Seafood Watch
Seafood Report

MONTEREY BAY AQUARIUM®

Hawaiian Deep 7 Species Complex:
Pink snapper/Opakapaka (*Pristipomoides filamentosus*)
Ruby snapper/Onaga/Longtail snapper (*Etelis coruscans*)
Red snapper/Ehu/Squirrelfish snapper (*Etelis carbunculus*)
Hawaiian grouper/Hapu'upu'u/Hawaiian sea bass (*Epinephelus quernus*)

Hawaii
September 26, 2011

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About Seafood Watch® and the Seafood Reports

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer
Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Capture Fisheries Evaluation

Species: *Pristipomoides filamentosus, Etelis coruscans, Etelis carbunculus, Epinephelus quernus*
Region: *Hawaii*
Analyst: *Lisa Max*
Date: *September 26, 2011*

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program. Species from sustainable capture fisheries:

- have a low vulnerability to fishing pressure, and hence a low probability of being overfished, because of their inherent life history characteristics;
- have stock structure and abundance sufficient to maintain or enhance long-term fishery productivity;
- are captured using techniques that minimize the catch of unwanted and/or unmarketable species;
- are captured in ways that maintain natural functional relationships among species in the ecosystem, conserves the diversity and productivity of the surrounding ecosystem, and do not result in irreversible ecosystem state changes; and
- have a management regime that implements and enforces all local, national and international laws and utilizes a precautionary approach to ensure the long-term productivity of the resource and integrity of the ecosystem.

Seafood Watch has developed a set of five sustainability **criteria,** corresponding to these guiding principles, to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Inherent vulnerability to fishing pressure
2. Status of wild stocks
3. Nature and extent of discarded bycatch
4. Effect of fishing practices on habitats and ecosystems
5. Effectiveness of the management regime

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other wild-caught invertebrates.

Each criterion includes:

- Primary factors to evaluate and rank
- Secondary factors to evaluate and rank
- Evaluation guidelines[2] to synthesize these factors
- A resulting **rank** for that criterion

Once a rank has been assigned to each criterion, an **overall seafood recommendation** for the species in question is developed based on additional evaluation guidelines. The ranks for each criterion, and the resulting overall seafood recommendation, are summarized in a table. Criterion ranks and the overall seafood recommendation are color-coded to correspond to the categories of the Seafood Watch pocket guide:

Best Choices/Green: Consumers are strongly encouraged to purchase seafood in this category. The wild-caught species is sustainable as defined by Seafood Watch.

Good Alternatives/Yellow: Consumers are encouraged to purchase seafood in this category, as they are better choices than seafood in the Avoid category. However there are some concerns with how this species is fished and thus it does not demonstrate all of the qualities of a sustainable fishery as defined by Seafood Watch.

Avoid/Red: Consumers are encouraged to avoid seafood in this category, at least for now. Species in this category do not demonstrate enough qualities to be defined as sustainable by Seafood Watch.

[2] Evaluation Guidelines throughout this document reflect common combinations of primary and secondary factors that result in a given level of conservation concern. Not all possible combinations are shown—other combinations should be matched as closely as possible to the existing guidelines.

I. Executive Summary

This report evaluates the ecological sustainability of four of the Hawaiian "Deep 7" bottomfish species complex. This complex includes: opakapaka or pink snapper (*Pristipomoides filamentosus*), onaga or ruby snapper (*Etelis coruscans*), ehu or squirrelfish Snapper (*Etelis carbunculus*), Hawaiian sea bass or hapu'upu'u (*Epinephelus quernus*). Additional species in the Deep 7 complex, gindai or Brigham's snapper (*Pristipomoides zonatus*), Kalekale or Von Seibold's snapper (*Pristipomoides seiboldii*) and lehi or silverjaw snapper (*Aphareus rutilans*) will not be evaluated here. The entire Hawaiian complex is managed together as one stock under a Total Allowable Catch (TAC) limit, which will be replaced by an Annual Catch Limit (ACL) in the 2011–2012 season.

The Hawaiian Deep 7 fishery serves a high demand, with 100% of the catch sold in the Honolulu seafood market (WPFMC 2009) and it is consumed locally throughout the island chain. Deep 7 species caught outside of Hawaii are sold and consumed in Hawaii and comprise greater than 50 percent of what's on the market, but their sustainability will not be evaluated here. In this report we focus on the active Main Hawaiian Island (MHI) fishery, with some discussion of the North West Hawaiian Island (NWHI) fishery. The NWFI fishery was closed in state waters, and was closed in remaining Federal waters as of June 15, 2011 as a result of the 2006 establishment of the Papahānaumokuākea Marine National Monument. This action served to conserve stocks of Deep 7 bottomfish, by protecting spawning stock that may contribute to the viability of the Main Hawaiian Island fishery.

The Inherent Vulnerabilities to fishing pressure of these species are difficult to assess individually because much is unknown or uncertain about their life history characteristics, but their intrinsic rates of increase, ages at first maturity and growth rates are considered moderate. The stock status of Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are considered a moderate conservation concern because the current stock assessment model finds that the complex's biomass is just below B_{MSY}. However, because stock assessments are carried out on the Deep 7 complex as a whole, it is impossible to assess the stock status of each fish on an individual basis. Bycatch is considered low, and likely does not adversely affect other fish or marine mammals. The habitat and ecosystem effects of the Deep 7 Bottomfish fishery are thought to be minimal. However, as new information emerges about sensitivity of the rocky bottom deep benthic habitats that Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass inhabit, habitat and ecosystem effects of fishing are judged to be moderate. The Deep 7 fishery has moderately effective management, but it is uncertain how this management regime performs for each individual species. There are several management measures in place, such as reporting requirements, a TAC (which will be an ACL next season) and non-commercial bag limits. Due to these rankings, Seafood Watch categorizes Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass as Good Alternatives.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks		√		
Nature of Bycatch	√			
Habitat & Ecosystem Effects		√		
Management Effectiveness		√		

About the Overall Seafood Recommendation:

- A seafood product is ranked **Best Choice** if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.
- A seafood product is ranked **Good Alternative** if the five criteria "average" to yellow (Moderate Conservation Concern) OR if the "Status of Stocks" and "Management Effectiveness" criteria are both of Moderate Conservation Concern.
- A seafood product is ranked **Avoid** if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.

Overall Seafood Recommendation:

Best Choice | Good Alternative | Avoid

II. Introduction

The Deep 7 fishery complex is composed of six snapper and one grouper species that inhabit the deep water slope region off the Hawaiian Island chain. They are: opakapaka or pink snapper (*Pristipomoides filamentosus*), Onaga or longtail snapper (*Etelis coruscans*), Ehu or squirrelfish snapper (*Etelis carbunculus*), Hawaiian sea bass or hapu'upu'u (*Epinephelus quernus*), gindai or Brigham's snapper (*Pristipomoides zonatus*), kalekale or Von Seibold's snapper (*Pristipomoides seiboldii*) and lehi or silverjaw snapper (*Aphareus rutilans*) fishery. The english common names (Pink snapper, Longtail snapper, Squirrelfish snapper, and Hawaiian sea bass) will be used primarily in this report. This report evaluates the sustainability of the first four species listed, Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass. In this introduction, we briefly describe what is known about the biology, ecology and distribution of these four species, then discuss the Hawaiian Deep 7 fishery.

Pristipomoides filamentosus (Fig 1) is an eteline snapper in the family Lutjanidae. Its English common name is pink snapper; in Hawaii, it is known as opakapaka. *P. filamentosus* is widely distributed throughout the Indo-West Pacific region (Mees 1993; Druzhinin 1970). Pink snapper is a deepwater species of snapper with a depth distribution of 30–360 m (Kami 1973; Moffitt 1993). It is relatively long-lived and slow-growing (compared to other tropical species), and is capable of reaching a length of 100 cm (39 in), a weight of 8 kg. (Fishbase 2011) Until recently, Pink snapper was thought to live to a maximum age of approximately 18 years (Moffitt 1993), but a recent aging study using radiocarbon and lead isotope dating techniques found that maximum age may exceed 45 years old. (Andrews unpublished data, Ralston and Miyamoto 1983 in Brodziak et al. 2011). It is thought that Pink snapper reach sexual maturity at approximately 1.8 years and spawn at 2.2 years. (DLNR, yr unknown).

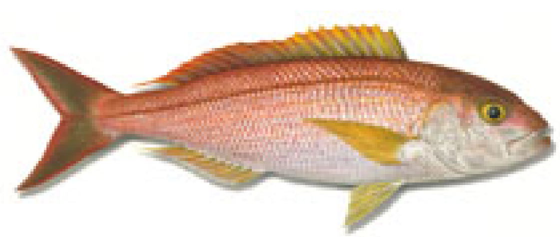


Figure 1: Pink snapper (image from HDAR)

Etelis coruscans (Fig. 2) is an eteline snapper in the family Lutjanidae. Its English common name is ruby snapper, while in Hawaii it is known as Longtail snapper or 'ula 'ula'koe 'e. *E. coruscans* is widely distributed throughout the Indo-West Pacific region ranging longitudinally from East Africa eastward to the Hawaiian Archipelago and latitudinally from Japan southward to Australia (Druzhinin 1970). Longtail snapper is a deepwater species with a depth distribution of 100–450 m (Randall et al. 1997). It is relatively long-lived and slow-growing, reaching maturity at 50% of its total growth at a mean length of 66.3cm (Everson *et al.*1989). It is not clear at what age they enter the fishery. Longtail snapper are capable of reaching a length of at least 120 cm (47 in) and a weight of 35 kg (Fishbase 2011; WPRFMC 1998).

Figure 2: Longtail snapper (image from HDAR)

Etelis carbunculus (Fig. 3) is an eteline snapper in the family Lutjanidae. Its English common name is red or squirrelfish snapper; in Hawaii, it is known as ehu. The species is found solitarily or in small groups at depths of 90 to 350 m (Allen 1985; Everson 1984; Ralston and Polovina 1982) and is widely distributed throughout the Indo-Pacific region, ranging east-west from East Africa to the Hawaiian Islands and north-south from southern Japan to Australia (Allen 1985; Everson 1984). Like most bottomfish species, *E. carbunculus* is important in western Pacific fisheries but its life history is not well known (Ralston 1979). Squirrelfish snapper is known to reach lengths of 127 cm (50 in) and its maximum age is unknown (Fishbase 2011).

