator

will set any management measure adjustments for the year.

In summary, the steps from the Tilefish Monitoring Committee to action by the Council and Regional Administrator are:

1. The Tilefish Monitoring Committee reviews the data and makes recommendations to the Tilefish Committee.

2. The Tilefish Committee considers the recommendations of the Monitoring Committee in determining any adjustments and makes recommendations to the Council.

3. The Council considers the recommendations of the Tilefish Committee and makes its recommendations to the Regional Administrator.

4. The Regional Administrator considers the recommendations of the Council and publishes proposed measures in the *Federal Register*.

3.1.1.7 Framework adjustment process

The Council would like to be able to add or modify management measures through a framework adjustment procedure. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process. As such, measures that have been identified in the plan could be implemented or adjusted at any time during the year (with the exception of the annual quotas). This process could also be used for purposes of resolving gear conflicts.

Possible management measures for the fishery include:

- Minimum fish size
- Minimum hook size
- Closed seasons
- Closed areas
- Gear restrictions or prohibitions
- Permitting restrictions
- Gear limits
- Trip limits
- Overfishing definition and related thresholds and targets
- Annual specification quota setting process
- FMP Monitoring Committee composition and process
- Description and Identification of Essential Fish Habitat
- Fishing gear management measures that impact EFH
- Habitat areas of particular concern
- Set aside quota for scientific research

Any of these measures that could be implemented could be frameworked. That is, the Tilefish Monitoring Committee, made up of representatives of the Council and NMFS, could review the condition of the resource and fishery and recommend measures (e.g., trip limits, quota, etc.) to achieve the desired goals and rebuilding schedule.

The adjustment procedure would involve the following steps. If the Council determines that an

adjustment to management measures is necessary to meet the goals and objectives of the Tilefish FMP, they will recommend, develop and analyze appropriate management actions over the span of at least two Council meetings. The Council will provide the public with advance notice of the availability of the recommendation, the appropriate justifications and economic and biological analyses, and opportunity to comment on the proposed adjustments prior to and at the second Council meeting. After developing management actions and receiving public testimony, the Council will then submit the recommendation to the Regional Administrator. The Council's recommendation to the Regional Administrator must include supporting rationale, an analysis of impacts, and a recommendation to the Regional Administrator on whether to publish the management measures as a final rule.

If the Council recommends that the management measures should be published as a final rule, the Council must consider at least the following factors and provide support and analysis for each factor considered:

1. Whether the availability of data on which the recommended management measures are based allows for adequate time to publish a proposed rule.

2. Whether regulations have to be in place for an entire harvest/fishing season.

3. Whether there has been adequate notice and opportunity for participation by the public and members of the affected industry in the development of the Council's recommended management measures.

4. Whether there is an immediate need to protect the resource.

5. Whether there will be a continuing evaluation of management measures adopted following their promulgation as a final rule.

If, after reviewing the Council's recommendation and supporting information:

1. The Regional Administrator concurs with the Council's recommended management measures and determines that the recommended management measures may be published as a final rule, then the action will be published in the Federal Register as a final rule; or

2. The Regional Administrator concurs with the Council's recommendation and determines that the recommended measures should be published first as a proposed rule, the action will be published as a proposed rule in the Federal Register. After additional public comment, if the Regional Administrator concurs with the Council's recommendation, the action will be published as a final rule in the Federal Register; or

3. The Regional Administrator does not concur, the Council will be notified, in writing, of the reason for non-concurrence.

3.1.1.8 Rebuilding schedule

The SFA requires the Council to set the overfishing definition to meet a new standard (F_{MSY}) or a suitable proxy. In addition, the resource must be rebuilt to the biomass associated with MSY, B_{MSY}

in as short a period as possible. The rebuilding period is not to exceed 10 years, except where biology, environmental conditions or international agreements dictate otherwise.

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through a constant harvest strategy that would significantly reduce fishing mortality every year in the ten year rebuilding time frame (Table 3). Fishing mortality will be reduced from an F of 0.45 (1998) to an F of roughly 0.30 in year 2000. The resource will be fully rebuilt to B_{MSY} within 10 years of plan implementation with 50% probability. Under the preferred alternative, landings for each of the next 10 fishing years would be set at 1.995 million pounds (Table 3). In November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed.

Twelve other rebuilding schedules were evaluated as alternatives and are considered as part of section 3.1.2. The no fishing alternative allows the resource to be rebuilt to the B_{MSY} level in 5 years with 50% probability but in seven years with 100% probability. Rebuilding schedules for constant fishing mortality and constant harvest vary, but in all cases the landings need to be reduced significantly in order to rebuild to the B_{MSY} level. The status quo alternative (F = 0.45) will continue to rapidly reduce biomass, such that by year 2005 the total biomass (4.1 million pounds) will be below the MSY equilibrium catch level of 4.2 million pounds (Table 4).

While the preferred alternative is the constant harvest strategy with rebuilding in 10 years with 50% probability (Table 3), not all of the other twelve alternatives were equally non-preferred for the public hearings. A constant harvest strategy with rebuilding in 10 years with 75% probability (Table 11) was preferred more than the other eleven alternatives by the Council for public hearings.

While the preferred alternative is a constant harvest strategy, there would be annual quota reductions for previous overages of the quota. There would also be a "benchmark" stock assessment conducted every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change which thus could warrant changes in the actual TAL. The strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used to get to the target.

3.1.1.9 Limited entry for the full-time and part-time quota categories

Vessels would have to qualify for a limited access commercial permit for tilefish (section 3.1.1.2). The qualifying criteria would be based on historical performance in the fishery. Landings of tilefish were examined though numerous selection criteria (Tables 73 through 79). The intent of this action is to limit the number of participants in the directed commercial fishery for tilefish.

NMFS (at the request of the MAFMC) published a control date (15 June 1993) for entry into the tilefish fishery**,** which means that commercial vessels that entered the tilefish fishery after 15 June 1993 "will not be assured of future access to or an allocation of the tilefish resource if a management regime is developed and implemented." NMFS' letter of 2 March 1999 to the Council states that "relatively new entrants into the fishery may have justly concluded that the Council did not intend

to implement limit access provisions for the fishery based on a control date which is so outdated."

The history of the development of this FMP (both in the early 1980s and again in the early 1990s) has always included the concept of limited access as the preferred alternative. When Congress reauthorized the Magnuson Act in 1996, they placed a hiatus on ITQ/IFQ options until at least October of 2000. Thus, part of the previously considered alternative can not be considered until an Amendment is developed for the FMP. However, a limited access program can still be implemented.

Access limitation is a complicated issue. Most individuals who fished in the 1970s and early 1980s are no longer tilefish fishermen but believe that since they developed the fishery they should have some long-term privilege to the fishery. In 1996, nearly 75% (1,071 of 1,450) of the trips that caught some tilefish, had less than 10% of the trips landings as tilefish. However, in 1996, 20% of the trips that landed tilefish, landed at least 85% of their catch as tilefish. Fully 90% of all the tilefish landings in 1996 were landed on those trips where tilefish constituted at least 85% of the trips landings.

The Council considered four alternatives for the full-time vessel category for public hearings (Table 80). The first, as well as the public hearing preferred alternative (alternative 3), would specify that in order to qualify for a full-time permit, the vessel must have landed greater than 50,000 pounds in any one year between 1988 and 1993 as well as landed at least 25,000 pounds per year for any two years between 1994 and 1998. Under this alternative there would have been 8 vessels that qualify for full-time permits and the quota allocation to this category would have been 75% of the annual quota under option 1 and 65% under option 3. The division of the quota between the full-time and part- time vessel groups is the percentage of the TAL after the TAL has been reduced the 5% for the incidental category. Not one single commentor supported the preferred position of option 3 during the public hearings.

The Council also considered three alternatives for the part-time vessel category (Table 80). The first alternative, would be that in order to qualify for a part-time category permit, the vessel must have landed a minimum of 10,000 pounds per year in any one year between 1988 and 15 June1993, and at least 10,000 pounds in one year between 1994 and 1998. The preferred public hearing part-time requirements were that the vessel had to have landed at least 10,000 pounds in one year between 1988 and 15 June 1993. Vessels that have had landings in the "other gear" category of data analyses could obtain a part-time directed tilefish permit if they met the qualifying criteria for this category, but they would have to pursue the fishery by longline gear only in the future. Any gear other than longline gear would only qualify for an incidental permit. The Council does not want to encourage any directed tilefish fishing with otter trawls for two reasons. First, very little directing with otter trawls on tilefish has occurred in the past decade. Second, there is the potential that bottom tending mobile gear may have an impact to tilefish habitat. Under the option 1 alternative there would have been 10 part-time vessels, whereas under the preferred public hearing alternative there would have been 49 vessels that qualify for part-time permits. The quota allocation to the part-time category would have been 25% of the annual limited entry quota under option 1 and 35% of the quota under option 3. The preferred position was not supported during public hearings either.

The specifics of the full-time and part-time vessel category criteria gave five reasonable options for the public hearings (Table 80) as follows:

Option 1: Full-time = at least 50,000 pounds in one year 1988-1993, and at least 25,000 pounds/year for two years 1994-1998. Part-time = at least 10,000 pounds in one year 1988-1993, and at least 10,000 pounds in one year between 1994-1998.

Option 2: Full-time = Tier 1 = at least 250,000 pounds/year for three years between 1993-1998, Tier 2 = at least 30,000 pounds/year for three years between 1993-1998 and for both tiers there had to be at least one pound of landings prior to the 15 June 1993 control date. Part-time = same as option 1.

Option 3: Full-time = same as option 1. Part-time = at least 10,000 pounds in one year between 1988 and 15 June 1993. The combination of the two separate preferred categories produces this as the overall preferred.

Option 4: Full-time = at least 50,000 pounds in one year 1988 to 15 June 1993. Part-time = same as option 3.

Option 5: Full-time = at least 50,000 pounds in one year 1977 to 15 June 1993. Part-time = at least 10,000 pounds in one year 1977 to 15 June 1993.

Representatives of the two major factions of tilefish fishermen, the Historic Tilefish Coalition (mostly the historical New Jersey fishermen who fished mainly in the 1980s) and The Montauk Tilefish Association (mostly New York fishermen who have been very active during the past decade) met, discussed often, and worked very hard to develop a compromise that best represented their memberships. They presented this compromise position to the Council at the 23 November Council meeting and the Council adopted their position. The compromise limited entry position, option 6 (Table 80), is a combination of option 2 for the full-time vessels and an expansion of the time allowed for qualifying for the part-time vessels. Specifically, the compromise that the Council adopted is a two tier full-time category, where a vessel would have had to land at least 250,000 pounds per year for three years between 1993 and 1998 to be in tier 1. The vessels in this full-time tier 1 category would receive 66% of the annual quota. To be in the full-time tier 2 category, a vessel would have had to land at least 30,000 pounds per year for 3 years between 1993 and 1998 and this tier 2 category would receive 15% of the annual quota allocation. To be in the part-time category, a vessel would have had to land 10,000 pounds of tilefish in one year between 1988 and 1993 and 10,000 pounds in one year between 1994 and 1998, or have landed 28,000 pounds of tilefish in one year between 1984 and 1993. This part-time category will receive 19% of the annual quota allocation. Overharvests in one fishing year would be deducted specifically from the offending category in the subsequent fishing year. Under harvests remain in the ocean during the rebuilding period.

The compromise industry position that the Council also adopted is that when the tilefish fishery is rebuilt or at the end of the 10 year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered.

3.1.1.10 Commercial management measures

3.1.1.10.1 Commercial quota divided into full-time, part-time and incidental categories

All MAFMC FMPs are managed through quotas. Quota measures are generally effective in preventing overfishing and in rebuilding overfished stocks. The Council's two previous attempts at tilefish management (in the early 1980s and in the early 1990s) have also been based on quotas. An overall quota, associated with a significant reduction in fishing mortality is the major management measure.

Under the preferred alternative, landings for each of the next 10 fishing years would be set at 1.995 million pounds (Table 3). In November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed. The quota will be set at 1.995 million pounds which is approximately a 35% reduction from 1998 landings of nearly 3 million pounds. Fishing mortality decreases consistently under this scenario with biomass building annually (Table 3).

While the preferred alternative is a constant harvest strategy, there would be annual quota reductions for previous overages of the quota. There would also be a "benchmark" stock assessment conducted every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change which thus could warrant changes in the actual TAL. The strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used to get to the target.

There are three categories that the quota is divided among. The is an incidental, a part-time and a full-time category for division of the quota. The full-time category is also divided into two tiers for quota distribution. The selection criteria for the full-time and part-time categories determines any split in the quota based on the historical proportion of the catch. The "target" estimate of landings for the incidental category (5% of the TAL) is first subtracted from the TAL and then the remainder of the TAL is divided among the full-time tier 1 category which receives 66%, the full-time tier 2 category which receives 15%, and the part-time category which receives 19% (Table 80).

It is important to note that the current Council's policy is that landings after 1998 will not assure future access to or an allocation of the tilefish resource. The purpose of this policy is to prevent a rush to fish, on this overfished resource, in the hopes of obtaining a larger future allocation.

3.1.1.10.2 Trip limits for the incidental category

"Incidental" vessels (mostly otter trawls and a few gillnet vessels) will have trip limits imposed and will have a trip limit designed to achieve a "target" or soft quota which will have equivalent reductions associated with the other two categories (in 50 pound increments). The trip limit will continue for the year and will not result in within year prohibitions of landings for this category. The trip limit may be reduced from one year to the next for overages in the target quota percentage.

There is no limited access permit required for this category. However, permit and reporting

requirements are necessary in order to land tilefish with any gear. The target quota for this incidental category will be based on 5% of the total annual quota.

The incidental category will have a bycatch allowance for otter trawl vessels and other gear. Evaluation of the 1992, 1993, 1997, and 1998 (Tables 82 through 85) data indicate a natural break of around 300 pounds in the "other gear" category. The Council assumed that anything below 300 pounds is truly a bycatch and not a targeted effort. The 300 pound limit was chosen because in 1997 and 1998, 99% of the incidental landings were 300 pounds and below with an average of 100 pounds. This average is highly skewed because of the large number of trips reporting landings averaging 28 to 30 pounds.

Five percent of the overall annual quota will be taken off the top of the quota (before it is distributed among the longline vessels) and will be provided to the incidental category for this "target" quota with a trip limit of 300 pounds set initially. Based on 1998 data (Table 85) only five non longline vessels made a total of 23 trips that landed more than 300 pounds of tilefish, and which will now be prohibited. The 300 pound trip limit is a compromise initially to balance the non directing fisheries' honest bycatch needs while trying to minimize the regulatory discards, but yet not have the limit provide incentive for anyone to direct on tilefish.

3.1.1.11 Description and identification of essential fish habitat and management measures to minimize identified adverse impacts to EFH from gear

The SFA significantly affected FMPs regarding habitat issues. The SFA contains provisions for the identification and protection of habitat essential to the production of federally managed species. The Act requires FMPs to include identification and description of essential fish habitat (EFH), description of non-fishing and fishing threats, and suggest conservation and enhancement measures. These new habitat requirements are addressed in the FMP.

EFH is identified as all offshore waters over the Continental Shelf and Slope with water depths from 250 to 1200 feet, from the United States/Canadian boundary to the Virginia/North Carolina boundary (Figure 4).

Also the area included as EFH in the statistical areas 537 and 616 should be identified as Habitat Areas of Particular Concern (HAPC) since greater than 90% of the recent landings come from these areas (Figure 5).

Based upon some available scientific information (Auster and Langton 1998; DeAlteris 1998; Collie *et al.* 1996), it was inferred for the purposes of the public hearing document that trawling was causing long-term physical adverse impacts to tilefish EFH. It was further implied that in some cases those adverse impacts could have been severe, at least locally. The basis of this conclusion was drawn from previous studies which show that in deep water, soft-bottomed sediments where environmental conditions are relatively stable, the impacts of trawling have resulted in destruction of benthic communities and habitat structure that was slow to recover following the cessation of fishing activity.

During the public hearing process, the Council received significant input from both the directed tilefish fishing industry and other fishing industry representatives that bottom-tending mobile gear was not significantly having an identifiable adverse effect on tilefish EFH. The environmental

community strongly supported the association that bottom tending mobile gear can destroy bottom structures and that since tilefish are significantly dependent on bottom structure for their burrows, bottom tending mobile gear should be banned in tilefish HAPC.

On 30 September 1999, the Tilefish Technical Team consisting of Council staff, a Council member, NMFS (both NERO and NEFSC) personnel, academics and industry representatives were hosted in a workshop by Dr. Ken Able of Rutgers University to discuss the impacts of fishing gear to tilefish habitat. It was concluded that there is nothing definitively known about tilefish-mobile fishing gear interactions. There is nothing specifically described about the sensitivity of tilefish burrows in the scientific literature. Unquestionably, from submersible vessel research, there are trawl door patterns observed in areas with tilefish burrows, but how much of an impact the doors have and how quickly tilefish can reopen their burrows, if sediment closed, is completely unknown at this time. It is fully recognized that tilefish are extremely important to maintaining the habitat around their burrows and this is important for the entire demersal community around these burrows. Any short-term or long-term impacts of bottom tending mobile gear specifically to tilefish habitat are unquantifiable at this time. The scientists and industry representatives at this meeting concluded that a research program to answer these questions was the appropriate approach to take. On 23 November 1999 when the Council approved the FMP for Secretarial submittal , they passed the following motion to address this question: "that the MAFMC, NMFS, conservation organizations, and the fishing industry shall join together to design and implement within two years a scientific research program in order to determine if the use of mobile fishing gear is having a deleterious impact on tilefish habitat." The scientific research program will be developed within the near term.

3.1.1.12 Other measures

The amount of tilefish on board a trawl vessel may not exceed the minimum threshold which is initially specified at three hundred pounds.

The Regional Administrator may place sea samplers aboard vessels if he/she determines a voluntary sea sampling system is not giving a representative sample from the tilefish fishery.

Fishing vessels are encouraged to leave the area following an interaction with an endangered species in order to minimize the probability of additional encounters.

The Regional Administrator, in consultation with the Executive Director, may exempt any person or vessel from the requirements of this FMP for the conduct of experimental fishing beneficial to the management of the tilefish resource or fishery. The Regional Administrator may not grant such exemption unless it is determined that the purpose, design, and administration of the exemption is consistent with the objectives of the FMP, the provisions of the Magnuson-Stevens Act, and other applicable law, and that granting the exemption will not:

1. have a detrimental effect on the tilefish resource and/or fishery or cause any quota to be exceeded; or
2. create significant enforcement problems.

Each vessel participating in any exempted experimental fishing activity is subject to all provisions of this FMP except those necessarily relating to the purpose and nature of the exemption. The exemption will be specified in a letter issued by the Regional Administrator to each vessel partici-

pating in the exempted activity. This letter must be carried aboard the vessel seeking the benefit of such exemption.

All experimental activities must be consistent with the harvest rates in the FMP. It is the intent of the Council that experimental fisheries are short-term fisheries to answer specific management questions and are not to be used to resolve short-comings in existing fishery management plans.

3.1.2 Alternatives to the Preferred Management Measures

3.1.2.1 Take no action at this time

This would mean that the tilefish fishery would remain unregulated and overfishing would continue.

3.1.2.2 Alternative rebuilding schedules

The Council considered 12 additional rebuilding schedules in addition to the preferred management rebuilding schedule. These rebuilding schedules are presented in Table 86. Varying the probability of reaching B_{MSY} landings as well as the time to achieve the rebuilt stock allows for significantly different yields (Figure36). There were six constant TAL projection levels, that covered eight years, ten years, or 10 years with a start in 1999 with voluntary management measures by industry which ideally would match to the TAL for future years. There are seven constant F scenarios that includes the status quo (F = 0.454, Table 4). Tables 11 through 21 identify the alternative rebuilding schedules with the associated biomass, F, and yield annually.

Under the preferred alternative, landings for each of the next 10 fishing years would be set at 1.995 million pounds (Table 3). In November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed. The quota will be set at 1.995 million pounds which is approximately a 35% reduction from 1998 landings of nearly 3 million pounds. Fishing mortality decreases consistently under this scenario with biomass building annually (Table 3).

3.1.2.3 Alternative limited entry criteria for full-time and part-time participation

The Council considered four non-preferred alternatives for the full-time vessel category (Table 80). The first non-preferred alternative for the full-time category was for a two-tiered full time system. The upper tier would be any three years of at least 250,000 pounds per year between 1993 and 1998. The second full-time tier would be any three years of landing at least 30,000 pounds per year from 1993 through 1998 with at least one pound of landings prior to the 15 June1993 control date. The second non-preferred alternative would be that in order to qualify for a full-time permit, the vessel must have landed greater than 50,000 pounds in any one year between 1988 and 15 June 1993. The third non-preferred alternative would have required the vessel must have landed greater than 50,000 pounds in any one year between 1988 and 1993, and at least 25,000 pounds/year for two years between 1994 and 1998. Finally, to qualify under the fourth non-preferred alternative the vessel must have landed greater than 50,000 pounds in any one year between1977 and 15 June1993.

The Council considered three non-preferred alternatives for the part-time vessel category (Table 80). In order to qualify for a part-time category permit under the first non-preferred alternative, the vessel must have landed a minimum of 10,000 pounds in any one year between 1988 and 15 June1993, as well as landed 10,000 pounds in any one year between 1994 and 1998. Qualifying criteria under the second non-preferred alternative for part-time category is that the vessel must have landed greater than 10,000 pounds in any one year between 1988 and 15 June 1993. The third qualifying criteria would have required landings of greater than 10,000 pounds in any one year between 1977 and 15 June 1993.

3.1.2.4 Coastwide trip limit

This alternative would establish a system of uniform trip limits established on a coastwide basis in conjunction with the quota system. To estimate allowable trip limits under any of the scenarios requires an estimation of the number of trips likely to be taken during each year of the management program. For example, there are roughly 5,000 vessels which currently possess permits to fish in the EEZ from ME to NC. Assuming that each vessel makes 100 trips per year, and that half of those trips could land tilefish, yields an estimate of 250,000 trips. If the annual TAL is 1.995 million pounds each fishing year, then the associated trip limit would be about 8 pounds. This analysis suggests that any trip limit specified on an annual basis would be very low. A trip limit could also be specified for a limited season which might allow for a higher trip limit.

3.1.2.5 Minimum size limits

A minimum fish size would be imposed where fish smaller than the minimum would be prohibited from being possessed. Initial reaction is that this type of measure would only result in dead discards since most landings occur from depths greater than 250 feet. Anecdotal evidence indicates that trawls catch smaller fish than the longline gear. Fifty percent of the females are mature by the time they reach 20 inches. Increased size equals increased yields (generally). Staff has been directed to work with industry on their desire to increase fish size for future management considerations. Scientists at the NEFSC have already begun to develop a research proposal with industry assistance that explores ways to increase both fish size and hook size.

3.1.2.6 Hook size restrictions

A minimum hook size would be imposed where hooks smaller than the minimum would not be allowed on the tilefish vessel. It is believed that increases in hook size from what is currently in use would allow the longline fishery to increase the size of tilefish landed. However, no quantifiable scientific study data are currently available to support this. Industry is interested in documenting associated benefits and the Council may consider hook size in the future. Scientists at the NEFSC have already begun to develop a research proposal with industry assistance that explores ways to increase both fish size and hook size.

3.1.2.7 Effort reductions as in days-at-sea measures

Instead of a quota, as the overall basis for management, a “days-at-sea” (DAS) effort reduction program would be used as the measure to attempt to reduce fishing mortality. The NEFMC uses “days-at-sea” effort reductions to correspond to attempts at reducing fishing mortality. The underlying assumption is that there is a direct relationship between fishing effort and fishing mortality, and

that the relationship holds over a wide range of effort. Also, there is an assumption that the relationship does not change over time. As evidenced by the difficulties that the NEFMC has had in groundfish and scallop management, the effort/mortality relationship is: 1) not well quantified, 2) does change over the range of the relationship, and 3) does change over time (fishermen have more technology). Staff and scientists at the NEFSC were directed to evaluate the usefulness and timeliness of using days-at-sea as a metric for management. It would require a significant amount of time to develop the data base and the usefulness of the data is questionable since tilefish fishermen have not been required to provide their landings in logbook form for the past several years. There was a major change in data collection by the NEFSC in 1994. Landings data since 1994 are obtained exclusively from dealer reports and vessel logbooks. Tilefish dealers and fishermen have not been required to report and thus effort data are very sparse. Prior to 1994 commercial data were mainly collected by port agents who interviewed fishermen about their landings and their effort which is the reason why days-at-sea could be used as a metric for fisheries prior to 1994. The Council solicited input from industry as to what types of data industry would be willing to provide that could form the basis for effort management in the future.

The MAFMC did seriously discuss DAS as a management approach since the tilefish that are landed in New England states are landed mostly by otter trawl vessels. The Council however, felt that the New England landings will be mostly taken care of by the incidental quota category and DAS will not really be useful for the otter trawl fishery that basically has a bycatch of tilefish. Although the MAFMC seriously discussed DAS based management, it is unlikely that they would use DAS now that the NEFMC has received a report from their Scientific and Statistical Committee. This Scientific and Statistical Committee report expressed concerns about the value and quality of DAS as an adequate measure of the effect of fishing effort. This report, presented by Dr. John Hoenig, at the NEFMC Council meeting on 16 November 1999 concludes that: "Days-at-sea can be used as a monitoring tool, as an indicator of fishing pressure or fishing mortality. It can also be used as a control for the fishery. And we certainly think it's worth looking at days-at-sea but we felt that it's a hard thing to pin your management on." Dr. Hoenig continued: "All we could do was say be careful with days-at-sea. It's got problems."

3.1.2.8 Quarterly allocation of the quota for the full-time and part-time categories

For public hearing purposes, the Council originally proposed that there be quarterly allocation of the quota which would apply only to the categories of longline vessels that are full-time or part-time. The purpose was to spread the proportion of each categories' quota over the year. The quarterly quotas were to be based on monthly landings during the past decade (Table 2). The quarter percentages would have been: January through March (31%), April through June (29%), July through September (18%), and October through December (22%). Any overage from one quarter for a vessel category (full or part-time) would be subtracted from the next year, the same quarter for that same vessel category. Another alternative would have been to have even (25%) quotas each quarter, but the Council felt they did not want to change the fishery from the historical distribution.

3.1.2.9 Closure of the directed tilefish fishery for a one calendar month period during May-September

This action would have required a one calendar month closure during the time period of May through September. Although tilefish landings are significant in nearly every month, landings in the summer are less (Table 2). Tilefish are fractional spawners from about March through Novem-

ber, although most of the reproduction occurs from May through September. Closures for spawning over this extended of a period would be difficult for the fishing industry. Some industry members did propose a one month period in the summer in order for tilefish to have a higher probability of successful spawning.

3.1.2.10 Prohibition or restrictions on bottom tending mobile gear because of EFH damage

The methodology for describing and identifying EFH and well as several alternatives is outlined in section 2.2.2 of the FMP.

The Council had four alternatives to mitigate what had been identified by the Tilefish Technical Team as the identifiable adverse effect of commercial otter trawling in tilefish EFH that were taken to public hearings. The preferred alternative (for public hearings) would have prohibited directed tilefish fishing with bottom tending mobile gear, in statistical areas 616 and 537, between 300 and 850 feet. Any other gear in those areas would have had to be modified to reduce bottom habitat impacts. Directed tilefish fishing with bottom tending mobile gear means the targeting and retention of more than the incidental trip limit (currently proposed to be 300 pounds) with any type of mobile gear (otter trawls, scallop dredges, etc.), but it did not prohibit directing with any hook and line gear. It was anticipated that the gear that may need to be modified in order to fish in this area would have included otter trawls, scallop dredges, clam dredges and others that fish for species such as: monkfish, squid, mackerel, butterfish, New England multispecies, summer flounder, sea scallops, ocean quahogs, etc.

The Council had three non-preferred alternatives (for public hearings) to mitigate the identifiable adverse effect of commercial otter trawling in tilefish EFH that were also being taken to public hearings. First, all bottom tending mobile gear (definitely otter bottom trawls and potentially scallop dredges and ocean quahog dredges) throughout the range of tilefish EFH, between 300 and 850 feet, would have been prohibited. The second alternative would have prohibited all bottom tending mobile gear in statistical areas 616 and 537, between 300 and 850 feet. The third alternative would have prohibited directed tilefish fishing with bottom tending mobile gear, between 300 and 850 feet, over the range of tilefish EFH. Any other gears in those areas would have had to be modified to reduce bottom habitat impacts. Directed tilefish fishing with bottom tending mobile gear means the targeting and retention of more than the incidental trip limit (currently proposed to be 300 pounds) with any type of mobile gear (otter trawls, scallop dredges, etc.), but it does not prohibit directing with any hook and line gear.

It was believed that the best way to make a bottom tending otter trawl into a gear that does not impact the bottom is to design it as is allowed in 50 CFR Chapter VI (10/1/95 edition) where in order to qualify as off-bottom gear, a trawl net must: (i) be a truly pelagic trawl net, operated with neither the doors nor the net mouth in contact with the bottom; or (ii) be rigged so that the net mouth operates not less than 60 cm (12 inches) above the bottom. An otherwise standard bottom trawl net will be considered to meet this requirement if: (A) it has attached perpendicular to the net mouth "hanging line" chains not shorter than 60 cm (12 inches); (B) each chain hangs loose or is attached to steel bobbins; and (C) no weights or other attachments are directly secured to the "hanging line" other than the chains specified in paragraph (c)(5)(ii)(A) of this section, or floatation devices.

3.1.3 The FMP Relative to the National Standards

Section 301(a) of the MSFCMA states: "Any fishery management plan prepared, and any regulation promulgated to implement such plan pursuant to this title shall be consistent with the following national standards for fishery conservation and management. The following is a discussion of the national standards and how this amendment meets them:

3.1.3.1 Conservation and management measures shall prevent overfishing while achieving, on a continuous basis, the optimum yield from each fishery for the United States fishing industry.

The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards. With respect to National Standard 1, the SFA imposed new requirements concerning definitions of overfishing in fishery management plans. To comply the SFA requires that each Council FMP define overfishing as a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis.

Each FMP must specify objective and measurable status determination criteria for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the requirements of the SFA, status determination criteria for tilefish are comprised of two components: 1) a maximum fishing mortality threshold and 2) a minimum stock size threshold. The maximum F threshold is specified as F_{MSY} and the minimum biomass threshold should be specified as ½ B_{MSY}.

Based on the estimated parameters from the surplus production model, maximum sustainable yield is estimated at around 4.2 million pounds (Nitschke *et al.* 1999). The fishing mortality rate at the MSY level was estimated to be approximately 0.22 (Table 5).

The non-equilibrium surplus production model for tilefish is the best method of assessing the tilefish stock at present (MAFMC Science and Statistical Committee conclusion of 31 March 1999). No fishery independent sources of information exist. Fishery independent surveys, routinely conducted by NEFSC since 1963, fail to sample the deep offshore regions where tilefish are caught by commercial longline gear. Despite the high total landings of tilefish in the last two decades, sampling of the commercial fishery is intermittent and suitable length or age composition data do not exist. Reliable estimates of the days at sea for trips catching tilefish are available from vessel trip reports, and these data are used with reported landings to calculate landings per unit effort indices of abundance. In view of the overall paucity of existing data, and the long period that would be required to obtain relevant new information, it was noted that the surplus production model is the best method for assessing stock status in the near term (USDC 1993a).
The SFA also requires that a risk averse fishing mortality target be specified as well as a biomass target, which is the stock level at MSY (B_{MSY}). For tilefish this value is 18.6 million pounds.

Recommended biological reference points that would define overfishing and overfished conditions for tilefish.

Reference point	Basis	Estimated value
Biomass target	B_{MSY} – the biomass that would produce the maximum sustainable yield level	18.6 million pounds (8,448 mt) based on surplus production model with 1998 data included (Nitschke *et al*. 1999)

Biomass threshold	½ B_{MSY}	9.3 million pounds (4,224 mt) stock biomass.
Current biomass	Current 1999 (beginning of year) estimate	6.2 million pounds (2,813 mt) (roughly 35% of the biomass target).
Fishing mortality target	Defined by the annual fishing mortality rate reduction schedule adopted by the Council (Table 3).	Defined according to the rebuilding schedule (Table 3). In 2000 it would be 0.30.
Fishing mortality threshold	F_{MSY} – the fishing mortality that would produce the maximum sustainable yield level	0.22 based on surplus production model with 1998 data included (Nitschke *et al.* 1999) .
Current fishing mortality	Current value for 1998	0.45

The SFA requires that stocks which are identified as overfished (i.e., stock biomass is less than minimum biomass threshold) must rebuilt to the level that will produce maximum sustainable yield (B_{MSY}). The SFA guidelines advise that, in most cases, the stock rebuilding period may not exceed 10 years. The most recent stock assessment data presented by NEFSC (Nitschke *et al.* 1999) indicates the resource can be rebuilt in as short as five years if there is no fishing mortality, or could take up to ten years if the Council so chooses (Tables 3, 4, 11 through 21). As a result of the various projections, the Council proposes to rebuild the tilefish stock to the B_{MSY} level (with 50% probability) over a ten year rebuilding period through the implementation of this FMP.

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through an immediate reduction in fishing mortality rate to a 0.30 level associated with a constant harvest strategy that results in landings in the first fishing year of 1.995 million pounds. This approach was chosen to minimize the impact of the rebuilding program on both the harvest and processing sectors of the industry, while balancing the needs of rebuilding the resource in the ten years of rebuilding (section 4). This schedule allows for stock rebuilding to the target biomass level in the year 2009. The FMP calls for a "benchmark" stock assessment conducted every three years from which the specifics of the B_{MSY}, F_{MSY}, and other biological reference points could change which thus could warrant changes in the actual TAL (section 3.1.1.8). The important factor is that the strategy itself would not change, in that the 10 year rebuilding duration, with 50% probability of achieving the B_{MSY} target, and the TAL are the measures used to get to the rebuilding target. Quota overages would be subtracted from the offending category the next year. Any amounts of each quota category landings not taken on an annual basis will be left in the ocean to facilitate rebuilding. There are also framework management measures (section 3.1.1.7) that the Council could implement expeditiously if needed. The Council choose a constant harvest strategy over a constant fishing mortality because it is always easier and faster to monitor and enforce quotas than it is to evaluate the annual fishing mortality. The Council believes that with their firm desire to rebuild this resource and the mechanisms of the benchmark assessment, the way quota overages are handled, and the capability of frameworking, that a 50% probability over the 10 years justifies offsetting the short-term economic impacts that will be required to rebuild this resource. The Council's goal is to certainly achieve rebuilding in 10 years, but the 50% probability for the 10 year duration was selected to mitigate the significant socioeconomic impact of rebuilding on the industry. Industry desires and supports the

rebuilding of this resource.

The intent of the Council is to rebuild the stock biomass of the tilefish stock to levels which will support the fisheries at long term, sustainable levels. The short term effect of the Tilefish FMP on the fishery and associated fishing communities will be to reduce the allowable catch. While the short term effects of the FMP are of negative consequence to the those involved in the fishery, the long term effects of the FMP are overwhelmingly positive (sections 4 and 5). The recent unregulated fishery, left unchecked, would deplete the tilefish biomass to a level below the level that could be harvested at MSY if the resource were rebuilt (Table 4). The overall biomass of the resource has been consistently declining and has been below the B_{MSY} level since the early 1980s (Figure 37) This could lead to stock collapse. Yields would be expected to plummet (even at current high levels of F) and the Council would be faced with an extended rebuilding period which could be decades in duration. The FMP will allow for the rebuilding of the biomass in a relatively short period of time and then allow for a sustainable fishery at yield levels of approximately 4.2 million pounds per year.

3.1.3.2 Conservation and management measures shall be based upon the best scientific information available.

This FMP is based on the best and most recent scientific information available. The stock assessment (Nitschke *et al*. 1999) was prepared by the NEFSC and peer-reviewed by the MAFMC Science and Statistical Committee. The EFH background document (Steimle *et al.* 1998) was also written by NEFSC personnel and has been reviewed by the MAFMC Habitat Advisors and Habitat Committee. Numerous NMFS and academic personnel worked with Council staff in the development of the FMP as part of the Tilefish Technical Team (section 8). Future tilefish research should be devoted toward both data collection and analysis in order to evaluate the effectiveness of this FMP. Future research to determine the level of post-release mortality of tilefish discarded in non-directed fisheries by gear type is of particular importance. This species should have a "benchmark" assessment every three years conducted at the NEFSC Stock Assessment Workshop. Reviews after each benchmark assessment also will be performed by the Tilefish Monitoring Committee which will be staffed by scientists from the NEFSC, NERO, MAFMC, and various states.

3.1.3.3 To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

The management unit is all golden tilefish (*Lopholatilus chamaeleonticeps*) under United States jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish south of the Virginia/North Carolina border are currently managed as part of the Fishery Management Plan for the Snapper-Grouper Fishery managed by the South Atlantic Fishery Management Council. The current stock assessment covers all tilefish North and east of the Virginia/North Carolina boundary to the United States/Canada boundary (Shepherd pers. comm.). Katz *et al.* (1983) used significant differences in allelic frequencies to identify distinct stocks between mid-Atlantic and South Atlantic tilefish. The authors also felt that certain aspects of tilefish distribution, life history and ocean circulation patterns supported their two stock hypothesis for the United States Atlantic.

Golden tilefish in the South Atlantic are also classified as overfished. The overfishing definition is based on SPR (spawning per recruit) with 1992 currently being the last time the resource was assessed. At that time, the SPR level was estimated at 21% with 30% being the overfishing level.

Currently there is a TAL of 1 million pounds and south Atlantic tilefish landings in 1998 were estimated at 369,000 pounds. The SAFMC has a limited access transferable permit and an initial trip-limited, non-transferable permit. Trawl caught tilefish is prohibited. Bottom longline gear is only allowed in depths of 300 feet (50 fathoms) or more.

Vessels landing tilefish from this management unit must land tilefish in the northeast/mid-Atlantic states of Maine through Virginia. This specification is consistent with National Standard 3.

3.1.3.4 Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

The FMP does not discriminate among residents of different states. It does not differentiate among United States citizens, nationals, resident aliens, or corporations on the basis of their state of residence. It does not incorporate or rely on a state statute or regulation that discriminates against residents of another state. Since the quota is based on stock size and is designed to assure that the target mortality rate is not exceeded, National Standard 4B is met.

In the commercial fishery, the quota will be applied coastwide. Fishermen involvement in either the part-time or full-time vessel categories is based on historical landings during the past decade plus (1984 through 1998). These provisions are, therefore, "fair and equitable to all fishermen." The management measures included in this FMP are all specified so they may be adjusted following procedures set forth in section 3.1.1.7 to assure that the fishing mortality target is achieved. These provisions are, therefore, "reasonably calculated to promote conservation." The ports and communities are described in section 2.3.3 and the social impact assessment (section 5) details the lack of discrimination. The limited entry categories are based on historical participation and were proposed by representatives of the vast majority of fishermen involved in the tilefish fishery.

3.1.3.5 Conservation and management measures shall, where practicable, consider efficiency in the utilization of the fishery resources; except that no such measure shall have economic allocation as its sole purpose.

The management regime is intended to allow the fishery to operate at the lowest possible cost (e.g., fishing effort, administration, and enforcement) given the FMP's objectives. The FMP places no restrictions on processing or marketing except for permitting and reporting. All the management measures of the FMP are designed to meet the overall goal through meeting the four objectives of the FMP.

3.1.3.6 Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The management measures in this FMP are all specified so that they may be adjusted following procedures set forth in the FMP to assure that the fishing mortality reduction strategy is followed. The definition of overfishing is based upon a fishing mortality rate strategy. As such, the quota may fluctuate to reflect changes in tilefish stock conditions after a benchmark stock assessment has been

conducted based on any changes among the biological reference points or the stock status relative to those reference points. The limited entry categories are based on historical participation (1984 through 1998) and were proposed by representatives of the vast majority of fishermen involved in the tilefish fishery.

3.1.3.7 Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

The FMP is consistent with and complements, but does not duplicate, management measures contained in other FMPs.

3.1.3.8 Conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens Act (including the prevention of overfishing and rebuilding of overfished stocks), take account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The SFA, which reauthorized and amended the Magnuson-Stevens Act made a number of changes to the existing National Standards, as well as to definitions and other provisions. In regard to National Standard 8, the SFA requires that the importance of the fishery to fishing communities must be taken into account when implementing conservation and management measures.

The port and community description is in section 2.3.3, the RIR is in section 4 and the SIA is in section 5. In 1998, the commercial harvesting sector landed 2.7 million pounds of tilefish valued at $4,778,000 and in 1997, there were 3.9 million pounds with a total value was $4,868,000. The affects on employment for the harvesting sector are currently unknown. The RIR and RFA (section 4) contains information on number of crew listed at each port. The SIA contains information on the social and cultural impacts of the FMP on communities and individuals.

In section 4, it is concluded that it is unlikely that this regulatory action will create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; materially alter the budgetary impact of entitlements, grants, user fees, or loan programs of the rights and obligations of recipients thereof; or, raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

Employment of crew on vessels may be significantly affected. Several industry advisors have indicated that due to the low TALs mandated by the plan, and the likely attendant reduction in the number of trips made targeting tilefish, employment reductions are a likely outcome of this scenario. Similarly, support industries that are heavily reliant on selling products and services to the tilefish industry will also be effected. However, specific data needed to quantify the extent of these impacts are unavailable.

Another area of concern is the preferred alternatives affect on certain ports. According to the most recent weighout data (1998), several ports are dependent on the tilefish fishery and derived a significant percent of landings value from tilefish, as compared to the combined value of all other species landed in that port (Clay pers. comm.). For example, in Montauk, NY tilefish landings in 1998 were again the highest in the northeast, with landings of 1.4 million pounds valued at 2.6 million dollars.

This phenomenon also manifests, but to a much lesser extent, in several other ports such as in Long Beach Island/Barnegat Light, and in Hampton Bay, NY, tilefish are important. These ports are dependent, to varying degrees, upon tilefish landings and will be impacted by the proposed regulatory action. The extent to which local communities and businesses will be affected "materially" is unknown, but it is likely that local businesses which support the commercial fishing industry will be adversely impacted by this FMP.

The proper management of the tilefish stock through implementation of the management measures described above will be beneficial to the commercial fishing communities of the Atlantic coast in the long-term once the stock is rebuilt. By preventing continued overfishing and allowing stock rebuilding, benefits to the fishing communities will be realized through increased tilefish abundance and subsequent harvests at sustainable levels. However, to meet the conservation objectives embodied in National Standard 1 of the SFA, short-term reductions in catch and revenue from the tilefish fisheries are necessary and unavoidable. The recent unregulated fishery, left unchecked, would deplete the stock biomass to the point where a stock collapse is likely. Yields would be expected to plummet and the Council would be faced with an extended rebuilding period which could be decades in duration. The FMP will allow for the rebuilding of the stock in a relatively short period of time and then allow for a sustainable fishery at yield levels of approximately 4.2 million pounds per year.

3.1.3.9 Conservation and management measures shall, to the extend practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

The SFA, which reauthorized and amended the Magnuson-Stevens Act made a number of changes to the existing National Standards, as well as to definitions and other provisions an the Magnuson-Stevens Act. In regard to National Standard 9, the SFA requires that bycatch issues must be considered when implementing conservation and management measures.

This national standard requires Councils to consider the bycatch effects of existing and planned conservation and management measures. Bycatch can, in two ways, impede efforts to protect marine ecosystems and achieve sustainable fisheries and the full benefits those resources can provide to the Nation. First, bycatch can increase substantially the uncertainty concerning total fishing-related mortality, which makes it more difficult to assess the status of stocks, to set the appropriate optimal yield (OY) and define overfishing levels, and to ensure that OYs are attained and overfishing levels are not exceeded. Second, bycatch may also preclude other more productive uses of fishery resources.

The term "bycatch" means fish that are harvested in a fishery, but that are not sold or kept for personal use. Bycatch includes the discard of whole fish at sea or elsewhere, including economic discards and regulatory discards, and fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality). Bycatch does not include any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade. Bycatch does not include fish released alive under a recreational catch-and-release fishery management program. A catch-and-release fishery management program is one in which the retention of a particular species is prohibited. In such a program, those fish released alive would not be considered bycatch.

Longlining for tilefish catches very few other species (Table 87). Only silver hake, eel, and some shark comprise any landings over 1000 pounds. Vessels that are targeting tilefish land over 98% tilefish (Table 87). Vessels targeting tilefish discard very little fish (Table 88). The data are sparse, but only dogfish and tilefish were discarded according to the VTR data base for longline vessels. Very small amounts of tilefish are actually discarded in any fishery (Table 89) based on the limited VTR data base. From 1995 through 1998, there were only 699 pounds of tilefish that were discarded according to the sea-sampling data in the otter trawl fishery (Table 90). Those sea sampled trips that discarded tilefish were targeting hake, summer flounder, butterfish and squid (Table 91). These same sea-sampled trips that had a landing of tilefish, had very small landings in terms of pounds landed per haul (Table 92). The Council believes there is limited data to actually determine the magnitude of the problem and data collection is identified as an objective to the FMP.

The Council originally proposed (for public hearings) to cut the trip limit for the incidental vessel category in half in order to have a roughly similar reduction in fishing mortality for all of the various vessel categories. However, concern over regulatory discards, in fisheries not targeting tilefish, led the Council to reconsider its position and now has the initial trip limit for the incidental category set at 300 pounds. Overall, discards appear as low as they can be at the present and there does not appear to be a problem. Vessels must report bycatch and the level of bycatch reported must be taken into account in the management plan. It is believed that since the implementation of the FMP requires that all vessels that land tilefish must have a permit, that the level of data reporting (both incidental and discard) is likely to improve. This measure is frameworked and can be easily adjusted should the "target" quota for this incidental vessel category become significant to the overall mortality estimate.

3.1.3.10 Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act. In regard to National Standard 10, the SFA requires that the safety of human life at sea must be promoted when implementing conservation and management measures.

National Standard 10 recognizes that fishery regulations by definition place constraints on fishing that would not otherwise exist. The purpose of this national standard is to ensure that fishery regulations do not create pressures on fishermen to fish under conditions they would otherwise avoid. None of the management measures in this amendment will promote or result in increased levels of unsafe behavior at sea relative to the status quo.

The management measures in this FMP should not alter the behavior or fishing practices of fishermen to the extent that they would engage in fishing practices that they would otherwise avoid. None of the measures should affect the vessel operating environment or gear loading requirements. The Council developed this FMP in consultation with industry advisors to help ensure that this was the case. In summary, the Council has concluded that this FMP will not impact or affect the safety of human life at sea. Therefore, National Standard 10 is met.

3.1.4 Fishery Impact Statement

The ports and communities involved in tilefish fishing are extensively described is section 2.3.3.

The Social Impact Assessment in section 5 outlines the impacts of the various management measures to the ports and communities.

3.1.5 Environmental Consequences of the Alternatives

This section presents an analysis of the impacts of the preferred and alternative management measurers considered by the Council on the environment. These actions were described in section 3.1.1 and 3.1.2 above. In this section each management measure is analyzed in terms of biological, economic, and social impacts, and its effects on marine mammals, turtles, and sea birds. The economic analyses are also described in section 4 the RIR and IRFS. Social impacts are also included in section 5 the social impact assessment. Finally, management measures effects are also addressed in section 6.1.3.1. The following table should facilitate the evaluation of the environmental consequences of the various alternatives considered in this FMP.

Management measures considered in this FMP and cross-referenced to appropriate sections and Tables.

Management Measure	Text Section	Table
1. No Action	3.1.5.1	4
2. Rebuilding Schedule and Commercial Quota	3.1.5.2	86
2.1 Preferred Rebuilding	3.1.5.2	3
2.2 Non-preferred 1	3.1.5.2.1	12
2.2 Non-preferred 2	3.1.5.2.1	13
2.3 Non-preferred 3	3.1.5.2.1	11

2.4 Non-preferred 4	3.1.5.2.2	14
2.5 Non-preferred 5	3.1.5.2.2	15
2.6 Non-preferred 6	3.1.5.2.3	16
2.7 Non-preferred 7	3.1.5.2.4	17
2.8 Non-preferred 8	3.1.5.2.4	18
2.9 Non-preferred 9	3.1.5.2.5	19
2.10 Non-preferred 10	3.1.5.2.6	20
2.11 Non-preferred 11	3.1.5.2.7	21
2.12 Non-preferred 12	3.1.5.1	4
3. Permit and Reporting	3.1.5.3 Full-time, Part-time, and Incidental Categories	73 through 81
4. Tilefish Monitoring Committee	3.1.5.4	NONE
5. Limited Entry	3.1.5.5	73 through 81
6. Trip Limits	3.1.5.6	82 through 85
7. Closed Seasons	3.1.5.7	2
8. Gear Restrictions	3.1.5.8	Tables 93 through 95, Figures 38 and 39
9. Minimum Fish Size and Minimum Hook Size	3.1.5.9	NONE

3.1.5.1 Take no action at this time

This would mean the tilefish fishery would remain unregulated and overfishing would continue. Current fishing mortality is estimated at 0.45 (Table 4) and would result in continuously decreasing biomass in the future, with the likely result of stock collapse. This alternative would not meet the requirements of the Sustainable Fisheries Act nor capture long-term economic benefits of rebuilt tilefish stocks. The no action alternative is considered as the twelfth non-preferred rebuilding schedule the Council considered (section 3.1.5.2).

Biological Impacts

With the implementation of this alternative, the tilefish fishery would remain unregulated. The no action alternative would not address the problems and objectives identified in sections 1.1.2 and 1.1.3, respectively. Overfishing would continue to occur and the stock would be expected to continue to decline. The recent unregulated fishery, left unchecked, would deplete the adult biomass, leading to stock collapse. Yields would be expected to plummet and the Council would be faced

with an extended rebuilding period which could be decades in duration.

Economic impacts

The implementation of this alternative would not reduce overfishing or rebuild the stock. As a result, economic benefits will not accrue in the long-term. As noted above, if fishing mortality remains at recent levels the consequences for the stock and fishery would be severe. The longer overfishing is allowed to continue, the more protracted the rebuilding period would be, during which time tilefish landings would have to be dramatically curtailed. The absolute magnitude of the economic consequences would depend on the duration of the rebuilding period, but would be expected to exceed the cumulative economic impact of the preferred alternative.

Social Impacts

With the implementation of this alternative, the Council will not address the requirements of the Magnuson-Stevens Act. A sustainable tilefish fishery will not be developed, and negative social and economic impacts would result if the stock is not rebuilt. The social impacts could be especially severe if the Council failed to arrest overfishing in this fishery.

Effects on Marine Mammals, Sea Turtles, and Seabirds

No action may jeopardize the continued existence of the threatened or endangered species mentioned below because there will be uncontrolled, unlimited fishing pressure on tilefish.

3.1.5.2 Rebuilding schedules and commercial quota management strategy

The SFA requires the Councils to set the overfishing definition to meet a new standard (F_{MSY}) or a suitable proxy. In addition, the resource must be rebuilt to the biomass associated with MSY (i.e., $B_{MSY,}$ or a suitable proxy) in as short a period as possible. The rebuilding period is not to exceed 10 years, except where biology, environmental conditions, or international agreements dictate.

The preferred alternative will eliminate overfishing and rebuild the tilefish stock through a constant harvest strategy that would significantly reduce fishing mortality every year in the ten year rebuilding time frame (Table 3). This approach was chosen to allow for a constant TAL while providing a 50% probability of reaching B_{MSY} by the 10^{th} year of the rebuilding schedule. It was felt that this probability provided the best balance between achieving a rebuilt stock within the legally maximum mandated 10 years while attempting, to the extent practicable, to minimize economic impacts. Landings will be reduced to 1.995 million pounds during the first fishing year and remain at this level for the duration of the plan (until 2009) assuming there are no overages and that when the benchmark assessment evaluations are completed they indicate that the rebuilding program is progressing as scheduled and the biological reference points have not changed.

Associated with the rebuilding, is a regulatory action which establishes a commercial fishing quota allocated on an annual basis. The quota would be divided by permit category (full-time tier 1, full-time tier 2, part-time, and incidental) based on the percentages agreed to by industry that the Council approved on 23 November 1999. The quota should succeed in reducing mortality rates to the point where tilefish stocks can be rebuilt within the mandated 10 year time-frame. Any overages in a vessel category for a specific year would be reduced from that vessel category's next-year's quota.

Biological Impacts

Tilefish are long lived and slow growing (section 2.1.3.2). This life history strategy (long lived with low reproductive potential) makes the species particularly vulnerable to overfishing. The rebuilding scenario selected by the Council will allow the biomass to be rebuilt to the level that can support MSY within 10 years (Table 3). The Council chose to set the probability of achieving the rebuilding scenario at 50%. This alternative does not rebuild as fast as the no fishing alternative or some other more stringent measures, but does try to balance all competing needs.

The annual quota is the major management measure for reducing fishing mortality and allowing for rebuilding of the stock. As such, it will have a positive impact on tilefish.

Economic impacts

This alternative is expected to rebuild tilefish stocks within 10 years. In the first fishing year, landings would be reduced by slightly over one million (a 35% reduction from 1998 landings) pounds. Tables 96 through 172 identify the various alternatives and provide the stream of benefits for discounted or nondiscounted rates. Section 4 of the FMP thoroughly evaluates the preferred alternative and all the non-preferred alternatives relative to costs, revenues, consumer surplus and producer surplus.

Social Impacts

The proposed rebuilding schedule will achieve the biomass rebuilding target in ten years while allowing for stability in projected yields during the recovery period. Once the stock is rebuilt, long-term social benefits should be realized though a sustainable tilefish fishery which can continue to capitalize on existing markets or take advantage of new markets.

As noted in Section 5 there may be reductions in crew due to this measure. Previous discussions have been of total number of vessels. Thus the numbers of impacted individuals has referred to the number of owners - those who will receive or not receive limited access. Crews are, affected by any measure impacting the vessel owner. Permit files provide some crew data, but are not very accurate. Specifically, permit data list the number of berths on a vessel - not taking into account either empty berths or “hot-bunking” where two crews may alternate, with one taking the vessel out as soon as the other arrives and packs out. We can, however, make some rough estimates of numbers of crew. We cannot always assume that crew will live in the same community as the vessel owner, so in the discussion of which communities would potentially be most impacted by crew reductions resulting from the TALs crew are assigned to the port of landing for their vessel.

Of the 250 vessels under discussion here, crew data within the last 5 years were available for 241. (Data from 1998 were available for all but 33 vessels.) The most common crew was 3-5. There were 242 crew members total, distributed across vessels as noted below:

No. of Crew	1	2	3	4	5	6	7	8	9	10	11	12
No. of Vessels with Crew Size	3	27	49	75	57	15	6	1	6	1	0	2

The crewmembers are distributed by county as in Table 182. Thus, Washington County, Rhode Island and Suffolk County, New York have the largest groups of crew members; followed by Ocean County, New Jersey and Dare County, North Carolina.

By port, the crew are distributed as in Table 183. In absolute terms, then, Point Judith, RI is most impacted -- followed by Hampton Bay and Montauk, NY and Newport, RI.

The intent of the Council is to rebuild the tilefish biomass to levels which will support the fisheries at long term, sustainable levels. The short term effect of the Tilefish FMP on the fishery and associated fishing communities will be to reduce the allowable catch. Landings during the ten year rebuilding period will remain level, except for quota overages and adjustments due to stock assessment and monitoring information (Table 3). While the short term effects of the FMP are of negative consequence to the those involved in the fishery, the long term effects of the FMP are overwhelmingly positive. The recent unregulated fishery, left unchecked, would deplete the stock, possibly leading to stock collapse. Yields would be expected to plummet and the Council would be faced with an extended rebuilding period which could be decades in duration. The FMP will allow for the rebuilding of the stock in a relatively short period of time and then allow for a sustainable fishery at yield levels of approximately 4.2 million pounds per year.

Effects on Marine Mammals, Sea Turtles, and Seabirds

Since data regarding takes and interaction with endangered species is not yet available for the tilefish bottom longline fishery, much of the discussion in this biological assessment is drawn from a recent biological opinion which describes two analogous fisheries, the bottom longline fishery for sharks, and the Atlantic pelagic longline fishery (NMFS 1998). Information on listed species impacted by the tilefish fishery, including biological, ecological, and spatial characteristics, has been provided by the NMFS, Office of Protected Resources (Raizin pers. comm.).

Tilefish have unique spatial and temporal behavior; their habitat is a relatively restricted band approximately 250 to 1200 feet deep and 47 - 65 ^{0} F referred to as the “warm belt” on the outer continental shelf and upper slope of the United States Atlantic coast. Although tilefish are found along the entire United States Atlantic coast and the Gulf of Mexico, this FMP is concerned only with the stock of tilefish inhabiting the area north of the Virginia/North Carolina border. This stock has been identified as a biologically discrete stock (Katz *et al.* 1983). Because of their restricted habitat and low biomass, the fishery for tilefish, in recent years, has occurred in a relatively small area in the mid-Atlantic Bight. The traditional fishery has occurred as far south as Virginia.

Endangered Sea Turtles Known to Occupy the Area of Concern

Two species of listed turtles are known to occupy the Area of Concern, loggerheads and leatherbacks. Although hard data does not exist on takes of these turtles in the area, anecdotal information suggests that both species have been taken by hook in tilefish bottom longline fishery. The fishery, historically, has used rope or monofilament for longline gear material. However, the present fishery utilizes steel cable. Therefore, the fishing operations may be less likely to entangle loggerhead or leatherback turtles. However, data to analyze entanglements does not exist, and at this point, reduction in entanglements due to a move away from monofilament line is merely conjecture.

Loggerhead Sea Turtle

The threatened loggerhead is the most abundant species of sea turtle in United States waters, commonly occurring throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. The loggerhead's winter and early spring range is south of 37°00' N in estuarine rivers, coastal bays, and shelf waters of the southeastern United States. Loggerheads move northward and enter northeast coastal embayments as water temperatures approach 69° F (Burke *et al*. 1989; Musick *et al.* 1984) to feed on benthic invertebrates, leaving the northern embayments in the fall when water temperatures drop.

Like the Kemp's ridley sea turtle, the activity of the loggerhead is limited by temperature. Keinath *et al*. (1987) observed sea turtle emigration from the Chesapeake Bay when water temperatures cooled to below 67° F, generally in November. Work in North Carolina showed a significant movement of sea turtles into more northern waters at 52° F. (Chester *et al.* 1994) and Morreale has seen sea turtles persist in New York waters for extended periods at temperatures as low as 46° F (see NMFS 1995). Surveys conducted offshore and sea turtle strandings during November and December off North Carolina suggest that sea turtles emigrating from northern waters in fall and winter months may concentrate in nearshore and southerly areas influenced by warmer Gulf stream waters (Epperly *et al*. 1995). Aerial surveys of loggerhead turtles at sea north of Cape Hatteras indicate that they are most common in waters from 70 to 150 feet deep, although they range from the beach to waters beyond the continental shelf (Shoop and Kenney 1992). There is no information regarding the activity of these offshore turtles.

Anecdotal information suggests that the tilefish fishery interacts with relatively large loggerhead turtles that occur on the slope of the continental shelf from the period May to October. Egg-bearing loggerheads nest in the South Atlantic and Gulf of Mexico during the late fall and winter. At-sea sampling data from the Atlantic pelagic longline fishery suggests that while interaction is frequent in this fishery, mortality is low. However, sea sampling data from the bottom longline shark fishery (Branstetter and Burgess 1997) revealed that in 408 sets observed, 25 loggerheads were taken and released live and another six were recorded dead, yielding a mortality rate of approximately 20%. While not conclusive, this suggests that bottom longlines may be more lethal for the loggerhead turtle. The predominant source of mortality in the longline fisheries is ingestion of the hook.

Leatherback Sea Turtle

Nest counts are the only reliable population information available for leatherback turtles. Recent declines have been seen in the number of leatherbacks nesting worldwide (NMFS & USFWS 1995). The NMFS/USFWS status review notes that it is unclear whether this observation is due to natural fluctuations or whether the population is at serious risk. With regard to repercussions of these observations for United States leatherback populations in general, it is unknown whether they are stable, increasing, or declining, but it is certain that some nesting populations (*e.g.*, St. John and St. Thomas, United States Virgin Islands) have been extirpated.

The leatherback is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS & USFWS 1995). Leatherback turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) and are often found in association with jellyfish. These turtles are found throughout the action area and, while predominantly pelagic, they occur annually in places such as Cape Cod Bay and Narragansett Bay during certain times of the year, particularly the fall. Of the turtle species common to the action area, leatherback turtles seem to be the most susceptible to entanglement in lobster gear and longline gear.

This susceptibility may be the result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface.

Witzell (1999) summarized turtle catch from logbook data (1992 - 1995) for pelagic longline sets targeting swordfish and tuna, or both. The northeast distant area accounted for 70% of the loggerhead and 47% of the leatherback captures that were reported north of the mid-Atlantic Bight. June through November were the peak months for reported captures.

A review of observer reports for sets targeting all species between 1990 - 1996, yielded similar results (Hoey, 1998). The northeast distant area accounted for 75% of the loggerhead and 40% of the leatherback captures for all sampling areas. The northeast distant area also was the only area where interactions of four or more turtles occurred on a single set. July through November were the predominant months for turtle captures (Hoey 1998).

Anecdotal information suggests that the tilefish fishery has occasionally taken leatherback sea turtles. Although takes and mortality rates are not available for the fishery, it can be assumed that mortality has occurred. Mortality of leatherback sea turtles due to ingestion/internal hooking in the Atlantic pelagic longline fishery has been estimated to be 29% (Aguilar *et al.* 1992). We would expect similar results for leatherback turtles hooked in the tilefish bottom longline fishery.

Endangered Marine Mammals Known to Occupy the Area of Concern

Two listed species of marine mammals, fin and sperm whales, are known to occupy the area. On occasion, especially in the summer months, humpback and sei whales may transit the area. As in the case of endangered turtles, hard data does not exist on interaction with these species. There are no documented cases of whale entanglements in the tilefish fishery although these may have occurred in the past. Currently, the fishery uses steel cable instead of traditional monofilament lines. This may reduce the chance of entanglement. However, as in the case of listed turtles, data to analyze interactions does not exist. While steel cable could reduce entanglements, it could also cause an increase in wounding and/or scarring events if whales forcefully swim into the buoy lines.

Fin Whale

The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (Waring *et al*. 1999). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, however, Clark (1995) reported a general southward “flow pattern” of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, and fin whales are found throughout the action area for this consultation in most months of the year. This species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). As with humpback whales, they feed by filtering large volumes of water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments. Due to these traits, fin whales are less prone to entanglements than are right and humpback whales, but because they do occur in many of the same areas, the potential exists. Fin whales are known to occupy the Area of Concern from March to October and appear to be most susceptible to interactions in the spring and fall.

Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the proximal cause of mortality was not known. In 1996, three reports of ship strikes were received, although this was only confirmed as cause of death for one of the incidents. One entanglement report was received in 1996.

At least five reports of entangled fin whales were received by NMFS in 1997. Four fin whales were reported as having stranded in the period from 1 January 1997 to 1 January 1998, in the northeast region; the cause of death was not determined for these animals. One ship strike mortality was documented in 1998 in the Virginia-North Carolina border area. One entanglement mortality was reported in September 1998.

Sperm Whale

There are estimated to be approximately two million sperm whales worldwide with a population of 130,000 or more thought to occur in the North Atlantic. In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the eastern United States EEZ are believed to represent only a portion of the total stock (Blaylock *et al*. 1995). Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Waring *et al*. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge. Like swordfish, which feed on similar prey, sperm whales migrate to higher latitudes during summer months, when they are concentrated east and northeast of Cape Hatteras. Bull sperm whales migrate much farther poleward than the cows, calves, and young males. Because most of the breeding herds are confined almost exclusively to warmer waters many of the larger mature males return in the winter to the lower latitudes to breed.

Sperm whales feed primarily on medium to large-sized mesopelagic squids *Architeuthis* and *Moroteuthis*. Sperm whales, especially mature males in higher latitude waters, also take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962 and 1980). Sperm whale populations are organized into two types of groupings: breeding schools and bachelor schools. Older males are often solitary (Best 1979). Breeding schools consist of females of all ages and juvenile males. The mature females ovulate April through August in the Northern Hemisphere. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born at a length of about 4 meters after a 15 month gestation period. A mature female will produce a calf every 3-6 years. Females attain sexual maturity at the mean age of nine years and a length of about nine meters. Males have a prolonged puberty and attain sexual maturity at about age 20 and a body length of 12 meters. Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979).

Sperm whales were hunted in America from the 17th century through the early 1900's. The International Whaling Commission estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1971). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, greater attention was paid to smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke 1954; Committee for

Whaling Statistics 1959 -1983). In recent years the catch of sperm whales has been drastically reduced as a result of the imposition of catch quotas. NMFS believes there are insufficient data to determine population trends for this species (Blaylock *et al.* 1995). Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Sperm whales have been taken in the pelagic driftnet fishery for swordfish, and could likewise be taken in the shark gillnet fishery on occasions when they may occur more nearshore, although this likely does not occur often.

Interactions between sperm whales and longlines for sable fish have been noted in Alaska waters. Therefore, it is not improbable that interactions could occur with the sperm whale in the Area of Concern. These interactions could take the form of entanglement or scarring. Scarring is especially relevant given the use of steel cable replacing monofilament line. Sperm whales generally occur in the Area of Concern from March to September and appear to be most susceptible to interaction in the months of July and August.

Impacts of Management Measures on Endangered Species

Encouragement to Move After an Interaction with an Endangered Species

Encouraging fishermen to move after an interaction with a marine mammal or endangered sea turtle is intended to mitigate for the interactions with marine mammals and sea turtles in the area where the tilefish fishery occurs. If fishermen comply with this provision, there could be a reduction in levels of serious injury and mortality of strategic stocks of marine mammals. Hoey (1998) noted that for the northeast distant fishing area, 68.1% of all loggerheads observed entangled in pelagic longline gear were caught on sets with other loggerheads. For leatherbacks, 31.7% were caught on sets with other leatherbacks. While the Council recognizes that this measure will be extremely difficult to enforce, it is hoped that there will be cooperation between enforcement agencies and tilefish fishermen to ensure compliance.

Rebuilding Schedule

The preferred rebuilding schedule of ten years would reduce F to 0.30 in the first fishing year. The F for the 1998 was estimated to be at 0.45. This large reduction in effort would yield a total allowable catch of 1.995 million pounds compared to landings of nearly 3 million pounds in 1998. It is certain that a reduction in effort of this magnitude would have a substantially large impact on reduction of takes and interactions with endangered species. Alternative rebuilding schedules (section 3.1.2.2) that presume large reductions in effort, would produce the greater effects. However, it is unlikely that the relationship between reductions in effort and reduced takes and or interactions is linear due to spatial differences between stocks of fish and endangered species. A linear relationship would occur only if the spatial relationship were constant throughout the range of the fishery for the fishing year.

Sea Samplers and Observers

The provision which would require vessels to take aboard sea samplers or observers at the request of the Regional Administrator would have no direct impact on the take or interaction with endangered species. However, it is commonly recognized that this fishery, among others, needs access

to hard data to more accurately analyze the fishery for levels of takes and interactions of listed species.

The stock recovery schedule proposed in this FMP will reduce fishing mortality over a ten year period. As such, these reductions in fishing mortality will result in reduced fishing effort that in turn will reduce interactions with marine mammals, sea turtles, the endangered shortnose sturgeon, and seabirds. Preventing overfishing of tilefish thus will be beneficial to some seabirds and certain species of marine mammals.

The Council considered 12 rebuilding schedules in addition to the preferred (Table 86). Varying the probability of reaching B_{MSY} landings as well as the time to achieve the rebuilt stock yields significantly different yields (Figure 36). There were six constant TAL projection levels, that covered eight years and ten years. There are two for ten years that start in 1999 with voluntary management measures by industry which ideally would match to the TAL for future years. There are seven constant F scenarios that include the status quo (F = 0.454, Table 4). Tables 11 through 21 identify the alternative rebuilding schedules with the associated biomass, F, and yield annually. In general the longer the rebuilding time the less immediate short-term impacts to the fishermen, however not necessarily the long-term impacts are minimized. The Council supports NMFS risk-averse policy for fishery management and tried to balance the probability of achieving the rebuilt resource and the duration of rebuilding with the short-term economic needs of the fishermen. These alternative rebuilding schedules are identified in the following subsections, but aside from the no action alternative identified in section 3.1.5.1, all other eleven non-preferred alternatives would allow the tilefish resource to rebuild within the next ten years, or sooner. In general, the shorter the rebuilding duration, the more beneficial the environmental consequences of the alternative and the more severe the economic and social impacts. Industry did not have a unified opinion prior to public hearings. The analyses of these various rebuilding schedules focuses mostly on the differences in the economic impacts of each alternative. These economic impacts of the various alternative rebuilding schedules are thoroughly described in Section 4, especially section 4.7 and Tables 95 through 172. The social impacts of the various alternative rebuilding strategies are found in Section 5.

3.1.5.2.1 Non-Preferred Alternatives 1 (TAL=1,422,000; Table 12), 2 (TAL=1,003,000; Table 13), 3 (TAL=1,412,000; Table 11) 4 (TAL=1,760,000; Table 14)

These alternatives have constant TALs set at 1,422,000; 1,003,000; 1,412,000, and 1,760,000 respectively. These levels allow for a consistent supply of fish to be supplied to the market but, overall, cumulative benefits of the preferred alternative are greater than any of these options. Non-preferred alternatives 1 and 4 have a 50% probability of reaching B_{MSY} in 8 and 10 years respectively, while non-preferred alternatives 2 and 3 have a 75% probability of reaching B_{MSY} in 8 and 10 years respectively.

3.1.5.2.2 Non-Preferred Alternative 5 (Table 15)

Non-preferred alternative 5 is similar to the preferred because the projections incorporate a voluntary limit on landings, by industry, in 1999. Although TALs remain constant for NP alternative 5, the net effect relative to status quo is that net landings increase as projected status quo landings decline.

3.1.5.2.3 Non-Preferred Alternative 6 (F=0.0; Table 16)

This non-preferred alternative would reduce landings to 0 pounds and necessitate the closure of the fishery until 2007 when the stock is projected to reach B_{MSY}. Although this alternative would rebuild the stock in the shortest time period, it has the greatest economic and social impacts associated with it. Successive revenue losses would likely displace many of the fishing and ancillary businesses and thus fail to capture the positive benefits that even the TALs that the preferred alternative provides.

3.1.5.2.4 Non-Preferred Alternative 7 (F = 0.134; Table 17), 8 (F=0.10; Table 18), 9 (F=0.168; Table 19), 10 (F=0.136; Table 20), and 11 (F=0.10; Table 21)

The analyses of these various rebuilding schedules focuses mostly on the differences in the economic impacts of each alternative. These economic impacts of the various alternative rebuilding schedules are thoroughly described in Section 4, especially section 4.7 and Tables 95 through 172. The social impacts of the various alternative rebuilding strategies are found in Section 5.

These five non-preferred options do not provide constant TALs but rather focus in on constant Fs; an omission which may disrupt the marketing of tilefish and minimize any additional benefits provided by this alternative. They are a viable alternative to the status quo but ones which were not supported by the majority of the industry due to the potential negative impact on the market for tilefish.

3.1.5.2.5 Non-Preferred Alternative Status Quo; Table 4) is discussed in section 3.1.5.1

3.1.5.3 Impacts of permit and reporting requirements under the preferred alternative

Under all alternatives there are proposed permit requirements for commercial vessels, dealers, and operators. Given the current status of the stock mechanisms which account for all activities in the fishery are necessary to enforce provisions of the FMP and ensure overfishing is prevented. Permits issued to all sectors which harvest or sell tilefish provides the foundation for effective monitoring and enforcement of regulations.

The current permitting proposal call for a tiered system of full-time, part-time, and incidental catch categories. Under the proposed permitting system, the quota would be allocated across the full and part time categories based mostly on the proportion to the historical catch levels of vessels that qualify for each category. Table 80 should be examined for vessel breakdown and qualification requirements.

It is estimated that in 1998, 215 different vessels landed tilefish along the Atlantic coast. Under all of the alternatives, any vessel desiring to fish commercially for tilefish must obtain a federal vessel/owner tilefish permit.

It is anticipated that vessels landing tilefish for sale will be required to have permits, dealers purchasing this species from permitted vessels will be required to have permits, operators of commercial vessels (vessels with permits to sell tilefish) will be required to obtain permits, vessels

landing tilefish for sale would need to submit logbook reports, and dealers purchasing this species from permitted commercial vessels would need to submit reports.

It is estimated that in 1998, 215 different vessels landed tilefish along the Atlantic coast. Under all of the alternatives, any vessel desiring to fish commercially for tilefish must obtain a federal vessel/owner tilefish permit. Using the 1988- June 15, 1993 time frame there were 312 vessels which landed at least 1 pound of tilefish. Assuming that every one of these vessels would be eligible for a tilefish permit and that they would all apply, this would mean 312 new permit applications under the proposed rule. Initial costs for vessel permits would be $2,340 for public burden ($7.5 per vessel) and $5,184 for the government burden. Similarly, for operator permits there would be a $1,275 cost for the public burden ($15 per operator) and a $2,805 for the government burden and a $960 for public cost burden ($11.29 per vessel) for vessel identification numbers. It is estimated that about 5 percent of the vessels (5 vessels) applying for the initial vessel permit may also incur in additional costs associated with confirmation of permit history, replacement and upgrades, and permit vessel appeals which are estimated at $675 for the public ($135 per vessel) and $1,485 for the government. Costs of submitting vessel logbooks would be $1,693 annually for the public ($20 per vessel) and $2,125 for the government. This is a total initial annual public burden of $7,980 and a total government burden of $12,331. Subsequence annual public burden and government burden associate with reporting requirements are $2,650 and $2,791, respectively.

Biological Impacts

Permit requirements for commercial vessels, dealers, and operators will not likely have any biological impacts. Given the current status of the stocks and the uncertainties regarding discard rates for tilefish, mechanisms which account for all activities in the fishery are necessary to enforce provisions of the FMP and ensure overfishing is prevented. Permits issued to all sectors which harvest, process, or sell tilefish provide the foundation for effective monitoring and enforcement of regulations.

There are no direct biological impacts associated with the implementation of these management actions. However, this alternative will help track the quota and therefore reduce the chance that the quota is exceeded, and as such, reduce the chance of overfishing. A commercial permit to sell is essential for the accurate monitoring of a quota based management system. The dealer permitting and reporting requirements are also very important in tracking the quota and forecasting necessary closures.

Economic Impacts

Under the Paperwork Reduction Act (SF-83) burden estimates for this Tilefish FMP were calculated the same way that NMFS used for Amendment 2 to the Summer Flounder Fishery Management Plan. It is estimated that there will be 10 new dealer permit applicants. Thus total cost for all new dealers (who do not currently have permits) for permitting requirements in the first year is (for IVR and 88-30 forms) is $952 and $18 for annual processed reports. The combined public and government burden will be $1,624.

Social Impacts

The issuance of permits and reporting requirements are essential ingredients in the management of fishery resources. Section 303(b)(1) of the MSFCMA specifically recognized the need for permit issuance. Almost every international, federal, state, and local fishery management authority recognizes the value of permits and uses permits as part of their management systems. The purpose and uses of permits are to: 1) register fishermen, fishing vessels, fish dealers and processors, 2) list the characteristics of fishing vessels and/or dealer/processor operations, 3) exercise influence over compliance (e.g., withhold issuance pending collection of unpaid penalties), 4) provide a mailing list for the dissemination of important information to the industry, and 5) provide a universe for data collection purposes and efficacy of the management program.

Commercial fishing permit information can be used by enforcement officials to check for regulatory infractions and by NOAA scientists and economists as a basis for analysis. The commercial fishing permit requirement ensures more complete reporting from the fishery. Commercial fishing permits will increase compliance with commercial quota management. With the implementation of a commercial fishing permit, the quota system should be tracked more accurately. Therefore, permit requirements will enhance enforcement.

Of the 250 vessels 33 possessed no federal fishing permits in the northeast region in 1998, though all but one have possessed at least one permit at some point in the past. For the 33 with no current permits, there will be some additional burden in paperwork. This will affect the quality of life experience of fishing, but is also increasingly the norm for all fisheries.

Most dealers in the northeast are already permitted in order to buy and sell the many other northeast species which require dealer permits and mandatory reporting. One additional species and the small number of vessels in question should not pose any significant impact.

Effects on Marine Mammals, Sea Turtles, and Seabirds

The various permitting and reporting requirements required by this FMP for the commercial fishery, dealers, and operators should a positive impact on marine mammals, sea turtles, shortnose sturgeon, and seabirds. There are currently no permits required to fish for tilefish and commercial fishermen are not required to report their landings for tilefish if no other regulated species are taken. The vessel permit and reporting requirements should provide the most benefit since they will improve the information available to define and monitor fishing activity within the directed tilefish fishery.

3.1.5.4 Impacts of Tilefish Monitoring Committee

The Tilefish Monitoring Committee is a joint committee made up of staff representatives of the Mid-Atlantic Fishery Management Council, the Northeast Regional Office, the Northeast Fisheries Science Center and state representatives. The state representatives will include any individual designated by an interested state from Maine to Virginia. There is a maximum of three state representatives with a maximum of two from the mid-Atlantic states. There is also a non-voting industry advisor who is appointed by the Council Chairman. The Mid-Atlantic Council Executive Director or his designee will chair the Committee.

The Tilefish Monitoring Committee is intended to expedite effective management. This FMP was developed rapidly and many industry participants expressed a desire to better evaluate the stock status and other management measures in the future. As additional efforts for tilefish management

are developed, with the help of the Tilefish Monitoring Committee, and implemented in the future those measures will be evaluated for their biological, economic, social and endangered species/marine mammals impacts. The existence of this Committee should allow for greater flexibility in adjusting management measures. Greater flexibility is generally advantageous for fishermen and their communities. Presently the Tilefish Monitoring Committee will not impact on any of these potentially impacted categories.

3.1.5.5 Limit entry into the directed longline tilefish fisheries

Access limitation is a complicated issue. Most individuals who fished in the 1970s and early 1980s are no longer tilefish fishermen, but believe that since they developed the fishery they should have some long term privilege. In 1996, nearly 75% (1071 of 1450) of the trips that caught some tilefish, had less than 10% of the trip's landings as tilefish. However, in 1996, 20% of the trips that landed tilefish, landed at least 85% of their catch as tilefish. Fully 90% of all the tilefish landings in 1996 were landed on those trips where tilefish constituted at least 85% of the trips landings.

Biological Impacts

Under this alternative, vessels would have to qualify for a limited access commercial permit for tilefish. Representatives of the major factions of tilefish fishermen proposed and the Council adopted the qualifying criteria for the various vessel categories (section 3.1.1.9). The intent of this limited entry action would be to limit the number of participants in the commercial fishery for tilefish. As such, this measure would not be expected to have any major biological impacts. However, limited entry does mean that, in general, there will be less future participation and therefore less of a "race to fish", thus a positive effect.

Economic Impacts

The stricter the requirements, the fewer the number of vessels that would qualify for a limited access permit. In general the economic consequences would be positive for the historical participants who qualify since they will be assured some share of the economic benefits derived from the stock rebuilding program. Much of the discussion of the economic impacts is wrapped up with the following social impacts. A thorough elaboration of the economic impacts occurs in Section 4 and the social impacts in Section 5.

Social Impacts

Limited access has a number of different impacts, some positive and some negative. Further, it affects different fishermen and their communities in different ways - depending on their gear type and qualification status. Those who qualify receive the benefit of assured access and the ability to reap a continuing and known share of the tilefish resource as it rebounds. Nonetheless, the need to limit the catch of tilefish in the near-term imposes negative financial impacts on even those who qualified for limited access.

In addition, those fishermen who qualified based on gear other than longline and currently rely on tilefish for some portion of their income, while using that non-longline gear, will now be unable to take tilefish in amounts greater than 300 pounds per trip (per the Incidental category) unless they

switch to longlining. In 1998, however only 5 non-longline vessels ever exceeded 300 pounds per trip.

Changing to a new gear entails not only the financial costs of the gear and any necessary re-fitting of the vessel, but also the cost imposed when learning a new form of fishing. It takes time to become proficient at a new gear and during the learning period profits may suffer. Some fishermen, further, simply prefer fishing with one type of gear over another, and their experience of fishing may not be as enjoyable if they switch gears. Of the 196 vessels which in 1998 caught tilefish with a gear other than longline, however, 9 used both longline and another gear. Thus, many vessels are already capable of switching gears.

Gear	Frequency	Percent	Frequency
1	18	8.4	18
2	187	87.4	205
3	9	4.2	214
* Gear 1 is longline, gear 2 is non-longline and gear 3 is both			

Then there are those who did not qualify for limited access at all. They too may lose income if they had depended in recent years on tilefish for some amount of their catch greater than 300 pounds per trip but less than required for qualification.

3.1.5.5.1 Those Who Did Not Qualify for Limited Access

3.1.5.5.1.1 By Home Town

Washington County in Rhode Island is the home county (by owner's home address) for the largest number of non-qualifying fishermen - those who will be most negatively impacted by the implementation of this FMP. These 48 fishermen constitute 7% of the 697 fishermen and fishing vessel captains in the county. The largest number of non-qualifiers (27) is located in Wakefield. The next largest number (7) is located in Narragansett. Both Wakefield and Narragansett are located in Washington county. However, neither is large enough to appear in the detailed occupational files, so numbers of fishermen, captains and other officers are unknown. However, data on numbers of employees in the broader category of agriculture, forestry and fisheries are available. In Narragansett in 1990 there were 26 people employed in agriculture, forestry and fishing; 7 would be 27% of this total. Narragansett also provides more up-to-date 1998 data, indicating that there were 58 persons employed in agriculture, forestry and fishing in that year; 7 would be 12% of this number. Wakefield is grouped in the census data with Peacedale, where 3 non-qualifiers are located. These 30 non-qualifiers (27 in Wakefield and 3 in Peacedale) are 36% of the 83 individuals employed in agriculture, forestry and fishing in that community.

As described in the community profiles, of areas landing tilefish the areas most heavily dependent on fishing alone vis-à-vis other economic activities is Washington County. Washington County is also heavily dependent when fish processing activities are included .

The second largest group of non-qualifiers is located in Hampton Bay, New York and the third largest group in Montauk, NY. Both ports are located in Suffolk County. Montauk is also the port where all the full-time, tier 1 permit holders are located. Suffolk County is much less dependent on fishing than is Washington County. The 22 fishermen in the two ports who did not qualify constitute only 3% of the 705 fishermen and fishing vessel captains in the county. However, per port these are large numbers. Montauk had only 3,001 residents in 1990. Fishing, agriculture and forestry employed 151 persons - 9% of all employed persons over age 16. Thus 11 fishermen are 7% of the sector's employees, and 4 fishermen (the qualifiers) are 3% of the sector's employees. In Hampton Bay, the population in 1990 was 7,893 and fishing, agriculture and forestry employed 133 people - 3% of all employed persons over age 16. Here 11 fishermen are 8% of the sector's employees. Further, if we add in all the non-qualifiers in the county (including those in communities other than Hampton Bay and Montauk) there are 41 non-qualifiers, or 6% of all the county's fishermen.

The fourth largest group is found in New Bedford/Fairhaven, where there are 11 non-qualifiers (8 in New Bedford and 3 in Fairhaven). If the other Bristol County non-qualifiers are added in, then a twelfth fisherman is added. These 11 fishermen constitute only 2% of the 589 fishermen and captains in New Bedford. The twelve in Bristol County constitute only 1% of its 1,043 fishermen and captains.

Fifth place goes to Cape May, New Jersey (Cape May County) with 7 non-qualifiers and sixth to Wanchese, North Carolina (Dare County) with 6 non-qualifiers. (North Carolina vessels that fish tilefish from this management unit must land north of the Virginia/North Carolina border. It is assumed that landings in North Carolina have and will continue to meet the requirements and laws governing the SAFMC Snapper/Grouper FMP which manages tilefish in North Carolina and south.) The 7 in Cape May constitute 28% of the 25 persons employed in agriculture, forestry and fishing according to the 1990 Census. The 6 in Wanchese are 4% of the 137 in that sector in that port. If all non-qualifiers in each county are added in, then Cape May County has 10 non-qualifiers and Dare County has 18. The 10 in Cape May County constitute 3% of its 375 fishermen and captains. For Dare County, the 18 constitute 5% of its 370 fishermen and captains.

By percentage employees impacted in the sector then, the greatest impacts are in Wakefield-Peacedale, followed by Cape May and Narragansett, and then by Montauk and Hampton Bay. Washington County, where Wakefield-Peacedale and Narragansett are located is the most fishery dependent of the tilefish ports.

By owner's home county only, the results are slightly different: Washington County, Rhode Island still has the highest number of non-qualifiers, followed by Suffolk County, New York. The third largest group of non-qualifiers is located in Dare County, however. The fourth largest is Bristol county in Massachusetts. Cape May County in New Jersey is fifth, and Cumberland County in Maine is sixth.

3.1.5.5.1.2 By Primary Port of Landing

If we examine numbers of non-qualifiers by port of landing rather than owner's home address, then Point Judith Rhode Island (Washington County) has the highest number of non-qualifiers with 52 -- 12% of those in agriculture, forestry and fisheries in the county sub-division of South Kingstown (which includes Point Judith). There has been a practice of New York and New Jersey boats landing in Point Judith due to better prices. However, for 1998 only 3 vessels with New Jersey home addresses landed in Point Judith, and one New York vessel. (An additional 5 vessels from Massachusetts and Connecticut also landed in Point Judith. Table 34 and section 2.3.3). There were also 7 vessels with Rhode Island post office box addresses who could conceivably be out of state vessels using a convenience address.

Point Judith is followed by Hampton Bay, New York (Suffolk County) with 23 -- 17% of employees in agriculture, forestry and fisheries. Third is Wanchese, North Carolina (Dare County) with 20 -- 15% of those in agriculture, forestry and fisheries, followed closely by Newport, Rhode Island (Newport County) with 18 -- 6% of those in agriculture, forestry and fisheries. Fifth is Montauk, New York (Suffolk County) with 15 --11% of those in agriculture, forestry and fisheries and sixth is Portland, Maine (Cumberland County) with 12 -- 3% of those in agriculture, forestry and fisheries.

Thus by percentage of employees impacted, Hampton Bay is the most impacted, followed by Wanchese, Point Judith and Montauk. As noted in the Community Profiles (section 2.3.3), Suffolk County is relatively little dependent on fishing, though the individual communities of Montauk and Hampton Bay are more so -- especially Hampton Bay. These communities also have good economic conditions and available jobs, but few with wages as high as those offered by fishing. Both Washington County and Dare County are relatively dependent on fishing, and the port of Wanchese is highly dependent.

Of the 52 Point Judith boats, most have other limited access permits already, and so have some alternatives: 49 have squid, mackerel, butterfish; 49 have multispecies; 2 have scallop; 49 have summer flounder; 47 have black sea bass; 48 have scup; and 49 have lobster. In addition, some have open access or recreational permits in other fisheries: 2 in squid, mackerel, butterfish; 2 in multispecies; and 47 in scallops.

Most of the 23 Hampton Bay boats also have limited access permits in other fisheries: 21 in squid, mackerel, butterfish; all 23 in multispecies; 22 in summer flounder, 21 in black sea bass; 22 in scup; and 18 in lobster. The same is true for the 15 Montauk vessels: 11 each have squid, mackerel, butterfish; multispecies; summer flounder; black sea bass and scup; while 10 have lobster.

The 20 Wanchese vessels have fewer northeast species options. In terms of limited access northeast permits, 2 have squid, mackerel, butterfish; 4 have multispecies; 1 has scallop; 5 have summer flounder; 18 have black sea bass; 5 have scup; and 6 have lobster.

Thus most of these vessels have some other fishing options - though it should be remembered that most of the region's limited access fisheries are already highly exploited (often over-exploited) and under strict rebuilding plans. Thus, it is unlikely that significant additional effort could be added.

However, most of these vessels also relied on tilefish for a very small percentage of their fishing income. Some in Montauk, Hampton Bay, Portland and Point Judith, however, did rely on tilefish

for 19-100% of their fishing income - though absolute levels are often low. Four of the Montauk vessels, for instance, relied on tilefish for 82-100% of their fishing income. And these most dependent vessels have few or no limited access permits for other fisheries. Thus, significant impacts are few per port and overall, though very severe for a small number of vessels.

If we examine numbers of non-qualifiers by port of landing county only, Washington County, Rhode Island is the most impacted (52) followed by Suffolk County, New York (48), Dare County, North Carolina (26), Newport County, Rhode Island (18), Cumberland County, Maine (12) and Bristol County, Massachusetts (9).

3.1.5.5.2 Those Who Qualified Only for Part-Time

3.1.5.5.2.1 By Home Town

The largest group of part-time qualifiers is located in Ocean County, New Jersey, followed by Washington County, Rhode Island. Within Ocean County, the largest group is 12 part-time vessels in Long Beach/Barnegat Light (31% of those in agriculture, forestry and fisheries). Other communities have only 1-3 part-time vessels. Within Washington County, no individual community has more than 2 part-time vessels.

3.1.5.5.2.2 By Primary Port of Landing

The largest group is still in Ocean County, followed by Washington County. There are 15 vessels in Barnegat Light (39% of employees in agriculture, forestry and fisheries) and 8 in Point Judith (2% of those in agriculture, forestry and fisheries in South Kingstown).

Thus by either home town or primary port, regulations for part-time vessels will ultimately have the most impact on the community of Barnegat Light in Ocean County, NJ. While Ocean County is not heavily dependent on fishing, the port of Barnegat Light is. Any vessel who fishes less tilefish under the new regulations than previously will be impacted.