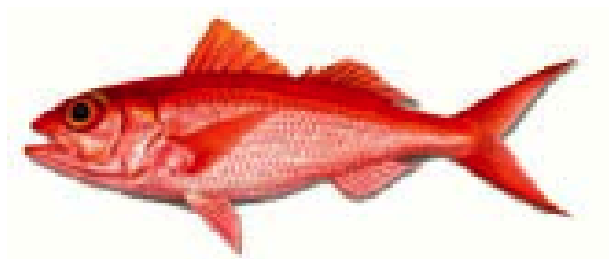


Figure 3: Squirrelfish snapper (image from HDAR)

Epinephelus quernus or alternatively *Hyporthodus quernus* (Froese & Pauly 2011) (Figure 4) is a grouper species. Its English common name is the Hawaiian sea bass; in Hawaii it is known as hapu'upu'u or simply hapu'u. Hawaiian sea bass occurs in deep waters, usually between 20–380 m, and is endemic to the Hawaiian Islands and Johnston Atoll (DLNR 2001). The species grows up to 1.2 meters (3.9 ft) in length and can weigh up to 27 kilograms (DLNR 2001). Maximum age for this species is unknown, but based on length/weight/age relationships Hawaiian sea bass are thought to live to about the mid-teens. Age at sexual maturity is also unknown, as is intrinsic rate of increase and frequency of spawning (DLNR 2001), but based on a survey of other grouper species, Hawaiian sea bass probably matures at between 4 and 8 years of age (NMFS 1999). Although little is known about the behavioral characteristics of Hawaiian sea bass, many other grouper species are protogynous hermaphrodites, first maturing as females and then changing to males later in life. (Coleman et al. 1996; Brule et al. 1999; NMFS 1999) There is evidence that Hawaiian sea bass follow this pattern (Everson 1992)

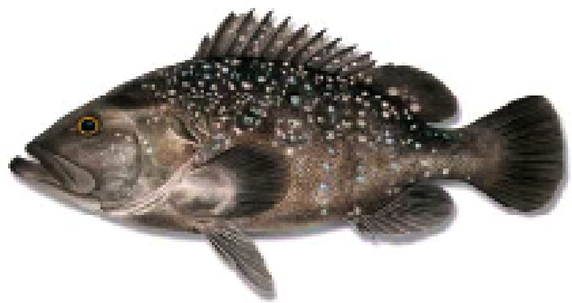


Figure 4: Hawaiian sea bass (image from HDAR)

Most of the fishing effort for deepwater bottomfish species occurs in the steep drop-off zone of high structural complexity that surrounds the islands and banks of the Hawaiian archipelago, which includes the Main Hawaiian Islands (MHI) and Northwest Hawaiian Islands (NWHI). (Ralston and Polovina 1982) (Figure 5). Historically, the MHI fishery, which uses boats ranging from 15 to 17 feet (WPRFMC 2010) has constituted the majority of the bottomfish catch (Figure 7), with the NWHI catch limited by access. As of 2010, there were over 508 MHI federal bottomfish permits, 58 of which were for non-commercial fishing (WPRFMC 2010) The Western Pacific Regional Fisheries Management Council (WPRFMC) manages the Hawaiian Archipelago Deep 7 fishery as part of the bottom fish management species unit complex (MUS) under the Fishery Ecosystem Plan (FEP). Of the bottom fish MUS, the Deep 7 are restricted catch species because they are managed through a TAC/ACL. Recently it was estimated that 47% of Deep 7 bottomfish habitat exists in state waters (0–3 miles from shore) and 53% in Federal waters (3–200 miles from shore) (Parke 2007). As species that may form large aggregations, Pink snapper and Longtail snapper are an easy target for fisherman with fish finding devices, and can easily be overfished as a result. By law, all commercial and recreational fishing for the Deep 7 species use human or electronically powered, weighted and baited hook and line, which is thought to be highly selective for the targeted species and sizes (WPRFMC 2009) and to have minimal impact on the benthos. This may not actually be the case, given the recent findings on sensitive species, like black coral, which live in Deep 7 bottomfish preferred rocky habitat. As a result of fishing at such great depths, the Deep 7 and most of the bycatch in this fishery are brought to the surface dead (DSEIS 2006).

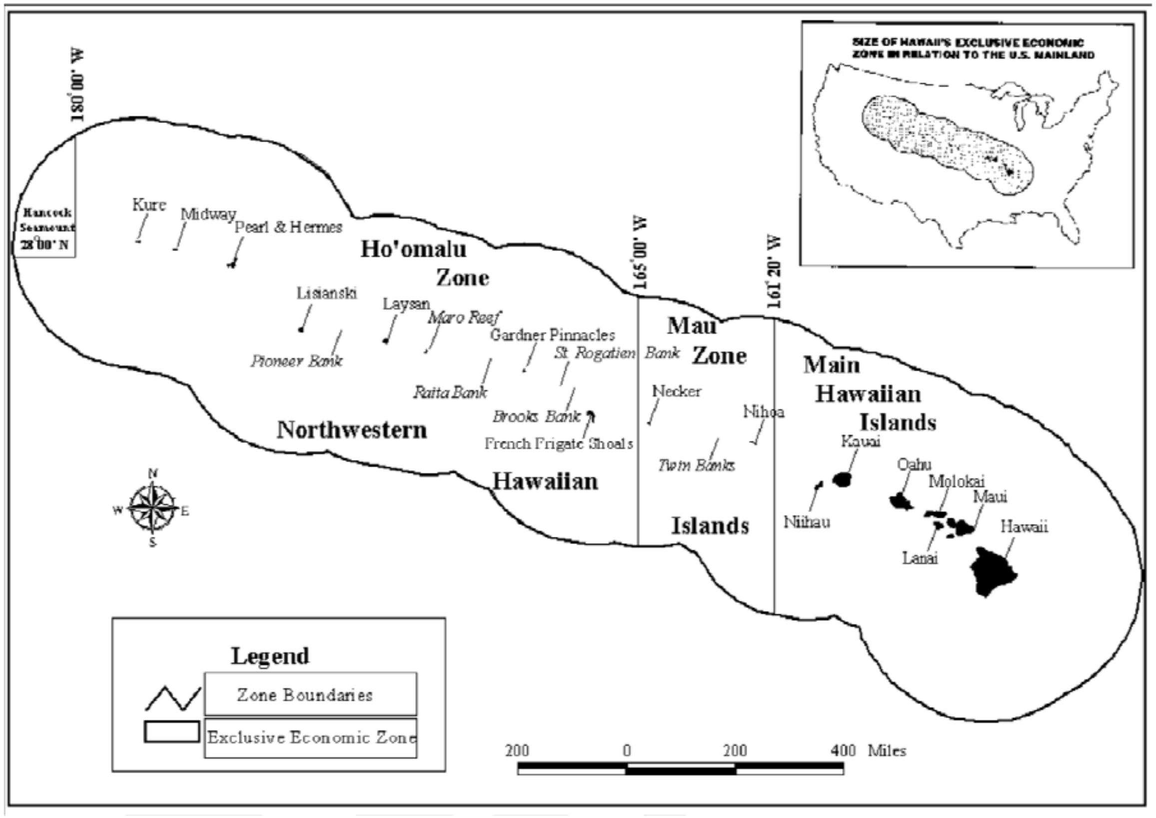


Figure 5: Hawaiian bottom fish fishery zones in the Main and Northwest Hawaiian Islands. The NWHI areas are now permanently closed to bottom fishing (from Brodziak et al. 2011)

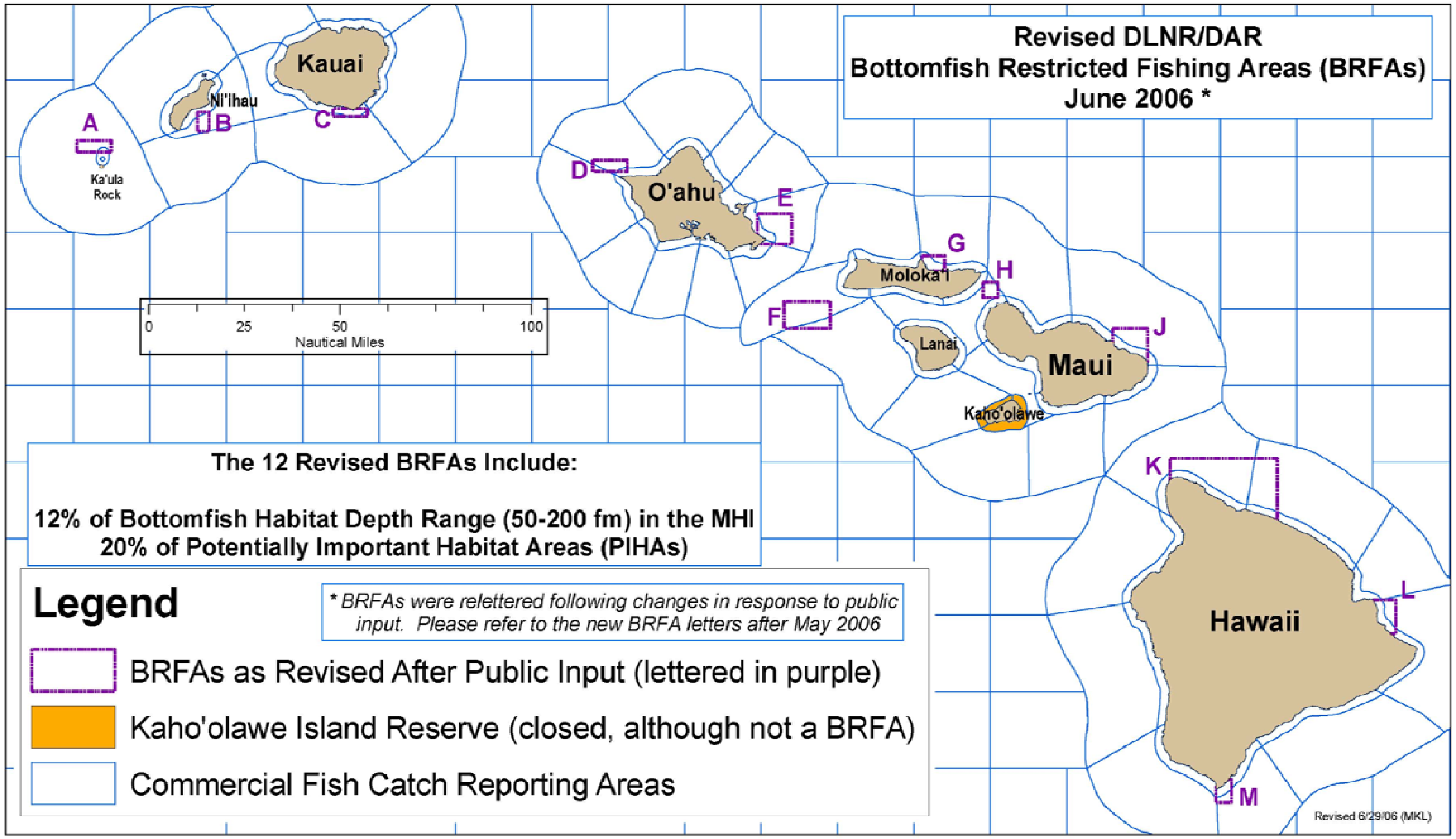


Figure 6: Areas closed to bottomfishing in the Main Hawaiian Islands, referred to as Bottomfish Restricted Fishing Areas (BRFAs)

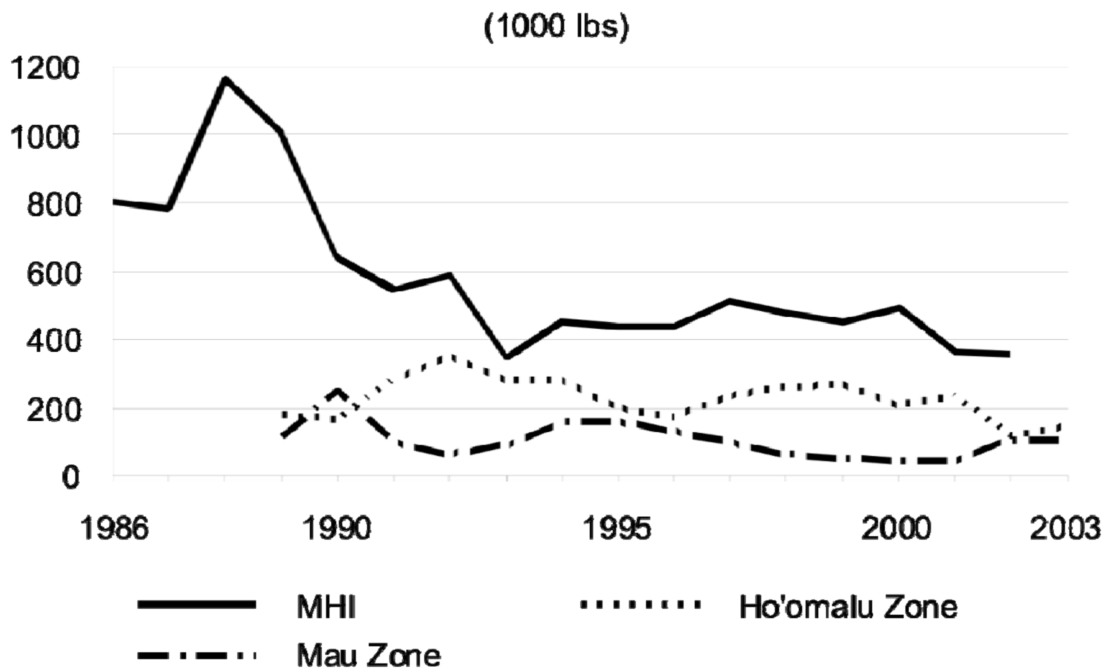


Figure 7: Bottomfish catch from the MHI and the two fishing zones of the NWHI (Mau and Ho'omalu) from 1986 to 2003. Western Pacific Regional Fishery Management Council. 2009. Fishery Ecosystem Plan for the Hawaii Archipelago.

Longtail snapper is possibly the most important demersal species of fish managed by the Western Pacific Regional Fishery Management Council (WPRFMC), and it is the Hawaiian bottomfish species of highest concern in terms of developing Essential Fish Habitat (O'Conner and Kelley 2008). In Hawaii, Guam, and the Northern Mariana Islands, Longtail snapper seasonally commands the highest price per pound of any bottomfish landed (Hospital and Pan 2009, Bottomfish News Vol 6, 2008) (Figures 8 and 9). It is second in total annual landings in Hawaii, surpassed only by Pink snapper (DLNR data) (Figure 10). Pink snapper is also an important demersal species of fish managed by the Western Pacific Regional Fishery Management Council (WPRFMC), commanding the second highest price per pound of any bottomfish in Hawaii, second to Longtail snapper (Figure 9).

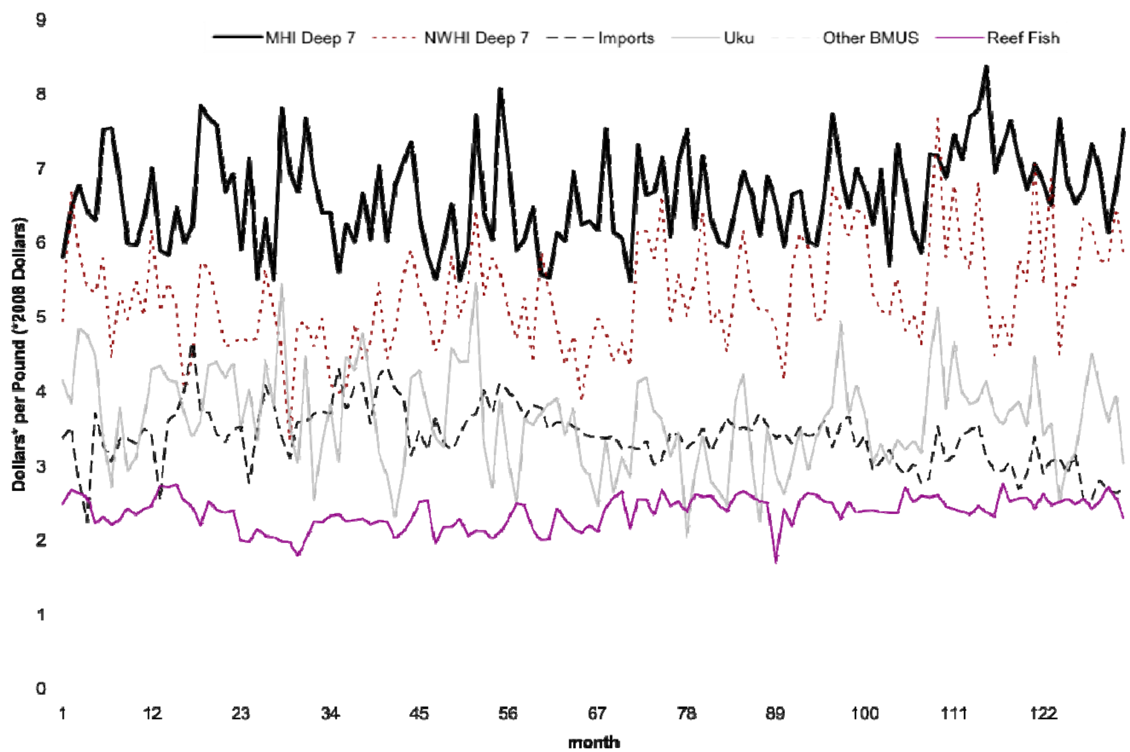


Figure 8: Average Price of Deep 7 Bottom fish in comparison to other Hawaiian caught and imported fish by month from 1996 to 2006, expressed in 208 dollars. The x axis is month, starting at 2006. From Hospital and Pan 2009.

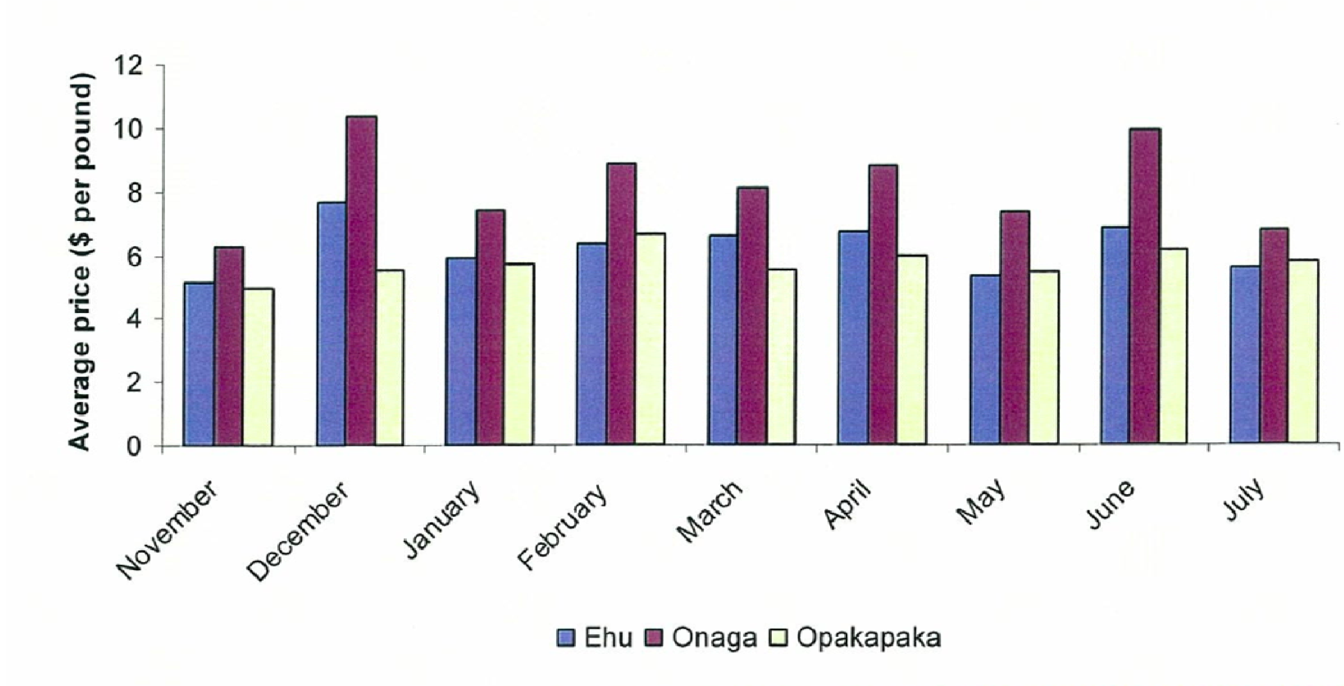


Figure 9: Average Price monthly per pound for Longtail snapper and 2 other "Deep 7" bottom fish species during 2008 (from Bottomfish News, Vol 6, 2008)

Commercial Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass landings have been recorded since 1948 and (Figure 10). Pink snapper historically and currently represents the largest percentage of Deep 7 landings. Its landings peaked in 1989 at 362,051 lbs, declining through the 90s. Longtail snapper, the highest valued Deep 7 fish, reached its peak in 1986 at 235,412 lbs, declining to a low of 86,040 in the early 1990s. (PIFSC 2011) In 1998 Hawaii instituted regulations for state waters (also affecting federal waters because all bottomfish from Federal and State fish are landed in the State and recorded as a combined catch) to control catch of the 7 bottomfish species that would become the Deep 7 fishery. Hawaii's Title 13, subtitle 4, Chapter 94 instituted non-commercial bag limits, boat license requirements, gear limitations and created Bottomfish Restricted Fishing Areas (BRFAs) throughout the MHI that were closed to bottomfishing (see Figure 6). In 2005, as members of the Deep 7 species complex, Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass were recognized by the National Marine Fisheries Service as overfished by 24% of their overall MSY in the MHI. This prompted the first closure of the Deep 7 fishery in 2007 while a long term management plan was developed. Federal regulations (73 FR 18450, 73 FR 41296, and 50 CFR Part 665) were set for the Deep 7 fishery in 2008, and encompass a commercial Total Allowable Catch (TACs for 2007 to current year listed in Figure 11), non-commercial permit and reporting requirements, and a required closed season to coincide with peak spawning times (Federal Register April 4, 2008) (however, throughout the year there is always a Deep 7 species spawning).