However, only 9 of the 42 part-time qualifiers actually fished for tilefish in 1998. Of these, 5 have home addresses in Washington County (2 in Wakefield, 2 in Charlestown, and 1 in Narragansett), 3 have home addresses in Ocean County (2 in Barnegat Light and 1 in Ship Bottom), and 1 has a home address in Portland, ME. By primary port, 6 land in Point Judith, 2 in Long Beach/Barnegat Light, and 1 in Portland. Thus Washington County may be more affected than Barnegat Light in the short-term.

The Washington County home town vessels all possess a variety of other limited access permits, however. Each has multispecies; squid, mackerel, butterfish; summer flounder; black sea bass; scup and lobster. The Ocean County home town vessels are less diversified: to possess multispecies and lobster limited access permits, and one possesses no federal northeast permits at all - either limited access or otherwise. The Portland vessel has multispecies and scup limited access permits. Further, none of these vessels relied on tilefish for even as much as a half percent of their fishing income.

3.1.5.5.3 Those Who Qualified for Full-Time

While in the long-run all those who qualified for full-time limited access - either tier 1 or tier 2 are

in a position to reap future benefits, those who are currently fishing may be unable to fish as much as in the past in the near-term. All four tier 1 qualifiers fished in 1998, but only two of the four tier 2 qualifiers fished then. The four tier 1 qualifiers relied on tilefish for 89-99% of their fishing income in that year. All four live and land in Montauk. All but one has at least one other limited access permit. The two tier 2 qualifiers both live and land in Barnegat Light/Long Beach and have one other limited access permit.

Effects on Marine Mammals, Sea Turtles, and Seabirds

Limiting entry into the tilefish fishery will not have any significant impact on marine mammals, sea turtles, shortnose sturgeon, and seabirds. However, limited entry does mean that, in general, there will be less future participation and therefore less of a "race to fish", thus a positive effect.

3.1.5.6 Trip limits for incidental category

Vessels included in the incidental category would be limited to landing a maximum of 300 pounds per trip before any quota reduction takes place. If the preferred alternative remains at a constant harvest strategy of 1.995 million pounds, a roughly 35% reduction would result for the directed fisheries. It is currently unknown how many vessels qualify for incidental catch permits but there are 312 vessels that landed at least 1 pound of tilefish between 1988 and June 15, 1993 (section 4).

It is estimated that in 1998, 215 different vessels landed tilefish in 1998 along the Atlantic coast. Under the all of the alternatives, any vessel desiring to fish commercially for tilefish must obtain a federal vessel/owner tilefish permit.

Biological Impacts

This alternative would establish a system of uniform trip limits for incidental category vessels established on a coastwide basis in conjunction with the quota system. The biological impacts would be the same as those identified in the sections described above for the commercial quota.

Economic Impacts

Under this alternative, the Council may establish trip limits for the incidental category to insure that the annual quota is not exceeded. Thus, the Council would be required to implement a uniform trip limit which would apply coastwide.

This alternative would establish a system of uniform trip limits in conjunction with the quota system. This would preclude a targeted fishery for tilefish and would create mostly a bycatch fishery by boats in the incidental category.

Social Impacts

Allowing an incidental catch for vessels not targeting tilefish allows vessels which normally encounter small amounts of tilefish to continue their activities relatively unaffected. In 1998 only 5 vessels would have exceeded the 300 pound trip limit.

Effects on Marine Mammals, Sea Turtles, and Seabirds

There should be no affect of this measure on marine mammals, sea turtles, or seabirds.

3.1.5.7 Impacts of closed seasons

For purposes of public hearings the Council considered a one calendar month closure during the time period of May through September. Although tilefish landings are significant in nearly every month, landings in the summer are slightly less (Table 2). Tilefish are fractional spawners from about March through November, although most of the reproduction occurs from May through September. Closures for spawning over this extended of a period would be difficult for industry. Some industry members did propose a one month period in the summer in order for tilefish to have a higher probability of successful spawning. This regulation would not likely add to the impacts of the overall quota. During these months, however, spawning is reported to be highest and demand is low and thus a closure may aid in protecting spawning stocks which would further facilitate rebuilding the stocks. This possibly could have enhanced the effectiveness of the FMP, however, the Council decided not to implement this measure at this time.

Biological Impacts

The closures could affect the allocation and would be expected to have mostly a positive impact. In general, the closure is intended to aid in protecting spawning stocks which would further facilitate rebuilding. However, increased discarding could occur, resulting in potentially negative biological consequences for the stock.

Economic Impacts

The overall initial quotas may be so constraining that no additional economic impact will occur to the directed tilefish fishermen.

Social Impacts

The effects of this alternative would depend largely upon the closure system recommended by industry and set up by the Council.

Effects on Marine Mammals, Sea Turtles, and Seabirds

Summer closures for one month will not preclude the overall harvest of the quota in the tilefish fishery, but it still might have had a significant impact on marine mammals, sea turtles, shortnose sturgeon, and seabirds. The public hearing preferred alternative which would have closed the fishery for a one month period during May-September could possibly have reduced interactions and takes of endangered species. The four listed species identified for this fishery inhabit the Area of Concern during this period. Optimally, the fishery would have closed during the months of July or August since these months have been identified with increased numbers of leatherback sea turtles and sperm whales in the area.

3.1.5.8 Impacts of gear restrictions or prohibitions because of EFH impacts

Based upon some available scientific information (Auster and Langton 1998; DeAlteris 1998; Collie

et al. 1996), it was inferred for the purposes of the public hearing document that trawling was causing long-term physical adverse impacts to tilefish EFH. It was further implied that in some cases those adverse impacts could have been severe, at least locally. The basis of this conclusion was drawn from previous studies which show that in deep water, soft-bottomed sediments where environmental conditions are relatively stable, the impacts of trawling have resulted in destruction of benthic communities and habitat structure that was slow to recover following the cessation of fishing activity.

During the public hearing process, the Council received significant input from both the directed tilefish fishing industry and other fishing industry representatives that bottom-tending mobile gear was not significantly having an identifiable adverse effect on tilefish EFH. The environmental community strongly supported the association that bottom tending mobile gear can destroy bottom structures and that since tilefish are significantly dependent on bottom structure for their burrows, bottom tending mobile gear should be banned in tilefish HAPC.

On 30 September 1999, the Tilefish Technical Team consisting of Council staff, a Council member, NMFS (both NERO and NEFSC) personnel, academics and industry representatives were hosted in a workshop by Dr. Ken Able of Rutgers University to discuss the impacts of fishing gear to tilefish habitat. It was concluded that there is nothing definitively known about tilefish-mobile fishing gear interactions. There is nothing specifically described about the sensitivity of tilefish burrows in the scientific literature. Unquestionably, from submersible vessel research, there are trawl door patterns observed in areas with tilefish burrows, but how much of an impact the doors have and how quickly tilefish can reopen their burrows, if sediment closed, is completely unknown at this time. It is fully recognized that tilefish are extremely important to maintaining the habitat around their burrows and this is important for the entire demersal community around these burrows. Any short-term or long-term impacts of bottom tending mobile gear specifically to tilefish habitat are unquantifiable at this time. The scientists and industry representatives at this meeting concluded that a research program to answer these questions was the appropriate approach to take. On 23 November 1999 when the Council approved the FMP for Secretarial submittal , they passed the following motion to address this question: "that the MAFMC, NMFS, conservation organizations, and the fishing industry shall join together to design and implement within two years a scientific research program in order to determine if the use of mobile fishing gear is having a deleterious impact on tilefish habitat." The scientific research program will be developed within the near term.

Had the Council moved forward with closure, under the public hearing preferred alternative and the second non-preferred alternative, of statistical areas 537 and 616 to bottom tending mobile gear there would have been an affected area of approximately 3,025 square nautical miles (Figure 38 and Table 93). Closure to bottom tending gear under the first and third non-preferred alternatives would comprise approximately 7,075 square nautical miles (Figure 38 and Tables 93 through 95).

Biological Impacts

The closures would have likely had positive biological impacts for both tilefish and other species. Tilefish are structure oriented animals and bottom tending gear destroys structure. Effort displacement from closed or restricted areas is possible with the result of concentrating other fishing effort in other areas, however these negative impacts should be less to the environment than the destruction of long-term habitat structures such as tilefish burrows.

Economic Impacts

The overall impacts to tilefish fishermen should be positive since more tilefish habitat will be available for the resource. Impacts to other fishermen are not known at this time but would likely be negative since other fisheries in these closed areas include: white hake, silver hake, pollock, *Loligo,* butterfish and mackerel. Many of these species can be fished off of the bottom. There is likely to be effort displacement from the areas where gear are prohibited or even areas where gear would have to be modified may cause fishermen to decide to fish other areas. This effort displacement is likely to reduce the economic returns to fishermen since they will be fishing in potentially less desirable locations than they currently fish, however no estimates are available presently of the costs and whether or not fishermen will modify their gear or simply move.

Social Impacts

The effects of this alternative would depend largely upon the capability of other fishermen to fish these areas without their gear coming in contact with the bottom. Fishing gear modification for most of the other species could have been possible.

Effects on Marine Mammals, Sea Turtles, and Seabirds

Marine mammals, sea turtles, and seabirds are infrequently found at the depths where these bottom tending mobile gear is impacting the bottom habitat. The use of raised footropes, replacing gear that scrapes the bottom should have no significant impact on takes of endangered species. Thus, no impact for these organisms is likely.

3.1.5.9 Minimum size limits and minimum hook size

Initial reaction is that this type of measure would only result in dead discards since most landings occur from depths greater than 250 feet. Anecdotal evidence indicates that trawls catch smaller fish than the longline gear. Fifty percent of the females are mature by 20 inches. Increased size equals increased yields (generally).

It is believed that increases in hook size from what is currently in use would allow the longline fishery to increase the size of tilefish landed. No quantifiable scientific study data are currently available. Industry is interested in documenting associated benefits and the Council may consider hook size in the future but at this time neither minimum size limits nor hook size restrictions are part of the preferred alternative.

Biological Impacts

Assuming that undersized fish are not caught and discarded, minimum size regulations would have positive impacts on the stock. In general, because minimum sizes increase the size at full recruitment, yields are increased as fishermen catch larger, heavier fish. In addition, minimum size regulations can increase the resilience of the stock to overfishing, i.e., the biological reference points (F_{MSY}) can increase. Finally, minimum size regulations can increase spawning stock biomass by allowing more fish to spawn. However, negative biological consequences of minimum size restric-

tions in the tilefish fishery would result from increased discarding. It is unlikely that tilefish fishermen could avoid catching sub-legal fish, and, as a result, increased levels of discards are expected, especially given the current size composition of the stock.

Economic Impacts

The economic impact from the implementation of these alternatives would vary between regions and gears employed. In general terms, reduction in revenues in the short-term would be expected. The degree of long term economic consequences would depend on the level and extent of discarding as the stock rebuilds.

Overall, these alternatives are expected to have some adverse economic effect on the tilefish fishery, at least in the short-term. However, benefits of a size restriction in the fishery could result from increased catches of tilefish in future years. Gains will accrue to fishermen through protecting small tile fish until they reach legal size. This management measure will result in a short-term reduction in the marketable catch and long-term benefits as more tilefish mature and increase the number of the spawning stock. In addition, a reduction in the mortality of small tilefish will allow for an increase in yield or harvest as small fish that were previously killed grow larger and add weight to the stock.

Social Impacts

The proposed commercial fish size limitations would reduce the commercial catch and increase discards. If commercial fishermen can substitute the potential income loss by landing another species without additional effort then they may see no negative impact. However, if this is not possible, short-term impacts could occur. Nevertheless, it is possible that commercial fishermen could be faced with substantial income loss as the result of the minimum size limit, with uncertain biological results.

Effects on Marine Mammals, Sea Turtles and Seabirds

Size restrictions in the tilefish fishery will not have any significant impact on marine mammals, sea turtles, shortnose sturgeon, and seabirds.

4.0 REGULATORY IMPACT REVIEW AND INITIAL REGULATORY FLEXIBILITY ANALYSIS

4.1 INTRODUCTION

A Regulatory Impact Review (RIR) for all regulatory actions which either implement a new fishery management plan (FMP) or significantly amend an existing plan is required by the National Marine Fisheries Service (NMFS). An RIR is required by NMFS for all regulatory actions, which are part of the "public interest." The Regional Fishery Management Council prepares the RIR with possible assistance from NMFS, proposing a plan or amendment. The RIR is a required component of the process of preparing and reviewing FMPs or amendments and provides a comprehensive review of the economic impacts associated with proposed regulatory actions. The RIR addresses many concerns posed by the regulatory philosophy and principles of Executive Order (E.O.) 12866. The RIR serves as the basis for assessing whether or not any proposed regulation is a "significant regulatory action" under criteria specified by E.O. 12866.

The RIR must provide the following information: (1) a comprehensive review of the level and incidence of economic impacts associated with a proposed regulatory action or actions; (2) a review of the problems and policy objectives prompting the regulatory proposals; and (3) an evaluation of the major alternatives which could be used to meet these objectives. In addition, an RIR must ensure that the regulatory agency systematically and comprehensively consider all available alternatives such that the public welfare can be enhanced in the most efficient and cost effective manner.

Under the Regulatory Flexibility Act (RFA) of 1980 as amended by Public Law 104-121, new FMPs or amendments also require an assessment of whether or not proposed regulations will have a significant economic impact on a substantial number of small business entities. The primary purposes of the RFA are to relieve small businesses, small organizations, and small government agencies from burdensome regulations and record-keeping requirements, to the extent possible.

Section 4 of the proposed FMP for tilefish (*Lopholatilus chamaeleonticeps*) provides an assessment and discussion of the potential economics impacts, as required of an RIR and the RFA, of various proposed management and regulatory actions consistent with the problems that must be resolved and the objectives outlined, respectively, in sections 1.1.2 and 1.1.3 of this document.

4.2 PROBLEMS AND OBJECTIVES

The biological aspects and habitat characteristics related to the tilefish fishery are described in sections 2.1 and 2.2 of this FMP document; the history of exploitation and the social and economic characteristics of the fishery are presented in section 2.3. The problems which should be resolved or addressed by the proposed management action are as follows (section 1.2): (1) overfishing must end and the stock biomass must be rebuilt; (2) overcapitalization should be avoided; (3) Measures must be based upon the best scientific information available; (4) the Council must identify and describe essential habitat for tilefish in the western Atlantic ocean north of North Carolina; and (5) management plans should minimize bycatch, a requirement of National Standard 9.

The overall goal of the proposed FMP is to rebuild tilefish so that the optimum yield may be

obtained from the resource. To achieve the overall goal, the following management objectives have been adopted: (1) prevent overfishing and rebuild the resource to the biomass that would support maximum sustainable yield (MSY); (2) prevent overcapitalization and limit new entrants; (3) identify and describe essential habitat; (4) collect data necessary to develop, monitor, and assess biological, economic, and social ramifications of management measures proposed to prevent overfishing and to reduce the bycatch in all fisheries.

4.3 METHODOLOGY AND FRAMEWORK FOR ANALYSIS

This section provides an overview and description of the procedures used to assess the potential economic impacts of allowing the fishery to continue operating with no regulation (i.e., the status quo); regulating the fishery using the preferred option which imposes an annual quota of 1.995 million pounds and allocates among the various fishery categories according to option 6 (Table 80); and each of the non-preferred alternative regulatory strategies and option 6 allocations of the TALs.. The analysis requires the following: (1) a price model for estimating prices, revenues, and consumer surplus; (2) information of costs to estimate net returns and an approximation of producer surplus; and (3) an expectations framework for calculating the expected value of the various regulatory options given that the probabilities of the options for rebuilding the biomass to maximum sustainable yield levels within a ten year horizon are different.

Edwards (1990) provides a framework for assessing the economic impacts and net benefits or net economic value of proposed regulations for fisheries. Estimation of net national benefits requires estimation of consumer and producer surpluses. Consumer surplus represents the maximum amount consumers are willing to pay to purchase a good or service less what they actually must pay. Producer surplus equals the difference between total revenue received by the producer and the resource costs of providing a good or service (e.g., fish). Although profit or net returns is not a true measure of producer surplus -- it does not reflect deductions for the value of entrepreneurs' assets, including labor, capital, and land -- profit or net returns is used as the measure of producer surplus in this study. As such, producer surplus is likely to be overestimated in the analysis.

The economic impacts were assessed in terms of changes in landings, prices, revenues, and net returns for each of the regulatory options relative to observed performance in 1998 and the status quo (i.e., Table 4 and the assumption of a constant F = 0.454). Performance relative to 1999 could not be assessed because data for 1999 activities were not available. All impacts were estimated in terms of current and constant dollar values. Current dollar values reflect values during a given period of time or the nominal values; constant dollar values measure dollar values in constant dollars or in terms of one time period. For the analysis conducted for this FMP, all future values were converted to 1999 dollar values using a discount factor of 0.07 or seven percent per year (e.g., revenues projected to occur in 2000 were divided by 1.07 to convert to 1999 dollar revenues). Changes in revenues were estimated by multiplying the price estimated from the price model by the likely level of landings corresponding to all potential regulatory options (tables 3-4 and 11-21). Net returns were estimated by deducting from the estimated ex-vessel revenues total operating costs, all fixed costs, and repair and maintenance costs. The impacts on landings, revenues, operating and total costs, and net returns were also assessed relative to the four proposed vessel categories (section 1.2.1.5 and option 6 of Table 80): (1) incidental, (2) part-time, (3) full-time tier 1, and (4) full-time tier 2. Information for estimating all costs components were obtained from the National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts. The impacts

are assessed relative to 1998 reference year and the status quo level of performance.

4.4 ANALYTICAL METHODS AND DATA

4.4.1 Data Used for the Analysis and Limitations

This section describes the data and data sources used for the economic analyses.

4.4.1.1 Landings and Ex-vessel Price Data

Data on golden tilefish landings and revenues for the period 1964 through 1998 and for all states landing golden tilefish were obtained from the National Marine Fisheries Service. Two basic types of data were collected: (1) data from the weight-outs or dealer slips, and (2) all data reported from the weight-outs and all data reported to NMFS by the various state agencies. Landings and ex-vessel revenues were grouped according to region of landings: (1) landings and ex-vessel revenues for all states between Maine and Virginia, and (2) landings and ex-vessel revenues from all other areas. Although tilefish are typically landed gutted, landings and prices were analyzed using the live weight equivalent data; the factor used by the Northeast Fisheries Science Center for converting gutted weight to live weight for tilefish harvested between Maine and Virginia is 1.09. Implicit ex-vessel price series were constructed by dividing observed revenues by observed live-weight equivalent landings.

The data used to estimate the price, or more formally, the price-dependent or inverse demand model for the region (Maine through Virginia) were restricted to weight-out data for the region and all reported landings and ex-vessel revenues for all other areas. Although actual landings and revenues for the Maine to Virginia region are higher than those reported from the weight-out data, the price and revenue analysis were based on the weight-out data. Total reported landings for Maine through North Carolina equaled 2.661 million pounds; landings from the weight-out data for the same region equaled 2.373 million pounds -- a difference of 287,668 pounds. The decision to base the analyses on the weight-out data was based on several factors: (1) the weight-out data were the only data which could be verified as being accurate; (2) data from some other states were not available because of confidentiality concerns or inadequate reporting; (3) the weight-out data could easily be linked back to individual vessel performance; and (4) the weight-out data were the data most consistent with landings of the four quota categories. Observed landings of part time and the two full-time tier quota category vessels equaled 2.128 million pounds in 1998. Landings by the incidental category equaled 0.092 of the total reported landings of 2.661 million pounds -- 244,812 pounds. The landings and ex-vessel revenue data for the other region (North Carolina through Texas) were obtained from the Webb site of National Marine Fisheries Service (Personal Communication from the National Marines Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, MD.).

Projected total Maine through Virginia landings for the status quo, preferred alternative, and all non-preferred alternatives were obtained from Nitschke (Tables 3-4 and 11-21). No attempt was made to project landings for the North Carolina to Texas region. Instead, three potential levels of landings were considered: (1) it was assumed that landings between 1999 and 2009 would equal the 1998 level (565,660 pounds.); (2) landings in each year would equal the 1964 through 1998 average (1,764,556 pounds.); and (3) annual landings would equal the quota imposed by the South

Atlantic Fishery Management Council (live weight equivalent of 1,091,813 pounds.). Prices, economic impacts, and net benefits were assessed relative to the status quo and proposed Mid-Atlantic alternatives and the three potential levels of landings for the southern region.

4.4.1.2 Cost Information and Data

Detailed cost data for the tilefish fishery were not readily available. After consultation with staff of the Northeast Fisheries Science Center, National Marine Fisheries Service, it was decided that information collected on the costs of operating tub trawls and longline vessels in 1996 obtained from a survey by Georgianna *et al.* (1998) could be used to estimate the various costs of harvesting and landing tilefish. Using information from the survey, the ratios of various costs to total revenues of each vessel contained in the survey were calculated and averaged (personal communication, NEFSC). Costs were then estimated for each of the alternatives by multiplying the ratios times each of the projected landings streams corresponding to the four quota categories and each of the management options (i.e., status quo, preferred alternative, and the 11 non-preferred alternatives).
One difficulty with using the costs to revenue ratios to estimate each of the cost components is that overhead and fixed costs will likely be seriously underestimated relative to the alternatives under consideration. Consequently, annual overhead and fixed costs corresponding to each quota category and regulatory option were also estimated by multiplying the ratio of overhead and fixed costs to revenue by observed revenue in 1998 for each of the four quota categories; fixed costs in each of the years for the four quota categories and the regulatory options were then assumed to equal the levels estimated for 1998. Even though there is the possibility of bias in the estimates of the fixed costs, the potential biases would affect only the magnitude of the estimates and not the subsequent rankings of the estimates of ex-vessel revenues, net returns, producer surplus, and net benefits.

A complication for assessing the fixed costs, as described in the preceding paragraph, is that many vessels land other species along with tilefish (joint in inputs) or fish for other species during other parts of the year independently of tilefish (nonjoint in outputs). If a technology is truly joint in inputs (i.e., more than one output is produced with a given bundle of inputs), it may not be possible to allocate fixed costs among the various outputs. Alternatively, if fixed costs cannot be allocated to each output, it is not possible to determine the fixed costs relative to one product of multiple product technology (e.g., one species caught with other species) (Shumway *et al.* 1984). For incidental and part-time vessels and those full time vessels, which also work in fisheries other than tilefish, it is unknown how much of their fixed costs is paid from tilefish receipts or revenues. Thus, the use of the ratio of fixed cost to revenue may be inappropriate for estimating future fixed cost, particularly when revenues may be declining. In this analysis, it is assumed that vessel owners proportion their fixed costs relative to each species and fishery; if this is the case, the ratio of fixed cost to tilefish revenues provides a reasonable estimate of fixed costs associated with tilefish production activities. For vessels that depend upon tilefish for a majority of their revenues, using the product of the ratio of fixed cost to revenue and 1998 revenue levels should provide reasonable and conservative estimates of fixed costs. Ex-vessel revenue in 1996, the year in which the survey was conducted, was higher than that observed in 1998; fixed costs calculated for the economic impact analysis, thus, may be substantially underestimated.

4.4.1.3 Limitations and Simplifying Assumptions

Although the analysis of the potential economic impacts utilized the best information available and "state-of-the-art" procedures, numerous problems exist with the data. The first problem is incom-

plete information on landings and ex-vessel prices. Information on cost is extremely limited, and thus, it is likely that fixed cost is underestimated. Another problem is that tilefish are often caught with other species, and data necessary for adequately assessing the multi-species nature of the fishery were not available. Alternatively, it is not possible to allocate the fixed and variable costs among all species harvested with tilefish. Another problem is that information necessary to correctly estimate producer surplus is unavailable, and thus, producer surplus is estimated as net returns or revenue minus all costs.

The ramifications of most of the above discussed problems are not likely very serious. Inadequate information on fixed costs, however, may be quite serious. Analyses of net returns (revenues less fixed costs), assuming that fixed costs equaled 1998 estimated levels, suggest that vessel operators who primarily depend on tilefish will experience substantial losses starting as early as 2002. It would be expected that in response to financial losses, vessel operators would redirect fishing activities to other fisheries; the other fisheries or species that might be targeted are unknown. Even though the data on fixed costs are incomplete, it is unlikely that the rankings of the regulatory options would change with more complete data.

The supporting analyses, however, are limited by data limitations. Economic theory and principles offer considerable structure for conducting economic analysis of management and regulatory options. Specifically, economic theory and principles offer specific guidance about mathematical functional forms and conditions required to satisfy theory (e.g., a demand function must be linearly homogeneous in prices and income; production functions should be globally convex). Analyses done in support of the proposed FMP, however, do not strictly adhere to traditional economic theory. Data limitations prevented the economic analysis from being done in accordance with strict economic theory. The analyses were done, however, in accordance with professional standards in economics given the available data and resources. The quantitative procedures and economic formulations used to conduct the economic analysis of the proposed regulatory options are generally well accepted by professional economists and government agencies (Kirkley pers. comm.).

4.5 DEMAND MODELS, PRICES, REVENUES, AND CONSUMER SURPLUS

4.5.1 The Inverse Demand, Price-Dependent, Ex-vessel Model

The ex-vessel price or demand model provides a cornerstone component of the economic impact assessment. In the initially submitted (March 2000) FMP supporting analysis, however, an extremely limited version of a demand model was specified and estimated. As such, it was viewed as a price response model rather than a true demand model. The analyses that follow is intended to expand the initial efforts on the model.

Buyer demand for tilefish is a derived demand. Buyers purchase tilefish from fishers in accordance with some underlying behavioral objective (e.g., maximization of profits or minimization of costs). Given profit maximization by buyers, the demand for tilefish may normally be viewed as being a function of the price (P) buyers expect to receive for tilefish and the prices (W) of all costs of acquiring and selling tilefish. Letting the quantity of tilefish demanded by buyers equal T, the buyer demand for tilefish might be expressed as a function of prices received for tilefish and prices paid to acquire and sell tilefish (e.g., $T = f(P, W)$). The derived demand function must satisfy certain mathematical conditions: (1) demand must be homogeneous of degree zero in output (P) and input

prices (W); and (2) the change in demand associated with a change in input price must be negative (i.e., as the price of acquiring tilefish increases for the buyer, it would be expected that the buyer's demand would decline in quantity). Additional conditions are summarized in Chambers (1988).

It is unlikely, however, that the demand for tilefish under the current MAFMC proposed FMP takes place in a closed market system. Alternatively, it is likely that the demand for mid-Atlantic tilefish is also influenced by the demand for tilefish landed in other regions and possibly several other species.

For the analysis supporting the proposed FMP, the market-level ex-vessel prices corresponding to each of the potential level of landings is desired. Market-level prices, however, are determined jointly by the market demand and supply. That is, given equilibrium between market demand and market supply, there is a corresponding equilibrium market price.

In the following economic analysis, the ex-vessel market prices corresponding to each of the potential regulatory options were estimated using an inverse or price-dependent demand model. Barten and Bettendorf (1989) illustrated that inverse demand specifications are likely the more appropriate specifications of demand for fish and numerous agricultural products. With an inverse demand model, it is assumed that fishers are price takers. The following model was specified an estimated:

$$\text{Ex-vessel Price}_t = \alpha + \beta_1 \text{Landings}_{\text{M-VA},t} + \beta_2 \text{Landings}_{\text{AllO},t} + \beta_3 \text{Year}_t$$

Where Ex-vessel Price is the observed annual (nominal) ex-vessel price per pound of tilefish landings between Maine and Virginia (M-VA), $\text{Landings}_{\text{M-VA}}$ is the annual ex-vessel level of landings between Maine and Virginia, $\text{Landings}_{\text{AllO}}$ is the annual ex-vessel landings of tilefish for all other geographic areas of the United States, Year is the year of observation (Year = 1964, …, 1998), t is time, and α and the βs are parameters to be estimated.

A conventional demand model should actually be specified in terms of constant dollar prices (i.e., real dollars), and landings and real expenditures on fish per capita. A correctly specified demand model would also normally include the prices of substitute species of fish. For the purposes of the analyses of the potential economic impacts, nominal values and year were used rather than real values and real expenditures. The decision to use these variables was based on the fact that if real prices and expenditures per capita were used, it would be necessary to forecast the nominal and real retail food prices, future population, and real expenditures for fish through 2009. The use of forecasts of these variables could introduce considerable imprecision in the analyses. Moreover, the variable Year is believed to adequately depict changes in food prices and food expenditures.

Initially, the inverse, ex-vessel, demand model was estimated using ordinary least squares. A variety of statistical problems were found and subsequently corrected; the autoregressive conditional heteroscedasticity (ARCH) process of Engle (1982) was used to estimate the model. The ARCH model specifically recognizes that there may be successive periods of relative volatility and stability and the conditional variance may evolve over time as a function of past errors. In addition, a causality test to determine whether or not landings from other areas affected the Maine through Virginia ex-vessel price was conducted; the null hypothesis of no causality was rejected ($F = 7.59$ with five restrictions and 17 degrees of freedom). Final estimates were as follows:

$$\text{Ex-vessel Price}_t = \underset{(-4.25)}{-130.63} \underset{(-3.98)}{- .000000118\ \text{Landings}_{M\text{-}VA,t}} \underset{(-2.44)}{- .000000078\ \text{Landings}_{AllO,t}} \underset{(4.29)}{+ .067\ \text{Year}_t}$$

where numbers in parentheses are the t-statistics; the adjusted R-squared equaled 0.9221; N = 35; and the corresponding Durbin-Watson equaled 1.875.

Prices for the years 2000 through 2009 corresponding to each of the potential regulatory options were projected by multiplying each of the estimated coefficients by the landings corresponding to the proposed regulatory options and three landings' scenarios for possible landings from other regions (the three levels of landings for the other regions were the low 1998 observed level of 565,660 pounds, the 1964 through 1998 mean level of landings per year -- 1,764,556 pounds, and the South Atlantic Fishery Management Council quota level of 1,091,813 pounds of gutted weight). These projected prices were then standardized relative to the observed ex-vessel price in 1998. Standardization was accomplished by dividing all projected prices between 1998 and 2009 by the 1998 projected price; these ratios were multiplied by the observed 1998 ex-vessel price to project standardized prices between 1998 and 2009. The summary of projected landings under each of the potential regulatory options are summarized in Tables 96 through 99. Projected prices corresponding to the three levels of landings and the potential regulatory options are summarized in Tables 100 through 102.

Ex-vessel revenues were subsequently calculated by multiplying the projected standardized prices by the landings corresponding to each of the regulatory options. All revenues were converted to year 2000 base values by dividing all future nominal revenues by 1.07 raised to the power of the difference between the future year and the base year (e.g., the revenue for 2009 equaled the nominal revenue divided by (1.07) raised to the ninth power (2009-2000 = 9). Revenues for 1998 and 1999 were obtained by multiplying the estimated revenues by 1.07 raised to the power of the difference between 2000 and 1998 and 1999 (i.e., 1 for 1999 and 2 for 1998). The projected constant dollar (2000 = 100) revenue values were subsequently summarized for each year and cumulatively over years between 2000 and 2009. In addition, the cumulative revenue values were multiplied by the probabilities of the proposed regulatory options to achieve the stated objectives in order to calculate the expected monetary values of each of the regulatory options.

4.5.2 Consumer Demand and Consumer Surplus

Consumer surplus or the net benefit a consumer receives in excess of actual expenditure requires an analysis of final demand. In order to estimate final consumer demand, however, it is necessary to have data on quantities and retail prices for at-home and away-from-home consumption. It also is desired to have information on consumer expenditures on fish. None of the desired data are available, and thus, it is not possible to accurately assess consumer surplus at the final consumer level.

For the analyses supporting the RIR, consumer surplus was estimated by integrating the ex-vessel demand model with respect to the quantities corresponding to each of the regulatory options and subtracting the projected ex-vessel revenues. In general form, the integration of the inverse demand model is

$$\int_{L} (-130.63 - .000000118\ \text{Landings}_{m\text{-}va,t} - .000000078\ \text{Landings}_{allo,t} + .067\ \text{Year}_t)\ dL,$$

o

where L is the level of landings corresponding to each of the regulatory options, and dL indicates the derivative with respect to landings. The value of the integral equals total economic value or benefits to the consumer. Consumer surplus equals total economic value less expenditure. Consumer surplus values for 2001 through 2009 were converted to 2000 constant dollar values by deflating by the discount factor of 1.07. The expected monetary values of consumer surplus values were also estimated by multiplying the probabilities of each regulatory option being successful by the estimates of consumer surplus.

4.6 COSTS, NET RETURNS, AND PRODUCER SURPLUS

4.6.1 Costs and Net Returns

As discussed in section 4.4, detailed cost data were not available. After conferring with economists at the Northeast Fisheries Science Center, NMFS, it was concluded that the estimates of the ratios of costs to revenues obtained from a survey by Georgianna *et al.* (1998) could be used to estimate production costs and net returns for the tilefish fishery. NMFS (pers. comm. NEFSC) made the following estimates of the ratios available:

Ratio of returns and expenditures to revenues

COST/RETURN ITEM	RATIO	COST/RETURN ITEM	RATIO
PROFIT	0.08637	VEHICLE	0.03878
CREW SHARE	0.24715	TAXES	0.01286
FUEL	0.05189	REPAIR/MAINT OF GENERATOR	0.00366
OIL	0.00621	REPAIR/MAINT OF LINES	0.00887
ICE	0.00834	REPAIR/MAINT OF GEAR	0.05159
FOOD AND WATER	0.01400	REPAIR/MAINT OF ELECTRONICS	0.00827
LUMPING	0.00339	REPAIR/MAINT OF	0.03003
SUPPLIES	0.01758	OTHER REPAIR/MAINT	0.00381
CONSIGNMENT	0.00328	OTHER OVERHEAD CHARGES	0.04572
BAIT	0.10692	REPAIR/MAINT OF ENGINE	0.01123
OTHER OPERATING COSTS	0.04288	MOORING	0.02672
INTEREST ON LOANS	0.04487	INSURANCE	0.05739
HAUL OUT	0.03195	ASSOCIATION FEES	0.00434
FISHING PERMITS	0.00567	PROFESSIONAL FEES	0.01157
OTHER PERMITS	0.00161	OFFICE EXPENSES	0.01305

Operating, fixed, and quasi-fixed costs were estimated by multiplying the projected revenues by the estimated ratios contained in the preceding table. Fixed costs were estimated by two methods: (1) first by simply multiplying the ratios by the projected revenues, and (2) multiplying the ratios times the 1998 observed revenues and holding them constant through 2009. Fixed costs were assumed to equal interest on loans, fishing and other permit fees, mooring, insurance, association and professional fees, and vehicle expenses. Haul out fees and office expenses are fixed costs but may likely vary with revenues received.

4.6.2 Producer Surplus

Marshal (1930) defined a producer's net benefit as the excess of gross receipts (revenue) which a producer receives for any commodities produced over their prime cost (i.e., over the extra cost a firm incurs in order to produce those things which it could have escaped if it had not produced them) (Just *et al.* 1982). Formally, producer surplus equals profit plus total fixed cost (Just *et al.* 1982). Profit underestimates the benefits accruing to firms doing business.

Following Just *et al.* (1982), profit, although understating the net benefits to a producer or producer welfare, is used in this analysis as a measure of producer welfare. For analytical purposes, profits or net returns are calculated in two ways: (1) projected revenues corresponding to each of the regulatory options are multiplied by the value 0.08637 (the ratio of profit to revenue), and (2) projected revenues less the projected variable costs—obtained by multiplying the ratios of variable costs to revenues—less the fixed cost estimated for 1998—estimated by multiplying the ratio of fixed cost to revenue by the 1998 observed revenues for each full-time vessel category. A constant value fixed cost was not calculated for the part-time and incidental vessel categories; the information necessary for allocating fixed costs among these two vessel categories was not available.

4.7 IMPACTS OF STATUS QUO, PREFERRED ALTERNATIVE, AND THE NON-PREFERRED ALTERNATIVES

4.7.1 Overview of Impacts

In this section, a summary of the potential impacts on each category grouping of the various regulatory options and assuming that landings in states outside the jurisdiction of the FMP equal the quota imposed by the South Atlantic Fishery Management Council (SAFMC) is presented (Tables 103 through 125). The potential impacts associated with alternative levels of landings for other states are presented in Tables (126 through 171); alternative levels of landings equal the 1998 level of 565,660 pounds and the 1964-1998 mean level of 1,764,556 pounds. Impacts are summarized in terms of landings, ex-vessel revenues, operating costs, net returns based on fixed cost equaling the fixed cost share of revenue and fixed cost equaling a constant value, consumer surplus, producer surplus, and net benefits. The impacts discussed in section 4.7 assume that landings in states other than those under mid-Atlantic jurisdiction will equal the quota imposed on tilefish by the SAFMC. Following the discussion of the estimated total values, the expected monetary valuations are discussed; the expected monetary values are calculated only with respect to the cumulative values and equal the probability of a given regulatory option to rebuild the resource to MSY within 10 years times the projected economic performance measures.

4.7.1.1 First Year Impacts

4.7.1.1.1 Impacts on Vessel Category Fleets

The economic impacts are summarized relative to the status quo, the preferred alternative, and the 11 non-preferred regulatory options; the potential regulatory options are summarized in the next text table. In the first year of regulation (year 2000 is assumed to be the first year), the various regulatory options have the potential to generate substantial impacts on the various vessel categories and in terms of the total fishery (the first year impacts on vessel categories and relative to the fishery are presented in the next two text tables). The impacts are assessed relative to the status quo in 1998; it is assumed that landings for each category under the status quo in future years would equal their

respective average percentages of total landings observed between 1984 and 1998 (see Table 79). Projected impacts for alternatives 8 and 11 are identical since they impose the same restriction on fishing mortality; the probabilities differ, however, because alternative 8 considers an eight year rebuilding schedule and alternative 11 considers a ten year rebuilding schedule.

Regulatory Options: Status Quo, Preferred, and Non-Preferred

Regulatory Option	Restriction	Level of Restriction	Probability	Years to Achieve Goal
Status Quo	None	Assume constant F = 0.454	0.00	10
Preferred	Industry Voluntary TAL	Quota= 1,995,000Pounds	0.50	10
Alternative 1	Total Allowable Landings	Quota = 1,422,000 Pounds	0.50	8
Alternative 2	Total Allowable Landings	Quota = 1,003,000 Pounds	0.75	8
Alternative 3	Total Allowable Landings	Quota = 1,412,000 Pounds	0.75	10
Alternative 4	Total Allowable Landings	Quota= 1,760,000 Pounds	0.50	10
Alternative 5	Industry Voluntary TAL	Quota= 1,719,000 Pounds	0.75	10
Alternative 6	Fishing Mortality--F	F = 0.0	1.00	5
Alternative 7	Constant Fishing Mortality	F = 0.134	0.50	8
Alternative 8	Constant Fishing Mortality	F = 0.10	0.75	8
Alternative 9	Constant Fishing Mortality	F = 0.168	0.50	10
Alternative 10	Constant Fishing Mortality	F = 0.136	0.75	10
Alternative 11	Constant Fishing Mortality	F = 0.10	1.00	10

Substantial reductions in landings, revenues, and net returns are predicted for all regulatory options and the incidental and full-time tier 1 vessel categories between 1998 and 2000. For all regulatory options except alternative (6) (moratorium on landings), the part-time vessels experience an increase in landings, revenues, and net returns. As would be expected, maintaining the status quo would generate the least economic impacts or changes. Relative to the incidental category and excluding the status quo option, first year changes would be, respectively, the least for alternative 4 and the preferred alternative. The part-time category would experience the largest gains in landings and economic performance, respectively, under alternative 4 and the preferred alternative. The full-time tier 1 vessels would also experience the minimum losses, respectively, under alternative 4 and the preferred alternative. The full-time tier 2 vessels would experience gains in landings and net returns for alternative 4 and the preferred alternative between the first year of implementation (2000) and the status quo in 1998.

First Year Changes in Economic Performance Given Regulatory Options and Assuming Other State Landings Equal SAFMC Quota: 2000 vs. 1998

Option	Category	Landings	Revenue	Net Returns-1	Net Returns-2
Status Quo	Incidental	-119,332	-263,595	-22,767	
	Part-time	350,764	641,384	55,396	
	Full-time Tier 1	-274,704	-814,944	-70,387	-148,081
	Full-time Tier 2	178,971	306,746	26,494	98,870

Preferred	Incidental	-145,062	-306,532	-26,475	
	Part-time	257,987	486,379	42,009	
	Full-time Tier 1	-596,982	-1,353,384	-119,892	-321,631
	Full-time Tier 2	105,726	184,373	15,924	59,427
Alternative 1	Incidental	-173,712	-357,599	-30,866	
	Part-time	154,560	302,028	26,086	
	Full-time Tier 1	-956,253	-1,993,762	-172,201	-528,037
	Full-time Tier 2	24,073	38,833	3,354	12,517
Alternative 2	Incidental	-194,662	-397,077	-34,296	
	Part-time	78,931	159,513	13,777	
	Full-time Tier 1	-1,208,966	-2,488,813	-214,959	-687,602
	Full-time Tier 2	-35,635	-73,679	-6,364	-23,748
Alternative 3	Incidental	-174,212	-358,520	-30,965	
	Part-time	152,755	298,702	25,799	
	Full-time Tier 1	-962,523	-2,005,313	-173,199	-531,760
	Full-time Tier 2	22,648	36,207	3,127	11,670
Alternative 4	Incidental	-156,812	-327,068	-164,070	
	Part-time	215,569	412,246	35,606	
	Full-time Tier 1	-744,327	-1,610,899	-139,133	-404,633
	Full-time Tier 2	72,238	125,847	10,869	40,563
Alternative 5	Incidental	-158,862	-330,709	-28,563	
	Part-time	208,169	399,102	34,470	
	Full-time Tier 1	-770,034	-1,656,556	-143,077	-419,349
	Full-time Tier 2	66,396	115,470	9,973	37,218
Alternative 6	Incidental	-244,812	-498,907	-43,091	
	Part-time	-102,111	-208,094	-17,973	
	Full-time Tier 1	-1,847,847	-3,765,763	-325,249	-1,099,189
	Full-time Tier 2	-178,562	-363,895	-31,430	-117,291
Alternative 7	Incidental	-201,312	-409,985	-35,410	
	Part-time	54,924	112,914	9,752	
	Full-time Tier 1	-1,302,357	-2,650,683	-228,940	-739,776
	Full-time Tier 2	-54,587	-110,468	-9,541	-35,606
Alternative 8	Incidental	-211,912	-430,937	-37,220	
	Part-time	16,658	37,279	3,220	
	Full-time Tier 1	-1,435,281	-2,913,416	-251,632	-824,460
	Full-time Tier 2	-84,797	-170,180	-14,698	-54,852
Alternative 9	Incidental	-191,362	-390,373	-33,748	
	Part-time	90,844	182,394	15,753	
	Full-time Tier 1	-1,177,584	-2,409,332	-208,094	-661,984
	Full-time Tier 2	-26,230	-55,615	-4,803	-17,926
Alternative 10	Incidental	-200,762	-408,911	-35,318	
	Part-time	56,910	116,793	10,087	
	Full-time Tier 1	-1,295,460	-2,637,209	-227,776	-735,433
	Full-time Tier 2	-53,020	-107,405	-9,277	-34,619
Alternative 11	Incidental	-211,812	-430,937	-37,220	
	Part-time	16,658	37,279	3,220	
	Full-time Tier 1	-1,435,281	-2,913,416	-251,632	-824,460
	Full-time Tier 2	-84,797	-170,180	-14,698	-54,852

A particular concern, however, is that if net returns are calculated assuming fixed cost in the first year (2000) equals fixed cost in 1998 (the ratio of fixed cost to revenue times the observed 1998 revenue for each vessel category), all regulatory options except the status quo and alternative 4 result in negative net returns during the first year for the full-time tier 1 vessel category (see subsequent table). Alternatives 6, 7, 8,10 and 11 result in negative net returns during the first year for the full-time tier 2 category fleet.

First Year (2000) Net Returns Given Fixed Cost in 2000 equals Fixed Cost in 1998

Regulatory Option	Net Returns Constant 2000 Dollar Value	
	Full-time Tier 1	Full-time Tier 2
Status Quo	177,168	130,300
Preferred Alternative	3,618	90,857
Alternative 1	-202,788	43,946

Alternative 2	-362,353	7,681
Alternative 3	-206,511	43,100
Alternative 4	-79,384	71,993
Alternative 5	-94,100	68,648
Alternative 6	-773,940	-85,861
Alternative 7	-414,527	-4,176
Alternative 8	-499,211	-23,423
Alternative 9	-336,735	13,504
Alternative 10	-410,184	-3,189
Alternative 11	-499,211	-23,423

4.7.1.1.2 Fleet and Fishery Impacts

In this section, the potential first year impacts on the total fishery or fleet are assessed and discussed. First-year impacts are summarized in terms of changes in landings, constant dollar revenue (2000 = 100), operating costs, total costs, net returns, consumer surplus, and net benefits (consumer plus producer surplus). The analyses and summaries of net returns and producer surplus are restricted to those values derived under the assumption that fixed cost equals a constant share of total revenue in each year (i.e., the coefficients presented in the cost to revenue ratio table times the projected revenues for each of the regulatory options).

Relative to the status quo, preferred alternative, and 11 non-preferred alternatives, the economic impacts are minimal for the status quo (see following text table). Under the status quo, total landings would decline by 152,000 pounds between 1998 and the first year of the plan (2000). Constant dollar revenue (2000 = 100) would decline by $130,409. Operating and total costs would, respectively, decline by $65,418 and $119,146. Net returns would decline by $11,263. Consumer surplus would decline by $214,899, and net benefits would decline by $227,162. Thus, even under the option of no regulation, there would be reductions in economic performance of the fleet and net national benefits.

First Year Changes in Fishery-wide Economic Performance and Net Benefits: 2000 vs. 1998[a]

Regulatory Option	Landings Pounds	Exvessel Revenue-$	Operating Costs-$	Total Cost-$	Net Returns-$	Consumer Surplus-$	Net Benefits-$
Status Quo	-152,000	-130,409	-65,418	-119,146	-11,263	-215,899	-227,162
Preferred	-666,000	989,165	-496,205	-903,730	-85,434	-483,124	-568,558
Alternative 1	-1,239,000	-2,010,500	-1,008,547	-1,836,854	-173,647	-753,872	-927,519
Alternative 2	-1,658,000	-2,800,055	-1,404,620	-2,558,215	-241,841	-933,736	-1,175,577
Alternative 3	-1,249,000	-2,028,924	-1,017,789	-1,853,686	-175,238	-758,343	-933,582

Alternative 4	-901,000	-1,399,874	-702,233	-1,278,967	-120,907	-597,626	-718,533
Alternative 5	-942,000	-1,472,693	-738,762	-1,345,497	-127,196	-617,110	-744,307
Alternative 6	-2,661,000	-4,836,659	-2,426,262	-4,418,917	-417,742	-1,302,121	-1,719,863
Alternative 7	-1,791,000	-3,058,223	-1,534,127	-2,794,084	-264,139	-987,629	-1,251,767
Alternative 8	-2,003,000	-3,477,253	-1,744,329	-3,176,923	-300,330	-1,070,344	-1,370,675
Alternative 9	-1,592,000	-2,673,292	-1,341,030	-2,442,400	-230,892	-906,420	-1,137,312
Alternative 10	-1,780,000	-3,036,733	-1,523,347	-2,774,450	-262,283	-983,230	-1,245,512
Alternative 11	-2,003,000	-3,477,253	-1,744,329	-3,176,923	-300,330	-1,070,344	-1,370,675

[a] All dollar values are in year 2000 constant dollar values.

Alternative 4 and the preferred alternative impose the minimal adverse impacts on the total fishery or fleet. Under the preferred alternative, ex-vessel revenue and net benefits, respectively, decline by $0.99 and $0.57 million. Ex-vessel revenue and net benefits decline by $1.4 and $0.72 million, respectively, under alternative 4. Alternatives 6, 8, and 11 impose the largest adverse impacts on the fishery.

4.7.1.2 Total and Expected Cumulative Total Economic Impacts of the Regulatory Options

This section presents a summary of the potential economic impacts over the ten-year planning horizon. Initially, the total estimated cumulative impacts are summarized in the following text table. Subsequently, the expected monetary equivalent or expected monetary value of the impacts are presented. The difference between the total estimated cumulative impacts and the expected monetary equivalent value reflects the fact that the expected values are adjusted for uncertainty; the expected values equal the probability of each regulatory option to restore the biomass to MSY levels within ten years times the sum of all projected impacts over the ten year horizon -- 2000-2009.

The probability of the status quo to rebuild the tilefish biomass to MSY levels within 10 years is likely to be very close to 0. Projections indicate that the no management option would likely decrease the biomass levels to approximately 18.0 percent of the MSY biomass levels by 2009. For the purpose of calculating the expected monetary equivalent valuation, a 50% chance is assumed. In essence, it is assumed that the resource, somehow, has a 50% chance of returning to the maximum sustainable yield biomass level within the ten year planning horizon. In actuality, the likelihood of the status quo achieving the stock objective of the FMP is likely to be very close to 0.

Total Cumulative Economic Impacts

Total cumulative impacts are assessed in terms of constant dollar ex-vessel revenues (2000 = 100), total operating costs, total cost, consumer surplus, net returns, and net benefits (sum of consumer and producer surplus or net returns) (see following text table). The calculation of net returns is based using the ratio of costs to revenues time the projected annual revenues.

Cumulative Economic Performance and Net Benefits between 2000 and 2009[a]

Regulatory Option	Exvessel Revenue-$	Operating Costs-$	Total Cost-$	Net Returns-$	Consumer Surplus-$	Net Benefits-$
Status Quo	31,771,526	15,937,868	29,027,420	2,744,107	6,625,683	9,369,789
Preferred	32,335,491	16,220,776	29,542,675	2,792,816	6,673,704	9,466,520
Alternative 1	23,677,434	11,877,548	21,632,414	2,045,020	4,489,972	6,534,992
Alternative 2	17,025,317	8,540,580	15,554,840	1,470,477	3,029,304	4,499,781
Alternative 3	23,521,831	11,799,491	21,490,251	2,031,581	4,453,771	6,485,351
Alternative 4	28,845,974	14,470,294	26,354,547	2,491,427	5,752,086	8,243,513

Alternative 5	28,228,425	14,160,507	25,790,336	2,438,089	5,595,000	8,033,090
Alternative 6	0	0	0	0	0	0
Alternative 7	29,799,810	14,948,777	27,226,000	2,573,810	6,127,655	8,701,465
Alternative 8	25,131,378	12,606,904	22,960,781	2,170,597	4,940,412	7,111,010
Alternative 9	33,626,695	16,868,495	30,722,357	2,904,338	7,188,265	10,092,603
Alternative 10	30,632,347	15,366,411	27,986,631	2,645,716	6,376,681	9,022,397
Alternative 11	25,671,034	12,877,617	23,453,827	2,217,207	5,091,813	7,309,021

[a] All dollar values are in year 2000 constant dollar values.

The cumulative impacts depict a different ranking of impacts than does the first year total impacts. The largest revenues, net returns, and net benefits are obtained with alternative 9, which imposes a constant rate of fishing mortality equal to 0.168. The preferred alternative is the second best after alternative 9. Relative to the status quo, all alternatives except nine and the preferred are projected to yield lower revenues, net returns, and net benefits than would occur under the status quo within the ten year time horizon.

4.7.1.2.1 Cumulative Impacts and Uncertainty

As projected by NMFS (pers. comm. NEFSC), the ability of each of the regulatory options to rebuild the resource to the MSY biomass level is not known with certainty. If the ability of the regulatory options to achieve the stated FMP objectives are uncertain and the probabilities of the options to achieve the stated objectives are different, the potential cumulative impacts should be assessed in terms of their expected monetary equivalent value (EMV). The expected monetary values of the cumulative economic impacts for each of the regulatory options are presented in the following text table.

When the EMV of the economic performance and net benefits is calculated, the magnitudes of the impacts substantially change. Adjusted for uncertainty, alternative 11 yields the highest ex-vessel revenue and net benefits to society. Alternatives 3, 5, 9, 10 and 11 all yield higher cumulative revenues and net benefits over the ten year horizon than does the preferred alternative. Many of the regulatory options, however, generate revenues or net benefits in excess of those offered by the status quo. The status quo option would generate cumulative revenues, net returns, consumer surplus, and net benefits equal, respectively, to $15.9, $1.4, $3.3, and $4.7 million between 2000 and 2009. The preferred alternative would generate, respectively, $16.1, $1.3, $3.3, and $4.7 in cumulative revenues, net returns, consumer surplus, and net benefits. The analysis of the status quo, however, assumes a probability of 0.50 of rebuilding the resource. It is likely that the probability of the status quo being adequate to rebuild the resource is extremely low; if the probability falls below 0.454, in fact, the preferred alternative has a higher expected value of revenue, net returns, consumer surplus, and net benefits.

Expected Monetary Value of Cumulative Economic Performance and Net Benefits between 2000 and 2009[a]

Regulatory Option	Exvessel Revenue-$	Operating Costs-$	Total Cost-$	Net Returns-$	Consumer Surplus-$	Net Benefits-$
Status Quo	15,885,763	7,968,934	14,513,710	1,372,053	3,312,841	4,684,895
Preferred	16,167,745	8,110,388	14,771,337	1,396,408	3,336,852	4,733,260
Alternative 1	11,838,717	5,938,774	10,816,207	1,022,510	2,244,986	3,267,496
Alternative 2	12,768,988	6,405,435	11,666,130	1,102,857	2,271,978	3,374,836
Alternative 3	17,641,373	8,849,619	16,117,688	1,523,685	3,340,328	4,864,014
Alternative 4	14,422,987	7,235,147	13,177,274	1,245,713	2,876,043	4,121,757

Alternative 5	21,171,319	10,620,381	19,342,752	1,828,567	4,196,250	6,024,817
Alternative 6	0	0	0	0	0	0
Alternative 7	14,899,905	7,474,388	13,613,000	1,286,905	3,063,828	4,350,732
Alternative 8	12,565,689	6,303,452	11,480,390	1,085,299	2,470,206	3,555,505
Alternative 9	16,813,348	8,434,248	15,361,179	1,452,169	3,594,133	5,046,301
Alternative 10	22,974,260	11,524,808	20,989,974	1,984,287	4,782,511	6,766,798
Alternative 11	25,671,034	12,877,617	23,453,827	2,217,207	5,091,813	7,309,021

[a] All dollar values are in year 2000 constant dollar values.

4.7.1.3 Potential Trends in Ex-vessel Revenue, Net Returns, Consumer Net Benefits, and Net Social Benefits

Although the previous analyses suggest that the status quo (i.e., no management) would generally induce the least adverse impacts over the ten year horizon (2000 to 2009), the annual trends in the economic performance measures and net benefits suggest that continued operation at the status quo would result in substantial reductions in the annual economic performance of the fishery and in annual net benefits. In year 2000, ex-vessel revenue, net returns, consumer surplus, and net benefits are projected to equal, respectively, $4.7, $0.4, $1.09, and $1.49 million (constant dollar value, 2000 = 100) under the status quo. The status quo values exceed the values for all regulatory options in year 2000. By 2004 however, the annual measures of economic performance and net benefits begin to exceed the annual status quo values (Table 172). From 2004 on, the annual values of the economic performance measures and net benefits associated with the preferred alternative consistently exceed the values associated with the status quo. Continued operation at the status quo would result in substantial reductions in economic performance and net benefits over time. The projected economic performance measures and net benefits for the preferred alternative and alternative 9 all exceed the status quo values in 2004. In 2005, the economic performance measures and net benefits for alternative 10 become higher than the status quo values. By 2006, the values corresponding to alternative 4 exceed those corresponding to the status quo. From 2007 on into the future, the annual values of the economic performance measures and net benefits associated with the preferred alternative and alternatives 4-5 and 7-11 consistently exceed the annual values corresponding to the status quo option.

The economic values and net benefits of the preferred alternative and alternatives 7 through 11 all are high. Alternatives 7 through 11, however, require large and drastic initial annual percentage reductions in landings, economic performance, and net benefits. For example, the annual rate of change in revenues for alternatives 7 through 11 between 1998 and 2000 are, respectively, -63.2, -71.9, -55.3, -62.8, and –71.9 percent. The annual rates of change in revenues for the preferred alternative is –20.5 percent. Relative to the preferred alternative and alternatives 4 and 5, the 2000-2009 annual rates of change in economic performance and net benefits are similar. Alternative 5, however, has a slightly more adverse impact on economic performance and net benefits than the preferred alternative and alternative 4.

4.7.1.4 Impacts of the Preferred Alternative on Recreational Fishing

The preferred alternative is not likely to affect demand for recreational fishing trips targeting tilefish. Although tilefish were a popular recreational fish during the early to mid-1970s, due to fluctuations in the availability of fish and changes in angling preference, the number of recreational fishing trips targeting tilefish has precipitously declined. In 1997 (the most recent MRFSS data) there were 3 intercepted trips which stated that tilefish was the primary species being targeted. This suggests that

there is not a substantial directed recreational fishery for tilefish. In light of this, there is expected to be no lessening of demand for recreational fishing trips due to this proposed action.

4.7.1.5 Impacts of Framework Adjustment Measures Under the Preferred Alternative

The next regulatory action establishes the framework adjustment process which enables the modification of management measures through a framework adjustment procedure. This adjustment procedure allows the Councils to add or modify management measures through a streamlined public review process.

The following management measures could be implemented or modified through framework adjustment procedures.

1. Minimum fish size
2. Minimum hook size
3. Closed seasons
4. Closed areas
5. Gear restrictions or prohibitions
6. Permitting restrictions
7. Gear limits
8. Trip limits
9. Overfishing definition and related thresholds and targets
10. Annual specification quota setting process
11. FMP Monitoring Committee composition and process
12. Description and Identification of Essential Fish Habitat
13. Fishing gear management measures that impact EFH
14. Habitat areas of particular concern
15. Set aside quota for scientific research

The framework adjustment procedures listed above may be used to modify the FMP to ensure the objective of rebuilding of the tilefish stock. The minimum fish and minimum hook size would likely do little to fetter the harvesting of tilefish beyond the proposed restrictions. These provisions may add flexibility to the method of managing tilefish as well as ensuring the timely rebuilding of fish stock. These provisions were not seen as favorable however since they may increase regulatory discards. Similarly a minimum hook size is seen as another method to facilitate the rebuilding of tilefish stock by reducing the number of small fish caught. The effectiveness of this measure, however, is not known and has been cited as an area for further research. Closed areas and seasonal fishing restrictions are discussed in section 3.1.2.2 and 3.1.2.8. Gear restrictions and trip limits are discussed in section 3.1.2.4 and 3.1.2.8 respectively. Section 2.2 should be viewed for EFH considerations and section 2.2.7 for scientific quota and area set aside considerations.

4.8 ADDITIONAL ISSUES AND NON-QUANTIFIABLE IMPACTS

The previous analyses indicated a wide array of potential impacts on the economic performance of the fleet and net social benefits. In addition to the potential impacts, there are numerous other potential issues for the fishery, which should be considered:

(1) The TALs and harvest levels associated with the fishing mortality restrictions are quite low; the harvesting and support industries, therefore, are not likely to experience any cumulative gains in economic performance during the ten year time horizon. In addition, the net benefits, when adjusted for uncertainty, are lower for all the regulatory options than they would be under the status quo.
(2) There is a possibility that vessel operations, which depend mostly on receipts from the tilefish fishery, will experience financial losses during the ten year horizon; this is particularly apropos for the full-time tier 1 vessels.
(3) Vessels, which might be forced out the tilefish fishery, may redirect fishing effort into other fisheries. The potential other fisheries which may be affected, however, have not been identified.
(4) The relatively low level of landings associated with each of the regulatory options could cause loss of markets for tilefish. The market for tilefish is primarily a fresh-fish market and buyers and consumers typically prefer regularity in supply. The reduced landings could result in buyers and consumers substituting other species to deal with market supply problems. At the same time, the low TALs and potential levels of landings could drive up the general market price of tilefish and result in increased production of tilefish from the southeastern states. Alternatively, black sea bass, tautog, and other species have been identified as consumer substitute species; it is possible that the proposed tilefish could force additional pressure on these species. A remaining issue that cannot be adequately assessed is the possibility of the TALs resulting in derby-style fisheries. When quotas are relatively low, fishers generally attempt to land as much as possible prior to closure of a fishery; this is known to cause considerable economic waste and additional market problems.
(5) The previous analyses were based on the assumption that landings of tilefish from the states under which the SAFMC has jurisdiction would equal the SAFMC quota. In 1998, however, actual landings were less than 50% of the SAFMC quota. Additional analyses summarized in Tables126 through 171 and based on 1998 and 1964-1998 average annual landings indicate no change in the relative assessments of the economic impacts; only the magnitudes of the impacts change.
(6) Although alternatives 7 through 11 all generate higher revenues, net returns, and net benefits from year 2004 on through 2009, they require large and drastic reductions during the first four years of the FMP. Such drastic reductions would likely cause severe financial problems for the harvesting, marketing, and support sectors. In terms of total economic performance and net benefits, there is little difference between the alternative 4 and alternative 5. Alternative 5, however, requires voluntary reductions and generally results in slightly smaller economic values and net benefits. The preferred alternative consistently provides higher economic values and net benefits than would be generated under the other alternatives. The preferred alternative, however, also required voluntary reductions by industry in 1999. Recent F calculations by the Northeast Fisheries Science Center (NEFSC), verify that the 1999 F was reduced to below 0.312, and thus the preferred alternative became the one with a fixed rebuilding schedule that allowed a quota of 1.995 million pounds.

4.9 REVIEW OF IMPACTS RELATIVE TO THE REGULATORY FLEXIBILITY ACT

4.9.1 Initial Regulatory Flexibility Act/Introduction and Methods

The Regulatory Flexibility Act (RFA) requires the Federal rulemaker to examine the impacts of proposed and existing rules on small businesses, small organizations, and small governmental jurisdictions. In reviewing the potential impacts of proposed regulations, the agency must either certify that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities." The Small Business Administration (SBA) defines a small business in the commercial fishing and recreational fishing activity, as a firm with receipts (gross revenues) of up

to $3.0 million.

A complete description of the tilefish fishery is found in section 2.3 of this document. In addition, the need for, and objectives of this FMP can be found in the introduction to the EIS. The legal basis of this rule can be found section 1.0 of the EIS.

The proposed measures regarding the 2000 quotas could affect any vessel that has participated in the tilefish fishery and have qualified in one of the categories describing their participation level in past years. Using the 1988- June 15, 1993 time frame there were 312 vessels that landed at least 1 pound of tilefish. Although the number of vessels targeting tilefish has decreased since the peak in the early 1980's, approximately a dozen vessels currently in the fishery (targeting tilefish) have more than adequate capacity to harvest the maximum economic yield level (section 1.1.2.2). "Incidental" vessels land smaller quantities of tilefish than vessels in the fishery and they are mostly otter trawls and a few gillnet vessels (section 1.2.1.6). Data from the Northeast dealer data (weighout database) show that in 1998, 191 and 215 vessels reported landings of tilefish from Maine through Virginia, and from Maine through North Carolina, respectively. All these vessels readily fall within the definition of small business.

A recreational fishery occurred briefly during the 1970's. The recreational fishery since then has been insignificant, with little or no data available (section 2.1.2). It is possible that due to fluctuations in the availability of fish and changes in angling preference, the number of recreational fishing trips targeting tilefish has precipitously declined. The recreational fishery is considered at its best minimal today (section 2.1.3.3). In 1997 (the most recent MRFSS data) there were 3 intercepted trips which stated that tilefish was the primary species being targeted (section 2.3.1.2). As such, it is assumed that no impacts to the recreational sector exits.

In the present IRFA the primary unit of observation for purposes of performing a threshold analysis is vessels that participated in the tilefish fishery during calendar year 1998 (base year) irrespective of their category status.

Not all landings and revenues reported through the Federal dealer data can be attributed to a specific vessel. Vessels with no Federal permits are not subject to any Federal reporting requirements with which to corroborate the dealer reports. This problem has two consequences for performing threshold analyses. First, the stated number of entities subject to the regulation is a lower bound estimate, since non-Federally permitted dealers cannot be counted. Second, the portion of activity by these un-counted vessels may cause the estimated economic impacts to be over- or underestimated.

The effects of actions were analyzed by employing quantitative approaches to the extent possible. Where quantitative data were not available, qualitative analyses were conducted.

In order to conduct a more complete analysis, vessel's cumulative impacts were examined for the preferred quota alternative (preferred alternative), the most restrictive quota alternative (alternative 6), and the least restrictive quota alternative (status quo). The criteria used to assess if a quota is more or less restrictive is the fishing opportunity in 2000 associated with the quota being evaluated compared to the 1998 landings. The preferred quota alternative was chosen because in November 2000, the Tilefish Technical Team reviewed an NEFSC analyses (Nitschke pers. comm.) that calculated the fishing mortality estimate that occurred in 1999. The importance of this determination

was the actual selection between two rebuilding schedules (Tables 3 and 14) which differed only in the assumption of what occurred in 1999. The Tilefish Technical Team concluded that the 1999 F was below the threshold 0.312 and thus the rebuilding schedule (Table 3) will yield an annual quota of 1.995 million pounds until a new benchmark stock assessment is performed. The most restrictive alternative examined the measures that would reduce landings by 100 percent or would reduce landings to 0 pounds. Finally, the least restrictive alternative examined the measures that would allow landings to continue without addressing the problems identified in section 1.

The three quota alternatives described above were evaluated along with the most restrictive limited entry option (option 1), the least restrictive limited entry option (option 5), and the preferred limited entry option (option 6). Limited entry option 1 examined the measures recommended by the Monitoring Committee, the fifth option considered is one of the Council proposed alternatives (options 3-4 were the other proposed Council options). Finally, option 6 looked at the qualifying criteria proposed by Industry and approved by Council. It is assumed that impacts associated with the rest of the quotas and limited entry measures fall within the impacts from the combined measures analyzed.

Procedurally, the economic effects of the quota alternatives and limited entry options were estimated using five steps. First, the qualifying vessels under each of the limited entry options landings in calendar year 1998 were identified. For purposes of the threshold analysis, active vessels were grouped into various classes: full-time (tier 1 or tier 2), part-time, and incidental. Note that the States of Connecticut and Delaware report canvas (summary) data to NMFS, so landings and revenues by individual vessels cannot be included. As such, typically the vessels that land exclusively in those states cannot be analyzed. Vessels that land in these, plus other states, are analyzed - but landings and revenues represent only that portion of business conducted in states other than Connecticut and Delaware. However, landings data indicate that there were no tilefish landings in those states in 1998. As such, in this analysis these factors will not affect the results.

The second step was to estimate total revenues from all species landed by each vessel during calendar year 1998. This estimate provides the base from which subsequent quota changes and their associated effects on vessel revenues were compared. Since 1998 is the last full year from which data are available at the time the FMP was being developed, it was chosen as the base year for the analyses.

The third step was to estimate the expected change in vessel revenues for the vessels in the various vessel categories associated with each limited entry option evaluated. This was accomplished by estimating proportional changes in the landings in 2000 due to the tilefish proposed quota versus the landings for the base year 1998. The fourth step was to divide the estimated 2000 revenues by the 1998 base revenues for every vessel in each combination of quota and limited entry option. For step five, if the dividend from step 4 was less than or equal to 0.95 then the vessel was defined as being impacted (i.e., had an expected loss of gross revenues of 5 percent or more) for purposes of the IRFA.

The threshold analysis just described is intended to identify impacted vessels and to characterize the potential economic impact on directly affected entities. To further characterize the potential impacts on indirectly impacted entities and the larger communities within which owners of impacted vessels reside, selected county profiles were constructed. The counties described are those where either the county as a whole or some port within the county has at least a 0.01 percent dependence on tilefish. Based on this criteria, 31 ports located in 19 Counties were described (section 2.3.3). In addition to this, a detailed description and analysis of the potential impacts to dealers was presented in the Social Impact Assessment (section 5.0). Additional analysis of the impacts of the proposed tilefish quotas

on dealers is presented in section 4.9.5.1. Lastly, the impacts associated with the proposed permit and reporting requirements for commercial vessels and dealers, and operators permit is presented in section 4.9.4.1.

It should be noted that the county profiles are intended to characterize the relative importance of commercial fishing and fishing related industries in the home counties. As such, the county profiles provide a link to the Social Impact Assessment (section 5.0) but are not intended to be a substitute for that analysis.

Counties were selected as the unit of observation because a variety of secondary economic and demographic statistical data were available from several different sources. Limited data are available for place names (i.e., by town or city name) but in most instances reporting is too aggregated or is not reported due to confidentiality requirements. Reported statistics include summaries of landings, Federal permits, demographic statistics, and employment, wages, and number of establishments for each county.

4.9.2 Description of Alternatives

4.9.2.1 Quota Alternatives

Thirteen rebuilding schedules were evaluated in this FMP. Detailed discussions of the rebuilding schedule alternatives was presented in sections 1.2.1.4, 3.1.1.8, 3.1.1.10.1, 3.1.2.2, and 3.1.5.2. As it was indicated above, in this analysis 3 quota alternatives were evaluated along with 3 limited entry options. More specifically, the preferred quota alternative, along with the most restrictive (alternative 6), and least restrictive (status quo) quota alternatives were evaluated simultaneously with the preferred (option 6), most restrictive (option 1), and least restrictive (option 5) limiting entry option. This 3x3 matrix yields 9 separate sets of impacts. It is anticipated that given the range of impacts derived from analyzing this mix of measures, the impacts of the remaining measures (i.e., rebuilding schedule alternatives and limited entry options) presented in this FMP would fall within the impacts of the measures analyzed in the 3x3 matrix.

4.9.2.1.1 Preferred Quota Alternative

The preferred quota alternative analyzes the impacts of the tilefish quota supported most by industry. This alternative would set tilefish commercial landings in 2000 at 1,995,000 pounds. Under this scenario, the tilefish specifications would result in an aggregate decrease in commercial landings of 15.94 percent in 2000 versus 1998.

4.9.2.1.2 Most Restrictive Quota Alternative (Alternative 6)

Alternative 6 analyzes the impacts of the most restrictive possible commercial harvest level for tilefish in 2000. This alternative would set tilefish commercial landings in 2000 at 0 pounds. Under this scenario, the tilefish specifications would result in an aggregate decrease in commercial landings of 100 percent in 2000 versus 1998.

4.9.2.1.3 Least Restrictive Quota Alternative (Status Quo)

The status quo alternative analyzes the impacts of the least restrictive possible commercial harvest

level for tilefish in 2000. This alternative would set tilefish commercial landings in 2000 at 2,509,000 pounds. Under this scenario, the tilefish specifications would result in an aggregate increase in commercial landings of 5.72 percent in 2000 versus 1998.

4.9.2.2 Limited Entry Alternatives

A detailed discussion of the limited entry options for full-time and part-time categories was presented in sections 1.2.1.5, 1.2.1.7, 3.1.1.9, and in sections 1.2.1.5 and 3.1.1.10.2 for the incidental category. As it was indicated above, in this analysis 3 limited entry options were evaluated along with 3 quota alternatives. More specifically, the preferred limited entry option (option 6), along with the most restrictive (option 1), and least restrictive (option 5) limited entry options were evaluated simultaneously with the preferred, most restrictive (alternative 6), and least restrictive (status quo) quota alternatives. This 3x3 matrix would yield 9 separate sets of impacts. It is anticipated that given the range of impacts derived from analyzing this mix of measures, the impacts of the remaining measures (i.e., limited entry options and rebuilding schedule alternatives) presented in this FMP would fall within the impacts of the measures analyzed in the 3x3 matrix.

4.9.2.2.1 Preferred Limited Entry Option (Option 6)

Under this specific limited entry option, 4 vessels would quality as full-time: tier 1, 4 vessels would qualify as full-time: tier 2, and 42 vessels would qualify as part-time (Table 80).

4.9.2.2.2 Most Restrictive Limited Entry Option (Option 1)

Under this specific limited entry option, 8 vessels would quality as full-time, and 10 vessels would qualify as part-time (Table 80).

4.9.2.2.3 Least Restrictive Limited Entry Option (Option 5)

The FMP identified that under this specific limited entry option 119 vessels would qualify as full-time/part-time (Table 80). Various sources of information were employed to identified qualifying vessels under this entry option because of historical data limitations. However, the dealer (weighout) data sets employed to identified vessels qualifying under this category for purpose of the IRFA in this section dates back to 1980. Earlier years were not used because the weighout data did not include landings for all states in those years. The data employed in this analysis provides information for only 104 vessels of the 119 vessels qualifying under this limited entry option are captured in the analysis of impacts described in this RIR/IRFA. Therefore, this analysis provides overall impacts on a lower limit to the number of qualifiers.

4.9.2.3 Permit and Reporting Requirements

A detailed discussion of all permit and reporting requirements was presented in sections 1.2.1.1 (general overview), 3.1.1.2 (permit requirements for commercial vessels), 3.1.1.3 (dealer permits and fees), 3.1.1.4 (operator permits and fees), 3.1.1.5.1 (commercial logbooks), 3.1.1.5.2 (dealers report), 3.1.1.5.3 (processors report), and 3.1.5.3 (impacts of permit and reporting requirements of the preferred alternative). Additional analysis on the impacts of permit and reporting requirements on small entities is presented in section 4.9.4.1 below.

4.9.3 Analyses of Impacts of Alternatives

4.9.3.1 Quota Alternatives and Limited Entry Options

In this section potential impacts of proposed quota alternatives and limited entry options on vessels are described. For the purpose of analysis of the tilefish quota, several assumptions must be made. First, average revenue changes noted in this analysis are made using 1998 weighout data and participation. This was accomplished by estimating proportional changes in the landings in 2000 due to the tilefish proposed quota versus the landings for the base year 1998. In addition, projected tilefish exvessel price for 2000 (Table 102) was employed to estimate tilefish exvessel revenues in 2000 associated with each of the quotas evaluated. Overall exvessel revenues for 2000 were estimated by adding tilefish exvessel revenues for 2000 plus the revenues from all other species in 1988 as they appear in the weighout data. Since there is no information on the projected change in landings and prices for all other species from 1998 to 2000, it was assumed that all other species revenues in 2000 were similar to all species revenues in 1998. As such, this assumption could be overestimating or underestimating change in revenues from all other species for the 1998 to 2000 time period. Exvessel revenues for 1998 were derived by adding 1998 tilefish exvessel revenues to 1998 exvessel revenues from all other species as they appear in the weighout data for each vessel.

It was also assumed that vessels qualifying as incidental vessels would make additional trips as needed in order to land the adjusted proportion of tilefish in 2000. As it was indicated in section 1.2.1.6 of the FMP, vessels that fall into this category are mostly otter trawls and gillnet vessels. The 300 pound limit was chosen because in 1997 and 1998, 99 percent of the incidental landings were 300 pounds and below with an average of 100 pounds. This average is highly skewed because of the large number of trips reporting landings averaging 28 to 30 pounds. Based on 1998 data (Table 85) only five non longline vessels made a total of 23 trips that landed more than 300 pounds of tilefish, and which will now be prohibited.

For the analyses itself, reductions are estimated by examining the total revenue earned by an individual vessel in 1998, and comparing it to its potential revenue in 2000, given the 2000 harvest levels. Generally, the percent of revenue reduction for impacted vessels varied considerably based on permits it held (i.e., based on the fisheries in which it was able to participate) and species it landed. Diversity in the fleet, perhaps, helps to balance loss in one fishery with revenue generated from other fisheries.

4.9.3.1.1 Preferred Rebuilding Schedule and Preferred Limited Entry Option (Option 6)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 1,995,000 pounds and the preferred limited entry option supported by the industry and Council (option 6). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in approximately 16 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.93 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1, the recreational fishery is almost nonexistent today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.1.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 173. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected losses of 50 percent or greater for 1 vessel to expected increase in revenues for 181 vessels in 2000 compared to 1998. In addition, a total of 10 vessels were projected to be impacted by revenue losses of 5 percent or greater, 35 vessels were projected to have no revenue change, and 24 vessels were projected to incur revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 4 (100%) full-time tier 1, 1 (25%) full-time tier 2, and 5 (3%) incidental vessels were projected to incur revenue losses of 5 percent or greater. Even though the proposed quota would reduce landings in 2000 by almost 16 percent compared to 1998, 14 percent of the vessels qualifying as full-time or part-time and 87 percent of the incidental vessels were projected to incur revenue gains in 2000 versus 1998. This is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is higher ($1.93 per pound) than the exvessel price received by those vessels in 1998. That is, for those vessels, the projected increase in tilefish exvessel price from 1998 to 2000 associated with the reduction in landings from 1998 to 2000 more than offsets any losses associated with the landings reduction from 1998 to 2000.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time tier 1 and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other categories.

In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 3 of the 4 vessels projected to incur revenue losses in the 5 percent to 29 percent range. Lastly, one incidental vessel was projected to incur revenue losses greater than 50 percent. This vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since this vessel is under the incidental category it is limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that this specific vessel would have revenue losses of 50 percent or greater.

4.9.3.1.2 Preferred Rebuilding Schedule and Most Restrictive Limited Entry (Option 1)

This alternative examines the impacts on industry that would result from a total harvest limit for tilefish 1,995,000 pounds and the most restrictive limited entry option (option 1). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in approximately 16 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.93 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1, the recreational fishery is almost nonexisting today. As such,

it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.2.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 174. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected losses of 50 percent or greater for 2 vessels to expected increase in revenue for 181 vessels in 2000 compared to 1998. In addition, a total of 10 vessels were projected to be impacted by revenue losses of 5 percent or greater, 7 vessels were projected to have no revenue change, and 24 vessels were projected to incur revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 4 (50%) full-time and 6 (3%) incidental vessels were projected to incur revenue losses of 5 percent or greater. Even though the proposed quota would reduce landings in 2000 by almost 16 percent compared to 1998, 22 percent of the vessels qualifying as full-time and part-time, and 87 percent of the incidental vessels were projected to incur revenue gains in 2000 versus 1998. This is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is higher ($1.93 per pound) than the exvessel price received by those vessels in 1998. That is, for those vessels, the projected increase in tilefish exvessel price from 1998 to 2000 associated with the reduction in landings from 1998 to 2000 more than offsets any losses associated with the landings reduction from 1998 to 2000.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other categories.

In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 2 of the 4 vessels projected to incur revenue losses in the 5 percent to 29 percent range. Lastly, two incidental vessels were projected to incur revenue losses greater than 50 percent. These vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since these vessels are under the incidental category they are limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that these specific vessels would have revenue losses of 50 percent or greater.

The overall impacts associated with these measures are very similar to those under both preferred alternatives (quota and limited entry option) discussed in section 4.9.3.1.1. The number of vessels impacted with revenue reductions of less than 5 percent, 5 percent or greater, or increase in revenue are the same as in the previous analysis. However, under this set of management measures 2 vessels are projected to incur revenue losses of 50 percent or more versus 1 vessel in the preferred set of management measures evaluated in section 4.9.3.1.1.

4.9.3.1.3 Preferred Rebuilding Schedule and Least Restrictive Limited Entry (Option 5)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 1,995,000 pounds and the least restrictive limited entry option (option 5). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in approximately 16 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.93 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1 the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.3.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 175. The economic impact for the vessels under the various limited qualifying criteria ranged from expected losses of 50 percent or greater for 2 vessels to expected increase in revenue for 182 vessels in 2000 compared to 1998. In addition, a total of 10 vessels were projected to be impacted by revenue losses of 5 percent or greater, 68 vessels were projected to have no revenue change, and 24 vessels were projected to incur revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 4 (4%) full-time/part-time and 6 (3%) incidental vessels were projected to incur revenue losses of 5 percent or greater. Even though the proposed quota would reduce landings in 2000 by almost 16 percent compared to 1998, 28 percent of the vessels qualifying as full-time/part-time, and 85 percent of the incidental vessels were projected to incur revenue gains in 2000 versus 1998. This is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is higher ($1.93 per pound) than the exvessel price received by those individual vessels in 1998. That is, for those vessels, the projected increase in tilefish exvessel price from 1998 to 2000 associated with the reduction in landings from1998 to 2000 more than offsets any losses associated with the landings reduction from1998 to 2000.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time/part-time and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other category.

In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 3 of the 4 vessels projected to incur revenue losses in the 5 percent to 29 percent range. Lastly, two incidental vessels were projected to incur revenue losses greater than 50 percent. These vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since these vessels are under the incidental category they are limited to land 300 pounds of tilefish per trip.

Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that these specific vessels would have revenue losses of 50 percent or greater.

The overall impacts associated with these measures are very similar to those under the preferred quota alternative and preferred limited entry option (section 4.9.3.1.1) and those discussed under the preferred quota alternative and most restrictive limited entry option (section 4.9.3.1.2). The number of vessels impacted with revenue reductions of less than 5 percent, 5 percent or greater, or increase in revenue are almost the same as in the previous two analysis. However, under this set of management measures 2 vessels are projected to incur revenue losses of 50 percent or more versus 1 vessel in the preferred set of management measures evaluated in section 4.9.3.1.1.

4.9.3.1.4 Summary of Impacts (4.9.3.1.1 to 4.9.3.1.3)

The preferred quota alternative was evaluated along with the preferred limited entry option (option 6), the most restrictive limited entry option (option 1), and the least restrictive limited entry option (option 5). When the proposed quota alternative was evaluated with each of the limited entry options, the number of vessels impacted with revenue reductions of less than 5 percent, of 5 percent or greater, and increase revenue was virtually similar across all three analysis. However, under the analysis of the preferred quota and limited entry option 1 and the analysis of the preferred quota and limited entry option 5, 2 vessels under the incidental category were projected to incur revenue losses of 50 percent or more compared to only 1 vessel in the preferred quota and preferred limited entry option 6 analysis.

4.9.3.1.5 Most Restrictive Rebuilding Schedule and Preferred Limited Entry (Option 6)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 0 pounds and the preferred limited entry option supported by the industry and Council (option 6). This quota alternative is associated with a rebuilding strategy that would rebuild the stock in the shortest period of time among all evaluated rebuilding alternatives. However, it also carries the greatest adverse economic and social impact associated with it. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in 100 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $2.13 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described above (section 4.9.1) the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.5.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 176. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected revenue losses of 50 percent or greater for 11 vessels to expected losses of less than 5 percent for 194 vessels in 2000 versus 1998. In addition, a total of 21 vessels were projected to be impacted by revenue losses of 5 percent or greater and 35 vessels were projected to have no revenue change. By limited entry category-- that is, of the total number of vessels under each category, 4 (100%) full-time tier 1, 2 (50%) full-time tier 2, 4 (10%) part-time, and 11 (6%) incidental vessels were projected to incur in revenue losses of 5 percent or greater. Since the proposed quota reduces tilefish landings by 100 percent, none of the

vessels are expected to experience increase in revenues.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time tier 1 and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other categories. In fact, 63 percent of the vessels that qualified as full-time vessels are projected to incur revenue losses of 50 percent or more and 13 percent are projected to incur revenue losses in the 20 to 29 percent bracket. The remainder 25 percent of the vessels that qualified as full-time vessels did not land tilefish in 1998. As such, they are not projected to have changes in revenues.

In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 4 of the 6 vessels projected to incur revenue losses in the 50 percent or greater. However, none of these vessels landed substantial quantities of tilefish in 1998. In fact, on average, these vessels landed less than 4,500 pounds of tilefish in 1998. One of the vessels in the incidental category projected to incur revenue losses of 50 percent or greater had substantial tilefish landings in 1998.

4.9.3.1.6 Most Restrictive Rebuilding Schedule and Most Restrictive Limited Entry Option (Option 1)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 0 pounds and the most restrictive limited entry option (option 1). This quota alternative is associated with a rebuilding strategy that would rebuild the stock in the shortest period of time among all evaluated rebuilding alternatives. However, it also carries the greatest adverse economic and social impact associated with it. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in 100 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $2.13 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1 the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.6.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 177. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected revenue losses of 50 percent or greater for 11 vessels to expected losses of less than 5 percent for 194 vessels in 2000 versus 1998. In addition, a total of 21 vessels were projected to be impacted by revenue losses of 5 percent or greater and 7 vessels were projected to have no revenue change. By limited entry category-- that is,

of the total number of vessels under each category, 6 (75%) full-time, 3 (30%) part-time, and 12 (6%) incidental vessels were projected to incur in revenue losses of 5 percent or greater. Since the proposed quota reduces tilefish landings by 100 percent, none of the vessels are expected to experience increase in revenues.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revenue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time and part-time and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other categories. In fact, 50 percent of the vessels that qualified as full-time vessels are projected to incur in revenue losses of 50 percent or more and 25 percent are projected to incur in revenue losses in the 10 to 29 percent range. The remainder 25 percent of the vessels that qualified as full-time vessels did not land tilefish in 1998. As such, they are not projected to have changes in revenues.

In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 4 of the 7 vessels projected to incur revenue losses in the 50 percent or greater. However, none of these vessels landed substantial quantities of tilefish in 1998. In fact, on average, these vessels landed less than 4,500 pounds of tilefish in 1998. Two of the vessels in the incidental category projected to incur revenue losses of 50 percent or greater had substantial tilefish landings in 1998.

The overall impacts associated with these measures are very similar to those under the most restrictive quota and preferred limited entry measures discussed in section 4.9.3.1.5. The number of vessels impacted with revenue reductions of less than 5 percent and 5 percent or greater are the same as in the previous analysis. However, under this set of management measures 7 vessels are projected to incur revenue losses of 50 percent or more versus 6 vessels under the most restrictive quota and preferred limited entry measures evaluated in section 4.9.3.1.5.

4.9.3.1.7 Most Restrictive Rebuilding Schedule and Least Restrictive Limited Entry Option (Option 5)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 0 pounds and the least restrictive limited entry option (option 5). This quota alternative is associated with a rebuilding strategy that would rebuild the stock in the shortest period of time among all evaluated rebuilding alternatives. However, it also carries the greatest adverse economic and social impact associated with it. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in 100 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $2.13 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1 the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.7.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 178. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected revenue losses of 50 percent or greater for 11 vessels to expected losses of less than 5 percent for 195 vessels in 2000 versus 1998. In addition, a total of 21 vessels were projected to be impacted by revenue losses of 5 percent or greater and 68 vessels were projected to have no revenue change. By limited entry category-- that is, of the total number of vessels under each category, 10 (10%) full-time/part-time and 11 (6%) incidental vessels were projected to incur in revenue losses of 5 percent or greater. Since the proposed quota reduces tilefish landings by 100 percent, none of the vessels are expected to experience increase in revenues.

The degree of revenue changes for the affected vessels is related to the revenue mix generated in 1998 versus the potential revue mix for 2000, the limited entry category that a vessel belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound for 2000. That is, the proportion of tilefish and its contribution to the total revenue mix of a vessel determines potential revenue changes when different tilefish quotas are evaluated. As such, vessels that were largely dependent on tilefish to generate the bulk of their revenues are more susceptible to incur larger revenue losses when the amount of tilefish that they are able to land is reduced. For this reason, a larger proportion of the vessels that qualified as full-time/part-time and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of more than 5 percent in the aggregate than the other categories. Four percent of the vessels that qualified as full-time/part-time vessels are projected to incur revenue losses of 50 percent or more, 6 percent are projected to incur revenue losses in the 10 to 29 percent range, and 35 percent are projected to incur losses of less than 5 percent. The remaining vessels that qualified as full-time/part-time vessels did not land tilefish in 1998. As such, they are not projected to have changes in revenues.

Four percent of the incidental vessels are projected to incur revenue losses of 50 percent or more, 2 percent are projected to incur revenue losses in the 5 to 19 percent range, and 94 percent are projected to incur losses of less than 5 percent. In addition, some of the incidental vessels that are projected to experience revenue losses in 2000 versus 1998 only landed tilefish in 1998. As such, potential impacts are higher for these vessels than other incidental category vessels that landed other species in addition to tilefish in 1998. In fact, this is the case for 4 of the 7 vessels projected to incur revenue losses in the 50 percent or greater. However, none of these vessels landed substantial quantities of tilefish in 1998. In fact, on average, these vessels landed less than 4,500 pounds of tilefish in 1998. Two of the vessels in the incidental category projected to incur revenue losses of 50 percent or greater had substantial tilefish landings in 1998.

The overall impacts associated with these measures are very similar to those under the most restrictive quota and preferred limited entry measure (section 4.9.3.1.5) and the most restrictive quota and most restrictive limited entry option (section 4.9.3.1.6). The number of vessels impacted with revenue reductions of less than 5 percent or 5 percent or greater are very similar to the previous two analysis.

4.9.3.1.8 Summary of Impacts (4.9.3.1.5 to 4.9.3.1.7)

The most restrictive quota alternative (alternative 6) was evaluated along with the preferred limited entry option (option 6), the most restrictive limited entry option (option 1), and the least restrictive limited entry option (option 5). When the most restrictive quota alternative was evaluated with each of the limited each of the limited entry options, the results were very similar across all three analysis.

4.9.3.1.9 Least Restrictive Rebuilding Schedule (Status Quo) and Preferred Limited Entry Option (Option 6)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 2,509,000 pounds and the preferred limited entry option supported by the industry and Council (option 6). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 could result in approximately 6 percent increase in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.88 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1, the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.9.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 179. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected losses of 50 percent or greater for 1 vessel to expected increase in revenues for 200 vessels in 2000 compared to 1998. In addition, a total of 1 vessel was projected to be impacted by revenue losses of 5 percent or greater, 18 vessels were projected to have no revenue change, and 14 vessels were projected to incur in revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 1 (<1%) incidental vessel was projected to incur in revenue losses of 5 percent or greater. Even though the proposed quota could increase landings in 2000 by almost 6 percent compared to 1998, some vessels were projected to incur revenue losses in 2000 versus 1998. For most cases, this is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is lower ($1.88 per pound) than the exvessel price received by those vessels in 1998. That is, for those vessels, the projected decrease in tilefish exvessel price from 1998 to 2000 associated with the increase in landings from 1998 to 2000 more than offsets any gains associated with the landings increase from 1998 to 2000.