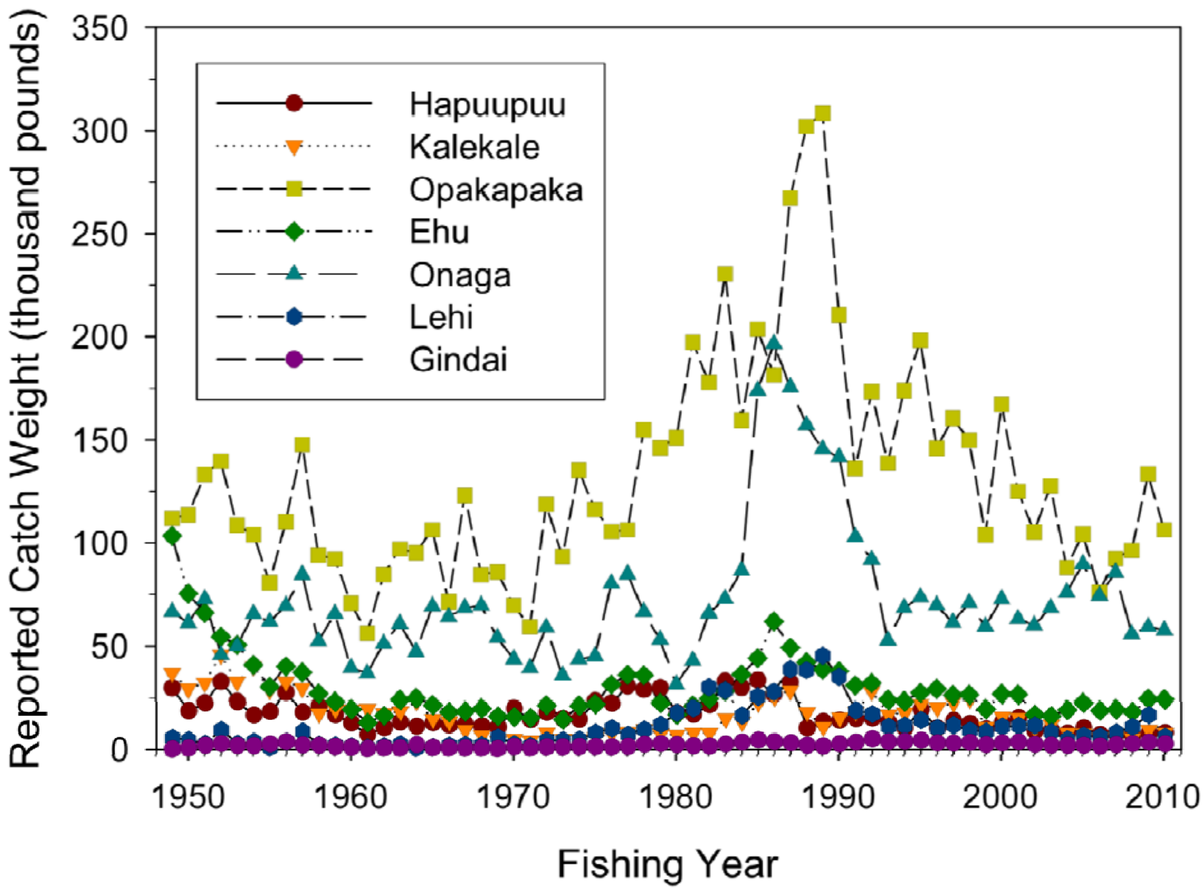


Figure 10: Reported Catches of the Deep 7 bottom fish, including Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass from 1948 to 2010. Note that catches crest in the 1980s then start to plummet, reaching a lower stable catch in the mid 1990s. Figure from Brodziak et al. 2011)

Year	No. Vessels	Year	No, Vessels	Year	No. Vessels
1948	207	1968	116	1988	572
1949	196	1969	130	1989	537
1950	164	1970	219	1990	501
1951	126	1971	198	1991	469
1952	110	1972	185	1992	407
1953	106	1973	238	1993	403
1954	103	1974	241	1994	423
1955	108	1975	295	1995	400
1956	106	1976	306	1996	487
1957	102	1977	377	1997	502
1958	96	1978	414	1998	498
1959	76	1979	423	1999	483
1960	69	1980	461	2000	495
1961	65	1981	430	2001	404
1962	98	1982	526	2002	386
1963	110	1983	541	*2003**	325
1964	87	1984	558	*M*	465
1965	85	1985	583	*SD*	66
1966	97	1986	538		
1967	99	1987	535		

Figure 11: Number of commercial fisherman in the MHI bottomfish fishery from 1948 to 2003. From the DSEIS 2006

In recent years, concerns have been raised over the occurrence of underreporting in the commercial bottomfish catch, and high levels of unrecorded non-commercial fishing (or recreational fishing) that are not counted towards the commercial TAC. Zeller et al. 2008 estimated the commercial catch as 28 to 128 percent higher than reported, and the non-commercial catch as 210 percent higher than the reported commercial catch. Other studies have also addressed the non-commercial catch (Hamm and Lum 1992, Martell et al. 2006, Zeller et al., 2005, 2007, Lamson 2007, Courtney and Brodziak 2011). Until the most recent stock assessment in 2011 (Broziak et al.), underreporting in the commercial bottom fishery and non-reporting in the recreational fishery were not taken into account.

The most recent stock assessment is more sophisticated than earlier assessments, and recommends a higher Deep 7 TAC than any previous year (383,000lbs) based on its finding that stocks are not overfished. This figure represents a 50% chance of overfishing the stock. Unlike previous years, the 2011 assessment 1) did take underreporting and non-commercial catch into account, 2) assessed the Deep 7 stock separately from other bottomfish stock, 3) assessed the Main Hawaiian Island stock independently from the Northwest Hawaiian Island stock and 4) revised its lifespan estimates for the species complex upward to reflect new research on one of the Deep 7 species (Brodziak et al. 2011).

As of this year, the Deep 7 fishery will be managed by an ACL (Annual Catch Limit) instead of by TAC, as required by the Magnuson Stevens Act (MSA). The chosen 2011–2012 ACL of 325,000 pounds, represents a 20 percent increase over last year's 254,000 pound TAC, but is lower than the 383,000 figure the WPRFMC recommended in March 2011 (Shikina 2011). An ACL differs from a TAC in that it incorporates both scientific and management uncertainty, as well as social and ecological factors (WPRFMC 2011c). Scientific uncertainty is incorporated by setting a P* level less than or equal to 50 percent of the Overfishing Limit (OFL), and is the acceptable risk of overfishing used to set an Acceptable Biological Catch (ABC), which in this case is the same as the ACL. Even though there is a current stock assessment for the complex, a P* of 41.5 percent (indicating a probability of 41.5% of exceeding the overfishing limit) was chosen due to the Deep 7 fishery's lack of the following: fishery independent data, spatially explicit fishery catch data, tagging data, an accounting system for depredation, species specific CPUE (Catch per Unit Effort) data and an acceptable reliability of non-commercial catch data (WPRFMC 2011c). The ACL can be reduced further to account for management uncertainty; in this case the ACL was reduced by a further 6%, bringing the risk of overfishing to 36% (WPRFMC 2011b). If set correctly, this ACL will result in a reduced chance of overfishing in the future, provided that similar levels of ACL are implemented at the recommendation of future stock assessments.

Scope of the analysis and the ensuing recommendation:
This report evaluates the ecological sustainability of the Hawaiian (United States) fisheries for Pink snapper or pink snapper (*Pristipomoides filamentosus*), Longtail snapper or ruby snapper (*Etelis coruscans*), ehu or squirrelfish snapper (*Etelis carbunculus*), Hawaiian sea bass or hapu'upu'u (*Epinephelus quernus*). These four species are members of the Deep 7 Bottomfish Complex, of which there are seven species. In particular we focus on the MHI fishery, as the NWHI fishery is now closed. These species are caught in other countries, imported to and sold in Hawaii to meet consumer demand, but those stocks are not evaluated in this report. As of the Draft 2011 Stock Assessment, commercial and non-commercial fishing for these species occurred throughout the deep slope regions off the MHI, except in BRFAs (described in the introduction). All species considered here are caught by hook and line (vertical line) only.

Availability of Science

Collecting life history information on Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass is difficult given that these species live at such great depth, beyond the reach of traditional scuba survey techniques. However, the Deep 7 bottomfish species are currently the focus of new, government funded scientific research in the Main Hawaiian Islands, and it is clear that more information will be available on these species in the near future. At this time, new information is emerging about these species. Chris Kelley and his team at the Hawaii Underwater Research Lab (HURL) are carrying out one large effort involving submersible-based work. This team is recommending new areas of Essential Fish Habitat (EFH) which will form the basis for new bottomfish restricted fishing areas in the Main Hawaiian Islands. EFH definitions for Hawaiian bottomfish species have been under review this year by the WPRFMC. (WPRFMC 2011d) New findings include information about habitat needs, namely that Longtail snapper adults and juveniles require high porosity rocky benthos, and that they feed above this substrate in large aggregations. This team has also found through underwater mapping, that the current set of bottomfish restricted fishing areas do not adequately cover this type of habitat. Some of this team's information has been published for the Northwest Hawaiian Islands, but no published information is available for the Main Hawaiian Island work, only PowerPoint presentations and website information is available. Bob Humphries and NOAA scientists are currently gathering information on the age and growth of juvenile and large adults of the Deep 7 complex, which has revealed new information on the maximal age of Pink snapper. (Lawai'a 2010) While previously thought to live a maximum of 18 years, isotope data has revealed that Pink snapper may live to at least 45 years of age (Andrews and Humphries in Brodziak et al. 2011). The Pacific Islands Fisheries Group, have been working on a Deep 7 tagging program, with a goal of tagging 2000 fish in order to gather scientific data on fish growth and movement inside and outside of the BRFA's. (Lawai'a, 2010) As of the writing of this report, no reports have been generated by the tagging project, and it is uncertain whether or not it is completed.

Other than this new habitat and associated behavioral information and the new age data for Pink snapper, very little is known about these four species, particularly in reference to the life history characteristics of the larval and juvenile stages, as well as of the large adults. Without further research on age and growth, it is difficult to predict how this species will respond to sustained or increased fishing pressure.

The deep-water habitat that Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass live in makes collecting data on these species difficult. More knowledge is needed about many of its life history parameters, especially age and growth, and size at entry to the fishery. Larval dispersal and movement patterns of all life stages of Longtail snapper need to be further studied. Even though the range of Longtail snapper includes most of the Indo-Pacific, their slow growth and relatively high age at sexual maturity, combined with the tendency to be aggregated in specific areas, makes them susceptible to localized depletion if the stocks are not managed carefully. Severe localized depletions have been documented in the main Hawaiian Islands, prompting the State of Hawaii to create several closed areas for the protection of Longtail snapper spawning stock biomass (DLNR 2002).

Most of the literature on the Deep 7 species is grey, with the majority of the information on these species available from NOAA documents authored by scientists at the Pacific Islands Fisheries Science Center, which addresses these species as a complex rather than on an individual basis. Stock assessments for Deep 7 bottomfish are available, with the most current report published in draft form in March 2011. Additional information is available from the Western Pacific Fisheries Management Council (WPFMC), and the Hawaiian Department of Land and Natural Resources (DLNR). There are a number of peer-reviewed publications on deep-water snappers by Ralston from the 1980s (1982, 1986, 1987) and Everson (1989) that form what we do know about the biology of these species.

Market Availability

Common and market names:
Opakapaka, Pink Snapper, Hawaiian Pink Snapper, Crimson Snapper, Crimson Jobfish
Onaga, Ruby Snapper, Long tail Red Snapper, Bright Redfish, Crimson Snapper, Scarlett Snapper, Lavender Jobfish, Red Snapper
Ehu, ‘Ula ‘ula, Squirrelfish Snapper, Red Snapper, Short Tail Red Snapper, Yellowstriped Red Snapper
Hapu’upu’u, Hapu’u, Hawaiian Sea Bass, Hawaiian Grouper, Hawaiian Black Grouper, Seale’s Grouper

Seasonal availability:
Year-round, or until catch limit is reached. In closed season (and often during open season) the snappers are substituted by imported snapper species from the Western Pacific. The highest demand for these Deep water fish occurs during holidays. They are also consumed on special occasions (WPRFMC 2010).

Product forms:

Fresh and frozen

Import and export sources and statistics:
Deep water (including the Pink snapper, Longtail snapper and Squirrelfish snapper) and other snappers are imported from the Western Pacific and Indian Ocean to meet Hawaiian demand. Countries importing snappers into Hawaii include: Australia, Fiji, Indonesia, Japan, Kiribati, New Zealand, Oman, Philippines, Singapore, Tonga, Vietnam, and Western Samoa. (NMFS Trade Statistics). (Figure 12 below) The majority of these fish are imported fresh. The highest quantity of imported snapper comes from Tonga, which superseded Australia as the largest importer in 2004. The highest quantity of imported grouper comes from New Zealand. In 2008, imports accounted for more than 50 percent of the Hawaii bottomfish market (WPRFMC 2010). All Pink snapper, Longtail snapper, Squirrelfish snapper, and Hawaiian sea bass caught in Hawaii are consumed on the islands (WPRFMC 2009).

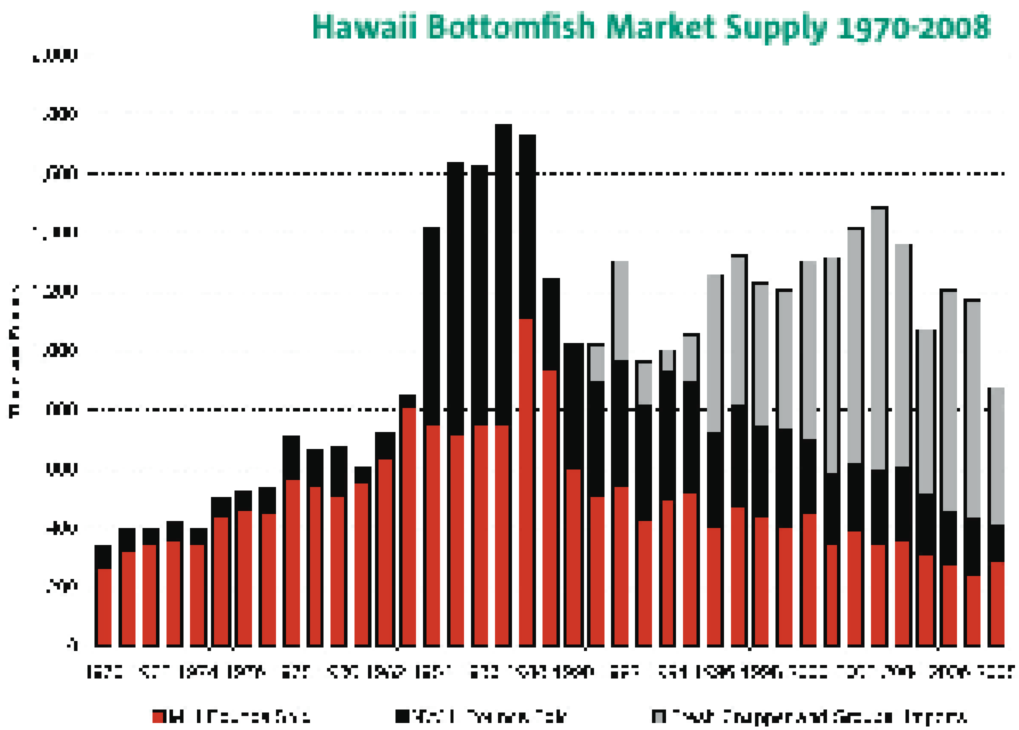


Figure 12: Pounds of snapper and grouper sold in the Hawaii bottomfish market, including Main Hawaiian Island catch, NWHI catch and imported snapper and grouper for 1970 to 2007. From Hawaii Division of Aquatic Resources, National Marine Fisheries Service, US Census Bureau Foreign Trade Division in WPRFMC 2010.

III. Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species

Criterion 1: Inherent Vulnerability to Fishing Pressure

Guiding Principle: Sustainable wild-caught species have a low vulnerability to fishing pressure, and hence a low probability of being overfished, because of their inherent life history characteristics.

Primary Factors[3] to evaluate

Intrinsic rate of increase ('r')

- High (> 0.16)
- Medium (0.05–0.16)
- Low (< 0.05)
- Unavailable/Unknown

[3] These primary factors and evaluation guidelines follow the recommendations of Musick et al. (2000). Marine, estuarine, and diadromous fish stocks at risk of extinction in North America (exclusive of Pacific salmonids). Fisheries 25:6-30.

Key relevant information

An "r" between 0.05 and 0.15 was used in the 2011 Deep 7 Bottom fish Stock Assessment for all Deep 7 species because that rate is typical for low productivity/slow growing fish (Musick et al 1999) and because it is consistent with recent research carried out on Pink snapper (*Pristipomoides filamentosus*). In 1998, the NOAA Fisheries Honolulu Laboratory, in response to the requirements of the Sustainable Fisheries Act, estimated growth and mortality rates of the Deep 7 species using procedures outlined in Ralston (1987). Using linear and functional regression formulas for the relationship between the von Bertalanffy growth coefficient (k) and natural mortality rate (M), they calculated intrinsic rate of increase (r) and natural mortality (M) for Longtail snapper at 0.14 and 0.30, Squirrelfish snapper at 0.18 and 0.35 respectively (Haight 2005). There are no values of "r" for Pink snapper or Hawaiian sea bass. The 2011 draft Stock Assessment does not list an r for any of the Deep 7 species. (Brodziak et al. 2011)

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Haight, W. 2005. Seafood Watch Seafood Report: Red Snapper (Ehu) *Etelis carbunculus.*

Haight, W. 2005. Seafood Watch Seafood Report: Ruby Snapper (Onaga) *Etelis coruscans*.

Musick, J.A. (1999). Criteria to define extinction risk in marine fishes. Fisheries/The American Fisheries Society Initiative 24(12): 6-14

Ralston, S. 1987. Mortality rates of snappers and groupers. *In* J. J. Polovina and S. Ralston (editors), Tropical snappers and groupers: Biology and fisheries management, p. 375-404. Westview Press, Boulder, Colorado.

Other notes

Age at 1st maturity

- Low (< 5 years) **for Pink snapper**
- Medium (5–10 years) **for Longtail snapper and Hawaiian sea bass**
- High (> 10 years)
- Unavailable/Unknown **for Squirrelfish snapper**

Key relevant information

In general, deepwater snappers reach sexually maturity at approximately 50% of their total length (Grimes 1987). Based on length frequency data, it has been estimated that sexual maturity for Longtail snapper occurs at a length of about 66 cm. In the 2011 Stock Assessment report age at maturity for Pink snapper and Hawaiian sea bass as 3.5 years and >7 years respectively. The draft assessment cites no age at maturity for Longtail snapper or Squirrelfish snapper. (Brodziak et al. 2011) Longtail snapper's age at maturity has been estimated elsewhere as between 5–6 years (Ralston and Kawamoto from a 1987 NOAA report as cited in Everson et al. 1989). The basis for these estimates is unclear.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Everson, A.R., H.A. Williams, and B.M. Ito. 1989. Maturation and reproduction in two Hawaiian Eteline snappers, Uku, *Aprion virescens*, and Longtail snapper, *Etelis coruscans*. U.S. Fish. Bull. 87:877-888.

Grimes CB. 1987. Reproductive biology of Lutjanidae: a review. In: Polovina JJ, Ralston S, editors. Tropical snappers and groupers: biology and fisheries management. Boulder, CO: Westview Pr. p 239–94.

Other notes

Von Bertalanffy growth coefficient ('k')

- High (> 0.16) **for Pink snapper, Longtail snapper & Hawaiian sea bass**
- Medium (0.05– 0.15) **for Squirrelfish snapper**
- Low (< 0.05)
- Unavailable/Unknown

Key relevant information

The von Bertalanffy growth parameter K used for Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass in the 2011 Bottomfish stock assessment were given as the ranges: 0.15–0.25, 0.11–0.37, 0.06–0.19 and 0.16–0.23 respectively (Brodziak et al. 2011).