In addition, one incidental vessel was projected to incur revenue losses greater than 50 percent. This vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since this vessel qualifies as an incidental vessel it is limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that this specific vessel would have revenue losses of 50 percent or greater.

4.9.3.1.10 Least Restrictive Rebuilding Schedule (Status Quo) and Most Restrictive Limited Entry Option (Option 1)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish

of 2,509,000 pounds and the most restrictive limited entry option (option 1). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 could result in approximately 6 percent increase in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.88 per pound was assumed for 2000 under this quota alternative (Table 102).

As it was described in section 4.9.1, the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.10.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 180. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected losses of 50 percent or greater for 2 vessels to expected increase in revenues for 199 vessels in 2000 compared to 1998. In addition, a total of 2 vessels were projected to be impacted by revenue losses of 5 percent or greater, 7 vessels were projected to have no revenue change, and 14 vessels were projected to incur revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 2 (1%) incidental vessels were projected to incur revenue losses of 5 percent or greater. Even though the proposed quota could increase landings in 2000 by almost 6 percent compared to 1998, some vessels were projected to incur revenue losses in 2000 versus 1998. For most cases, this is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is lower ($1.88 per pound) than the exvessel price received by those vessels in 1998. That is, for those vessels, the projected decrease in tilefish exvessel price from 1998 to 2000 associated with the increase in landings from 1998 to 2000 more than offsets any gains associated with the landings increase from 1998 to 2000.

In addition, two incidental vessels were projected to incur revenue losses greater than 50 percent. These vessels had substantial landings of tilefish in 1998 and very few landings of other species. Since these vessels qualify as incidental vessels, they are limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that these specific vessels would have revenue losses of 50 percent or greater.

The overall impacts associated with these measures are very similar to those under the least restrictive quota alternative and preferred limited entry option discussed in section 4.9.3.1.9. The number of vessels impacted with revenue reductions of less than 5 percent or increase in revenue are the same as in the previous analysis. However, under this set of management measures 2 vessels are projected to incur in revenue losses of 50 percent or more versus 1 vessels in the preferred set of management measures evaluated in section 4.9.3.1.9.

4.9.3.1.11 Preferred Rebuilding Schedule (Status Quo) and Least Restrictive Limited Entry Option (Option 5)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 2,509,000 pounds and the least restrictive limited entry option (option 5). Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in approximately 6 percent increase in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.88 per pound was assumed for 2000 under this quota alternative

(Table 102).

As it was described in section 4.9.1 the recreational fishery is almost nonexisting today. As such, it is assumed that impacts to the recreational sector do not exits.

4.9.3.1.11.1 Threshold Analysis for Participating Vessels

The results of the threshold analysis are reported in Table 181. The economic impact for the vessels under the various limited entry qualifying criteria ranged from expected losses of 50 percent or greater for 2 vessels to expected increase in revenues for 200 vessels in 2000 compared to 1998. In addition, a total of 2 vessels were projected to be impacted by revenue losses of 5 percent or greater, 68 vessels were projected to have no revenue change, and 14 vessels were projected to incur revenue losses of less than 5 percent in 2000 versus 1998. By limited entry category-- that is, of the total number of vessels under each category, 2 (1%) incidental vessels were projected to incur revenue losses of 5 percent or greater. Even though the proposed quota could increase landings in 2000 by almost 6 percent compared to 1998, some vessels were projected to incur revenue losses in 2000 versus 1998. For most cases, this is due to the fact that the projected exvessel price of tilefish associated with the proposed 2000 quota is lower ($1.88 per pound) than the exvessel price received by those vessels in 1998. That is, for those vessels, the projected decrease in tilefish exvessel price from 1998 to 2000 associated with the increase in landings from 1998 to 2000 more than offsets any gains associated with the landings increase from 1998 to 2000.

In addition, two incidental vessels were projected to incur revenue losses greater than 50 percent. These vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since these vessels qualify as incidental vessels they are limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that these specific vessels would have revenue losses of 50 percent or greater.

The overall impacts associated with these measures are very similar to those under the least restrictive quota and preferred limited entry option (section 4.9.3.1.9) and the least restrictive quota and most restrictive limited entry option (section 4.9.3.1.10). The number of vessels impacted with revenue reductions of less than 5 percent, 5 percent or greater, or increase in revenue are very similar to the results in the previous two analysis. However, under this set of management measures 2 vessels are projected to incur revenue losses of 50 percent or more versus 1 vessel in the least restrictive quota and preferred limited entry option evaluated in section 4.9.3.1.9.

4.9.3.1.12 Summary of Impacts (4.9.3.1.9 to 4.9.3.1.11)

The least restrictive quota alternative (status quo) was evaluated along with the preferred limited entry option (option 6), the most restrictive limited entry option (option 1), and the least restrictive limited entry option (option 5). When the proposed quota alternative was evaluated with each of the limited entry options, the number of vessels impacted by reduction percentile or revenue increase was similar across all three analysis. However, under the analysis of the least restrictive quota and limited entry option 1 and the analysis of the least restrictive quota and limited entry option 5, 2 vessels in the incidental category were projected to incur revenue losses of 50 percent or more compared to only 1 vessel in the least restrictive and preferred limited entry option 6 analysis.

4.9.3.1.13 Commutative Impacts (4.9.3.1.1 to 4.9.3.1.11)

A threshold analysis was conducted in order to estimate the potential impact on vessels associated with the implementation of the preferred quota alternative (preferred alternative), the most restrictive quota alternative (alternative 6), and the least restrictive quota alternative (status quo) along with the most restrictive limiting entry option (option 1), the least restrictive limited entry option (option 5), and the preferred limiting entry option (option 6). Since the analyzed management measures contain the preferred, most restrictive, and least restrictive alternatives/options, it is anticipated that the impact of all other proposed quota measures and limited entry options will fall within the results from the analysis of these management measures.

The threshold analysis indicates that the potential change in revenues for the affected vessels is related to the revenue mix generated in 1998 versus the potential revenue mix for 2000, the limited entry category that a vessels belongs to, and the difference between the exvessel tilefish price per pound received in 1998 by those vessels versus the projected tilefish exvessel price per pound projected for 2000. It was found that vessels that had larger proportions of their total revenue for the base year derived from tilefish and also received a higher price per pound for tilefish in the base year compared to 2000 would incur higher revenue reductions as a consequence of potential decrease in landings in 2000 compared to the base year. A such, a larger proportion of the vessels that qualified under full-time and part-time status and revenues depended mostly on tilefish in 1998 incurred higher revenue reductions of 5 percent or more in the aggregate than vessels under other categories when faced with landings reductions.

The threshold analysis also indicates that when a specific quota alternative was analyzed along the various proposed limited entry options, the overall number of vessels impacted by revenue increases or the overall number of vessels and distribution by percentile impacted by revenue reductions were virtually the same across the various limited entry options. However, regardless of the quota alternative been evaluated, the number of incidental vessels projected to have revenue reductions of 50 percent or greater increased by 1 vessel when the most restrictive and less restrictive limited entry options were evaluated.

The total number of vessels affected by revenue reductions of 5 percent or greater was the same across all evaluated limited entry options under the preferred quota and most restrictive quota analysis. Regardless of the type of limited entry option evaluated, under the preferred quota and the most restrictive quota alternatives, a total of 10 and 21 vessels were projected to have revenue reductions of 5 percent or greater, respectively. However, under the least restrictive quota the number of affected vessels with revenue reductions of 5 percent or greater ranged from 1 to 2 vessels across the evaluated limited entry options.

A ranking of potential impacts for the various scenarios evaluated (quota measures and limited entry measures) by vessel category can be useful to evaluate potential impacts for the various management measures evaluated. However, since vessels can qualify under various limited entry categories which are not the same across all limited entry options (i.e., full-time, full-time tier 1, full-time tier 2, or part-time), the impacts on all vessels that qualified as full-time/part-time were grouped together to facilitate comparisons. By vessel category - - that is of the total number of vessels under each category - - the percentage of impacted vessels with 5 percent or greater revenue losses are presented below :

Proposed Management Measures	Vessel Category		
	Full Time/ Part-Time	Non-Qualified	Total Vessels
Preferred Quota/Preferred LE Option (Sec.4.9.3.1.1)	10.0%	2.5%	4%
Preferred Quota/Most Restrictive LE Option (Sec. 4.9.3.1.2)	22.2%	2.9%	4.5%
Preferred Quota/Least Restrictive LE Option (Sec. 4.9.3.1.3)	3.8%	3.3%	3.5%
Most Restrictive Quota/Preferred LE Option (Sec. 4.9.3.1.5)	20.0%	5.5%	8.4%
Most Restrictive Quota/Most Restrictive LE Option (Sec. 4.9.3.1.6)	50.0%	2.9%	9.5%
Most Restrictive Quota/Least Restrictive LE Option (Sec. 4.9.3.1.7)	9.6%	6.1%	7.4%
Least Restrictive Quota/Preferred LE Option (Sec. 4.9.3.1.9)	0.0%	0.5%	0.4%
Least Restrictive Quota/Most Restrictive LE Option (Sec. 4.9.3.1.10)	0.0%	1.0%	0.9%
Least Restrictive Quota/Least Restrictive LE Option (Sec. 4.9.3.1.11)	0.0%	1.1%	0.7%

The general purpose of the information presented above is to provide a general overview of the potential impacts associated with the evaluated sets of management measures. The management measures containing the most restrictive quota show the largest number of affected vessels with revenue losses of 5 percent or greater regardless of limited entry option. On the other hand, the management measures containing the least restrictive quota shows the smallest number of affected vessels with revenue losses of 5 percent or greater regalness of limited entry option. In addition, the management measures containing the preferred quota shows that the number of affected vessels with

revenue losses of 5 percent or greater regardless of limited entry option is in between those described above.

The preferred management quota and preferred limited entry option indicate that the percentage of the full-time/part-time, incidental, and total vessels that would be affected with revenue losses of 5 percent or greater was 10.0 percent, 2.5 percent, 4.0 percent, respectively. However, by specific limited entry qualifying criteria, 100 percent of the full-time tier 1 vessels, 25 percent of the full-time tier 2 vessels, and none of the part-time vessels would have revenue reductions of 5 percent or greater. For full-time vessels which are dependent on tilefish the potential loss of revenues of 5 percent or greater are higher than for part-time vessels, which in recent years, have been less dependent on tilefish. In addition, one non-qualifying vessel (incidental) is projected to incur revenue losses of 50 percent or greater. This vessel had substantial landings of tilefish in 1998 and very few landings of other species. Since this vessel is under the incidental category it is limited to land 300 pounds of tilefish per trip. Given these circumstances, in the absence of a different revenue mix and the proposed landings limit that incidental vessels are restricted to, it is projected that this specific vessel would have revenue losses of 50 percent or greater. Given the preferred management quota and preferred limited entry option a substantial number of entities are projected to have significant economic impact under various limited entry vessel categories.

4.9.4.1 Impacts of Permit and Reporting Requirements

Under all alternatives there are proposed permit and reporting requirements for commercial vessels and dealers, and permit requirements for operators. Given the current status of the stock mechanisms which account for all activities in the fishery are necessary to enforce provisions of the FMP and ensure that overfishing is prevented. Permits and/or reporting issued to all sectors which harvest or sell tilefish provides the foundation for effective monitoring and enforcement of regulations.

The current permitting proposal calls for a tiered system of full-time, part-time, and incidental catch categories. Under the proposed permitting system, the quota would be allocated across two full-time, one part-time, and an incidental catch category in proportion to the historical catch levels of vessels that qualify for each category. Table 80 should be examined for vessel breakdown and qualification requirements.

It is anticipated that vessels landing tilefish for sale will be required to have permits, dealers purchasing this species from permitted vessels will be required to have permits, operators of commercial vessels (vessels with permits to sell tilefish) will be required to obtain permits, vessels landing tilefish for sale would need to submit logbook reports, and dealers purchasing this species from permitted commercial vessels would need to submit reports.

It is estimated that there will be 10 new dealer permit applicants. The cost associated with the dealer and processed products reports are $30 for the public and $66 for the government. The total cost for all new dealers (who do not currently have permits) for reporting requirements in the first year is (for IVR and 88-30 forms) is $957 for the public ($95.7 per dealer). The combined public and government burden will be $1,791 for the first year.

It is estimated that in 1998, 215 different vessels landed tilefish along the Atlantic coast. Under all of the alternatives, any vessel desiring to fish commercially for tilefish must obtain a federal vessel/owner tilefish permit. Using the 1988- June 15, 1993 time frame there were 312 vessels which

landed at least 1 pound of tilefish. Assuming that every one of these vessels would be eligible for a tilefish permit and that they would all apply, this would mean 312 new permit applications under the proposed rule. Initial costs for vessel permits would be $2,340 for public burden ($7.5 per vessel) and $5,184 for the government burden. Similarly, for operator permits there would be a $1,275 cost for the public burden ($15 per operator) and a $2,805 for the government burden and a $960 for public cost burden ($11.29 per vessel) for vessel identification numbers. It is estimated that about 5 percent of the vessels (5 vessels) applying for the initial vessel permit may also incur in additional costs associated with confirmation of permit history, replacement and upgrades, and permit vessel appeals which are estimated at $675 for the public ($135 per vessel) and $1,485 for the government. Costs of submitting vessel logbooks would be $1,693 annually for the public ($20 per vessel) and $2,125 for the government. This is a total initial annual public burden of $7,980 and a total government burden of $12,331. Subsequence annual public burden and government burden associate with reporting requirements are $2,650 and $2,791, respectively.

4.9.5.1 Impacts of Quota Alternatives on Dealers/Processors

A description of tilefish dealers and their overall dependence on tilefish was presented in section 5.1.2 of the Social Impact Assessment. In 1998 there were 83 federal seafood dealers who handled tilefish. Of these 83, 73 depended on tilefish for only 0-5% of their revenues and only 5 depended on tilefish for more than 20% of their revenues - one of them, however, for 100% of his revenues. Another way to look at dependence is by absolute value. By this measure, 21 dealers depended on tilefish revenues for over $10,000, 7 for over $50,000 and 1 for between 1 and 5 million dollars (Clay pers. comm.).

These dealers are located in Maine (2), Massachusetts (8), Maryland (1), New Jersey (8), New York (19), North Carolina (11), Rhode Island (29) and Virginia (5). By county, dealers are located in Washington (25) and Newport (4) Counties, Rhode Island; Suffolk (18) and Nassau (1) Counties, New York; Bristol (8) County, Massachusetts; Cape May (4), Ocean (3), and Monmouth (1) Counties, New Jersey; Dare (7), Carteret (3), and Hyde (1) Counties, North Carolina; Hampton (2), Accomac (1), Newport News (1), and Virginia Beach (1), Virginia; Cumberland (2) County, Maine; and Worcester (1) County, Maryland. When all revenues for federal dealers handling tilefish in these counties are lumped together, a county-wide average percentage dependence can be calculated. Only Washington County, Rhode Island has more than a 5% dependence. The counties where federal tilefish dealers with the largest absolute levels of dependence are located are: Washington County, Rhode Island; Ocean County, New Jersey; Suffolk County, New York; Dare County, North Carolina and Newport County, Rhode Island.

Processing data for 1998 indicates that less than 3 tilefish processors reported processing tilefish for the Northeast and South Atlantic combined in the NMFS Processed Products Survey. As such, all data for these processors is confidential. All the firms reporting are small entities and tilefish constitute a very small percentage of their total volume and value (Clay pers. comm.).

Potential impacts of the preferred quota alternative (preferred alternative), the most restrictive quota alternative (alternative 6), and the least restrictive quota alternative (status quo) on revenues for federal seafood dealers that handle tilefish are discussed below. It is assumed that impacts associated with the rest of the quotas fall within the impacts from the measures analyzed. The same basic methodology and assumptions used in the vessel threshold analysis described in sections 4.9.1 and

4.9.3.1 were used to assess potential impacts of the quota alternatives on dealers. More specifically, the economic effects of the quota alternatives and limited entry options were estimated using five steps. The first step, was to identify dealers that handle tilefish in 1998, then all poundage and value of tilefish and all other species handled by those dealers in 1998 were estimated. This estimate provides the base from which subsequent quota changes and their associated effects on dealers revenues were compared.

The second step was to estimate the expected change in dealer revenues. This was accomplished by estimating proportional changes in the landings in 2000 due to the tilefish proposed quota versus the landings for the base year 1998. The third step was to divide the estimated 2000 revenues by the 1998 base revenues for every dealer in each quota alternative. For step four, if the dividend from step 3 was less than or equal to 0.95 then the dealer was defined as being impacted (i.e., had an expected loss of gross revenues of 5 percent or more) for purposes of the IRFA.

In addition, for the purpose of analysis of the projected impacts of the tilefish quota on dealers, several assumptions must be made. Projected tilefish exvessel price for 2000 (Table 102) was employed to estimate tilefish dealer revenues in 2000 associated with each of the quotas evaluated. Overall dealer revenues for 2000 were estimated by adding tilefish dealer revenues for 2000 plus the revenues from all other species in 1988 as they appear in the dealer data. Since there is no information on the projected change in the amount of fish handle and prices for all other species from 1998 to 2000, it was assumed that all other species revenues in 2000 were similar to all species revenues in 1998. As such, this assumption could be overestimating or underestimating change in revenues from all other species for the 1998 to 2000 time period. Dealer revenues for 1998 were derived by adding 1998 tilefish revenues to 1998 revenues from all other species as they appear in the dealer data for each dealer. Finally, it was also assumed that the change in the amount of tilefish handled by dealers would be similar to the changes in tilefish landings as a consequence of implementing the various quota alternatives evaluated.

The threshold analysis just described is intended to identify impacted dealers and to characterize the potential economic impact on directly affected entities. To further characterize the potential impacts on indirectly impacted entities and the larger communities selected county profiles were described in section 2.2.3. In addition to this, a detailed description and analysis of the potential impacts to dealers was presented in the Social Impact Assessment (section 5.0).

It should be noted that the county profiles are intended to characterize the relative importance of commercial fishing and fishing related industries in the home counties. As such, the county profiles provide a link to the Social Impact Assessment (section 5.0) but are not intended to be a substitute for that analysis.

Counties were selected as the unit of observation because a variety of secondary economic and demographic statistical data were available from several different sources. Limited data are available for place names (i.e., by town or city name) but in most instances reporting is too aggregated or is not reported due to confidentiality requirements. Reported statistics include summaries of landings, Federal permits, demographic statistics, and employment, wages, and number of establishments for each county.

4.9.5.1.1 Preferred Rebuilding Schedule

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 1,995,000 pounds. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in approximately 16 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.93 per pound was assumed for 2000 under this quota alternative (Table 102).

4.9.5.1.1.1 Threshold Analysis for Dealers

It is projected that under the preferred quota alternative a total of 3 dealers would incur revenue losses of 5 percent or greater in 2000 versus 1998. More specifically, 2 dealers would incur losses of 5 to 9 percent and one dealer would incur losses of 10 to 19 percent. Two of the dealers are located in Washington County, Rhode Island and one dealer is located Suffolk County, New York. These Counties are described in section 2.2.3. In addition to this, 13 dealers would incur revenue losses of less than 5 percent. The rest of the dealers were projected to incur revenue increases.

4.9.5.1.2 Most Restrictive Rebuilding Schedule (Alternative 6)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 0 pounds. This quota alternative is associated with a rebuilding strategy that would rebuild the stock in the shortest period of time among all evaluated rebuilding alternatives. However, it also carries the greatest adverse economic and social impact associated with it. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 would result in 100 percent reduction in commercial landings in 2000 relative to 1998. A projected tilefish price of $2.13 per pound was assumed for 2000 under this quota alternative (Table 102).

4.9.5.1.2.1 Threshold Analysis for Dealers

It is projected that under the most restrictive quota alternative a total of 10 dealers would incur revenue losses of 5 percent or greater in 2000 versus 1998. More specifically, 2 dealers would incur losses of 50 percent or greater, of 30 to 39 percent for 2 dealers, of 20 to 29 percent for 1 dealer, of 10 to 19 percent for 2 dealers, and of 5 to 9 percent for 3 dealers. Five of the affected dealers with revenue reductions of 5 percent or greater are located in Washington County, Rhode Island, 4 are located in Suffolk County, New York; and 1 is located in Ocean, New Jersey. These Counties are described in section 2.2.3. In addition to this, 73 dealers would incur revenue losses of less than 5 percent.

4.9.5.1.3 Least Restrictive Rebuilding Schedule (Status Quo)

This alternative examines the impacts on industry that would result from total harvest limit for tilefish of 2,509,000 pounds. Tilefish landings were estimated at 2,373,332 pounds in 1998, as such, the proposed allowable commercial landings in 2000 could result in approximately 6 percent increase in commercial landings in 2000 relative to 1998. A projected tilefish price of $1.88 per pound was assumed for 2000 under this quota alternative (Table 102).

4.9.5.1.3.1 Threshold Analysis for Dealers

It is projected that under the least restrictive quota alternative a total of 6 dealers would incur revenue losses of less than 5 percent in 2000 versus 1998. The remainder dealers were projected to incur

revenue increases.

4.9.5.4 Commutative Impacts (4.9.5.1.1 to 4.9.5.1.3)

A threshold analysis was conducted in order to estimate the potential impact on dealers associated with the implementation of the preferred quota alternative (preferred alternative), the most restrictive quota alternative (alternative 6), and the least restrictive quota alternative (status quo). Since the analyzed management measure contain the preferred, most restrictive, and least restrictive alternatives, it is anticipated that the impact of all other proposed quota measures will fall within the results from the analysis of these management alternatives.

The threshold analysis indicates that the potential change in revenues for the affected dealers is related to the revenue mix generated in 1998 versus the potential revenue mix for 2000 and the difference between the tilefish price per pound for those dealers in 1998 versus the projected tilefish price per pound projected for 2000. It was found that dealers that had larger proportions of their total revenue for the base year derived from tilefish and also received a higher price per pound for tilefish in the base year compared to 2000 would incur in higher revenue reductions as a consequence of potential decrease in landings in 2000 compared to the base year.

Overall, it was found that a larger number of dealers would be affected with revenue reductions of 5 percent or greater in 2000 versus 1998 under the most restrictive quota alternative (10 dealers) followed by the preferred alternative (3 dealers). Under the least restrictive alternative none of the dealers were projected to incur losses of 5 percent or greater.

4.9.5.5 Competitive Effects Analysis

There are no large businesses involved in the industry, therefore, there are no disproportionate small versus large effects. There are no disproportionate costs of compliance among the effected small entities.

4.9.5.6 Identification of Overlapping Regulations

The proposed action does not create regulations that conflict with any state regulation or other federal laws.

4.10 PAPERWORK REDUCTION ACT OF 1990

The Paperwork Reduction Act concerns the collection of information. The intent of the Act is to minimize the Federal paperwork burden for individuals, small businesses, state and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government. The associated costs of the various permits and reporting requirements of this FMP are described in section 4.9.4.1 above. It was estimated that permit and reporting requirements in this FMP would have a total of 497 burden hours during the first year. Then annual burden hours were estimated at 138 hours. It was estimated that this FMP will not affect the reporting process to any significant extent nor substantially add to the paperwork burden of effected entities.

5.0 SOCIAL IMPACT ASSESSMENT

5.1 INTRODUCTION

The discussion below focuses on social and cultural impacts of the FMP on communities and individuals. Because economic impacts also have social and cultural ramification, they are also included, though in a different form than seen in the economic impact sections of the document. The discussion is divided into sections on each of the conservation measures adopted in the FMP.

It should be noted that of the preferred and non-preferred options, the preferred alternative is certainly not the most drastic considered. One alternative, for instance, would close the fishery completely. This was rejected as having too extreme impacts on participants and communities. The current preferred alternative is the product of negotiations among the largest groups of tilefish fishermen, and as such represents a consensus approach favored by many in the most important tilefish communities. See RIR/IRFA (section 4.4.2) for further discussion of overall impacts of individual non-preferred alternatives.

In 1998, there were 215 vessels which landed tilefish. Of these, 15 qualified for limited access. Another 35 vessels which did not land tilefish in 1998 also qualified for limited access. For purposes of analyzing the current impacts of this FMP, therefore a total of 250 vessels will be examined. They can be broken out by qualification status as below:

Category	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Full-Time --Tier 1	4	1.6	4	1.6
Full-Time – Tier 2	4	1.6	8	3.2
Non-Qualified	200	80.0	208	83.2
Part-Time	42	16.8	250	100.0

For all but one of these vessels data on home port, primary port of landing and owner's home address, as well as vessel characteristics, were available from the NMFS permit and commercial landings files. For that vessel only landings data and vessel characteristics were available, not owner's address or home port.

Table 182 breaks out these vessels by qualification status, primary port of landing and owner's home county. Port level statistics are included in the text. In addition, a similar table showing relationship of home port to primary port of landing can be found in the Community Profiles section of this document (section 2.3.3).

5.1.1 Vessel Permits

Of the 250 vessels 33 possessed no federal fishing permits in the northeast region in 1998, though all but one have possessed at least one permit at some point in the past. For the 33 with no current permits, there will be some additional burden in paperwork. This will affect the quality of life experience of fishing, but is also increasingly the norm for all fisheries.

5.1.2 Dealer Impacts

Permits

Most dealers in the northeast are already permitted in order to buy and sell the many other northeast species which require dealer permits and mandatory reporting. One additional species and the small number of vessels in question should not pose any significant impact.

Changes in Landings Levels or Prices

In 1998 there were 83 federal seafood dealers who handled tilefish. Of these 83, 73 depended on tilefish for only 0-5% of their revenues and only 5 depended on tilefish for more than 20% of their revenues - one of them, however, for 100% of his revenues. Another way to look at dependence is by absolute value. By this measure, 21 dealers depended on tilefish revenues for over $10,000, 7 for over $50,000 and 1 for between 1 and 5 million dollars. These are not insignificant amounts. Tables 182 - 187 and the discussion below break out these dealer impacts in a general way by community. The RIR and IRFA (section 4.0) provide an overview discussion of these impacts for the fishery as a whole.

These dealers are located in Maine, Massachusetts, Maryland, New Jersey, New York, North Carolina, Rhode Island and Virginia. By county, the largest numbers of dealers are in Washington County, Rhode Island; Suffolk County, New York; Bristol County, Massachusetts and Dare County, North Carolina. When all revenues for federal dealers handling tilefish in these counties are lumped together, a county-wide average percentage dependence can be calculated. Only Washington County, Rhode Island has more than a 5% dependence. The counties where federal tilefish dealers with the largest absolute levels of dependence are located are: Washington County, Rhode Island; Ocean County, New Jersey; Suffolk County, New York; Dare County, North Carolina and Newport County, Rhode Island.

Counties where there are fewer than 3 seafood dealers are not described individually for reasons of confidentiality. However, none of these counties had significant percentage or absolute levels of revenues. Thus, Washington County, Rhode Island and Ocean County, New Jersey are the most likely to be impacted - especially the former.

By port community, the largest numbers of federal seafood dealers handling tilefish are found in Point Judith, Rhode Island; Montauk and Hampton Bay, New York; and New Bedford, Massachusetts. The largest levels of absolute dependence are Point Judith, Rhode Island; followed by Newport, Rhode Island; and Montauk and Hampton Bay, New York. The largest levels of percentage dependence are found in Point Judith and Montauk. Thus any revenue decrease are most likely to impact the communities of Point Judith and Montauk.

5.1.3 Tilefish Monitoring Committee

The existence of this Committee should allow for greater flexibility in adjusting management measures. Greater flexibility is generally advantageous for fishermen and their communities. The presence of an industry member on the committee should aid in keeping the fishermen's perspective and knowledge before the Committee and the Council as adjustments are considered.

5.1.4 Frameworks

Frameworks should facilitate a speedier response to any changing conditions which require adjustments to the management measures. This can make planning difficult for fishermen as changes occur more frequently than under an amendment process, but the more rapid response can also mean less drastic measures in the case of cutbacks (earlier reactions often need not be as severe) and quicker relief in the case of easements.

5.1.5 Limited Access

Limited access has a number of different impacts, some positive and some negative. Further, it affects different fishermen and their communities in different ways - depending on their gear type and qualification status. Those who qualify receive the benefit of assured access and the ability to reap a continuing and known share of the tilefish resource as it rebounds. Nonetheless, the need to limit the catch of tilefish in the near-term imposes negative financial impacts on even those who qualified for limited access.

In addition, those who qualified based on gear other than longline and currently rely on tilefish for some portion of their income, while using that other gear, will now be unable to take tilefish in amounts greater than 300 pounds per trip (per the Incidental category) unless they switch to longlining. In 1998, however only 5 non-longline vessels ever exceeded 300 pounds per trip.

Changing to a new gear entails not only the financial costs of the gear and any necessary re-fitting of the vessel, but also the cost imposed when learning a new form of fishing. It takes time to become proficient at a new gear and during the learning period profits may suffer. Some fishermen, further, simply prefer fishing with one type of gear over another, and their experience of fishing may not be as enjoyable if they switch gears. Of the 196 vessels which in 1998 caught tilefish with a gear other than longline, however, 9 used both longline and another gear. Thus, many vessels are already capable of switching gears.

Gear*	Frequency	Percent	Cumulative Frequency
1	18	8.4	18
2	187	87.4	205
3	9	4.2	214
* Gear 1 is longline, gear 2 is non-longline and gear 3 is both			

Then there are those who did not qualify for limited access at all. They too may lose income if they had depended in recent years on tilefish for some amount of their catch greater than 300 pounds per trip but less than required for qualification.

5.1.5.1 Those Who Did Not Qualify for Limited Access

By Home Town

Washington County in Rhode Island is the home county (by owner's home address) for the largest number of non-qualifying fishermen - those who will be most negatively impacted by the implementation of this FMP. These 48 fishermen constitute 7% of the 697 fishermen and fishing vessel captains in the county. The largest number of non-qualifiers (27) is located in Wakefield. The next largest number (7) is located in Narragansett. Both Wakefield and Narragansett are located in Washington county. However, neither is large enough to appear in the detailed occupational files, so numbers of fishermen, captains and other officers are unknown. However, data on numbers of employees in the broader category of agriculture, forestry and fisheries are available. In Narragansett in 1990 there were 26 people employed in agriculture, forestry and fishing; 7 would be 27% of this total. Narragansett also provides more up-to-date 1998 data, indicating that there were 58 persons employed in agriculture, forestry and fishing in that year; 7 would be 12% of this number. Wakefield is grouped in the census data with Peacedale, where 3 non-qualifiers are located. These 30 non-qualifiers (27 in Wakefield and 3 in Peacedale) are 36% of the 83 individuals employed in agriculture, forestry and fishing in that community.

As described in the community profiles, of areas landing tilefish the areas most heavily dependent on fishing alone vis-à-vis other economic activities is Washington County. Washington County is also heavily dependent when fish processing activities are included .

The second largest group of non-qualifiers is located in Hampton Bay, New York and the third largest group in Montauk, NY. Both ports are located in Suffolk County. Montauk is also the port where all the full-time, tier 1 permit holders are located. Suffolk County is much less dependent on fishing than is Washington County. The 22 fishermen in the two ports who did not qualify constitute only 3% of the 705 fishermen and fishing vessel captains in the county. However, per port these are large numbers. Montauk had only 3,001 residents in 1990. Fishing, agriculture and forestry employed 151 persons - 9% of all employed persons over age 16. Thus 11 fishermen are 7% of the sector's employees, and 4 fishermen (the qualifiers) are 3% of the sector's employees. In Hampton Bay, the population in 1990 was 7,893 and fishing, agriculture and forestry employed 133 people - 3% of all employed persons over age 16. Here 11 fishermen are 8% of the sector's employees. Further, if we add in all the non-qualifiers in the county (including those in communities other than Hampton Bay and Montauk) there are 41 non-qualifiers, or 6% of all the county's fishermen.

The fourth largest group is found in New Bedford/Fairhaven, where there are 11 non-qualifiers (8 in New Bedford and 3 in Fairhaven). If the other Bristol County non-qualifiers are added in, then a twelfth fisherman is added. These 11 fishermen constitute only 2% of the 589 fishermen and captains in New Bedford. The twelve in Bristol County constitute only 1% of its 1,043 fishermen and captains.

Fifth place goes to Cape May, New Jersey (Cape May County) with 7 non-qualifiers and sixth to Wanchese, North Carolina (Dare County) with 6 non-qualifiers. (North Carolina vessels that fish tilefish from this management unit must land north of the Virginia/North Carolina border. It is

assumed that landings in North Carolina have and will continue to meet the requirements and laws governing the SAFMC Snapper/Grouper FMP which manages tilefish in North Carolina and south.) The 7 in Cape May constitute 28% of the 25 persons employed in agriculture, forestry and fishing according to the 1990 Census. The 6 in Wanchese are 4% of the 137 in that sector in that port. If all non-qualifiers in each county are added in, then Cape May County has 10 non-qualifiers and Dare County has 18. The 10 in Cape May County constitute 3% of its 375 fishermen and captains. For Dare County, the 18 constitute 5% of its 370 fishermen and captains.

By percentage employees impacted in the sector then, the greatest impacts are in Wakefield-Peacedale, followed by Cape May and Narragansett, and then by Montauk and Hampton Bay. Washington County, where Wakefield-Peacedale and Narragansett are located is the most fishery dependent of the tilefish ports. By owner's home county only, the results are slightly different: Washington County, Rhode Island still has the highest number of non-qualifiers, followed by Suffolk County, New York. The third largest group of non-qualifiers is located in Dare County, however. The fourth largest is Bristol county in Massachusetts. Cape May County in New Jersey is fifth, and Cumberland County in Maine is sixth.

By Primary Port of Landing

If we examine numbers of non-qualifiers by port of landing rather than owner's home address, then Point Judith Rhode Island (Washington County) has the highest number of non-qualifiers with 52 -- 12% of those in agriculture, forestry and fisheries in the county sub-division of South Kingstown (which includes Point Judith). There has been a practice of New York and New Jersey boats landing in Point Judith due to better prices. However, for 1998 only 3 vessels with New Jersey home addresses landed in Point Judith, and one New York vessel. (An additional 5 vessels from Massachusetts and Connecticut also landed in Point Judith. (section 2.3.3). There were also 7 vessels with Rhode Island post office box addresses who could conceivably be out of state vessels using a convenience address.

Point Judith is followed by Hampton Bay, New York (Suffolk County) with 23 -- 17% of employees in agriculture, forestry and fisheries. Third is Wanchese, North Carolina (Dare County) with 20 -- 15% of those in agriculture, forestry and fisheries, followed closely by Newport, Rhode Island (Newport County) with 18 -- 6% of those in agriculture, forestry and fisheries. Fifth is Montauk, New York (Suffolk County) with 15 --11% of those in agriculture, forestry and fisheries and sixth is Portland, Maine (Cumberland County) with 12 -- 3% of those in agriculture, forestry and fisheries.

Thus by percentage of employees impacted, Hampton Bay is the most impacted, followed by Wanchese, Point Judith and Montauk. As noted in the Community Profiles (section 2.3.3), Suffolk County is relatively little dependent on fishing, though the individual communities of Montauk and Hampton Bay are more so -- especially Hampton Bay. These communities also have good economic conditions and available jobs, but few with wages as high as those offered by fishing. Both Washington County and Dare County are relatively dependent on fishing, and the port of Wanchese is highly dependent.

Of the 52 Point Judith boats, most have other limited access permits already, and so have some alternatives: 49 have squid, mackerel, butterfish; 49 have multispecies; 2 have scallop; 49 have summer flounder; 47 have black sea bass; 48 have scup; and 49 have lobster. In addition, some have open access or recreational permits in other fisheries: 2 in squid, mackerel, butterfish; 2 in multispecies; and 47 in scallops.

Most of the 23 Hampton Bay boats also have limited access permits in other fisheries: 21 in squid, mackerel, butterfish; all 23 in multispecies; 22 in summer flounder, 21 in black sea bass; 22 in scup; and 18 in lobster. The same is true for the 15 Montauk vessels: 11 each have squid, mackerel, butterfish; multispecies; summer flounder; black sea bass and scup; while 10 have lobster.

The 20 Wanchese vessels have fewer northeast species options. In terms of limited access northeast permits, 2 have squid, mackerel, butterfish; 4 have multispecies; 1 has scallop; 5 have summer flounder; 18 have black sea bass; 5 have scup; and 6 have lobster.

Thus most of these vessels have some other fishing options - though it should be remembered that most of the region's limited access fisheries are already highly exploited (often over-exploited) and under strict rebuilding plans. Thus, it is unlikely that significant additional effort could be added.

However, most of these vessels also relied on tilefish for a very small percentage of their fishing income. Some in Montauk, Hampton Bay, Portland and Point Judith, however, did rely on tilefish for 19-100% of their fishing income - though absolute levels are often low. Four of the Montauk vessels, for instance, relied on tilefish for 82-100% of their fishing income. And these most dependent vessels have few or no limited access permits for other fisheries. Thus, significant impacts are few per port and overall, though very severe for a small number of vessels.

If we examine numbers of non-qualifiers by port of landing county only, Washington County, Rhode Island is the most impacted (52) followed by Suffolk County, New York (48), Dare County, North Carolina (26), Newport County, Rhode Island (18), Cumberland County, Maine (12) and Bristol County, Massachusetts (9).

5.1.5.2 Those Who Qualified Only for Part-Time

By Home Town
The largest group of part-time qualifiers is located in Ocean County, New Jersey, followed by Washington County, Rhode Island. Within Ocean County, the largest group is 12 part-time vessels in Long Beach/Barnegat Light (31% of those in agriculture, forestry and fisheries). Other communities have only 1-3 part-time vessels. Within Washington County, no individual community has more than 2 part-time vessels.

By Primary Port of Landing
The largest group is still in Ocean County, followed by Washington County. There are 15 vessels in Barnegat Light (39% of employees in agriculture, forestry and fisheries) and 8 in Point Judith (2% of those in agriculture, forestry and fisheries in South Kingstown).

Thus by either home town or primary port, regulations for part-time vessels will ultimately have the most impact on the community of Barnegat Light in Ocean County, NJ. While Ocean County is not heavily dependent on fishing, the port of Barnegat Light is. Any vessel who fishes less tilefish under the new regulations than previously will be impacted.

However, only 9 of the 42 part-time qualifiers actually fished for tilefish in 1998. Of these, 5 have home addresses in Washington County (2 in Wakefield, 2 in Charlestown, and 1 in Narragansett), 3 have home addresses in Ocean County (2 in Barnegat Light and 1 in Ship Bottom), and 1 has a

home address in Portland, ME. By primary port, 6 land in Point Judith, 2 in Long Beach/Barnegat Light, and 1 in Portland. Thus Washington County may be more affected than Barnegat Light in the short-term.

The Washington County home town vessels all possess a variety of other limited access permits, however. Each has multispecies; squid, mackerel, butterfish; summer flounder; black sea bass; scup and lobster. The Ocean County home town vessels are less diversified: to possess multispecies and lobster limited access permits, and one possesses no federal northeast permits at all - either limited access or otherwise. The Portland vessel has multispecies and scup limited access permits. Further, none of these vessels relied on tilefish for even as much as a half percent of their fishing income.

5.1.5.3 Those Who Qualified for Full-Time

While in the long-run all those who qualified for full-time limited access - either tier 1 or tier 2 are in a position to reap future benefits, those who are currently fishing may be unable to fish as much as in the past in the near-term. All four tier 1 qualifiers fished in 1998, but only two of the four tier 2 qualifiers fished then. The four tier 1 qualifiers relied on tilefish for 89-99% of their fishing income in that year. All four both live and land in Montauk. All but one has at least one other limited access permit. The two tier 2 qualifiers both live and land in Barnegat Light/Long Beach and have one other limited access permit.

5.1.6 Trip Limits

Allowing an incidental catch for vessels not targeting tilefish allows vessels which normally encounter small amounts of tilefish to continue their activities relatively unaffected. In 1998 only 5 vessels would have exceeded the 300 pound trip limit.

5.1.7 Total Allowable Landings Limits

As noted in the RIR/IRFA (section 4.5) there may be reductions in crew due to this measure. Previous discussions have been of total number of vessels. Thus the numbers of impacted individuals has referred to the number of owners - those who will receive or not receive limited access. Crews are, of course, affected by any measure impacting the vessel owner. Permit files provide some crew data, but are not very accurate. Specifically, permit data list the number of berths on a vessel - not taking into account either empty berths or "hot-bunking" where two crews may alternate, with one taking the vessel out as soon as the other arrives and packs out. We can, however, make some estimates of numbers of crew. We cannot assume that crew will live in the same community as the vessel owner, so in the discussion of which communities would be most impacted by any crew reductions resulting from the TALs crew are assigned to the port of landing for their vessel.

Of the 250 vessels under discussion here, crew data within the last 5 years were available for 241. (Data from 1998 were available for all but 33 vessels.) There were 242 crew members total, distributed across vessels as noted in the table below. The most common crew was 3-5.

No. of Crew	1	2	3	4	5	6	7	8	9	10	11	12
No. of Vessels with Crew Size	3	27	49	75	57	15	6	1	6	1	0	2

The crewmembers are distributed by county as in Table 186. Thus, Washington County, Rhode Island and Suffolk County, New York have the largest groups of crew members; followed by Ocean County, New Jersey and Dare County, North Carolina.

By port, the crew are distributed as in Table 187. In absolute terms, then, Point Judith, RI is most impacted -- followed by Hampton Bay and Montauk, NY and Newport, RI.

6.0 OTHER APPLICABLE LAWS

6.1 RELATION OF RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

6.1.1 FMPs

This FMP is related to other plans to the extent that all fisheries of the northwest Atlantic are part of the same general geophysical, biological, social, and economic setting. United States fishermen usually are active in more than a single fishery. Thus regulations implemented to govern harvesting of one species or a group of related species may impact on other fisheries by causing transfers of fishing effort.

6.1.2 Treaties or International Agreements

No treaties or international agreements, other than GIFAs entered into pursuant to the MSFCMA, relate to this fishery.

6.1.3 Federal Law and Policies

6.1.3.1 Marine mammals and endangered species

Activities conducted under this FMP have not yet been considered for their impacts on endangered species in order to do a Section 7 of the Endangered Species Act consultation. NMFS will be performing a Section 7 consultation while the FMP is out for public review during the next few months. The Fish and Wildlife Service may also perform a Section 7 consultation on any seabirds that may be impacted by this FMP. The following background information is provided to facilitate evaluations of the alternatives relative to the order of magnitude these tilefish fisheries may have on these threatened or endangered species.

Since data regarding takes and interaction with endangered species is not yet available for the tilefish bottom longline fishery, much of the discussion in this biological assessment is drawn from a recent biological opinion which describes two analogous fisheries, the bottom longline fishery for sharks, and the Atlantic pelagic longline fishery (NMFS 1998). Information on listed species impacted by the tilefish fishery, including biological, ecological, and spatial characteristics, has been provided by the NMFS, Office of Protected Resources (Raizin pers. comm.).

Tilefish have unique spatial and temporal behavior; their habitat is a relatively restricted band approximately 250 to 1200 feet deep and 47 - 65 ^{0} F referred to as the “warm belt” on the outer continental shelf and upper slope of the United States Atlantic coast. Although tilefish are found along the entire United States Atlantic coast and the Gulf of Mexico, this FMP is concerned only with the stock of tilefish inhabiting the area north of the Virginia/North Carolina border. This stock has been identified as a biologically discrete stock (Katz *et al.* 1983). Because of their restricted habitat and low biomass, the fishery for tilefish, in recent years, has occurred in a relatively small area in the mid-Atlantic Bight, south of New England and west of New Jersey. The traditional fishery has occurred as far south as Virginia.

Endangered Sea Turtles Known to Occupy the Area of Concern

Two species of listed turtles are known to occupy the Area of Concern, loggerheads and leatherbacks. Although hard data does not exist on takes of these turtles in the area, anecdotal information suggests that both species have been taken by hook in tilefish bottom longline fishery. The fishery, historically, has used rope or monofilament for longline gear material. However, the present fishery utilizes steel cable. Therefore, the fishing operations may be less likely to entangle loggerhead or leatherback turtles. However, data to analyze entanglements does not exist, and at this point, reduction in entanglements due to a move away from monofilament line is merely conjecture.

Loggerhead Sea Turtle

The threatened loggerhead is the most abundant species of sea turtle in United States waters, commonly occurring throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. The loggerhead's winter and early spring range is south of 37°00' N in estuarine rivers, coastal bays, and shelf waters of the southeastern United States. Loggerheads move northward and enter northeast coastal embayments as water temperatures approach 69° F (Burke *et al*. 1989; Musick *et al.* 1984) to feed on benthic invertebrates, leaving the northern embayments in the fall when water temperatures drop.

Like the Kemp's ridley sea turtle, the activity of the loggerhead is limited by temperature. (Keinath *et al*. 1987) observed sea turtle emigration from the Chesapeake Bay when water temperatures cooled to below 67° F, generally in November. Work in North Carolina showed a significant movement of sea turtles into more northern waters at 52° F. (Chester *et al.* 1994) and Morreale has seen sea turtles persist in New York waters for extended periods at temperatures as low as 46° F (see NMFS 1995). Surveys conducted offshore and sea turtle strandings during November and December off North Carolina suggest that sea turtles emigrating from northern waters in fall and winter months may concentrate in nearshore and southerly areas influenced by warmer Gulf stream waters (Epperly *et al*. 1995). Aerial surveys of loggerhead turtles at sea north of Cape Hatteras indicate that they are most common in waters from 70 to 150 feet deep, although they range from the beach to waters beyond the continental shelf (Shoop and Kenney 1992). There is no information regarding the activity of these offshore turtles.

Anecdotal information suggests that the tilefish fishery interacts with relatively large loggerhead turtles that occur on the slope of the continental shelf from the period May to October. Egg-bearing loggerheads nest in the South Atlantic and Gulf of Mexico during the late fall and winter. At-sea sampling data from the Atlantic pelagic longline fishery suggests that while interaction is frequent in this fishery, mortality is low. However, sea sampling data from the bottom longline shark fishery (Branstetter and Burgess 1997) revealed that in 408 sets observed, 25 loggerheads were taken and released live and another six were recorded dead, yielding a mortality rate of approximately 20%. While not conclusive, this suggests that bottom longlines may be more lethal for the loggerhead turtle. The predominant source of mortality in the longline fisheries is ingestion of the hook.

Leatherback Sea Turtle

Nest counts are the only reliable population information available for leatherback turtles. Recent declines have been seen in the number of leatherbacks nesting worldwide (NMFS & USFWS 1995). The NMFS/USFWS status review notes that it is unclear whether this observation is due to natural

fluctuations or whether the population is at serious risk. With regard to repercussions of these observations for United States leatherback populations in general, it is unknown whether they are stable, increasing, or declining, but it is certain that some nesting populations (*e.g.*, St. John and St. Thomas, United States Virgin Islands) have been extirpated.

The leatherback is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS & USFWS 1995). Leatherback turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) and are often found in association with jellyfish. These turtles are found throughout the action area and, while predominantly pelagic, they occur annually in places such as Cape Cod Bay and Narragansett Bay during certain times of the year, particularly the fall. Of the turtle species common to the action area, leatherback turtles seem to be the most susceptible to entanglement in lobster gear and longline gear. This susceptibility may be the result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface.

Witzell (1999) summarized turtle catch from logbook data (1992 - 1995) for pelagic longline sets targeting swordfish and tuna, or both. The northeast distant area accounted for 70% of the loggerhead and 47% of the leatherback captures that were reported north of the mid-Atlantic Bight. June through November were the peak months for reported captures.

A review of observer reports for sets targeting all species between 1990 - 1996, yielded similar results (Hoey, 1998). The northeast distant area accounted for 75% of the loggerhead and 40% of the leatherback captures for all sampling areas. The northeast distant area also was the only area where interactions of four or more turtles occurred on a single set. July through November were the predominant months for turtle captures (Hoey 1998).

Anecdotal information suggests that the tilefish fishery has occasionally taken leatherback sea turtles. Although takes and mortality rates are not available for the fishery, it can be assumed that mortality has occurred. Mortality of leatherback sea turtles due to ingestion/internal hooking in the Atlantic pelagic longline fishery has been estimated to be 29% (Aguilar *et al.* 1992). We would expect similar results for leatherback turtles hooked in the tilefish bottom longline fishery.

Endangered Marine Mammals Known to Occupy the Area of Concern

Two listed species of marine mammals, fin and sperm whales, are known to occupy the area. On occasion, especially in the summer months, humpback and sei whales may transit the area. As in the case of endangered turtles, hard data does not exist on interaction with these species. There are no documented cases of whale entanglements in the tilefish fishery although these may have occurred in the past. Currently, the fishery uses steel cable instead of traditional monofilament lines. This may reduce the chance of entanglement. However, as in the case of listed turtles, data to analyze interactions does not exist. While steel cable could reduce entanglements, it could also cause an increase in wounding and/or scarring events if whales forcefully swim into the buoy lines.

Fin Whale

The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (Waring *et al*. 1999). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, however, Clark (1995) reported a general southward "flow pattern" of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, and fin whales are found throughout the action area for this consultation in most months of the year. This species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). As with humpback whales, they feed by filtering large volumes of water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments. Due to these traits, fin whales are less prone to entanglements than are right and humpback whales, but because they do occur in many of the same areas, the potential exists. Fin whales are known to occupy the Area of Concern from March to October and appear to be most susceptible to interactions in the spring and fall.

Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the proximal cause of mortality was not known. In 1996, three reports of ship strikes were received, although this was only confirmed as cause of death for one of the incidents. One entanglement report was received in 1996.

At least five reports of entangled fin whales were received by NMFS in 1997. Four fin whales were reported as having stranded in the period from 1 January 1997 to 1 January 1998, in the northeast region; the cause of death was not determined for these animals. One ship strike mortality was documented in 1998 in the Virginia-North Carolina border area. One entanglement mortality was reported in September 1998.

Sperm Whale

There are estimated to be approximately two million sperm whales worldwide with a population of 130,000 or more thought to occur in the North Atlantic (IWC 1983). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the eastern United States EEZ are believed to represent only a portion of the total stock (Blaylock *et al*. 1995). Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Waring *et al*. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge. Like swordfish, which feed on similar prey, sperm whales migrate to higher latitudes during summer months, when they are concentrated east and northeast of Cape Hatteras. Bull sperm whales migrate much farther poleward than the cows, calves, and young males. Because most of the breeding herds are confined almost exclusively to warmer waters many of the larger mature males return in the winter to the lower latitudes to breed.

Sperm whales feed primarily on medium to large-sized mesopelagic squids *Architeuthis* and *Moroteuthis*. Sperm whales, especially mature males in higher latitude waters, also take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962 and 1980). Sperm whale populations are organized into two types of groupings: breeding schools and bachelor schools. Older males are often solitary (Best 1979). Breeding schools consist of females of all ages and juvenile males. The mature females ovulate April through August in the Northern Hemisphere.

During this season one or more large mature bulls temporarily join each breeding school. A single calf is born at a length of about 4 meters after a 15 month gestation period. A mature female will produce a calf every 3-6 years. Females attain sexual maturity at the mean age of nine years and a length of about nine meters. Males have a prolonged puberty and attain sexual maturity at about age 20 and a body length of 12 meters. Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979).

Sperm whales were hunted in America from the 17th century through the early 1900's. The International Whaling Commission estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1971). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, greater attention was paid to smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke 1954; Committee for Whaling Statistics 1959 -1983). In recent years the catch of sperm whales has been drastically reduced as a result of the imposition of catch quotas. NMFS believes there are insufficient data to determine population trends for this species (Blaylock *et al.* 1995). Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Sperm whales have been taken in the pelagic driftnet fishery for swordfish, and could likewise be taken in the shark gillnet fishery on occasions when they may occur more nearshore, although this likely does not occur often.

Interactions between sperm whales and longlines for sable fish have been noted in Alaska waters. Therefore, it is not improbable that interactions could occur with the sperm whale in the Area of Concern. These interactions could take the form of entanglement or scarring. Scarring is especially relevant given the use of steel cable replacing monofilament line. Sperm whales generally occur in the Area of Concern from March to September and appear to be most susceptible to interaction in the months of July and August.

Impacts of Management Measures on Endangered Species

Encouragement to Move After an Interaction with an Endangered Species

Encouraging fishermen to move after an interaction with a marine mammal or endangered sea turtle is intended to mitigate for the interactions with marine mammals and sea turtles in the area where the tilefish fishery occurs. If fishermen comply with this provision, there could be a reduction in levels of serious injury and mortality of strategic stocks of marine mammals. Hoey (1998) noted that for the northeast distant fishing area, 68.1% of all loggerheads observed entangled in pelagic longline gear were caught on sets with other loggerheads. For leatherbacks, 31.7% were caught on sets with other leatherbacks. While the Council recognizes that this measure will be extremely difficult to enforce, it is hoped that there will be cooperation between enforcement agencies and tilefish fishermen to ensure compliance.

Rebuilding Schedule

The preferred rebuilding schedule of ten years would reduce F to 0.30 in the first fishing year. The F for the 1998 was estimated to be at 0.45. This large reduction in effort would yield a total allow-

able catch of 1.995 million pounds compared to landings of nearly 3 million pounds in 1998. It is certain that a reduction in effort of this magnitude would have a substantially large impact on reduction of takes and interactions with endangered species. Alternative rebuilding schedules (section 3.1.2.2) that presume large reductions in effort, would produce the greater effects. However, it is unlikely that the relationship between reductions in effort and reduced takes and or interactions is linear due to spatial differences between stocks of fish and endangered species. A linear relationship would occur only if the spatial relationship were constant throughout the range of the fishery for the fishing year.

Sea Samplers and Observers

The provision which would require vessels to take aboard sea samplers or observers at the request of the Regional Administrator would have no direct impact on the take or interaction with endangered species. However, it is commonly recognized that this fishery, among others, needs access to hard data to more accurately analyze the fishery for levels of takes and interactions of listed species.

The only endangered species of fish occurring in the northwest Atlantic is the shortnose sturgeon (*Acipenser brevirostrum*). The Council urges fishermen to report any incidental catches of this species to the Regional Administrator, NMFS, One Blackburn Drive, Gloucester, Massachusetts 01930, who will forward the information to persons responsible for the active sturgeon data base. Shortnose sturgeon may be caught incidentally in trawl fisheries. Sturgeon will be included in the Incidental Take Statement of the pending Biological Opinion. As shortnose sturgeon are generally associated with the estuarine environment, rather than the truly marine environment, it is anticipated that the gear and fishing locations of these tilefish fisheries will rarely encounter shortnose sturgeon.

The gears managed under this FMP are listed under Categories II and III for the final List of Fisheries for 1999 for the taking of marine mammals by commercial fishing operations under section 118 of the Marine Mammal Protection Act (MMPA) of 1972. Section 118 of the MMPA establishes a long-term regime for governing interactions between marine mammals and commercial fisheries and requires NMFS to publish and annually update the List of Fisheries, along with the marine mammals and the number of vessels or persons involved in each fishery. The classification criteria consist of a two tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock (Tier 1) and then addresses the impact of the individual fisheries on each stock (Tier 2). If the total annual mortality and serious injury of all fisheries that interact with a stock is less than 10% of the Potential Biological Removal (PBR) for the stock then the stock is designated as Tier 1 and all fisheries interacting with this stock would be placed in Category III. Otherwise, these fisheries are subject to categorization under Tier 2. Under Tier 2, individual fisheries are subject to the following categorization

Category I. Annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50% of the PBR level;

Category II. Annual mortality and serious injury of a stock in a given fishery is greater than one percent and less than 50% of the PBR level; or

Category III. Annual mortality and serious injury of a stock in a given fishery is less than one percent of the PBR level.

In Category II, there is documented information indicating an "occasional" incidental mortality and injury of marine mammals in the fishery. Some of the tilefish incidental otter trawl fisheries are in this category. With the mandatory reductions in tilefish fishing mortality in the preferred alternative, there should be an overwhelming beneficial impact from the preferred alternative management measures on the marine mammal populations of the east coast.

In Category III, there is information indicating no more than a "remote likelihood" of an incidental taking of a marine mammal in the fishery or, in the absence of information indicating the frequency of incidental taking of marine mammals, other factors such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, and species and distribution of marine mammals in the area suggest there is no more than a remote likelihood of an incidental take in the fishery. The demersal longline fishery for tilefish is considered Category III fisheries.

Pelagic seabirds are not likely to come into contact with tilefish fisheries. Most of the following information is taken from the Mid-Atlantic Regional Marine Research Program (1994). Fulmars occur as far south as Virginia in late winter and early spring. Shearwaters, storm petrels (both Leach's and Wilson's), jaegers, skuas, and some terns pass through this region in their annual migrations. Gannets and phalaropes occur in the Mid-Atlantic during winter months. Nine gulls breed in eastern North America and occur in shelf waters off the northeastern United States These gulls include: glaucous, Iceland, great black-backed, herring, laughing, ring-billed, Bonaparte's and Sabine's gulls, and black-legged caduceus. Royal and sandwich terns are coastal inhabitants from Chesapeake Bay south to the Gulf of Mexico. The Roseate tern is listed as endangered under the ESA, while the Least tern is considered threatened (Safina pers. comm.).

Tilefish are not important prey for the Common and Roseate terns (Safina 1987, Safina *et al*. 1988, and Safina *et al.* 1990). Safina *et al.* (1988) note that few other seabird studies have measured ambient food levels among foraging birds, but many studies which have examined food provisioning to chicks and reproductive performance in seabirds have found results similar to theirs. Laying dates, clutch sizes, growth, and fledgling success of seabirds have been linked to food availability by a number of workers. Safina *et al*. (1988) recorded that prey fish were more abundant in 1984 than it was in 1985 and noted that reproductive productivity of terns was greater in 1984 for most parameters measured. Although they studied productivity for only two seasons, the results suggest that prey population fluctuations may limit reproductive success in the terns they studied.

Safina *et al.* (1990) noted that observing prey deliveries at nests cannot address the question of how foraging birds select prey or foraging habitat from the range of possibilities. However, the variability they found shows that either prey availability or birds' selection criteria changes, and that prey availability or selection varies differently between the two tern species, Common and Roseate, they studied. Some prey species may have their own consistent internal rhythms (or influencing factors) which make them differentially susceptible to tern predation on a daily time scale.

The stock recovery schedule proposed in this FMP will reduce fishing mortality over a ten year period. As such, these reductions in fishing mortality will result in reduced fishing effort that in turn will reduce interactions with marine mammals, sea turtles, the endangered shortnose sturgeon, and seabirds. Preventing overfishing of tilefish thus will be beneficial to some seabirds and certain species of marine mammals.

6.1.3.2 Marine sanctuaries

National marine sanctuaries are allowed to be established under the National Marine Sanctuaries Act of 1973. Currently there are 12 designated marine sanctuaries that creates a system that protects over 14,000 square miles (National Marine Sanctuary Program 1993).

There are four designated national marine sanctuaries in the area covered by this FMP and the South Atlantic Councils FMP that covers tilefish: the *Monitor* National Marine Sanctuary off North Carolina, and the Stellwagen Bank National Marine Sanctuary off Massachusetts, Gray's Reef off Georgia and the Florida Keys National Marine Sanctuary . There is currently one additional proposed sanctuary on the east coast, the Norfolk Canyon. Should the Norfolk Canyon proposed area, off of the mid-Atlantic, become a marine sanctuary there is the possibility that there could be some impacts to the tilefish fishery, however very little tilefish fishing has occurred during the past decade in the Norfolk Canyon area.

The *Monitor* National Marine Sanctuary was designated on 30 January 1975, under Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). Implementing regulations (15 CFR 924) prohibit deploying any equipment in the Sanctuary, fishing activities which involve "anchoring in any manner, stopping, remaining, or drifting without power at any time" (924.3 (a)), and "trawling" (924.3 (h)). The Sanctuary is clearly designated on all National Ocean Service (NOS) charts by the caption "protected area." This minimizes the potential for damage to the Sanctuary by fishing operations. Correspondence for this sanctuary should be addressed to: *Monitor* NMS, NOAA, Building 1519, Fort Ousts, Virginia 23604.

Gray's Reef was designated a National Marine Sanctuary in January 1981. Located 17 miles off the coast of Georgia, Gray's Reef is one of the largest nearshore sandstone reefs in the southeastern United States. The sanctuary encompasses 17 nm^2 of live-bottom habitat. Implementing regulations (15 CFR 922.90) permit recreational fishing and commercial fishing is restricted. Specifically, wire fish traps and bottom tending fishing gears (dredges, trawls etc.) are prohibited. Correspondence for this sanctuary should be addressed to: Gray's Reef Sanctuary Manager, 10 Ocean Science Circle, Savannah, Georgia 31411.

NOAA/NOS issued a proposed rule on 8 February 1991 (56 FR 5282) proposing designation under MPRSA of the Stellwagen Bank National Marine Sanctuary, in federal waters between Cape Cod and Cape May, Massachusetts. On 4 November 1992, the Sanctuary was Congressionally designated. Implementing regulations (15 CFR 940) became effective March 1994. Commercial fishing is not specifically regulated by Stellwagen Bank regulations. The regulations do however call for consultation between federal agencies and the Secretary of Commerce on proposed agency actions in the vicinity of the Sanctuary that "may affect" sanctuary resources. Correspondence for this sanctuary should be addressed to: Stellwagen Bank NMS, 14 Union Street, Plymouth, Massachusetts 02360.

The United States Congress passed the Florida Keys National Marine Sanctuary and Protection Act of 1990 designating the Florida Keys a National Marine Sanctuary. The act required NOAA to develop a comprehensive management plan with implementing regulations to govern the overall management of the Sanctuary and to protect and conserve it's resources. The Sanctuary consists of 2,800 nm^2 of coastal and oceanic waters, and the associated submerged lands surrounding the Florida Keys, extending westward to include the Dry Tortugas, but excluding the Dry Tortugas National Park. The sanctuary prohibits the taking of coral or live rock, except as permitted by the NMFS or the state of Florida. The sanctuary contains designated Sanctuary Preservation Areas and Replenishment Reserves where the taking or disturbance of sanctuary resources is prohibited. Fishing is

prohibited in these non-consumptive areas. Correspondence for this sanctuary should be addressed to Superintendent, NOAA/Florida Keys National Marine Sanctuary, P.O. Box 500368, Marathon, Florida 33050.

Details on sanctuary regulations may be obtained from the Chief, Sanctuaries and Reserves Division (SSMC4) Office of Ocean and Coastal Resource Management, NOAA, 1305 East-West Highway, Silver Spring, Maryland 20910.

6.1.3.3 Indian treaty fishing rights

No Indian treaty fishing rights are known to exist in the fishery.

6.1.3.4 Oil, gas, mineral, and deep water port development

While Outer Continental Shelf (OCS) development plans may involve areas overlapping those contemplated for offshore fishery management, no major conflicts have been identified to date. The Councils, through involvement in the Intergovernmental Planning Program of the MMS, monitor OCS activities and have opportunity to comment and to advise MMS of the Councils' activities. Certainly, the potential for conflict exists if communication between interests is not maintained or appreciation of each other's efforts is lacking. Potential conflicts include, from a fishery management position: (1) exclusion areas, (2) adverse impacts to sensitive biologically important areas, (3) oil contamination, (4) substrate hazards to conventional fishing gear, and (5) competition for crews and harbor space. The Councils are unaware of pending deep water port plans which would directly impact offshore fishery management goals in the areas under consideration, and are unaware of potential effects of offshore FMPs upon future development of deep water port facilities.

6.1.3.5 Paper work reduction act of 1995

The Paperwork Reduction Act concerns the collection of information. The intent of the Act is to minimize the Federal paperwork burden for individuals, small businesses, state and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government.

The Council proposes, through this FMP, to establish the implementation of a vessel, dealer, and operator permits. The total public reporting burdens for the time for reviewing instructions, searching existing data, collection of information and maintaining the data needed, reviewing the collection of information, and reporting requirements are estimated to be minimal (section 4).

Since this FMP proposes new reporting requirements which solicit facts from “10 or more persons,” the collection will have to be cleared through the Office of Management and Budget. The sponsor agency (NMFS) must submit an information collection budget, containing a listing of all new information collections planned for the upcoming fiscal year.

6.1.3.6 Impacts of the plan relative to federalism

The Amendment does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under Executive Order 12612.

6.1.4 State, Local, and Other Applicable Law and Policies

6.1.4.1 State management activities

This plan will apply to all states from Virginia to Maine. This includes: Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. There are currently no state management activities specific to tilefish.

6.1.4.2 Impact of federal regulations on state management activities

There are currently no state management activities specific to tilefish.

6.1.4.3 Coastal zone management program consistency

The CZM Act of 1972, as amended, provides measures for ensuring stability of productive fishery habitat while striving to balance development pressures with social, economic, cultural, and other impacts on the coastal zone. It is recognized that responsible management of both coastal zones and fish stocks must involve mutually supportive goals.

The Council must determine whether the FMP will affect a state's coastal zone. If it will, the FMP must be evaluated relative to the state's approved CZM program to determine whether it is consistent to the maximum extent practicable. The states have 45 days in which to agree or disagree with the Councils' evaluation. If a state fails to respond within 45 days, the state's agreement may be presumed. If a state disagrees, the issue may be resolved through negotiation or, if that fails, by the Secretary.

The FMP was reviewed relative to CZM programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. Letters were sent to all of the states listed along with a hearing draft of the FMP. The letters to all of the states stated that the Council concluded that the FMP would not affect the state's coastal zone and was consistent to the maximum extent practicable with the state's CZM program as understood by the Council.

The Council received responses from New Hampshire, Rhode Island, Connecticut, New Jersey, Pennsylvania, Delaware, and Virginia. Virginia, Delaware, Pennsylvania, New Jersey and New Hampshire concurred with the finding or had no objection. Rhode Island and Connecticut both expressed concern over the proposed restrictions on bottom-tending mobile gear for minimizing impacts to essential fish habitat. Fishing gear is no longer restricted because of EFH so the concerns have been alleviated.

7.0 COUNCIL REVIEW AND MONITORING OF THE FMP

The Council will monitor the fishery using the best available data, including that specified in the FMP. The commercial fishery and biological data are critical to the evaluation of the management measures implemented and those for future consideration. It is necessary that NMFS incorporate all of the data types from all tilefish fisheries into the overall NEFSC data bases. Additionally, improved stock assessments are necessary for FMP monitoring. As a result of that monitoring, the Council will determine whether it is necessary to amend the FMP.

The primary organization in the review and monitoring process will be the Tilefish FMP Monitoring Committee (section 3.1.1.6).

Two of the five initial problems for resolution (section 1.1.2) dealt with data needs in that section 1.1.2.3 states:

National Standard 2 of MSFCMA states that "measures shall be based upon the best scientific information available". The 14th NEFSC Stock Assessment Workshop noted that the weighout interview coverage of the fishery was low and that other data which would allow for detection of changes in abundance would be useful to corroborate trends observed in the abundance indices. That workshop also called for the collection of size samples from landings. These data are necessary to assess the impact and effectiveness of management measures, as well as, monitor fishing mortality and changes in stock size to determine if additional management measures for the FMP may be necessary. The most recent stock assessment (Nitschke *et al.* 1999) and the habitat background document (Steimle *et al.* 1998) identified numerous problems with the need for better data that are included in sections 2.1.2 and 2.2.7).

Section 1.1.2.5 states:

National Standard 9 requires that management plans minimize bycatch. There is currently insufficient data to determine the magnitude of this problem. Bycatch data needs to be collected especially in non directed fisheries.

Additionally, the fourth management objective (section 1.1.3) states:

Collect necessary data to develop, monitor, and assess biological, economic, and social impacts of management measures designed to prevent overfishing and to reduce bycatch in all fisheries.

In section 3.1.1.5 it is stated that:

Section 303(a)(5) of the MSFCMA requires that the Councils specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter/party fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls and the estimated processing capacity of, and actual processing capacity utilized by, United States fish processors. In order to achieve the objectives of this FMP and to manage the fishery for the maximum benefit of the United States, it is necessary that, at a minimum, the Secretary collect on a continuing basis and make available to the Council: (1) tilefish catch,

effort, and exvessel value and the catch and exvessel value of those species caught in conjunction with tilefish for the commercial fishery provided in a form that analysis can be performed at the trip, water area, gear, month, year, principal (normal) landing port, landing port for trip, and state levels of aggregation; (2) catch, effort and discards for any recreational fishery; (3) biological (e.g., length, weight, age, and sex) samples from both the commercial and recreational fisheries; and (4) annual and fully comparable NMFS bottom trawl surveys for analyses of both CPUE and age/size frequency. The Secretary may implement necessary data collection procedures through amendments to the regulations. It is mandatory that these data be collected for the entire management unit on a compatible and comparable basis.

Commercial logbooks must be submitted on a weekly basis by federal commercial permit holders in order to monitor the fishery.

It is intended that the reports required by this section are the same as the reports required by the Summer Flounder FMP, the Multispecies FMP, Dogfish FMP, and the Atlantic Sea Scallop FMP. That is, fishermen need to submit one logbook report, not one report for each FMP.

Foreign fishermen are subject to the reporting and record keeping requirements in 50 CFR 611.

The absence of age and other recent biological data was of great concern in the 1999 stock assessment and Council's Scientific and Statistical Committee that peer reviewed the assessment. Most research recommendations made by the S&S Committee and in the stock assessment (Nitschke *et al.* 1999) revolved around length, weight, and age data, including:

1. Ensure that market category distributions accurately reflect the landings.

2. Ensure that length frequency sampling is proportional to landings by market category.

3. Increase and ensure adequate length sampling coverage of the fishery.

4. Update age- and length- weight relationships.

5. Update the maturity-at-age, weight-at-age, and partial recruitment patterns.

6. Develop fork length to total length conversion factors for the estimation of total length to weight relationships.

Finally, these research recommendations are from the Steimle *et al.* (1998) habitat background document.

1. Are tilefish protogynous (size-related sex change from female to male) at pre-maturation (Dooley 1978; Idelberger 1985; Grimes *et al.* 1988)? If so, how is it affected by the social structure of a local population (sex ratio of mature fish) and how is that affected by fishing?

2. Do tilefish off southern New England leave suitable habitats during the winter and where do they go (Grimes *et al.* 1986)?

3. Assume that the boundaries of tilefish habitat are flexible and dictated by physical (sediments, shelter, temperature), biological (burrow builders, prey, competition, recruitment), and fishery (stock size, harvest intensity, and population size structure) processes. Can a probabilistic model be developed that identifies the size and shape of suitable habitat (after Warner 1986)?

4. Are adult male tilefish territorial? If so, how does the removal by the fishery of large, dominant males effect the social structure of a local population (Grimes *et al.* 1988)?

5. If vertical burrows, the primary habitat of tilefish according to Able *et al.* (1982) and Grimes *et al.* (1986), are filled with sediments because of trawling (Churchill 1989), offshore sediment disposal, or a major storm, can the burrows be cleared and reused by the tilefish? By other organisms?

6. What degree of symbiosis or mutualism exists between tilefish and other developers/users of burrow habitats (e.g., galatheid crabs) (Grimes *et al.* 1987)?

7. Do tilefish form long-term associations with individuals of the opposite sex (pair bonds) (Grimes *et al.* 1986)? How does harvesting affect the social structure and breeding of the population?

8. Peak activity and feeding in tilefish has been reported to be day (Freeman and Turner 1977) and night (Grimes *et al.* 1987). Peak activity and feeding are usually coincident (for energetic reasons) unless feeding grounds are well away from resting grounds; why the difference in conclusions?

9. The Katz *et al.* (1983) study of stock identification between the Middle and South Atlantic bights did not examine tilefish between Toms Canyon (south of Hudson Canyon) and the border between North Carolina and South Carolina. Do tilefish from Cape Hatteras (e.g., Norfolk Canyon) support separating the population into two biologically distinct stocks?

10. More information on the age structure of the population in different years are needed to improve estimates of mortality rate and to determine sexual differences in mortality rate (Turner *et al.* 1983).

11. The attributes of habitat that trigger larval tilefish settlement and juvenile transition are unknown. These are especially important for recruitment and maintenance of local, non-migratory populations.

12. The range of environmental parameters for tilefish egg survival and development are unknown.

13. Are tilefish affected by the relatively low levels of anthropogenic contaminants that are in their tissues (Steimle *et al.* 1996)?

14. Do juvenile tilefish aggregate in certain areas? If so, where and what are their characteristics (Freeman and Turner 1977)?

15. Does the oxygen minimum band on the upper slope affect tilefish distribution?

16. Is tilefish cannibalism caused by inadequate shelter habitat for small juveniles or the territoriality of adults? If so, can juvenile shelter and survival be increased artificially?

17. Do juveniles tolerate lower temperatures than adults?

8.0 LIST OF PREPARERS

This Amendment was prepared by the following members of the MAFMC staff: Dr. Thomas B. Hoff, Dr. Christopher M. Moore, Jose L. Montanez, and Valerie M. Whalon. The Tilefish Technical Team was comprised of: Dr. Hoff (Chairman) and NMFS personnel: Gary Shepherd (biology), Paul Nitschke (biology), Barbara Rountree (computer analyses and economics), Lou Chiarella (habitat), Dr. Patricia Clay (sociology), and Myles Raizin (marine mammals and policy). Other members of NMFS Habitat Division who assisted in documenting the potential gear impacts to tilefish EFH included: Peter Colosi, Timothy Goodger, and Stanley Gorski. Dr. James Kirkley (Virginia Institute of Marine Sciences) provided the majority of the economic analyses presented in this document.

9.0 AGENCIES AND ORGANIZATIONS

In preparing the Amendment, the Council consulted with the NMFS, the New England and South Atlantic Fishery Management Councils, the Fish and Wildlife Service, the Department of State, and the States of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina through their membership on the Council and the following committees - Mid-Atlantic EFH Technical Committee, Northeast Region Steering Committee, MAFMC Habitat Committee, and the MAFMC Tilefish Committee. In addition, states that are members within the management unit were also consulted through the Coastal Zone Management Program consistency process.

10.0 REFERENCES

Able, K.W., C.B. Grimes, R.A. Cooper, and J.R. Uzmann. 1982. Burrow construction and behavior of tilefish, *Lopholatilus chamaeleonticeps*, in the Hudson Submarine Canyon. Environ. Biol. Fishes 7: 199-205.

Able, K.W., C.B. Grimes, R.S. Jones, and D.C. Twichell. 1993. Temporal and spatial variation in habitat characteristics of tilefish (*Lopholatilus chamaeleonticeps*) off the east coast of Florida. Bull. Mar. Sci. 53: 1013-1026.

Aguilar, R., J. Mas, and X. Pastor. 1992. Impact of Spanish swordfish longline fisheries on logger-head sea turtle, *Caretta caretta*, population in the western Mediterranean. Presented at the 12th Annual Workshop on Sea Turtle Biology and Conservation. February 25-29 1992. Jekyll Island, GA.

Alliance for the Chesapeake Bay. 1993. Nutrients and the Chesapeake: Refining the Bay cleanup effort. 10 pp.

Alverson,, D.L., M.H. Freeberg, J.G. Pope, and S.A. Murawski. 1994. A global assessment of fisheries bycatch and discards. FAO Fish. Tech. Pap. 339:1-233.

Aschman, S.G., D. Anderson, and R.J. Croft. 1997. Challenges for Sustainable Nutrient Cycling in Watersheds. Presented at the 89th Annual Meeting, American Society of Agronomy, October 26-30, 1997, Anaheim, CA.

Auster, P.J. and R.W. Langton. 1998. The Indirect Effects of Fishing.

Auster, P.J., R.J. Malatesta, and S.C. LaRosa. 1995. Patterns of microhabitat utilization by mobile megafauna on the southern New England (USA) continental shelf and slope. Mar. Ecol. Prog. Ser. 127:77-85.

Auster, P.J., R.J. Malatesta, R.W. Langton, L. Watling, P.C. Valentine, C.L.S. Donaldson, E.W. Langton, A.N. Shepard and I.G. Babb. 1996. The impacts of mobile fishing gear on seafloor habitats in the Gulf of Maine (Northwest Atlantic): implications for conservation of fish populations. Reviews in Fisheries Science 4(2):185-202.

Auster, P.J., R.J. Malatesta, and C.L.S. Donaldson. 1997. Distributional responses to small-scale habitat variability by early juvenile hake, *Merluccius bilinearis*. *Env. Biol. Fish.* 50:195-200.

Barten, A.P. and L.J. Bettendorf. 1989. Price formation of fish: anapplication of an inverse demand system. European Economic Review. 33: 1509-1525.

Berrien, P. and J. Sibunka. In press. Distribution patterns of fish eggs in the United States northeast continental shelf ecosystem, 1977-1987. NOAA Tech. Rep. NMFS.

Best, P.B. 1979. Social organization in sperm whales, *Physeter macrocephalus*. *In*: H. Winn and B. L. Olla (Eds.). Behavior of marine animals, Vol. 3: Cetacean. Plenum Press, New York. pp. 227-289.

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish Wildl. Serv., Fish. Bull. 53 577 p.

Bigford, T.E. 1991. Sea-level rise, nearshore fisheries, and the fishing industry. Coastal Management 19:417-437.

Blaylock, R.A., J.W. Hain, L.J. Hansen, D.L. Palka, and G.T. Waring. 1995. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. NOAA Tech. Memo. NMFS-SEFSC-363. U.S. Department of Commerce, Washington, D.C. 211 p.

Bort, J. 1980. Summary of Newport, RI and Stonington, CT in small fishing ports of southern New England. University of Rhode Island Marine Bulletin #39.

Bowman, T.E. 1986. *Tridentella recava*, a new isopod from tilefish burrows in the New York Bight (Flabellifera:Tridentellidae). Proc. Biol. Soc. Wash. 99: 269-273.

Branstetter, S., and G. Burgess. 1997. Final Report. MARFIN Award NA57FF0286. Continuation of observer program to characterize and compare the directed commercial shark fishery in the eastern Gulf of Mexico and South Atlantic. May.

Bumpus, H.C. 1899. The reappearance of the tilefish. Bull. U.S. Fish Comm. XVIII: 321-333.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1989. Environmental factors and seasonal occurrence of sea turtles in Long Island, New York. *In:* Eckert, S.A., K.L. Eckert and T.H. Richardson (Compilers). Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-232. pp. 21-23.

Carr, H.A. and H. Milliken. 1998. Conservation engineering: options to minimize fishing's impacts to the sea floor, in Effects of Fishing Gear on the Sea Floor of New England. E.L. Dorsey and J. Pederson (Eds.). Conservation Law Foundation, Boston, MA.

Chang, S. 1990. Seasonal distribution patterns of commercial landings of 45 species off the northeastern United States during 1977-88. NOAA Tech. Mem. NMFS-F/NEC-78. 130 p.

Chester, A.J., J. Braun, F.A. Cross, S.P. Epperly, J.V. Merriner, and P.A. Tester. 1994. AVHRR imagery and the near real-time conservation of endangered sea turtles in the western North Atlantic. Proceedings of the WMO/IOC Technical Conference on Space-Based Ocean Observations, September, 1993 (WMO/TD-No. 649). Bergen, Norway. pp. 184-189.

Chiarella, L. Personal communication. NMFS. Gloucester, MA.

Church, T.M., C.N.K. Mooers, and A.D. Voorhis. 1984. Exchange processes over a Middle Atlantic Bight canyon. Estuarine Coastal Shelf Sci. 19: 393-411.

Churchill, J.H. 1989. The effect of commercial trawling on sediment resuspension and transport over the Middle Atlantic Bight continental shelf. Continent. Shelf Res. 9: 841-864.

Chytalo, K. 1996. Summary of Long Island sound dredging windows strategy workshop. *In*: Management of Atlantic Coastal Marine Fish Habitat: Proceedings of a Workshop for Habitat Managers. ASMFC Habitat Management Series #2.

Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. Rep. Int. Whal. Commn. 45:210-212.

Clarke, M.R. 1962. Stomach contents of a sperm whale caught off Madeira in 1959. Norsk Hvalfangst-tidende 51(5):173-191.

Clarke, M.R. 1980. Cephalapoda in the diet of sperm whales of the Southern Hemisphere and their bearing on sperm whale biology. Discovery Rep. 37:1-324.

Clay, P. Personal communication. NMFS. Woods Hole, MA.

Collie, J.S., G.A. Escanero and L. Hunke and P.C. Valentine. 1996. Scallop dredging on Georges Bank: photographic evaluation of effects on benthic fauna. ICES C.M. 1996/Mini:9.
14 p.

Collie, J.S., G.A. Escanero and P.C. Valentine, 1997. Effects of bottom fishing on the benthic megafauna of Georges bank. Mar. Ecol. Prog. Ser. 155:159-172.

Collins, J.W. 1884. History of the tilefish. U.S. Comm. Fish Fisheries Rep. Commissioner for 1882, Part X. Appendix B (XI):237-294a.

Colosi, P. Personal communication. NMFS. Gloucester, MA.

Colton, J.B., Jr. and R.R. Stoddard. 1973. Bottom-water temperatures on the continental shelf, Nova Scotia to New Jersey. NOAA Tech. Rep. NMFS Circ. 376. 55 p.

Cooper, R. A. 1974. Personal communication. NMFS, Woods Hole, MA. *In:* Freeman and Turner 1977.

Cooper, R.A. and J.R. Uzmann. 1977. Ecology of juvenile and adult clawed lobsters, Homarus americanus, Homarus gammarus, and Nephrops norvegicus - a review. In: B.F. Phillips and J.S. Cobb. (Eds.). Workshop on lobster and rock lobster, ecology and physiology. Australian Commonwealth Sci. Industrial Res. Org., Div. Fish. Oceanogr., Circ. 7: 187-208.

Cooper, R.A., P. Valentine, J.R. Uzmann, and R.A. Slater. 1987. Submarine canyons. In: R.H. Backus and D.W. Bourne. (eds.). Georges Bank. p. 52-65. MIT Press, Cambridge, MA.

Cooper, R.A., A. Shepard, P. Valentine, J.R. Uzmann, and A. Hulbert. 1987. Pre and post drilling benchmarks and monitoring data of ocean floor fauna, habitats and contaminant loads on Georges Bank and its submarine canyons. NOAA Symp. Ser. – Undersea Res. 2(2): 17-48.

Cutchin, J.H. 1998. Wanchese: the outer banks best kept secret; the outer banks of old. (http://www.talking-pages.com/villages/wanchese).

DeAlteris, J. 1998. Training Manual: Fisheries Science and Technology, prepared for the NOAA Corps Officer Program.

Ditton, R.B., B.L. Bohnsack, J.R. Stoll. 1998. A social and economic study of the winter recreational Atlantic bluefin tuna fishery in Hatteras, North Carolina. Texas A&M University.

Dooley, J.K. 1978. Systematics and biology of the tilefishes (Perciformes: Brachiostegidae and Malacanthidae), with descriptions of two new species. NOAA Tech. Rep. NMFS Circ. 411. 78 p.

Dyer, C. and R. Burroughs. 1996. Perceptions of Rhode Island oil spill. University of Colorado.

Dyer, C. and D. Griffith. 1996. An appraisal of the social and cultural aspects of the multispecies groundfish fishery in New England and the Mid-Atlantic region. NOAA contract # 50-DGNF-5-00008.

Engle, R. 1982. Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom Inflations. Econometrica. 50: 987-1008.

Erickson, D.L. and G.D. Grossman. 1986. Reproductive demography of tilefish from the South Atlantic Bight with a test for the presence of protogynous hermaphroditism. Trans. Am. Fish. Soc. 115: 279-285.

Epperly, S. P., J. Braun, A. J. Chester, F. A. Cross, J. V. Merriner, and P. A. Tester. 1995. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bull. Mar. Sci. 56(2):519-540.

Fahay, M.P. and P. Berrien. 1981. Preliminary description of larval tilefish, Lopholatilus chamaeleonticeps. *In:* R. Lasker and K. Sherman. (Eds.). The early life history of fish: Recent studies. Rapp. P.-V. Reun. Cons. Int. Explor. Mer., 1978. pp. 600-602.

Field, E. 1902. State of Rhode Island and Providence plantations at the end of the century: a history, Volume 2. Mason Publishing Co. Boston.

Flagg, C.N. 1987. Hydrographic structure and variability. *In:* R.H. Backus and D.W. Bourne. (Eds.). Georges Bank. MIT Press, Cambridge, MA. pp. 108-124.

Fletcher, J. Personal communication. North Carolina.

Foerster. Personal communication. Department of Naval Research. Annapolis, MD.

Freeman, B.L. Personal communication. NJ Fish, Game, and Wildlife. Trenton, NJ

Freeman, B.L. and S.C. Turner. 1977. Biological and fisheries data on tilefish, *Lopholatilus chamaeleonticeps* Goode and Bean. U.S. Natl. Mar. Fish. Serv., Northeast Fisheries Sci. Cent. Sandy Hook Lab. Tech. Ser. Rep. No. 5. 41 p.

Goode, G.B. 1881. Descriptions of seven new species of fishes from deep soundings on the southern New England coast, with diagnoses of two undescribed genera of flounders and a genus related to *Merlucius*. Proc. U.S. Nat. Mus. 3: 337-350.

Goode, G.B. 1884. The fisheries and fishery industries of the United States. Section I: Natural history of useful aquatic animals. Govt. Print. Office, Washington, DC.

Goodger, T. Personal communication. NMFS. Oxford, MD.

Greater Portland Council of Governments. 1991a. Portland harbor waterfront business survey summary. Portland, ME.

Greater Portland Council of Governments. 1991b. Casco Bay waterfront survey: summary of results. Portland, ME.

Griffith, D. and C. Dyer. 1996. An Appraisal of the Social and Cultural Aspects of the Multispecies Groundfish Fishery in New England and the Mid-Atlantic Regions. Report submitted by Aquirre International.

Grimes, C.B., K.W. Able and R.S. Jones. 1982. Direct observation from a submersible vessel of commercial longlines for tilefish. Trans. of Am. Fish Soc. 111(1):94-98.

Grimes, C.B., K.W. Able and R.S. Jones. 1986. Tilefish, *Lopholatilus chamaeleonticeps*, habitat, behavior and community structure in Mid-Atlantic and southern New England waters. Environ. Biol. Fishes 15: 273-292.

Grimes, C.B., K.W. Able, and S.C. Turner. 1980. A preliminary analysis of the tilefish, *Lopholatilus chamaeleonticeps*, fishery in the Mid-Atlantic Bight. Mar. Fish. Rev. 42(11):13-18.

Grimes, C.B., S.C. Turner, and K.W. Able. 1983. A technique for tagging deepwater fish. Fish. Bull. (U.S.) 81: 663-666.

Grimes, C.B., C.F. Idelberger, K.W. Able, and S.C. Turner. 1988. The reproductive biology of tilefish, *Lopholatilus chamaeleonticeps* Goode and Bean, from the United States Mid-Atlantic Bight, and the effects of fishing on the breeding system. Fish. Bull. (U.S.) 86: 745-762.

Grimes, C.B., K.W. Able, R.S. Jones, D.C. Twichell, and S.C. Turner. 1987. Studies on tilefish fishery biology, ecology and bioerosion on the Middle Atlantic and southern New England continental shelf. NOAA Symp. Ser. Undersea Res. 2(2):49-68.

Haedrich, R.L., G.T. Rowe, and P.T. Polloni. 1975. Zonation and faunal composition of epibenthic populations on the continental slope south of New England. J. Mar. Res. 33: 191-212.

Haedrich, R.L., G.T. Rowe, and P.T. Polloni. 1980. The megabenthic fauna in the deep sea south of New England, USA. Mar. Biol. 57: 165-179.

Hill, J. 1996. Environmental considerations in licensing hydropower projects: policies and practices at the federal energy regulatory commission. American Fisheries Society Symposium 16:190-199.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. (U.S.) 82: 898-903.

Hoey, J. Analysis of gear, environmental, and operating practices that influence pelagic longline interactions with sea turtles. 1998. Final report No. 50EANA700063 to the Northeast Regional Office, Gloucester, MA. 32 pp.

Hood, P.B., K.W. Able, and C.B. Grimes. 1988. The biology of the conger eel, *Conger oceanicus*, in the Mid-Atlantic Bight. I. Distribution, age, growth and reproduction. Mar. Biol. 98:587-596.

Howarth, R.W. 1991. Assessing the ecological effects of oil pollution from outer continental shelf oil development. *In*: Fisheries and Oil Development on the Continental Shelf. American Fisheries Society Symposium 11:1-8.

Hurley, J. 1958. An angler deliberately releasing a blue marlin!. New York Mirror.

Idelberger, C.F. 1985. Reproductive biology of the tilefish, Lopholatilus chamaeleonticeps, in the Middle Atlantic Bight. M.S. thesis, Rutgers Univ., New Brunswick, NJ. 51 p.

IWC. 1983. Report of the Scientific Committee. Rep. Int. Whal. Commn. Vol. 33.

Just, R.E., D.L. Hueth, and A. Schmitz. 1982. Applied welfare economics and public policy. Prentice-Hall International. London.

Katz, S.J., C.B. Grimes, and K.W. Able. 1983. Delineation of tilefish, *Lopholatilus chamaeleonticeps*, stocks along the United States east coast and in the Gulf of Mexico. Fish. Bull. (U.S.) 81: 41-50.

Kirkley, J. Personnel communication. VIMS. Gloucester Point, VA.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia Journal of Science. 38(4):329-336.

Leatherwood, S., and R.R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, California. 302 pp.