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

Maximum age

- Low (< 11 years)
- Medium (11–30 years) **for Longtail snapper, Squirrelfish snapper & Hawaiian sea bass**
- High (> 30 years) **for Pink snapper**
- Unavailable/Unknown

Key relevant information

There have been few aging studies on the Deep 7 species, with little to no age information available for juvenile specimens. A recent aging study was carried out on Pink snapper (*Pristipomoides filamentosus*) found, using radiocarbon and lead isotope dating techniques, that maximum age may exceed 45 years old (Figure 13 below), whereas previous studies had yielded maximum age of approximately 15 years (Andrews and Humphreys unpublished data, Ralston and Miyamoto 1983 in Brodziak et al. 2011). The 2011 draft stock assessment lists the following maximum ages for Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass: ≈40 years, 13 years, 13 years and 11 years. (Brodziak et al. 2011)

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

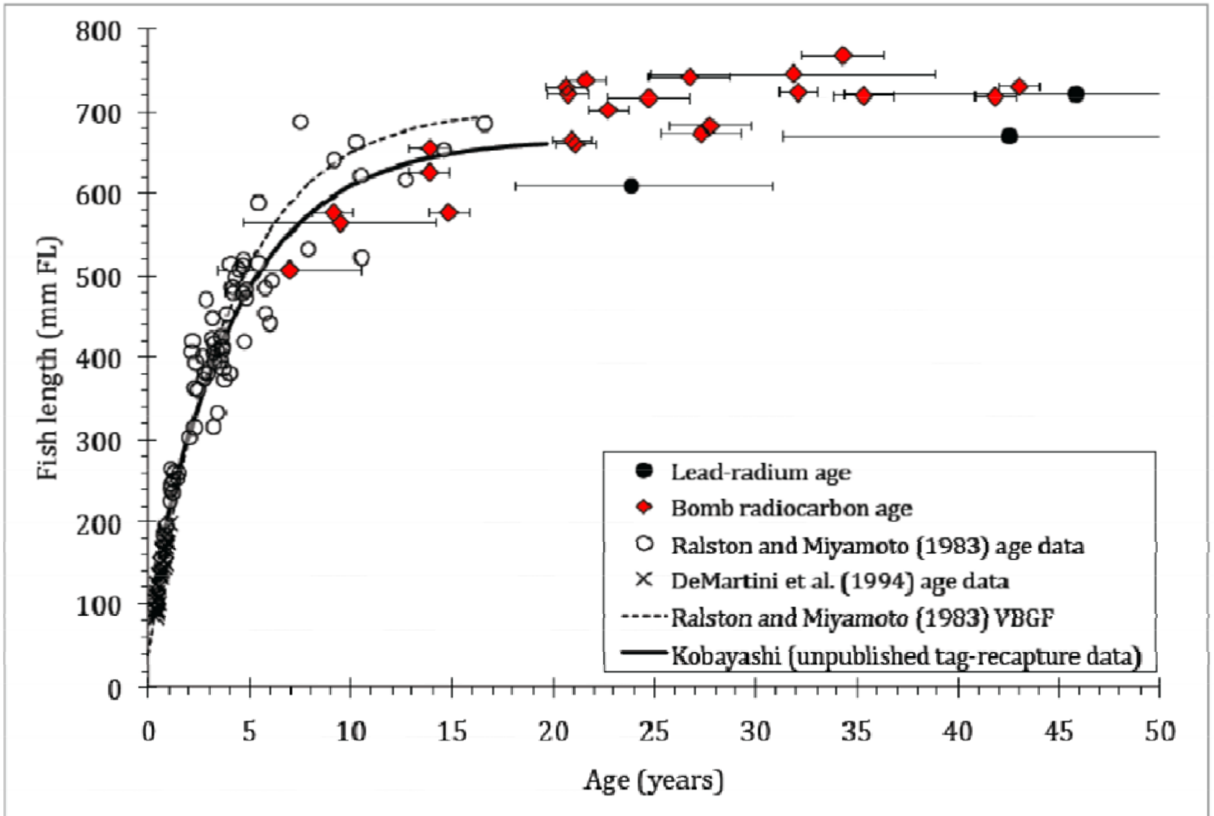


Figure 13: (Brodziak et al. 2011)

Reproductive potential (fecundity)

- High (> 100 inds./year)
- Moderate (10–100 inds./year)
- Low (< 10 inds./year)
- Unavailable/Unknown

Key relevant information

Gonadal studies on four snapper species in Hawaii indicate that spawning may occur serially over a protracted period but is at a maximum during the summer months starting in June, peaking from July to September, continuing through November (Everson et al. 1989; Kikkawa 1984; Uchida and Uchiyama 1986) (Figure 14). Estimated annual fecundity is 0.5 to 1.5 million eggs. The 2011 stock assessment report estimates fecundity as $\geq 10^5$ per year, but it is unlikely that this estimate takes larval survival rates into account. The recent aging study on Pink snapper (cited above in Brodziak et al. 2011) suggests that this species, which matures early in its life, may be highly fecund over its lifetime, more so than the shorter lived Deep 7 species.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Everson, A.R., H.A. Williams, and B.M. Ito. 1989. Maturation and reproduction in two Hawaiian Eteline snappers, Uku, *Aprion virescens*, and Longtail snapper, *Etelis coruscans*. U.S. Fish. Bull. 87:877-888.

Kikkawa, B.S. 1984. Maturation, spawning, and fecundity of Squirrelfish snapper, Etelis carbunculus, in the Northwestern Hawaiian Islands. pp. 149-160 In: Grigg, R.W. and K.Y. Tanoue (Eds.). Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands. Vol. 2. University of Hawaii Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-84-01. Honolulu, Hawaii

Uchida, R.N. and J.H. Uchiyama (Eds.). 1986. Fishery Atlas of the Northwestern Hawaiian Islands. NOAA Technical Report NMFS 38. 142 pp.

Other notes

BOTTOMFISH SPAWNING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Opakapaka Spawning Season						XXX	XXX	XXX	XXX	XXX	XXX	XXX
Onaga Spawning Season						XXX	XXX	XXX	XXX	XXX	XXX	
Uku Spawning Season					XXX	XXX	XXX	XXX	XXX	XXX		
Ehu Spawning Season							XXX	XXX	XXX			
Hapu'upu'u Spawning Season	XXX	XXX	XXX	XXX	XXX	XXX						

Figure 14: Spawning season for Longtail snapper and other bottomfish species. Note that Longtail snapper spawns from June through November, recalling that the Deep 7 fishery season generally opens September 1 each year.

Secondary Factors to evaluate

Species range

- Broad (e.g. species exists in multiple ocean basins,
- has multiple intermixing stocks or is highly migratory) **Pink snapper, Longtail snapper, Squirrelfish snapper**
- Limited (e.g. species exists in one ocean basin)
- Narrow (e.g. endemism or numerous evolutionary significant units or restricted to one coastline) **Hawaiian sea bass**

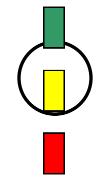
Key relevant information
Pink snapper, Longtail snapper and Squirrelfish snapper are widely distributed across the Western Pacific to Indian Oceans, with populations ranging latitudinally from Japan to Australia and longitudinally from East Africa to Hawaii (Froese and Pauly 2011). Hawaiian sea bass is endemic to the Hawaiian archipelago and Johnston Atoll (Fishbase 2011).

Reference(s)
Froese, R. and D. Pauly. Editors. 2011. FishBase. World Wide Web electronic publication. www.fishbase.org, version (06/2011).

Other notes

Special Behaviors or Requirements: Existence of special behaviors that increase ease or population consequences of capture (e.g. migratory bottlenecks, spawning aggregations, site fidelity, unusual attraction to gear, sequential hermaphrodites, segregation by sex, etc., OR specific and limited habitat requirements within the species' range).

- No known behaviors or requirements OR behaviors that decrease vulnerability (e.g. widely dispersed during spawning)
- Some (i.e. 1–2) behaviors or requirements
- Many (i.e. > 2) behaviors or requirements



Key relevant information

Essential Fish Habitat for the Deep 7 bottomfish complex is currently being delineated (WRFMC 2011d), which will set forth the requirements of the different life history stages of this species. There are currently 12 Bottomfish Restricted Areas (BRFAs) closed to fishing throughout state waters the Main Hawaiian Islands (Hawaii Administrative Rules §13-94-8). These areas were set up to conserve the spawning populations of bottomfish (Hawaii Administrative Rules §13-94-8). Pink snapper, Longtail snapper and Squirrelfish snapper typically occur in large aggregations over rocky bottom (O'Conner and Kelley 2008), and tropical snappers generally spawn in aggregations. Hawaiian sea bass is a protogynous hermaphrodite (O'Conner and Kelley 2008)—it starts out life as a female then becomes a male later in life. Longtail snapper and Squirrelfish snapper feed in the water column while Hawaiian sea bass and Pink snapper remain closer to the substrate. (O'Conner and Kelley 2008)

Reference(s)

Hawaii Administrative Rules, Title 13, Department of Land and Natural Resources, Title 4 Fisheries, Part V Protected Marine fisheries Resources, Chapter 94, Fisheries Management

O'Conner, R. and C. Kelley (2008). Bottomfish Habitat and Restricted Fishing Area Analysis. Powerpoint presentation. http://www.slideshare.net/higicc/bottomfish-habitat-and-restricted-fishing-area-analysis

WPRFMC. 2011d. Memorandum. Action item summary for the 151st Council Meeting. May 27, 2011.

Other notes

Quality of Habitat: Degradation from non-fishery impacts

- Habitat is robust
- Habitat has been moderately altered by non-fishery impacts
- Habitat has been substantially compromised from non-fishery impacts and thus has reduced capacity to support this species (e.g. from dams, pollution, or coastal development)

Key relevant information

Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are found in deepwater benthic environments, which generally are not subject to non-fishery impacts. Pink snapper is found 30–360 m (Kami 1973; Moffitt 1993), Longtail snapper between 90 and 400 meters (Froese and Pauly 2011), Squirrelfish snapper between 90 and 350 m (Allen 1985; Everson 1984; Ralston and Polovina 1982) and Hawaiian sea bass between 20 and 380 m (DLNR 2001)

Reference(s)

Allen, G. R. 1985. FAO species catalogue. Volume 6. Snappers of the world. FAO. 208p.
DLNR. 2001. Current Line Fish Facts for Bottom Fishes of Hawaii
Everson, A.R. 1984. Spawning and gonadal maturation of the Squirrelfish snapper, Etelis carbunculus, in the Northwestern Hawaiian Islands. pp. 128–148 *In*: Grigg, R.W. and K.Y. Tanoue (Eds.). Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands. Vol. 2. University of Hawaii Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-84-01. Honolulu, Hawaii.
Froese, R. and D. Pauly. Editors. 2011. FishBase. World Wide Web electronic publication. www.fishbase.org, version (06/2011).
Kami, H.T. 1973. The *Etelis* (Pisces: Lutjanidae) of Guam with notes on their biology. Micronesica 9(1):97–117.
Moffitt, R.B. 1993. Deepwater demersal fish. In: Wright A, Hill L, editors. Nearshore marine resources of the South Pacific, 73–95, FFA, Honiara. Suva: Institute of Pacific Studies; Honiara: Forum Fisheries Agency; Canada: International Centre for Ocean Development.
Ralston S, Polovina JJ. 1982. A multispecies analysis of the commercial deep-sea handline fishery in Hawaii. Fish Bull 80(3):435–48.

Other notes

Synthesis
Much is unknown or uncertain about the life history characteristics of Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass, making it difficult to assess the above criteria effectively. While estimates of “r” and “k” are given in grey literature, it is possible that these are higher than actual values. Given that new evidence exists that Pink snapper’s lifespan is four times as long as formerly estimated, it is possible that the other deep water snappers (Longtail snapper and Squirrelfish snapper) are also longer lived and slower growing, which would bring down estimates of “r” and “k”. Based on the best currently available data, however, Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are considered moderately vulnerable to fishing, due to their moderate intrinsic rate of increase, age at maturity, and growth rate.

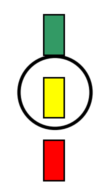
Evaluation Guidelines

1) Primary Factors
   a) If ‘r’ is known, use it as the basis for the rank of the Primary Factors.
   b) If ‘r’ is unknown, then the rank from the remaining Primary Factors (in order of importance, as listed) is the basis for the rank.

2) Secondary Factors
   a) If a majority (2 out of 3) of the Secondary Factors rank as Red, reclassify the species into the next lower rank (i.e. Green becomes Yellow, Yellow becomes Red). No other combination of Secondary Factors can modify the rank from the Primary Factors.
   b) No combination of primary and secondary factors can result in a Critical Conservation Concern for this criterion.

Conservation Concern: Inherent Vulnerability

- Low (Inherently Resilient)
- Moderate (Moderately Vulnerable)
- High (Highly Vulnerable)



Criterion 2: Status of Wild Stocks

Guiding Principle: Sustainable wild-caught species have stock structure and abundance sufficient to maintain or enhance long-term fishery productivity.

Primary Factors to evaluate

Management classification status

- Underutilized OR close to virgin biomass
- Fully fished OR recovering from overfished OR unknown
- Recruitment or growth overfished, overexploited, depleted or "threatened"

Key relevant information

In 2005 NMFS notified the WRPMC that overfishing of the Deep 7 species complex was occurring, and that it would become overfished if the current level of fishing mortality were to be maintained (70 FR 34452). Two analyses confirmed this declaration, using catch data spanning back to 1948. The first was from NOAA, and compared the estimated size of the fish stock in a given year to the size of the fish stock that would produce MSY, using Catch Per Unit Effort (CPUE) as a proxy for the size of the fish stock. The current CPUE was found to be 40–50 percent less than it would be at MSY. The second was from the University of British Columbia, and it compared fishing mortality in a given year with the fishing mortality that would produce MSY, using the number of days fished as a proxy for fishing mortality. The current fishing mortality (number of days fished) to produce a given catch was found to be about twice the level of effort that would maintain MSY. (WPRFMC, 2007c) As a result of these analyses, NMFS issued a temporary rule to close the fishery from May 15 through September 30, 2007 due to overfishing while management measures were being crafted (72 FR 27065). Since the MHI fishery's reopening, the MHI and NWHI fishery take has been controlled by a joint Total Allowable Catch limit (TAC) and an established fishing season that opens on September 1st, and closes once the TAC has been reached or by August 31st, as well as other management measures (73 FR 18450). Since the first TAC was put in place, the fishery has remained open for an average of 6.125 months (Figure 15). The fishery is said to be recovering, with the current stock assessment recommending a TAC 1.5 times higher than the current year (which would only cover the MHI since the NWHI is permanently closed as of June 15, 2011), representing a 50% risk of overfishing (Brodziak et al. 2011). While it may appear that the Deep 7 stock is faring well, it is possible that some of the species in the complex recover at slower rates than other Deep 7 species. For example, Longtail snapper's total catch has decreased since 2007 as the combined annual TAC has progressively increased. Also, it may be telling that NMFS recently issued a final ruling that it can close the Deep 7 fishery within 7 days, rather than the original 14 days allowed once it is forecast (based on catch data) that the TAC will be reached (76 FR 15222 amending 50 CFR Part 665)

This ranking also takes into consideration that the NWHI is now closed to bottomfishing. The NWHI and MHI bottomfish stocks are connected via an interchange of larvae/eggs, and likely adults (Moffitt et al. 2006), so that recruits from the NWHI may act to replenish the formerly overfished stock in the MHI.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.
"Hawaiian Bottomfish and Seamount Groundfish Fisheries; Modifications of Fisheries Closures" 76 Federal Register 54 (26 March 2011) pp. 15222-15223.
"Fisheries in the Western Pacific; Bottomfish and Seamount Groundfish Fisheries; Closed Season" 72 Federal Register 94 (14 May 2007) pp. 27065–27067.
"Fisheries in the Western Pacific; Bottomfish and Seamount Groundfish Fisheries; Management Measures in the Main Hawaiian Islands" 76 Federal Register 66 (4 April 2008) pp.18450–18460.
"Fisheries off West Coast States and in the Western Pacific; Bottomfish Fisheries; Overfishing Determination on Bottomfish Multi-Species Stock Complex; Hawaiian Archipelago" 70 Federal Register 113. (14 June 2005) pp. 34452–34453.
Moffitt, R., D. Kobyashi, and G. DiNardo. 2006. Status of the Hawaiian bottomfish stocks, 2004. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-06-01, 45 p.
WPRFMC. 2007c. The Science behind the Overfishing Determination for MHI Bottomfish.

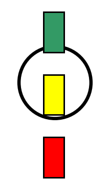
Other notes

Year	Total allowable catch	Final landings	Opening date	Closing date	Season length
2007-2008	178,000 lbs	195,861 lbs	Oct. 1, 2007	April 16, 2008	6.5 months
2008-2009	241,000 lbs	258,544 lbs	Nov. 15, 2008	July 6, 2009	7.75 months
2009-2010	254,050 lbs	208,369 lbs*	Sept. 1, 2009	April 20, 2010	7.75 months
2010-2011	254,050 lbs	267,569 lbs**	Sept. 1, 2010	March 12, 2011	6.5 months
2011-2012	383,000 lbs***		Sept. 1, 2011		

Figure 15: Total Allowable Catch limits, Final Landings and Season Dates for the Deep 7 Bottomfish Fishery (figure from Pacific Island Fishery News 2011). From Figure 10 above, the corresponding Longtail snapper landings for years listed were: 2007 (79,428)m 2008 (71,590), 2009 (65,709), 2010 (58,422). The corresponding Pink snapper landings for the years listed were: 2007 (87,362), 2008 (95,861), 2009 (132,276), 2010 (104,867). (PIFSC 2011) As the TAC has risen, the percent of Longtail snapper of the total catch has decreased, while the percent of Pink snapper has increased.

Current population abundance relative to B_{MSY}

- At or above B_{MSY} (> 100%)
- Moderately Below B_{MSY} (50%–100%) OR unknown
- Substantially below B_{MSY} (< 50%)



Key relevant information
Based on the baseline population model used in the 2011 stock assessment, the current estimate for B_{MSY} for the combined Deep 7 MHI fishery is 14.49 million lbs, while the combined population carrying capacity is approximately double that at 27.24 million lbs. According to the stock assessment's baseline model, the stock is moderately below B_{MSY}, but is not depleted because B/B_{MSY} for 2010 was 0.92 (Figure 16). Also, the baseline model shows that the stock is not currently experiencing overfishing because H/H_{MSY} for 2010 was 0.58. (Brodziak et al. 2011). From the stock assessment it is unclear if B_{MSY} is informed by actual measurements or surveys of the stock, rather it appears to be estimated from catch data. The B_{MSY} and the carrying capacity of each individual species stock (Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass) is unknown because biomass estimates for the

entire stock are combined and assessed as one unit.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

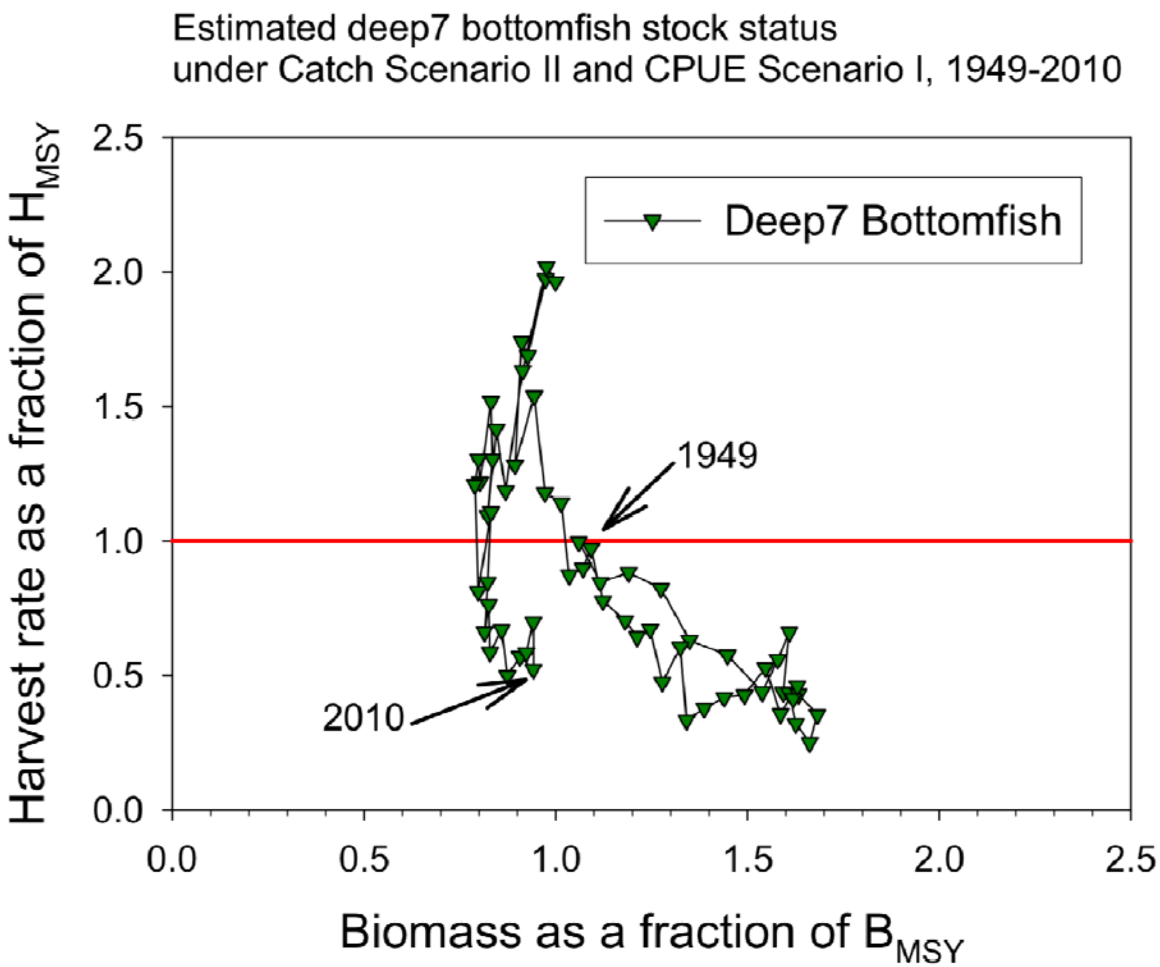


Figure 16: A plot of biomass as a fraction of B_{MSY} against harvest rate as a fraction of H_{MSY}. The current stock biomass is just below B_{MSY}, B/B_{MSY} for 2010 is 0.92, from Brodziak et al. 2011