Levy, A., K.W. Able, C.B. Grimes, and P. Hood. 1988. Biology of the conger eel, *Conger oceanicus*, in the Mid-Atlantic Bight. II. Foods and feeding ecology. Mar. Biol. 98: 597-600.

Lindholm, J., M. Ruth, L. Kaufman, and P. Auster. 1998. A modeling approach to the design of marine refugia for fishery management. *In:* Linking Protected Areas With Working Landscapes. Science and Management of Protected Areas Association, Wolfville, Nova Scotia. In press.

Linton, E. 1901a. Fish parasites collected at Woods Hole in 1898. Bulletin of the United States Fish Commission. 19:267-304.

Linton, E. 1901b. Parasites of fishes of the Woods Hole region. Bull. U.S. Fish. Comm. 19: 405-492.

Low, R.A., Jr., G.F. Ulrich, and F. Blum. 1983. Tilefish off South Carolina and Georgia. Mar. Fish. Rev. 45(4-6):16-26.

Lucas, F.A. 1891. Animals recently extinct or threatened with extermination, as represented in the collections of the U.S. National Museum for the year ending June 30, 1889. pp. 647-649.

Ludwig, M. and E. Gould. 1988. Contaminant input, fate, and biological effects. *In:* Characterization of the Middle Atlantic Water Management Unit of the Northeast Regional Action Plan. U.S. Department of Commerce, NOAA, NMFS. NOAA Technical Memorandum NMFS-F/NEC-56.

Maine Department of Labor. 1995. Maine employment statistical handbook. Division of economic analysis and research. Statistical data series: SH-13. Augusta, ME.

Markle, D.F., W.B. Scott, and A.C. Kohler. 1980. New and rare records of Canadian fishes and the influence of hydrography on resident and nonresident Scotian Shelf ichthyofauna. Can. J. Fish. Aquat. Sci. 37: 49-65.

Marshall, A. 1930. Principles of economics. MacMillan and Company, Ltd. London.

Matlock, G.C., W.R. Nelson, R.S. Jones, A.W. Green, T.J. Cody, E. Gutherz, and J. Doerzbacher. 1991. Comparison of two techniques for estimating tilefish, yellowedge grouper and other deepwater fish populations. Fish. Bull. (U.S.) 89: 91-99.

Mayer, L.M., D.F. Schick, R.H. Findlay and D.L. Rice, 1991. Effects of commercial dragging on sedimentary organic matter. Mar. Environ. Res 31:249-261.

McCay, B.J., B. Blinkoff, R. Blinkoff, and D. Bart. 1993. Report, part 2, phase I, fishery impact management project, to the MAFMC. Dept. of Human Ecology, Cook College, Rutgers Univ., New Brunswick, N.J. 179 p.

McHugh, J.L. 1977. Fisheries and fishery resources of the New York Bight. NOAA Tech. Rep. NMFS Circ. 401. 50 p.

Mid-Atlantic Fishery Management Council (MAFMC). 1990. Ocean Disposal Policy. Dover, DE.

Mid-Atlantic Regional Marine Research Program (MARMRP). 1994. Mid-Atlantic Research Plan. University of MD. College Park, MD. 163 p.

Morse, W.W. 1981. Length, weight, spawning, and fecundity of the tilefish, *Lopholatilus chamaeleonticeps*, from New Jersey waters. U.S. Natl. Mar. Fish. Serv., Northeast Fish. Sci. Cent. Sandy Hook Lab. Rep. 81-02.

Moyle, P.B. 1991. AFS Position Statement - Ballast Water Introductions. Fisheries 16(1):4-6.

Musick, J.A., R. Byles, R.E. Klinger, and S. Bellmund. 1984. Mortality and behavior of sea turtles in the Chesapeake Bay, Summary Report to NMFS for 1979 through 1983. Contract No. NA80FAC00004. Virginia Institute of Marine Science, Gloucester Point, Virginia.

Murphy, M. 1995. Forestry impacts on freshwater habitat of anadromous salmonids in the Pacific Northwest and Alaska – requirements for protection and restoration. U.S. Dept. of Commerce, NOAA Coastal Ocean Office.

National Marine Sanctuary Program. 1993. Marine Sanctuary. Volume 1, No. 1. 20 p.

NMFS. 1996. NMFS gravel extraction policy. National Marine Fishery Service and Office of Habitat Conservation and Assessment, National Ocean Service. Office of Habitat.

NMFS. 1995. Endangered Species Act section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. September 15.

NMFS. 1998. Reinitiation of Consultation on the Atlantic Pelagic Fisheries for Swordfish, Tuna, Shark and Billfish in the U.S. Exclusive Economic Zone (EEZ): Proposed Rule to Implement the Final Highly Migratory Species Fishery Management Plan, including Bluefin Tuna Addendum and Amendment 1 to the Billfish Fishery Management Plan. Biological Opinion.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland.

Nelson, W. R. and J.S. Carpenter. 1968. Bottom longline explorations in the Gulf of Mexico. A report on "Oregon II's" first cruise. Comm. Fish. Rev. 30(10):57-62.

New Jersey Department of Agriculture. 1995. The status and condition of New Jersey's marine fisheries and seafood industries. Trenton, NJ.

Nitschke, P. Personal communication. NMFS. Woods Hole, MA.

Nitschke, P., G. Shepherd, and M. Terceiro. 1999. Assessment of tilefish in the middle Atlantic - southern New England region. 12 p.

Nolan, L. Personal communication. Montauk, NY.

NEFSC. 1993. Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW). Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. USDC, NOAA, NMFS, Woodshole, MA.

O'Brien, L., J. Burnett, and R.K. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Tech. Rep. NMFS 113. 66 p.

Olsen, S.B. and D.K. Stevenson. 1975. Commercial marine fish and fisheries of Rhode Island. Marine Technical Report 34. University of Rhode Island.

OTA (Office of Technology Assessment). 1987. Wastes in Marine Environments. OTA Pub. OTA-O-335.

Parker, R.O. and R.W. Mays. 1998. Southeastern U.S. deepwater reef fish assemblages, habitat characteristics, catches, and life history summaries. NOAA Tech. Rep. NMFS 138. 41 p.

Pearson, J.C. 1932. Winter trawl fishery off the Virginia and North Carolina coasts. U.S. Dep. Commer., Bur. Fish. Investig. Rep. No. 10. 31 p.

Pelligrino, J. Personal communication. NMFS. New Jersey.

Poggie, J. and C. Gersuny. 1974. Fishermen of Galilee, Narragansett, RI. University of Rhode Island Marine Advisory Service.

Rader, D. Personal communication. Environmental Defense Fund. Raleigh, NC.

Raizin, M. Personal communication. NMFS. Gloucester, MA.

Reid, R., F. Almeida, and C. Zetlin. 1998. Essential fish habitat source document: Fishery surveys, data sources, and methods. NOAA Tech. Mem. NMFS-NE. 39 p.

Reiswig, H.M. 1973. Population dynamics of three Jamaican Demspongiae. Bull. Mar. Sci. 23:191-226.

Rhodes, R.J. 1995. Ghost traps, the silent killers have moved north. Outdoor Life. February 1995. p. 83.

Rountree, B. Personal communication. NMFS. Woods Hole, MA.

Safina, C. 1994. Personal communication. National Audubon Society. Islip, NY.

Safina, C., J. Burger, M. Gochfeld, and R.H. Wagner. 1988. Evidence for prey limitation of common and Roseate tern reproduction. The Condor. 90: 852-859.

Safina, C., R.H. Wagner, D.A. Witting and K.J. Smith. 1990. Prey delivered to roseate and common tern chicks: composition and temporal variability. J. Field Ornithol. 61(3):331-338.

Schaefer, R.H. 1995. Memorandum on NMFS Policy of Risk Aversion in Face of Uncertainty.

Schmitz, W.J., T.M. Joyce, W.R. Wright, and N.G. Hogg. 1987. Physical oceanography. *In:* J.D. Milliman and W.R. Wright. (eds.). The marine environment of the U.S. Atlantic continental slope and rise. Jones and Bartlett Publishers, Inc., Boston, MA. pp. 27-55.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetol. Monogr. 6:43-67.

Shepherd, G. Personal communication. NMFS. Woods Hole, MA.

Shepherd, G. 1995. Tilefish. In: Conservation and Utilization Division, Northeast Fisheries Science Center. (eds.). Status of the fishery resources off the northeastern United States for 1994. NOAA Tech. Mem. NMFS/NE-108. pp. 96-97.

Shumway, C.R., R.D. Pope, and E.K. Nash. 1984. Allocatable fixed inputs and jointness. American Journal of agricultural Economics. 66: 72-78.

Smith, H.M. 1905. Report on the inquiry respecting food fishes and the fishing-grounds. U.S. Commission of Fish and Fisheries, Report of the Commissioner for the year ending June 30, 1903, part 19. pp.17-51.

Smith, E.M., M.A. Alexander, M.M. Blake, L. Gunn, P.T. Howell, M.W. Johnson, R.E. MacLeod, R.F. Sampson, Jr., D.G. Simpson, W.H. Webb, L.L. Stewart, P.J. Auster, N.K. Bender, K. Buchholz, J. Crawford, and T.J. Visel. 1985. A study of lobster fisheries in the Connecticut waters of Long Island Sound with special reference to the effects of trawling on lobsters. Connecticut Department of Environmental Protection, Marine Fisheries Program, Hartford, Connecticut.

Stanley, D.J. 1971. Fish-produced markings on the outer continental margin east of the Middle Atlantic States. J. Sediment. Petrol. 41:159-170.

Stansby, M.E. 1963. Industrial Fishing Technology. Reinhold Publishing Corp., New York, NY. 393 pp.

Steimle, F.W. Personal communication. NMFS. Sandy Hook, NJ.

Steimle, F.W. and C. J. Sindermann. 1978. Review of oxygen depletion and associated mass mortalities of shellfish in the Middle Atlantic Bight in the 1976. NMFS. Mar. Fish. Reve. 40(12):17-25.

Steimle, F., D. Gadbois, S. Chang, G. Sennefelder, and R. Greig. 1996. Organic and metallic contaminants in tissues of tilefish Lopholatilus chamaeleonticeps Goode and Bean and sewage sludge disposal at the 106-mile dumpsite. J. Mar. Env. Eng. 3: 227-246.

Steimle, F.D, C. Zetlin, P. Berrien, D. Johnson, S. Chang, and the Essential Fish Habitat Information Team. 1998. Tilefish ("golden") *Lopholatilus chamaeleonticeps* Goode and Beane 1879: life history and habitat use in the northeast. NMFS, NEFSC, Highlands, NJ.

Stillwell, C.E. and N.E. Kohler. 1992. Food habits of the sandbar shark Carcharhinus plumbeus off the U.S. northeast coast, with estimates of daily ration. Fish. Bull. (U.S.) 91: 138-150.

Sulak, K.J. and S.W. Ross. 1996. Lilliputian bottom fish fauna of the Hatteras upper middle continental slope. J. Fish Biol. 49 (Suppl. A):91-113.

Suffolk County Department of Health Services. 1998. Brown Tide Fact Sheet. Office of Ecology.

Suffolk County Department of Labor. 1999. Suffolk County 1997-1998 employer survey. Smithtown, NY.

Theroux, R.B. and R.L. Wigley. 1998. Quantitative composition and distribution of the macrobenthic invertebrate fauna of the continental shelf ecosystems of the northeastern United States. NOAA Tech. Report. NMFS 140. 240 p.

Thorne-Miller, B. and J. Catena. 1991. The Living Ocean. Island Press. Washington, D.C.

Thrush, S.F., V.J. Cummings, J.E. Hewitt, P.K. Dayton, S.J. Turner, G. Funnell, R. Budd, C. Milburn, and M.R. Wilkinson. In press. Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. Ecol. Appl.

Turner, S.C. 1986. Population dynamics of and, impact of fishing on, tilefish, Lopholatilus chamaeleonticeps, in the Middle Atlantic-southern New England region during the 1970's and early 1980's. Ph.D. dissertation, Rutgers Univ., New Brunswick, NJ. 289 p.

Turner, S.C., C.B. Grimes, and K.W. Able. 1983. Growth, mortality, age/size structure of the fisheries for tilefish, *Lopholatilus chamaelonticeps*, in the Middle Atlantic-southern New England Region. Fish. Bull. (U.S.) 81:751-763.

Twichell, D.C., C.B. Grimes, R.S. Jones, and K.W. Able. 1985. The role of erosion by fish in shaping topography around Hudson Submarine Canyon. J. Sediment. Petrol. 55: 712-719.

U.S. Department of Commerce (USDC). 1985. Regional action plan: northeast regional office and northeast fisheries center. *In*: NOAA. NMFS. Tech. memo. F/NEC-37. 20 p.

USDC. 1993. Our living oceans. NOAA Tech. Memo. NMFS-F/SPO-15. 156 p.

USDC. 1996. NMFS Habitat Conservation Program. NMFS, Silver Spring, MD.

USDC. 1997a. Technical guidance manual for implementation of essential fish habitat.

USDC. 1997b. Four hundred years of Arctic data provide insight into climate change. 2 p.

USDC. 1998. Draft Technical Guidance Manual to NMFS Implementing the Essential Fish Habitat Requirements for the Magnuson-Stevens Act. NOAA, NMFS, Office of Habitat Conservation, Silver Spring, MD.

U.S. Environmental Protection Agency (USEPA). 1993. Guidance for specifying management measures for sources of nonpoint pollution in coastal waters. Office of Water. 840-B-92-002. 500 p.

U.S. Geological Survey. 1997. News Release - What we know so far...Nutrients, Ground Water, and the Chesapeake Bay - A Link with Pfiesteria? Office of outreach, Reston, VA.

University of Rhode Island (URI). 1982. A characterization of marine mammals and turtles in the Mid and North Atlantic areas of the US outer continental shelf. Final Report. Prepared for USDI under contract #AA551-CT8-48.

Valentine, P.C., J.R. Uzmann, and R.A. Cooper. 1980. Geology and biology of Oceanographer Submarine Canyon. Mar. Geol. 38: 283-312.

Valentine, P.C. and E.A. Schmuck. 1995. Geological mapping of biological habitats on Georges Bank and Stellwagen Bank, Gulf of Maine region. p. 31-40. In: Applications of side-scan sonar and laser-line systems in fisheries research. Alaska Department of Fish and Game, Special Publication No. 9.

Verrill, A.E. 1882. Notice of remarkable marine fauna occupying the southern coast of New England and some additions to the fauna of Vineyard Sound. Am. J. Sci. 24(3):360-371.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fish. Oceanogr. 2(2):101-105.

Waring, G.T., D.L. Palka, P.J. Clapham, S. Swartz, M.C. Rossman, T.V.N. Cole, K.D. Bisack, and L.J. Hansen. 1999. U.S. Atlantic marine mammal stock assessments- 1998. NOAA Tech. Memo. NMFS-NE-116. U.S. Department of Commerce, Washington, D.C. 182 pp.

Warme, J.E., R.A. Slater, and R.A. Cooper. 1977. Bioerosion in submarine canyons. *In:* D.J. Stanley and G. Keiling (Eds.), Submarine canyon, fan, and trench sedimentation. Dowden, Hutchinson, and Ross, Stroudsburg, PA. pp. 65-70.

Warner, L.S. 1986. Delineation of marine habitat: a study of spatial error. Ph.D. dissertation, Rutgers Univ. New Brunswick, NJ. 170 p.

Warner, L.S., K.W. Able, and C.B. Grimes. 1983. A methodology for delineating marine fish habitat on the Mid-Atlantic outer continental shelf. Bull. Coast. Soc. 7(3-4):8-11.

Watkins, W.A., K.E. Moore, J. Sigurjónsson, D. Wartzok, and G.N. DI Sciara. 1984. Fin whale (*Balaenoptera physalus*) tracked by radio in the Irminger Sea. Rit Fiskideildar. 8(1):1-14.

Watling, L. and E.A. Norse. MS1997. Physical disturbance of the sea bottom by mobile fishing gear: a comparison with forest clear-cutting. (Submitted to Conservation Biology).

Wigley, R.L. and R.B. Theroux. 1981. Atlantic continental shelf and slope of the United States – macrobenthic invertebrate fauna of the middle Atlantic Bight region – faunal composition and quantitative distribution. U.S. Geol. Surv. Prof. Pap. 529-N. 198p.

Williams, A.B. 1988. Notes on decapod and euphausiid crustaceans, continental margin, western Atlantic, Georges Bank to western Florida, USA. Fish. Bull. (U.S.) 86:67-76.

Wilson, D. 1999. Social and cultural impact assessment of the highly migratory species fisheries management plan and the amendment to the Atlantic billfish fisheries management plan. NMFS. Washington.

Witman, J.D. and K.P. Sebens. 1985. Distribution and ecology of sponges at a subtidal rock ledge in the central Gulf of Maine. p. 391-396 In: K. Rutzler (ed.) New Perspectives in Sponge Biology. Smithsonian Institution Press, Washington, D.C.

Witman, J.D., J.J. Leichter, S.J. Genovese, and D.A. Brooks. 1993. Pulsed phytoplankton supply to the rocky subtidal zone: influence of internal waves. Proc. Nat. Acad. Sci. U.S. 90:1686-1690.

Witzell, W.N. 1999. Distribution and relative abundance of sea turtles caught incidentally by the U.S. pelagic longline fleet in the western North Atlantic Ocean, 1992-1995. Fisheries Bulletin. 97:200-211.

Zetlin, C. Personal communication. NMFS. Sandy Hook, NJ.

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Table 1. Commercial U.S. Tilefish Landings (Thousands of Pounds) from Maine to Virginia, 1949-1998.

YEAR	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	TOTAL	PERCENT
1949	-	-	201	33	38	914	49	-	*	3	1,238	0.97%
1950	-	-	956	201	45	1,047	111	-	-	44	2,404	1.87%
1951	-	-	1,130	454	131	448	96	-	-	16	2,275	1.77%
1952	-	-	984	447	218	377	90	-	*	10	2,126	1.66%
1953	-	-	2,116	650	117	212	75	-	-	2	3,172	2.47%
1954	-	-	1,881	1,067	34	399	105	-	-	2	3,488	2.72%
1955	-	-	1,926	1,181	67	309	104	-	-	6	3,593	2.80%
1956	-	-	837	493	2	175	49	-	-	4	1,560	1.22%
1957	-	-	240	144	-	123	41	-	-	8	556	0.43%
1958	-	-	1,093	214	-	89	82	-	-	3	1,481	1.15%
1959	-	-	394	335	-	66	26	-	*	16	837	0.65%
1960	-	-	1,193	1,019	-	78	45	-	-	11	2,346	1.83%
1961	-	-	357	285	*	102	82	-	-	29	855	0.67%
1962	-	-	61	68	-	125	92	-	*	25	371	0.29%
1963	-	-	93	101	-	28	31	-	-	14	267	0.21%
1964	-	-	226	935	1	82	67	-	-	3	1,314	1.02%
1965	-	-	234	1,053	-	45	19	-	-	3	1,354	1.06%
1966	-	-	28	806	3	121	6	-	-	*	964	0.75%
1967	-	-	4	60	-	18	18	-	-	10	110	0.09%
1968	-	-	3	50	-	6	7	-	-	*	66	0.05%
1969	-	-	4	29	-	10	23	-	-	*	66	0.05%
1970	-	-	17	79	-	7	22	-	-	3	128	0.10%
1971	-	-	1	46	-	55	33	-	-	3	138	0.11%
1972	-	-	4	6	-	12	244	-	-	*	266	0.21%
1973	-	-	113	38	-	7	711	-	-	*	869	0.68%
1974	*	-	358	47	-	49	838	-	-	-	1,292	1.01%
1975	-	-	383	222	-	5	956	-	-	-	1,566	1.22%
1976	-	-	468	123	-	50	1,584	-	-	-	2,225	1.74%

Table 1 (Continued). Commercial U.S. Tilefish Landings (Thousands of Pounds) from Maine to Virginia, 1949-1998.

YEAR	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	TOTAL	PERCENT
1977	-	-	186	780	-	691	2,933	-	-	-	4,590	3.58%
1978	-	-	210	643	*	2,137	4,189	-	-	*	7,179	5.60%
1979	-	-	50	953	-	3,010	4,735	-	-	-	8,748	6.82%
1980	-	-	3	192	*	3,199	5,176	-	3	*	8,573	6.69%
1981	-	-	13	277	2	2,830	4,592	-	-	*	7,714	6.02%
1982	12	-	11	93	-	1,418	2,840	-	12	*	4,386	3.42%
1983	-	1	27	15	1	1,860	2,208	-	25	*	4,137	3.23%
1984	-	-	2	11	-	2,412	1,980	-	24	1	4,430	3.45%
1985	5	-	22	457	-	2,113	1,713	-	8	6	4,324	3.37%
1986	6	-	3	403	-	2,371	1,515	-	1	1	4,300	3.35%
1987	-	-	15	593	10	4,401	2,037	-	1	18	7,075	5.52%
1988	*	-	72	222	3	1,914	778	-	2	9	3,000	2.34%
1989	*	-	2	62	-	550	384	-	3	-	1,001	0.78%
1990	16	-	16	43		1,335	512	-	4	*	1,926	1.50%
1991	9	-	2	41	-	1,588	978	-	2	-	2,620	2.04%
1992	17	-	6	321	-	2,124	1,189	-	-	1	3,658	2.85%
1993	129	-	31	608	9	2,210	1,069	-	-	2	4,058	3.16%
1994	55	-	5	111	-	1,278	280	-	-	-	1,729	1.35%
1995	18	-	1	63	2	1,214	166	-	-	-	1,464	1.14%
1996	13	-	-	195	11	2,022	243	-	2	-	2,486	1.94%
1997	29	-	-	143	8	3,293	432	-	-	-	3,905	3.05%
1998	31	-	8	508	-	1,801	313	-	*	*	2,661	2.08%
TOTAL	309	1	15,982	16,412	702	48,929	45,555	0	87	253	128,230	100.00%
PERCENT	0.24%	0.00%	12.46%	12.80%	0.55%	38.16%	35.53%	0.00%	0.07%	0.20%	100.00%	
MEAN	5.62	0.02	290.58	298.40	12.76	889.62	828.27	0.00	1.58	4.60		

Note: * = less than 1,000 pounds; - = no landings.

Source: 1949-1992 USDC. 1994-1998 State and Federal reported landings.

Table 2. Commercial landings ('000 lbs.) of tilefish by month by state, 1989-1998 combined.

	MONTH												
	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	ALL
STATE													
ME	8	15	47	118	77	18	5	3	6	4	5	9	315
NH	*	*	*	*	*	*	*	0	0	0	0	0	0
MA	3	22	32	6	2	2	*	*	*	*	*	*	67
RI	299	608	523	188	87	63	59	36	16	73	95	90	2137
CT	7	5	2	3	*	*	*	*	*	*	*	1	18
NY	1475	1662	1722	1771	1639	1389	1153	1282	1204	1489	1268	1521	17575
NJ	388	500	683	724	795	574	297	327	261	346	360	313	5568
MD	0	0	2	*	2	*	*	*	*	4	*	*	8
VA	*	*	2	*	*	*	*	0	0	*	0	*	2
ALL	2180	2812	3013	2810	2602	2046	1514	1648	1487	1916	1728	1934	25690
Quarter %		31			29			18			22		

Source: State and Federal reported landings.

Note: ✖ = less than 1,000 pounds.

Table 3. Ten year rebuilding schedule projections assuming a TAL of 1,995,000 lbs and a 50% probability of reaching B_{MSY} in 10 years with the assumption that industry voluntarily cuts back 1999 harvest. B_{msy} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.312	1,995
1	2000	6,574	0.292	1,995
2	2001	7,070	0.270	1,995
3	2002	7,723	0.245	1,995
4	2003	8,572	0.219	1,995
5	2004	9,652	0.193	1,995
6	2005	10,990	0.169	1,995
7	2006	12,593	0.148	1,995
8	2007	14,442	0.129	1,995
9	2008	16,486	0.114	1,995
10	2009	18,636	1,995	1,995

Source: Nitschke pers. comm.

Table 4. Rebuilding schedule assuming the status quo F (0.45).

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.454	2,509
2	2001	5,329	0.454	2,337
3	2002	4,974	0.454	2,186
4	2003	4,661	0.454	2,052
5	2004	4,383	0.454	1,933
6	2005	4,136	0.454	1,826
7	2006	3,911	0.454	1,730
8	2007	3,710	0.454	1,643
9	2008	3,527	0.454	1,563
10	2009	3,360	0.454	1,491

Source: Nitschke pers. comm.

Table 5. ASPIC model results for tilefish for Days Fished (DF1) and Days Absent (DA2) runs. Bootstrap estimates from 500 iterations are given for the DA2 run. DF1 run used DF1 and Turner's CPUE series as tuning indices. DA2 run used DA2 and Turner's CPUE series as tuning indices.

	DF1	DA2 1998 Bootstrap Run		
		original estimate	Bias corrected	Relative Inter-quartile range
r^2 (DF1 or DA1)	0.70	0.74		
r^2 square (Turner)	0.48	0.51		
B-ratio coverage	1.74	1.69		
B1-ratio	2.008	2.010	2.019	0.063
MSY (live, lbs)	4,489	4,162	3,997	0.199
r	0.54	0.45	0.41	0.496
K (lbs)	33,135	37,258	38,294	0.296
q (DF1 or DA1)	0.300	0.222	0.209	0.444
q (Turner's)	0.010	0.009	0.008	0.374
B_{MSY} (live, lbs)	16,570	18,625	19,147	0.296
F_{MSY} (Biomass weighted)	0.27	0.22	0.21	0.496
B_{97}	6,810	7,397		
F_{97} (Biomass weighted)	0.59	0.54		
B_{98}		6,473		
F_{98} (Biomass weighted)		0.45		

Source: Nitschke pers. comm.

Table 6. Total weighout and dealer landings of tilefish and CPUE standardization based on GLM incorporating year and vessel effects for the Days Fished (DF1) and Days Absent (DA2) CPUE series. Turner's CPUE series (1986) was calculated as kg/tubs fished from logbooks maintained by fishermen in Barnegat, NJ.

	Dealer Landings				
Year	Longlinee	Total	Turner	DF1	DA2
1973	370	394	0.206		
1974	531	586	0.135		
1975	588	710	0.096		
1976	950	1,010	0.114		
1977	1,772	2,082	0.125		
1978	2,938	3,257	0.132		
1979	3,362	3,968	0.100	3.26	2.79
1980	3,794	3,889	0.091	3.04	2.71
1981	3,366	3,499	0.090	3.01	2.61
1982	1,935	1,990	0.051	1.95	1.59
1983	1,857	1,876		1.45	1.04
1984	2,003	2,009		1.00	1.00
1985	1,929	1,961		1.00	0.89
1986	1,874	1,950		1.15	1.08
1987	3,029	3,210		1.50	1.27
1988	1,319	1,361		0.96	0.74
1989	421	454		0.75	0.63
1990	852	874		0.89	0.68
1991	1,164	1,189		0.68	0.62
1992	1,497	1,653		0.77	0.80
1993	1,597	1,838		0.63	0.73
1994	764	786		0.39	0.46
1995	617	666		0.57	0.53
1996	1,017	1,129		1.02	0.69
1997	1,699	1,810		1.64	1.17
1998	1,179	1,333		----	0.67

Note: 1 metric ton (mt)=2,205 pounds

Source: Nitschke pers. comm.

Table 7. Days Absent (DA2) subset in landed mt. Data from 1977 to the first half of 1994 are from the weighout system, while data from the second half of 1994 to 1998 are from the dealer and VTR system (below the dotted line). DA2 subset are limited to longline trips which target tilefish where days absent (DA) is greater than 1. Nominal CPUE series are calculated from days absent (DA), trips, and days absent minus trips (DA2) using the DA2 subset. DA2 estimates are slightly off in 1984-1988 due to rounding error on split trips (trips < 1).

Year	No. of Vessels	Subset Landings	DA	No. of Trips	DA2	DA CPUE	Trips CPUE	DA2 CPUE
1977	4	66	43	11	32	1.53	5.96	2.05
1978	19	1,749	2,021	366	1,655	0.87	4.78	1.06
1979	20	1,837	1,257	400	857	1.46	4.59	2.14
1980	18	1,975	1,390	396	994	1.42	4.99	1.99
1981	21	1,808	1,262	333	929	1.43	5.43	1.95
1982	18	1,171	1,284	231	1,053	0.91	5.06	1.11
1983	21	929	1,451	179	1,272	0.64	5.19	0.73
1984	21	809	1,264	150	1,115	0.64	5.41	0.73
1985	25	864	1,685	227	1,458	0.51	3.80	0.59
1986	23	704	1,186	188	998	0.59	3.75	0.71
1987	30	931	1,343	206	1137	0.69	4.52	0.82
1988	24	388	848	156	692	0.46	2.48	0.56
1989	11	154	409	80	329	0.38	1.93	0.47
1990	11	219	536	66	471	0.41	3.34	0.46
1991	7	815	1,922	214	1,708	0.42	3.81	0.48
1992	13	538	969	105	864	0.56	5.13	0.62
1993	10	524	959	105	854	0.55	4.99	0.61
1994	7	117	385	42	343	0.30	2.78	0.34
1994	4	24	76	9	67	0.32	2.69	0.36
1995	4	480	970	95	875	0.50	5.06	0.55
1996	7	589	1,036	105	931	0.57	5.61	0.63
1997	5	936	947	95	852	0.99	9.85	1.10
1998	8	704	1,153	121	1,032	0.61	5.82	0.68

Note: 1 metric ton (mt)=2,205 pounds

Source: Nitschke pers. comm.

Table 8. Parameters of the von Bertalanffy growth formula for female, male and all tilefish combined in 1978, 1982, and 1977 - 1982. Data for males in 1982 were not analyzed, because no males over age 12 were sexed by examining their gonad in that year.

Year	Sex	n	L_o	K	t_o
1978	Females	291	90.239	0.153	0.026
1978	Males	232	111.337	0.130	0.213
1978	All	674	97.624	0.162	0.742
1982	Females	144	86.249	0.153	0.272
1982	All	377	91.424	0.161	0.707
1977-82	Females	822	85.759	0.180	0.671
1977-82	Males	686	113.680	0.121	0.254
1977-82	All	1,949	92.296	0.174	0.796

Note: Values expressed in metric. Divide cm by 2.54 to convert to inches.

Source: Turner 1986.

Table 9. Functional regressions (Ricker 1973) of the natural logs (ln) of weight (g) on fork length (cm) for male, female, and all tilefish combined. Sex specific formulae for eviscerated weight are not given, because they were not significantly different. Sample size is n and r^2 is the coefficient of determination of the least squares regression.

Sex	n	r^2	Functional Regression
		Whole Weight	
All	857	0.983	lnWT = -5.3992 + (3.2835 x lnFL)
Male	360	0.988	lnWT = -5.3841 + (3.2761 x lnFL)
Female	470	0.977	lnWT = -5.5166 + (3.3151 x lnFL)
		Eviscerated Weight	
All	789	0.979	lnWT = -5.4601 + (3.2979 x lnFL)

Note: Values expressed in metric. Multiply kg by 2.205 to obtain lbs and divide cm by 2.54 to convert to inches.

Source: Turner 1986.

Table 10. Food items of tilefish (*Lopholatilus chamaeleonticeps*) in the Middle Atlantic Bight.

MOLLUSCA (mollusks)
Gastropoda (univalve mollusks)
Unidentified
Pelecypoda = Bivalvia (bivalve mollusks)
Protobranchia
Nuculanidae
Naculana acuta
Pteroconchidae
Mytilidae
Musculus discors
Pectinidae
Cyclopecten nanus
Eudesmodontida
Pandoridae
Pandora inflata
Cephalopoda (squids, octupuses)
Unidentified

ANNELIDA (segmented worms)
Polychaeta (sandworms, tube worms)
Eunicida
Lumbrinereidae
Unidentified

ARTHROPODA (joint-footed animals)
Crustacea (crabs, barnacles, lobsters)
Stomatopoda
Lysiosquillidae
Heterosquilla armata
Isopoda
Cirolanidae
Cirolana polita
Unidentified isopoda
Decapoda
Crangonidae
Crangon septemspinosa
Nephropsidae
Homarus americanus
Galatheidae
Munida iris
Paguridae
Catapagurus sherreri
Calappidae
Acanthocarpus alexandri
Majidae
Euprognatha rastellifera
Callodes robustus
Cancridae
Cancer borealis
Cancer irroratus
Cancer sp.
Unidentified decapods
Unidentified crustaceans

ECHINODERMATA (echinoderms)
Stelleroides = Asteroidea (starfishes)
Unidentified
Ophiuroida (brittle stars)
Ophiurida
Amphiuridae
Axiognathus squamata
Amphiura centiculata

CHORDATA (chordates)
Tunicata = Urochordata (tunicates)
Ascidiacea (ascidians)
Unidentified ascidian
Agnathostomata
Agnatha (jawless fishes)
Myxinidae
Myxine glutinosa (Atlantic hagfish)
Gnathostomata (jawed vertebrates)
Chondrichthyes (cartilaginous fishes)
Squalidae
Squalus acanthias – spiny dogfish
Osteichthyes (bony fishes)
Clupeidae
Brevoortia tyrannus – Atlantic menhaden
Clupea harengus – Atlantic herring
Myctophidae
Ceratoscopelus maderensis – "lantern fish"
Congridae
Conger oceanicus – conger eel
Ophichtidae
Omochelys cruentifer – snake eel
Gadidae
Merluccius albidus – offshore hake
Serranidae
Protogrammus aureorubens – streamer bass
Branchiostegidae
Lopholatilus chamaeleonticeps - tilefish
Scombridae
Scomber scombrus – Atlantic mackerel
Scorpaenidae
Helicolenus dactylapterus – blackbelly rosefish
Ammodytidae
Ammodytes americanus – American sand lance
Stromateidae
Poronotus triacanthus - butterfish
Peuronectidae
Paralichthys oblongus – fourspot flounder
Limanda ferruginea – yellowtail flounder
Lophiidae
Lophius americanus - goosefish

SIPUNCULOIDEA (peanut worms)
Unidentified

Source: Freeman and Turner 1977.

Table 11. Ten year rebuilding schedule projections assuming a TAL of 1,412,000 lbs and a 75% probability of reaching B_{MSY} in 10 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.229	1,412
2	2001	6,623	0.196	1,412
3	2002	7,809	0.165	1,412
4	2003	9,341	0.137	1,412
5	2004	11,252	0.114	1,412
6	2005	13,530	0.095	1,412
7	2006	16,098	0.081	1,412
8	2007	18,825	0.070	1,412
9	2008	21,537	0.062	1,412
10	2009	24,074	0.056	1,412

Source: Nitschke pers. comm.

Table 12. Eight year rebuilding schedule projections assuming a TAL of 1,422,000 lbs and a 50% probability of reaching B_{MSY} in 8 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.231	1,422
2	2001	6,612	0.198	1,422
3	2002	7,782	0.167	1,422
4	2003	9,297	0.139	1,422
5	2004	11,186	0.116	1,422
6	2005	13,442	0.097	1,422
7	2006	15,992	0.082	1,422
8	2007	18,706	0.071	1,422

Source: Nitschke pers. comm.

Table 13. Eight year rebuilding schedule projections assuming a TAL of 1,003,000 lbs and a 75% probability of reaching B_{MSY} in 8 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.157	1,003
2	2001	7,099	0.126	1,003
3	2002	8,893	0.100	1,003
4	2003	11,155	0.080	1,003
5	2004	13,856	0.065	1,003
6	2005	16,876	0.054	1,003
7	2006	20,025	0.046	1,003
8	2007	23,060	0.041	1,003

Source: Nitschke pers. comm.

Table 14. Ten year rebuilding schedule projections assuming a TAL of 1,760,000 lbs and a 50% probability of reaching B_{MSY} in 10 years with the assumption that industry voluntarily cuts back 1999 harvest. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5.734	0.295	1,760
2	2001	6,217	0.269	1,760
3	2002	6,865	0.241	1,760
4	2003	7,725	0.213	1,760
5	2004	8,841	0.185	1,760
6	2005	10,249	0.159	1,760
7	2006	11,969	0.136	1,760
8	2007	13,982	0.117	1,760
9	2008	16,230	0.101	1,760
10	2009	18,609	0.089	1,760

Source: Nitschke pers. comm.

Table 15. Ten year rebuilding schedule projections assuming a TAL of 1,719,000 lbs and a 75% probability of reaching B_{MSY} in 10 years with the assumption that industry voluntarily cuts back 1999 harvest. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.263	1,719
1	2000	6,898	0.234	1,719
2	2001	7,815	0.205	1,719
3	2002	9,004	0.176	1,719
4	2003	10,498	0.151	1,719
5	2004	12,311	0.129	1,719
6	2005	14,416	0.110	1,719
7	2006	16,744	0.096	1,719
8	2007	19,176	0.084	1,719
9	2008	21,574	0.076	1,719
10	2009	23,810	0.069	1,719

Source: Nitschke pers. comm.

Table 16. Rebuilding schedule assuming no fishing after 1999. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0	0
2	2001	8,250	0	0
3	2002	11,468	0	0
4	2003	15,278	0	0
5	2004	19,403	0	0
6	2005	23,457	0	0
7	2006	27,073	0	0
8	2007	30,027	0	0
9	2008	32,276	0	0
10	2009	33,907	0	0

Source: Nitschke pers. comm.

Table 17. Eight year rebuilding schedule projections assuming a constant F=0.134 and a 50% probability of reaching B_{MSY} in 8 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.134	870
2	2001	7,253	0.134	1,090
3	2002	8,995	0.134	1,336
4	2003	10,911	0.134	1,601
5	2004	12,928	0.134	1,874
6	2005	14,947	0.134	2,140
7	2006	16,876	0.134	2,390
8	2007	18,638	0.134	2,610

Source: Nitschke pers. comm.

Table 18. Eight year rebuilding schedule projections assuming a constant F=0.100 and a 75% probability of reaching B_{MSY} in 8 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.100	658
2	2001	7,498	0.100	850
3	2002	9,577	0.100	1,072
4	2003	11,914	0.100	1,314
5	2004	14,396	0.100	1,563
6	2005	16,881	0.100	1,805
7	2006	19,229	0.100	2,028
8	2007	21,323	0.100	2,222

Source: Nitschke pers. comm.

Table 19. Ten year rebuilding schedule projections assuming a constant F=0.168 and a 50% probability of reaching B_{MSY} in 10 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.168	1,069
2	2001	7,022	0.168	1,299
3	2002	8,459	0.168	1,550
4	2003	10,009	0.168	1,816
5	2004	11,618	0.168	2,088
6	2005	13,228	0.168	2,355
7	2006	14,778	0.168	2,606
8	2007	16,215	0.168	2,835
9	2008	17,505	0.168	3,038
10	2009	18,622	0.168	3,210

Source: Nitschke pers. comm.

Table 20. Ten year rebuilding schedule projections assuming a constant F=0.136 and a 75% probability of reaching B_{MSY} in 10 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.136	881
2	2001	7,240	0.136	1,101
3	2002	8,964	0.136	1,349
4	2003	10,860	0.136	1,615
5	2004	12,853	0.136	1,887
6	2005	14,850	0.136	2,155
7	2006	16,760	0.136	2,403
8	2007	18,501	0.136	2,628
9	2008	20,029	0.136	2,820
10	2009	21,319	0.136	2,978

Source: Nitschke pers. comm.

Table 21. Ten year rebuilding schedule projections assuming a constant F=0.100 and a 100% probability of reaching B_{MSY} in 10 years. B_{MSY} = 18.6 million pounds.

	Year	Biomass (1000 lbs)	F	Yield (1000 lbs)
	1998	6,755	0.454	2,939
	1999	6,204	0.454	2,707
1	2000	5,734	0.100	658
2	2001	7,498	0.100	850
3	2002	9,577	0.100	1,072
4	2003	11,914	0.100	1,314
5	2004	14,396	0.100	1,563
6	2005	16,881	0.100	1,805
7	2006	19,229	0.100	2,028
8	2007	21,323	0.100	2,222
9	2008	23,104	0.100	2,383
10	2009	24,560	0.100	2,511

Source: Nitschke pers. comm.

Table 22. Summary of life history and habitat characteristics for tilefish, *Lopholatilus chamaeleonticeps.*

Life Stage	Time of Year	Size and Growth	Geographic Location	Habitat	Substrate	Temperature
Eggs	Serial spawning March -Nov; peaks April-	1.16-1.25 mm	Shelf break; Georges Bank to Cape Hatteras	Water column, 80-800 m	Water column	8-19 C
Larvae	Feb-Oct; peaks July–Oct	2.6 to ~9.0 mm	Outer continental shelf; Georges Bank to Cape	Water column, 50-150 m	Water column	13-18 C
Juveniles (£50 cm)	All year; may leave Georges Bank in winter	~15-500 mm	Shelf break, submarine canyon walls and flanks; Georges Bank to Cape Hatteras	Rough bottom, shelter, small burrows, 80-540 m	Rocky, stiff clay, human debris	~8-18 C
Adults (>50 cm)	All year; but may leave Georges Bank in winter	Females: 50-~100 cm; Males: 50-~120 cm	Shelf break, submarine canyon walls and flanks; Georges Bank to Cape Hatteras	Rough bottom, shelter, larger burrows, 80-540 m	Rocky, exposed ledges, stiff clay	~8-18 C

Life Stage	Salinity	Dissolved Oxygen	Prey	Predators	Notes
Eggs	~34-36 ppt	~4-8 ml/L			
Larvae	~33-35 ppt	~4-8 ml/L			
Juveniles £50 cm	~33-36 ppt	~3-6 mg/L	Decapod-crustaceans, small fish, benthic-epifauna, human-trash.	Tilefish, goosefish, sharks, dogfish, and conger-eel.	
Adults >50 cm	~33-36 ppt	~3-6 mg/L	Juvenile tilefish, other fish, decapods, benthic epifauna	Sharks, lampreys	Pair-bonding possible.

Source: Steimle *et. al.* 1998.

Table 23. Tilefish commercial landings by gear, Maine to Virginia, 1989-1998 combined.

Gear	1000 lbs	Percent
Otter Trawl Bottom, Fish	1,983	7
Otter Trawl Bottom, Lobster	✖	✖
Otter Trawl Bottom, Shrimp	✖	✖
Otter Trawl Bottom, Other	✖	✖
Otter Trawl, Midwater	✖	✖
Pound Nets, Other	✖	✖
Pots and Traps, Fish	✖	✖
Pots and Traps, Lobster Inshore	✖	✖
Pots and Traps, Lobster Offshore	✖	✖
Gill Nets, Sink, Other	2	✖
Lines Hand, Other	1	✖
Lines Troll, Other	0	✖
Lines Long Set with Hooks	26,830	93
Dredges Scallop, Sea	✖	✖
Unknown, Combined Gears	19	✖
ALL GEAR	28,816	100

Source: State and Federal reported landings.

Note: ✖ = less than 1,000 lbs or less than 1%.

Table 24. Tilefish commercial landings by year and gear type (% of year total), 1989-1998.

GEAR	YEAR									
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Otter Trawl Bottom, Fish	7.3	2.5	2.1	9.4	13.1	2.8	7.1	9.9	4.5	9.2
Otter Trawl Bottom, Lobster	.	.	0.0	.	.	.	.	.	.	.
Otter Trawl Bottom, Shrimp	.	.	.	.	.	.	.	.	.	.
Otter Trawl Bottom, Other	.	.	.	.	.	.	0.0	0.0	.	.
Otter Trawl Midwater	.	.	0.0	.	.	.	.	.	.	.
Trawl Midwater, Paired	.	.		.	.	.	.	.	.	.
Trawl Bottom, Paired	.	.	.	.	.	.	.	.	.	.
Pound Nets, Other	.	.	.	.	0.0	.	.	.	.	.
Floating Traps (Shallow)	.	.	.	.	.	.	.	.	.	.
Pots and Traps, Fish	.	.	.	.	0.0	0.0	0.0	.	.	0.0
Pots and Traps, Lobster Inshore	.	.	.	.	0.0	.	0.0	.	.	.
Pots and Traps, Lobster Offshore	.	0.0	.	0.0	0.0	.	0.0	0.0	.	0.0
Gill Nets, Sink, Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.
Lines Hand, Other	0.0	0.0	.	.	.	0.0	.	0.0	0.0	.
Lines Troll, Other	0.0	.	.	.	.	.	.	.	.	.
Lines Long Set With Hooks	92.7	97.5	97.9	90.6	86.7	97.2	92.7	90.0	95.4	90.8
Dredges Scallop, Sea	.	.	.	.	.	.	0.0	.	0.0	0.0
Unknown Combined Gears	.	.	.	.	0.2	0.0	0.2	0.0	.	
ALL GEAR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: State and Federal reported landings.

Table 25. Tilefish commercial landings by state and gear type (% of year total), 1989-1998 combined.

	STATE								
	ME	NH	MA	RI	CT	NY	NJ	MD	VA
GEAR	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total
Otter Trawl Bottom, Fish	0.9	.	30.2	69.8	70.7	0.0	0.6	.	22.7
Otter Trawl Bottom, Lobster	.	.	.	.	.	.	0.0	.	.
Otter Trawl Bottom, Shrimp	0.0	.	.	.	.	.	.	.	.
Otter Trawl Bottom, Other	.	.	.	.	.	.	.	0.0	0.0
Otter Trawl, Midwater	.	.	.	0.0	.	.	.	.	.
Pound Nets, Other	.	.	0.0	.	.	.	.	.	.
Pots and Traps, Fish	.	.	.	0.0	.	.	.	.	0.1
Pots and Traps, Lobster Inshore	.	.	0.0	0.0	.	.	.	.	.
Pots and Traps, Lobster Offshore	.	18.7	.	0.0	.	0.0	.	0.0	.
Gill Nets, Sink, Other	0.3	.	0.0	0.0	.	.	0.1	0.0	.
Lines Hand, Other	.	.	.	0.0	.	0.0	.	0.0	5.4
Lines Troll, Other	.	.	.	0.0	.	.	.	.	.
Lines Long Set with Hooks	98.7	81.3	69.7	30.0	.	98.2	99.3	99.9	71.8
Dredges Scallop, Sea	.	.	0.1	.	.	.	.	.	.
Unknown Combined Gears	0.0	.	.	0.0	26.8	.	0.0	.	.
ALL GEAR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: State and Federal reported landings.

Table 26. Matrix of prioritized threats in regards to their potential impact to tilefish EFH. An * means that there is an impact from the threat.

Threat	IMPACTS																								
	A. Change in topography	B. Fish blockage	C. Wetland alteration	D. Loss of SAV	E. Loss of riparian habitat	F. Erosion	G. Change in nature of substrate	H. Suspended sediments, turbidity	I. Change in temperature regime	J. Change in salinity regime	K. Change in circulation pattern	L. Hypoxia / anoxia	M. Nutrient loading, eutrophication	N. Change in photosynthesis regime	O. Water contamination	P. Sediment contamination	Q. Litter	R. Atmospheric deposition	S. Loss in benthic organisms	T. Physical damage to organism	U. Gene pool deterioration	V. Trophic alteration	W. Pathogens, disease	X. Displacement of species	Y. Introduction of exotic species
1.0 Energy production and transport		*	*				*	*	*	*	*				*	*		*		*				*	
2.0 Ocean disposal and dredge spoil placement	*		*	*			*	*				*	*	*	*	*							*	*	
3.0 Nonpoint source pollution	*			*			*	*	*	*	*	*	*	*	*	*	*	*	*				*	*	
4.0 Shipping							*	*				*		*	*				*	*			*	*	
5.0 Marine mining	*					*	*	*																*	

Table 27. Physical characteristics and nutrient loadings for eight major Mid-Atlantic estuaries.

Location	Volume (cubic ft.)	Surface Area (sq. mi.)	Average Daily Inflow (cfs)	Total Drainage Area (sq. mi.)	Estimated Nitrogen Loadings (tons/yr.)	Estimated Phosphorus Loadings (tons/yr.)
Delaware Bay	4.48×10^{11}	768	19,800	13,450	50,199 (High)	13,109 (High)
Delaware Inland Bays*	3.85×10^{9}	33.3	300	292	1,425 (Med-High)	82 (Med.)
Chincoteague Bay	2.25×10^{10}	137	400	300	292 (Low)	84 (Low)
Chesapeake Bay	2.59×10^{12}	3,830	85,800	69,280	119,929 (High)	16,813 (High)
Albemarle-Pamlico Sound	1.08×10^{12}	2,949	46,000	29,574	28,224 (High)	3,565 (High)
Bogue Sound	1.31×10^{10}	102	1,300	680	710 (Low)	56 (Low)
New River	5.18×10^{9}	32	800	470	616 (Low)	112 (Med.)
Cape Fear River	1.22×10^{10}	38	10,100	9,090	8,102 (Med.)	1,486 (High)

Source: MARMRP 1994.

Table 28. Tilefish commercial landings by region, area and year.

			YEAR									
REGION	AREA		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
New	ST (<3 MI)	1000 LBS	1	✖	✖	0	0	0	✖	✖	1	✖
England		% REG	✖	✖	✖	0	0	0	✖	✖	✖	✖
		% CST	100	100	100	0	0	0	68	100	1	55
	EEZ (>3MI)	1000 LBS	482	411	607	293	64	75	53	351	777	118
		% REG	99	99	99	100	100	100	99	99	99	99
		% CST	21	9	8	9	6	3	2	9	19	7
	ALL	1000 LBS	483	411	607	293	64	75	53	351	779	118
		% REG	100	100	100	100	100	100	100	100	100	100
		% CST	21	9	8	9	6	3	2	9	19	7
Mid-	ST (<3 MI)	1000 LBS	0	0	0	29	0	0	✖	0	154	✖
Atlantic		% REG	0	0	0	1	0	0	✖	0	4	✖
		% CST	0	0	0	100	0	0	31	0	98	44
	EEZ (>3MI)	1000 LBS	1,726	3,887	6,457	2,673	936	1,851	2,568	3,292	3,127	1,514
		% REG	100	100	100	98	100	100	99	100	95	99
		% CST	78	90	91	90	93	96	97	90	80	92
	ALL	1000 LBS	1,726	3,887	6,457	2,702	936	1,851	2,568	3,292	3,281	1,514
		% REG	100	100	100	100	100	100	100	100	100	100
		% CST	78	90	91	90	93	96	97	90	80	92
ALL	ST (<3 MI)	1000 LBS	1	✖	✖	29	0	0	✖	✖	156	✖
		% REG	✖	✖	✖	✖	0	0	✖	✖	3	✖
		% CST	100	100	100	100	0	0	100	100	100	100
	EEZ (>3MI)	1000 LBS	2,208	4,299	7,065	2,967	1,001	1,927	2,621	3,643	3,904	1,633
		% REG	99	99	99	99	100	100	99	99	96	99
		% CST	100	100	100	100	100	100	100	100	100	100
	ALL	1000 LBS	2,209	4,299	7,065	2,996	1,001	1,927	2,621	3,643	4,061	1,633
		% REG	100	100	100	100	100	100	100	100	100	100
		% CST	100	100	100	100	100	100	100	100	100	100

Source: State and Federal reported landings.

Note: Does not include landings from unknown areas. ✖ = less than 1,000 lbs or less than 1%.
Due to a change in the reporting system, commercial landings by water area are not available after 1994.

Table 29. The average annual commercial landings of tilefish by state, 1989-1998.

STATE	POUNDS	PERCENT
ME	31,700	1.24
NH	26	0.00
MA	7,100	0.27
RI	209,500	8.21
CT	3,000	0.12
NY	1,741,500	68.27
NJ	556,600	21.82
MD	1,150	0.04
VA	332	0.01
ALL STATES	2,550,800	100

Source: State and Federal reported landings.

Table 30. Landings of tilefish (lbs, live) by statistical area from 1977 to 1998. Percentages are given below the line. Statistical area landings from 1994-1998 were calculated by the redistribution of total dealer landing according to the statistical area proportions for each year in the VTR data (excluding the data were statistical area is unknown).

YEAR	525	526	533	534	537	616	636	other	unknown	total
77	1,300	1,001,400	0	0	1,489,500	2,018,100	0	80,800	0	4,591,101
78	7,000	2,196,400	0	0	2,905,500	2,049,000	0	22,400	0	7,180,301
79	7,700	3,909,701	0	0	3,204,601	1,586,900	0	38,300	0	8,747,202
80	900	3,755,501	0	17,100	2,879,500	1,914,100	0	6,000	0	8,573,102
81	4,000	2,676,900	0	0	2,857,800	2,162,500	0	12,300	0	7,713,501
82	2,400	1,169,800	0	0	2,286,200	816,000	0	112,400	0	4,386,801
83	18,400	935,300	0	0	2,241,700	907,100	0	34,000	0	4,136,501
84	1,300	1,502,600	17,200	4,500	2,326,200	402,600	0	175,100	0	4,429,501
85	67,800	1,655,600	0	15,900	1,427,000	1,060,300	0	95,800	0	4,322,401
86	108,200	1,071,500	18,500	0	1,875,000	1,185,700	0	40,700	0	4,299,601
87	78,600	2,248,500	122,700	0	3,762,801	833,800	0	29,500	0	7,075,901
88	14,200	971,000	49,100	0	1,239,000	631,400	4,100	90,300	500	2,999,601
89	9,700	261,700	0	0	85,700	627,600	0	15,000	1,500	1,001,200
90	1,793	694,625	88,944	542,166	260,918	295,184	24	37,531	5,974	1,927,159
91	11,254	13,737	227,919	0	648,161	1,669,890	0	50,795	87	2,621,843
92	42,137	167,974	0	0	2,532,372	813,148	244	87,578	0	3,643,454
93	126,903	278,577	627	8,121	2,913,857	550,832	0	172,413	0	4,051,330
94	120,002	323	0	0	1,268,695	177,486	107,649	58,077	-	1,732,231
95	7,903	3,459	67	160	1,337,692	108,719	0	9,640	-	1,467,641
96	2,051	6,382	0	0	1,552,933	807,861	0	120,271	-	2,489,498
97	1,713	154	452	452	3,095,861	814,777	0	75,974	-	3,989,383
98	38,421	40,771	1,448	195	2,559,993	187,666	8,564	100,742	-	2,937,799
77	0.0%	21.8%			32.4%	44.0%		1.8%		
78	0.1%	30.6%			40.5%	28.5%		0.3%		
79	0.1%	44.7%			36.6%	18.1%		0.4%		
80	0.0%	43.8%		0.2%	33.6%	22.3%		0.1%		
81	0.1%	34.7%			37.0%	28.0%		0.2%		
82	0.1%	26.7%			52.1%	18.6%		2.6%		
83	0.4%	22.6%			54.2%	21.9%		0.8%		
84	0.0%	33.9%	0.4%	0.1%	52.5%	9.1%		4.0%		
85	1.6%	38.3%		0.4%	33.0%	24.5%		2.2%		
86	2.5%	24.9%	0.4%		43.6%	27.6%		0.9%		
87	1.1%	31.8%	1.7%		53.2%	11.8%		0.4%		
88	0.5%	32.4%	1.6%		41.3%	21.0%	0.1%	3.0%	0.0%	
89	1.0%	26.1%			8.6%	62.7%		1.5%	0.1%	
90	0.1%	36.0%	4.6%	28.1%	13.5%	15.3%	0.0%	1.9%	0.3%	
91	0.4%	0.5%	8.7%		24.7%	63.7%		1.9%	0.0%	
92	1.2%	4.6%			69.5%	22.3%	0.0%	2.4%		
93	3.1%	6.9%	0.0%	0.2%	71.9%	13.6%		4.3%		
94	6.7%	0.0%			71.0%	9.9%	6.0%	3.3%	3.0%	
95	0.5%	0.2%	0.0%	0.0%	90.3%	7.3%		0.7%	1.0%	
96	0.1%	0.3%			61.8%	32.2%		4.8%	0.9%	
97	0.0%	0.0%	0.0%	0.0%	77.5%	20.4%		1.9%	0.1%	
98	1.0%	1.1%	0.0%	0.0%	68.2%	5.0%	0.2%	2.7%	21.7%	

Source: Nitschke pers. comm..

Table 31. Exvessel value of commercial tilefish landings by year, Maine to Virginia.

YEAR	Nominal Value 1000 $	Nominal Price Mean	1997 Adjusted Mean
1989	2,016	2.01	1.75
1990	3,799	1.97	1.80
1991	4,216	1.61	1.50
1992	5,519	1.51	1.42
1993	5,015	1.23	1.17
1994	3,447	1.99	1.91
1995	2,857	1.95	1.91
1996	4,194	1.68	1.69
1997	4,868	1.25	1.26
1998	4,778	1.80	1.80

Source: State and Federal reported landings.

Table 32. Commercial landings, exvessel value and price of tilefish by state, 1998.

STATE	Landings 1000's lbs	Exvessel Value 1000's $	Price $ / LB
ME	31	49	1.58
NH	0	0	0
MA	7.5	13	1.73
RI	50	12	0.61
CT	0	0	0
NY	1,801	3,329	1.85
NJ	313	550	1.76
MD	✖	1	2.07
VA	✖	✖	0.86

Source: State and Federal reported landings.
Note: ✖ = less than 1,000 lbs or $1,000.

Table 33. Value ('000 $) of commercial landings of tilefish by month by state, 1989-1998 combined.

	MONTH												
	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	ALL
STATE													
ME	19	34	79	175	99	29	8	6	9	6	10	16	490
NH	*	*	*	*	*	*	*	0	0	0	1	0	1
MA	6	22	33	8	2	2	*	1	*	*	*	1	75
RI	284	355	529	187	102	98	110	61	24	137	141	112	2140
CT	5	5	3	3	*	*	*	*	*	*	*	*	16
NY	2579	2730	2833	2714	2409	2372	1888	2252	2094	2560	2165	2744	29340
NJ	670	787	1055	1103	1060	849	441	542	472	546	566	575	8666
MD	0	0	4	*	3	*	1	*	*	9	*	*	17
VA	*	*	2	*	*	*	*	0	0	*	0	*	2
ALL	3563	3933	4538	4190	3675	3350	2448	2862	2599	3258	2883	3448	40746

Source: State and Federal reported landings.

Note: ✖ = less than $1,000.

Table 34. Relationship of primary port of landing to tilefish vessel owner's home town.

Primary port of Landing	Number of Vessels	Owner's Home State	Home State	Home County
Avon, NC	1	Buxton	NC	Dare
	1	Manteo	NC	Dare
Beaufort, NC	1	Salter Path	NC	Carteret
Belford, NJ	2	Belford	NJ	Monmouth
	2	Port Monmouth	NJ	Monmouth
Cape May, NJ	5	Cape May	NJ	Cape May
	1	North Cape May	NJ	Cape May
	1	Secretary	MD	Dorchester
Chincoteague, VA	1	Wanchese	NC	Dare
Englehard, NJ	1	Scranton	NC	Hyde
Freeport, NY	1	Dix Hills	NY	Suffolk
	1	Long Beach/ Barnegat Light	NJ	Ocean
	1	Wantagh	NY	Nassau
Gloucester, MA	2	Gloucester	MA	Essex
	1	Rockport	MA	Essex
	1	Kittery	ME	York
Greenport, NY	4	Greenport	NY	Suffolk
	1	Montauk	NY	Suffolk
	1	Port Jefferson	NY	Suffolk
	1	New York City	NY	New York
	1	Scituate	MA	Plymouth
	1	Wakefield	RI	Washington
Hampton, VA	1	Bayboro	NC	Pamlico
	2	Hampton	VA	City of Hampton
Hampton Bay, NY	1	Bay Shore	NY	Suffolk
	1	East Northport	NY	Suffolk
	5	East Quogue	NY	Suffolk
	10	Hampton Bay	NY	Suffolk
	1	Manorville	NY	Suffolk
	2	Southampton	NY	Suffolk
	1	Watermill	NY	Suffolk
	1	Point Lookout	NY	Nassau
	1	Manalapan	NY	Monmouth
Long Beach/Barnegat Light	12	Barnegat Light	NJ	Ocean
	2	West Creek	NJ	Ocean
	1	Forked River	NJ	Ocean
	1	Brooklyn	NY	Kings
	1	Bayville	NY	Nassau
	1	Midlothian	VA	Chesterfiled
	1	South Thomaston	ME	Knox
	1	Eliot	ME	York
	1	Unknown	NK	Unknown
Mattituck, NY	1	Hampton Bay	NY	Suffolk
Montauk, NY	1	Brooklyn	NY	Kings
	2	Dix Hills	NY	Suffolk
	1	East Northport	NY	Suffolk
	1	Fort Walton Beach	FL	Okaloosa
	1	Manville	RI	Providence
	1	Sea Girt	NJ	Monmouth
	1	Sequim	WA	Clallam
New Bedford, MA	1	Acushnet	MA	Bristol
	3	Fairhaven	MA	Bristol
	3	New Bedford	MA	Bristol
	1	Nantucket	MA	Nantucket
	1	Adamsville	RI	Newport
Newport, RI	2	Cape May	NJ	Cape May
	4	Freeport	NY	Nassau
	1	Milford	DE	Sussex
	1	Ledyard	CT	New London
	4	New Bedford	MA	Bristol
	2	Middletown	RI	Newport
	1	Jamestown	RI	Newport
	3	Newport	RI	Newport
	1	Saunderstown	RI	Washington
	2	Wakefield	RI	Washington

Table 34 (continued). Relationship of primary port of landing to tilefish vessel owner's home town.

Primary port of Landing	Number of Vessels	Owner's Home State	Home State	Home County
Newport News, VA	1	Swan Quarter	NC	Hyde
Ocean City, MD	1	Millsboro	DE	Sussex
Other Barnstable, MA	1	Milton	MA	Norfolk
Other Cape May, NJ	1	Cape May Courthouse	NJ	Cape May
	1	Seaville	NJ	Cape May
	1	Ocean City	MD	Worcester
Other Dare, NC	1	Buxton	NC	Dare
	3	Hatteras	NC	Dare
Other Monmouth, NJ	1	Brant Beach	NJ	Ocean
Other Ocean, NJ	1	Barnegat Light	NJ	Ocean
	2	Brant Beach	NJ	Ocean
	1	South Thomaston	ME	Knox
Point Judith, RI	6	Charlestown	RI	Washington
	8	Narragansett	RI	Washington
	1	North Kingstown	RI	Washington
	3	Peacedake	RI	Washington
	1	North Shoreham	RI	Washington
	1	Saunderstown	RI	Washington
	2	West Kingston	RI	Washington
	1	Westerley	RI	Washington
	1	Exeter	RI	Washington
	25	Wakefield	RI	Washington
	1	Montauk	NY	Suffolk
	2	Portsmouth	NH	Rockingham
	1	Englewood	NJ	Bergen
	1	Newark	NJ	Essex
	1	Ship Bottom	NJ	Ocean
	1	Toms River	NJ	Ocean
	1	Gloucester	MA	Essex
	1	New Bedford	MA	Bristol
	1	Stonington	CT	New London
Point Pleasant, NJ	1	Barnegat	NJ	Ocean
	1	Barnegat Light	NJ	Ocean
	2	Brick	NJ	Ocean
	1	Lavallette	NJ	Ocean
	2	Point Pleasant	NJ	Ocean
Portland, ME	2	Freeport	ME	Cumberland
	1	Gorham	ME	Cumberland
	6	Portland	ME	Cumberland
	1	Orrs Island	ME	Cumberland
	2	Scarborough	ME	Cumberland
	1	Green	ME	Androscoggin
	1	Kennebunk	ME	York
Virginia Beach, VA	1	Virginia Beach	VA	City of Virginia Beach
Wanchese, NC	1	Dagsboro	DE	Sussex
	1	Berlin	MD	Worcester
	1	Carollton	VA	Isle of Wight
	1	Hampton	VA	Hampton
	1	Columbia	NC	Tyrell
	1	Fairfiled	NC	Hyde
	1	Scranton	NC	Hyde
	1	Point Harbor	NC	Currituck
	1	Manns Harbor	NC	Dare
	1	Manteo	NC	Dare
	1	Stumpy Point	NC	Dare
	5	Wanchese	NC	Dare
	2	Nags Head	NC	Dare
	1	Belhaven	NC	Beaufort

*Primary port of landing in this table is the port in which a vessel landed the largest quantity of tilefish during 1998.

Source: Clay pers. comm.

Table 35. Fishing ports with various poundage dependence on tilefish in 1998.

Ports with at least 1% poundage dependence on tilefish

Port	County	State	Percent
Montauk	Suffolk	NY	11.54%
Long Beach/ Barnegat Light	Ocean	NJ	3.03%
Hampton Bay	Suffolk	NY	2.98%
Other Ocean	Ocean	NJ	0.77%
Point Judith	Washington	RI	0.68%

Ports with at least 0.1% poundage dependence on tilefish

Port	County	State	Percent
Montauk	Suffolk	NY	11.54%
Long Beach/ Barnegat Light	Ocean	NJ	3.03%
Hampton Bay	Suffolk	NY	2.98%
Other Ocean	Ocean	NJ	0.77%
Point Judith	Washington	RI	0.68%
Avon	Dare	NC	0.42%
Morehead City	Carteret	NC	0.37%
Newport	Newport	RI	0.23%
Stonington	New London	CT	0.22%
Other Dare	Dare	NC	0.22%
Greenport	Suffolk	NY	0.15%
New London	New London	CT	0.14%
Other Suffolk	Suffolk	NY	0.11%
Mattituk	Suffolk	NY	0.11%
Wanchese	Dare	NC	0.08%
Portland	Cumberland	ME	0.08%
Freeport	Nassau	NY	0.05%

Source: Clay pers. comm.

Table 36. Fishing ports with various revenue dependence on tilefish in 1998.

Ports with at least 1% revenue dependent on tilefish

Port	County	State	Percent
Montauk	Suffolk	NY	21.22%
Hampton Bay	Suffolk	NY	7.59%
Long Beach/ Barnegat Light	Ocean	NJ	5.23%
Point Judith	Washington	RI	1.96%
Other Ocean	Ocean	NJ	1.25%
Avon	Dare	NC	0.85%

Ports with at least 0.1% revenue dependent on tilefish

Port	County	State	Percent
Montauk	Suffolk	NY	21.22%
Hampton Bay	Suffolk	NY	7.59%
Long Beach/ Barnegat Light	Ocean	NJ	5.23%
Point Judith	Washington	RI	1.96%
Other Ocean	Ocean	NJ	1.25%
Avon	Dare	NC	0.85%
Other Dare	Dare	NC	0.64%
Greenport	Suffolk	NY	0.34%
Morehead City	Carteret	NC	0.25%
New London	New London	CT	0.24%
Newport	Newport	RI	0.19%
Wanchese	Dare	NC	0.17%
Mattituck	Suffolk	NY	0.16%
Portland	Cumberland	ME	0.14%
Stonington	New London	CT	0.12%
Freeport	Nassau	NY	0.07%
Other Suffolk	Suffolk	NY	0.05%

Source: Clay pers. comm.

Table 37. Counties with dependence (poundage and revenue) on tilefish in 1998.

Counties with at least 1% poundage dependence on tilefish

County	State	Percent
Suffolk	NY	4.60%
Ocean	NJ	0.73%
Washington	RI	0.68%

Counties with at least 0.1% poundage dependence on tilefish

County	State	Percent
Suffolk	NY	4.60%
Ocean	NJ	0.73%
Washington	RI	0.68%
New London	CT	0.18%
Dare	RI	0.16%
Carteret	NC	0.12%
Cumberland	NC	0.07%
Nassau	NY	0.05%

Counties with at least 1% revenue dependent on tilefish

County	State	Percent
Suffolk	NY	4.60%
Washington	RI	1.96%
Ocean	NJ	1.96%

Counties with at least 0.1% revenue dependent on tilefish

County	State	Percent
Suffolk	NY	6.93%
Washington	RI	1.96%
Ocean	NJ	1.96%
Dare	NC	0.28%
Newport	RI	0.16%
New London	CT	0.15%
Cumberland	ME	0.14%
Carteret	NC	0.09%
Nassau	NY	0.07%

Source: Clay pers. comm.

Table 38. Counties dependent on commercial fishing in 1995.

County	State	Total Value of Goods and Services Sold (1995 $millions)	Total Value of Commercial Fishing Sales (1995 $millions)	Percent of Fishing Sales to Total Sales
Washington	RI	3542	102.478	2.89325
Newport	RI	3125	33.277	1.0649%
Cumberland	ME	13242	19.376	0.1463%
Dare	NC	1097	0.579	0.0528%
Suffolk	NY	59592	24.03	0.0403%
Ocean	NJ	12543	3.64	0.0290%
New London	CT	13589	2.778	0.0204%
Carteret	NC	1496	0.115	0.0077%
Nassau	NY	70388	3.674	0.0052%

Source: Clay pers. comm.

Table 39. Counties dependent on commercial fishing and processing in 1995.

County	State	Total Value of Goods and Services Sold (1995 $Millions)	Total Value of Commercial Fishing Sales (1995 $millions)	Total Value of Fresh & Frozen Seafood Processing (1995 $millions)	Total Value	Percent
Washington	RI	3542	102.478	11.255	0	3.2119%
Newport	RI	3125	33.277	0.213	0.253	1.0798%
Cumberland	ME	13242	19.376	41.367	0.198	0.4602%
Dare	NC	1097	0.579	3.588	0	0.3799%
Carteret	NC	1496	0.115	0.556	0	0.0449%
Suffolk	NY	59592	24.03	1.613	0	0.0430%
Ocean	NJ	12543	3.64	1.316	0	0.0395%
New London	CT	13589	2.778	0	0.077	0.0210%
Nassau	NY	70388	3.674	0.237	0	0.0056%

Source: Clay pers. comm.

Table 40. County economies dependent on fishing in 1995.

State	County	# of Establishments in Fishing & Fishing Related Businesses	% of Establishments in Fishing and Fishing Related Businesses
NC	Carteret	354	18.94%
RI	Newport	385	14.49%
RI	Washington	419	12.39%
CT	New London	527	9.08%
ME	Cumberland	872	8.90%
NC	Dare	132	8.22%
NY	Suffolk	3,202	7.79%
NJ	Ocean	693	6.55%
NY	Nassau	2,745	5.97%

Source: Clay pers. comm.

Table 41. Individual port level dependence in 1995.

Port	State	Number of Employees	Percent of all Employed Persons age 16+
Wanchese	NC	137	20%
Montauk	NY	134	9%
Barnegat Light	NJ	39	8%
Hatteras	NC	88	6%
Mattituck	NY	103	6%
Greenport	NY	16	5%
New London	CT	448	4%
South Kingstown	RI	448	4%
Manteo	NC	20	4%
Stonington	CT	18	3%
Morehead City	NC	77	3%
Hampton Bay	NY	133	3%
Newport	RI	291	2%
Ship Bottom	NJ	9	2%
Portland	ME	449	1%
Freeport	NY	241	1%

Source: Clay pers. comm.

Table 42. Various industries and employment for Suffolk County, NY in 1997.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments	% Employees	% Annual Payroll
Agricultural Services, Forestry & Fishing	3,907	98,204	1,087	0.82%	0.65%
Mining	149	9,072	23	0.02%	0.03%
Construction	26,444	957,847	5,223	2.77%	3.19%
Manufacturing	73,870	2,782,411	2,526	7.97%	9.58%
Transportation & Public Utilities	26,111	924,105	1,583	3.12%	3.52%
Wholesale Trade	47,842	1,866,167	3,798	5.79%	7.37%
Retail Trade	94,558	1,701,838	8,946	12.14%	7.25%
Finance, Insurance & Real Estate	31,809	1,413,226	3,109	4.65%	6.49%
Services	173,399	5,287,691	14,453	26.58%	25.99%
Unclassified Establishments	204	8,711	336	0.04%	0.06%
Total	478,793	15,049,272	41,084		

Source: Clay pers. comm.

Table 43. Fishery dependent industries added to check level of dependence using 1997 data for Suffolk County, NY.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
900	Fishing, Hunting and Trapping	(B)	(D)	46
1751	Carpentry Work	2,145	66,369	509
2000	Food and Kindred Products	3,226	108,213	89
2077	Animal and Marine Fats and Oils	(A)	(D)	1
2092	Fresh or Frozen Prepared Fish	(A)	(D)	1
2097	Manufactured Ice	(A)	(D)	1
2394	Canvas and Related Products	207	6,738	19
2448	Wood Pallets and Skids	(A)	(D)	2
2833	Medicinals and Botanicals	500	14,744	9
2850	Paints and Allied Products	48	1,406	8
3315	Steel Wire and Related Products	(A)	(D)	2
3400	Fabricated Metal Products	6,136	214,398	280
3496	Misc. Fabricated Wire Products	35	952	7
3498	Fabricated Pipe and Fittings	(A)	(D)	3
3499	Fabricated Metal Products, n.e.c.	171	5,114	14
3500	Industrial Machinery and Equipment	8,258	379,450	424
3510	Engines and Turbines	(A)	(D)	4
3556	Food Products and Machinery	56	2,074	5
3580	Refrigeration and Service Machinery	224	8,170	12
3710	Motor Vehicles and Equipment	1,184	38,550	34
3730	Ship and Boat Building and Repairing	152	3,951	33
3731	Ship building and Repairing	38	1,088	4
3732	Boat Building and Repairing	114	2,863	29
3750	Motorcycles, Bicycles and Parts	(B)	(D)	1
3949	Sporting and Athletic Goods, n.e.c.	138	5,346	7
4226	Special Warehousing and Storage, n.e.c	(B)	(D)	5
4400	Water Transportation	1,038	34,984	159
4410	Deep Sea Foreign Transportation of Freight	(A)	(D)	1
4420	Deep Sea Domestic Transportation of Freight	(A)	(D)	1
4440	Water Transportation of Freight, n.e.c.	(B)	(D)	2
4480	Water Transportation of Passengers	282	8,411	16
4481	Deep Sea Passenger Transportation, ex. ferry	(A)	(D)	1
4482	Ferries	247	7,197	6
4489	Water Passenger Transportation, n.e.c.	(A)	(D)	9
4490	Water Transportation Services	694	23,319	139
4491	Marine Cargo Handling	(A)	(D)	1
4492	Towing& Tugboat Service	(A)	(D)	4
4493	Marinas	635	21,054	1

Table 44. Employment sector for Montauk, NY from 1990 census.

Industry	Number of Employees
Agriculture, Forestry & Fishing	139
Mining	0
Construction	203
Manufacturing, Non-durable Goods	0
Manufacturing, Durable Goods	30
Transportation	59
Communications & Other Public Utilities	0
Wholesale Trade	0
Retail Trade	368
Finance, Insurance & Real Estate	114
Business & Repair Service	59
Personal Services	280
Entertainment & Recreation Services	40
Professional & Related Services	-
--Health Services	66
–Educational Services	92
–Other Professional & Related Services	199
Public Administration	24

Source: Clay pers. comm.

Table 45. Prime charter boat fishing seasons at Montauk

Offshore- Big Game	Best Time	Season
Tuna	August/September/October	July-October
Shark	June/July/October	June-October
Marlin	July/August	July-August

Inshore	Best Time	Season
Cod	July/September	March-December
Flounder	May	April-May
Striped Bass		June-December
Night Time (Trophy Striped Bass)	August-October	
Day Time	July-December	
Bluefish	July-November	

Source: Clay pers. com

Table 46. Employment in Hampton, NY in 1990.

Industry	Number of Employees
Agriculture, Forestry & Fishing	133
Mining	0
Construction	372
Manufacturing, Non-durable Goods	149
Manufacturing, Durable Goods	153
Transportation	216
Communications & Other Public Utilities	65
Wholesale Trade	97
Retail Trade	615
Finance, Insurance & Real Estate	249
Business & Repair Services	175
Entertainment & Recreation Services	67
Professional & Related Services	
–Health Services	307
–Educational Services	379
–Other Professional & Related Services	269
Public Administration	342

Source: Clay pers. comm.

Table 47. Employment in Port of Greenport, NY in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	39
Mining	0
Construction	116
Manufacturing, nondurable goods	27
Manufacturing, durable goods	30
Transportation	41
Communications & Other public utilities	14
Wholesale trade	43
Retail trade	249
Finance, insurance & real estate	58
Business & repair services	24
Personal services	37
Entertainment & recreation services	17
Professional & related services	
-- Health services	129
-- Educational services	45
-- Other professional & related services	94
Public Administration	37

Source: Clay pers. comm.

Table 48. Employment in Mattituck, NY in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	103
Mining	0
Construction	141
Manufacturing, nondurable goods	53
Manufacturing, durable goods	131
Transportation	48
Communications & Other public utilities	45
Wholesale trade	52
Retail trade	386
Finance, insurance & real estate	163
Business & repair services	87
Personal services	26
Entertainment & recreation services	34
Professional & related services	
-- Health services	168
-- Educational services	238
-- Other professional & related services	75
Public Administration	85

Source: Clay pers. comm.

Table 49. Various industries and employment for Nassau County, NY in 1997.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
Agricultural Services, Forestry & Fishing	3,355	87,919	990
Mining	154	5,433	6
Construction	21,140	827,892	3,768
Manufacturing	41,197	1,576,292	1,606
Transportation & Public Utilities	27,551	1,066,598	1,742
Wholesale Trade	42,402	1,779,560	4,521
Retail Trade	114,248	2,145,649	9,595
Finance, Insurance & Real Estate	54,467	2,407,333	5,046
Services	220,377	6,874,653	18,320
Unclassified Establishments	193	8,907	387

Source: Clay pers. comm.

Table 50. Fishery-dependent industries added to check level of dependence using 1998 data for Nassau County, NY.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
----	TOTAL	525,084	16,780,236	45,981
900	Fishing, Hunting & Trapping	97	2,935	9
1751	Carpentry Work	1,213	33,610	321
1799	Special Trade Contractors, n.e.c.	1,453	54,930	150
2092	Fresh or Frozen Prepared Fish	(A)	(D)	1
2097	Manufactured Ice	(A)	(D)	2
2385	Waterproof Outerwear	(A)	(D)	1
2394	Canvas & Related Products	(B)	(D)	10
2448	Wood Pallets & Skids	(A)	(D)	2
2833	Medicinals & Botanicals	(B)	(D)	3
2850	Paints & Allied Products	5	213	3
3496	Misc. fabricated wire products	129	6,388	7
3556	Food Products Machinery	(B)	(D)	2
3731	Ship Building & Repairing	(A)	(D)	1
3732	Boat Building & Repairing	(B)	(D)	21
3810	Search & Navigation Equipment	972	54,608	11
3940	Toys & Sporting Goods	(B)	(D)	16
3949	Sporting & Athletic Goods, n.e.c	23	444	7
4222	Refrigerated Warehousing & Storage	(B)	(D)	2
4400	Water Transportation	793	39,409	109
4410	Deep Sea Foreign Transportation of Freight	94	5,499	7
4420	Deep Sea Domestic Transportation of Freight	(C)	(D)	29

Table 50 (continued). Fishery-dependent industries added to check level of dependence using 1998 data for Nassau County, NY.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
4440	Water Transportation of Freight, n.e.c.	(B)	(D)	1
4480	Water Transportation of Passengers	(A)	(D)	4
4489	Water Passenger Transportation, n.e.c.	(A)	(D)	4
4490	Water Transportation Services	486	19,296	68
4492	Towing & Tugboat Service	(C)	(D)	16
4493	Marinas	200	6,820	46
4499	Water Transportation Services, n.e.c.	(C)	(D)	6
5091	Sporting & Recreational Goods	209	8,271	41
5146	Fish & Seafoods	154	5,167	33
5198	Paints, Varnishes & Supplies	240	16,182	18
5420	Meat & Fish Markets	453	7,886	110
5550	Boat Dealers	172	4,067	28
5560	Recreational Vehicle Dealers	(A)	(D)	2
5570	Motorcycle Dealers	86	2,707	13
5941	Sporting Goods & Bicycle Shops	1,295	23,471	148
5980	Fuel Dealers	2,017	77,781	101
6330	Fire, Marine & Casualty Insurance	6,631	280,403	177
7990	Misc. Amusement & Recreation Services	5,285	109,112	431

Source: Clay pers. com.

(D) – Withheld to avoid disclosing data for individual companies; data are included in broader industry totals.
(A)-(C), (E)-(M) – Employment-size classes are indicated as follows:
A – 0 to 19 B – 20 to 99 C – 100 to 249 E – 250 to 499 F – 500 to 999 G – 1,000 to 2,499 H – 2,500 to 4,999 I – 5,000 to 9,999 J – 10,000 to 24,999 K – 25,000 to 49,999 L – 50,000 to 99,999 M –100,000 or more

Table 51. Employment in Freeport, NY in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	241
Mining	5
Construction	1061
Manufacturing, nondurable goods	1451
Manufacturing, durable goods	1845
Transportation	1470
Communications & Other public utilities	589
Wholesale trade	1003
Retail trade	3202
Finance, insurance & real estate	1792
Business & repair services	1314
Personal services	729
Entertainment & recreation services	353
Professional & related services	
-- Health services	2220
-- Educational services	1865
-- Other professional & related services	1378
Public Administration	108

Source: Clay pers. comm.

Table 52. Various industries and employment for Ocean County, NJ in 1990.

Industry	Number of Employees	Annual Payroll	Total Establishments
TOTAL	101,619	2,493,446	10,578
Agricultural Services, Forestry& Fishing	915	21,383	263
Mining	84	3,701	11
Construction	6,515	211,639	1,581
Manufacturing	7,397	219,217	316
Transportation & Public Utilities	5,142	177,159	438
Wholesale Trade	3,892	118,928	514
Retail Trade	32,335	540,742	2,750
Finance, Insurance & Real Estate	5,291	172,127	833
Services	40,015	1,027,390	3,793
Unclassified Establishments	33	1,160	79

Source: Clay pers. comm.

Table 53. Fishery-dependent industries added to check level of dependence using 1997 data for Ocean County, NJ.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
TOTAL	101,619	2,493,446	10,578
Fishing, Hunting & Trapping	19	312	21
Carpentry Work	434	13,690	135
Special Trade Contractors, n.e.c.	213	5,236	74
Fresh or Frozen Prepared Fish	(A)	(D)	2
Canvas & Related Products	42	1,302	10
Paints & Allied Products	(A)	(D)	1
Food Products & Machinery	(A)	(D)	2
Refrigeration & Service Machinery	(E)	(D)	4
Boat Building & Repairing	(B)	(D)	26
Search & Navigation Equipment	(A)	(D)	1
Sporting & Athletic Goods, n.e.c.	(A)	(D)	2
Refrigerated Warehousing & Storage`	(B)	(D)	1
Water Transportation of Passengers	(A)	(D)	2
Water Passenger Transportation, n.e.c.	(A)	(D)	2
Water Transportation Services	(E)	(D)	84
Marinas	303	8,554	80
Water Transportation Services, n.e.c.	(A)	(D)	4
Refrigeration Equipment & Supplies	(A)	(D)	1
Sporting & Recreational Goods	49	1,755	7
Packaged Frozen Foods	22	605	4
Fish & Seafoods	61	1,581	7

Table 53 (continued). Fishery-dependent industries added to check level of dependence using 1997 data for Ocean County, NJ.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
Paints, Varnishes & Supplies	(A)	(D)	2
Grocery Stores	6,154	100,205	234
Meat & Fish Markets	104	1,695	19
Boat Dealers	405	9,500	51
Recreational Vehicle Dealers	(B)	(D)	1
Sporting Goods & Bicycle Shops	118	2,124	40
Fuel Dealers	280	9,120	17
Fire, Marine & Casualty Insurance	(C)	(D)	17
Amusement & Recreation, n.e.c.	195	4,660	83

Source: Clay pers. comm.

(D) – Withheld to avoid disclosing data for individual companies; data are included in broader industry totals.
(A)-(C), (E)-(M) – Employment-size classes are indicated as follows:
A – 0 to 19 B – 20 to 99 C – 100 to 249 E – 250 to 499 F – 500 to 999 G – 1,000 to 2,499 H – 2,500 to 4,999 I – 5,000 to 9,999 J – 10,000 to 24,999 K – 25,000 to 49,999 L – 50,000 to 99,999 M –100,000 or more

Table 54. Employment in Barnegat Light Borough, NJ in 1990.

Industry	Number of Employees
Agriculture, Forestry & Fishing	39
Mining	0
Construction	39
Manufacturing, Non-Durable Goods	10
Manufacturing, Durable Goods	13
Transportation	7
Communications & Other Public Utilities	6
Wholesale Trade	4
Retail Trade	65
Finance, Insurance & Real Estate	33
Business & Repair Services	16
Personal Services	2
Entertainment & Recreation Services	9
Professional & Related Services	
–Health Services	12
–Educational Services	11
–Other Professional & Related Services	33
Public Administration	10

Source: Clay pers. comm.

Table 55. Employment in "Other Ocean County," NJ ports in 1990.

Industry	Number of Employees
Agriculture, Forestry & Fishing	9
Mining	0
Construction	79
Manufacturing, Non-Durable Goods	20
Manufacturing, Durable Goods	19
Transportation	30
Communications & Other Public Utilities	22
Wholesale Trade	5
Retail Trade	141
Finance, Insurance & Real Estate	44
Business & Repair Services	11
Personal Services	10
Entertainment & Recreation Services	18
Professional & Related Services	
–Health Services	55
–Educational Services	64
–Other Professional & Related Services	21
Public Administration	50

Source: Clay pers. comm.

Table 56. Various industries and employment for Dare County, NC in 1997.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
TOTAL	10,473	198,251	1,605
Agricultural Services, Forestry & Fishing	98	1,781	31
Mining	(A)	(D)	1
Construction	896	19,993	221
Manufacturing	413	9,652	49
Transportation & Public Utilities	271	7,462	49
Wholesale Trade	478	10,511	58
Retail Trade	4,360	74,044	575
Finance, Insurance & Real Estate	1,259	25,735	158
Services	2,689	48,781	455

Source: Clay pers. comm.

Table 57. Fishery dependent industries added to check level of dependence using 1997 data for Dare County, NC.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
TOTAL	10,473	198,251	1,605
Fishing, Hunting & Trapping	(A)	(D)	7
Carpentry Work	(B)	(D)	22
Fresh or Frozen Prepared Fish	(A)	(D)	1
Manufactured Ice	(A)	(D)	1
Ship & Boat Building & Repairing	160	3,165	11
Ship Building & Repairing	(B)	(D)	1
Boat Building & Repairing	(C)	(D)	10
Water Transportation of Passengers	(A)	(D)	2
Water Passenger Transportation, n.e.c.	(A)	(D)	2
Water Transportation Services	(B)	(D)	12
Marine Cargo Handling	(A)	(D)	1
Marinas	(B)	(D)	10
Water Transportation Services, n.e.c.	(A)	(D)	1
Sporting & Recreational Goods	(A)	(D)	1
Fish & Seafoods	208	3,676	10
Meat & Fish Markets	48	626	5
Boat Dealers	(A)	(D)	1
Motorcycle Dealers	(A)	(D)	1
Sporting Goods & Bicycle Shops	112	2,408	26
Fuel Dealers	26	649	6
Welding Repair	(A)	(D)	1

Source: Clay pers. comm.

Table 58. Employment in Port of Wanchese, NC in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	137
Mining	0
Construction	35
Manufacturing, nondurable goods	9
Manufacturing, durable goods	57
Transportation	17
Communications & Other public utilities	9
Wholesale trade	46
Retail trade	133
Finance, insurance & real estate	23
Business & repair services	25
Personal services	27
Entertainment & recreation services	20
Professional & related services	
-- Health services	16
-- Educational services	43
-- Other professional & related services	53
Public Administration	46

Source: Clay pers. comm.

Table 59. Employment in ports of "Other Dare County", NC in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	20
Mining	0
Construction	48
Manufacturing, nondurable goods	21
Manufacturing, durable goods	15
Transportation	17
Communications & Other public utilities	21
Wholesale trade	7
Retail trade	132
Finance, insurance & real estate	26
Business & repair services	27
Personal services	36
Entertainment & recreation services	17
Professional & related services	
-- Health services	21
-- Educational services	49
-- Other professional & related services	45
Public Administration	26

Source: Clay pers. comm.

Table 60. Employment in Hatteras, NC in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	88
Mining	0
Construction	223
Manufacturing, nondurable goods	21
Manufacturing, durable goods	26
Transportation	55
Communications & Other public utilities	34
Wholesale trade	37
Retail trade	359
Finance, insurance & real estate	109
Business & repair services	16
Personal services	134
Entertainment & recreation services	16
Professional & related services	
-- Health services	14
-- Educational services	99
-- Other professional & related services	43
Public Administration	104

Source: Clay pers. comm.

Table 61.Various industries and employment Carteret County, NC in 1997.

Industry	Number of Employees	Total Establishments
TOTAL	16,957	1,869
Agricultural Services, Forestry & Fishing	242	43
Construction	1,265	258
Manufacturing	1,710	72
Transportation & Public Utilities	894	83
Wholesale Trade	997	75
Retail Trade	5,929	559
Finance, Insurance & Real Estate	940	194
Services	4,976	569
Unclassified Establishments	4	16

Source: Clay pers. comm.

Table 62. Fishery-dependent industries added to check level of dependence using 1997 data for Carteret County, NC.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
TOTAL	16,957	293,439	1,869
Fishing, Hunting & Trapping	(A)	(D)	4
Carpentry Work	41	690	19
Special Trade Contractors, n.e.c.	(B)	(D)	7
Animal & Marine Fats & Oils	(B)	(D)	1
Manufactured Ice	(A)	(D)	2
Canvas & Related Products	(A)	(D)	6
Wood Pallets & Skids	(A)	(D)	1
Ship & Boat Building & Repairing	(E)	(D)	19
Ship Building & Repairing	(A)	(D)	1
Boat Building & Repairing	(E)	(D)	18
Motorcycles, bicycles & Parts	(A)	(D)	1
Sporting & Athletic Goods, n.e.c.	(B)	(D)	2
Water Transportation	290	7,393	31
Water Transportation of Passengers	36	397	6
Ferries	(A)	(D)	2
Water Passenger Transportation, n.e.c.	(B)	(D)	4
Water Transportation Services	254	6,996	25
Marine Cargo H&ling	(C)	(D)	2
Towing & Tugboat Service	(A)	(D)	2
Marinas	107	2,129	19
Water Transportation Services, n.e.c.	(A)	(D)	2
Sporting & Recreational Goods	(E)	(D)	2

Table 62 (continued). Fishery-dependent industries added to check level of dependence using 1997 data for Carteret County, NC.

Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
Fish & Seafoods	56	1,615	15
Meat & Fish Markets	(A)	(D)	4
Boat Dealers	99	2,180	16
Motorcycle Dealers	(A)	(D)	2
Sporting Goods & Bicycle Shops	44	611	20
Fuel Dealers	(B)	(D)	8
Fire, Marine & Casualty Insurance	(A)	(D)	3
Amusement & Recreation Services	237	(D)	40
Misc. Amusement & Recreation Services	(C)	(D)	38
Membership Sports & Recreation Clubs	70	1,075	6
Amusement & Recreation, n.e.c	90	1,477	26

Source: Clay pers. comm.

(D) – Withheld to avoid disclosing data for individual companies; data are included in broader industry totals.
(A)-(C), (E)-(M) – Employment-size classes are indicated as follows:
A – 0 to 19 B – 20 to 99 C – 100 to 249 E – 250 to 499 F – 500 to 999 G – 1,000 to 2,499 H – 2,500 to 4,999 I – 5,000 to 9,999 J – 10,000 to 24,999 K – 25,000 to 49,999 L – 50,000 to 99,999 M –100,000 or more

Table 63. Employment in Carteret County in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	77
Mining	7
Construction	183
Manufacturing, nondurable goods	106
Manufacturing, durable goods	120
Transportation	118
Communications & Other public utilities	28
Wholesale trade	67
Retail trade	730
Finance, insurance & real estate	190
Business & repair services	86
Personal services	105
Entertainment & recreation services	32
Professional & related services	227
-- Health services	
-- Educational services	123
-- Other professional & related services	154
Public Administration	197

Source: Clay pers. comm.

Table 64. Various industries and employment for Newport County, RI in 1990.

SIC	Industry	Number of Employees	Annual Payroll	Total Establishments
----	TOTAL	25,988	757,795	2,657
07–	Agricultural Services, Forestry & Fishing	190	5,056	76
10–	Mining	(A)	(D)	2
15–	Construction	1,083	29,921	302
20–	Manufacturing	2,588	213,813	106
40–	Transportation & Public Utilities	693	21,706	84
50–	Wholesale Trade	659	19,525	109
52–	Retail Trade	7,139	109,952	773
66–	Finance, Insurance & Real Estate	1,160	41,871	184
70–	Services	12,466	315,365	1,002
99–	Unclassified Establishments	(A)	(D)	19

Source: Clay pers. comm.

Table 65. Fishery-dependent industries added to check level of dependence using 1998 data for Newport County, RI.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
----	TOTAL	25,988	757,795	2,657
----	Total for subset below	4,611	63,272	385
900	Fishing, Hunting & Trapping	21	837	9
1751	Carpentry Work	(B)	(D)	27
2091	Canned & Cured Fish & Seafoods	(A)	(D)	1
2298	Cordage & Twine	(A)	(D)	1
2394	Canvas & Related Products	(A)	(D)	3
3730	Ship & Boat Building & Repairing	(E)	(D)	27
3731	Ship Building & Repairing	(B)	(D)	2
3732	Boat Building & Repairing	427	14,174	25
3750	Motorcycles, Bicycles & Parts	(A)	(D)	1
3810	Search & Navigation Equipment	(G)	(D)	2
3949	Sporting & Athletic Goods, n.e.c.	(A)	(D)	2
4400	Water Transportation	156	6,671	23
4480	Water Transportation of Passengers	(A)	(D)	4
4481	Deep Sea Passenger Transportation, ex. ferry	(A)	(D)	2
4482	Ferries	(A)	(D)	1
4489	Water Passenger Transportation, n.e.c.	(A)	(D)	1
4490	Water Transportation Services	19	(C)	(D)

Table 65. Fishery-dependent industries added to check level of dependence using 1998 data for Newport County, RI.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
----	TOTAL	25,988	757,795	2,657
----	Total for subset below	4,611	63,272	385
900	Fishing, Hunting & Trapping	21	837	9
1751	Carpentry Work	(B)	(D)	27
2091	Canned & Cured Fish & Seafoods	(A)	(D)	1
2298	Cordage & Twine	(A)	(D)	1
2394	Canvas & Related Products	(A)	(D)	3
3730	Ship & Boat Building & Repairing	(E)	(D)	27
3731	Ship Building & Repairing	(B)	(D)	2
3732	Boat Building & Repairing	427	14,174	25
3750	Motorcycles, Bicycles & Parts	(A)	(D)	1
3810	Search & Navigation Equipment	(G)	(D)	2
3949	Sporting & Athletic Goods, n.e.c.	(A)	(D)	2
4400	Water Transportation	156	6,671	23
4480	Water Transportation of Passengers	(A)	(D)	4
4481	Deep Sea Passenger Transportation, ex. ferry	(A)	(D)	2
4482	Ferries	(A)	(D)	1
4489	Water Passenger Transportation, n.e.c.	(A)	(D)	1
4490	Water Transportation Services	19	(C)	(D)

Table 65 (continued). Fishery-dependent industries added to check level of dependence using 1997 data for Carteret County, NC.

SIC	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments
4492	Towing & Tugboat Services	(A)	(D)	1
4493	Marinas	129	5,030	12
4499	Water Transportation Services, n.e.c.	10	(D)	6
5091	Sporting & Recreational Goods	60	(D)	5
5146	Fish & Seafoods	67	1,866	12
5420	Meat & Fish Markets	35	447	5
5550	Boat Dealers	70	1,424	13
5941	Sporting Goods & Bicycle Shops	49	788	16
5980	Fuel Dealers	143	3,583	15
6330	Fire, Marine & Casualty Insurance	10	(D)	5
7692	Welding Repair	10	(D)	2
7900	Amusement & Recreation Services	423	12,475	64
7990	Misc. Amusement & Recreation Services	55	371	12,004
7999	Amusement & Recreation, n.e.c.	110	4,273	24

Source: Clay pers. comm.

(D) – Withheld to avoid disclosing data for individual companies; data are included in broader industry totals.
(A)-(C), (E)-(M) – Employment-size classes are indicated as follows:
A – 0 to 19 B – 20 to 99 C – 100 to 249 E – 250 to 499 F – 500 to 999 G – 1,000 to 2,499 H – 2,500 to 4,999 I – 5,000 to 9,999 J – 10,000 to 24,999 K – 25,000 to 49,999 L – 50,000 to 99,999 M –100,000 or more

Table 66. Employment in Newport, RI in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	291
Mining	0
Construction	812
Manufacturing, nondurable goods	216
Manufacturing, durable goods	810
Transportation	347
Communications & Other public utilities	224
Wholesale trade	225
Retail trade	2953
Finance, insurance & real estate	653
Business & repair services	685
Personal services	832
Entertainment & recreation services	256
Professional & related services	
-- Health services	1099
-- Educational services	1280
-- Other professional & related services	1317
Public Administration	899

Source: Clay pers. comm.

Table 67. Newport, RI economy in 1990 & 1998.

Newport Residential Labor Force	1990	1998
Total Employment	12,984	10,746
Unemployment	848	624
Labor Force	13,832	11,370
Unemployment Rate	6.1%	5.5%
Average Annual Private Industry Employment	**1990**	**1998**
Agriculture, Forestry & Fishing	95	143
Construction	581	434
Manufacturing	572	499
Transportation Communications & Utilities	427	489
Wholesale Trade	119	172
Retail Trade	3,137	3,516
Finance, Insurance & Real Estate	666	362
Service Industries	6,828	6,350
Total Covered Private	*12,425*	*11,975*
Percent of State	3.22%	3.09%
Construction		
Industrial Construction in Square Feet	0	0
Commercial Construction in Square Feet	1,904	98,504
Total	*1,904*	*98,504*
Industrial Construction ($) Value	0	0
Commercial Construction ($) Value	400,000	11,320,000
Total ($) Value	*400,000*	*11,320,000*
Authorized New Housing Units	**1990**	**1998**
Single Family	9	20
Multi Family	49	2
Total	*58*	22

Table 67 (continued). Newport, RI economy in 1990 and 1998.

Median Selling Price of Existing Family Home	1990	1998
	$143,000	$140,750
Vital Statistics/US Census	**1990**	**1998**
Population	28,227	24,279
Births	422	
Deaths	267	
Natural Increase	155	
Gross Retail Sales	**1990**	
	$471,406	
Local Property Taxes	**1990**	**1998**
Real Estate Tax Per $1,000	$31.05	$23.69
Motor Vehicles	$31.05	$23.69
Business Personal Property	$31.05	$23.69

Source: Clay pers. comm.

Table 68. Employment In Washington County, RI in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	448
Mining	0
Construction	758
Manufacturing, nondurable goods	348
Manufacturing, durable goods	961
Transportation	296
Communications & Other public utilities	131
Wholesale trade	269
Retail trade	2454
Finance, insurance & real estate	587
Business & repair services	458
Personal services	347
Entertainment & recreation services	191
Professional & related services	
-- Health services	891
-- Educational services	2431
-- Other professional & related services	903
Public Administration	489

Source: Clay pers. comm.

Table 69. Washington County, RI economy in 1990 and 1998.

Narragansett Residential Labor Force	1990	1998
Total Employed	8,230	8,515
Unemployed	350	224
Labor Force	8,580	8,759
Unemployment Rate	4.1%	3.2%

Average Annual Private Industry Employment		
Agriculture Forestry & Fisheries	26	58
Construction	140	78
Manufacturing	91	171
Transportation Communications & Utilities	113	98
Wholesale Trade	263	173
Retail Trade	770	1,368
Finance, Insurance & Real Estate	56	113
Service Industries	634	1,088
Total Covered Private	*2,093*	*3,147*
% of State	0.54%	0.81%

Construction	1990	1998
Industrial Construction in Square Feet	9,600	
Commercial Construction in Square Feet	17,480	
Total	*27,080*	
Industrial Construction ($) Value	300,000	
Commercial Construction ($) Value	1,289,00	
Total	*1,589,000*	

Authorized New Housing Units	1990	1998
Single Family	50	74
Multi Family	6	10
Total	*56*	*84*

Table 69. Washington County, RI economy in 1990 and 1998.

Narragansett Residential Labor Force	1990	1998
Total Employed	8,230	8,515
Unemployed	350	224
Labor Force	8,580	8,759
Unemployment Rate	4.1%	3.2%

Average Annual Private Industry Employment		
Agriculture Forestry & Fisheries	26	58
Construction	140	78
Manufacturing	91	171
Transportation Communications & Utilities	113	98
Wholesale Trade	263	173
Retail Trade	770	1,368
Finance, Insurance & Real Estate	56	113
Service Industries	634	1,088
Total Covered Private	*2,093*	*3,147*
% of State	0.54%	0.81%

Construction	1990	1998
Industrial Construction in Square Feet	9,600	
Commercial Construction in Square Feet	17,480	
Total	*27,080*	
Industrial Construction ($) Value	300,000	
Commercial Construction ($) Value	1,289,00	
Total	*1,589,000*	

Authorized New Housing Units	1990	1998
Single Family	50	74
Multi Family	6	10
Total	*56*	*84*

Table 69 (continued). Washington County, RI economy in 1990 and 1998.

Median Selling Price of Existing Single Family Home	1990	1998
	$139,250	$136,925
Vital Statistics/US Census	**1990**	**1998**
Population	15,004	15,888
Births	188	
Deaths	90	
Natural Increase	*98*	
Gross Retail Sales in $1,000	**1990**	**1998**
	$117,987	
Local Property Taxes	**1990**	**1998**
Real Estate Tax per $1,000	$24.63	$16.85
Motor Vehicles	$24.63	$16.85
Business Personal Property	$24.63	$16.85

Source: Clay pers. comm.

TABLE 70. Employment in Port of Stonington, CT in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	18
Mining	0
Construction	40
Manufacturing, nondurable goods	56
Manufacturing, durable goods	116
Transportation	5
Communications & Other public utilities	8
Wholesale trade	7
Retail trade	92
Finance, insurance & real estate	37
Business & repair services	22
Personal services	26
Entertainment & recreation services	13
Professional & related services	
-- Health services	35
-- Educational services	42
-- Other professional & related services	66
Public Administration	20

Source: Clay pers. comm.

TABLE 71. Employment in Port of New London, CT in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	448
Mining	0
Construction	758
Manufacturing, nondurable goods	348
Manufacturing, durable goods	961
Transportation	296
Communications & Other public utilities	131
Wholesale trade	269
Retail trade	2454
Finance, insurance & real estate	587
Business & repair services	458
Personal services	347
Entertainment & recreation services	191
Professional & related services	
-- Health services	891
-- Educational services	2431
-- Other professional & related services	903
Public Administration	489

Source: Clay pers. comm.

TABLE 72. Employment in Port of Portland, ME. in 1990.

Industry	Number of Employees
Agriculture, forestry & fishing	449
Mining	17
Construction	1593
Manufacturing, nondurable goods	1762
Manufacturing, durable goods	1489
Transportation	1225
Communications & Other public utilities	829
Wholesale trade	1809
Retail trade	6675
Finance, insurance & real estate	3411
Business & repair services	1626
Personal services	1189
Entertainment & recreation services	499
Professional & related services	
-- Health services	3749
-- Educational services	2625
-- Other professional & related services	3290
Public Administration	1141

Source: Clay pers. comm.

Table 73. Annual tilefish landed weight (lbs) by vessel, for those vessels who landed greater than 50,000 lbs in any year of the time period, 1988-1998, for long-line gears only.

	YEAR										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
vessel id											
1	0	0	0	0	70500	409256	135015	0	0	0	0
2	0	0	0	0	38261	67553	0	0	0	0	0
3	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
4	58372	0	0	0	8547	18934	4278	5880	273	143	28421
5	78910	0	0	0	0	0	0	0	0	0	0
6	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
7	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
8	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
9	58055	305	0	0	0	0	0	0	110093	160156	60176
10	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
11	25392	57802	85395	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	13845	0	23697	304051	346028
13	0	0	0	0	0	90936	32306	36256	0	0	0
14	0	0	0	124145	130527	113134	0	0	0	0	0
15	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
16	4700	0	0	0	0	0	200636	301128	419538	703516	350802
17	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386
18	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
19	0	0	0	0	0	0	0	0	0	0	51000
20	0	0	0	0	0	301830	253916	230590	476370	595186	464969

Source: Rountree pers. comm.

Table 74. Option 1 for limited entry to full-time and part-time categories. Numbers are reported pounds landed for vessel per year.

OPTION 1-FULL-TIME

Vessel	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
2	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
3	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
4	58055	305	0	0	0	0	0	0	110093	160156	60176
5	0	0	0	0	0	90936	32306	36256	0	0	0
6	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386
7	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
8	0	0	0	0	0	301830	253916	230590	476370	595186	464969

PART-TIME

Vessel	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
9	0	0	0	0	70500	409256	135015	0	0	0	0
10	58372	0	0	0	8547	18934	4278	5880	273	143	28421
11	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
12	31394	0	0	0	0	47442	32207	0	0	0	0
13	25667	0	0	0	0	30420	30015	0	0	0	8154
14	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
15	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
16	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
17	0	0	0	0	71	18797	10997	2596	6147	0	0
18	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm.

Table 75. Option 2 for limited entry to full-time and part-time categories. Numbers are reported pounds landed for vessel per year.

OPTION 2- FULL TIME: TIER 1

Vessel	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
3	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
19	4700	0	0	0	0	0	200636	301128	419538	703516	350802
7	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
8	0	0	0	0	0	301830	253916	230590	476370	595186	464969

FULL- TIME: TIER 2

Vessel	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
2	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
4	58055	305	0	0	0	0	0	0	110093	160156	60176
5	0	0	0	0	0	90936	32306	36256	0	0	0
6	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386

PART -TIME

Vessel	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
9	0	0	0	0	70500	409256	135015	0	0	0	0
1	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
10	58372	0	0	0	8547	18934	4278	5880	273	143	28421
11	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
12	31394	0	0	0	0	47442	32207	0	0	0	0
13	25667	0	0	0	0	30420	30015	0	0	0	8154
14	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
15	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
16	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
17	0	0	0	0	71	18797	10997	2596	6147	0	0
18	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm.

Table 76. Option 3 for limited entry to full-time and part-time categories. Numbers are reported landed pounds per vessel per year.

OPTION 3-FULL-TIME

vessel id	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
2	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
3	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
4	58055	305	0	0	0	0	0	0	110093	160156	60176
5	0	0	0	0	0	90936	32306	36256	0	0	0
6	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386
7	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
8	0	0	0	0	0	301830	253916	230590	476370	595186	464969

PART-TIME

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
9	0	0	0	0	70500	409256	135015	0	0	0	0
21	0	0	0	0	38261	67553	0	0	0	0	0
25	17501	0	0	0	0	0	0	0	0	0	0
10	58372	0	0	0	8547	18934	4278	5880	273	143	28421
22	78910	0	0	0	0	0	0	0	0	0	0
11	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
12	31394	0	0	0	0	47442	32207	0	0	0	0
26	5773	1365	26568	0	0	0	0	0	0	0	0
27	0	0	0	0	16000	0	0	0	0	0	0
28	0	0	0	4226	0	11960	0	0	0	0	0
29	0	0	0	3656	20294	1651	0	0	0	0	0
30	23251	0	0	0	0	0	0	0	0	0	0
13	25667	0	0	0	0	30420	30015	0	0	0	8154
14	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
23	25392	57802	85395	0	0	0	0	0	0	0	0
31	0	0	10200	0	0	0	0	0	0	0	0
24	0	0	0	124145	130527	113134	0	0	0	0	0
32	49625	4813	0	0	0	0	0	0	0	0	0
15	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
33	3688	1639	1044	1059	27128	12534	745	702	4876	2326	4772
34	104	524	120	424	4285	12743	1182	66	0	0	0
35	4880	2390	1402	1213	11445	7509	1693	168	896	1735	3743
36	0	0	0	0	0	45754	0	5330	0	19	0
37	1670	1471	0	1377	554	14658	1025	0	444	751	4947
38	15138	0	0	0	0	0	0	0	0	0	0
39	6540	3014	2733	300	21817	9291	849	206	5500	5423	1175
40	0	2407	640	451	18611	29141	1136	90	3542	332	2915
41	49900	0	0	0	800	1950	0	0	0	0	0
42	17810	0	70	0	0	0	0	0	0	0	0
43	0	0	0	0	0	47765	0	0	0	0	0
44	2909	422	171	677	8296	11396	758	435	134	1174	238
45	18332	0	0	0	0	0	0	0	0	0	0
46	615	105	0	251	5985	13010	827	1326	4491	1056	1637
47	49120	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	498	23188	155	139	3052	4888	4145
49	1487	1600	602	566	5924	15970	465	3907	7276	2866	9043
50	28447	0	0	0	0	0	0	0	0	0	0
16	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
51	1832	1506	1444	2305	12548	13434	961	393	6286	5454	3560
52	2710	1000	355	620	9937	13195	1069	573	1019	495	2165
53	0	0	9	0	0	46286	0	0	0	0	0
54	260	139	680	403	11463	8192	1089	427	1761	4258	5483
55	340	20	0	0	410	16857	1848	380	765	644	140
56	0	0	13505	1650	3380	0	0	0	0	0	0
17	0	0	0	0	71	18797	10997	2596	6147	0	0
57	2965	2477	651	0	11879	5128	1309	3420	4280	1182	2029
58	11941	0	0	0	0	0	0	0	0	0	0
18	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796
59	0	125	1243	447	7765	19700	0	0	0	0	7

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm.

Table 77. Option 4 for limited entry to full-time and part-time categories. Numbers are reported landed pounds per vessel per year.

OPTION 4-FULL-TIME

vessel id	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
9	0	0	0	0	70500	409256	135015	0	0	0	0
21	0	0	0	0	38261	67553	0	0	0	0	0
1	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
10	58372	0	0	0	8547	18934	4278	5880	273	143	28421
22	78910	0	0	0	0	0	0	0	0	0	0
11	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
2	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
4	58055	305	0	0	0	0	0	0	110093	160156	60176
14	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
23	25392	57802	85395	0	0	0	0	0	0	0	0
24	0	0	0	124145	130527	113134	0	0	0	0	0
15	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
6	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386

PART-TIME

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
25	17501	0	0	0	0	0	0	0	0	0	0
12	31394	0	0	0	0	47442	32207	0	0	0	0
26	5773	1365	26568	0	0	0	0	0	0	0	0
3	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
27	0	0	0	0	16000	0	0	0	0	0	0
28	0	0	0	4226	0	11960	0	0	0	0	0
29	0	0	0	3656	20294	1651	0	0	0	0	0
30	23251	0	0	0	0	0	0	0	0	0	0
13	25667	0	0	0	0	30420	30015	0	0	0	8154
31	0	0	10200	0	0	0	0	0	0	0	0
32	49625	4813	0	0	0	0	0	0	0	0	0
33	3688	1639	1044	1059	27128	12534	745	702	4876	2326	4772
34	104	524	120	424	4285	12743	1182	66	0	0	0
35	4880	2390	1402	1213	11445	7509	1693	168	896	1735	3743
36	0	0	0	0	0	45754	0	5330	0	19	0
37	1670	1471	0	1377	554	14658	1025	0	444	751	4947
38	15138	0	0	0	0	0	0	0	0	0	0
39	6540	3014	2733	300	21817	9291	849	206	5500	5423	1175
40	0	2407	640	451	18611	29141	1136	90	3542	332	2915
41	49900	0	0	0	800	1950	0	0	0	0	0
42	17810	0	70	0	0	0	0	0	0	0	0
7	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
43	0	0	0	0	0	47765	0	0	0	0	0
44	2909	422	171	677	8296	11396	758	435	134	1174	238
45	18332	0	0	0	0	0	0	0	0	0	0
46	615	105	0	251	5985	13010	827	1326	4491	1056	1637
47	49120	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	498	23188	155	139	3052	4888	4145
49	1487	1600	602	566	5924	15970	465	3907	7276	2866	9043
50	28447	0	0	0	0	0	0	0	0	0	0
16	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
51	1832	1506	1444	2305	12548	13434	961	393	6286	5454	3560
52	2710	1000	355	620	9937	13195	1069	573	1019	495	2165
53	0	0	9	0	0	46286	0	0	0	0	0
54	260	139	680	403	11463	8192	1089	427	1761	4258	5483
55	340	20	0	0	410	16857	1848	380	765	644	140
56	0	0	13505	1650	3380	0	0	0	0	0	0
8	0	0	0	0	0	301830	253916	230590	476370	595186	464969
17	0	0	0	0	71	18797	10997	2596	6147	0	0
57	2965	2477	651	0	11879	5128	1309	3420	4280	1182	2029
58	11941	0	0	0	0	0	0	0	0	0	0
18	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796
59	0	125	1243	447	7765	19700	0	0	0	0	7

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm.

Table 78. Approved option for limited entry to full-time and part-time categories. Landings are reported landed pounds per vessel per year, 1984-1998.

Vessel ID	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
FULL TIME - Tier 1															
1	0	0	0	0	0	0	0	0	7300	138125	174250	178626	290068	367345	332606
2	0	0	0	0	4700	0	0	0	0	0	200636	301128	419538	703516	350802
3	0	0	0	0	0	0	0	0	18000	286742	337759	317453	406781	642248	413273
4	0	0	0	0	0	0	0	0	0	301830	253916	230590	476370	595186	464969
FULL TIME - Tier 2															
5	19210	0	0	0	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
6	0	31844	233612	179816	58055	305	0	0	0	0	0	0	110093	160156	60176
7	0	0	0	0	0	0	0	0	0	90936	32306	36256	0	0	0
8	0	0	0	0	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386
PART TIME															
9	0	0	0	34051	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	70500	409256	135015	0	0	0	0
11	70587	6362	0	0	0	0	0	0	38261	67553	0	0	0	0	0
12	0	68841	61170	78117	17501	0	0	0	0	0	0	0	0	0	0
13	47941	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
15	0	0	0	11658	58372	0	0	0	8547	18934	4278	5880	273	143	28421
16	0	0	0	28375	78910	0	0	0	0	0	0	0	0	0	0
17	0	0	0	83995	87495	3009	13085	5467	6647	6563	51	555	2233	9144	13064
18	99622	125198	67987	59083	31394	0	0	0	0	47442	32207	0	0	0	0
19	5837	112890	83194	82807	5773	1365	26568	0	0	0	0	0	0	0	0
20	0	0	152821	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	6278	30304	25667	0	0	0	0	30420	30015	0	0	0	8154
22	140057	143399	108725	139310	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
23	121572	142045	0	9479	0	0	0	0	0	0	0	0	0	0	0
24	0	0	4872	219117	25392	57802	85395	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	124145	130527	113134	0	0	0	0	0
26	310245	234326	76182	0	0	0	0	0	0	0	0	0	0	0	0
27	192951	231374	260179	197233	49625	4813	0	0	0	0	0	0	0	0	0
28	119376	83752	79402	274680	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
29	0	60223	53162	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	57492	13410	0	0	0	0	0	45754	0	5330	0	19	0

Table 78 (continued). Approved option for limited entry to full-time and part-time categories. Landings are reported landed pounds per vessel per year, 1984-1998.

Vessel ID	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
31	97529	33844	0	0	0	0	0	0	0	0	0	0	0	0	0
32	155924	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	2407	640	451	18611	29141	1136	90	3542	332	2915
34	0	0	0	46501	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	49900	0	0	0	800	1950	0	0	0	0	0
36	0	0	11238	47797	131	0	0	0	0	0	58	0	0	0	0
37	0	0	0	0	0	0	0	0	0	47765	0	0	0	0	0
38	0	0	0	51120	18332	0	0	0	0	0	0	0	0	0	0
39	86306	71260	39266	55907	0	0	0	0	0	60	0	0	0	0	0
40	0	0	31510	0	0	0	0	0	0	0	0	0	0	0	0
41	0	344970	131564	102810	49120	0	0	0	0	0	0	0	0	0	0
42	0	0	0	13750	28447	0	0	0	0	0	0	0	0	0	0
43	65	45	3850	4857	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
44	0	0	0	0	0	0	9	0	0	46286	0	0	0	0	0
45	86965	0	0	119555	0	0	0	0	0	0	0	0	0	0	0
46	106430	117712	40390	31180	0	0	0	0	0	0	0	0	0	19371	0
47	0	0	0	0	0	0	0	0	71	18797	10997	2596	6147	0	0
48	109751	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	83193	114090	144967	11941	0	0	0	0	0	0	0	0	0	0
50	35	438	1241	2790	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796
															93414

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm.

Table 79. Option 6 for limited entry to full-time and part-time categories. Landings are reported landed pounds per vessel per year, 1984-1998. Tier 1 landings have been updated with additional New York landings.

Vessel ID	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
FULL TIME - Tier 1															
1	0	0	0	0	122240	63535	120645	125875	113990	202965	174250	178626	290068	367345	332606
2	0	0	0	0	230892	352599	474145	456382	474280	551212	265418	326449	419872	706014	444960
3	0	0	0	0	191711	203028	224424	297807	500516	611100	337933	337757	415629	750830	566152
4	0	0	0	0	0	0	0	0	484919	581427	255259	230235	527187	810911	499129
FULL TIME - Tier 2															
5	19210	0	0	0	0	4046	48104	157439	205864	224132	61320	58029	0	37153	0
6	0	31844	233612	179816	58055	305	0	0	0	0	0	0	110093	160156	60176
7	0	0	0	0	0	0	0	0	0	90936	32306	36256	0	0	0
8	0	0	0	0	0	56502	154670	205920	174231	206134	38997	38522	56745	0	118386
PART TIME															
9	0	0	0	34051	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	70500	409256	135015	0	0	0	0
11	70587	6362	0	0	0	0	0	0	38261	67553	0	0	0	0	0
12	0	68841	61170	78117	17501	0	0	0	0	0	0	0	0	0	0
13	47941	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	19473	22713	12288	94954	55822	87314	28526	0	26449	37	30749
15	0	0	0	11658	58372	0	0	0	8547	18934	4278	5880	306	143	28421
16	0	0	0	28375	78910	0	0	0	0	0	0	0	0	0	0
17	0	0	0	83995	87495	3009	13085	5467	6647	6563	51	555	2584	9144	17969
18	99622	125198	67987	59083	31394	0	0	0	0	47442	32207	0	0	0	0
19	5837	112890	83194	82807	5773	1365	26568	0	0	0	0	0	0	0	0
20	0	0	152821	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	6278	30304	25667	0	0	0	0	30420	30015	0	0	0	8154
22	140057	143399	108725	139310	174645	185510	128957	222408	249844	142857	72880	0	0	0	0
23	121572	142045	0	9479	0	0	0	0	0	0	0	0	0	0	0
24	0	0	4872	219117	25392	57802	85395	0	0	65	152	260	494	350	1855
25	0	0	0	0	0	0	0	124145	130527	113134	0	0	0	0	0
26	310245	234326	76182	0	0	0	0	0	0	0	0	0	0	0	0
27	192951	231374	260179	197233	49625	4813	0	0	0	0	0	0	0	0	0
28	119376	83752	79402	274680	75081	10925	4060	91511	214579	123695	50740	0	0	0	0
29	0	60223	53162	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	57492	13410	0	0	0	0	0	45754	0	5330	0	19	0
31	97529	33844	0	0	0	0	0	0	0	0	0	0	0	0	0
32	155924	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	2407	640	451	18611	29141	1136	90	3542	332	2915
34	0	0	0	46501	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	49900	0	0	0	800	2105	0	0	0	0	0

Table 79 (continued). Option 6 for limited entry to full-time and part-time categories. Landings are reported landed pounds per vessel per year, 1984-1998. Tier 1 landings have been updated with additional New York landings.

Vessel ID	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
PART TIME															
36	0	0	11238	47797	131	0	0	0	0	0	58	0	0	0	0
37	0	0	0	0	0	0	0	0	0	47765	0	0	0	0	0
38	0	0	0	51120	18332	0	0	0	0	0	0	0	0	0	0
39	86306	71260	39266	55907	0	0	0	0	0	60	0	0	0	0	0
40	47	0	31560	12845	615	105	0	251	5985	13010	827	1326	4491	1056	1637
41	15	344970	131564	102810	49120	0	0	0	0	0	0	0	0	0	0
42	0	0	0	13750	28447	0	0	0	0	0	0	10	0	0	0
43	65	45	3850	4857	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
44	0	0	0	0	0	0	9	0	0	46286	0	0	0	0	0
45	86965	0	0	119555	0	0	0	0	0	0	0	0	0	0	0
46	106430	117712	40390	31180	0	0	0	0	0	0	0	0	0	19371	0
47	0	0	0	0	0	0	0	0	71	18797	10997	2596	6147	0	0
48	109751	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	83193	114090	144967	11941	0	0	0	0	0	0	0	0	0	0
50	35	438	1241	2790	2103	2450	897	2464	15176	11424	488	516	10026	7838	7096

Note: Vessel numbers are not consistent among tables 74-79.

Source: Rountree pers. comm..

Table 80. Summary of limited entry options. Option 3 was the Council preferred option for public hearings which received no support. Option 6 was the compromise developed by the Historic Tilefish Coalition and the Montauk Tilefish Association that the Council adopted 23 November 1999.

	# of Vessels	Allocation**
Option 1		
full-time	8	75%
part-time	10	25%
Option 2		
full-time: tier 1	4	59%
full-time: tier 2	4	17%
part-time	11	24%
Option 3*		
full-time	8	65%
part-time	49	35%
Option 4		
full-time	13	43%
part-time	43	57%
Option 5		
total	119	100%
Option 6		
full-time: tier 1	4	66%
full-time: tier 2	4	15%
part-time	42	19%

** Percentage (options 1-5) was calculated based on 11 year (1988-1998) average of all vessels in each category divided by the 11 year average total landings of known vessels. Percentages were adjusted to account for 100% of landings. Option 6 allocation percentages were negotiated by industry.

Option 1: Full-time = at least 50,000 pounds in one year 1988-1993, and at least 25,000 pounds/year for two years 1994-1998. Part-time = at least 10,000 pounds in one year 1988-1993, and at least 10,000 pounds in one year between 1994-1998.

Option 2: Full-time: Tier1: at least 250,000 pounds/year for three years between 1993-1998, Tier 2: at least 30,000 pounds/year for three years between 1993-1998 and for both tiers there had to be at least one pound of landings prior to the 15 June 1993 control date. Part-time = same as option 1.

Option 3: Full-time = same as option 1. Part-time = at least 10,000 pounds in one year between 1988 and 15 June 1993.

Option 4: Full-time = at least 50,000 pounds in one year 1988 to 15 June 1993. Part-time = same as option 3.

Option 5: Full-time = at least 50,000 pounds in one year 1977 to 15 June 1993. Part-time = at least 10,000 pounds in one year 1977 to 15 June 1993. Actual numbers unknown at this time because of historical data limitations.
Option 6: Full-time: Tier1: same as option 2, Tier2 = same as option 2. Part-time = same as option 1 or 28,000 pounds in one year between 1984 and 1993.

Source: Rountree pers. comm.

Table 81. Annual tilefish (landed weight) lbs by vessel, for those vessels who landed greater than 10,000 lbs in any year in the time period, 1988-1998, other gear only.

	YEAR										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
vessel id											
1	3688	1639	1044	1059	27128	12534	745	702	4876	2326	4772
2	104	524	120	424	4285	12743	1182	66	0	0	0
3	4880	2390	1402	1213	11445	7509	1693	168	896	1735	3743
4	1670	1471	0	1377	554	14658	1025	0	444	751	4947
5	6540	3014	2733	300	21817	9291	849		5500	5423	1175
6	0	2407	640	451	18611	29141	1136	90	3542	332	2915
7	0	0	0	0	0	0	0	17212	0	0	140
8	0	0	0	0	0	0	0	15009	0	0	0
9	0	0	0	0	0	0	0	10003	10839	0	360
10	2909	422	171	677	8296	11396	758	435	134	1174	238
11	615	105	0	251	5985	13010	827	1326	4491	1056	1637
12	0	0	0	0	498	23188	155	139	3052	4888	4145
13	1487	1600	602	566	5924	15970	465	3907	7276	2866	9043
14	15	228	777	808	12841	48041	2348	1241	10326	2079	3315
15	1832	1506	1444	2305	12548	13434	961	393	6286	5454	3560
16	2710	1000	355	620	9937	13195	1069	573	1019	495	2165
17	260	139	680	403	11463	8192	1089	427	1761	4258	5483
18	340	20	0	0	410	16857	1848	380	765	644	140
19	2965	2477	651	0	11879	5128	1309	3420	4280	1182	2029
20	2103	2450	897	2464	15176	11424	488	516	10026	7838	6796
21	0	125	1243	447	7765	19700	0	0	0	0	7

Source: Rountree pers. comm.

Table 82. Number of vessels, trips, pounds and the marginal change per vessel of tilefish for various trip thresholds based on 1992 weighout data.

A. ALL GEARS

Trip Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	136	1407	1,511,071	686	52	139	3,728	2.7	27
50-100	91	1335	1,507,343	684	22	246	17,419	11.2	71
101-300	69	1089	1,489,924	676	33	469	87,330	14.2	186
301-600	36	620	1,402,594	636	19	317	123,789	16.7	391
601-1000	17	303	1,278,805	580	4	105	74,203	26.3	707
1001-2000	13	198	1,204,602	547	1	2	3,380	2.0	1690
2001-3000	12	196	1,201,222	545	2	23	58,555	11.5	2546
3001-4000	10	173	1,142,667	518	2	69	261,686	34.5	3793
4001-5000	8	104	880,981	400	1	37	174,231	37.0	4709
>5000	7	67	706,750	321	7	67	706,750	9.6	10549

B. LONGLINE GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	28	264	1,224,633	556	5	10	242	2.0	24
50-100	23	254	1,224,391	556	2	5	335	2.5	67
101-300	21	249	1,224,056	555	5	23	3,460	4.6	150
301-600	16	226	1,220,596	554	2	17	9,347	8.5	550
601-1000	14	209	1,211,249	550	1	11	6,647	11.0	604
1001-2000	13	198	1,204,602	547	1	2	3,380	2.0	1690
2001-3000	12	196	1,201,222	545	2	23	58,555	11.5	2546
3001-4000	10	173	1,142,667	518	2	69	261,686	34.5	3793
4001-5000	8	104	880,981	400	1	37	174,231	37.0	4709
>5000	7	67	706,750	321	7	67	706,750	9.6	10549

C. OTHER GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	115	1210	286,438	130	47	129	3,486	2.7	27
50-100	68	1081	282,952	128	20	241	17,084	12.1	71
101-300	48	840	265,868	121	28	446	83,870	15.9	188
301-600	20	394	181,998	83	17	300	114,442	17.6	381
601-1000	3	94	67,556	31	3	94	67,556	31.3	719

Source: Rountree pers. comm.

Table 83. Number of vessels, trips, pounds and the marginal change per vessel for various trip thresholds based on 1993 weighout data.

A. ALL GEARS

Trip Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	176	1961	2,958,460	1,342	62	160	3,809	2.6	24
50-100	114	1801	2,954,651	1,341	19	180	13,955	9.5	78
101-300	95	1621	2,940,696	1,334	30	635	130,283	21.2	205
301-600	65	986	2,810,413	1,275	29	429	170,612	14.8	398
601-1000	36	557	2,639,801	1,198	10	133	100,762	13.3	758
1001-2000	26	424	2,539,039	1,152	7	118	155,250	16.9	1316
2001-3000	19	306	2,383,789	1,082	3	49	117,285	16.3	2394
3001-4000	16	257	2,266,504	1,028	4	130	445,213	32.5	3425
4001-5000	12	127	1,821,291	826	3	74	339,202	24.7	4584
>5000	9	53	1,482,089	672	9	53	1,482,089	5.9	27964

B. LONGLINE GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	35	475	2,495,753	1,132	2	5	140	2.5	28
50-100	33	470	2,495,613	1,132	3	5	373	1.7	75
101-300	30	465	2,495,240	1,132	4	35	5,696	8.8	163
301-600	26	430	2,489,544	1,130	3	34	13,254	11.3	390
601-1000	23	396	2,476,290	1,124	4	64	52,665	16.0	823
1001-2000	19	332	2,423,625	1,100	1	28	46,286	28.0	1653
2001-3000	18	304	2,377,339	1,079	3	49	117,285	16.3	2394
3001-4000	15	255	2,260,054	1,025	3	128	438,763	42.7	3428
4001-5000	12	127	1,821,291	826	3	74	339,202	24.7	4584
>5000	9	53	1,482,089	672	9	53	1,482,089	5.9	27964

C. OTHER GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	141	1486	462,707	210	60	155	3669	2.6	24
50-100	81	1331	459,038	208	16	175	13,582	10.9	78
101-300	65	1156	445,456	202	26	600	124,587	23.1	208
301-600	39	556	320,869	146	26	395	157,358	15.2	398
601-1000	13	161	163,511	74	6	69	48,097	11.5	697
1001-2000	7	92	115,414	52	6	90	108,964	15.0	1211
2001-3000	1	2	6,450	3	0	0	0	0.0	0
3001-4000	1	2	6,450	3	1	2	6,450	2.0	3225

Source: Rountree pers. comm.

Table 84. Number of vessels, trips, pounds and the marginal change per vessel for various trip thresholds based on 1997 weighout data.

A. ALL GEARS

Trip Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	188	2570	3,086,568	1,400	91	373	10233	4.1	27
50-100	97	2197	3,076,335	1,396	42	533	38,900	12.7	73
101-300	55	1664	3,037,435	1,378	37	640	100,442	17.3	157
301-600	18	1024	2,936,993	1,333	5	86	29,842	17.2	347
601-1000	13	938	2,907,151	1,319	2	18	13,846	9.0	769
1001-2000	11	920	2,893,305	1,313	2	24	37,164	12.0	1549
2001-3000	9	896	2,856,141	1,296	3	287	690,767	95.7	2407
3001-4000	6	609	2,165,374	982	4	437	1,410,032	109.3	3227
4001-5000	2	172	755,342	343	1	144	595,186	144.0	4133
>5000	1	28	160,156	73	1	28	160,156	28.0	5720

B. LONGLINE GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	25	1044	2,932,111	1,330	9	28	557	3.1	20
50-100	16	1016	2,931,554	1,330	1	4	227	4.0	57
101-300	15	1012	2,931,327	1,330	1	3	773	3.0	258
301-600	14	1009	2,930,554	1,330	2	73	24,941	36.5	342
601-1000	12	936	2,905,613	1,318	1	16	12,308	16.0	769
1001-2000	11	920	2,893,305	1,313	2	24	37,164	12.0	1549
2001-3000	9	896	2,856,141	1,296	3	287	690,767	95.7	2407
3001-4000	6	609	2,165,374	982	4	437	1,410,032	109.3	3227
4001-5000	2	172	755,342	343	1	144	595,186	144.0	4133
>5000	1	28	160,156	73	1	28	160,156	28.0	5720

C. OTHER GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	163	1526	154,457	70	82	345	9676	4.2	28
50-100	81	1181	144,781	66	41	529	38,673	12.9	73
101-300	40	652	106,108	48	36	637	99,669	17.7	156
301-600	4	15	6,439	3	3	13	4,901	4.3	377
601-1000	1	2	1,538	1	1	2	1,538	2.0	769

Source: Rountree pers. comm.

Table 85. Number of vessels, trips, pounds and the marginal change per vessel for various trip thresholds based on 1998 weighout data.

A. ALL GEARS

Trip Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	223	4074	2,561,834	1,162	97	607	18383	6.3	30
50-100	126	3467	2,543,451	1,154	57	1136	77,807	19.9	68
101-300	69	2331	2,465,644	1,119	43	1035	147,937	24.1	143
301-600	26	1296	2,317,707	1,052	5	19	9,645	3.8	508
601-1000	21	1277	2,308,062	1,047	5	126	98,288	25.2	780
1001-2000	16	1151	2,209,774	1,003	9	736	1,313,561	81.8	1785
2001-3000	7	415	896,213	407	7	415	896,213	59.3	2160

B. LONGLINE GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	27	1308	2,292,295	1,040	4	24	816	6.0	34
50-100	23	1284	2,291,479	1,040	0	0	0	0.0	0
101-300	23	1284	2,291,479	1,040	2	11	1,782	5.5	162
301-600	21	1273	2,289,697	1,039	3	5	2,175	1.7	435
601-1000	18	1268	2,287,522	1,038	5	126	98,288	25.2	780
1001-2000	13	1142	2,189,234	993	9	736	1,313,561	81.8	1785
2001-3000	4	406	875,673	397	4	406	875,673	101.5	2157

C. OTHER GEAR ONLY

Threshold lbs	total vessels	total # trips	total catch lbs	total catch mt	# vessels	change # trips	catch (lbs)	trips/ vessel	catch/ trip
0-50	196	2766	269,539	122	93	583	17567	6.3	30
50-100	103	2183	251,972	114	57	1136	77,807	19.9	68
101-300	46	1047	174,165	79	41	1024	146,155	25.0	143
301-600	5	23	28,010	13	2	14	7,470	7.0	534
601-1000	3	9	20,540	9	0	0	0	0.0	0
1001-2000	3	9	20,540	9	0	0	0	0.0	0
2001-3000	3	9	20,540	9	3	9	20540	3.0	2282

Source: Rountree pers. comm.

Table 86. Summary of rebuilding schedules for tilefish. The preferred alternative is a constant TAL of 1.76 million pounds with 50% probability of reaching B_{MSY} in 10 years.

Type of projection	years	reaching BMSY	TAL or F	Table*
TAC	10	50%	1,760	3
Status Quo F	10		0.454	4
TAC	10	75%	1,412	11
TAC	8	50%	1,422	12
TAC	8	75%	1,003	13
TAC	11	50%	1,995	14
TAC	11	75%	1,719	15
No fishing F = 0	10		0	16
Constant F	8	50%	0.134	17
Constant F	8	75%	0.100	18
Constant F	10	50%	0.168	19
Constant F	10	75%	0.136	20
Constant F	10	100%	0.100	21

*Table identified includes additional information on biomass, F and yield.

Source: Nitschke pers. comm.

Table 87. Species composition in landed lbs from 6 possible vessels that target tilefish (4, 5, and 4 vessel out of six reporting from 1995-1997) based on the VTR data. Data was also limited to trips that caught tilefish. Percentages are given below the dotted line. NS stands for species not specified. Shark species are made up of mako, porbeagle, blue, sandbar, and species not specified categories.

Species	1995	1996	1997
Eel (NS)		7,086	421
Hake (NS)	1,929		
Silver Hake	5,932	4,854	5,100
kingfish		1,919	
Shark	1,491	3,848	1,393
Tilefish	1,082,859	1,335,544	2,036,893
Other	608	3,437	666
Total	1,092,819	1,356,688	2,044,473
Eel (NS)		0.52%	0.02%
Hake (NS)	0.18%		
Silver Hake	0.54%	0.36%	0.25%
kingfish		0.14%	
Shark	0.14%	0.28%	0.07%
Tilefish	99.09%	98.44%	99.63%
Other	0.06%	0.25%	0.03%

Note: 1kg=2.205 lbs

Source: Nitschke pers. comm.

Table 88. Discarded species composition in lbs from 6 possible vessels that target tilefish based on VTR data. Data were also limited to trips that caught tilefish. Number of trips are in parenthesis.

Species	1995	1996	1997
Eel (NS)	0	0	0
Hake (NS)	0	0	0
Silver Hake	0	0	0
kingfish	0	0	0
Dogfish	0	600 (2)	0
Shark	0	0	0
Tilefish	0	54 (1)	23 (1)
Other	0	0	0
Total	0	654	23

Source: Nitschke pers. comm.

Table 89. Discarded pounds of tilefish in VTR data for longline and other gear.

	1996	1997	1998
Longline	54	23	0
Other	991	453	356
Total	1,045	476	356

Source: Nitschke pers. comm.

Table 90. Number of trips, kept and discarded lbs for sea-sampled trawl trips which caught tilefish between 1995 - 1998. Total amount of sea-sampling trawl trips are also given.

	Kept			Discards			
Year	trips	lbs	lbs/trip	trips	lbs	lbs/trip	Total trips
1995	6	90	15	2	45	23	301
1996	10	3,390	339	5	123	25	239
1997	13	2,472	190	9	431	48	127
1998	11	1,146	104	7	100	14	68
total	40	7,098		23	699		735

Source: Nitschke pers. comm.

Table 91. Target species for sea sampled trips which discard tilefish.

target species	hauls	lbs	lbs/haul
hake	9	142	16
fluke	20	187	9
butterfish	15	113	8
squid	37	255	7

Source: Nitschke pers. comm.

Table 92. Target species for sea sampled trips which kept tilefish from 1994-1998.

target species	hauls	lbs	lbs/haul
hake	16	365	23
monkfish	2	36	18
mackerel	7	211	30
fluke	34	541	16
butterfish	30	1,586	53
squid	122	4,306	35

Source: Nitschke pers. comm.

Table 93. The area between 300 feet and 850 feet in Statistical Areas 616 and 537 (Roughly 3025 sq. n.m.).

300 feet curve		850 feet curve
A 39-00.0N 072-55.0W		1 39-00.0N 072-47.0W
B 39-40.7N 072-30.0W		2 39-03.5N 072-42.8W
C 40-00.0N 071-50.5W		3 39-08.7N 072-41.3W
D 40-07.6N 071-22.1W		4 39-08.2N 072-38.1W
E 40-16.8N 071-16.8W		5 39-17.7N 072-17.9W
F 40-23.5N 070-50.6W		6 39-25.0N 072-14.7W
G 40-15.7N 070-00.0W		7 39-32.5N 072-25.5W
		8 39-35.0N 072-35.2W
		9 39-38.5N 072-26.4W
		10 39-38.0N 072-24.7W
		11 39-32.6N 072-23.1W
		12 39-30.0N 072-12.8W
		13 39-30.0N 072-09.7W
		14 39-51.8N 071-44.4W
		15 40-01.5N 071-08.2W
		16 40-00.0N 070-36.5W
		17 40-01.3N 070-14.4W
		18 40-04.0N 070-11.2W
		19 39-58.2N 070-08.1W
		20 39-57.4N 070-00.0W

Source: Chiarella pers. comm.

Table 94. The area between 300 feet and 850 feet from Statistical Area 537 to the Hague Line (Roughly 2700 sq. n.m.).

300 feet curve	850 feet curve
G 40-15.7N 070-00.0W	20 39-57.4N 070-00.0W
H 40-06.8N 069-18.5W	21 39-55.1N 069-40.5W
I 40-19.1N 069-03.6W	22 39-59.4N 069-36.8W
J 40-32.5N 068-22.8W	23 39-55.5N 069-34.3W
K 40-34.0N 067-49.0W	24 39-56.2N 069-12.7W
L 41-00.0N 066-36.1W	25 40-01.8N 069-09.5W
M 41-22.1N 066-17.0W	26 40-03.2N 068-57.3W
	27 40-06.4N 068-50.8W
	28 40-12.2N 068-35.1W
	29 40-15.5N 068-10.5W
	30 40-26.8N 068-08.4W
	31 40-18.0N 068-05.7W
	32 40-18.2N 067-55.3W
	33 40-29.7N 067-11.0W
	34 40-33.4N 067-04.6W
	35 40-38.0N 067-02.5W
	36 40-36.8N 066-57.2W
	37 41-00.0N 066-25.6W
	38 41-09.3N 066-28.0W

Source: Chiarella pers. comm.

Table 95. The area between 300 feet and 850 feet from Statistical Area 616 to the VA/NC border (Roughly 1350 sq. n.m.).

300 feet curve		850 feet curve
A 39-00.0N 072-55.0W		1 39-00.0N 072-47.0W
Z 38-00.0N 074-09.4W		39 38-38.0N 073-09.0W
Y 37-15.0N 074-39.0W		40 38-23.8N 073-25.2W
X 36-31.1N 074-45.6W		41 38-03.7N 073-50.6W
		42 37-52.2N 074-03.0W
		43 37-23.6N 074-27.5W
		44 37-00.0N 074-36.7W
		45 36-31.1N 074-43.1W

Source: Chiarella pers. comm.

Table 96. Observed 1998 annual landings and 1999-2009 projected landings for each of the tilefish Regulatory options: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	244,812	244,812	244,812	244,812	244,812	244,812	244,182	244,812	244,812	244,812	244,812	244,812	244,812
1999	135,350	99,750	135,350	135,350	99,750	135,350	85,950	135,350.00	135,350.00	135,350	135,350.00	135,350	135,350
2000	125,450	99,750	71,100	50,150	70,600	88,000	85,950	0.00	43,500.00	32,900	53,450.00	44,050	32,900
2001	116,850	99,750	71,100	50,150	70,600	88,000	85,950	0.00	54,500.00	42,500	64,950.00	55,050	42,500
2002	109,300	99,750	71,100	50,150	70,600	88,000	85,950	0.00	66,800.00	53,600	77,500.00	67,450	53,600
2003	102,600	99,750	71,100	50,150	70,600	88,000	85,950	0.00	80,050.00	65,700	90,800.00	80,750	65,700
2004	96,650	99,750	71,100	50,150	70,600	88,000	85,950	0.00	93,700.00	78,150	104,400.00	94,350	78,150
2005	91,300	99,750	71,100	50,150	70,600	88,000	85,950	0.00	107,000.00	90,250	117,750.00	107,750	90,250
2006	86,500	99,750	71,100	50,150	70,600	88,000	85,950	0.00	119,500.00	101,400	130,300.00	120,150	101,400
2007	82,150	99,750	71,100	50,150	70,600	88,000	85,950	0.00	130,500.00	111,100	141,750.00	131,400	111,100
2008	78,150	99,750	71,100	50,150	70,600	88,000	85,950	0.00	130,500.00	111,100	151,900.00	141,000	119,150
2009	74,550	99,750	71,100	50,150	70,600	88,000	85,950	0.00	130,500.00	111,100	160,500.00	148,900	125,550
Change	-119,362	-145,062	-173,712	-194,662	-174,212	-156,812	-158,862	-244812	-201312	-211,912	-191362	-200,762	-211,912

[a]Projections derived from Nitschke (pers comm..) and option 6 allocations among the vessel categories. Landings for 1998 are derived from vessel category landings presented in Table 79 and percentages presented in Table 24. Change is the change in landings between 1998 and 2000, which is considered as the first year of the FMP.
Source: Kirkley pers. comm.

Table 97. Observed 1998 annual landings and 1999-2009 projected landings for each of the tilefish regulatory options: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111	102,111
1999	488,614	360,098	488,614	488,614	360,098	488,614	310,280	488,614	488,614	488,614	488,614	488,614	488,614
2000	452,875	360,098	256,671	181,042	254,866	317,680	310,280	0	157,035	118,769	192,955	159,021	118,769
2001	421,829	360,098	256,671	181,042	254,866	317,680	310,280	0	196,745	153,425	234,470	198,731	153,425
2002	394,573	360,098	256,671	181,042	254,866	317,680	310,280	0	241,148	193,496	279,775	243,495	193,496
2003	370,386	360,098	256,671	181,042	254,866	317,680	310,280	0	288,981	237,177	327,788	291,508	237,177
2004	348,907	360,098	256,671	181,042	254,866	317,680	310,280	0	338,257	282,122	376,884	340,604	282,122
2005	329,593	360,098	256,671	181,042	254,866	317,680	310,280	0	386,270	325,803	425,078	388,978	325,803
2006	312,265	360,098	256,671	181,042	254,866	317,680	310,280	0	431,395	366,054	470,383	433,742	366,054
2007	296,562	360,098	256,671	181,042	254,866	317,680	310,280	0	471,105	401,071	511,718	474,354	401,071
2008	282,122	360,098	256,671	181,042	254,866	317,680	310,280	0	471,105	401,071	548,359	509,010	430,132
2009	269,126	360,098	256,671	181,042	254,866	317,680	310,280	0	471,105	401,071	579,405	537,529	453,236
Change	350,764	257,987	154,560	78,931	152,755	215,569	208,169	-102,111	54,924	16,658	90,844	56,910	16,658

[a]Projections derived from Nitschke (pers comm..) and option 6 allocations among the vessel categories. Landings for 1998 are derived from vessel category landings presented in Table 79 and percentages presented in Table 24. Change is the change in landings between 1998 and 2000, which is considered as the first year of the FMP.
Source: Kirkley pers. comm.

Table 98. Observed 1998 annual landings and 1999-2009 projected landings for each of the tilefish regulatory options: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847	1,847,847
1999	1,697,289	1,250,865	1,697,289	1,697,289	1,250,865	1,697,289	1,077,813	1,697,289	1,697,289	1,697,289	1,697,289	1,697,289	1,697,289
2000	1,573,143	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	545,490	412,566	670,263	552,387	412,566
2001	1,465,299	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	683,430	532,950	814,473	690,327	532,950
2002	1,370,622	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	837,672	672,144	971,850	845,823	672,144
2003	1,286,604	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,003,827	823,878	1,138,632	1,012,605	823,878
2004	1,211,991	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,174,998	980,001	1,309,176	1,183,149	980,001
2005	1,144,902	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,341,780	1,131,735	1,476,585	1,351,185	1,131,735
2006	1,084,710	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,498,530	1,271,556	1,633,962	1,506,681	1,271,556
2007	1,030,161	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,636,470	1,393,194	1,777,545	1,647,756	1,393,194
2008	980,001	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,636,470	1,393,194	1,904,826	1,768,140	1,494,141
2009	934,857	1,250,865	891,594	628,881	885,324	1,103,520	1,077,813	0	1,636,470	1,393,194	2,012,670	1,867,206	1,574,397
Change	-274,704	-596,982	-956,253	-1,218,966	-962,523	-744,327	-770,034	-1,847,847	-1,302,357	-1,435,281	-1,177,584	-1,295,460	-1,435,281

[a]Projections derived from Nitschke (pers comm..) and option 6 allocations among the vessel categories. Landings for 1998 are derived from vessel category landings presented in Table 79 and percentages presented in Table 24. Change is the change in landings between 1998 and 2000, which is considered as the first year of the FMP.
Source: Kirkley pers. comm.

Table 99. Observed 1998 annual landings and 1999-2009 projected landings for each of the tilefish regulatory options: full-time Tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562	178,562
1999	385,748	284,288	385,748	385,748	284,288	385,748	244,958	385,747.50	385,747.50	385,748	385,747.50	385,748	385,748
2000	357,533	284,288	202,635	142,928	201,210	250,800	244,958	0.00	123,975.00	93,765	152,332.50	125,543	93,765
2001	333,023	284,288	202,635	142,928	201,210	250,800	244,958	0.00	155,325.00	121,125	185,107.50	156,893	121,125
2002	311,505	284,288	202,635	142,928	201,210	250,800	244,958	0.00	190,380.00	152,760	220,875.00	192,233	152,760
2003	292,410	284,288	202,635	142,928	201,210	250,800	244,958	0.00	228,142.50	187,245	258,780.00	230,138	187,245
2004	275,453	284,288	202,635	142,928	201,210	250,800	244,958	0.00	267,045.00	222,728	297,540.00	268,898	222,728
2005	260,205	284,288	202,635	142,928	201,210	250,800	244,958	0.00	304,950.00	257,213	335,587.50	307,088	257,213
2006	246,525	284,288	202,635	142,928	201,210	250,800	244,958	0.00	340,575.00	288,990	371,355.00	342,428	288,990
2007	234,128	284,288	202,635	142,928	201,210	250,800	244,958	0.00	371,925.00	316,635	403,987.50	374,490	316,635
2008	222,728	284,288	202,635	142,928	201,210	250,800	244,958	0.00	371,925.00	316,635	432,915.00	401,850	339,578
2009	212,468	284,288	202,635	142,928	201,210	250,800	244,958	0.00	371,925.00	316,635	457,425.00	424,365	357,818
Change	178,971	105,726	24,073	-35,635	22,648	72,238	66,396	-178,562	-54,587	-84,797	-26,230	-53,020	-84,797

[a]Projections derived from Nitschke (pers comm..) and option 6 allocations among the vessel categories. Landings for 1998 are derived from vessel category landings presented in Table 79 and percentages presented in Table 24. Change is the change in landings between 1998 and 2000, which is considered as the first year of the FMP.
Source: Kirkley pers. comm.

Table 100. Observed 1998 annual nominal ex-vessel prices and 1999-2009 projected prices for tilefish under each of the regulatory options and landings from all other states equaling 1998 observed level of landings (565,660 pounds.landings)[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
1999	1.83	1.91	1.83	1.83	1.91	1.83	1.93	1.83	1.83	1.83	1.83	1.83	1.83
2000	1.91	1.96	2.02	2.07	2.02	1.99	1.99	2.17	2.08	2.10	2.06	2.08	2.10
2001	1.99	2.02	2.08	2.12	2.08	2.05	2.05	2.23	2.11	2.14	2.09	2.11	2.14
2002	2.06	2.08	2.14	2.18	2.14	2.10	2.11	2.28	2.15	2.17	2.13	2.15	2.17
2003	2.13	2.14	2.20	2.24	2.20	2.16	2.17	2.34	2.18	2.21	2.16	2.18	2.21
2004	2.20	2.20	2.25	2.30	2.26	2.22	2.22	2.40	2.21	2.24	2.19	2.21	2.24
2005	2.27	2.25	2.31	2.36	2.31	2.28	2.28	2.46	2.24	2.27	2.22	2.24	2.27
2006	2.34	2.31	2.37	2.41	2.37	2.34	2.34	2.52	2.27	2.31	2.25	2.27	2.31
2007	2.40	2.37	2.43	2.47	2.43	2.39	2.40	2.57	2.31	2.35	2.28	2.30	2.35
2008	2.47	2.43	2.49	2.53	2.49	2.45	2.45	2.63	2.36	2.40	2.32	2.34	2.39
2009	2.54	2.48	2.54	2.59	2.54	2.51	2.51	2.69	2.42	2.46	2.36	2.38	2.43

[a]Projections based on estimated price model: ex-vessel $Price_t$ = -130.63 - .000000118 $landings_{M\text{-}VA,t}$ - .000000078 $landings_{AllO,t}$ + .067 year. Ex-vessel price is the annual (nominal) ex-vessel price per pound of tilefish landings ($landings_{M\text{-}VA}$) between Maine and Virginia (M-VA), $landings_{AllO}$ is the annual ex-vessel landings for all other areas. Source: Kirkley pers. comm.

Table 101. Observed 1998 annual nominal ex-vessel prices and 1999-2009 projected prices for tilefish under each of the regulatory options and landings from all Other States equaling 1964-1998 mean annual.(1,764,556 pounds) landings[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
1999	1.75	1.83	1.75	1.75	1.83	1.75	1.85	1.75	1.75	1.75	1.75	1.75	1.75
2000	1.83	1.88	1.94	1.99	1.94	1.91	1.91	2.09	2.00	2.02	1.98	2.00	2.02
2001	1.91	1.94	2.00	2.04	2.00	1.97	1.97	2.15	2.03	2.06	2.01	2.03	2.06
2002	1.98	2.00	2.06	2.10	2.06	2.02	2.03	2.20	2.07	2.09	2.04	2.07	2.09
2003	2.05	2.06	2.12	2.16	2.12	2.08	2.08	2.26	2.10	2.13	2.08	2.10	2.13
2004	2.12	2.11	2.17	2.22	2.17	2.14	2.14	2.32	2.13	2.16	2.10	2.13	2.16
2005	2.19	2.17	2.23	2.27	2.23	2.20	2.20	2.38	2.16	2.19	2.14	2.16	2.19
2006	2.26	2.23	2.29	2.33	2.29	2.25	2.26	2.44	2.19	2.23	2.17	2.19	2.23
2007	2.32	2.29	2.35	2.39	2.35	2.31	2.32	2.49	2.22	2.26	2.20	2.22	2.26
2008	2.39	2.35	2.40	2.45	2.41	2.37	2.37	2.55	2.28	2.32	2.24	2.26	2.31
2009	2.46	2.40	2.46	2.51	2.46	2.43	2.43	2.61	2.34	2.38	2.28	2.30	2.35

[a]Projections based on estimated price model: ex-vessel $Price_t$ = -130.63 - .000000118$landings_{M\text{-}VA,t}$ - .000000078$landings_{AllO,t}$ + .067 year. Ex-vessel price is the annual (nominal) ex-vessel price per pound of tilefish landings ($Landings_{M\text{-}VA}$) between Maine and Virginia (M-VA), $Landings_{AllO}$ is the annual ex-vessel landings for all other areas. Source: Kirkley pers. comm.

Table 102. Observed 1998 annual nominal ex-vesselprices and 1999-2009 projected prices for tilefish under each of the regulatory options and landings from all other states equaling South Atlantic Fishery Management Council quota of 1,001,813 pounds (live weight)[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
1999	1.80	1.87	1.80	1.80	1.87	1.80	1.90	1.80	1.80	1.80	1.80	1.80	1.80
2000	1.88	1.93	1.99	2.03	1.99	1.95	1.96	2.13	2.04	2.07	2.02	2.04	2.07
2001	1.95	1.99	2.05	2.09	2.05	2.01	2.01	2.19	2.08	2.10	2.06	2.08	2.10
2002	2.02	2.04	2.10	2.15	2.10	2.07	2.07	2.25	2.11	2.14	2.09	2.11	2.14
2003	2.10	2.10	2.16	2.20	2.16	2.13	2.13	2.31	2.14	2.17	2.12	2.14	2.17
2004	2.17	2.16	2.22	2.26	2.22	2.18	2.19	2.36	2.17	2.20	2.15	2.17	2.20
2005	2.24	2.22	2.28	2.32	2.28	2.24	2.25	2.42	2.20	2.24	2.18	2.20	2.24
2006	2.30	2.28	2.33	2.38	2.34	2.30	2.30	2.48	2.23	2.27	2.21	2.23	2.27
2007	2.37	2.33	2.39	2.44	2.39	2.36	2.36	2.54	2.27	2.31	2.25	2.27	2.31
2008	2.44	2.39	2.45	2.49	2.45	2.42	2.42	2.60	2.33	2.37	2.28	2.31	2.35
2009	2.50	2.45	2.51	2.55	2.51	2.47	2.48	2.65	2.39	2.43	2.32	2.35	2.40

[a]Projections based on estimated price model: ex-vessel $Price_t = -130.63 - .000000118\ Landings_{M\text{-}VA,t} - .000000078 landings_{AllO,t} + .067\ year_t$. Ex-vessel price is the annual (nominal) ex-vessel price per pound of tilefish landings ($landings_{M\text{-}VA}$) between Maine and Virginia (M-VA), $landings_{AllO}$ is the annual ex-vessel landings for all other areas. Source: Kirkley pers. comm.

Table 103. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907
1999	260,334	199,670	260,334	260,334	199,670	260,334	174,655	260,334	260,334	260,334	260,334	260,334	260,334
2000	235,312	192,375	141,308	101,830	140,387	171,839	168,198	0	88,922	67,970	108,168	89,996	67,970
2001	213,086	185,179	135,905	97,878	135,017	165,353	161,839	0	105,913	83,572	124,917	106,924	83,572
2002	193,280	178,102	130,605	94,008	129,750	158,979	155,592	0	123,222	100,143	141,471	124,342	100,143
2003	175,558	171,159	125,416	90,224	124,594	152,732	149,470	0	140,002	116,486	157,165	141,131	116,486
2004	159,723	164,361	120,348	86,534	119,557	146,622	143,482	0	155,281	131,417	171,262	156,262	131,417
2005	145,490	157,721	115,405	82,940	114,646	140,657	137,639	0	168,047	143,956	183,076	169,107	143,956
2006	132,725	151,245	110,595	79,446	109,865	134,846	131,946	0	177,959	153,518	192,115	178,820	153,518
2007	121,219	144,943	105,920	76,055	105,220	129,193	126,408	0	184,488	159,821	198,351	185,609	159,821
2008	110,777	138,817	101,383	72,767	100,712	123,702	121,031	0	176,810	153,104	201,916	189,265	163,050
2009	101,405	132,873	96,986	69,583	96,344	118,377	115,816	0	169,347	146,582	202,894	190,161	163,618
Change	-263,595	-306,532	-357,599	-397,077	-358,520	-327,068	-330,709	-498,907	-409,985	-430,937	-390,739	-408,911	-430,937

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 104. Observed 1998 annual revenue and 1999-2009 projected ex-vesselrevenue for each of the tilefish: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094
1999	939,805	720,808	939,805	939,805	720,808	939,805	630,504	939,805	939,805	939,805	939,805	939,805	939,805
2000	849,478	694,473	510,122	367,607	506,796	620,340	607,196	0	321,008	245,373	390,488	324,887	245,373
2001	769,242	668,498	490,618	353,341	487,413	596,923	584,239	0	382,345	301,696	450,951	385,994	301,696
2002	697,740	642,949	471,484	339,367	468,397	573,915	561,687	0	444,831	361,515	510,710	448,875	361,515
2003	633,766	617,883	452,753	325,710	449,783	551,362	539,585	0	505,406	420,516	567,366	509,483	420,516
2004	576,600	593,344	434,455	312,388	431,600	529,304	517,971	0	560,566	474,416	618,256	564,107	474,416
2005	525,220	569,372	416,614	299,414	413,871	507,773	496,876	0	606,651	519,681	660,903	610,475	519,681
2006	479,137	545,996	399,247	286,801	396,614	486,793	476,324	0	642,432	554,201	693,536	645,540	554,201
2007	437,602	523,243	382,370	274,557	379,844	466,385	456,335	0	666,001	576,953	716,046	670,048	576,953
2008	399,903	501,129	365,992	262,688	363,571	446,564	436,922	0	638,284	552,705	728,915	683,247	588,610
2009	366,072	479,670	350,121	251,196	347,801	427,340	418,096	0	611,343	529,160	732,449	686,483	590,662
Change	641,384	486,379	302,028	159,513	298,702	412,246	399,102	-208,094	112,914	37,279	182,394	116,793	37,279

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 105. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763
1999	3,264,587	2,503,861	3,264,587	3,264,587	2,503,861	3,264,587	2,190,172	3,264,587	3,264,587	3,264,587	3,264,587	3,264,587	3,264,587
2000	2,950,819	2,412,379	1,772,001	1,276,950	1,760,450	2,154,864	2,109,207	0	1,115,080	852,347	1,356,431	1,128,554	852,347
2001	2,672,104	2,322,151	1,704,254	1,227,393	1,693,119	2,073,521	2,029,461	0	1,328,147	1,047,995	1,566,461	1,340,821	1,047,995
2002	2,423,730	2,233,403	1,637,786	1,178,855	1,627,063	1,993,598	1,951,123	0	1,545,202	1,255,790	1,774,044	1,559,251	1,255,790
2003	2,201,501	2,146,329	1,572,722	1,131,415	1,562,404	1,915,258	1,874,348	0	1,755,621	1,460,739	1,970,849	1,769,784	1,460,739
2004	2,002,927	2,061,090	1,509,160	1,085,136	1,499,242	1,838,636	1,799,268	0	1,947,228	1,647,970	2,147,625	1,959,530	1,647,970
2005	1,824,449	1,977,817	1,447,185	1,040,071	1,437,656	1,763,842	1,725,990	0	2,107,313	1,805,209	2,295,768	2,120,599	1,805,209
2006	1,664,370	1,896,618	1,386,859	996,257	1,377,712	1,690,965	1,654,599	0	2,231,607	1,925,118	2,409,123	2,242,404	1,925,118
2007	1,520,090	1,817,579	1,328,233	953,725	1,319,459	1,620,075	1,585,162	0	2,313,477	2,004,152	2,487,319	2,327,534	2,004,152
2008	1,389,138	1,740,764	1,271,342	912,494	1,262,931	1,551,222	1,517,729	0	2,217,196	1,919,921	2,532,021	2,373,383	2,044,645
2009	1,271,618	1,666,221	1,216,210	872,576	1,208,152	1,484,445	1,452,335	0	2,123,611	1,838,133	2,544,296	2,384,623	2,051,773
Change	-814,944	-1,353,384	-1,993,762	-2,488,813	-2,005,313	-1,610,899	-1,656,556	-3,765,763	-2,650,683	-2,913,416	-2,409,332	-2,637,209	-2,913,416

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 106. Observed 1998 annual revenue and 1999-2009projected ex-vessel revenue for each of the tilefish: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895
1999	741,952	569,059	741,952	741,952	569,059	741,952	497,766	741,952	741,952	741,952	741,952	741,952	741,952
2000	670,641	548,298	402,728	290,216	400,102	489,742	479,365	0	253,427	193,715	308,280	256,490	193,715
2001	607,296	527,762	387,330	278,953	384,800	471,255	461,241	0	301,852	238,181	356,014	304,732	238,181
2002	550,848	507,592	372,224	267,922	369,787	453,090	443,437	0	351,182	285,407	403,192	354,375	285,407
2003	500,341	487,802	357,437	257,140	355,092	435,286	425,988	0	399,005	331,986	447,920	402,224	331,986
2004	455,211	468,429	342,991	246,622	340,737	417,872	408,925	0	442,552	374,539	488,097	445,348	374,539
2005	414,648	449,504	328,906	236,380	326,740	400,873	392,271	0	478,935	410,275	521,765	481,954	410,275
2006	378,266	431,050	315,195	226,422	313,116	384,310	376,045	0	507,183	437,527	547,528	509,637	437,527
2007	345,475	413,086	301,871	216,756	299,877	368,199	360,264	0	525,790	455,489	565,300	528,985	455,489
2008	315,713	395,628	288,941	207,385	287,030	352,551	344,938	0	503,908	436,346	575,459	539,405	464,692
2009	289,004	378,687	276,411	198,313	274,580	337,374	330,076	0	482,639	417,758	578,249	541,960	466,312
Change	306,746	184,373	38,833	-73,679	36,207	125,847	115,470	-363,895	-110,468	-170,180	-55,615	-107,405	-170,180

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 107. Estimated total costs for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816
1999	237,849	182,424	237,849	237,849	182,424	237,849	159,570	237,849	237,849	237,849	237,849	237,849	237,849
2000	214,989	175,759	129,103	93,035	128,262	156,997	153,671	0	81,242	62,100	98,826	82,223	62,100
2001	194,682	169,186	124,167	89,425	123,356	151,071	147,861	0	96,765	76,354	114,128	97,689	76,354
2002	176,586	162,720	119,325	85,888	118,543	145,248	142,153	0	112,579	91,493	129,252	113,603	91,493
2003	160,395	156,376	114,584	82,432	113,832	139,540	136,560	0	127,910	106,425	143,591	128,942	106,425
2004	145,928	150,165	109,953	79,060	109,231	133,958	131,090	0	141,870	120,067	156,470	142,766	120,067
2005	132,924	144,098	105,438	75,777	104,744	128,509	125,751	0	153,533	131,523	167,263	154,501	131,523
2006	121,261	138,182	101,043	72,585	100,376	123,199	120,550	0	162,589	140,259	175,522	163,375	140,259
2007	110,750	132,424	96,771	69,486	96,132	118,034	115,491	0	168,554	146,017	181,219	169,578	146,017
2008	101,209	126,827	92,626	66,482	92,014	113,018	110,578	0	161,539	139,880	184,476	172,918	148,967
2009	92,647	121,396	88,610	63,573	88,023	108,153	105,813	0	154,720	133,921	185,370	173,737	149,487
Change	-240,828	-280,057	-326,713	-362,781	-327,555	-298,819	-302,145	-455,816	-374,575	-393,717	-356,991	-373,593	-393,717

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 108. Estimated total costs for 1998-2009: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121
1999	858,634	658,552	858,634	858,634	658,552	858,634	576,047	858,634	858,634	858,634	858,634	858,634	858,634
2000	776,109	634,491	466,062	335,857	463,024	566,761	554,752	0	293,282	224,180	356,761	296,826	224,180
2001	702,803	610,760	448,244	322,823	445,315	545,366	533,778	0	349,322	275,638	412,002	352,656	275,638
2002	637,477	587,418	430,762	310,056	427,942	524,346	513,174	0	406,411	330,291	466,600	410,106	330,291
2003	579,027	564,516	413,649	297,579	410,935	503,741	492,981	0	461,754	384,196	518,362	465,479	384,196
2004	526,799	542,097	396,931	285,407	394,323	483,588	473,234	0	512,150	433,440	564,857	515,385	433,440
2005	479,857	520,195	380,631	273,554	378,125	463,916	453,961	0	554,254	474,796	603,821	557,749	474,796
2006	437,754	498,839	364,764	262,030	362,359	444,749	435,184	0	586,945	506,334	633,635	589,785	506,334
2007	399,806	478,050	349,345	250,844	347,037	426,103	416,921	0	608,478	527,121	654,202	612,176	527,121
2008	365,364	457,847	334,382	239,999	332,169	407,994	399,185	0	583,155	504,967	665,959	624,235	537,772
2009	334,454	438,241	319,881	229,500	317,762	390,431	381,985	0	558,541	483,456	669,187	627,191	539,646
Change	585,988	444,370	275,942	145,736	272,903	376,640	364,631	-190,121	103,161	34,059	166,640	106,705	34,059

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 109. Estimated total costs for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514
1999	2,982,625	2,287,602	2,982,625	2,982,625	2,287,602	2,982,625	2,287,602	2,982,625	2,982,625	2,982,625	2,982,625	2,982,625	2,982,625
2000	2,695,956	2,204,022	1,618,954	1,166,660	1,608,400	1,968,748	2,204,022	0	1,018,770	778,730	1,239,276	1,031,081	778,730
2001	2,441,314	2,121,587	1,557,057	1,121,383	1,546,884	1,894,431	2,121,587	0	1,213,435	957,480	1,431,166	1,225,014	957,480
2002	2,214,393	2,040,504	1,496,331	1,077,038	1,486,534	1,821,411	2,040,504	0	1,411,743	1,147,328	1,620,820	1,424,578	1,147,328
2003	2,011,358	1,960,951	1,436,886	1,033,695	1,427,459	1,749,837	1,960,951	0	1,603,988	1,334,575	1,800,627	1,616,928	1,334,575
2004	1,829,934	1,883,073	1,378,814	991,413	1,369,752	1,679,833	1,883,073	0	1,779,046	1,505,635	1,962,135	1,790,285	1,505,635
2005	1,666,872	1,806,993	1,322,191	950,240	1,313,486	1,611,499	1,806,993	0	1,925,304	1,649,293	2,097,482	1,937,442	1,649,293
2006	1,520,619	1,732,807	1,267,076	910,211	1,258,719	1,544,917	1,732,807	0	2,038,863	1,758,845	2,201,047	2,048,727	1,758,845
2007	1,388,800	1,660,595	1,213,513	871,352	1,205,497	1,480,149	1,660,595	0	2,113,662	1,831,054	2,272,489	2,126,505	1,831,054
2008	1,269,158	1,590,415	1,161,536	833,682	1,153,851	1,417,243	1,590,415	0	2,025,697	1,754,097	2,313,330	2,168,394	1,868,049
2009	1,161,789	1,522,310	1,111,166	797,212	1,103,804	1,356,234	1,522,310	0	1,940,195	1,679,374	2,324,545	2,178,664	1,874,561
Change	-744,558	-1,236,492	-1,821,560	-2,273,854	-1,832,114	-1,471,766	-1,236,492	-3,440,514	-2,421,744	-2,661,784	-2,201,238	-2,409,433	-2,661,784

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 110. Estimated total costs for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465
1999	677,869	519,910	677,869	677,869	519,910	677,869	454,774	677,869	677,869	677,869	677,869	677,869	677,869
2000	612,717	500,914	367,944	265,150	365,545	447,443	437,962	0	231,539	176,984	281,654	234,337	176,984
2001	554,844	482,179	353,877	254,860	351,565	430,552	421,404	0	275,781	217,609	325,265	278,412	217,609
2002	503,271	463,751	340,075	244,781	337,849	413,957	405,137	0	320,851	260,756	368,368	323,768	260,756
2003	457,127	445,671	326,565	234,931	324,423	397,690	389,196	0	364,543	303,312	409,233	367,484	303,312
2004	415,894	427,971	313,367	225,321	311,307	381,780	373,606	0	404,329	342,190	445,940	406,883	342,190
2005	378,834	410,680	300,498	215,964	298,520	366,250	358,390	0	437,569	374,839	476,701	440,328	374,839
2006	345,595	393,820	287,972	206,866	286,073	351,117	343,566	0	463,378	399,738	500,238	465,620	399,738
2007	315,636	377,408	275,798	198,035	273,977	336,397	329,148	0	480,378	416,149	516,475	483,297	416,149
2008	288,445	361,458	263,985	189,473	262,239	322,101	315,146	0	460,386	398,659	525,757	492,817	424,557
2009	264,043	345,979	252,538	181,184	250,864	308,235	301,567	0	440,953	381,676	528,306	495,151	426,037
Change	280,252	168,449	35,479	-67,315	33,080	114,977	105,497	-332,465	-100,927	-155,481	-50,812	-98,129	-155,481

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 111. Estimated net returns for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091
1999	22,485	17,245	22,485	22,485	17,245	22,485	15,085	22,485	22,485	22,485	22,485	22,485	22,485
2000	20,324	16,615	12,205	8,795	12,125	14,842	14,527	0	7,680	5,871	9,342	7,773	5,871
2001	18,404	15,994	11,738	8,454	11,661	14,281	13,978	0	9,148	7,218	10,789	9,235	7,218
2002	16,694	15,383	11,280	8,119	11,206	13,731	13,438	0	10,643	8,649	12,219	10,739	8,649
2003	15,163	14,783	10,832	7,793	10,761	13,191	12,910	0	12,092	10,061	13,574	12,189	10,061
2004	13,795	14,196	10,394	7,474	10,326	12,664	12,393	0	13,412	11,350	14,792	13,496	11,350
2005	12,566	13,622	9,968	7,164	9,902	12,149	11,888	0	14,514	12,433	15,812	14,606	12,433
2006	11,463	13,063	9,552	6,862	9,489	11,647	11,396	0	15,370	13,259	16,593	15,445	13,259
2007	10,470	12,519	9,148	6,569	9,088	11,158	10,918	0	15,934	13,804	17,132	16,031	13,804
2008	9,568	11,990	8,756	6,285	8,699	10,684	10,453	0	15,271	13,224	17,439	16,347	14,083
2009	8,758	11,476	8,377	6,010	8,321	10,224	10,003	0	14,627	12,660	17,524	16,424	14,132
Change	-22,767	-26,475	-30,886	-34,296	-30,965	-28,249	-28,563	-43,091	-35,410	-37,220	-33,748	-35,318	-37,220

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 112. Estimated net returns for 1998-2009: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973
1999	81,171	62,256	81,171	81,171	62,256	81,171	54,457	81,171	81,171	81,171	81,171	81,171	81,171
2000	73,369	59,982	44,059	31,750	43,772	53,579	52,444	0	27,725	21,193	33,726	28,060	21,193
2001	66,439	57,738	42,375	30,518	42,098	51,556	50,461	0	33,023	26,057	38,949	33,338	26,057
2002	60,264	55,532	40,722	29,311	40,455	49,569	48,513	0	38,420	31,224	44,110	38,769	31,224
2003	54,738	53,367	39,104	28,132	38,848	47,621	46,604	0	43,652	36,320	49,003	44,004	36,320
2004	49,801	51,247	37,524	26,981	37,277	45,716	44,737	0	48,416	40,975	53,399	48,722	40,975
2005	45,363	49,177	35,983	25,860	35,746	43,856	42,915	0	52,396	44,885	57,082	52,727	44,885
2006	41,383	47,158	34,483	24,771	34,256	42,044	41,140	0	55,487	47,866	59,901	55,755	47,866
2007	37,796	45,192	33,025	23,714	32,807	40,282	39,414	0	57,523	49,831	61,845	57,872	49,831
2008	34,540	43,283	31,611	22,688	31,402	38,570	37,737	0	55,129	47,737	62,956	59,012	50,838
2009	31,618	41,429	30,240	21,696	30,040	36,909	36,111	0	52,802	45,704	63,262	59,291	51,015
Change	55,396	42,009	26,086	13,777	25,799	35,606	34,470	-17,973	9,752	3,220	15,753	10,087	3,220

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 113. Estimated net returns for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	281,962	216,258	281,962	281,962	216,258	281,962	189,165	281,962	281,962	281,962	281,962	281,962	281,962
2000	254,862	208,357	153,048	110,290	152,050	186,116	182,172	0	96,309	73,617	117,155	97,473	73,617
2001	230,790	200,564	147,196	106,010	146,235	179,090	175,285	0	114,712	90,515	135,295	115,807	90,515
2002	209,338	192,899	141,456	101,818	140,529	172,187	168,518	0	133,459	108,463	153,224	134,672	108,463
2003	190,144	185,378	135,836	97,720	134,945	165,421	161,887	0	151,633	126,164	170,222	152,856	126,164
2004	172,993	178,016	130,346	93,723	129,489	158,803	155,403	0	168,182	142,335	185,490	169,245	142,335
2005	157,578	170,824	124,993	89,831	124,170	152,343	149,074	0	182,009	155,916	198,285	183,156	155,916
2006	143,752	163,811	119,783	86,047	118,993	146,049	142,908	0	192,744	166,272	208,076	193,676	166,272
2007	131,290	156,984	114,719	82,373	113,962	139,926	136,910	0	199,815	173,099	214,830	201,029	173,099
2008	119,980	150,350	109,806	78,812	109,079	133,979	131,086	0	191,499	165,824	218,691	204,989	176,596
2009	109,830	143,912	105,044	75,364	104,348	128,212	125,438	0	183,416	158,760	219,751	205,960	177,212
Change	-70,387	-116,892	-172,201	-214,959	-173,199	-139,133	-143,077	-325,249	-228,940	-251,632	-208,094	-227,776	-251,632

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 114. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	64,082	49,150	64,082	64,082	49,150	64,082	42,992	64,082	64,082	64,082	64,082	64,082	64,082
2000	57,923	47,354	34,784	25,066	34,557	42,299	41,403	0	21,889	16,731	26,626	22,153	16,731
2001	52,452	45,583	33,454	24,093	33,235	40,702	39,837	0	26,071	20,572	30,749	26,320	20,572
2002	47,577	43,841	32,149	23,140	31,939	39,133	38,300	0	30,332	24,651	34,824	30,607	24,651
2003	43,214	42,131	30,872	22,209	30,669	37,596	36,793	0	34,462	28,674	38,687	34,740	28,674
2004	39,317	40,458	29,624	21,301	29,429	36,092	35,319	0	38,223	32,349	42,157	38,465	32,349
2005	35,813	38,824	28,408	20,416	28,221	34,623	33,880	0	41,366	35,435	45,065	41,626	35,435
2006	32,671	37,230	27,223	19,556	27,044	33,193	32,479	0	43,805	37,789	47,290	44,017	37,789
2007	29,839	35,678	26,073	18,721	25,900	31,801	31,116	0	45,413	39,341	48,825	45,688	39,341
2008	27,268	34,170	24,956	17,912	24,791	30,450	29,792	0	43,523	37,687	49,702	46,588	40,135
2009	24,961	32,707	23,874	17,128	23,715	29,139	28,509	0	41,686	36,082	49,943	46,809	40,275
Change	26,494	15,924	3,354	-6,364	3,127	10,869	9,973	-31,430	-9,541	-14,698	-4,803	-9,277	-14,698

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 115. Estimated net returns for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	278,302	33,105	278,302	278,302	33,105	278,302	-68,003	278,302	278,302	278,302	278,302	278,302	278,302
2000	177,168	3,618	-202,788	-362,353	-206,511	-79,384	-94,100	-773,940	-414,527	-499,211	-336,735	-410,184	-499,211
2001	87,333	-25,464	-224,625	-378,326	-228,214	-105,602	-119,804	-773,940	-345,851	-436,150	-269,038	-341,766	-436,150
2002	7,277	-54,069	-246,048	-393,971	-249,505	-131,363	-145,054	-773,940	-275,890	-369,173	-202,130	-271,362	-369,173
2003	-64,352	-82,135	-267,020	-409,262	-270,346	-156,614	-169,800	-773,940	-208,068	-303,114	-138,696	-203,503	-303,114
2004	-128,356	-109,609	-287,507	-424,178	-290,704	-181,311	-193,999	-773,940	-146,309	-242,766	-81,717	-142,344	-242,766
2005	-185,883	-136,450	-307,483	-438,704	-310,554	-205,418	-217,618	-773,940	-94,711	-192,085	-33,968	-90,428	-192,085
2006	-237,480	-162,622	-326,927	-452,826	-329,875	-228,908	-240,629	-773,940	-54,648	-153,436	2,569	-51,168	-153,436
2007	-283,984	-188,098	-345,824	-466,535	-348,652	-251,757	-263,010	-773,940	-28,260	-127,961	27,773	-23,729	-127,961
2008	-326,193	-212,856	-364,161	-479,825	-366,872	-273,950	-284,745	-773,940	-59,293	-155,111	42,181	-8,951	-114,910
2009	-364,072	-236,883	-381,931	-492,691	-384,528	-295,473	-305,823	-773,940	-89,457	-181,473	46,138	-5,328	-112,612
Change	-148,081	-321,631	-528,037	-687,602	-531,760	-404,633	-419,349	-1,099,189	-739,776	-824,460	-661,984	-735,433	-824,460

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 116. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	153,285	97,558	153,285	153,285	97,558	153,285	74,579	153,285	153,285	153,285	153,285	153,285	153,285
2000	130,300	90,857	43,946	7,681	43,100	71,993	68,648	-85,861	-4,176	-23,423	13,504	-3,189	-23,423
2001	109,883	84,247	38,983	4,051	38,168	66,034	62,806	-85,861	11,432	-9,091	28,889	12,360	-9,091
2002	91,688	77,746	34,114	496	33,329	60,179	57,068	-85,861	27,332	6,131	44,096	28,361	6,131
2003	75,409	71,367	29,348	-2,980	28,592	54,440	51,444	-85,861	42,746	21,145	58,513	43,784	21,145
2004	60,862	65,123	24,692	-6,370	23,965	48,827	45,944	-85,861	56,782	34,860	71,462	57,683	34,860
2005	47,788	59,023	20,152	-9,671	19,454	43,348	40,576	-85,861	68,509	46,379	82,314	69,482	46,379
2006	36,062	53,075	15,733	-12,881	15,063	38,010	35,346	-85,861	77,614	55,163	90,618	78,405	55,163
2007	25,492	47,285	11,438	-15,996	10,795	32,817	30,259	-85,861	83,612	60,952	96,346	84,641	60,952
2008	15,900	41,658	7,271	-19,017	6,654	27,773	25,320	-85,861	76,559	54,782	99,621	88,000	63,919
2009	7,291	36,197	3,232	-21,941	2,642	22,881	20,529	-85,861	69,703	48,791	100,520	88,823	64,441
Change	98,870	59,427	12,517	-23,748	11,670	40,563	37,218	-117,291	-35,606	-54,852	-17,926	-34,619	-54,852

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 117. Observed and projected 1999-2000 fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659
1999	5,206,678	3,993,398	5,206,678	5,206,678	3,993,398	5,206,678	3,493,098	5,206,678	5,206,678	5,206,678	5,206,678	5,206,678	5,206,678
2000	4,706,250	3,847,494	2,826,159	2,036,604	2,807,735	3,436,785	3,363,966	0	1,778,436	1,359,406	2,163,367	1,799,926	1,359,406
2001	4,261,729	3,703,590	2,718,108	1,957,565	2,700,349	3,307,050	3,236,780	0	2,118,256	1,671,444	2,498,343	2,138,470	1,671,444
2002	3,865,598	3,562,047	2,612,099	1,880,152	2,594,997	3,179,582	3,111,838	0	2,464,437	2,002,855	2,829,417	2,486,843	2,002,855
2003	3,511,166	3,423,173	2,508,328	1,804,490	2,491,873	3,054,638	2,989,391	0	2,800,033	2,329,726	3,143,300	2,822,622	2,329,726
2004	3,194,461	3,287,224	2,406,954	1,730,680	2,391,135	2,932,434	2,869,647	0	3,105,626	2,628,341	3,425,240	3,125,247	2,628,341
2005	2,909,808	3,154,413	2,308,110	1,658,805	2,292,913	2,813,145	2,752,776	0	3,360,945	2,879,121	3,661,512	3,382,135	2,879,121
2006	2,654,498	3,024,910	2,211,897	1,588,927	2,197,309	2,696,914	2,638,914	0	3,559,181	3,070,363	3,842,302	3,576,401	3,070,363
2007	2,424,386	2,898,851	2,118,394	1,521,093	2,104,400	2,583,851	2,528,170	0	3,689,756	3,196,415	3,967,016	3,712,175	3,196,415
2008	2,215,532	2,776,339	2,027,658	1,455,333	2,014,243	2,474,039	2,420,621	0	3,536,198	3,062,075	4,038,311	3,785,300	3,260,998
2009	2,028,099	2,657,450	1,939,728	1,391,668	1,926,877	2,367,536	2,316,323	0	3,386,940	2,931,632	4,057,888	3,803,227	3,272,365
Change	-130,409	-989,165	-2,010,500	-2,800,055	-2,028,924	-1,399,874	-1,472,693	-4,836,659	-3,058,223	-3,477,253	-2,673,292	-3,036,733	-3,477,253

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 118. Projected 1998-2000 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742
1999	449,701	344,910	449,701	449,701	344,910	449,701	301,699	449,701	449,701	449,701	449,701	449,701	449,701
2000	406,479	332,308	244,095	175,901	242,504	296,835	290,546	0	153,604	117,412	186,850	155,460	117,412
2001	368,085	319,879	234,763	169,075	233,229	285,630	279,561	0	182,954	144,363	215,782	184,700	144,363
2002	333,872	307,654	225,607	162,389	224,130	274,620	268,769	0	212,853	172,987	244,377	214,789	172,987
2003	303,259	295,659	216,644	155,854	215,223	263,829	258,194	0	241,839	201,218	271,487	243,790	201,218
2004	275,906	283,918	207,889	149,479	206,522	253,274	247,851	0	268,233	227,010	295,838	269,928	227,010
2005	251,320	272,447	199,351	143,271	198,039	242,971	237,757	0	290,285	248,670	316,245	292,115	248,670
2006	229,269	261,261	191,042	137,236	189,782	232,932	227,923	0	307,406	265,187	331,860	308,894	265,187
2007	209,394	250,374	182,966	131,377	181,757	223,167	218,358	0	318,684	276,074	342,631	320,621	276,074
2008	191,355	239,792	175,129	125,697	173,970	213,683	209,069	0	305,421	264,471	348,789	326,936	281,652
2009	175,167	229,524	167,534	120,198	166,424	204,484	200,061	0	292,530	253,205	350,480	328,485	282,634
Change	-11,263	-85,434	-173,647	-241,841	-175,238	-120,907	-127,196	-417,742	-264,139	-300,330	-230,892	-262,283	-300,330

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 119. Projected 1998-2000 fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121
1999	1,253,581	857,610	1,253,581	1,253,581	857,610	1,253,581	716,834	1,253,581	1,253,581	1,253,581	1,253,581	1,253,581	1,253,581
2000	1,086,222	818,997	548,249	368,385	543,778	704,495	685,011	0	314,492	231,777	395,701	318,891	231,777
2001	948,343	781,766	524,034	352,504	519,774	672,829	654,284	0	386,944	293,434	472,197	391,342	293,434
2002	833,210	745,901	500,642	337,125	496,584	642,291	624,645	0	465,990	363,133	553,261	471,192	363,133
2003	735,870	711,383	478,068	322,249	474,203	612,869	596,084	0	548,444	436,709	635,988	554,044	436,709
2004	653,127	678,189	456,304	307,876	452,626	584,548	568,586	0	629,515	508,879	716,261	634,697	508,879
2005	581,954	646,293	435,342	294,005	431,842	557,309	542,136	0	702,911	574,083	789,267	708,842	574,083
2006	520,572	615,668	415,170	280,631	411,840	531,132	516,712	0	764,988	627,796	850,475	770,057	627,796
2007	467,140	586,284	395,774	267,749	392,608	505,996	492,295	0	810,592	666,687	897,786	817,466	666,687
2008	420,126	558,110	377,139	255,351	374,129	481,875	468,861	0	770,882	634,411	930,282	847,931	690,112
2009	379,120	531,113	359,248	243,430	356,387	458,744	446,386	0	732,898	603,505	947,047	862,218	699,204

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 120. Projected 1998-2000 fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863
1999	1,703,281	1,202,520	1,703,281	1,703,281	1,202,520	1,703,281	1,018,533	1,703,281	1,703,281	1,703,281	1,703,281	1,703,281	1,703,281
2000	1,492,701	1,151,305	792,344	544,286	786,282	1,001,330	975,557	0	468,096	349,189	582,551	474,351	349,189
2001	1,316,429	1,101,645	758,797	521,579	753,003	958,459	933,844	0	569,897	437,797	687,979	576,041	437,797
2002	1,167,081	1,053,555	726,249	499,513	720,714	916,911	893,414	0	678,843	536,119	797,638	685,980	536,119
2003	1,039,129	1,007,042	694,712	478,102	689,426	876,698	854,278	0	790,283	637,928	907,475	797,834	637,928
2004	929,032	962,106	664,193	457,355	659,148	837,822	816,438	0	897,748	735,888	1,012,099	904,625	735,888
2005	833,274	918,740	634,694	437,276	629,881	800,280	779,893	0	993,196	822,752	1,105,511	1,000,957	822,752
2006	749,841	876,930	606,212	417,867	601,622	764,065	744,635	0	1,072,395	892,983	1,182,335	1,078,951	892,983
2007	676,534	836,658	578,740	399,126	574,365	729,163	710,653	0	1,129,276	942,761	1,240,417	1,138,087	942,761
2008	611,481	797,902	552,268	381,048	548,099	695,557	677,930	0	1,076,303	898,882	1,279,071	1,174,867	971,764
2009	554,287	760,637	526,783	363,628	522,812	663,228	646,447	0	1,025,428	856,710	1,297,526	1,190,703	981,839

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 121. Observed and projected 2000-2009 cumulative fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	4,706,250	3,847,494	2,826,159	2,036,604	2,807,735	3,436,785	3,363,966	0	1,778,436	1,359,406	2,163,367	1,799,926	1,359,406
2001	8,967,978	7,551,084	5,544,266	3,994,169	5,508,084	6,743,835	6,600,746	0	3,896,693	3,030,850	4,661,710	3,938,397	3,030,850
2002	12,833,577	11,113,131	8,156,366	5,874,321	8,103,082	9,923,417	9,712,584	0	6,361,130	5,033,705	7,491,126	6,425,240	5,033,705
2003	16,344,743	14,536,304	10,664,694	7,678,810	10,594,955	12,978,055	12,701,975	0	9,161,163	7,363,431	10,634,426	9,247,862	7,363,431
2004	19,539,204	17,823,529	13,071,648	9,409,491	12,986,090	15,910,488	15,571,622	0	12,266,790	9,991,772	14,059,666	12,373,109	9,991,772
2005	22,449,011	20,977,942	15,379,758	11,068,296	15,279,003	18,723,634	18,324,398	0	15,627,735	12,870,893	17,721,177	15,755,243	12,870,893
2006	25,103,509	24,002,851	17,591,654	12,657,223	17,476,311	21,420,548	20,963,312	0	19,186,916	15,941,256	21,563,480	19,331,645	15,941,256
2007	27,527,895	26,901,702	19,710,048	14,178,316	19,580,711	24,004,399	23,491,482	0	22,876,672	19,137,671	25,530,496	23,043,820	19,137,671
2008	29,743,427	29,678,041	21,737,706	15,633,649	21,594,955	26,478,438	25,912,102	0	26,412,870	22,199,746	29,568,807	26,829,120	22,398,668
2009	31,771,526	32,335,491	23,677,434	17,025,317	23,521,831	28,845,974	28,228,425	0	29,799,810	25,131,378	33,626,695	30,632,347	25,671,034

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 122. Projected cumulative 2000-2009 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	406,479	332,308	244,095	175,901	242,504	296,835	290,546	0	153,604	117,412	186,850	155,460	117,412
2001	774,564	652,187	478,858	344,976	475,733	582,465	570,106	0	336,557	261,774	402,632	340,159	261,774
2002	1,108,436	959,841	704,465	507,365	699,863	857,086	838,876	0	549,411	434,761	647,009	554,948	434,761
2003	1,411,695	1,255,501	921,110	663,219	915,086	1,120,915	1,097,070	0	791,250	635,980	918,495	798,738	635,980
2004	1,687,601	1,539,418	1,128,998	812,698	1,121,609	1,374,189	1,344,921	0	1,059,483	862,989	1,214,333	1,068,665	862,989
2005	1,938,921	1,811,865	1,328,350	955,969	1,319,647	1,617,160	1,582,678	0	1,349,767	1,111,659	1,530,578	1,360,780	1,111,659
2006	2,168,190	2,073,126	1,519,391	1,093,204	1,509,429	1,850,093	1,810,601	0	1,657,174	1,376,846	1,862,438	1,669,674	1,376,846
2007	2,377,584	2,323,500	1,702,357	1,224,581	1,691,186	2,073,260	2,028,959	0	1,975,858	1,652,921	2,205,069	1,990,295	1,652,921
2008	2,568,940	2,563,292	1,877,486	1,350,278	1,865,156	2,286,943	2,238,028	0	2,281,280	1,917,392	2,553,858	2,317,231	1,934,573
2009	2,744,107	2,792,816	2,045,020	1,470,477	2,031,581	2,491,427	2,438,089	0	2,573,810	2,170,597	2,904,338	2,645,716	2,217,207

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 123. Projected 2000-2009 cumulative fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,086,222	818,997	548,249	368,385	543,778	704,495	685,011	0	314,492	231,777	395,701	318,891	231,777
2001	2,034,566	1,600,763	1,072,283	720,889	1,063,552	1,377,323	1,339,294	0	701,436	525,211	867,899	710,233	525,211
2002	2,867,775	2,346,664	1,572,925	1,058,014	1,560,135	2,019,614	1,963,939	0	1,167,426	888,344	1,421,159	1,181,425	888,344
2003	3,603,645	3,058,047	2,050,993	1,380,262	2,034,339	2,632,483	2,560,023	0	1,715,869	1,325,053	2,057,147	1,735,469	1,325,053
2004	4,256,772	3,736,235	2,507,297	1,688,138	2,486,965	3,217,030	3,128,610	0	2,345,384	1,833,932	2,773,408	2,370,166	1,833,932
2005	4,838,725	4,382,528	2,942,640	1,982,143	2,918,807	3,774,339	3,670,745	0	3,048,295	2,408,014	3,562,675	3,079,009	2,408,014
2006	5,359,297	4,998,197	3,357,810	2,262,775	3,330,647	4,305,472	4,187,458	0	3,813,283	3,035,810	4,413,150	3,849,066	3,035,810
2007	5,826,437	5,584,481	3,753,584	2,530,524	3,723,255	4,811,467	4,679,753	0	4,623,875	3,702,497	5,310,936	4,666,532	3,702,497
2008	6,246,563	6,142,591	4,130,723	2,785,875	4,097,384	5,293,342	5,148,614	0	5,394,757	4,336,908	6,241,219	5,514,463	4,392,609
2009	6,625,683	6,673,704	4,489,972	3,029,304	4,453,771	5,752,086	5,595,000	0	6,127,655	4,940,412	7,188,265	6,376,681	5,091,813

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 124. Projected 2000-2009 cumulative fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,492,701	1,151,305	792,344	544,286	786,282	1,001,330	975,557	0	468,096	349,189	582,551	474,351	349,189
2001	2,809,130	2,252,950	1,551,141	1,065,865	1,539,285	1,959,788	1,909,401	0	1,037,993	786,986	1,270,530	1,050,392	786,986
2002	3,976,211	3,306,505	2,277,390	1,565,379	2,259,999	2,876,700	2,802,815	0	1,716,836	1,323,105	2,068,168	1,736,373	1,323,105
2003	5,015,341	4,313,547	2,972,102	2,043,481	2,949,425	3,753,397	3,657,093	0	2,507,119	1,961,033	2,975,643	2,534,207	1,961,033
2004	5,944,373	5,275,653	3,636,295	2,500,836	3,608,573	4,591,219	4,473,531	0	3,404,867	2,696,921	3,987,742	3,438,832	2,696,921
2005	6,777,647	6,194,393	4,270,989	2,938,112	4,238,454	5,391,499	5,253,424	0	4,398,062	3,519,673	5,093,253	4,439,789	3,519,673
2006	7,527,487	7,071,323	4,877,201	3,355,979	4,840,076	6,155,564	5,998,059	0	5,470,457	4,412,657	6,275,588	5,518,740	4,412,657
2007	8,204,022	7,907,981	5,455,941	3,755,105	5,414,441	6,884,727	6,708,712	0	6,599,733	5,355,418	7,516,005	6,656,827	5,355,418
2008	8,815,503	8,705,883	6,008,209	4,136,153	5,962,540	7,580,285	7,386,642	0	7,676,037	6,254,300	8,795,077	7,831,694	6,327,182
2009	9,369,789	9,466,520	6,534,992	4,499,781	6,485,351	8,243,513	8,033,090	0	8,701,465	7,111,010	10,092,603	9,022,397	7,309,021

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in year 2000 constant dollar value. Projections assume other landings equal SAFMC quota of 1,091,813 lbs.
Source: Kirkley pers. comm.

Table 125. Expected monetary value of the potential economic impacts associated with the potential regulatory options[a].

Regulatory Option	Probability Of Success	Ex-vessel Revenue	Net Returns	Consumer Surplus	Net Benefits
Status Quo	0.50	15,885,763	1,372,053	3,261,375	4,684,895
Preferred Alternative	0.50	14,422,987	1,245,713	2,876,043	4,121,757
Alternative 1	0.50	11,838,717	1,022,510	2,244,986	3,267,496
Alternative 2	0.75	12,768,988	1,102,857	2,271,978	3,374,836
Alternative 3	0.75	17,641,373	1,523,685	3,340,328	4,864,014
Alternative 4	0.50	16,167,745	1,396,408	3,336,852	4,733,260
Alternative 5	0.75	21,171,319	1,828,567	4,196,250	6,024,817
Alternative 6		0	0	0	0
Alternative 7	0.50	14,899,905	1,286,905	3,063,828	4,350,732
Alternative 8	0.50	12,565,689	1,085,299	2,470,206	3,555,505
Alternative 9	0.50	16,813,348	1,452,169	3,594,133	5,046,301
Alternative 10	0.75	22,974,260	1,984,287	4,782,511	6,766,798
Alternative 11	1.00	25,671,034	2,217,207	5,091,813	7,309,021

[a]Expected monetary value calculated by multiplying the probability of each option to rebuild the resource to MSY biomass levels within 10 years times the cumulative 2000-2009 economic performance measures and net benefits. Landings from other states assumed to equal SAFMC quota of 1,091,813 pounds (live weight). All values are in terms of year 2000 constant dollar values. Although the probability of the status quo achieving the desired objectives of the FMP is likely to be close to use, the analysis assumes a 0.50 probability that the status quo will achieve the objectives. Source: Kirkley pers. comm.

Table 126. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907.09	498,907.09	498,907	498,907.09	498,907	498,907
1999	265,476	203,460	265,476	265,476	203,460	265,476	177,920	265,476.09	265,476.09	265,476	265,476.09	265,476	265,476
2000	239,767	195,916	143,832	103,611	142,894	174,964	171,250	0.00	90,466.35	69,138	110,066.16	91,560	69,138
2001	216,964	188,490	138,265	99,542	137,360	168,273	164,691	0.00	107,721.32	84,982	127,072.41	108,750	84,982
2002	196,670	181,196	132,810	95,563	131,939	161,708	158,257	0.00	125,293.51	101,805	143,874.32	126,434	101,805
2003	178,532	174,050	127,477	91,678	126,640	155,282	151,961	0.00	142,321.82	118,391	159,796.72	143,472	118,391
2004	162,341	167,063	122,274	87,892	121,469	149,005	145,811	0.00	157,819.43	133,534	174,089.93	158,818	133,534
2005	147,802	160,246	117,205	84,210	116,433	142,885	139,815	0.00	170,756.03	146,241	186,056.49	171,834	146,241
2006	134,771	153,606	112,277	80,633	111,536	136,928	133,979	0.00	180,786.35	155,917	195,197.93	181,663	155,917
2007	123,036	147,148	107,492	77,164	106,781	131,138	128,309	0.00	187,373.37	162,277	201,485.14	188,514	162,277
2008	112,392	140,878	102,852	73,803	102,171	125,520	122,807	0.00	179,506.69	155,400	205,054.57	192,179	165,512
2009	102,845	134,799	98,360	70,552	97,707	120,076	117,476	0.00	171,867.36	148,727	205,994.16	193,037	166,043
Change	-259,140	-302,991	-355,075	-395,296	-356,014	-323,943	-327,657	-498,907.09	-408,440.74	-429,769	-388,840.93	-407,347	-429,769

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 127. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094
1999	958,369	734,489	958,369	958,369	734,489	958,369	642,292	958,369	958,369	958,369	958,369	958,369	958,369
2000	865,558	707,259	519,235	374,035	515,846	631,619	618,213	0	326,584	249,590	397,339	330,533	249,590
2001	783,240	680,447	499,136	359,348	495,870	607,464	594,535	0	388,874	306,787	458,731	392,588	306,787
2002	709,977	654,117	479,444	344,982	476,301	583,767	571,309	0	452,310	367,516	519,386	456,427	367,516
2003	644,501	628,320	460,192	330,958	457,170	560,570	548,578	0	513,782	427,390	576,866	517,932	427,390
2004	586,051	603,098	441,408	317,292	438,504	537,909	526,376	0	569,728	482,058	628,465	573,333	482,058
2005	533,564	578,488	423,112	303,997	420,323	515,815	504,731	0	616,429	527,929	671,664	620,323	527,929
2006	486,525	554,516	405,320	291,085	402,644	494,309	483,665	0	652,639	562,861	704,665	655,803	562,861
2007	444,159	531,205	388,045	278,560	385,480	473,410	463,195	0	676,418	585,821	727,361	680,536	585,821
2008	405,734	508,571	371,296	266,429	368,838	453,129	443,334	0	648,019	560,993	740,247	693,765	597,499
2009	371,270	486,624	355,078	254,693	352,723	433,476	424,089	0	620,441	536,906	743,639	696,864	599,415
Change	657,464	499,165	311,141	165,941	307,752	423,525	410,119	-208,094	118,490	41,496	189,245	122,439	41,496

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 128. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763
1999	3,329,070	2,551,383	3,329,070	3,329,070	2,551,383	3,329,070	2,231,120	3,329,070	3,329,070	3,329,070	3,329,070	3,329,070	3,329,070
2000	3,006,675	2,456,793	1,803,659	1,299,280	1,791,885	2,194,046	2,147,476	0	1,134,448	866,996	1,380,230	1,148,167	866,996
2001	2,720,728	2,363,659	1,733,840	1,248,262	1,722,497	2,110,139	2,065,227	0	1,350,825	1,065,681	1,593,488	1,363,728	1,065,681
2002	2,466,237	2,272,196	1,665,437	1,198,359	1,654,520	2,027,821	1,984,548	0	1,571,181	1,276,635	1,804,184	1,585,482	1,276,635
2003	2,238,792	2,182,584	1,598,563	1,149,642	1,588,064	1,947,242	1,905,587	0	1,784,716	1,484,618	2,003,851	1,799,133	1,484,618
2004	2,035,757	2,094,973	1,533,312	1,102,171	1,523,223	1,868,528	1,828,464	0	1,979,056	1,674,516	2,183,088	1,991,579	1,674,516
2005	1,853,433	2,009,483	1,469,756	1,055,991	1,460,069	1,791,778	1,753,276	0	2,141,281	1,833,859	2,333,148	2,154,805	1,833,859
2006	1,690,034	1,926,213	1,407,954	1,011,136	1,398,659	1,717,074	1,680,100	0	2,267,061	1,955,202	2,447,782	2,278,051	1,955,202
2007	1,542,869	1,845,238	1,347,947	967,631	1,339,035	1,644,475	1,608,995	0	2,349,662	2,034,958	2,526,624	2,363,968	2,034,958
2008	1,409,390	1,766,614	1,289,766	925,490	1,281,226	1,574,027	1,540,002	0	2,251,014	1,948,711	2,571,384	2,409,922	2,075,522
2009	1,289,673	1,690,379	1,233,429	884,722	1,225,250	1,505,758	1,473,151	0	2,155,217	1,865,040	2,583,167	2,420,685	2,082,180
Change	-759,088	-1,308,970	-1,962,104	-2,466,483	-1,973,878	-1,571,717	-1,618,287	-3,765,763	-2,631,315	-2,898,767	-2,385,533	-2,617,596	-2,898,767

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 129. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895
1999	756,607	579,860	756,607	756,607	579,860	756,607	507,073	756,607	756,607	756,607	756,607	756,607	756,607
2000	683,335	558,362	409,922	295,291	407,246	498,647	488,063	0	257,829	197,045	313,689	260,947	197,045
2001	618,347	537,195	394,055	283,696	391,477	479,577	469,370	0	307,006	242,200	362,156	309,938	242,200
2002	560,508	516,408	378,508	272,354	376,027	460,868	451,034	0	357,086	290,144	410,042	360,337	290,144
2003	508,816	496,042	363,310	261,282	360,924	442,555	433,088	0	405,617	337,413	455,421	408,894	337,413
2004	462,672	476,130	348,480	250,493	346,187	424,665	415,560	0	449,785	380,572	496,156	452,631	380,572
2005	421,235	456,701	334,035	239,998	331,834	407,222	398,472	0	486,655	416,786	530,261	489,728	416,786
2006	384,099	437,776	319,989	229,804	317,877	390,244	381,841	0	515,241	444,364	556,314	517,739	444,364
2007	350,652	419,372	306,352	219,916	304,326	373,744	365,681	0	534,014	462,490	574,233	537,266	462,490
2008	320,316	401,503	293,129	210,339	291,188	357,733	350,000	0	511,594	442,889	584,406	547,709	471,710
2009	293,108	384,177	280,325	201,073	278,466	342,218	334,807	0	489,822	423,873	587,083	550,156	473,223
Change	319,440	194,467	46,027	-68,604	43,352	134,752	124,168	-363,895	-106,066	-166,850	-50,206	-102,948	-166,850

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 130. Estimated total costs for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816.49	455,816.49	455,816	455,816.49	455,816	455,816
1999	242,547	185,887	242,547	242,547	185,887	242,547	162,553	242,546.92	242,546.92	242,547	242,546.92	242,547	242,547
2000	219,058	178,995	131,410	94,662	130,552	159,852	156,459	0.00	82,652.77	63,167	100,559.74	83,652	63,167
2001	198,225	172,210	126,323	90,945	125,496	153,739	150,467	0.00	98,417.43	77,643	116,097.16	99,357	77,643
2002	179,683	165,546	121,339	87,309	120,544	147,741	144,589	0.00	114,471.91	93,012	131,447.89	115,514	93,012
2003	163,112	159,017	116,467	83,760	115,702	141,871	138,836	0.00	130,029.49	108,165	145,995.08	131,080	108,165
2004	148,320	152,634	111,713	80,301	110,978	136,136	133,217	0.00	144,188.57	122,001	159,053.79	145,101	122,001
2005	135,036	146,405	107,082	76,937	106,377	130,544	127,739	0.00	156,007.83	133,610	169,986.79	156,993	133,610
2006	123,131	140,339	102,580	73,669	101,902	125,101	122,407	0.00	165,171.84	142,451	178,338.69	165,973	142,451
2007	112,409	134,439	98,208	70,499	97,558	119,812	117,227	0.00	171,189.93	148,261	184,082.86	172,232	148,261
2008	102,684	128,711	93,969	67,429	93,347	114,679	112,200	0.00	164,002.70	141,978	187,344.00	175,580	151,217
2009	93,962	123,156	89,864	64,458	89,268	109,705	107,330	0.00	157,023.18	135,882	188,202.45	176,364	151,702
Change	-236,758	-276,821	-324,407	-361,155	-325,265	-295,964	-299,357	-455,816.49	-373,163.72	-392,650	-355,256.74	-372,164	-392,650

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 131. Estimated total costs for 1998-2009: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,120.90	190,120.90	190,121	190,120.90	190,121	190,121
1999	875,594	671,051	875,594	875,594	671,051	875,594	586,817	875,594.37	875,594.37	875,594	875,594.37	875,594	875,594
2000	790,800	646,173	474,389	341,730	471,292	577,066	564,818	0.00	298,376.50	228,033	363,020.67	301,985	228,033
2001	715,591	621,677	456,025	328,311	453,042	554,998	543,185	0.00	355,286.92	280,290	419,110.76	358,681	280,290
2002	648,657	597,621	438,034	315,186	435,163	533,347	521,965	0.00	413,243.58	335,774	474,526.89	417,005	335,774
2003	588,835	574,052	420,446	302,373	417,684	512,153	501,197	0.00	469,406.44	390,476	527,042.25	473,198	390,476
2004	535,434	551,009	403,284	289,887	400,630	491,450	480,913	0.00	520,520.72	440,422	574,184.17	523,814	440,422
2005	487,480	528,524	386,567	277,741	384,020	471,264	461,137	0.00	563,188.27	482,332	613,652.33	566,745	482,332
2006	444,504	506,622	370,313	265,944	367,868	451,616	441,891	0.00	596,270.33	514,247	643,802.66	599,161	514,247
2007	405,797	485,325	354,530	254,501	352,186	432,521	423,189	0.00	617,995.65	535,224	664,539.14	621,758	535,224
2008	370,690	464,645	339,228	243,417	336,981	413,992	405,043	0.00	592,049.73	512,540	676,311.85	633,845	545,893
2009	339,203	444,595	324,410	232,695	322,259	396,036	387,460	0.00	566,853.68	490,533	679,410.84	636,676	547,644
Change	600,679	456,052	284,268	151,609	281,171	386,945	374,697	-190,120.90	108,255.60	37,912	172,899.77	111,864	37,912

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 132. Estimated total costs for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514
1999	3,041,538	2,331,020	3,041,538	3,041,538	2,331,020	3,041,538	2,038,418	3,041,538	3,041,538	3,041,538	3,041,538	3,041,538	3,041,538
2000	2,746,989	2,244,600	1,647,877	1,187,061	1,637,119	2,004,546	1,961,998	0	1,036,466	792,114	1,261,019	1,049,000	792,114
2001	2,485,738	2,159,510	1,584,088	1,140,450	1,573,725	1,927,887	1,886,853	0	1,234,155	973,638	1,455,858	1,245,943	973,638
2002	2,253,228	2,075,947	1,521,593	1,094,856	1,511,619	1,852,678	1,813,143	0	1,435,478	1,166,372	1,648,357	1,448,544	1,166,372
2003	2,045,427	1,994,075	1,460,495	1,050,348	1,450,903	1,779,059	1,741,002	0	1,630,570	1,356,391	1,830,778	1,643,742	1,356,391
2004	1,859,929	1,914,030	1,400,880	1,006,977	1,391,662	1,707,143	1,670,539	0	1,808,125	1,529,888	1,994,534	1,819,566	1,529,888
2005	1,693,352	1,835,924	1,342,813	964,785	1,333,963	1,637,022	1,601,845	0	1,956,338	1,675,469	2,131,634	1,968,694	1,675,469
2006	1,544,066	1,759,846	1,286,349	923,804	1,277,857	1,568,770	1,534,990	0	2,071,255	1,786,331	2,236,367	2,081,296	1,786,331
2007	1,409,611	1,685,865	1,231,525	884,056	1,223,382	1,502,442	1,470,026	0	2,146,722	1,859,199	2,308,399	2,159,793	1,859,199
2008	1,287,661	1,614,031	1,178,369	845,555	1,170,566	1,438,078	1,406,992	0	2,056,594	1,780,401	2,349,294	2,201,777	1,896,259
2009	1,178,284	1,544,381	1,126,898	808,308	1,119,425	1,375,705	1,345,915	0	1,969,071	1,703,957	2,360,059	2,211,610	1,902,342
Change	-693,525	-1,195,914	-1,792,637	-2,253,453	-1,803,395	-1,435,968	-1,478,516	-3,440,514	-2,404,048	-2,648,400	-2,179,495	-2,391,514	-2,648,400

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 133. Estimated total costs for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465
1999	691,259	529,777	691,259	691,259	529,777	691,259	463,277	691,259	691,259	691,259	691,259	691,259	691,259
2000	624,316	510,136	374,517	269,787	372,073	455,579	445,909	0	235,560	180,026	286,595	238,409	180,026
2001	564,941	490,798	360,020	259,193	357,665	438,156	428,830	0	280,490	221,281	330,877	283,169	221,281
2002	512,097	471,806	345,817	248,831	343,550	421,063	412,078	0	326,245	265,085	374,626	329,215	265,085
2003	464,870	453,199	331,931	238,715	329,751	404,332	395,682	0	370,584	308,271	416,086	373,578	308,271
2004	422,711	435,007	318,382	228,858	316,287	387,987	379,668	0	410,937	347,702	453,303	413,538	347,702
2005	384,853	417,256	305,185	219,269	303,173	372,051	364,056	0	444,622	380,788	484,462	447,430	380,788
2006	350,924	399,965	292,352	209,956	290,422	356,539	348,861	0	470,740	405,984	508,265	473,022	405,984
2007	320,366	383,151	279,892	200,922	278,041	341,464	334,097	0	487,891	422,545	524,636	490,862	422,545
2008	292,650	366,825	267,811	192,172	266,038	326,836	319,771	0	467,408	404,637	533,930	500,404	430,968
2009	267,792	350,996	256,113	183,706	254,415	312,660	305,890	0	447,516	387,263	536,377	502,639	432,350
Change	291,850	177,671	42,052	-62,679	39,607	123,113	113,443	-332,465	-96,905	-152,440	-45,870	-94,056	-152,440

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 134. Estimated net returns for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091
1999	22,929	17,573	22,929	22,929	17,573	22,929	15,367	22,929	22,929	22,929	22,929	22,929	22,929
2000	20,709	16,921	12,423	8,949	12,342	15,112	14,791	0	7,814	5,971	9,506	7,908	5,971
2001	18,739	16,280	11,942	8,597	11,864	14,534	14,224	0	9,304	7,340	10,975	9,393	7,340
2002	16,986	15,650	11,471	8,254	11,396	13,967	13,669	0	10,822	8,793	12,426	10,920	8,793
2003	15,420	15,033	11,010	7,918	10,938	13,412	13,125	0	12,292	10,225	13,802	12,392	10,225
2004	14,021	14,429	10,561	7,591	10,491	12,870	12,594	0	13,631	11,533	15,036	13,717	11,533
2005	12,766	13,840	10,123	7,273	10,056	12,341	12,076	0	14,748	12,631	16,070	14,841	12,631
2006	11,640	13,267	9,697	6,964	9,633	11,826	11,572	0	15,615	13,467	16,859	15,690	13,467
2007	10,627	12,709	9,284	6,665	9,223	11,326	11,082	0	16,183	14,016	17,402	16,282	14,016
2008	9,707	12,168	8,883	6,374	8,825	10,841	10,607	0	15,504	13,422	17,711	16,598	14,295
2009	8,883	11,643	8,495	6,094	8,439	10,371	10,146	0	14,844	12,846	17,792	16,673	14,341
Change	-22,382	-26,169	-30,668	-34,142	-30,749	-27,979	-28,300	-43,091	-35,277	-37,119	-33,584	-35,183	-37,119

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 135. Estimated net returns for 1998-2009: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973
1999	82,774	63,438	82,774	82,774	63,438	82,774	55,475	82,774	82,774	82,774	82,774	82,774	82,774
2000	74,758	61,086	44,846	32,305	44,554	54,553	53,395	0	28,207	21,557	34,318	28,548	21,557
2001	67,648	58,770	43,110	31,037	42,828	52,467	51,350	0	33,587	26,497	39,621	33,908	26,497
2002	61,321	56,496	41,410	29,796	41,138	50,420	49,344	0	39,066	31,742	44,859	39,422	31,742
2003	55,666	54,268	39,747	28,585	39,486	48,416	47,381	0	44,375	36,914	49,824	44,734	36,914
2004	50,617	52,090	38,124	27,404	37,874	46,459	45,463	0	49,207	41,635	54,280	49,519	41,635
2005	46,084	49,964	36,544	26,256	36,303	44,551	43,594	0	53,241	45,597	58,012	53,577	45,597
2006	42,021	47,894	35,007	25,141	34,776	42,693	41,774	0	56,368	48,614	60,862	56,642	48,614
2007	38,362	45,880	33,515	24,059	33,294	40,888	40,006	0	58,422	50,597	62,822	58,778	50,597
2008	35,043	43,925	32,069	23,011	31,857	39,137	38,291	0	55,969	48,453	63,935	59,921	51,606
2009	32,067	42,030	30,668	21,998	30,465	37,439	36,629	0	53,588	46,373	64,228	60,188	51,772
Change	56,785	43,113	26,873	14,332	26,581	36,580	35,422	-17,973	10,234	3,584	16,345	10,575	3,584

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 136. Estimated net returns for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	287,532	220,363	287,532	287,532	220,363	287,532	192,702	287,532	287,532	287,532	287,532	287,532	287,532
2000	259,687	212,193	155,782	112,219	154,765	189,500	185,477	0	97,982	74,882	119,210	99,167	74,882
2001	234,989	204,149	149,752	107,812	148,772	182,253	178,374	0	116,671	92,043	137,630	117,785	92,043
2002	213,009	196,250	143,844	103,502	142,901	175,143	171,405	0	135,703	110,263	155,827	136,938	110,263
2003	193,364	188,510	138,068	99,295	137,161	168,183	164,586	0	154,146	128,226	173,073	155,391	128,226
2004	175,828	180,943	132,432	95,195	131,561	161,385	157,924	0	170,931	144,628	188,553	172,013	144,628
2005	160,081	173,559	126,943	91,206	126,106	154,756	151,430	0	184,942	158,390	201,514	186,110	158,390
2006	145,968	166,367	121,605	87,332	120,802	148,304	145,110	0	195,806	168,871	211,415	196,755	168,871
2007	133,258	159,373	116,422	83,574	115,652	142,033	138,969	0	202,940	175,759	218,224	204,176	175,759
2008	121,729	152,582	111,397	79,935	110,659	135,949	133,010	0	194,420	168,310	222,090	208,145	179,263
2009	111,389	145,998	106,531	76,413	105,825	130,052	127,236	0	186,146	161,084	223,108	209,075	179,838
Change	-65,562	-113,056	-169,467	-213,030	-170,484	-135,749	-139,771	-325,249	-227,267	-250,366	-206,039	-226,082	-250,366

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 137. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	65,348	50,082	65,348	65,348	50,082	65,348	43,796	65,348	65,348	65,348	65,348	65,348	65,348
2000	59,020	48,226	35,405	25,504	35,174	43,068	42,154	0	22,269	17,019	27,093	22,538	17,019
2001	53,407	46,398	34,034	24,503	33,812	41,421	40,539	0	26,516	20,919	31,279	26,769	20,919
2002	48,411	44,602	32,692	23,523	32,477	39,805	38,956	0	30,842	25,060	35,415	31,122	25,060
2003	43,946	42,843	31,379	22,567	31,173	38,223	37,406	0	35,033	29,142	39,335	35,316	29,142
2004	39,961	41,123	30,098	21,635	29,900	36,678	35,892	0	38,848	32,870	42,853	39,094	32,870
2005	36,382	39,445	28,851	20,729	28,660	35,172	34,416	0	42,032	35,998	45,799	42,298	35,998
2006	33,175	37,811	27,637	19,848	27,455	33,705	32,980	0	44,501	38,380	48,049	44,717	38,380
2007	30,286	36,221	26,460	18,994	26,285	32,280	31,584	0	46,123	39,945	49,596	46,404	39,945
2008	27,666	34,678	25,318	18,167	25,150	30,897	30,230	0	44,186	38,252	50,475	47,306	40,742
2009	25,316	33,181	24,212	17,367	24,051	29,557	28,917	0	42,306	36,610	50,706	47,517	40,872
Change	27,590	16,796	3,975	-5,925	3,744	11,639	10,724	-31,430	-9,161	-14,411	-4,336	-8,892	-14,411

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 138. Estimated net returns for 1998-2009: full-time tier 1category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	299,086	48,422	299,086	299,086	48,422	299,086	-54,805	299,086	299,086	299,086	299,086	299,086	299,086
2000	195,172	17,934	-192,584	-355,156	-196,379	-66,755	-81,765	-773,940	-408,284	-494,489	-329,064	-403,862	-494,489
2001	103,005	-12,085	-215,088	-371,600	-218,744	-93,800	-108,276	-773,940	-338,542	-430,450	-260,327	-334,383	-430,450
2002	20,978	-41,565	-237,136	-387,685	-240,655	-120,332	-134,280	-773,940	-267,517	-362,455	-192,415	-262,907	-362,455
2003	-52,332	-70,449	-258,691	-403,387	-262,075	-146,305	-159,731	-773,940	-198,690	-295,418	-128,058	-194,043	-295,418
2004	-117,774	-98,688	-279,723	-418,688	-282,974	-171,676	-184,589	-773,940	-136,050	-234,210	-70,287	-132,014	-234,210
2005	-176,541	-126,243	-300,208	-433,573	-303,330	-196,414	-208,824	-773,940	-83,762	-182,850	-21,919	-79,403	-182,850
2006	-229,208	-153,083	-320,128	-448,030	-323,124	-220,492	-232,410	-773,940	-43,221	-143,739	15,029	-39,678	-143,739
2007	-276,642	-179,183	-339,469	-462,053	-342,342	-243,892	-255,329	-773,940	-16,597	-118,032	40,442	-11,985	-118,032
2008	-319,665	-204,525	-358,222	-475,636	-360,975	-266,599	-277,566	-773,940	-48,393	-145,831	54,869	2,826	-104,957
2009	-358,252	-229,097	-376,381	-488,776	-379,017	-288,604	-299,114	-773,940	-79,270	-172,800	58,667	6,296	-102,812
Change	-236,758	-276,821	-324,407	-361,155	-325,265	-295,964	-299,357	-455,816	-373,164	-392,650	-355,257	-372,164	-392,650

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 139. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	158,009	101,039	158,009	158,009	101,039	158,009	77,579	158,009	158,009	158,009	158,009	158,009	158,009
2000	134,392	94,110	46,265	9,317	45,403	74,863	71,451	-85,861	-2,758	-22,350	15,247	-1,753	-22,350
2001	113,445	87,288	41,151	5,580	40,320	68,716	65,426	-85,861	13,093	-7,795	30,869	14,038	-7,795
2002	94,802	80,588	36,140	1,924	35,340	62,686	59,516	-85,861	29,235	7,658	46,304	30,283	7,658
2003	78,141	74,023	31,241	-1,644	30,472	56,783	53,732	-85,861	44,878	22,894	60,930	45,934	22,894
2004	63,267	67,605	26,461	-5,122	25,722	51,017	48,082	-85,861	59,114	36,805	74,060	60,031	36,805
2005	49,911	61,343	21,805	-8,505	21,096	45,395	42,574	-85,861	70,998	48,478	85,053	71,988	48,478
2006	37,942	55,243	17,278	-11,791	16,597	39,922	37,214	-85,861	80,212	57,366	93,450	81,017	57,366
2007	27,161	49,311	12,882	-14,978	12,229	34,604	32,005	-85,861	86,262	63,209	99,226	87,310	63,209
2008	17,383	43,551	8,620	-18,065	7,995	29,444	26,951	-85,861	79,036	56,891	102,505	90,677	66,180
2009	8,613	37,967	4,493	-21,051	3,894	24,443	22,054	-85,861	72,018	50,762	103,368	91,465	66,668
Change	-236,758	-276,821	-324,407	-361,155	-325,265	-295,964	-299,357	-455,816.49	-373,163.72	-392,650	-355,256.74	-372,164	-392,650

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 140. Observed 1998 and projected 1999-2000 fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659
1999	5,309,522	4,069,192	5,309,522	5,309,522	4,069,192	5,309,522	3,558,406	5,309,522	5,309,522	5,309,522	5,309,522	5,309,522	5,309,522
2000	4,795,335	3,918,330	2,876,649	2,072,216	2,857,870	3,499,276	3,425,001	0	1,809,327	1,382,769	2,201,323	1,831,208	1,382,769
2001	4,339,278	3,769,791	2,765,295	1,990,848	2,747,205	3,365,454	3,293,823	0	2,154,426	1,699,650	2,541,448	2,175,005	1,699,650
2002	3,933,392	3,623,917	2,656,199	1,911,258	2,638,787	3,234,164	3,165,149	0	2,505,870	2,036,101	2,877,486	2,528,679	2,036,101
2003	3,570,641	3,480,996	2,549,543	1,833,560	2,532,798	3,105,649	3,039,214	0	2,846,436	2,367,811	3,195,934	2,869,431	2,367,811
2004	3,246,821	3,341,264	2,445,473	1,757,849	2,429,383	2,980,108	2,916,210	0	3,156,389	2,670,679	3,481,799	3,176,361	2,670,679
2005	2,956,034	3,204,917	2,344,108	1,684,197	2,328,658	2,857,701	2,796,293	0	3,415,121	2,924,815	3,721,130	3,436,690	2,924,815
2006	2,695,429	3,072,110	2,245,540	1,612,658	2,230,716	2,738,555	2,679,585	0	3,615,727	3,118,344	3,903,959	3,633,255	3,118,344
2007	2,460,715	2,942,963	2,149,836	1,543,271	2,135,622	2,622,768	2,566,179	0	3,747,467	3,245,547	4,029,703	3,770,285	3,245,547
2008	2,247,831	2,817,566	2,057,044	1,476,060	2,043,422	2,510,410	2,456,144	0	3,590,134	3,107,993	4,101,091	3,843,575	3,310,242
2009	2,056,895	2,695,980	1,967,191	1,411,039	1,954,147	2,401,527	2,349,522	0	3,437,347	2,974,546	4,119,883	3,860,742	3,320,861
Change	-41,324	-918,329	-1,960,010	-2,764,443	-1,978,789	-1,337,383	-1,411,658	-4,836,659	-3,027,332	-3,453,890	-2,635,336	-3,005,451	-3,453,890

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 141. Projected 1998-2000 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742
1999	458,583	351,456	458,583	458,583	351,456	458,583	307,339	458,583	458,583	458,583	458,583	458,583	458,583
2000	414,173	338,426	248,456	178,977	246,834	302,232	295,817	0	156,272	119,430	190,128	158,161	119,430
2001	374,783	325,597	238,839	171,950	237,276	290,674	284,487	0	186,078	146,799	219,505	187,855	146,799
2002	339,727	312,998	229,416	165,075	227,912	279,335	273,374	0	216,432	175,858	248,528	218,402	175,858
2003	308,396	300,654	220,204	158,365	218,758	268,235	262,497	0	245,847	204,508	276,033	247,833	204,508
2004	280,428	288,585	211,216	151,825	209,826	257,392	251,873	0	272,617	230,667	300,723	274,342	230,667
2005	255,313	276,809	202,461	145,464	201,126	246,820	241,516	0	294,964	252,616	321,394	296,827	252,616
2006	232,804	265,338	193,947	139,285	192,667	236,529	231,436	0	312,290	269,331	337,185	313,804	269,331
2007	212,532	254,184	185,681	133,292	184,454	226,528	221,641	0	323,669	280,318	348,045	325,639	280,318
2008	194,145	243,353	177,667	127,487	176,490	216,824	212,137	0	310,080	268,437	354,211	331,970	285,906
2009	177,654	232,852	169,906	121,871	168,780	207,420	202,928	0	296,884	256,912	355,834	333,452	286,823
Change	-3,569	-79,316	-169,286	-238,765	-170,908	-115,510	-121,925	-417,742	-261,471	-298,312	-227,614	-259,581	-298,312

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 142. Projected 1998-2000 fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121
1999	1,269,177	869,104	1,269,177	1,269,177	869,104	1,269,177	726,738	1,269,177	1,269,177	1,269,177	1,269,177	1,269,177	1,269,177
2000	1,099,732	829,739	555,905	373,786	551,381	713,972	694,267	0	319,177	235,320	401,457	323,635	235,320
2001	960,104	791,805	531,190	357,552	526,880	681,686	662,934	0	392,429	297,712	478,734	396,882	297,712
2002	843,491	755,284	507,330	341,842	503,225	650,568	632,730	0	472,273	368,175	560,551	477,536	368,175
2003	744,889	720,152	484,318	326,657	480,410	620,605	603,640	0	555,481	442,485	643,970	561,143	442,485
2004	661,067	686,384	462,146	311,996	458,426	591,777	575,648	0	637,213	515,299	724,838	642,449	515,299
2005	588,964	653,952	440,802	297,856	437,263	564,066	548,735	0	711,126	581,012	798,308	717,116	581,012
2006	526,779	622,826	420,272	284,230	416,907	537,447	522,880	0	773,564	635,073	859,826	778,679	635,073
2007	472,650	592,974	400,543	271,112	397,342	511,897	498,059	0	819,344	674,138	907,293	826,279	674,138
2008	425,024	564,362	381,596	258,494	378,554	487,390	474,248	0	779,061	641,374	939,803	856,768	697,580
2009	383,487	536,956	363,413	246,367	360,523	463,899	451,421	0	740,542	610,013	956,448	870,940	706,559
Change	-202,389	-472,382	-746,216	-928,335	-750,740	-588,149	-607,854	-1,302,121	-982,944	-1,066,801	-900,664	-978,486	-1,066,801

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 143. projected 1998-2000 fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863	1,719,863
1999	1,727,761	1,220,560	1,727,761	1,727,761	1,220,560	1,727,761	1,034,078	1,727,761	1,727,761	1,727,761	1,727,761	1,727,761	1,727,761
2000	1,513,905	1,168,165	804,362	552,763	798,215	1,016,204	990,084	0	475,449	354,750	591,586	481,796	354,750
2001	1,334,888	1,117,402	770,029	529,501	764,156	972,360	947,422	0	578,507	444,510	698,239	584,738	444,510
2002	1,183,218	1,068,281	736,746	506,917	731,137	929,903	906,103	0	688,705	544,033	809,079	695,938	544,033
2003	1,053,286	1,020,805	704,522	485,022	699,168	888,840	866,137	0	801,328	646,993	920,003	808,975	646,993
2004	941,495	974,969	673,361	463,822	668,252	849,169	827,521	0	909,830	745,966	1,025,561	916,791	745,966
2005	844,276	930,761	643,262	443,320	638,389	810,885	790,251	0	1,006,090	833,629	1,119,702	1,013,943	833,629
2006	759,583	888,164	614,220	423,515	609,574	773,976	754,316	0	1,085,854	904,404	1,197,011	1,092,483	904,404
2007	685,182	847,158	586,224	404,405	581,796	738,426	719,700	0	1,143,013	954,455	1,255,338	1,151,918	954,455
2008	619,169	807,715	559,262	385,982	555,044	704,214	686,385	0	1,089,141	909,812	1,294,014	1,188,738	983,486
2009	561,141	769,808	533,320	368,239	529,302	671,319	654,349	0	1,037,426	866,924	1,312,283	1,204,393	993,382
Change	-205,958	-551,698	-915,502	-1,167,100	-921,648	-703,659	-729,779	-1,719,863	-1,244,415	-1,365,114	-1,128,278	-1,238,067	-1,365,114

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 144. Projected 2000-2009 cumulative fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	4,795,335	3,918,330	2,876,649	2,072,216	2,857,870	3,499,276	3,425,001	0	1,809,327	1,382,769	2,201,323	1,831,208	1,382,769
2001	9,134,614	7,688,121	5,641,944	4,063,065	5,605,075	6,864,729	6,718,824	0	3,963,753	3,082,419	4,742,771	4,006,213	3,082,419
2002	13,068,006	11,312,038	8,298,143	5,974,323	8,243,862	10,098,894	9,883,973	0	6,469,623	5,118,520	7,620,258	6,534,892	5,118,520
2003	16,638,647	14,793,034	10,847,686	7,807,883	10,776,660	13,204,543	12,923,187	0	9,316,060	7,486,331	10,816,192	9,404,323	7,486,331
2004	19,885,468	18,134,298	13,293,159	9,565,732	13,206,043	16,184,651	15,839,398	0	12,472,448	10,157,010	14,297,991	12,580,684	10,157,010
2005	22,841,502	21,339,216	15,637,267	11,249,929	15,534,701	19,042,351	18,635,691	0	15,887,569	13,081,825	18,019,121	16,017,374	13,081,825
2006	25,536,931	24,411,326	17,882,807	12,862,586	17,765,417	21,780,906	21,315,276	0	19,503,296	16,200,169	21,923,079	19,650,629	16,200,169
2007	27,997,646	27,354,289	20,032,644	14,405,857	19,901,038	24,403,674	23,881,455	0	23,250,763	19,445,716	25,952,782	23,420,914	19,445,716
2008	30,245,477	30,171,855	22,089,688	15,881,917	21,944,461	26,914,083	26,337,599	0	26,840,897	22,553,709	30,053,873	27,264,489	22,755,959
2009	32,302,372	32,867,834	24,056,879	17,292,956	23,898,608	29,315,611	28,687,121	0	30,278,245	25,528,255	34,173,757	31,125,231	26,076,819

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 145. Projected cumulative 2000-2009 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	414,173	338,426	248,456	178,977	246,834	302,232	295,817	0	156,272	119,430	190,128	158,161	119,430
2001	788,957	664,023	487,295	350,927	484,110	592,907	580,305	0	342,349	266,229	409,633	346,017	266,229
2002	1,128,684	977,021	716,711	516,002	712,022	872,241	853,679	0	558,781	442,087	658,162	564,419	442,087
2003	1,437,080	1,277,674	936,915	674,367	930,780	1,140,476	1,116,176	0	804,628	646,594	934,195	812,251	646,594
2004	1,717,508	1,566,259	1,148,130	826,192	1,140,606	1,397,868	1,368,049	0	1,077,245	877,261	1,234,917	1,086,594	877,261
2005	1,972,821	1,843,068	1,350,591	971,656	1,341,732	1,644,688	1,609,565	0	1,372,209	1,129,877	1,556,311	1,383,421	1,129,877
2006	2,205,625	2,108,406	1,544,538	1,110,942	1,534,399	1,881,217	1,841,000	0	1,684,500	1,399,209	1,893,496	1,697,225	1,399,209
2007	2,418,157	2,362,590	1,730,219	1,244,234	1,718,853	2,107,745	2,062,641	0	2,008,168	1,679,527	2,241,542	2,022,864	1,679,527
2008	2,612,302	2,605,943	1,907,886	1,371,721	1,895,343	2,324,569	2,274,778	0	2,318,248	1,947,964	2,595,753	2,354,834	1,965,432
2009	2,789,956	2,838,795	2,077,793	1,493,593	2,064,123	2,531,989	2,477,707	0	2,615,132	2,204,875	2,951,587	2,688,286	2,252,255

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 146. Projected 2000-2009 cumulative fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,099,732	829,739	555,905	373,786	551,381	713,972	694,267	0	319,177	235,320	401,457	323,635	235,320
2001	2,059,836	1,621,545	1,087,096	731,337	1,078,260	1,395,657	1,357,201	0	711,606	533,032	880,192	720,517	533,032
2002	2,903,327	2,376,828	1,594,426	1,073,179	1,581,485	2,046,225	1,989,931	0	1,183,879	901,206	1,440,742	1,198,054	901,206
2003	3,648,216	3,096,980	2,078,744	1,399,836	2,061,895	2,666,830	2,593,570	0	1,739,360	1,343,691	2,084,712	1,759,197	1,343,691
2004	4,309,284	3,783,364	2,540,890	1,711,833	2,520,321	3,258,608	3,169,218	0	2,376,573	1,858,990	2,809,551	2,401,646	1,858,990
2005	4,898,247	4,437,316	2,981,691	2,009,688	2,957,584	3,822,673	3,717,954	0	3,087,699	2,440,002	3,607,858	3,118,761	2,440,002
2006	5,425,026	5,060,142	3,401,964	2,293,918	3,374,491	4,360,121	4,240,834	0	3,861,263	3,075,075	4,467,684	3,897,440	3,075,075
2007	5,897,676	5,653,117	3,802,506	2,565,031	3,771,833	4,872,018	4,738,893	0	4,680,607	3,749,213	5,374,977	4,723,719	3,749,213
2008	6,322,700	6,217,479	4,184,102	2,823,525	4,150,387	5,359,408	5,213,141	0	5,459,668	4,390,587	6,314,780	5,580,487	4,446,793
2009	6,706,186	6,754,435	4,547,515	3,069,892	4,510,910	5,823,307	5,664,562	0	6,200,211	5,000,600	7,271,228	6,451,428	5,153,351

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 147. Projected 2000-2009 cumulative fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,513,905	1,168,165	804,362	552,763	798,215	1,016,204	990,084	0	475,449	354,750	591,586	481,796	354,750
2001	2,848,793	2,285,568	1,574,391	1,082,264	1,562,371	1,988,564	1,937,506	0	1,053,955	799,260	1,289,825	1,066,534	799,260
2002	4,032,011	3,353,849	2,311,136	1,589,181	2,293,507	2,918,467	2,843,610	0	1,742,660	1,343,293	2,098,904	1,762,472	1,343,293
2003	5,085,296	4,374,654	3,015,659	2,074,203	2,992,675	3,807,306	3,709,746	0	2,543,988	1,990,285	3,018,907	2,571,448	1,990,285
2004	6,026,791	5,349,623	3,689,020	2,538,025	3,660,927	4,656,476	4,537,267	0	3,453,818	2,736,251	4,044,468	3,488,239	2,736,251
2005	6,871,068	6,280,384	4,332,282	2,981,345	4,299,316	5,467,361	5,327,518	0	4,459,908	3,569,880	5,164,170	4,502,182	3,569,880
2006	7,630,651	7,168,549	4,946,502	3,404,860	4,908,890	6,241,337	6,081,834	0	5,545,763	4,474,284	6,361,180	5,594,665	4,474,284
2007	8,315,832	8,015,707	5,532,726	3,809,264	5,490,686	6,979,763	6,801,534	0	6,688,775	5,428,739	7,616,519	6,746,583	5,428,739
2008	8,935,002	8,823,422	6,091,988	4,195,246	6,045,730	7,683,978	7,487,920	0	7,777,916	6,338,551	8,910,533	7,935,321	6,412,225
2009	9,496,142	9,593,230	6,625,308	4,563,485	6,575,032	8,355,297	8,142,269	0	8,815,343	7,205,475	10,222,815	9,139,714	7,405,606

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in terms of year 2000 constant dollar value. Projections assume other state landings equal 1998 value of 565,660 pounds.
Source: Kirkley pers. comm.

Table 148. Expected monetary value of the potential economic impacts associated with the potential regulatory options[a].

Regulatory Option	Probability Of Success	Ex-vessel Revenue	Net Returns	Consumer Surplus	Net Benefits
Status Quo	0.00	32,302,372	2,789,956	6,706,186	9,496,142
Preferred Alternative	0.50	14,657,805	1,265,995	2,911,654	4,177,648
Alternative 1	0.50	12,028,439	1,038,896	2,273,758	3,312,654
Alternative 2	0.75	12,969,717	1,120,194	2,302,419	3,422,614
Alternative 3	0.75	17,923,956	1,548,092	3,383,182	4,931,274
Alternative 4	0.50	16,433,917	1,419,397	3,377,217	4,796,615
Alternative 5	0.75	21,515,341	1,858,280	4,248,422	6,106,702
Alternative 6	1.00	0	0	0	0
Alternative 7	0.50	15,139,122	1,307,566	3,100,105	4,407,671
Alternative 8	0.50	12,764,128	1,102,438	2,500,300	3,602,737
Alternative 9	0.50	17,086,878	1,475,794	3,635,614	5,111,408
Alternative 10	0.75	23,343,923	2,016,215	4,838,571	6,854,785
Alternative 11	1.00	26,076,819	2,252,255	5,153,351	7,405,606

[a]Expected monetary value calculated by multiplying the probability of each option to rebuild the resource to MSY biomass levels within 10 years times the cumulative 2000-2009 economic performance measures and net benefits. Based on landings from other states equaling 1998 observed level of 565,660 pounds. All values are in terms of year 2000 constant dollar values. Although the probability of the status quo achieving the desired objectives of the FMP is likely to be close to use, the analysis assumes a 0.50 probability that the status quo will achieve the objectives.
Source: Kirkley pers. comm.

Table 149. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907	498,907
1999	253,759	194,824	253,759	253,759	194,824	253,759	170,480	253,759	253,759	253,759	253,759	253,759	253,759
2000	229,617	187,846	138,080	99,553	137,182	167,844	164,296	0	86,947	66,477	105,742	87,997	66,477
2001	208,129	180,947	132,889	95,750	132,022	161,619	158,192	0	103,600	81,769	122,161	104,588	81,769
2002	188,946	174,147	127,786	92,019	126,950	155,490	152,184	0	120,573	98,017	138,398	121,668	98,017
2003	171,756	167,462	122,782	88,366	121,977	149,471	146,284	0	137,035	114,052	153,800	138,139	114,052
2004	156,376	160,906	117,885	84,797	117,112	143,574	140,505	0	152,036	128,710	167,646	152,995	128,710
2005	142,535	154,492	113,104	81,317	112,360	137,809	134,857	0	164,584	141,035	179,264	165,619	141,035
2006	130,108	148,228	108,444	77,929	107,730	132,184	129,346	0	174,344	150,451	188,173	175,185	150,451
2007	118,897	142,122	103,910	74,637	103,224	126,705	123,978	0	180,798	156,680	194,343	181,894	156,680
2008	108,712	136,181	99,504	71,442	98,847	121,377	118,760	0	173,362	150,168	197,902	185,539	159,902
2009	99,564	130,409	95,231	68,345	94,600	116,204	113,694	0	166,124	143,838	198,931	186,484	160,518
Change	-269,290	-311,061	-360,827	-399,354	-361,725	-331,063	-334,611	-498,907	-411,960	-432,430	-393,165	-410,911	-432,430

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 150. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094	208,094
1999	916,070	703,316	916,070	916,070	703,316	916,070	615,432	916,070	916,070	916,070	916,070	916,070	916,070
2000	828,918	678,125	498,469	359,388	495,226	605,917	593,110	0	313,879	239,981	381,728	317,667	239,981
2001	751,344	653,219	479,728	345,659	476,599	583,444	571,074	0	373,998	295,186	441,003	377,562	295,186
2002	682,094	628,671	461,306	332,189	458,291	561,318	549,383	0	435,269	353,843	499,616	439,220	353,843
2003	620,039	604,538	443,241	319,001	440,338	539,589	528,086	0	494,697	411,726	555,218	498,680	411,726
2004	564,516	580,872	425,566	306,117	422,773	518,302	507,225	0	548,850	464,644	605,203	552,310	464,644
2005	514,552	557,716	408,306	293,554	405,621	497,490	486,833	0	594,148	509,135	647,144	597,885	509,135
2006	469,691	535,103	391,483	281,325	388,904	477,183	466,938	0	629,382	543,127	679,306	632,419	543,127
2007	429,217	513,062	375,113	269,439	372,639	457,404	447,562	0	652,682	565,614	701,579	656,637	565,614
2008	392,449	491,614	359,210	257,904	356,837	438,170	428,724	0	625,836	542,107	714,426	669,797	577,245
2009	359,426	470,778	343,783	246,725	341,508	419,496	410,434	0	599,709	519,256	718,141	673,209	579,470
Change	620,824	470,031	290,375	151,294	287,132	397,823	385,016	-208,094	105,785	31,887	173,634	109,573	31,887

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 151. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish regulatory options: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763	3,765,763
1999	3,182,138	2,443,098	3,182,138	3,182,138	2,443,098	3,182,138	2,137,816	3,182,138	3,182,138	3,182,138	3,182,138	3,182,138	3,182,138
2000	2,879,400	2,355,591	1,731,524	1,248,400	1,720,257	2,104,766	2,060,275	0	1,090,315	833,617	1,326,002	1,103,476	833,617
2001	2,609,933	2,269,078	1,666,424	1,200,711	1,655,556	2,026,700	1,983,731	0	1,299,150	1,025,383	1,531,904	1,311,531	1,025,383
2002	2,369,381	2,183,803	1,602,432	1,153,918	1,591,958	1,949,840	1,908,384	0	1,511,986	1,229,138	1,735,507	1,525,711	1,229,138
2003	2,153,821	2,099,974	1,539,680	1,108,109	1,529,595	1,874,363	1,834,406	0	1,718,420	1,430,206	1,928,653	1,732,258	1,430,206
2004	1,960,950	2,017,767	1,478,281	1,063,355	1,468,579	1,800,416	1,761,939	0	1,906,532	1,614,028	2,102,283	1,918,552	1,614,028
2005	1,787,391	1,937,328	1,418,325	1,019,715	1,409,000	1,728,122	1,691,103	0	2,063,881	1,768,576	2,247,973	2,076,862	1,768,576
2006	1,631,557	1,858,778	1,359,887	977,233	1,350,930	1,657,582	1,621,994	0	2,186,274	1,886,652	2,359,694	2,196,825	1,886,652
2007	1,490,965	1,782,215	1,303,026	935,945	1,294,429	1,588,876	1,554,690	0	2,267,211	1,964,764	2,437,064	2,280,948	1,964,764
2008	1,363,244	1,707,713	1,247,784	895,877	1,239,538	1,522,065	1,489,251	0	2,173,957	1,883,109	2,481,691	2,326,664	2,005,167
2009	1,248,533	1,635,332	1,194,193	857,046	1,186,290	1,457,195	1,425,719	0	2,083,201	1,803,730	2,494,595	2,338,515	2,012,895
Change	-886,363	-1,410,172	-2,034,239	-2,517,363	-2,045,506	-1,660,997	-1,705,488	-3,765,763	-2,675,448	-2,932,146	-2,439,761	-2,662,287	-2,932,146

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 152. Observed 1998 annual revenue and 1999-2009 projected ex-vessel revenue for each of the tilefish: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895	363,895
1999	723,213	555,250	723,213	723,213	555,250	723,213	485,867	723,213	723,213	723,213	723,213	723,213	723,213
2000	654,409	535,362	393,528	283,727	390,968	478,356	468,244	0	247,799	189,458	301,364	250,790	189,458
2001	593,167	515,700	378,733	272,889	376,263	460,614	450,848	0	295,261	233,042	348,160	298,075	233,042
2002	538,496	496,319	364,189	262,254	361,809	443,145	433,724	0	343,633	279,349	394,434	346,753	279,349
2003	489,505	477,267	349,927	251,843	347,635	425,992	416,910	0	390,550	325,047	438,330	393,695	325,047
2004	445,671	458,583	335,973	241,672	333,768	409,185	400,441	0	433,303	366,825	477,792	436,035	366,825
2005	406,225	440,302	322,347	231,753	320,227	392,755	384,342	0	469,064	401,949	510,903	472,014	401,949
2006	370,808	422,450	309,065	222,098	307,030	376,723	368,635	0	496,881	428,784	536,294	499,278	428,784
2007	338,856	405,049	296,142	212,715	294,188	361,108	353,339	0	515,275	446,537	553,878	518,397	446,537
2008	309,828	388,117	283,587	203,609	281,713	345,924	338,466	0	494,081	427,979	564,021	528,787	455,720
2009	283,757	371,666	271,407	194,783	269,611	331,181	324,027	0	473,455	409,939	566,953	531,481	457,476
Change	290,514	171,467	29,633	-80,168	27,073	114,461	104,349	-363,895	-116,096	-174,436	-62,531	-113,105	-174,436

[a]Projections derived from multiply projected landings by the projected prices. Change is the change in ex-vessel revenue between 1998 and 2000, which is considered as the first year of the FMP. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 153. Estimated total costs for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816	455,816
1999	231,842	177,997	231,842	231,842	177,997	231,842	155,755	231,842	231,842	231,842	231,842	231,842	231,842
2000	209,785	171,622	126,154	90,955	125,333	153,347	150,106	0	79,437	60,735	96,609	80,396	60,735
2001	190,153	165,319	121,411	87,480	120,619	147,660	144,529	0	94,652	74,707	111,610	95,555	74,707
2002	172,627	159,106	116,749	84,071	115,986	142,060	139,040	0	110,159	89,552	126,444	111,159	89,552
2003	156,921	152,998	112,177	80,734	111,442	136,561	133,650	0	125,199	104,201	140,516	126,208	104,201
2004	142,869	147,009	107,703	77,473	106,997	131,173	128,370	0	138,905	117,594	153,167	139,780	117,594
2005	130,224	141,148	103,335	74,294	102,656	125,906	123,209	0	150,369	128,854	163,781	151,315	128,854
2006	118,871	135,425	99,078	71,199	98,425	120,767	118,174	0	159,286	137,456	171,921	160,055	137,456
2007	108,628	129,847	94,935	68,190	94,309	115,761	113,270	0	165,183	143,147	177,558	166,184	143,147
2008	99,322	124,419	90,910	65,271	90,309	110,893	108,503	0	158,389	137,198	180,809	169,514	146,091
2009	90,965	119,146	87,006	62,442	86,430	106,167	103,874	0	151,776	131,415	181,749	170,378	146,654
Change	-246,031	-284,195	-329,662	-364,861	-330,483	-302,469	-305,710	-455,816	-376,379	-395,081	-359,208	-375,420	-395,081

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 154. Estimated total costs for 1998-2009: part-time category[a]

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121	190,121
1999	836,949	642,571	836,949	836,949	642,571	836,949	562,277	836,949	836,949	836,949	836,949	836,949	836,949
2000	757,324	619,555	455,416	328,348	452,453	553,584	541,883	0	286,769	219,254	348,758	290,230	219,254
2001	686,451	596,801	438,294	315,805	435,436	533,052	521,750	0	341,695	269,691	402,913	344,952	269,691
2002	623,182	574,372	421,463	303,497	418,708	512,837	501,933	0	397,675	323,281	456,464	401,285	323,281
2003	566,487	552,324	404,958	291,449	402,306	492,985	482,476	0	451,970	376,165	507,264	455,609	376,165
2004	515,759	530,702	388,810	279,678	386,258	473,536	463,416	0	501,446	424,513	552,931	504,607	424,513
2005	470,110	509,546	373,040	268,200	370,588	454,522	444,785	0	542,831	465,161	591,250	546,245	465,161
2006	429,123	488,886	357,670	257,027	355,315	435,969	426,608	0	575,022	496,217	620,634	577,797	496,217
2007	392,146	468,749	342,715	246,167	340,454	417,898	408,906	0	596,310	516,762	640,984	599,923	516,762
2008	358,553	449,154	328,185	235,629	326,017	400,325	391,695	0	571,783	495,285	652,721	611,947	527,388
2009	328,383	430,116	314,090	225,416	312,012	383,264	374,985	0	547,912	474,407	656,115	615,064	529,421
Change	567,204	429,434	265,295	138,227	262,332	363,463	351,762	-190,121	96,648	29,133	158,637	100,110	29,133

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 155. Estimated total costs for 1998-2009:full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514	3,440,514
1999	2,907,297	2,232,087	2,907,297	2,907,297	2,232,087	2,907,297	1,953,172	2,907,297	2,907,297	2,907,297	2,907,297	2,907,297	2,907,297
2000	2,630,706	2,152,139	1,581,972	1,140,576	1,571,679	1,922,977	1,882,329	0	996,145	761,618	1,211,475	1,008,169	761,618
2001	2,384,513	2,073,098	1,522,495	1,097,005	1,512,566	1,851,654	1,812,396	0	1,186,942	936,821	1,399,593	1,198,254	936,821
2002	2,164,737	1,995,188	1,464,030	1,054,254	1,454,460	1,781,432	1,743,557	0	1,381,396	1,122,977	1,585,612	1,393,936	1,122,977
2003	1,967,796	1,918,599	1,406,698	1,012,402	1,397,484	1,712,474	1,675,968	0	1,570,000	1,306,680	1,762,075	1,582,643	1,306,680
2004	1,791,583	1,843,492	1,350,601	971,513	1,341,738	1,644,914	1,609,760	0	1,741,865	1,474,624	1,920,708	1,752,847	1,474,624
2005	1,633,014	1,770,001	1,295,824	931,642	1,287,304	1,578,865	1,545,042	0	1,885,624	1,615,824	2,053,815	1,897,484	1,615,824
2006	1,490,639	1,698,236	1,242,434	892,829	1,234,251	1,514,417	1,481,903	0	1,997,446	1,723,702	2,155,888	2,007,085	1,723,702
2007	1,362,191	1,628,285	1,190,483	855,108	1,182,629	1,451,645	1,420,412	0	2,071,392	1,795,067	2,226,575	2,083,943	1,795,067
2008	1,245,501	1,560,218	1,140,012	818,501	1,132,479	1,390,604	1,360,624	0	1,986,192	1,720,465	2,267,347	2,125,710	1,831,980
2009	1,140,697	1,494,089	1,091,050	783,023	1,083,830	1,331,337	1,302,580	0	1,903,274	1,647,942	2,279,137	2,136,537	1,839,041
Change	-809,808	-1,288,375	-1,858,542	-2,299,938	-1,868,835	-1,517,537	-1,558,185	-3,440,514	-2,444,370	-2,678,896	-2,229,039	-2,432,345	-2,678,896

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 156. Estimated total costs for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465	332,465
1999	660,749	507,293	660,749	660,749	507,293	660,749	443,903	660,749	660,749	660,749	660,749	660,749	660,749
2000	597,888	489,122	359,539	259,222	357,200	437,040	427,802	0	226,396	173,095	275,335	229,129	173,095
2001	541,935	471,159	346,022	249,319	343,765	420,830	411,908	0	269,760	212,914	318,089	272,330	212,914
2002	491,986	453,452	332,734	239,603	330,559	404,871	396,263	0	313,954	255,222	360,366	316,804	255,222
2003	447,226	436,045	319,704	230,091	317,610	389,199	380,902	0	356,818	296,973	400,472	359,692	296,973
2004	407,178	418,975	306,955	220,799	304,940	373,844	365,855	0	395,878	335,142	436,525	398,374	335,142
2005	371,139	402,273	294,506	211,737	292,569	358,833	351,146	0	428,551	367,233	466,776	431,246	367,233
2006	338,782	385,963	282,371	202,916	280,511	344,186	336,796	0	453,965	391,750	489,974	456,156	391,750
2007	309,589	370,065	270,564	194,343	268,779	329,919	322,821	0	470,771	407,970	506,040	473,623	407,970
2008	283,068	354,595	259,094	186,023	257,382	316,046	309,233	0	451,407	391,015	515,306	483,116	416,359
2009	259,249	339,566	247,966	177,960	246,325	302,577	296,041	0	432,562	374,532	517,986	485,577	417,964
Change	265,422	156,657	27,074	-73,244	24,734	104,575	95,337	-332,465	-106,069	-159,370	-57,130	-103,336	-159,370

[a]Estimated costs based on ratios of costs to revenue obtained from Georgianna *et al.* (1998). All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 157. Estimated net returns for 1998-2009: incidental category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091	43,091
1999	21,917	16,827	21,917	21,917	21,917	21,917	14,724	21,917	21,917	21,917	21,917	21,917	21,917
2000	19,832	16,224	11,926	8,598	14,497	14,497	14,190	0	7,510	5,742	9,133	7,600	5,742
2001	17,976	15,628	11,478	8,270	13,959	13,959	13,663	0	8,948	7,062	10,551	9,033	7,062
2002	16,319	15,041	11,037	7,948	13,430	13,430	13,144	0	10,414	8,466	11,953	10,508	8,466
2003	14,835	14,464	10,605	7,632	12,910	12,910	12,635	0	11,836	9,851	13,284	11,931	9,851
2004	13,506	13,897	10,182	7,324	12,400	12,400	12,135	0	13,131	11,117	14,480	13,214	11,117
2005	12,311	13,343	9,769	7,023	11,903	11,903	11,648	0	14,215	12,181	15,483	14,305	12,181
2006	11,237	12,802	9,366	6,731	11,417	11,417	11,172	0	15,058	12,994	16,253	15,131	12,994
2007	10,269	12,275	8,975	6,446	10,943	10,943	10,708	0	15,616	13,532	16,785	15,710	13,532
2008	9,389	11,762	8,594	6,170	10,483	10,483	10,257	0	14,973	12,970	17,093	16,025	13,811
2009	8,599	11,263	8,225	5,903	10,037	10,037	9,820	0	14,348	12,423	17,182	16,107	13,864
Change	-23,259	-26,866	-31,165	-34,492	-28,594	-28,594	-28,900	-43,091	-35,581	-37,349	-33,958	-35,490	-37,349

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 158. Estimated net returns for 1998-2009: part-time category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973	17,973
1999	79,121	60,745	79,121	79,121	60,745	79,121	53,155	79,121	79,121	79,121	79,121	79,121	79,121
2000	71,594	58,570	43,053	31,040	42,773	52,333	51,227	0	27,110	20,727	32,970	27,437	20,727
2001	64,894	56,419	41,434	29,855	41,164	50,392	49,324	0	32,302	25,495	38,089	32,610	25,495
2002	58,912	54,298	39,843	28,691	39,583	48,481	47,450	0	37,594	30,561	43,152	37,935	30,561
2003	53,553	52,214	38,283	27,552	38,032	46,604	45,611	0	42,727	35,561	47,954	43,071	35,561
2004	48,757	50,170	36,756	26,439	36,515	44,766	43,809	0	47,404	40,131	52,271	47,703	40,131
2005	44,442	48,170	35,265	25,354	35,033	42,968	42,048	0	51,317	43,974	55,894	51,639	43,974
2006	40,567	46,217	33,812	24,298	33,590	41,214	40,329	0	54,360	46,910	58,672	54,622	46,910
2007	37,071	44,313	32,399	23,271	32,185	39,506	38,656	0	56,372	48,852	60,595	56,714	48,852
2008	33,896	42,461	31,025	22,275	30,820	37,845	37,029	0	54,053	46,822	61,705	57,850	49,857
2009	31,044	40,661	29,693	21,310	29,496	36,232	35,449	0	51,797	44,848	62,026	58,145	50,049
Change	53,621	40,597	25,080	13,067	24,800	34,360	33,254	-17,973	9,137	2,754	14,997	9,464	2,754

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 159. Estimated net returns for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	274,841	211,010	274,841	274,841	211,010	274,841	184,643	274,841	274,841	274,841	274,841	274,841	274,841
2000	248,694	203,452	149,552	107,824	148,579	181,789	177,946	0	94,171	72,000	114,527	95,307	72,000
2001	225,420	195,980	143,929	103,705	142,990	175,046	171,335	0	112,208	88,562	132,311	113,277	88,562
2002	204,643	188,615	138,402	99,664	137,497	168,408	164,827	0	130,590	106,161	149,896	131,776	106,161
2003	186,026	181,375	132,982	95,707	132,111	161,889	158,438	0	148,420	123,527	166,578	149,615	123,527
2004	169,367	174,275	127,679	91,842	126,841	155,502	152,179	0	164,667	139,404	181,574	165,705	139,404
2005	154,377	167,327	122,501	88,073	121,695	149,258	146,061	0	178,257	152,752	194,157	179,379	152,752
2006	140,918	160,543	117,453	84,404	116,680	143,165	140,092	0	188,829	162,950	203,807	189,740	162,950
2007	128,775	153,930	112,542	80,838	111,800	137,231	134,279	0	195,819	169,697	210,489	197,006	169,697
2008	117,743	147,495	107,771	77,377	107,059	131,461	128,627	0	187,765	162,644	214,344	200,954	173,186
2009	107,836	141,244	103,142	74,023	102,460	125,858	123,139	0	179,926	155,788	215,458	201,978	173,854
Change	-76,555	-121,797	-175,697	-217,425	-176,670	-143,460	-147,303	-325,249	-231,078	-253,249	-210,722	-229,942	-253,249

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 160. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	62,464	47,957	62,464	62,464	47,957	62,464	41,964	62,464	62,464	62,464	62,464	62,464	62,464
2000	56,521	46,239	33,989	24,506	33,768	41,316	40,442	0	21,402	16,364	26,029	21,661	16,364
2001	51,232	44,541	32,711	23,569	32,498	39,783	38,940	0	25,502	20,128	30,071	25,745	20,128
2002	46,510	42,867	31,455	22,651	31,249	38,274	37,461	0	29,680	24,127	34,067	29,949	24,127
2003	42,279	41,222	30,223	21,752	30,025	36,793	36,009	0	33,732	28,074	37,859	34,003	28,074
2004	38,493	39,608	29,018	20,873	28,828	35,341	34,586	0	37,424	31,683	41,267	37,660	31,683
2005	35,086	38,029	27,841	20,017	27,658	33,922	33,196	0	40,513	34,716	44,127	40,768	34,716
2006	32,027	36,487	26,694	19,183	26,518	32,538	31,839	0	42,916	37,034	46,320	43,123	37,034
2007	29,267	34,984	25,578	18,372	25,409	31,189	30,518	0	44,504	38,567	47,838	44,774	38,567
2008	26,760	33,522	24,493	17,586	24,332	29,877	29,233	0	42,674	36,965	48,714	45,671	39,361
2009	24,508	32,101	23,441	16,823	23,286	28,604	27,986	0	40,892	35,406	48,968	45,904	39,512
Change	25,092	14,810	2,559	-6,924	2,338	9,886	9,013	-31,430	-10,027	-15,066	-5,401	-9,769	-15,066

[a]Estimated net returns based on costs calculated using ratios of costs to revenue time projected revenues. All values are in terms of year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 161. Estimated net returns for 1998-2009: full-time tier 1 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249	325,249
1999	251,727	13,520	251,727	251,727	13,520	251,727	-84,879	251,727	251,727	251,727	251,727	251,727	251,727
2000	154,149	-14,685	-215,835	-371,555	-219,466	-95,532	-109,872	-773,940	-422,509	-505,248	-346,543	-418,267	-505,248
2001	67,294	-42,570	-236,818	-386,927	-240,321	-120,694	-134,544	-773,940	-355,198	-443,438	-280,176	-351,207	-443,438
2002	-10,241	-70,056	-257,444	-402,009	-260,820	-145,467	-158,829	-773,940	-286,596	-377,764	-214,551	-282,172	-377,764
2003	-79,720	-97,076	-277,670	-416,774	-280,921	-169,795	-182,674	-773,940	-220,058	-312,956	-152,296	-215,598	-312,956
2004	-141,886	-123,573	-297,460	-431,199	-300,587	-193,630	-206,032	-773,940	-159,426	-253,706	-96,332	-155,552	-253,706
2005	-197,828	-149,500	-316,785	-445,265	-319,791	-216,931	-228,863	-773,940	-108,710	-203,892	-49,373	-104,525	-203,892
2006	-248,056	-174,818	-335,621	-458,958	-338,508	-239,668	-251,138	-773,940	-69,260	-165,834	-13,363	-65,859	-165,834
2007	-293,372	-199,496	-353,948	-472,266	-356,719	-261,813	-272,832	-773,940	-43,172	-140,657	11,575	-38,744	-140,657
2008	-334,539	-223,509	-371,754	-485,180	-374,412	-283,348	-293,924	-773,940	-73,230	-166,976	25,959	-24,009	-127,634
2009	-371,513	-246,839	-389,027	-497,696	-391,575	-304,257	-314,402	-773,940	-102,482	-192,561	30,118	-20,190	-125,143
Change	-171,100	-339,934	-541,084	-696,804	-544,715	-420,781	-435,121	-1,099,189	-747,758	-830,497	-671,792	-743,516	-830,497

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 162. Estimated net returns for 1998-2009: full-time tier 2 category[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
1999	147,245	93,107	147,245	147,245	93,107	147,245	70,744	147,245	147,245	147,245	147,245	147,245	147,245
2000	125,068	86,697	40,981	5,590	40,156	68,323	65,064	-85,861	-5,990	-24,795	11,275	-5,026	-24,795
2001	105,328	80,359	36,212	2,097	35,416	62,604	59,456	-85,861	9,308	-10,747	26,358	10,215	-10,747
2002	87,707	74,112	31,524	-1,331	30,757	56,974	53,937	-85,861	24,899	4,179	41,273	25,904	4,179
2003	71,916	67,972	26,928	-4,687	26,189	51,445	48,518	-85,861	40,021	18,908	55,422	41,035	18,908
2004	57,788	61,950	22,430	-7,965	21,719	46,028	43,209	-85,861	53,801	32,374	68,141	54,682	32,374
2005	45,073	56,057	18,038	-11,162	17,355	40,732	38,020	-85,861	65,328	43,695	78,813	66,279	43,695
2006	33,658	50,303	13,757	-14,274	13,101	35,564	32,957	-85,861	74,294	52,345	86,997	75,066	52,345
2007	23,359	44,694	9,592	-17,299	8,962	30,531	28,027	-85,861	80,222	58,067	92,665	81,229	58,067
2008	14,003	39,237	5,545	-20,234	4,941	25,637	23,233	-85,861	73,391	52,085	95,934	84,578	61,027
2009	5,600	33,935	1,619	-23,078	1,040	20,885	18,579	-85,861	66,743	46,270	96,879	85,446	61,593
Change	93,639	55,267	9,551	-25,840	8,726	36,893	33,634	-117,291	-37,420	-56,224	-20,155	-36,456	-56,224

[a]Estimated net returns based on variable costs calculated using ratios of costs to revenue times revenue, and fixed cost equaling 1998 ratio of fixed cost to 1998 revenue times 1998 revenue and held constant from 1999-2009. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 163. Observed 1998 and projected 1999-2000 fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659	4,836,659
1999	5,075,181	3,896,488	5,075,181	5,075,181	3,896,488	5,075,181	3,409,594	5,075,181	5,075,181	5,075,181	5,075,181	5,075,181	5,075,181
2000	4,592,344	3,756,924	2,761,601	1,991,069	2,743,632	3,356,883	3,285,926	0	1,738,939	1,329,533	2,114,836	1,759,930	1,329,533
2001	4,162,573	3,618,944	2,657,774	1,915,009	2,640,440	3,232,376	3,163,845	0	2,072,009	1,635,379	2,443,228	2,091,756	1,635,379
2002	3,778,917	3,482,939	2,555,713	1,840,380	2,539,007	3,109,793	3,043,675	0	2,411,461	1,960,347	2,767,954	2,433,351	1,960,347
2003	3,435,121	3,349,241	2,455,630	1,767,320	2,439,546	2,989,414	2,925,687	0	2,740,702	2,281,031	3,076,001	2,762,772	2,281,031
2004	3,127,512	3,218,129	2,357,704	1,695,942	2,342,231	2,871,477	2,810,110	0	3,040,721	2,574,207	3,352,923	3,059,892	2,574,207
2005	2,850,703	3,089,837	2,262,081	1,626,339	2,247,208	2,756,176	2,697,134	0	3,291,676	2,820,695	3,585,283	3,312,380	2,820,695
2006	2,602,164	2,964,559	2,168,879	1,558,585	2,154,594	2,643,672	2,586,913	0	3,486,881	3,009,014	3,763,468	3,503,708	3,009,014
2007	2,377,935	2,842,448	2,078,191	1,492,736	2,064,480	2,534,092	2,479,570	0	3,615,966	3,133,594	3,886,865	3,637,876	3,133,594
2008	2,174,233	2,723,626	1,990,085	1,428,832	1,976,935	2,427,535	2,375,200	0	3,467,235	3,003,364	3,958,039	3,710,789	3,198,033
2009	1,991,281	2,608,186	1,904,613	1,366,900	1,892,009	2,324,075	2,273,874	0	3,322,489	2,876,762	3,978,621	3,729,689	3,210,359
Change	-244,315	-1,079,735	-2,075,058	-2,845,590	-2,093,027	-1,479,776	-1,550,734	-4,836,659	-3,097,720	-3,507,126	-2,721,823	-3,076,729	-3,507,126

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 164. Projected 1998-2000 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742
1999	438,343	336,540	438,343	438,343	336,540	438,343	294,487	438,343	438,343	438,343	438,343	438,343	438,343
2000	396,641	324,486	238,520	171,969	236,967	289,934	283,805	0	150,192	114,832	182,658	152,005	114,832
2001	359,521	312,568	229,552	165,399	228,055	279,180	273,261	0	178,959	141,248	211,022	180,665	141,248
2002	326,385	300,821	220,737	158,954	219,294	268,593	262,882	0	208,278	169,315	239,068	210,169	169,315
2003	296,691	289,274	212,093	152,643	210,704	258,196	252,692	0	236,714	197,013	265,674	238,621	197,013
2004	270,123	277,950	203,635	146,478	202,298	248,009	242,709	0	262,627	222,334	289,592	264,283	222,334
2005	246,215	266,869	195,376	140,467	194,091	238,051	232,951	0	284,302	243,623	309,661	286,090	243,623
2006	224,749	256,049	187,326	134,615	186,092	228,334	223,432	0	301,162	259,889	325,051	302,615	259,889
2007	205,382	245,502	179,493	128,928	178,309	218,870	214,160	0	312,311	270,649	335,709	314,203	270,649
2008	187,789	235,240	171,884	123,408	170,748	209,666	205,146	0	299,465	259,401	341,856	320,501	276,214
2009	171,987	225,269	164,501	118,059	163,413	200,730	196,395	0	286,963	248,466	343,633	322,133	277,279
Change	-21,101	-93,257	-179,223	-245,774	-180,775	-127,808	-133,937	-417,742	-267,550	-302,910	-235,084	-265,737	-302,910

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 165. Projected 1998-2000 fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121	1,302,121
1999	1,233,639	842,913	1,233,639	1,233,639	842,913	1,233,639	704,171	1,233,639	1,233,639	1,233,639	1,233,639	1,233,639	1,233,639
2000	1,068,948	805,262	538,458	361,479	534,056	692,377	673,176	0	308,503	227,247	388,341	312,826	227,247
2001	933,306	768,929	514,885	346,050	510,689	661,504	643,223	0	379,930	287,965	463,839	384,258	287,965
2002	820,064	733,904	492,091	331,093	488,093	631,707	614,308	0	457,956	356,686	543,940	463,080	356,686
2003	724,338	700,171	470,076	316,612	466,268	602,977	586,423	0	539,446	429,324	625,782	544,968	429,324
2004	642,974	667,710	448,835	302,608	445,210	575,303	559,558	0	619,672	500,669	705,294	624,786	500,669
2005	572,990	636,500	428,362	289,082	424,911	548,669	533,698	0	692,406	565,222	777,706	698,264	565,222
2006	512,635	606,516	408,647	276,030	405,363	523,058	508,826	0	754,024	618,492	838,520	759,033	618,492
2007	460,096	577,731	389,677	263,449	386,554	498,450	484,925	0	799,402	657,160	885,631	806,199	657,160
2008	413,863	550,116	371,441	251,332	368,471	474,822	461,973	0	760,423	625,507	918,109	836,631	680,563
2009	373,536	523,642	353,923	239,673	351,100	452,153	439,949	0	723,124	595,184	935,025	851,066	689,801
Change	-233,173	-496,859	-763,663	-940,641	-768,065	-609,744	-628,945	-1,302,121	-993,618	-1,074,874	-913,780	-989,295	-1,074,874

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 166. Projected 1998-2000 fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
1998	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742	417,742
1999	438,343	336,540	438,343	438,343	336,540	438,343	294,487	438,343	438,343	438,343	438,343	438,343	438,343
2000	396,641	324,486	238,520	171,969	236,967	289,934	283,805	0	150,192	114,832	182,658	152,005	114,832
2001	359,521	312,568	229,552	165,399	228,055	279,180	273,261	0	178,959	141,248	211,022	180,665	141,248
2002	326,385	300,821	220,737	158,954	219,294	268,593	262,882	0	208,278	169,315	239,068	210,169	169,315
2003	296,691	289,274	212,093	152,643	210,704	258,196	252,692	0	236,714	197,013	265,674	238,621	197,013
2004	270,123	277,950	203,635	146,478	202,298	248,009	242,709	0	262,627	222,334	289,592	264,283	222,334
2005	246,215	266,869	195,376	140,467	194,091	238,051	232,951	0	284,302	243,623	309,661	286,090	243,623
2006	224,749	256,049	187,326	134,615	186,092	228,334	223,432	0	301,162	259,889	325,051	302,615	259,889
2007	205,382	245,502	179,493	128,928	178,309	218,870	214,160	0	312,311	270,649	335,709	314,203	270,649
2008	187,789	235,240	171,884	123,408	170,748	209,666	205,146	0	299,465	259,401	341,856	320,501	276,214
2009	171,987	225,269	164,501	118,059	163,413	200,730	196,395	0	286,963	248,466	343,633	322,133	277,279
Change	-21,101	-93,257	-179,223	-245,774	-180,775	-127,808	-133,937	-417,742	-267,550	-302,910	-235,084	-265,737	-302,910

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 167. Projected 2000-2009 cumulative fishery revenues[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	4,592,344	3,756,924	2,761,601	1,991,069	2,743,632	3,356,883	3,285,926	0	1,738,939	1,329,533	2,114,836	1,759,930	1,329,533
2001	8,754,917	7,375,868	5,419,376	3,906,078	5,384,072	6,589,259	6,449,771	0	3,810,948	2,964,913	4,558,063	3,851,686	2,964,913
2002	12,533,833	10,858,808	7,975,088	5,746,458	7,923,079	9,699,051	9,493,445	0	6,222,409	4,925,260	7,326,018	6,285,038	4,925,260
2003	15,968,955	14,208,048	10,430,718	7,513,777	10,362,625	12,688,466	12,419,132	0	8,963,111	7,206,291	10,402,019	9,047,809	7,206,291
2004	19,096,467	17,426,177	12,788,423	9,209,719	12,704,856	15,559,942	15,229,242	0	12,003,833	9,780,498	13,754,942	12,107,701	9,780,498
2005	21,947,170	20,516,014	15,050,504	10,836,058	14,952,064	18,316,119	17,926,376	0	15,295,509	12,601,193	17,340,225	15,420,081	12,601,193
2006	24,549,333	23,480,573	17,219,384	12,394,644	17,106,658	20,959,791	20,513,289	0	18,782,390	15,610,207	21,103,693	18,923,789	15,610,207
2007	26,927,268	26,323,021	19,297,574	13,887,379	19,171,138	23,493,883	22,992,859	0	22,398,356	18,743,802	24,990,558	22,561,665	18,743,802
2008	29,101,502	29,046,647	21,287,660	15,316,211	21,148,073	25,921,418	25,368,059	0	25,865,591	21,747,166	28,948,597	26,272,454	21,941,834
2009	31,092,782	31,654,832	23,192,273	16,683,111	23,040,082	28,245,493	27,641,933	0	29,188,080	24,623,928	32,927,218	30,002,143	25,152,193

[a]Revenue estimated by multiplying projected price times fleet wide landings. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 168. Projected cumulative 2000-2009 fishery net returns[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	396,641	324,486	238,520	171,969	236,967	289,934	283,805	0	150,192	114,832	182,658	152,005	114,832
2001	756,162	637,054	468,071	337,368	465,022	569,114	557,067	0	329,152	256,080	393,680	332,670	256,080
2002	1,082,547	937,875	688,808	496,322	684,316	837,707	819,949	0	537,429	425,395	632,748	542,839	425,395
2003	1,379,239	1,227,149	900,901	648,965	895,020	1,095,903	1,072,640	0	774,144	622,407	898,422	781,459	622,407
2004	1,649,362	1,505,099	1,104,536	795,443	1,097,318	1,343,912	1,315,350	0	1,036,771	844,742	1,188,014	1,045,742	844,742
2005	1,895,577	1,771,968	1,299,912	935,910	1,291,410	1,581,963	1,548,301	0	1,321,073	1,088,365	1,497,675	1,331,832	1,088,365
2006	2,120,326	2,028,017	1,487,238	1,070,525	1,477,502	1,810,297	1,771,733	0	1,622,235	1,348,254	1,822,726	1,634,448	1,348,254
2007	2,325,708	2,273,519	1,666,731	1,199,453	1,655,811	2,029,167	1,985,893	0	1,934,546	1,618,902	2,158,434	1,948,651	1,618,902
2008	2,513,497	2,508,759	1,838,615	1,322,861	1,826,559	2,238,833	2,191,039	0	2,234,011	1,878,303	2,500,290	2,269,152	1,895,116
2009	2,685,484	2,734,028	2,003,117	1,440,920	1,989,972	2,439,563	2,387,434	0	2,520,974	2,126,769	2,843,924	2,591,285	2,172,395

[a]Net returns estimated using cost to revenue ratios times projected revenues. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 169. Projected 2000-2009 cumulative fishery consumer surplus[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,068,948	805,262	538,458	361,479	534,056	692,377	673,176	0	308,503	227,247	388,341	312,826	227,247
2001	2,002,254	1,574,191	1,053,343	707,530	1,044,745	1,353,882	1,316,399	0	688,433	515,212	852,180	697,083	515,212
2002	2,822,319	2,308,095	1,545,434	1,038,623	1,532,838	1,985,589	1,930,707	0	1,146,388	871,898	1,396,120	1,160,163	871,898
2003	3,546,656	3,008,266	2,015,510	1,355,235	1,999,106	2,588,566	2,517,130	0	1,685,834	1,301,222	2,021,902	1,705,131	1,301,222
2004	4,189,630	3,675,976	2,464,346	1,657,843	2,444,315	3,163,869	3,076,687	0	2,305,506	1,801,891	2,727,196	2,329,917	1,801,891
2005	4,762,620	4,312,476	2,892,708	1,946,924	2,869,226	3,712,539	3,610,385	0	2,997,912	2,367,114	3,504,903	3,028,181	2,367,114
2006	5,275,255	4,918,992	3,301,354	2,222,954	3,274,589	4,235,597	4,119,211	0	3,751,936	2,985,606	4,343,423	3,787,214	2,985,606
2007	5,735,351	5,496,723	3,691,032	2,486,403	3,661,143	4,734,047	4,604,136	0	4,551,338	3,642,766	5,229,054	4,593,412	3,642,766
2008	6,149,214	6,046,839	4,062,473	2,737,735	4,029,613	5,208,869	5,066,109	0	5,311,761	4,268,273	6,147,163	5,430,043	4,323,329
2009	6,522,750	6,570,481	4,416,396	2,977,408	4,380,713	5,661,022	5,506,058	0	6,034,885	4,863,457	7,082,188	6,281,109	5,013,130

[a]Consumer surplus estimated by solving for the integral of the inverse demand function and subtracting expenditures. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 170. Projected 2000-2009 cumulative fishery net benefits[a].

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
2000	1,465,589	1,129,747	776,978	533,448	771,024	982,311	956,981	0	458,695	342,078	571,000	464,831	342,078
2001	2,758,417	2,211,245	1,521,415	1,044,898	1,509,767	1,922,996	1,873,465	0	1,017,584	771,291	1,245,860	1,029,753	771,291
2002	3,904,866	3,245,970	2,234,243	1,534,945	2,217,154	2,823,296	2,750,655	0	1,683,818	1,297,293	2,028,869	1,703,002	1,297,293
2003	4,925,895	4,235,415	2,916,411	2,004,200	2,894,126	3,684,469	3,589,770	0	2,459,978	1,923,630	2,920,325	2,486,590	1,923,630
2004	5,838,992	5,181,075	3,568,882	2,453,286	3,541,634	4,507,782	4,392,037	0	3,342,277	2,646,633	3,915,211	3,375,659	2,646,633
2005	6,658,197	6,084,444	4,192,620	2,882,835	4,160,636	5,294,502	5,158,686	0	4,318,985	3,455,479	5,002,578	4,360,013	3,455,479
2006	7,395,581	6,947,009	4,788,592	3,293,479	4,752,091	6,045,894	5,890,944	0	5,374,171	4,333,860	6,166,149	5,421,661	4,333,860
2007	8,061,059	7,770,242	5,357,763	3,685,856	5,316,954	6,763,213	6,590,029	0	6,485,884	5,261,668	7,387,488	6,542,063	5,261,668
2008	8,662,711	8,555,598	5,901,088	4,060,596	5,856,172	7,447,702	7,257,148	0	7,545,772	6,146,576	8,647,453	7,699,195	6,218,446
2009	9,208,234	9,304,509	6,419,513	4,418,328	6,370,685	8,100,586	7,893,492	0	8,555,860	6,990,226	9,926,112	8,872,394	7,185,525

[a]Net benefits equal the sum of consumer surplus and net returns. Values are in year 2000 constant dollar value. Projections assume other landings equal 64-98 mean annual landings (1,764,556 lbs.).
Source: Kirkley pers. comm.

Table 171. Expected monetary value of the potential economic impacts associated with the potential regulatory options[a].

Regulatory Option	Probability Of Success	Ex-vessel Revenue	Net Returns	Consumer Surplus	Net Benefits
Status Quo	0.00	15,546,391	1,342,742	3,261,375	4,604,117
Preferred Alternative	0.50	14,122,747	1,219,782	2,830,511	4,050,293
Alternative 1	0.50	11,596,137	1,001,558	2,208,198	3,209,756
Alternative 2	0.75	12,512,333	1,080,690	2,233,056	3,313,746
Alternative 3	0.75	17,280,061	1,492,479	3,285,535	4,778,014
Alternative 4	0.50	15,827,416	1,367,014	3,285,240	4,652,254
Alternative 5	0.75	20,731,450	1,790,575	4,129,543	5,920,119
Alternative 6		0	0	0	0
Alternative 7	0.50	14,594,040	1,260,487	3,017,443	4,277,930
Alternative 8	0.50	12,311,964	1,063,384	2,431,728	3,495,113
Alternative 9	0.50	16,463,609	1,421,962	3,541,094	4,963,056
Alternative 10	0.75	22,501,607	1,943,464	4,710,832	6,654,296
Alternative 11	1.00	25,152,193	2,172,395	5,013,130	7,185,525

[a]Expected monetary value calculated by multiplying the probability of each option to rebuild the resource to MSY biomass levels within 10 years times the cumulative 2000-2009 economic performance measures and net benefits. Based on landings from other states equaling 1964-1998 mean annual level of 1,764,556 pounds. All values are in t erms f year 2000 constant dollar value. Although the probability of the status quo achieving the desired objectives of the FMP is likely to be close to use, the analysis assumes a 0.50 probability that the status quo will achieve the objectives.
Source: Kirkley pers. comm.

Table 172. Tilefish Regulatory Options and Projected Annual Ex-vessel Revenue, Net Returns, Consumer Surplus, and Net National Benefits: 2004-2009 (Year 2000 Constant Dollar Value).

Year	Status Quo	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11
Ex-vessel Revenue													
2004	3,194,461	3,287,224	2,406,954	1,730,680	2,391,135	2,932,434	2,869,647	0	3,105,626	2,628,341	3,425,240	3,125,247	2,628,341
2005	2,909,808	3,154,413	2,308,110	1,658,805	2,292,913	2,813,145	2,752,776	0	3,360,945	2,879,121	3,661,512	3,382,135	2,879,121
2006	2,654,498	3,024,910	2,211,897	1,588,927	2,197,309	2,696,914	2,638,914	0	3,559,181	3,070,363	3,842,302	3,576,401	3,070,363
2007	2,424,386	2,898,851	2,118,394	1,521,093	2,104,400	2,583,851	2,528,170	0	3,689,756	3,196,415	3,967,016	3,712,175	3,196,415
2008	2,215,532	2,776,339	2,027,658	1,455,333	2,014,243	2,474,039	2,420,621	0	3,536,198	3,062,075	4,038,311	3,785,300	3,260,998
2009	2,028,099	2,657,450	1,939,728	1,391,668	1,926,877	2,367,536	2,316,323	0	3,386,940	2,931,632	4,057,888	3,803,227	3,272,365
Rate[a]	-6.32	-3.44	-3.49	-3.52	-3.49	-3.46	-3.46		10.05	12.85	9.73	12.37	15.64
Net Returns													
2004	275,906	283,918	207,889	149,479	206,522	253,274	247,851	0	268,233	227,010	295,838	269,928	227,010
2005	251,320	272,447	199,351	143,271	198,039	242,971	237,757	0	290,285	248,670	316,245	292,115	248,670
2006	229,269	261,261	191,042	137,236	189,782	232,932	227,923	0	307,406	265,187	331,860	308,894	265,187
2007	209,394	250,374	182,966	131,377	181,757	223,167	218,358	0	318,684	276,074	342,631	320,621	276,074
2008	191,355	239,792	175,129	125,697	173,970	213,683	209,069	0	305,421	264,471	348,789	326,936	281,652
2009	175,167	229,524	167,534	120,198	166,424	204,484	200,061	0	292,530	253,205	350,480	328,485	282,634
Rate[a]	-6.32	-3.44	-3.49	-3.52	-3.49	-3.46	-3.46		10.05	12.85	9.73	12.37	15.64
Consumer Surplus													
2004	653,127	678,189	456,304	307,876	452,626	584,548	568,586	0	629,515	508,879	716,261	634,697	508,879
2005	581,954	646,293	435,342	294,005	431,842	557,309	542,136	0	702,911	574,083	789,267	708,842	574,083
2006	520,572	615,668	415,170	280,631	411,840	531,132	516,712	0	764,988	627,796	850,475	770,057	627,796
2007	467,140	586,284	395,774	267,749	392,608	505,996	492,295	0	810,592	666,687	897,786	817,466	666,687
2008	420,126	558,110	377,139	255,351	374,129	481,875	468,861	0	770,882	634,411	930,282	847,931	690,112
2009	379,120	531,113	359,248	243,430	356,387	458,744	446,386	0	732,898	603,505	947,047	862,218	699,204
Rate[a]	-7.23	-3.91	-3.83	-3.77	-3.83	-3.88	-3.87		14.78	17.82	15.48	18.93	22.41
Net Benfits													
2004	929,032	962,106	664,193	457,355	659,148	837,822	816,438	0	897,748	735,888	1,012,099	904,625	735,888
2005	833,274	918,740	634,694	437,276	629,881	800,280	779,893	0	993,196	822,752	1,105,511	1,000,957	822,752
2006	749,841	876,930	606,212	417,867	601,622	764,065	744,635	0	1,072,395	892,983	1,182,335	1,078,951	892,983
2007	676,534	836,658	578,740	399,126	574,365	729,163	710,653	0	1,129,276	942,761	1,240,417	1,138,087	942,761
2008	611,481	797,902	552,268	381,048	548,099	695,557	677,930	0	1,076,303	898,882	1,279,071	1,174,867	971,764
2009	554,287	760,637	526,783	363,628	522,812	663,228	646,447	0	1,025,428	856,710	1,297,526	1,190,703	981,839
Rate[a]	-6.99	-3.77	-3.72	-3.69	-3.72	-3.75	-3.75		13.23	16.15	13.64	16.78	20.13

[a]Rate refers to the annual percentage rate of change between 2000 and 2009.
Source: Kirkley pers.comm.

Table 173. Threshold analysis of revenue impacts for participating vessels under the preferred quota and the preferred limited entry option (Option 6).

Preferred Quota Alternative and Limited Entry Option 6			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time:Tier 1	4	4	0	0	0	2	2	0	0	0	0
Full-Time:Tier 2	4	1	1	2[a]	0	1	0	0	0	0	0
Part-Time	42	0	6	33[b]	3	0	0	0	0	0	0
Incidental	200	5	174	0	21	1	2	1	0	0	1
Totals	250	10	181	35	24	4	4	1	0	0	1

[a]None of these vessels reported landings of tilefish in 1998.
[b]Sixteen vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 174. Threshold analysis of revenue impacts for participating vessels under the preferred quota and the most restrictive limited entry option (Option 1).

Preferred Quota Alternative and Limited Entry Option 1			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time	8	4	1	2[a]	1	3	1	0	0	0	0
Part-Time	10	0	3	5[b]	2	0	0	0	0	0	0
Incidental	204	6	177	0	21	1	2	1	0	0	2
Totals	222	10	181	7	24	4	3	1	0	0	2

[a]None of these vessels reported landings of tilefish in 1998.
[b]Four vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 175. Threshold analysis of revenue impacts for participating vessels under the preferred quota and the least restrictive limited entry option (Option 5).

Preferred Quota Alternative and Limited Entry Option 5			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time and Part-Time	104	4	29	68[a]	3	3	1	0	0	0	0
Incidental	180	6	153	0	21	1	2	1	0	0	2
Totals	284	10	182	68	24	4	3	1	0	0	2

[a]Twenty-five vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 176. Threshold analysis of revenue impacts for participating vessels under the most restrictive quota (Alternative 6) and the preferred limited entry option (Option 6).

Quota Alternative 6 and Limited Entry Option 6			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time:Tier 1	4	4	0	0	0	0	0	0	0	0	4
Full-Time:Tier 2	4	2	0	2[a]	0	0	0	1	0	0	1
Part-Time	42	4	0	33[b]	5	0	4	0	0	0	0
Incidental	200	11	0	0	189	1	3	1	0	0	6
Totals	250	21	0	35	194	1	7	2	0	0	11

[a]None of these vessels reported landings of tilefish in 1998.
[b]Sixteen vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 177. Threshold analysis of revenue impacts for participating vessels under the most restrictive quota and the most restrictive limited entry option (Option 1).

Quota Alternative 6 and Limited Entry Option 1			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time	8	6	0	2[a]	0	0	1	1	0	0	4
Part-Time	10	3	0	5[b]	2	0	3	0	0	0	0
Incidental	204	12	0	0	192	1	3	1	0	0	7
Totals	222	21	0	7	194	1	7	2	0	0	11

[a]None of these vessels reported landings of tilefish in 1998.
[b]Four vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 178. Threshold analysis of revenue impacts for participating vessels under the most restrictive quota and the least restrictive limited entry option (Option 5).

Quota Alternative 6 and Limited Entry Option 5			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time and Part-Time	104	10	0	68[a]	26	0	4	2	0	0	4
Incidental	180	11	0	0	169	1	3	0	0	0	7
Totals	284	21	0	68	195	1	7	2	0	0	11

[a]Twenty-five vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 179. Threshold analysis of revenue impacts for participating vessels under the least restrictive quota (Status Quo) and the preferred limited entry option (Option 6).

Status Quo Quota Alternative and Limited Entry Option 6			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time:Tier 1	4	0	4	0	0	0	0	0	0	0	0
Full-Time:Tier 2	4	0	2	2[a]	0	0	0	0	0	0	0
Part-Time	42	0	7	33[b]	2	0	0	0	0	0	0
Incidental	200	1	187	0	12	0	0	0	0	0	1
Totals	250	1	200	18	14	0	0	0	0	0	1

[a]None of these vessels reported landings of tilefish in 1998.
[b]Sixteen vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 180. Threshold analysis of revenue impacts for participating vessels under the least restrictive quota (Status Quo) and the most restrictive limited entry option (Option 1).

Status Quo Quota Alternative and Limited Entry Option 1			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time	8	0	6	2[a]	0	0	0	0	0	0	0
Part-Time	10	0	3	5[b]	2	0	0	0	0	0	0
Incidental	204	2	190	0	12	0	0	0	0	0	2
Totals	222	2	199	7	14	0	0	0	0	0	2

[a]None of these vessels reported landings of tilefish in 1998.
[b]Four vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 181. Threshold analysis of revenue impacts for participating vessels under the least restrictive quota (Status Quo) and the least restrictive limited entry option (Option 5).

Status Quo Quota Alternative and Limited Entry Option 5			Increased Revenue (number)	No Change in Revenue (number)	Number of Impacted Vessels by Reduction Percentile (%)						
Vessel Type	Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction			<5	5-9	10-19	20-29	30-39	40-49	50
Full-Time and Part-Time	104	0	34	68[a]	2	0	0	0	0	0	0
Incidental	180	2	166	0	12	0	0	0	0	0	2
Totals	284	2	200	68	14	0	0	0	0	0	2

[a]Twenty-five vessels did not report landings of tilefish in 1998 and the remainder did not report landings of any species in 1998.

Table 182. Tilefish vessels qualification status, primary port of landings and owner's home country based on 1998 NEFSC data.

By Port of Landing					ST	County	By Owner's Home					
F1	F2	PT	NQ	Total			F1	F2	PT	NQ	Total	
				0	CT	New London				1	1	2
				0	DE	Sussex				3	3	
				0	FL	Okaloosa				1	1	
		1		1	MA	Barnstable					0	
			9	9	MA	Bristol				12	12	
			4	4	MA	Essex				4	4	
				0	MA	Nantucket				1	1	
				0	MA	Norfolk			1		1	
				0	MA	Plymouth				1	1	
				0	MD	Dorchester				1	1	
			2	2	MD	Worcester				2	2	
				0	ME	Androscoggin				1	1	
		3	12	15	ME	Cumberland			3	9	12	
				0	ME	Knox			2		2	
				0	ME	York		1		2	3	
				0	NC	Beaufort				1	1	
			1	1	NC	Carteret				1	1	
				0	NC	Currituck				1	1	
			26	26	NC	Dare				18	18	
			1	1	NC	Hyde				5	5	
				0	NC	Pamlico				1	1	
				0	NC	Tyrrell				1	1	
				0	NJ	Bergen				1	1	
		3	7	10	NJ	Cape May			3	10	13	
				0	NJ	Essex				1	1	
		1	4	5	NJ	Monmouth				6	6	
	4	21	7	32	NJ	Ocean		2	20	5	27	
				0	NY	Kings			1	1	2	
			3	3	NY	Nassau				7	7	
				0	NY	New York				1	1	
4		2	48	54	NY	Suffolk	4		1	41	46	
				0	RI	Kent				1	1	
		3	18	21	RI	Newport			2	7	9	
				0	RI	Providence				1	1	
		8	52	60	RI	Washington			6	48	54	
			1	1	VA	Accomack					0	
				0	VA	Chesterfield		1			1	
			3	3	VA	City of Hampton				3	3	
			1	1	VA	City of Newport News						0
				0	VA	City of Norfolk					0	
			1	1	VA	City of Virginia Beach				1	1	
				0	VA	Isle of Wight					1	1
				0	WA	Clallam			1		1	
				0	NK	Unknown			1		1	

F1 = full-time, tier 1; F2 = full-time, tier 2; PT = part-time; NQ = non qualifying vessel for limited entry category.

Source: Clay pers. comm. 22 November 2000

Table 183. Level of dependence of the 83 seafood dealers who landed tilefish in 1998.

Percentage Level of Dependence	Number of Dealers	Absolute Level of Dependence	Number of Dealers
0-5%	73	$0-100	13
6-10%	3	$101-1,000	26
16-20%	2	$1,001-10,000	23
21-25%	1	$10,001-50,000	14
26-30%	1	$100,001-500,000	5
36-40%	1	$500,001-1,000,000	1
41-50%	1	$1,000,001-5,000,000	1
TOTAL	83		83

Source: Clay per. comm.

Table 184. Counties and their level of dependence on tilefish based on 1998 data.

State	County	Number of Federal Tilefish Dealers	Percentage Dependence on Tilefish of These Dealers as a Group	Absolute Dependence on Tilefish of These Dealers as a Group
Maine	Cumberland			
Maryland	Bristol	8	0-5%	$1-1,000
Massachusetts	Worcester	1		
New Jersey	Cape May	4	0-5%	$1-1,000
	Ocean	3	0-5%	$1,001-500,000
	Monmouth	1		
New York	Nassau	1		
	Suffolk	18	0-5%	$1-50,000
North Carolina	Carteret	3	0-5%	$1-10,000
	Dare	7	0-5%	$101-50,000
	Hyde	1		
Rhode Island	Newport	4	0-5%	$1-50,000
	Washington	25	0-10%	$1-5,000,000
Virginia	Accomac	1		
	Newport News	1		
	Virginia Beach	1		

Source: Clay pers.comm.

Table 185. Port dependence of seafood dealers handling tilefish based on 1998 data.

State	Port	Number of Federal Tilefish Dealers	Percentage of Dependence on Tilefish of These Dealers	Absolute Dependence on Tilefish of These Dealers
Maine	Portland	2		
Maryland	Ocean City	1		
Massachusetts	New Bedford	8	0-5%	$1,-1,000
New Jersey	Belford	1		
	Cape May	4	0-5%	$1-1,000
	Long Beach/Barnegat Light	2		
	Point Pleasant	1		
New York	Montauk	6	0-35%	$1,001-50,000
	Hampton Bay	10	0-10%	$1-50,000
	Greenport	1		
	Mattituck	1		
	Freeport	1		
North Carolina	Beaufort	1		
	Morehead City	2		
	Wanchese	1		
	Other Dare	2		
	Englehard	1		
Rhode Island	Newport	3	0-5%	$1-50,000
	Tiverton	1		
	Point Judith	25	0-100%	$1-5,000,000
Virginia	Chincoteague	1		
	Hampton	2		
	Newport News	1		
	Virginia Beach	1		

Source: Clay pers. comm.

Table 186. Distribution of crew members by country.

State	County	Number of Crew
Maine	Cumberland	15
Massachusetts	Barnstable	6
	Bristol	9
	Essex	4
Maryland	Worcester	2
New Jersey	Cape May	8
	Monmouth	4
	Ocean	27 (with 4 vessel missing crew data)
New York	Nassau	3
	Suffolk	53 (with 1 vessel missing crew data)
North Carolina	Carteret	4
	Dare	26
	Hyde	4
Rhode Island	Newport	20 (with 1 vessel missing crew data)
	Washington	60
Virginia	Accomac	4
	City of Hampton	3
	City of Newport News	1
	City of Virginia Beach	1

Source: Clay pers. comm.

Table 187. Distribution of crew members by port.

State	Port of Landing	Number of Crew
Maine	Portland	15
Massachusetts	Gloucester	4
	New Bedford	9
	Other Barnstable	1
New Jersey	Belford	4
	Cape May	7
	Other Cape May	2 (with 1 vessel missing crew data)
	Other Monmouth	1
	Other Ocean	3 (with 1 vessel missing crew data)
	Point Pleasant	6 (with 1 vessel missing crew data)
	Long Beach/Barnegat Light	18 (with 3 vessels missing crew data)
New York	Freeport	3
	Greenport	9
	Hampton Bay	23
	Mattituck	1
	Montauk	20 (with 1 vessel missing crew data)
North Carolina	Avon	2
	Beaufort	1
	Engelhard	1
	Wanchese	20
	Other Dare	4
Rhode Island	Newport	20 (with 1 vessel missing crew data)
	Point Judith	60
Virginia	Chincoteague	1
	Hampton	3
	Newport News	1
	Virginia Beach	1

Source: Clay pers. comm.

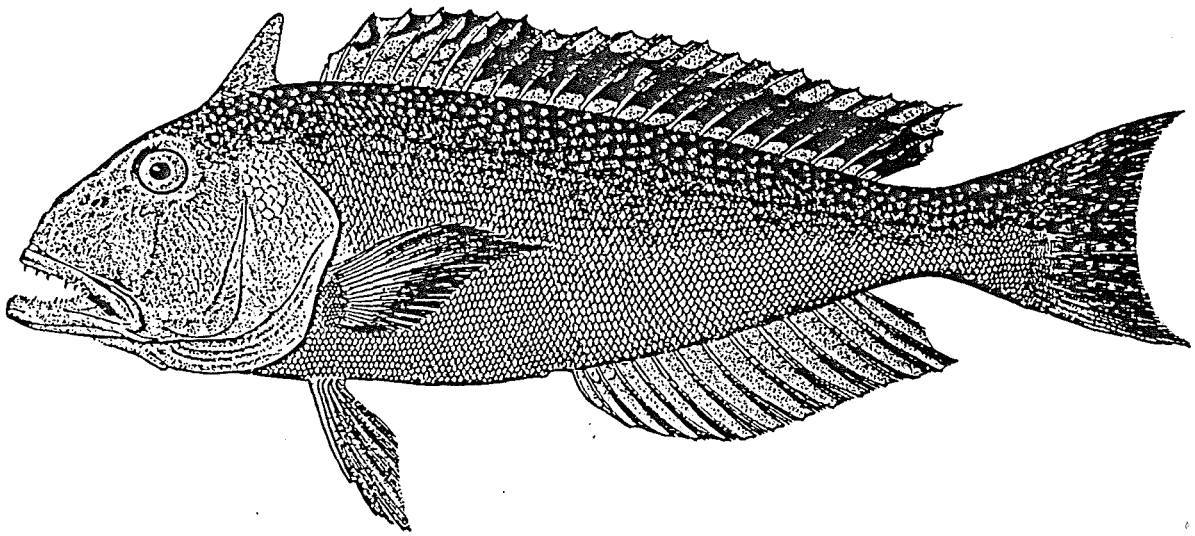

Figure 1. The tilefish, *Lopholatilus chamaeleonticeps*.

Source: Goode 1884.

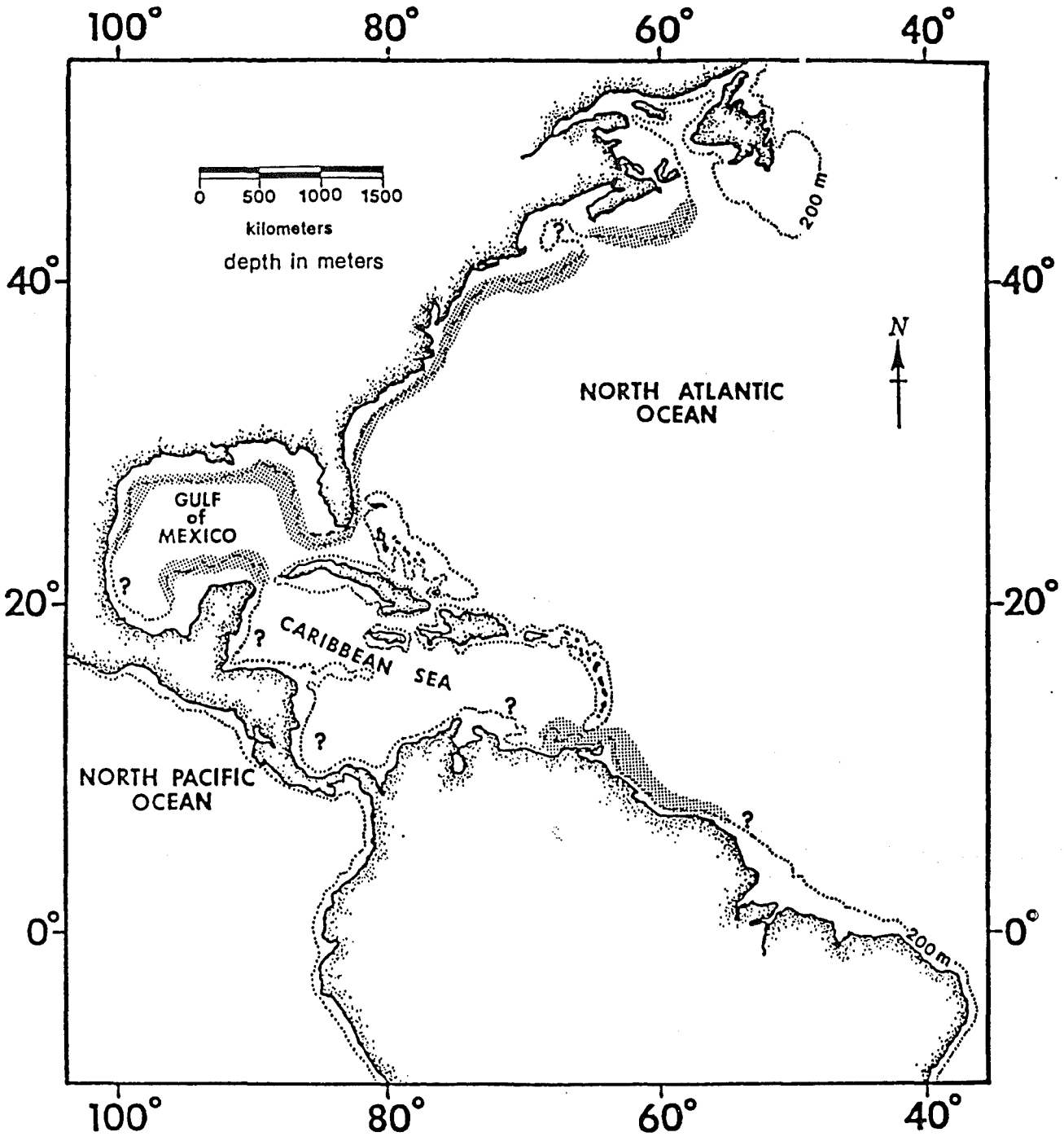

Figure 2. The distribution of tilefish (*Lopholatilus chamaeleonticeps*) as derived from captures.

Source: Freeman and Turner 1977.

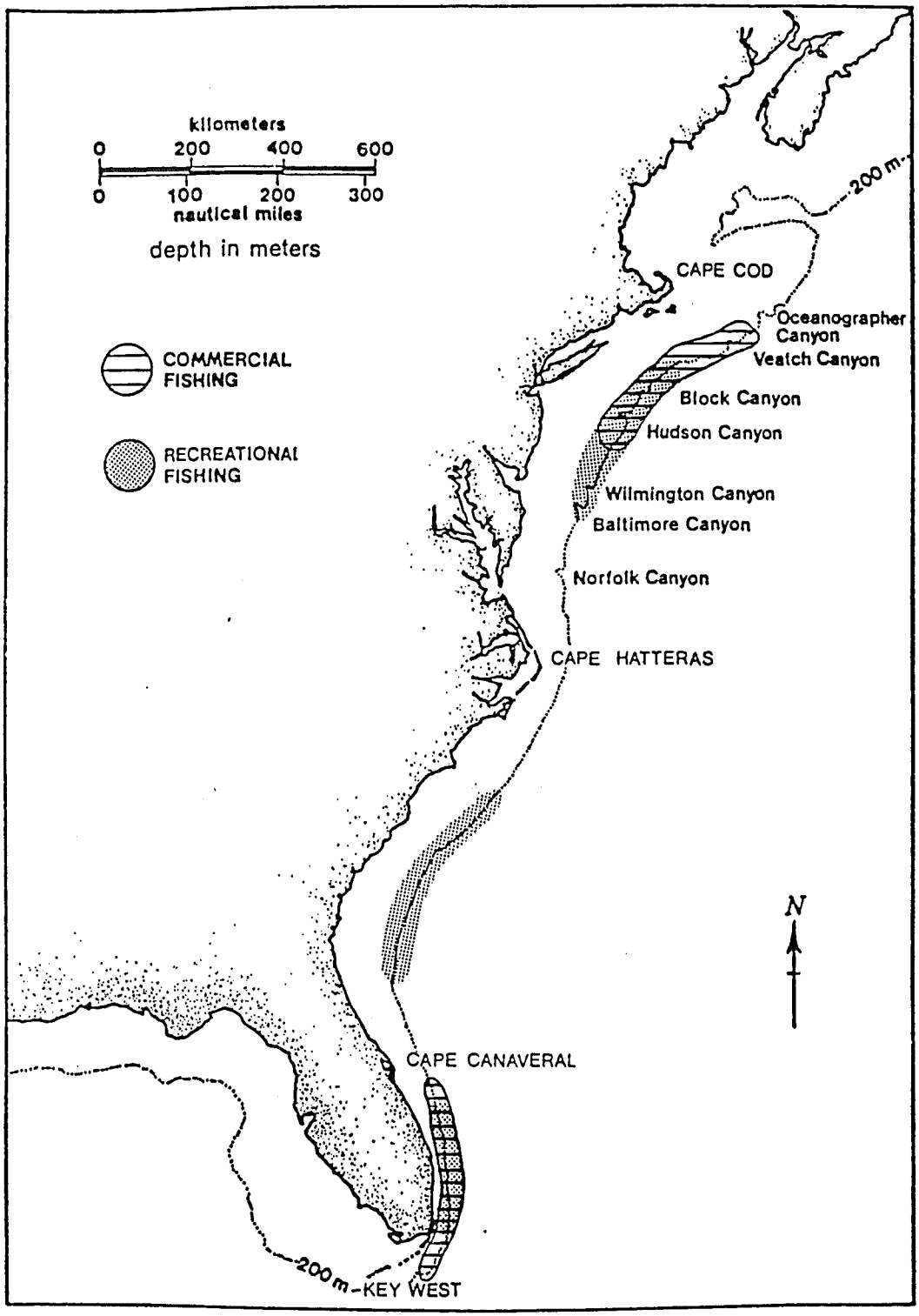

Figure 3. Fishing areas for tilefish (*Lopholatilus chamaeleonticeps*) along the east coast of the United States.

Source: Freeman and Turner 1977.

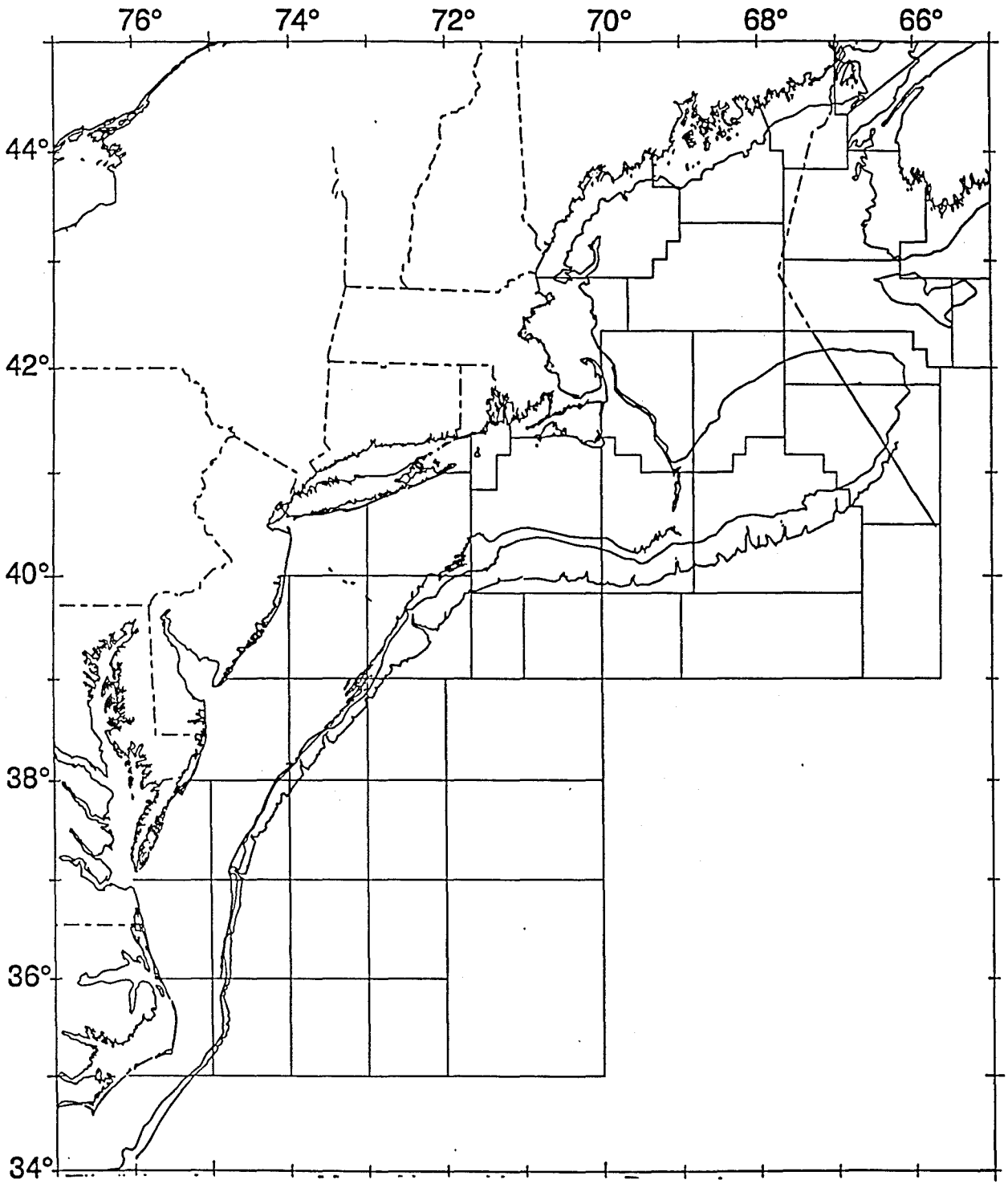

Figure 4. Essential Fish Habitat. Inner most bathymetric contour in roughly 250 feet (40 fathoms), middle contour is roughly 600 feet (200 meters) and outer contour is roughly 1200 feet (200 fathoms). EFH is identified as benthic waters and substrate between 250 and 1200 feet isobaths, from the U.S./Canadian boundary to the Virginia/North Carolina boundary.

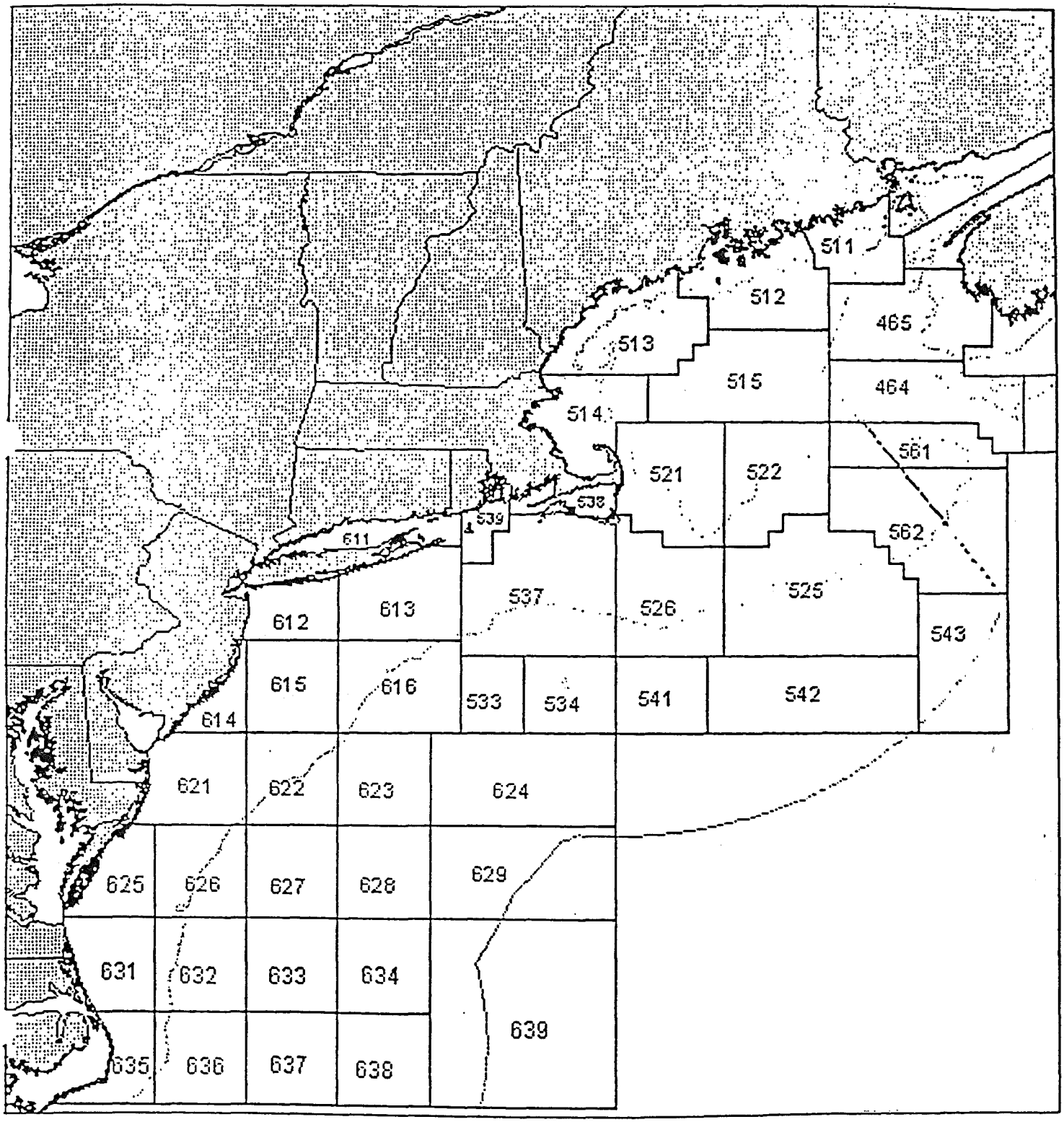

Figure 5. Northeast region statistical areas.

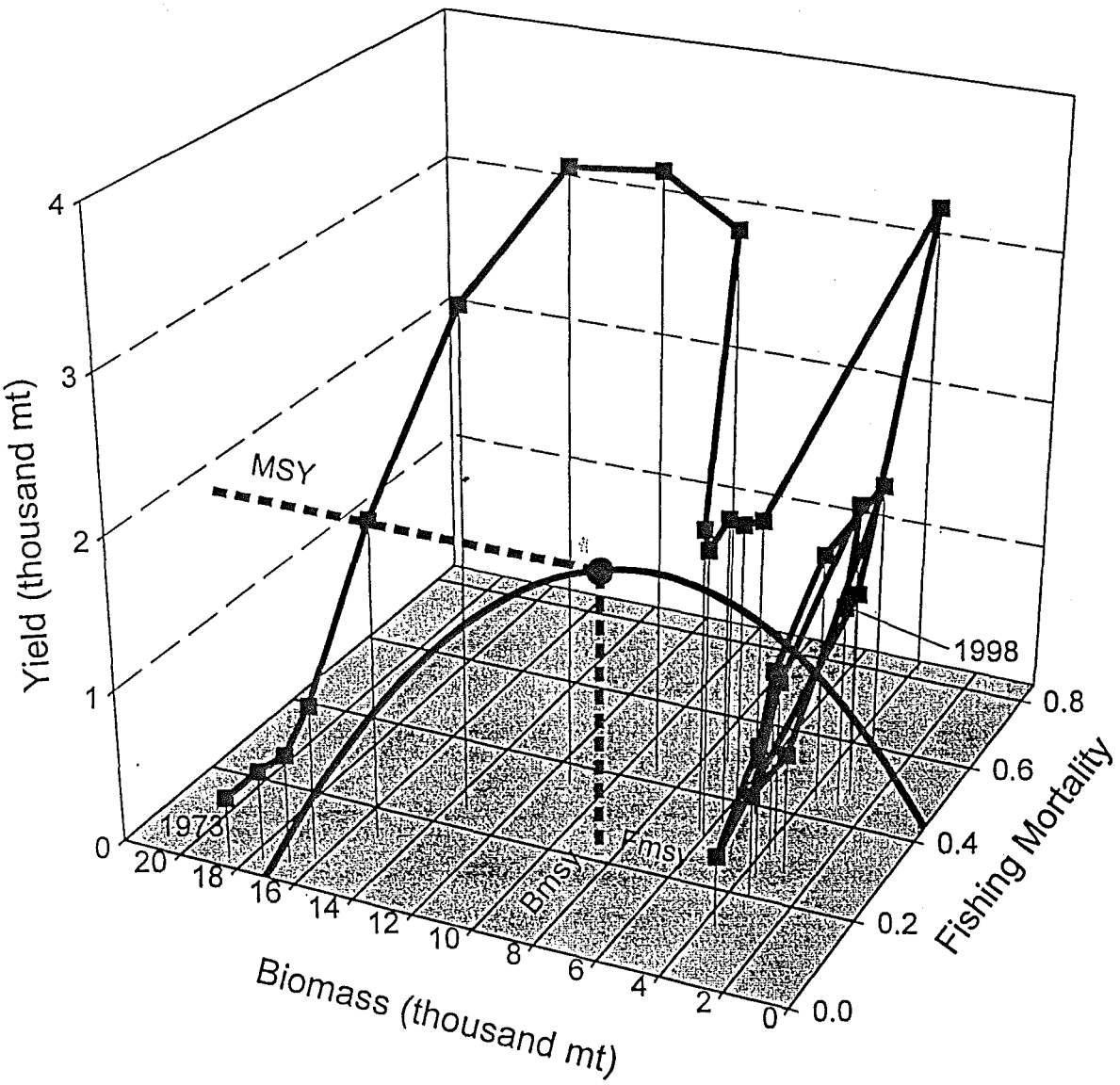

Figure 6. Biomass dynamics of tilefish from the DA2 ASPIC analyses, 1973-1998.

Source: Nitschke pers. comm.

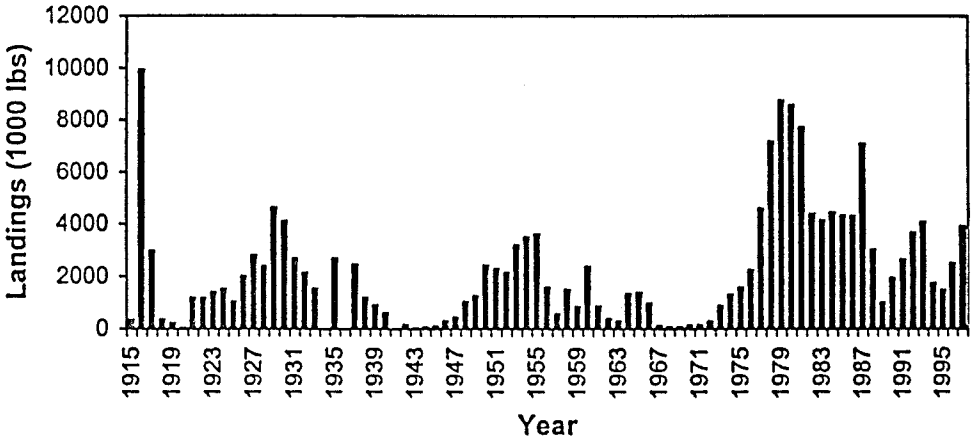

Figure 7. Commercial landings of tilefish from Main to Virginia, 1915-1997.

Source: Freeman and Turner 1977; State and Federal reported landings.

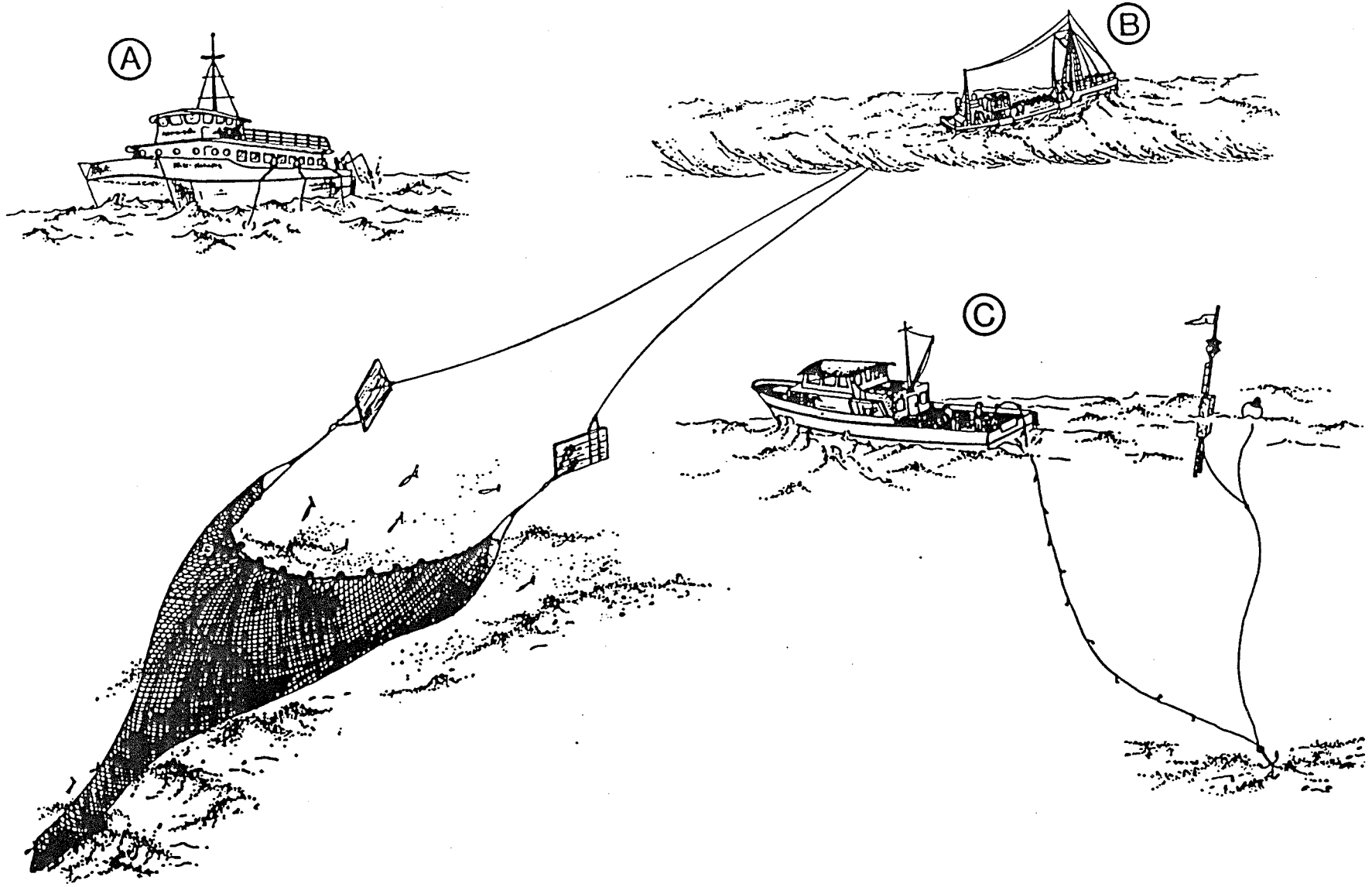

Figure 8. Various types of fishing gear used to capture tilefish, *Lopholatilus chamaeleonticeps*, A. recreational fishermen using a rod and reel, B. commercial fishermen using an otter trawl, and C. commercial fishermen using a longline.

Source: Freeman and Turner 1977.

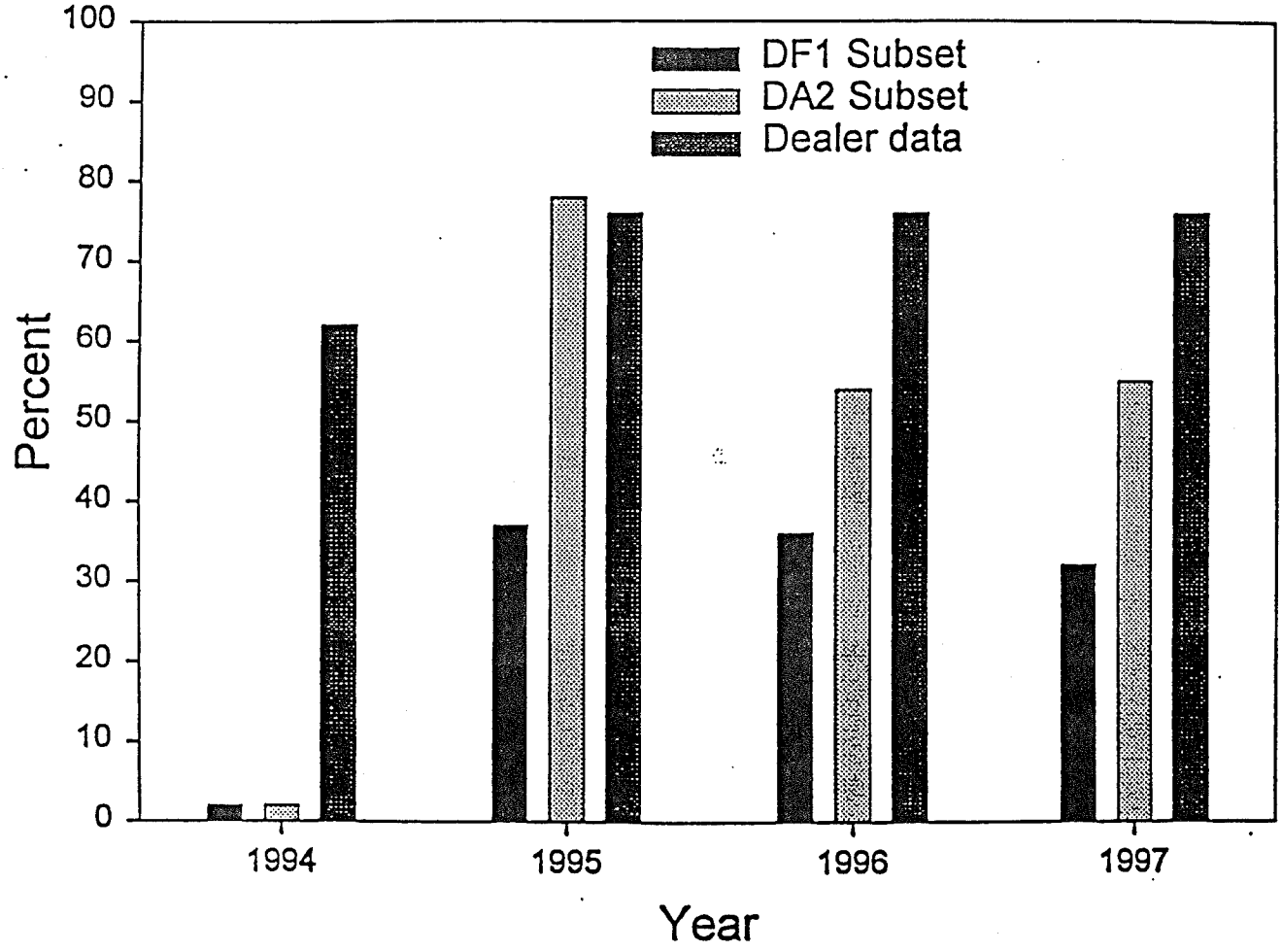

Figure 9. Percent of annual commercial landings of tilefish from MA-SNE region accounted for by six vessels in the VTR and Dealer databases, 1994-1997. DF1 (days fished CPUE) and DA2 (days absent CPUE) subsets were calculated from the VTR system.

Source: Nitschke *et al.* 1999.

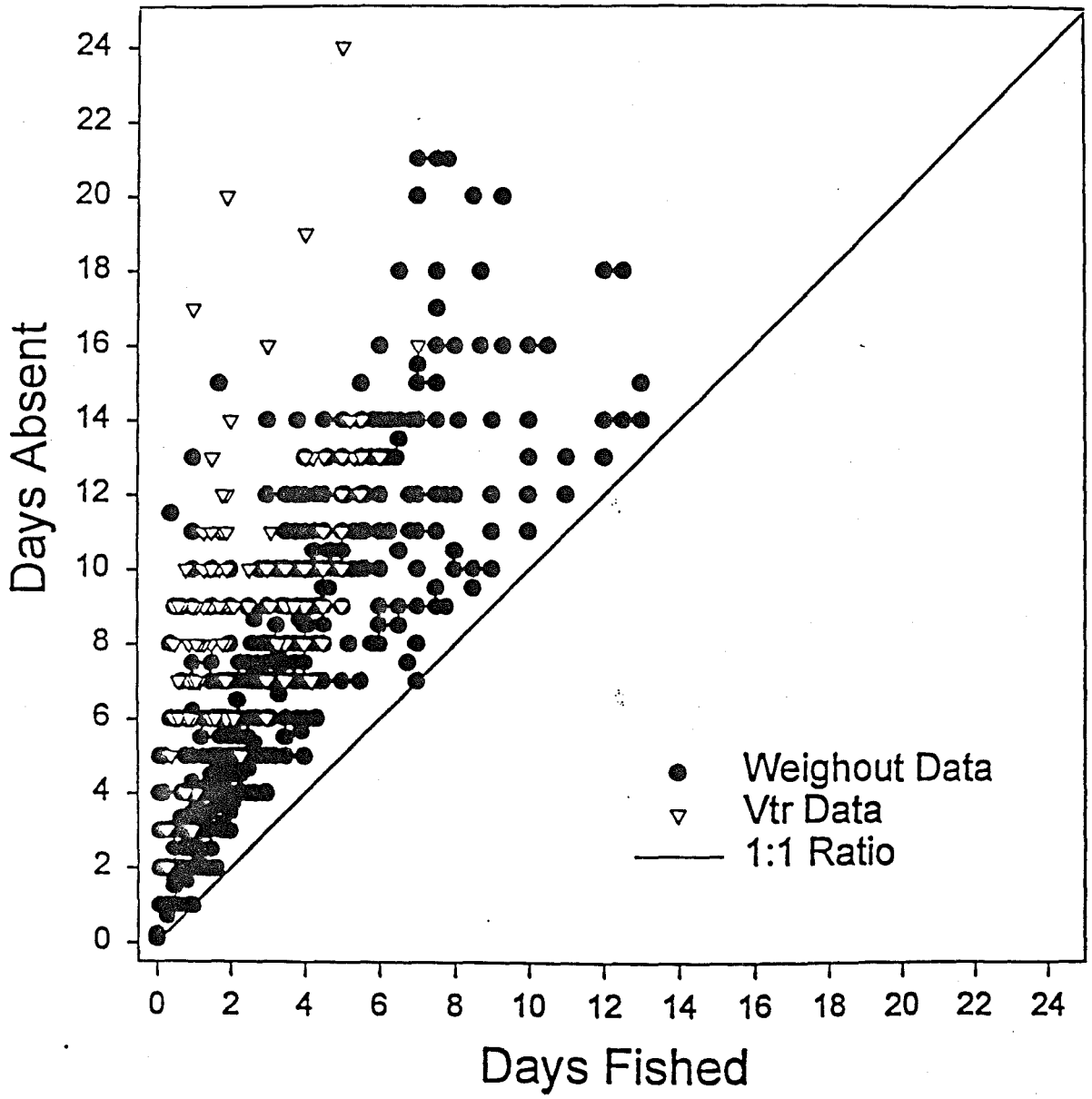

Figure 10. Ratio of days fished to days absent for tilefish in the Weighout and VTR systems.

Source: Nitschke *et al.* 1999.

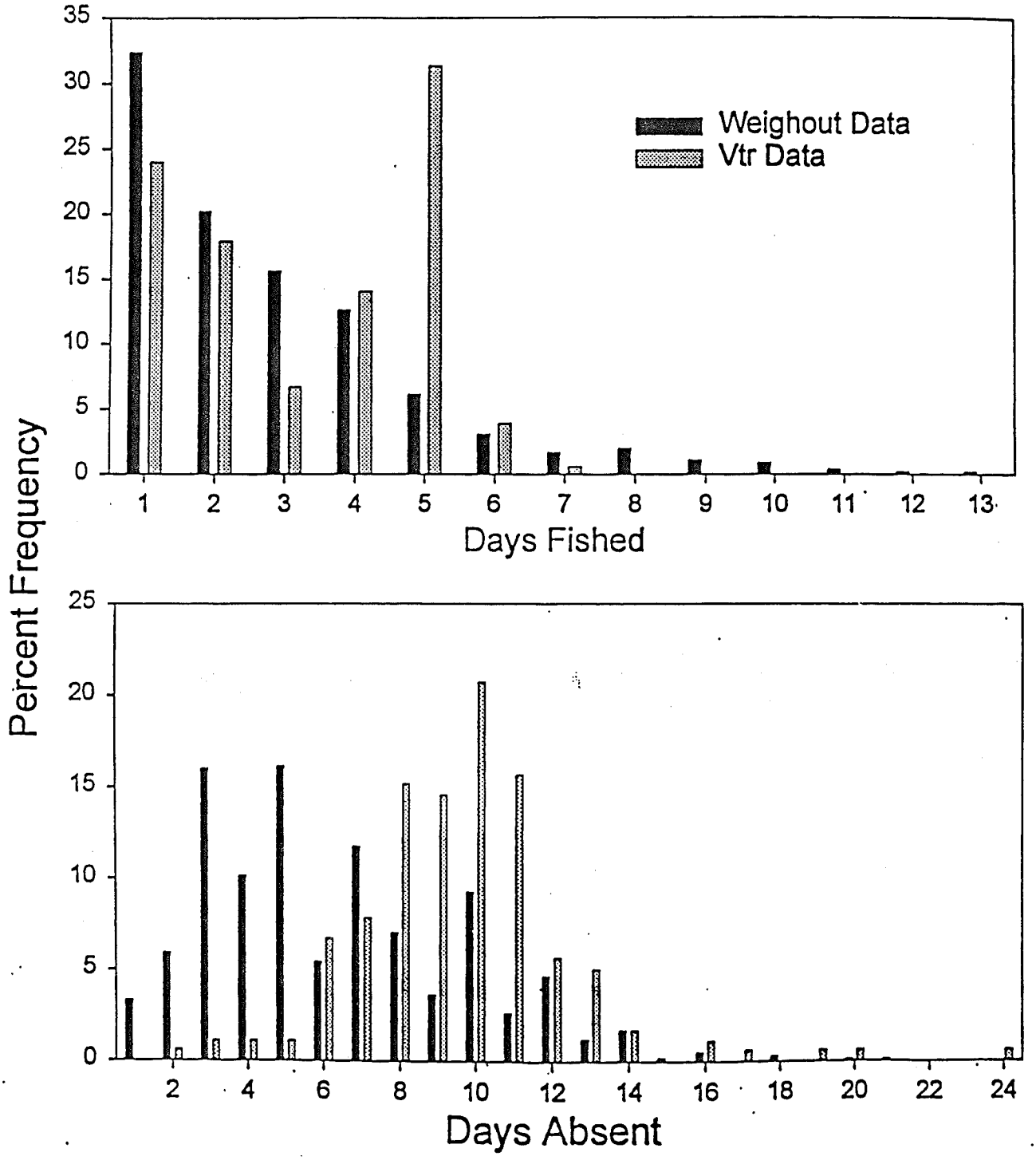

Figure 11. Percent frequency of days fished and days absent per trip for tilefish in the Weighout and VTR systems.

Source: Nitschke *et al.* 1999.

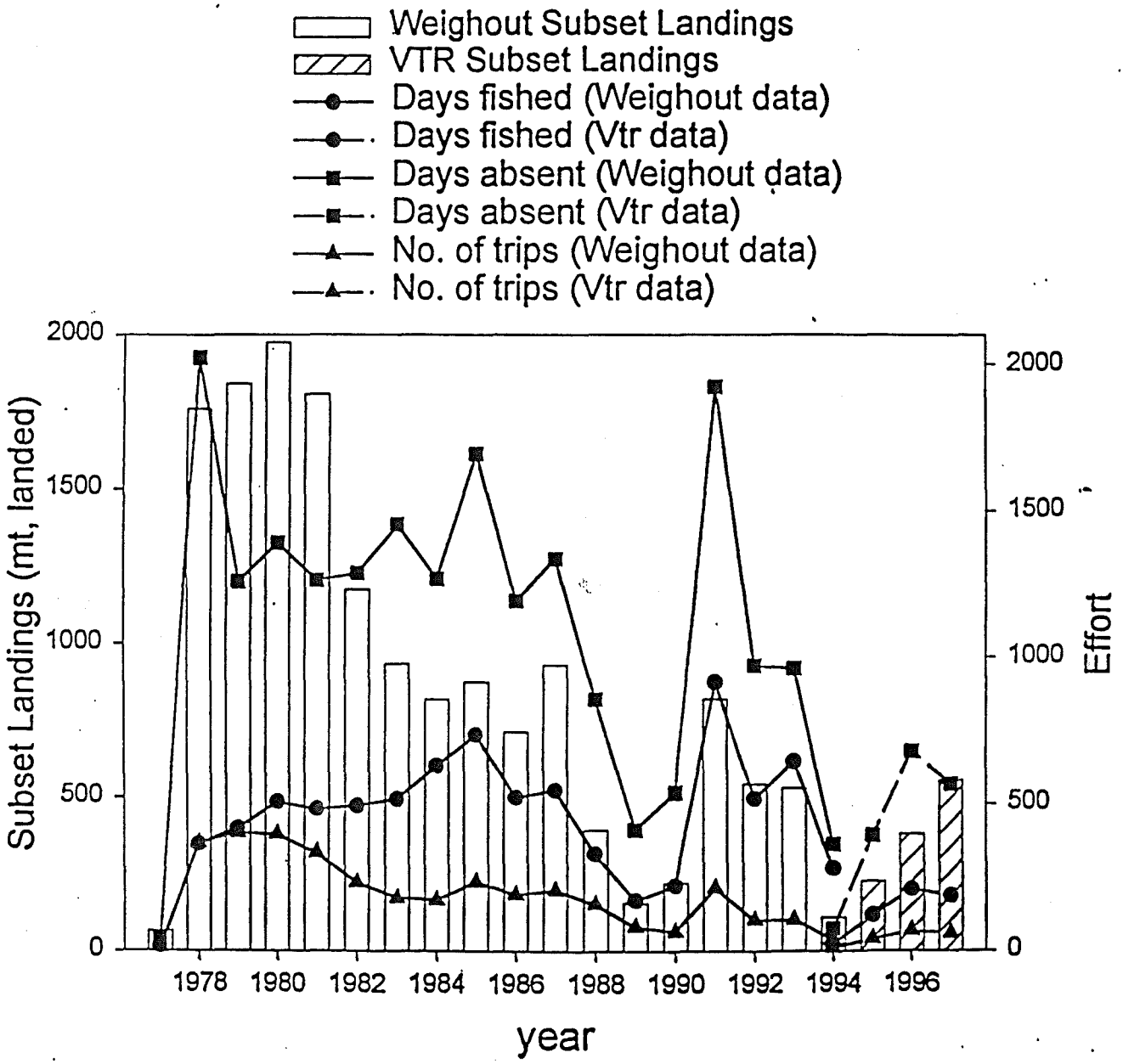

Figure 12. Data used from the Weighout and VTR systems to calculate days fished, days absent, and trip CPUE for tilefish. Data were limited to restrictions of the DF1 subset.

Source: Nitschke *et al.* 1999.

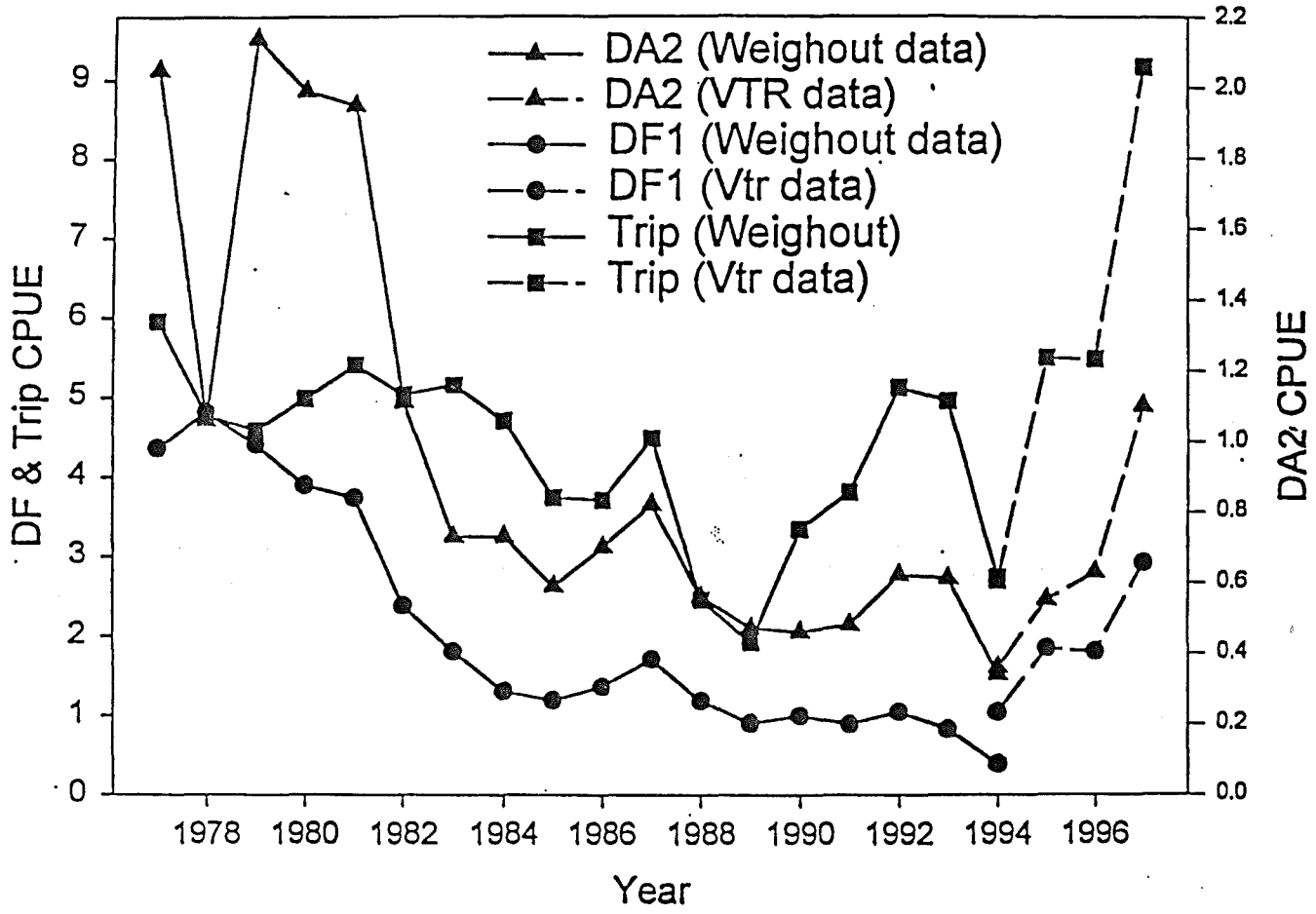

Figure 13. CPUE trends for tilefish calculated from the Weighout and VTR systems. Nominal DF1 and trip CPUE data were limited to restrictions of the DF1 subset. Nominal DA2 CPUE data were limited to restrictions of the DA2 subset.

Source: Nitschke *et al.* 1999.

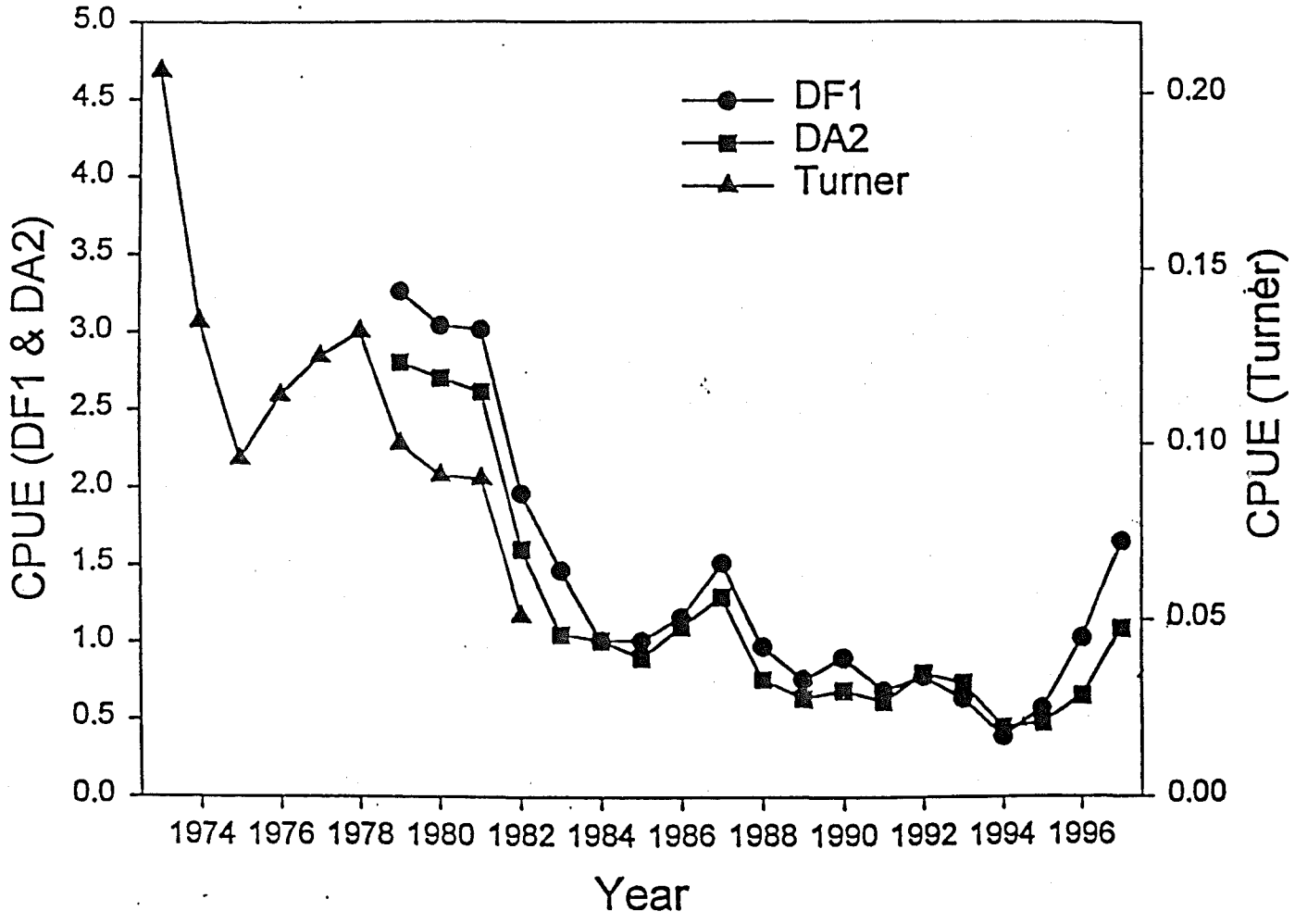

Figure 14. GLM standardized CPUE series and Turner's (1986) CPUE series.

Source: Nitschke *et al.* 1999.

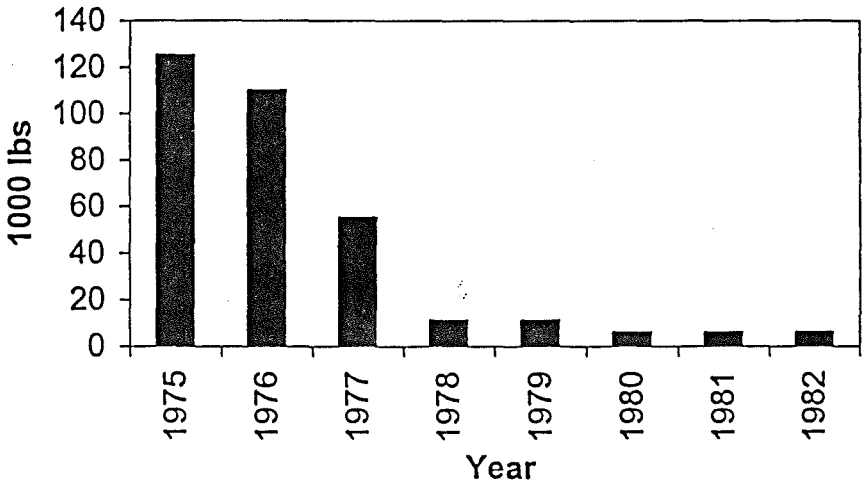

Figure 15. Estimated recreational landings of tilefish from 1975-1982.

Source: Turner 1986.

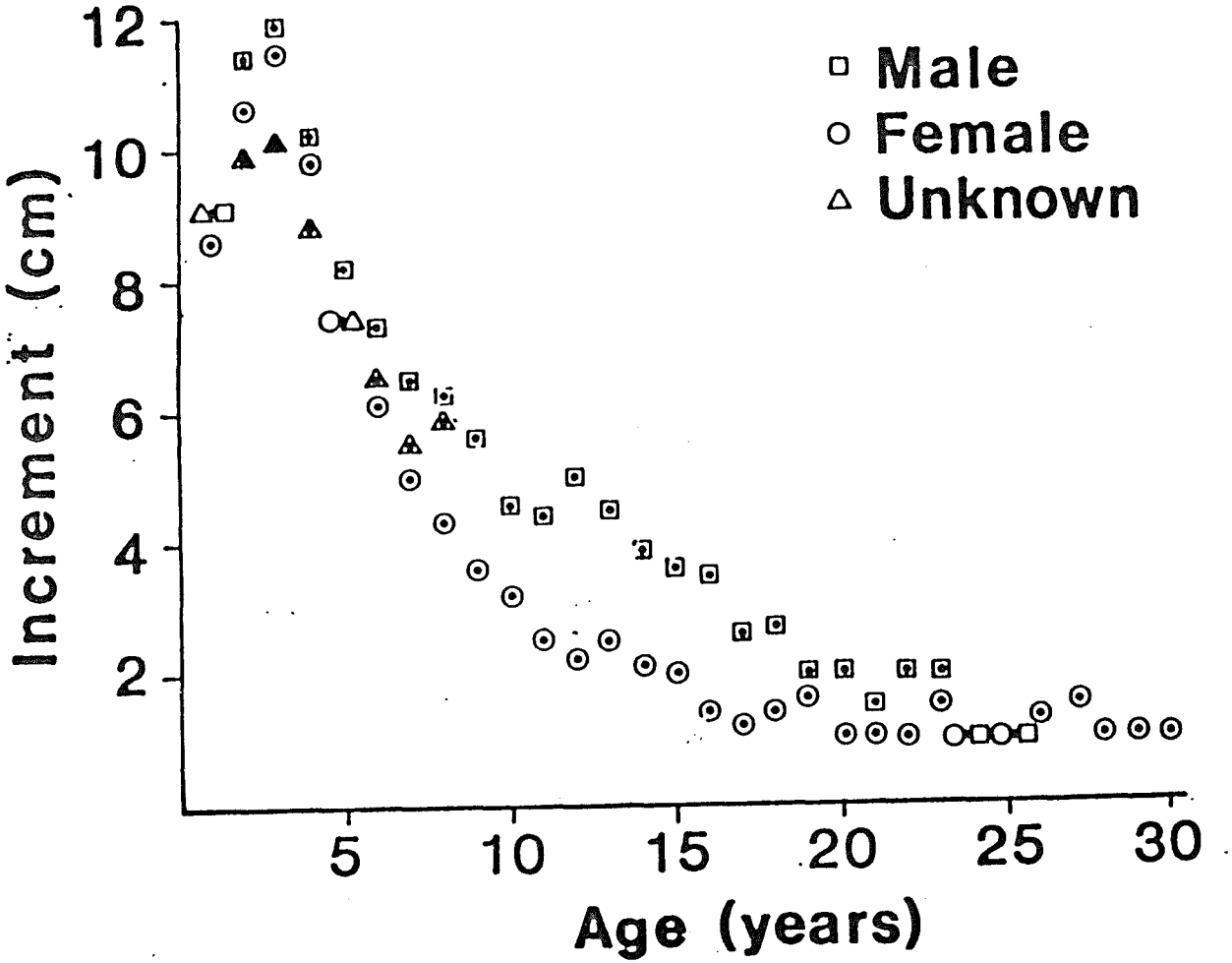

Figure 16. Annual growth increment by age for males, females, and tilefish of unknown sex sampled in 1978. Data for the first year may be inaccurate, because the back-calculation formula was fit to tilefish that were nearly two years old. The mean of each increment is shown by the point (.) either in the center or to the side of each symbol.

Source: Turner 1986.

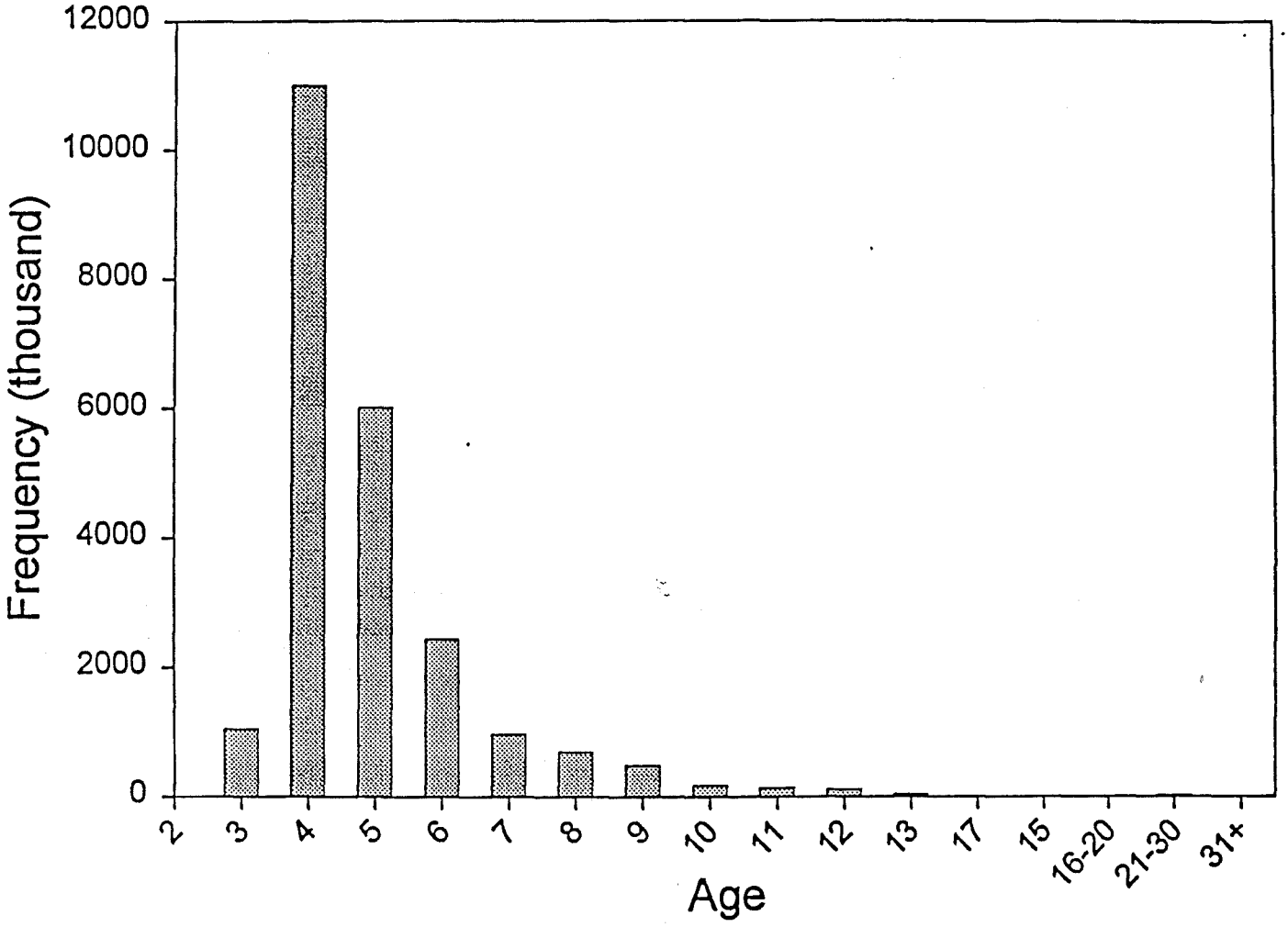

Figure 17. Commercial tilefish age-frequency distribution for 1996 and 1997 calculated from the expanded length-frequency using Turner's (1986) age-length key.

Source: Nitschke *et al.* 1999.

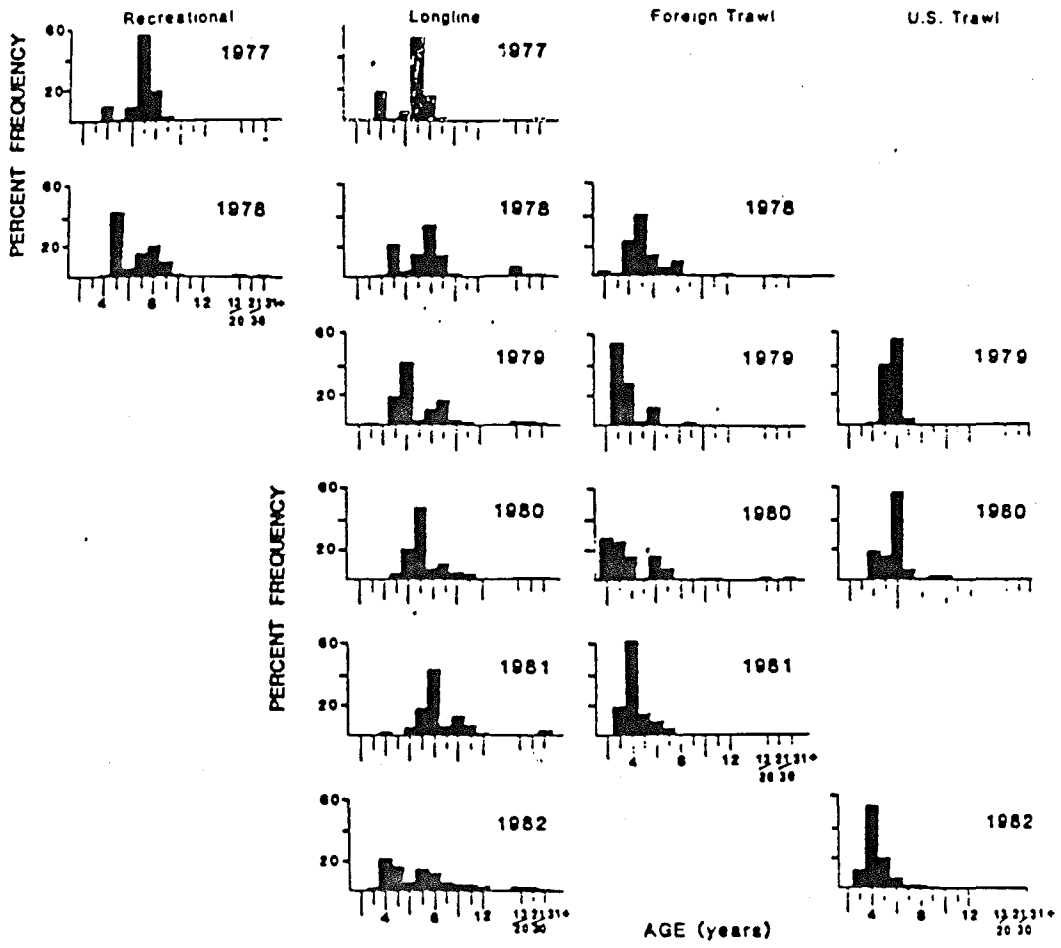

Figure 18. Age structure of tilefish caught throughout the Middle Atlantic-Southern New England region by the recreational, longline, foreign trawl, and domestic trawl fisheries in 1977-1982.

Source: Turner 1986.

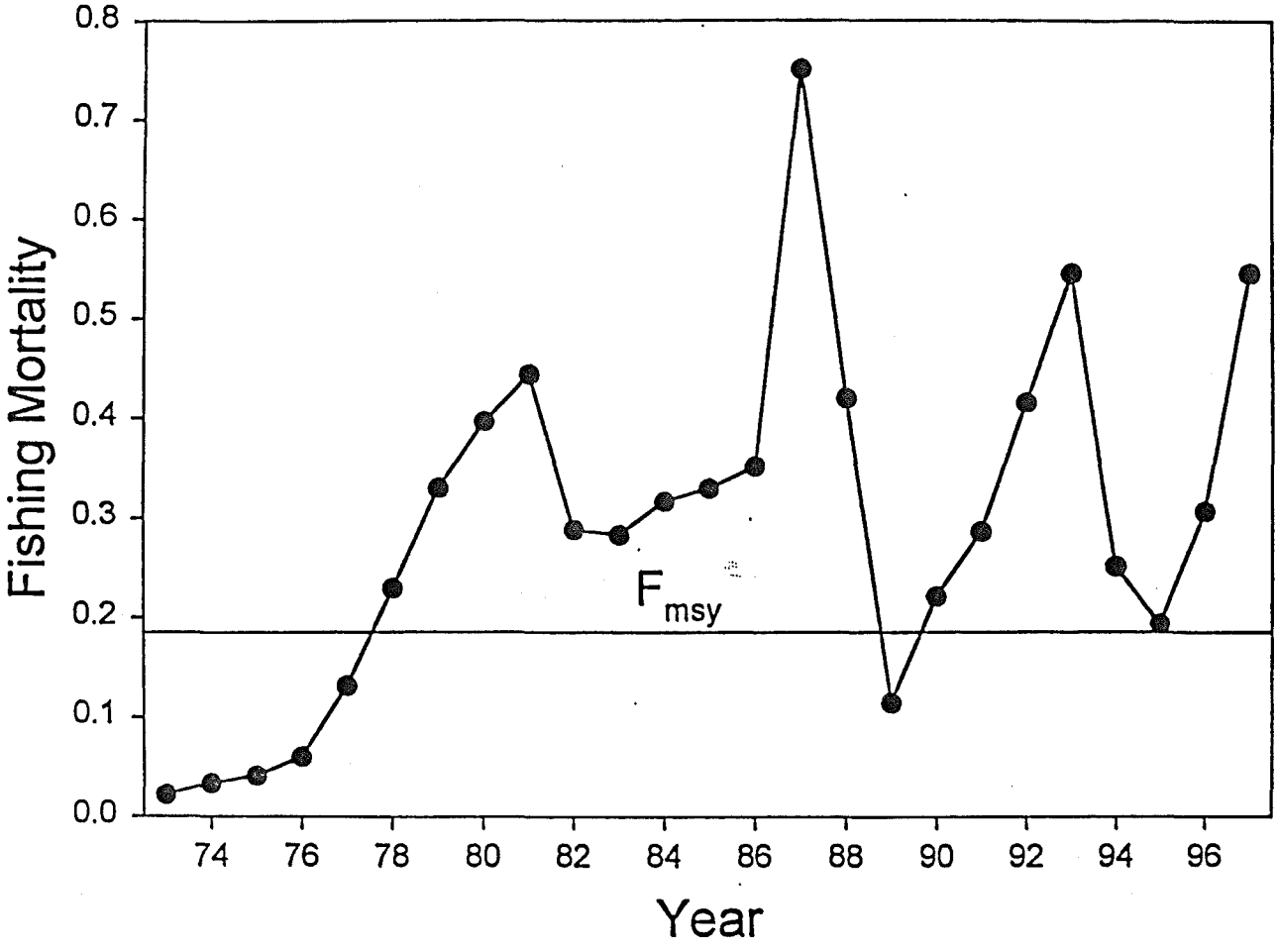

Figure 19. Fishing mortality rate (biomass weighted) for tilefish from the surplus production analysis, 1973-1997.

Source: Nitshcke *et al.* 1999.

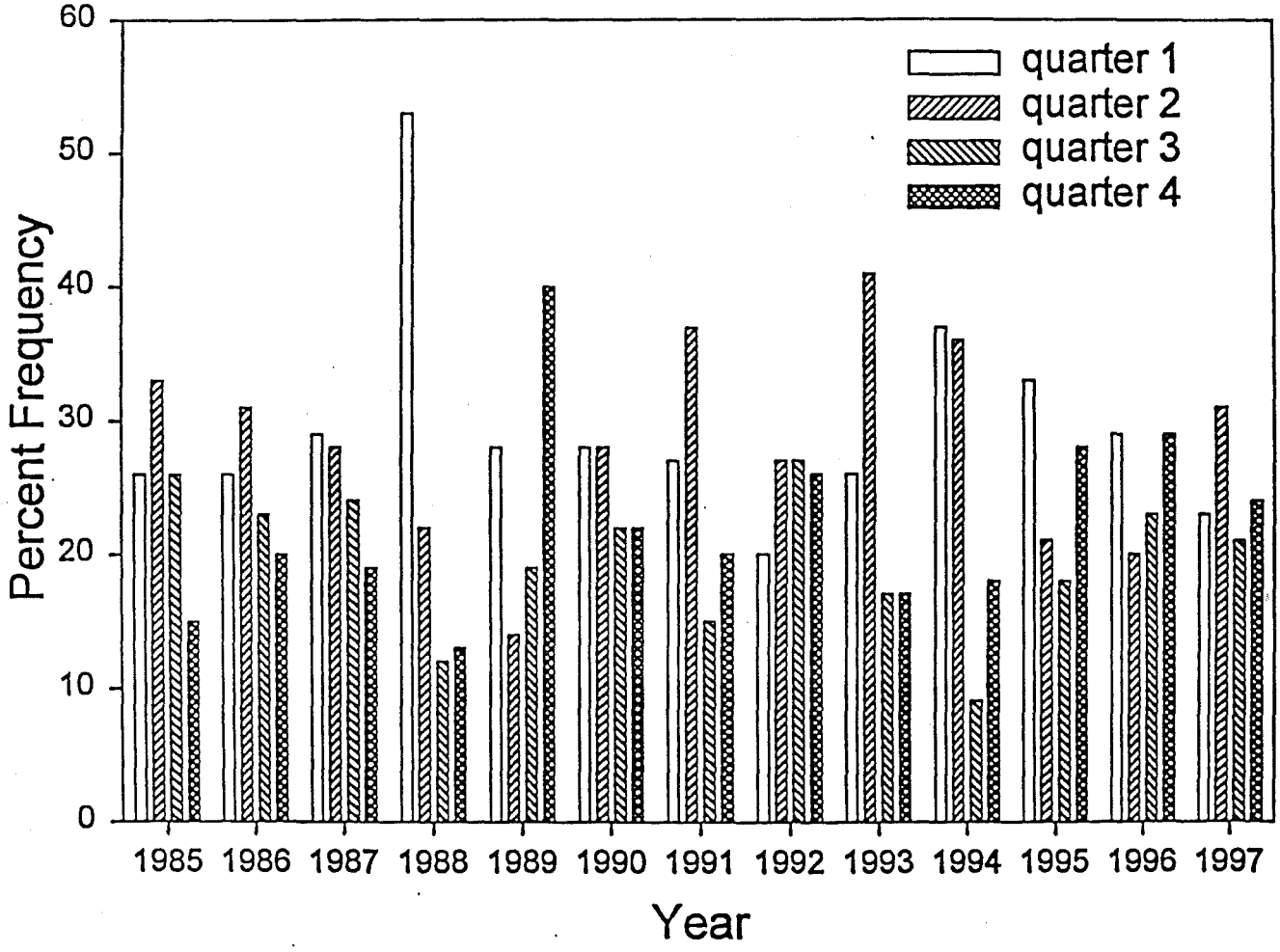

Figure 20. Percentages of tilefish longline landings by quarter.

Source: Nitschke *et al.* 1999.

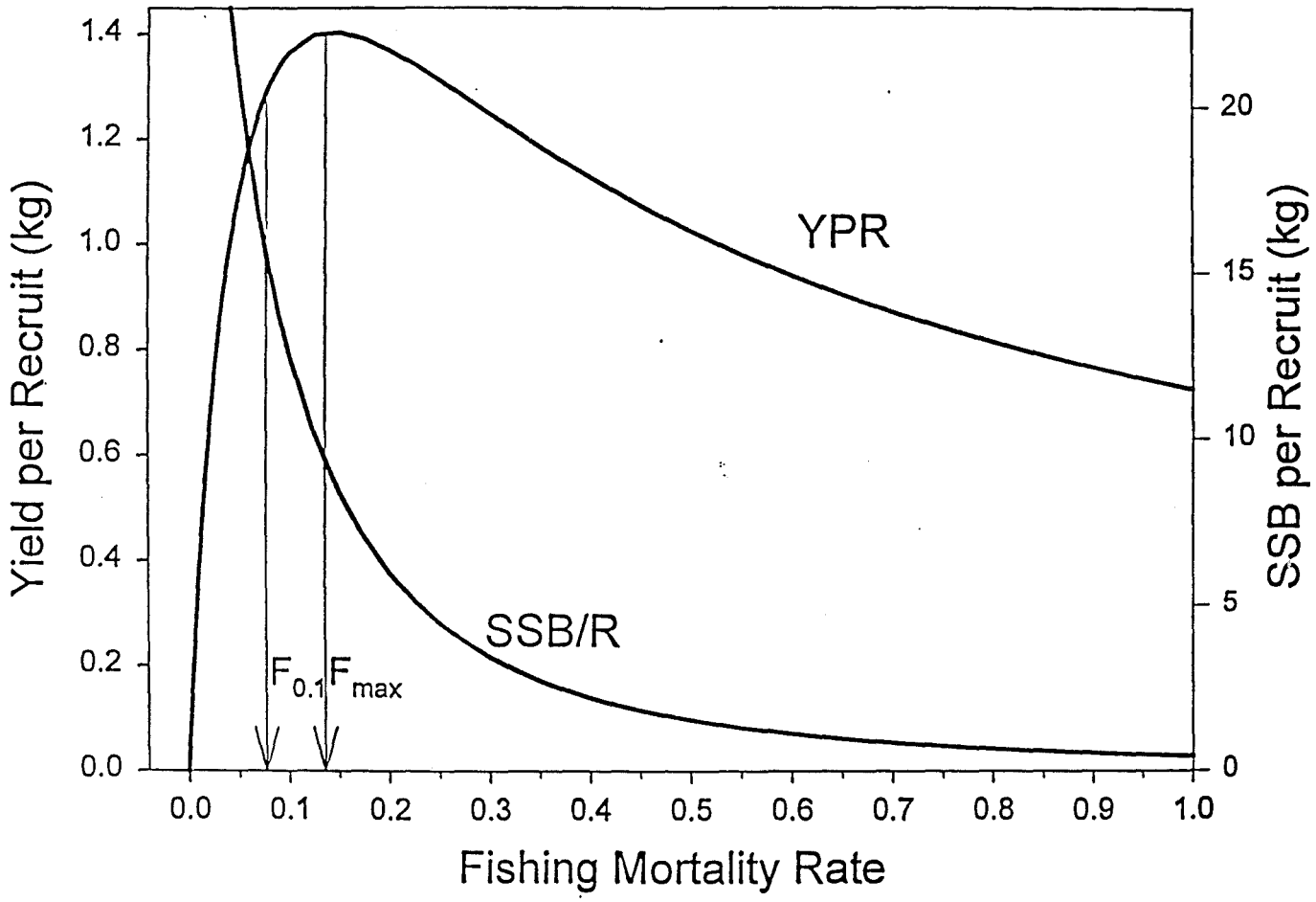

Figure 21. Yield and spawning stock biomass per recruit estimates for tilefish.

Source: Nitschke *et al.* 1999.

TILEFISH
FOOD HABITS
PERCENT MEAN PERCENT GROUP PREY WEIGHTS
1973-1980 NMFS TRAWL DATA

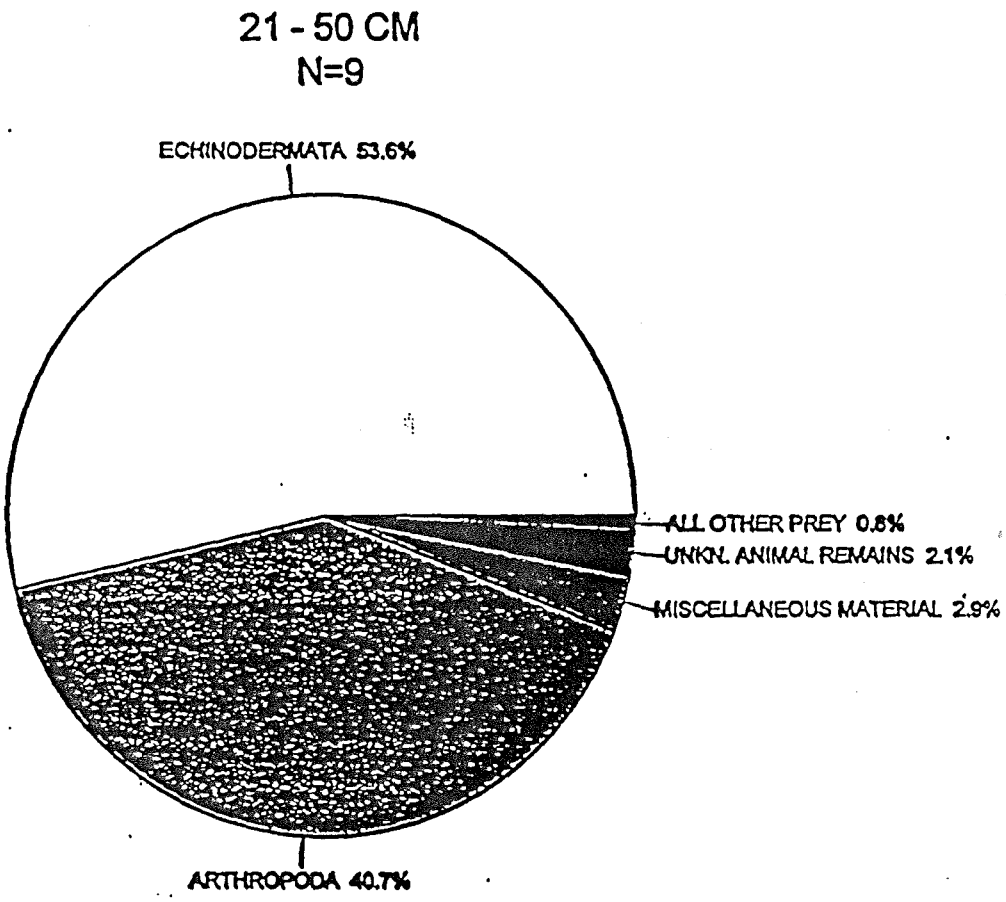

Figure 22. Tilefish food habits, percent mean percent group prey weights, 1973 -1980 NMFS trawl data.

Source: Steimle *et al.* 1998.

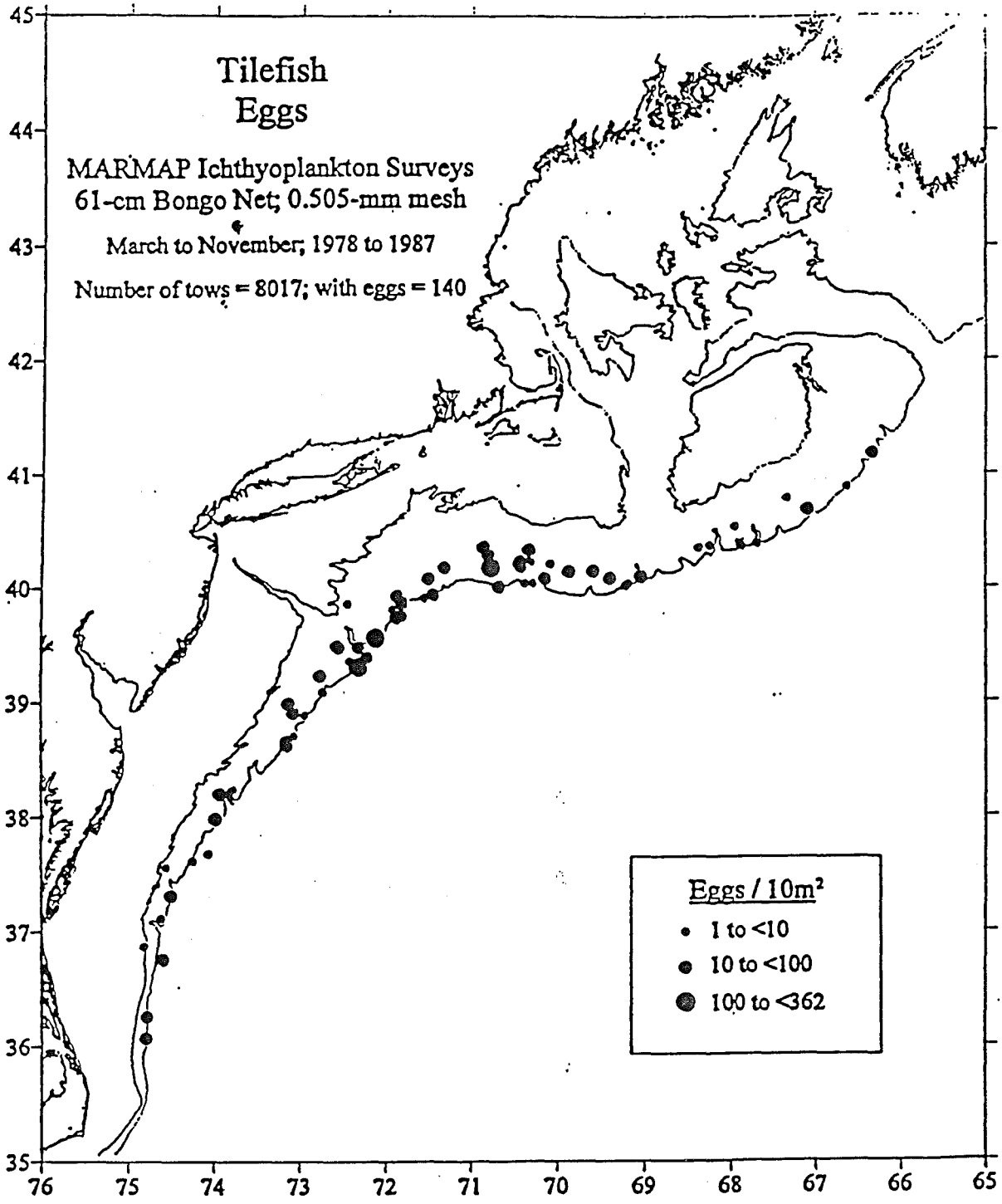

Figure 23. Summary of the distribution and relative abundance of tilefish, *Lopholatilus chamaeleonticeps*, eggs collected north of Cape Hatteras NC during 1977-1987 MARMAP ichthyoplankton surveys.

Note: The 1977 egg samples were lost in a fire, so egg data are only available since 1978.

Source: Steimle *et al.* 1998.

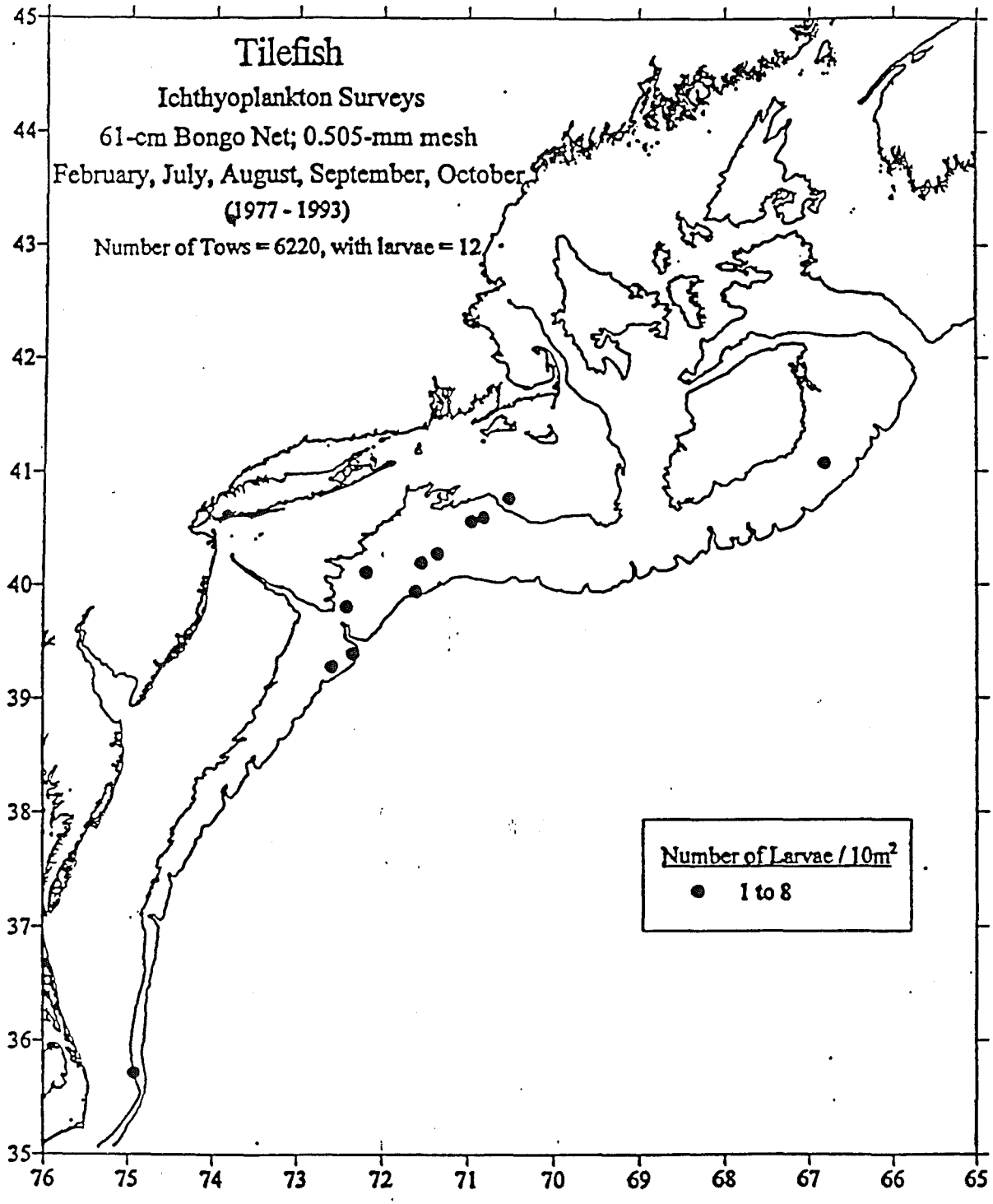

Figure 24. Summary of the distribution and relative abundance of tilefish, *Lopholatilus chamaeleonticeps*, larvae collected north of Cape Hatteras NC during 1977-1993 MARMAP ichthyoplankton surveys.

Source: Steimle *et al.* 1998.

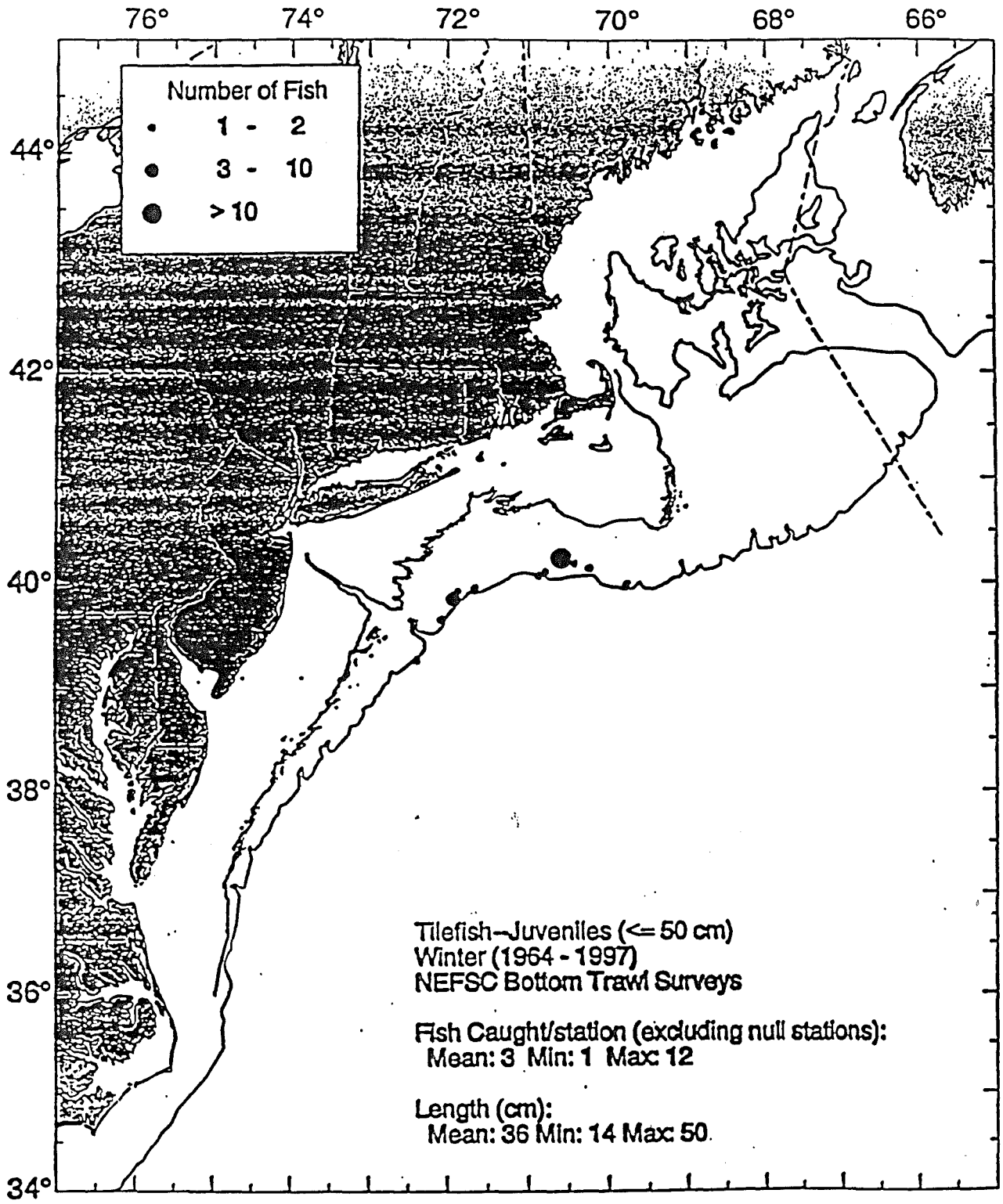

Figure 25. Summary of the seasonal distribution and relative abundance of juvenile (≤50 cm FL) tilefish, *Lopholatilus chamaeleonticeps*, from north of Cape Hatteras based on NEFSC bottom trawl survey data, 1963-1997. (Winter and summer results are presented only as presence/absence because of variability in the areal coverage and vessel/gears used during those seasons.)

Source: Steimle *et al.* 1998.

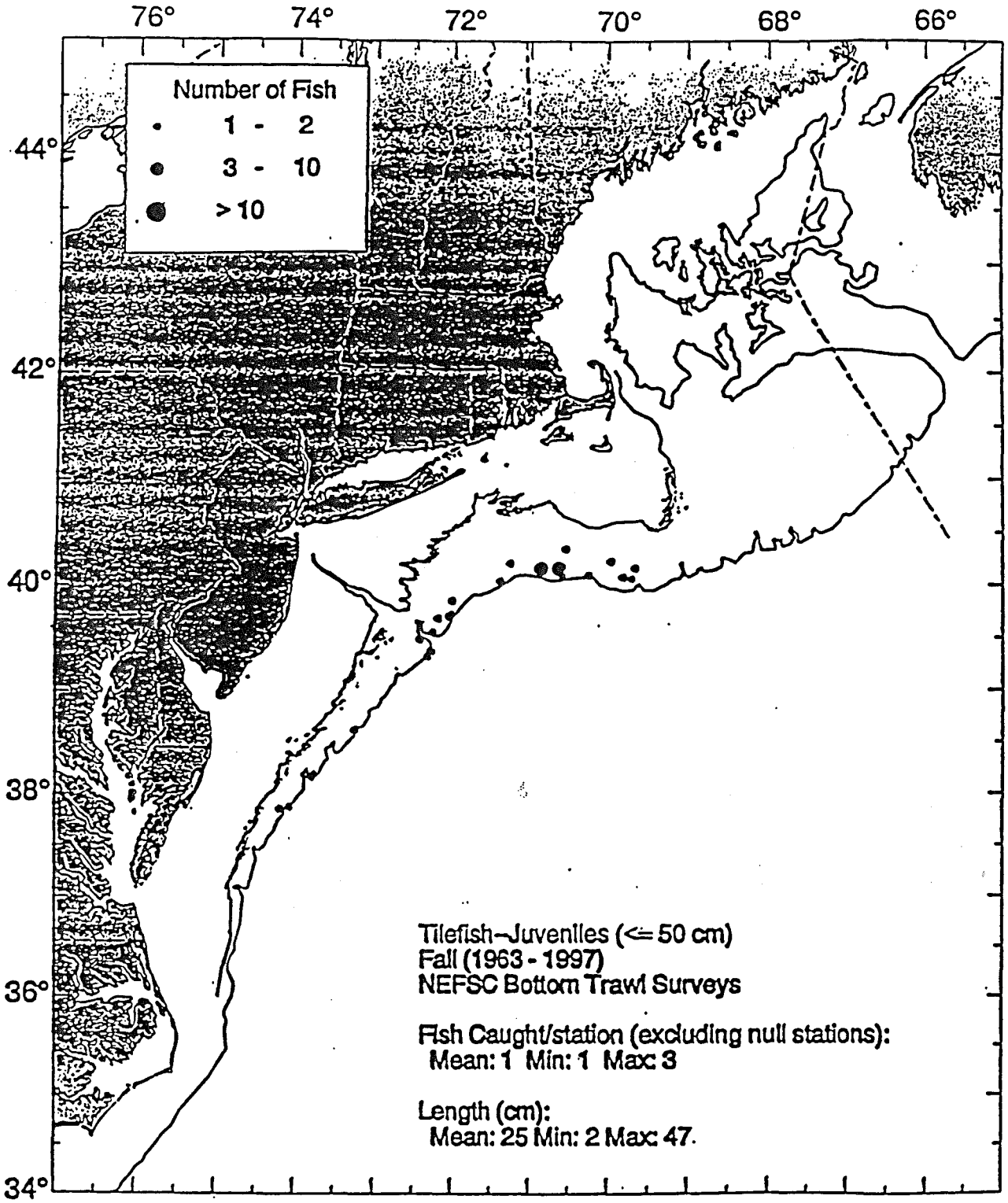

Figure 25 (Continued). Summary of the seasonal distribution and relative abundance of juvenile (≤50 cm FL) tilefish, *Lopholatilus chamaeleonticeps*, from north of Cape Hatteras based on NEFSC bottom trawl survey data, 1963-1997. (Winter and summer results are presented only as presence/absence because of variability in the areal coverage and vessel/gears used during those seasons.)

Source: Steimle *et al.* 1998.

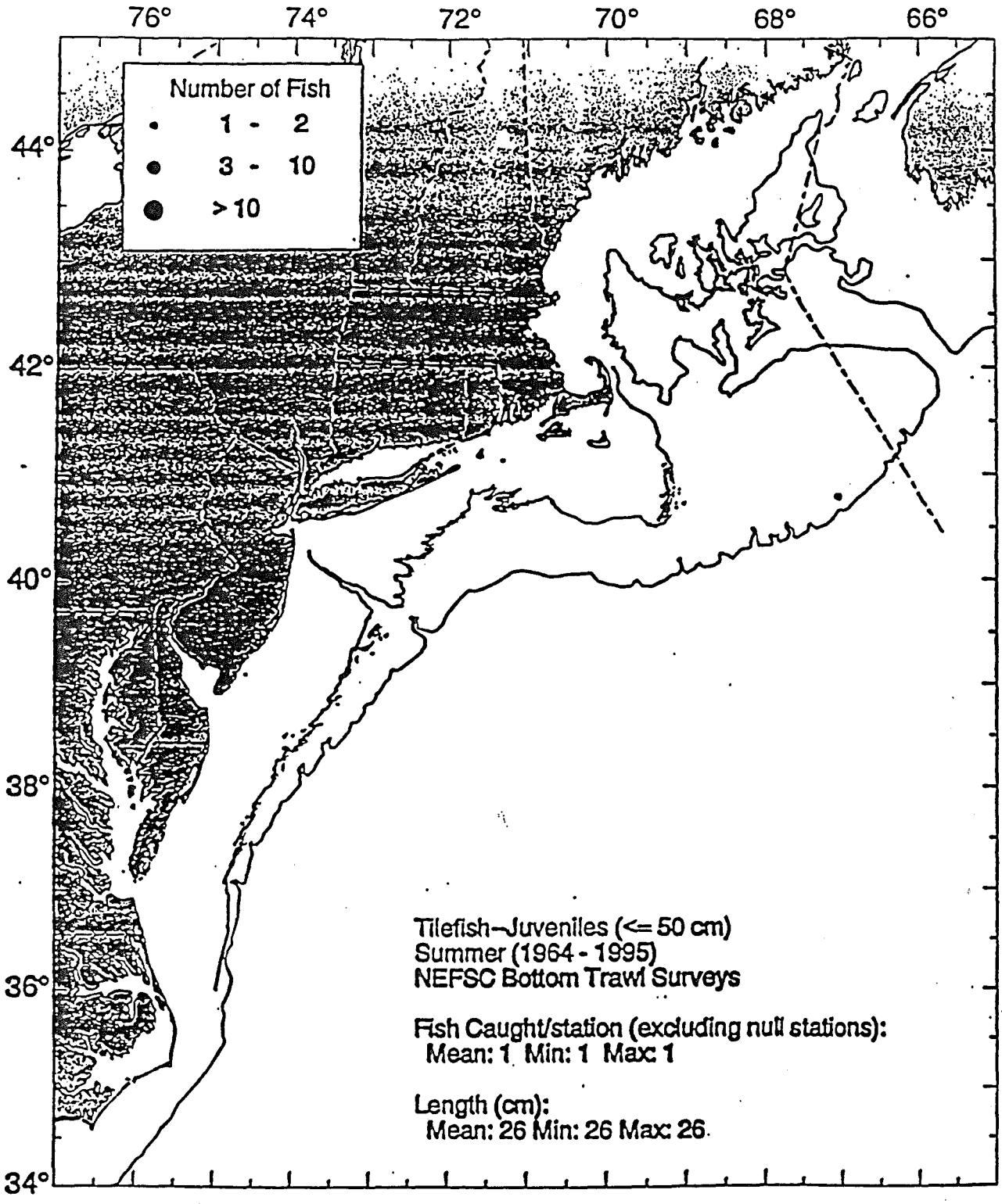

Figure 25 (Continued). Summary of the seasonal distribution and relative abundance of juvenile (≤50 cm FL) tilefish, *Lopholatilus chamaeleonticeps*, from north of Cape Hatteras based on NEFSC bottom trawl survey data, 1963-1997. (Winter and summer results are presented only as presence/absence because of variability in the areal coverage and vessel/gears used during those seasons.)

Source: Steimle *et al.* 1998.

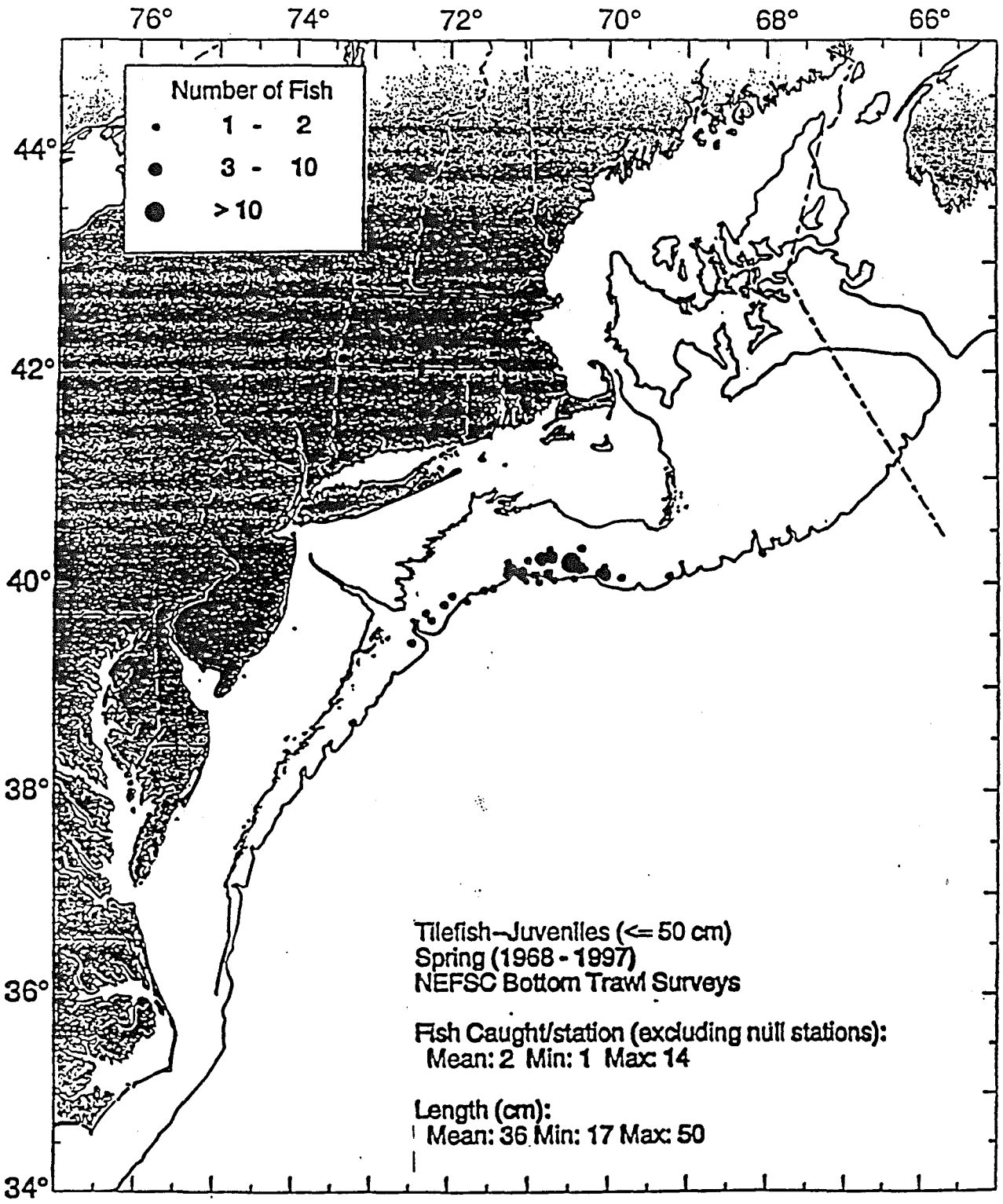

Figure 25 (Continued). Summary of the seasonal distribution and relative abundance of juvenile (≤50 cm FL) tilefish, *Lopholatilus chamaeleonticeps*, from north of Cape Hatteras based on NEFSC bottom trawl survey data, 1963-1997. (Winter and summer results are presented only as presence/absence because of variability in the areal coverage and vessel/gears used during those seasons.)

Source: Steimle *et al.* 1998.

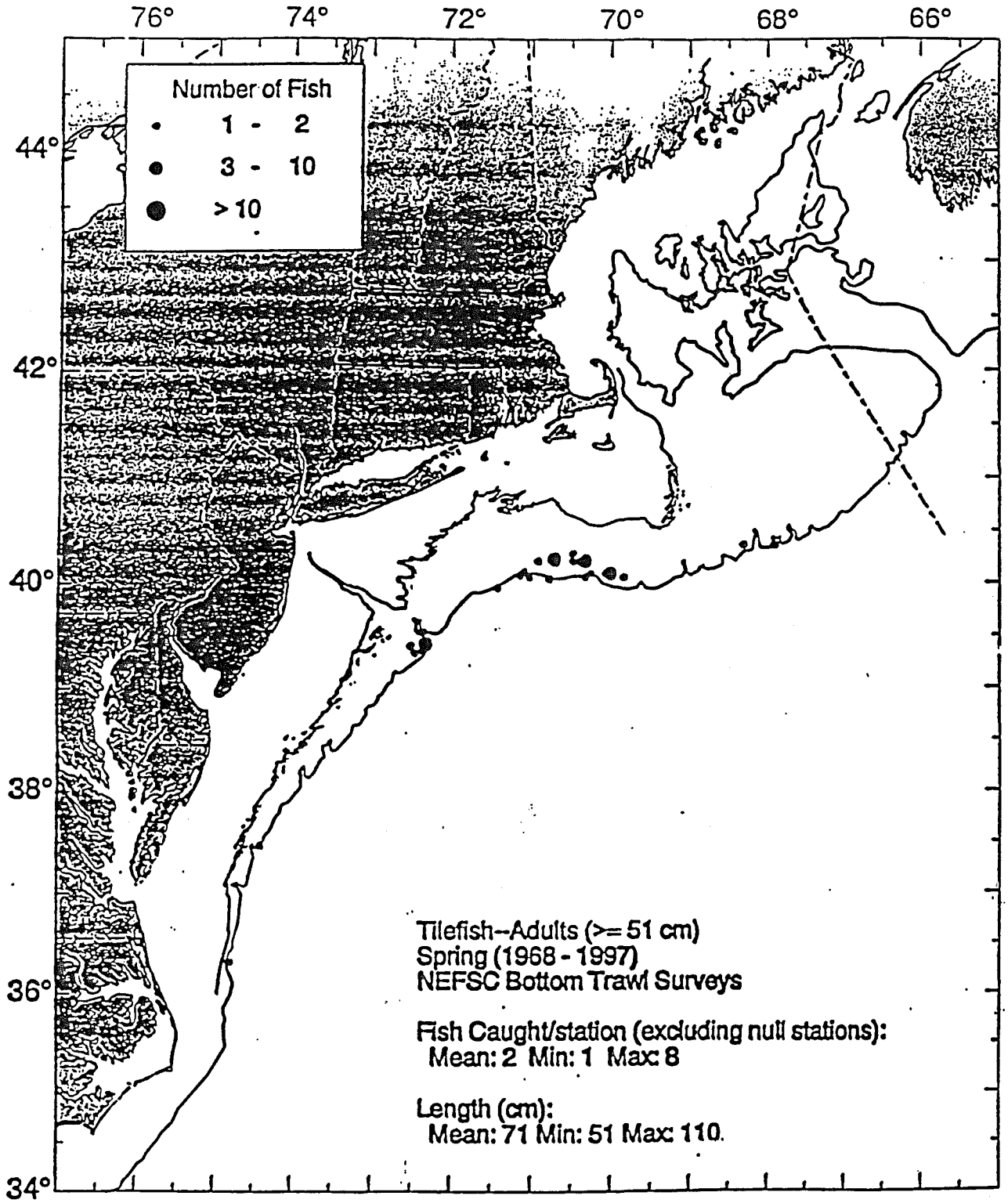

Figure 26. Distribution of adult tilefish captured in spring NEFSC bottom trawl surveys.

Source: Steimle *et al.* 1998.

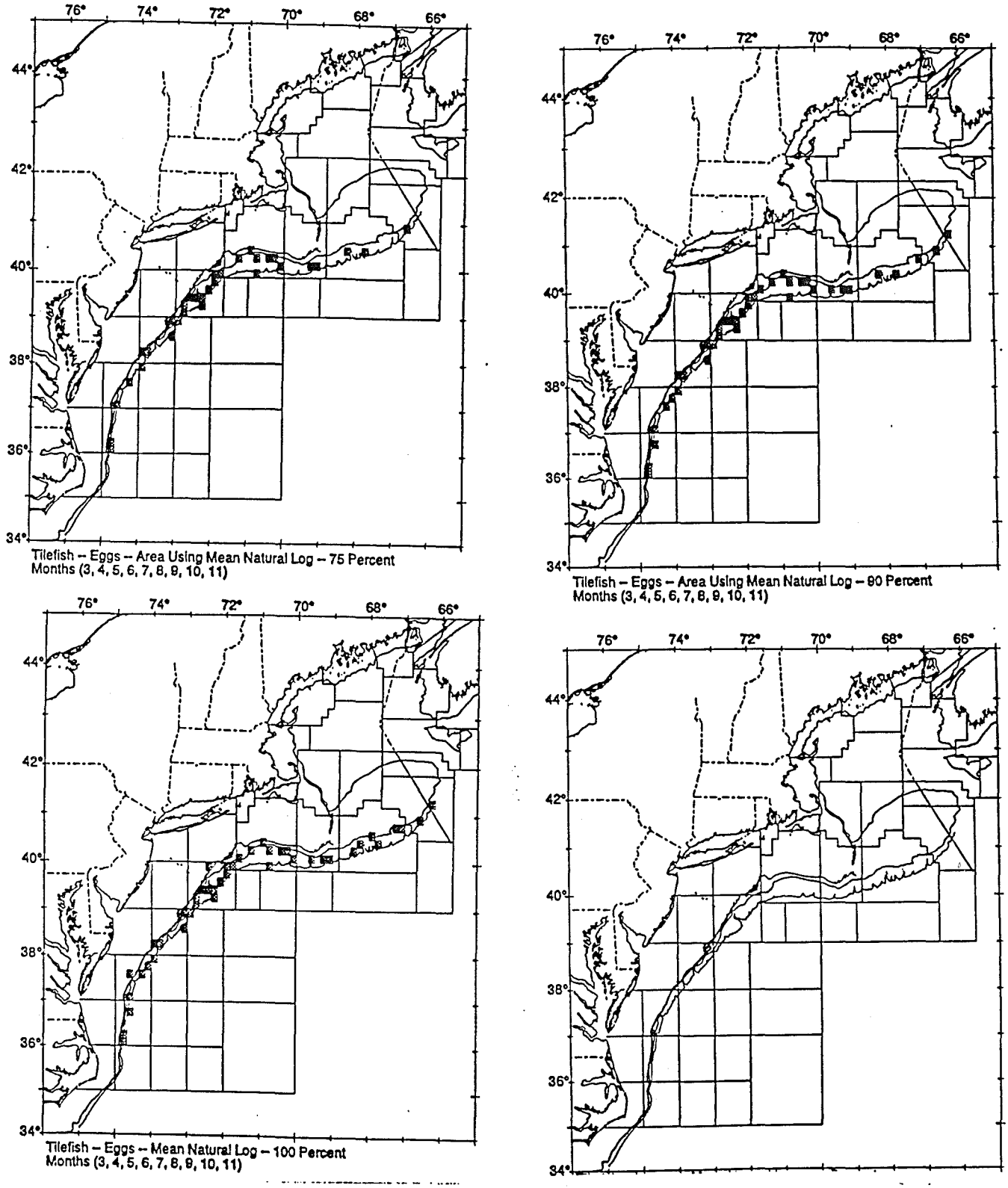

Figure 27. Four options for designating EFH for tilefish eggs: 1) the top 75% of the area, 2) the top 90% of the area, 3) 100% of the area where tilefish are caught in the MARMAP icthyoplankton survey, and 4) the water column between the 250 and 1200 foot isobaths from the U.S./Canadian boundary to the Virginia/North Carolina boundary (preferred).

Source: Zetlin pers. comm.

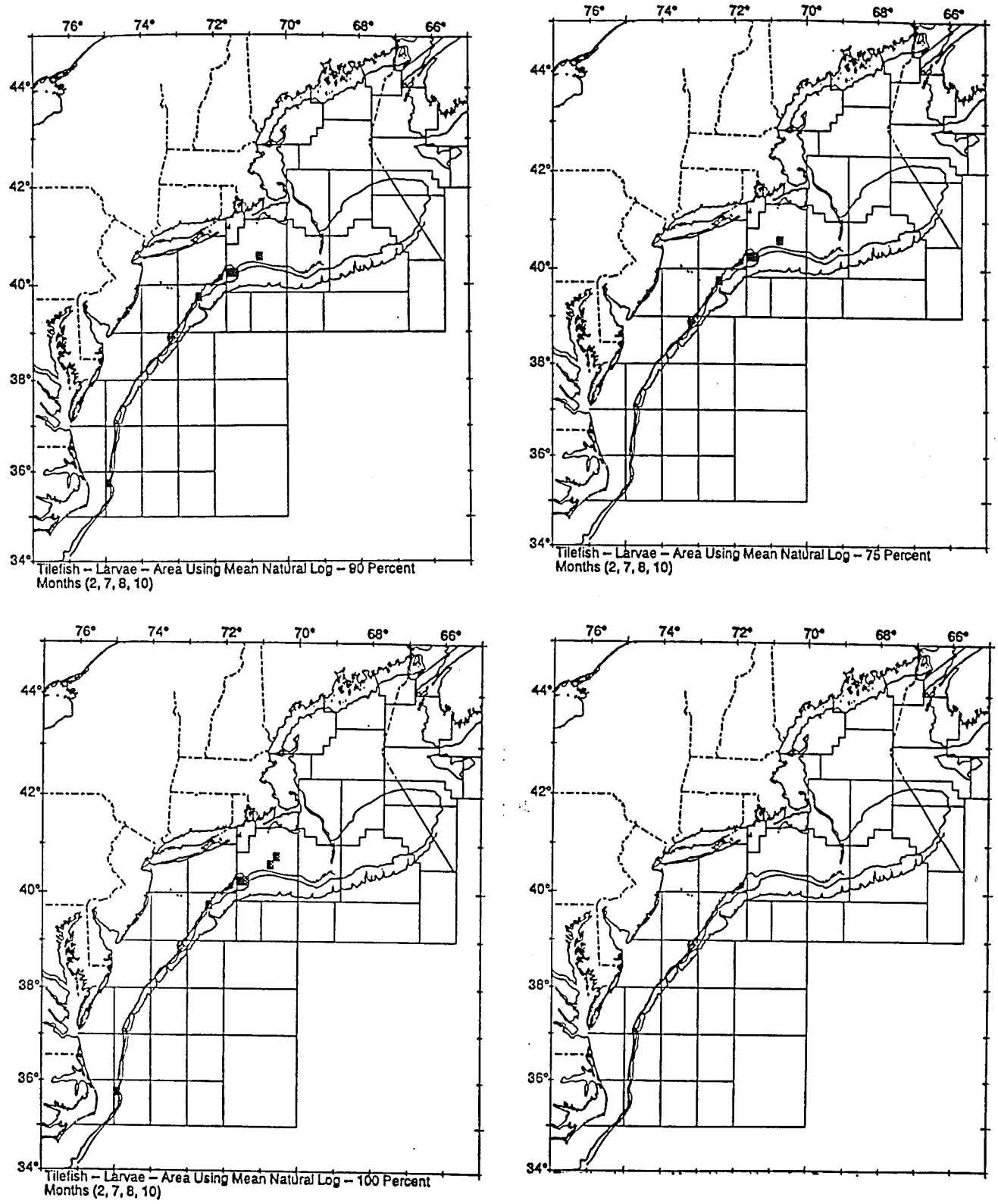

Figure 28. Four options for designating EFH for tilefish larvae: 1) the top 75% of the area, 2) the top 90% of the area, 3) 100% of the area where tilefish are caught in the MARMAP icthyoplankton survey, and 4) the water column between the 250 and 1200 foot isobaths from the U.S./Canadian boundary to the Virginia/North Carolina boundary (preferred).

Source: Zetlin pers. comm.

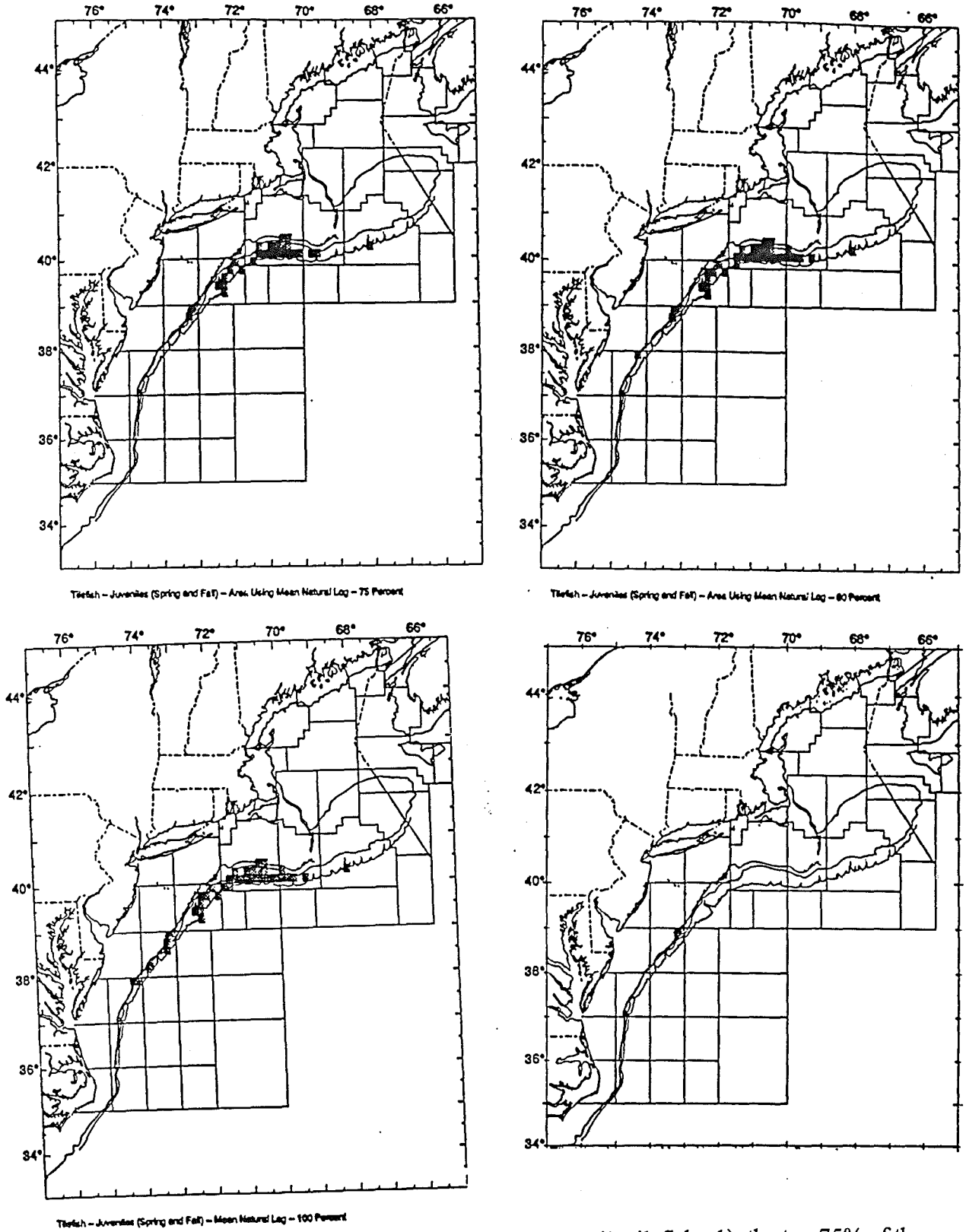

Figure 29. Four options for designating EFH for juvenile tilefish: 1) the top 75% of the area, 2) the top 90% of the area, 3) 100% of the area where tilefish are caught in the MARMAP icthyoplankton survey, and 4) the water column between the 250 and 1200 foot isobaths from the U.S./Canadian boundary to the Virginia/North Carolina boundary (preferred).

Source: Zetlin pers. comm.

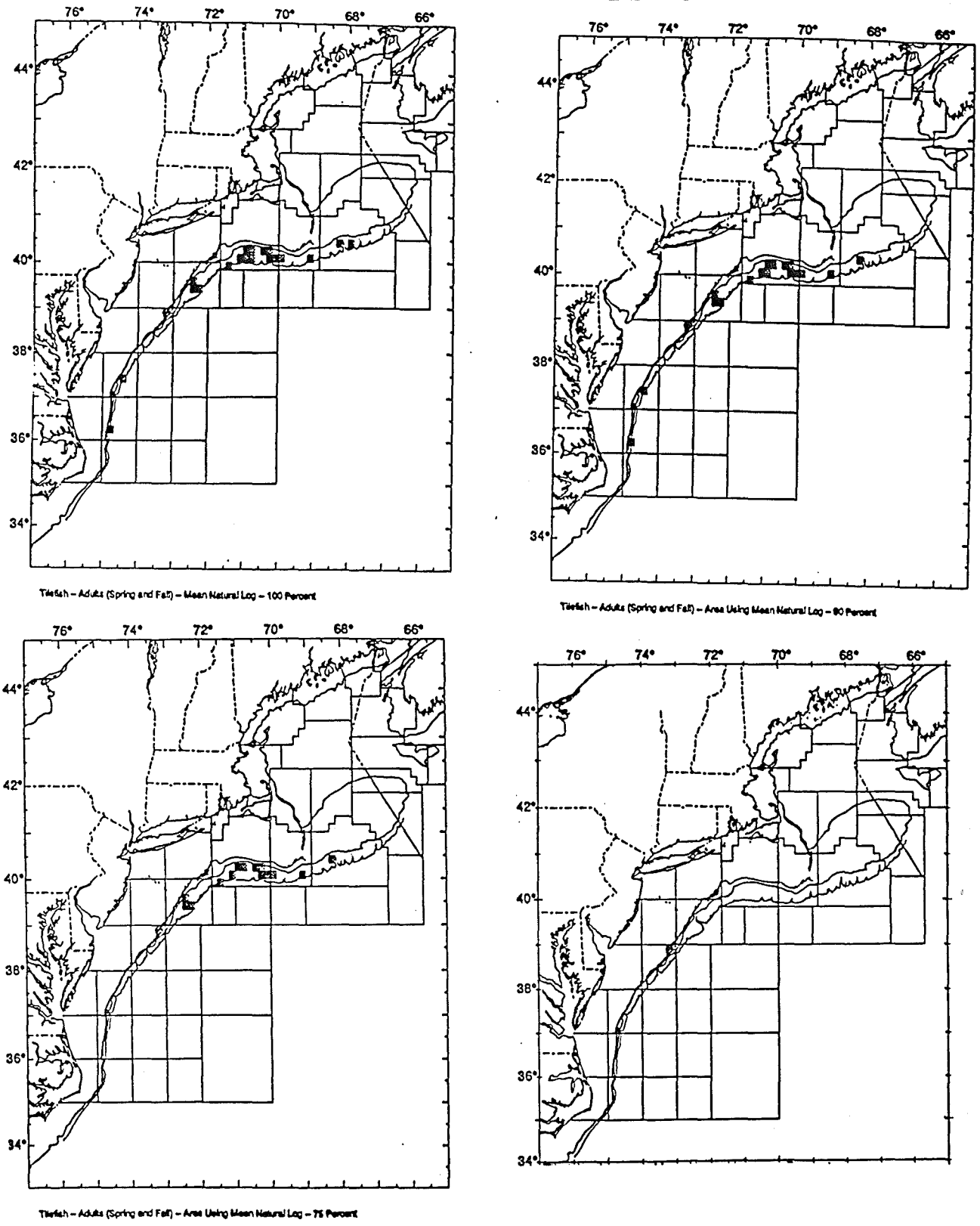

Figure 30. Four options for designating EFH for adult tilefish: 1) the top 75% of the area, 2) the top 90% of the area, 3) 100% of the area where tilefish are caught in the MARMAP icthyoplankton survey, and 4) the water column between the 250 and 1200 foot isobaths from the U.S./Canadian boundary to the Virginia/North Carolina boundary (preferred).

Source: Zetlin pers. comm.

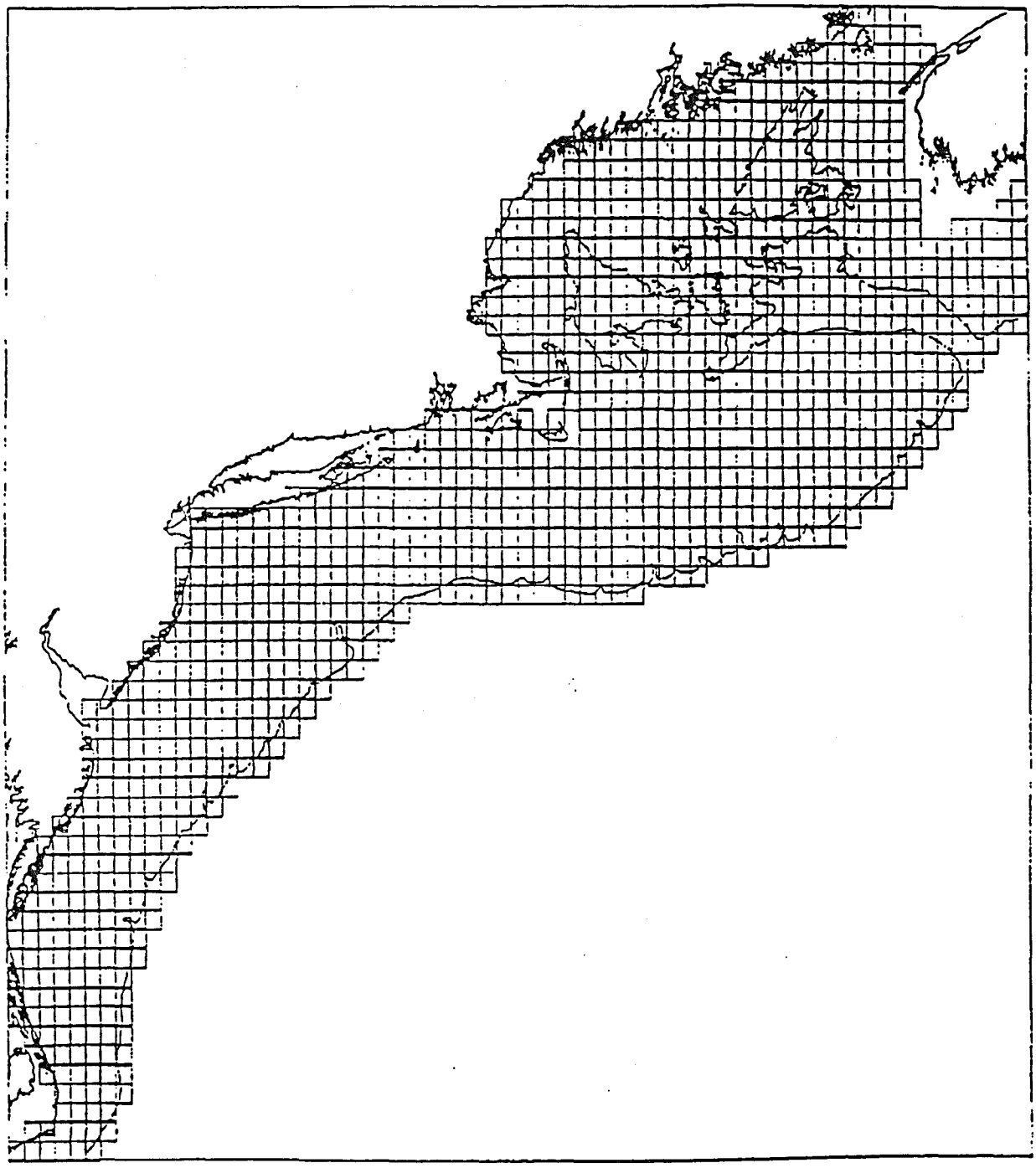

Figure 31. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on tilefish.

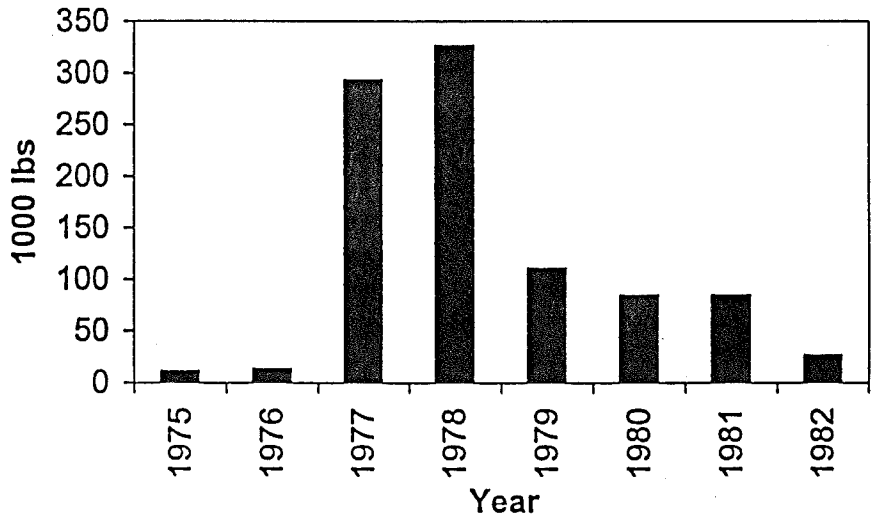

Figure 32. Foreign landings of tilefish from 1975-1982.

Source: Turner 1986.

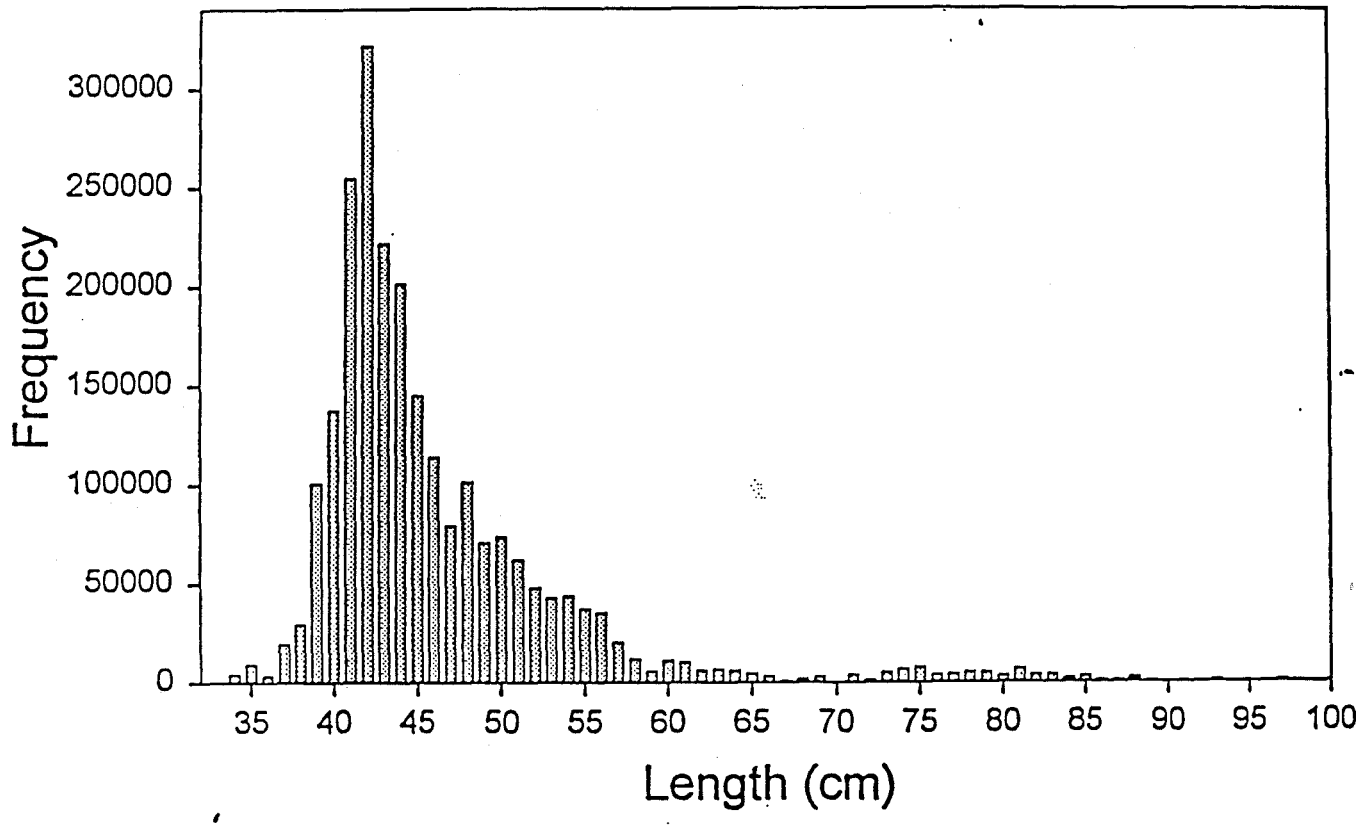

Figure 33. Tilefish expanded longline length frequency for the combined 1996 and 1997 landings by half year and market category using commercial length samples. Large, ex-large and half year periods were combined. Kittens from Rhode island in the 2nd half of 1997 were omitted.

Note: 1 inch = 2.54 cm.

Source: Nitschke *et al.* 1998.

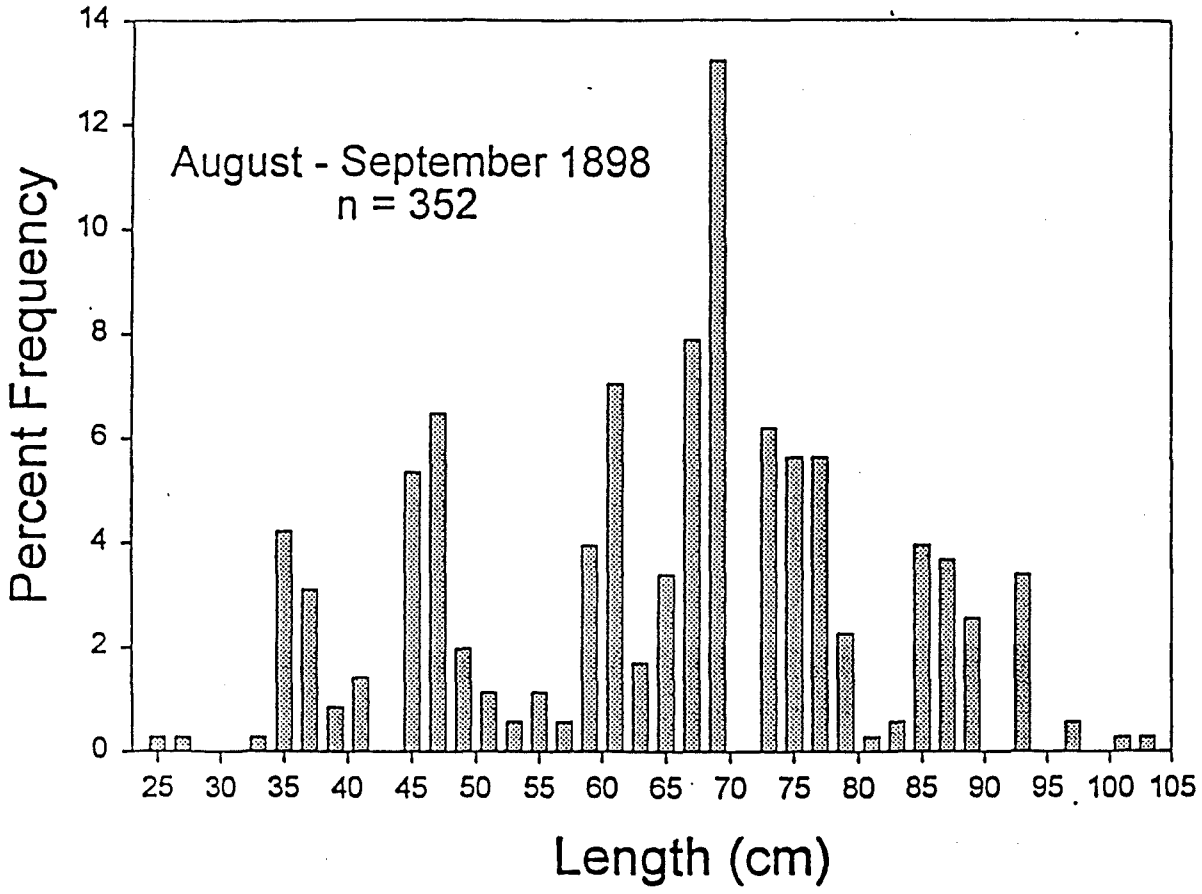

Figure 34. Tilefish length frequency from 1898 longline survey (Bumpus 1899).

Note: 1 inch = 2.54 cm.

Source: Nitschke *et al.* 1998.

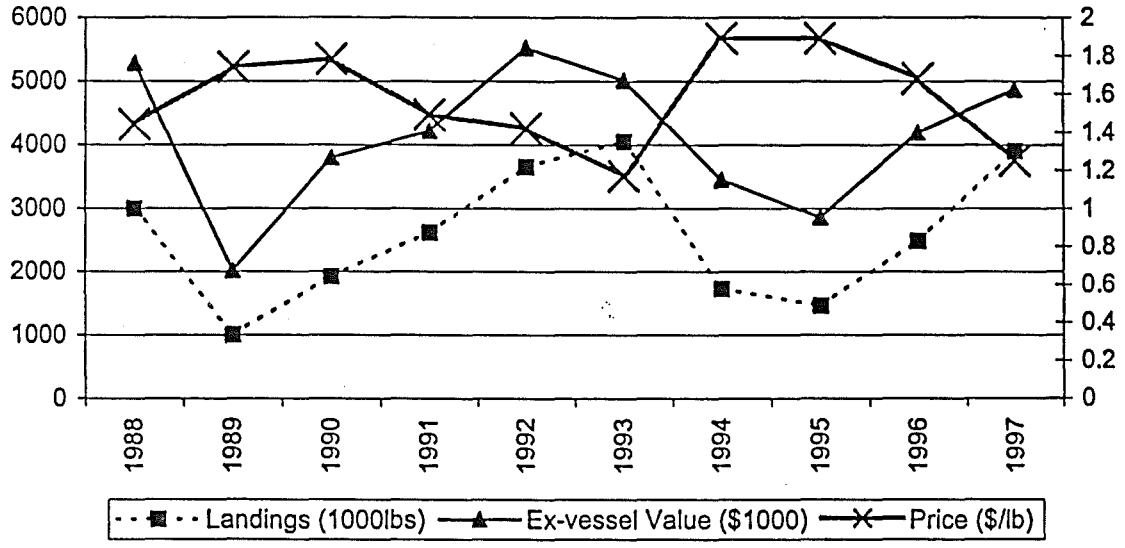

Figure 35. US commercial landings, ex-vessel value, and price for tilefish, 1988-1997.

Source: State and Federal reported landings.

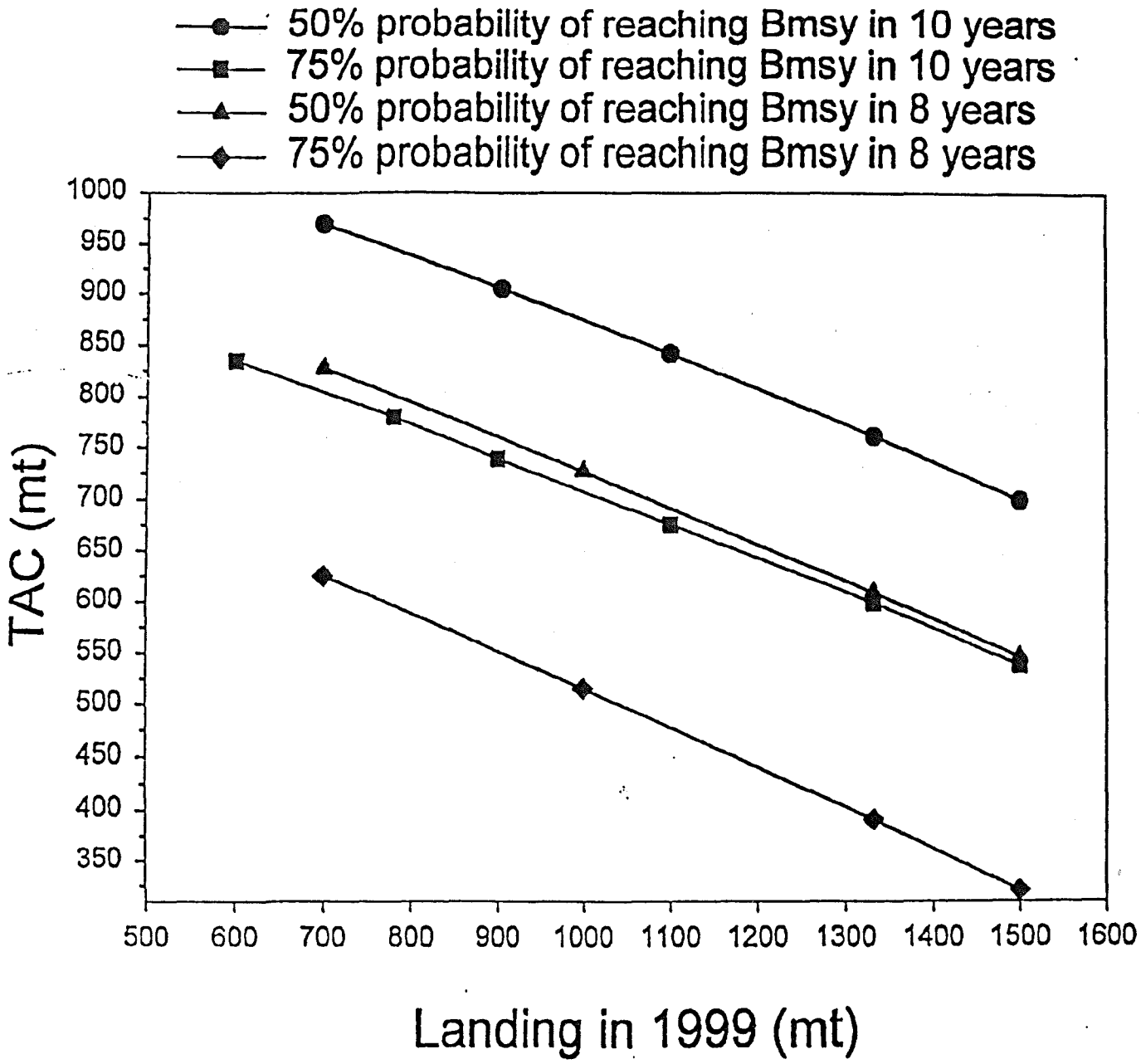

Figure 36. Various TAC scenarios (different probabilities and years) given different land levels in 1999.

Source: Nitschke pers. comm.

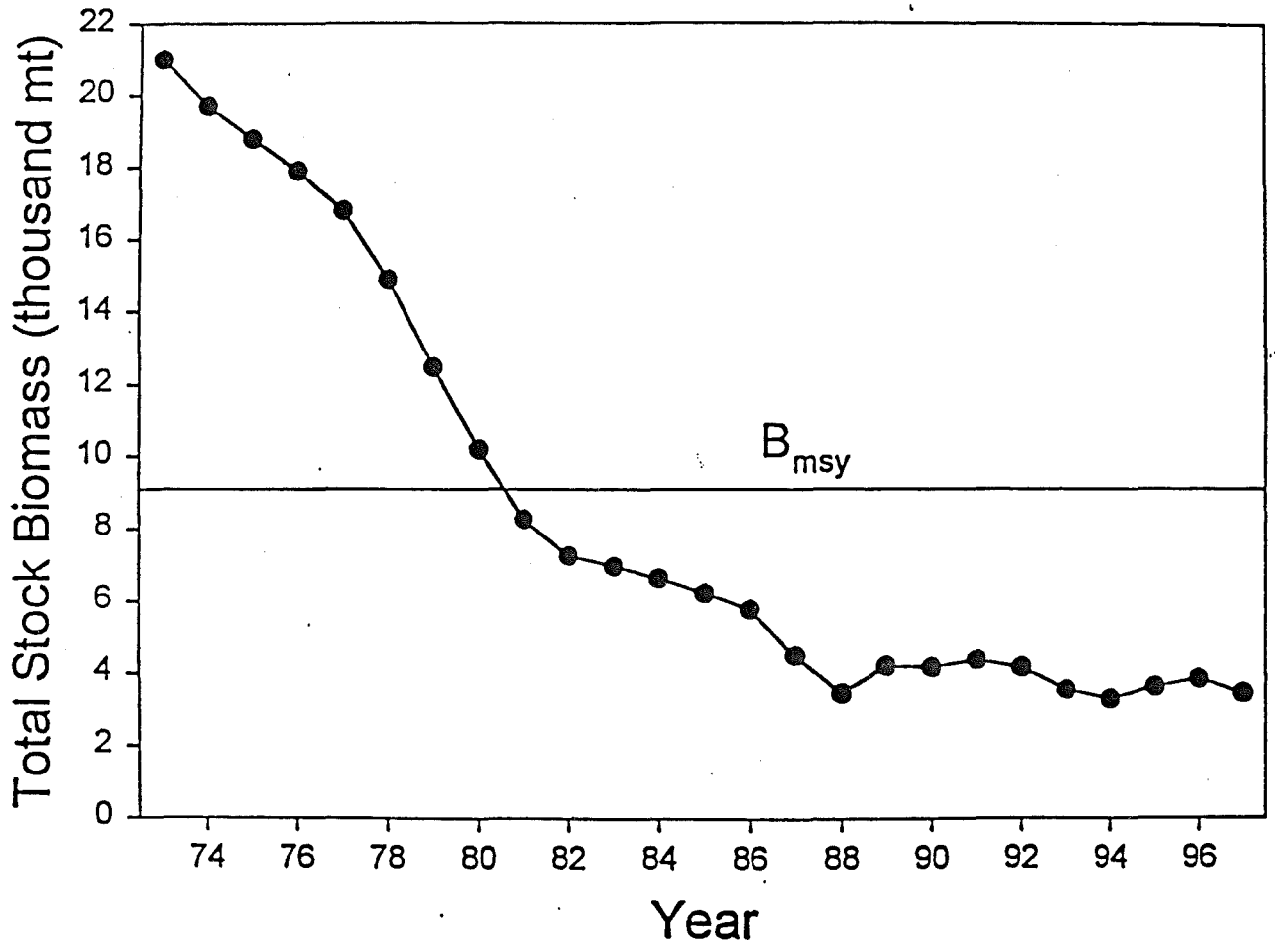

Figure 37. Calculated biomass of tilefish from the surplus production analysis, 1973-1997.

Note: Units are metric and to convert to pounds multiply metric tons by 2205.

Source: Nitschke *et al.* 1999.

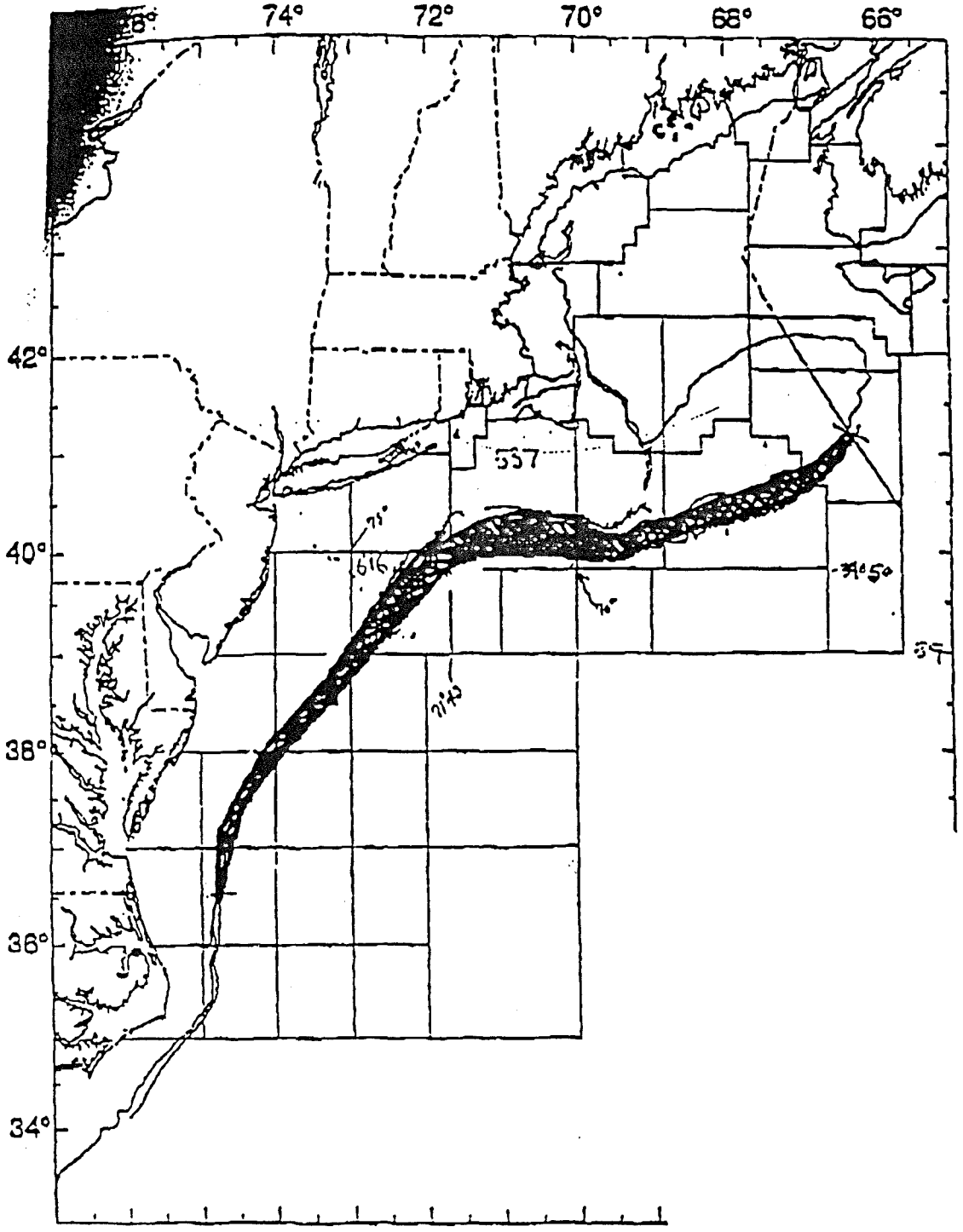

Figure 38. Area proposed during public hearings to be closed to mobile bottom gear -300 to 850 feet, Hague line to North Carolina\Virginia border. Comprises approximately 7,075 square nautical miles.

Source: Chiarella pers. comm.

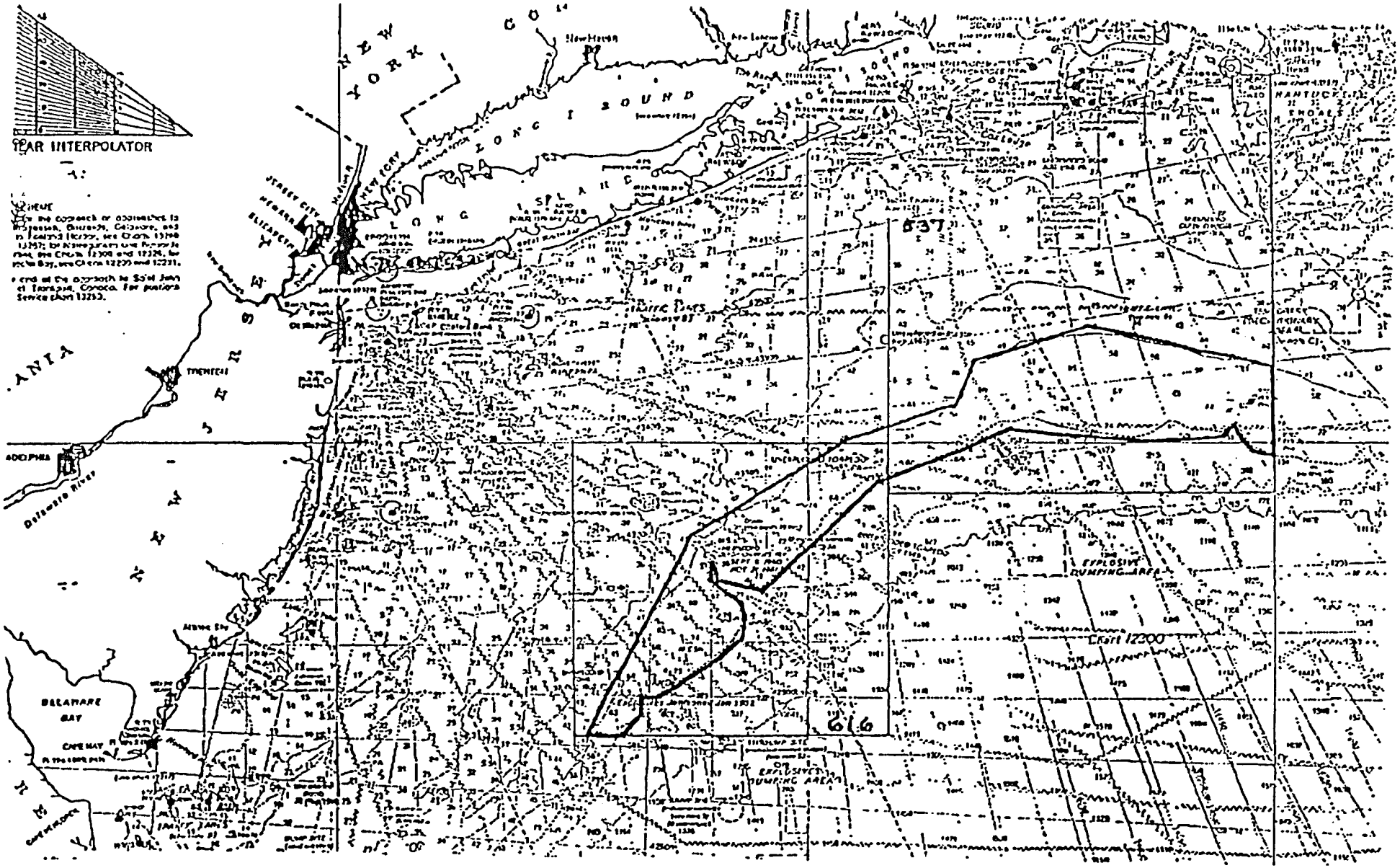

Figure 39. Area proposed during public hearings to be closed to mobile bottom gear -300 to 850 feet within statistical areas 616 and 537, comprises approximately 3,025 square nautical miles.

Source: Chiarella pers. comm.