Occurrence of overfishing (current level of fishing mortality relative to overfishing threshold)

- Overfishing not occurring ($F_{curr}/F_{msy} < 1.0$)
- Overfishing is likely/probable OR fishing effort is increasing with poor understanding of stock status OR Unknown
- Overfishing occurring ($F_{curr}/F_{msy} > 1.0$)

Key relevant information

The harvest rate (F_{curr}) of the Deep 7 Fishery is below F_{MSY}. As stated above, the baseline model shows that the stock is not currently experiencing overfishing because H/H_{MSY} (the equivalent of F_{curr}/F_{msy}) for 2010 was 0.58. (Brodziak et al. 2011) (Figure 16 above). Individually, it is not possible to say if okapakapa, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are experiencing overfishing because the complex is assessed as one stock.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

Overall degree of uncertainty in status of stock

- Low (i.e. current stock assessment and other fishery-independent data are robust OR reliable long-term fishery-dependent data available)
- Medium (i.e. only limited, fishery-dependent data on stock status are available)
- High (i.e. little or no current fishery-dependent or independent information on stock status OR models/estimates broadly disputed or otherwise out-of-date)

Key relevant information

Reliable long-term fishery dependent data is available and is incorporated into the 2011 Draft Stock Assessment. (Brodziak et al. 2011) Currently, there is no fishery independent data available. The most recent stock assessment factored unreported commercial catch and non-commercial catch into its calculations, which prior stock assessments did not do.

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

Long-term trend (relative to species' generation time) in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up
- Trend is flat or variable (among areas, over time or among methods) OR Unknown
- Trend is down

Key relevant information

For the four species: Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass, generation time is poorly quantified, but Pink snapper is now thought to live at least 45 years, while the others in the group are known to live at least ten years. According to CPUE data, the long-term trend (relative to the species' generation time) is down (Figure 17 below) (Brodziak et al. 2011). It is important to point out that when the Deep 7 fishery was closed in 2007 (after being declared overfished in 2005) its CPUE was 40 to 50 percent lower than it would be at MSY (WPRFMC 2007c).

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Western Pacific Regional Fisheries Management Council. 2007c. The Science behind the Overfishing Determination for MHI

Bottomfish.

Other notes

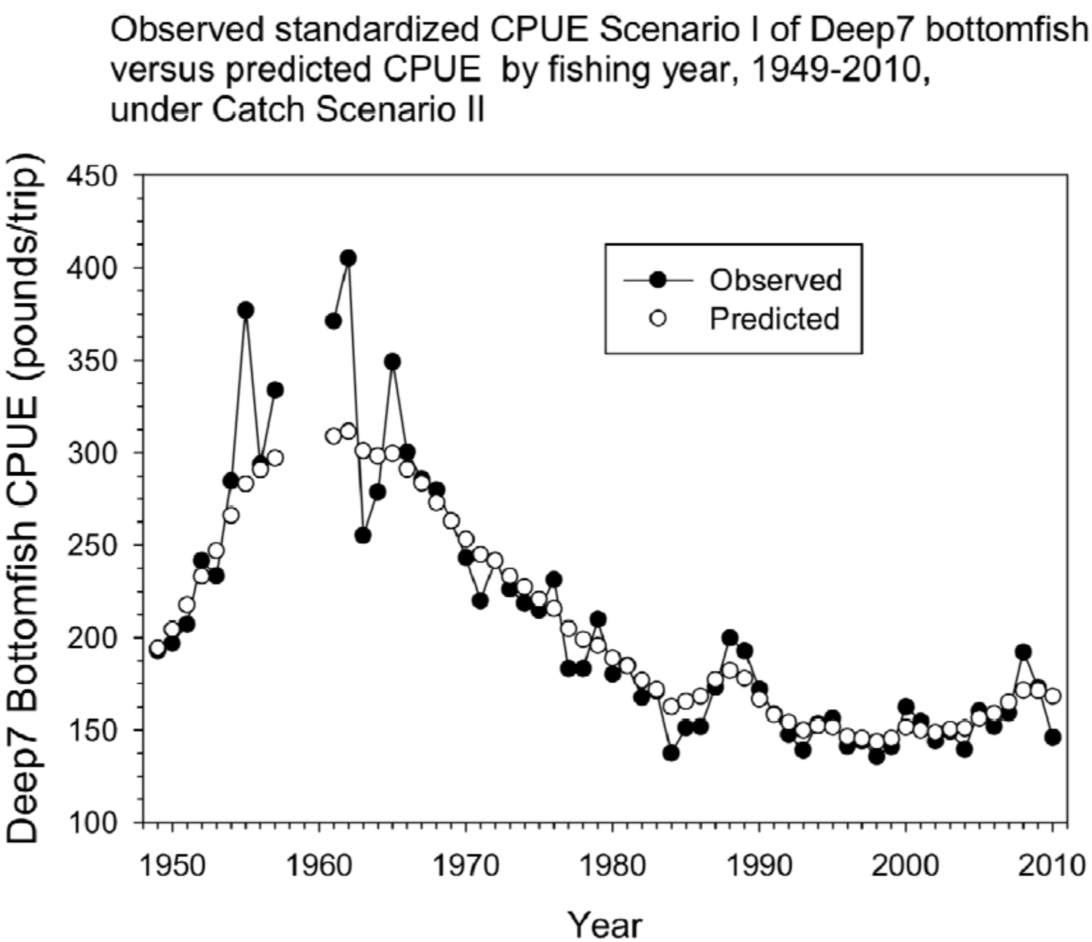


Figure 17: Deep 7 CPUE calculated from the baseline condition used in the 2011 Stock Assessment. From Brodziak et al. 2011

Short-term trend in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up
- Trend is flat or variable (among areas, over time or among methods) OR Unknown
- Trend is down

Key relevant information

Short-term trends in Deep 7 abundance as measured by CPUE data are flat. (Brodziak et al. 2011) (Figure 17 above)

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.

Other notes

Current age, size or sex distribution of the stock relative to natural condition

- Distribution(s) is(are) functionally normal
- Distribution(s) unknown
- Distribution(s) is(are) skewed

Key relevant information

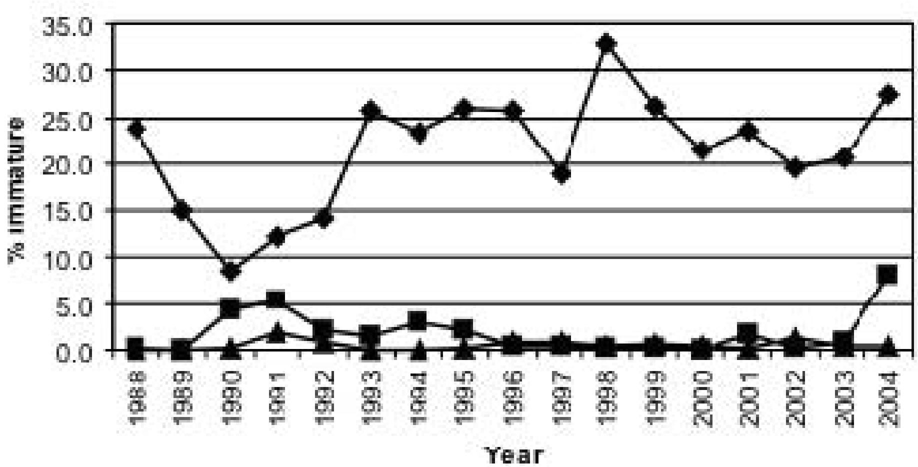
In 2000 approximately 84% of the Deep 7 catch was composed of juvenile fish (DLNR, year unknown), and it is not certain what percentage of the current catch is juvenile vs. adult. Given that little is known about the juvenile stage of Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass, and it is not well resolved at what age they enter the Deep 7 fishery, it is difficult to determine the distribution of the different lifestages of these species relative to the natural condition of these species. The proportion of the catch composed of immature fish has fluctuated over time but has not shown strong trends (Figure 18).

Reference(s)

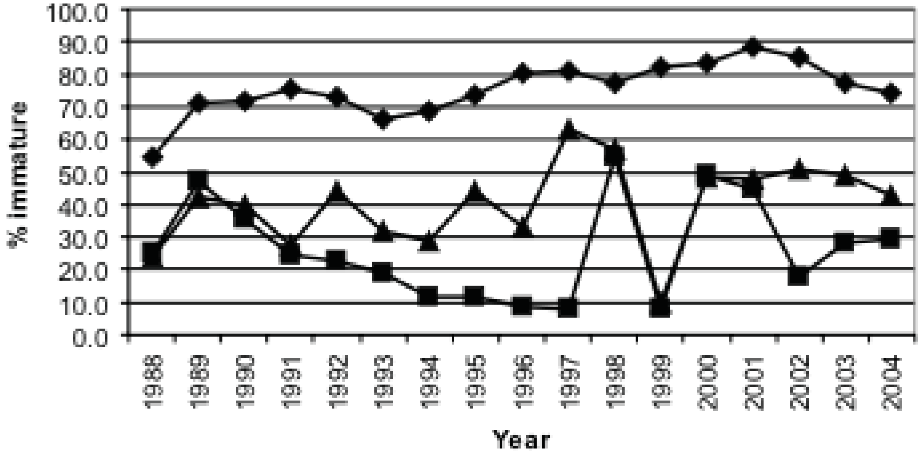
DLNR. Year unknown. Hawaii's Bottomfish Fishery.

Other notes

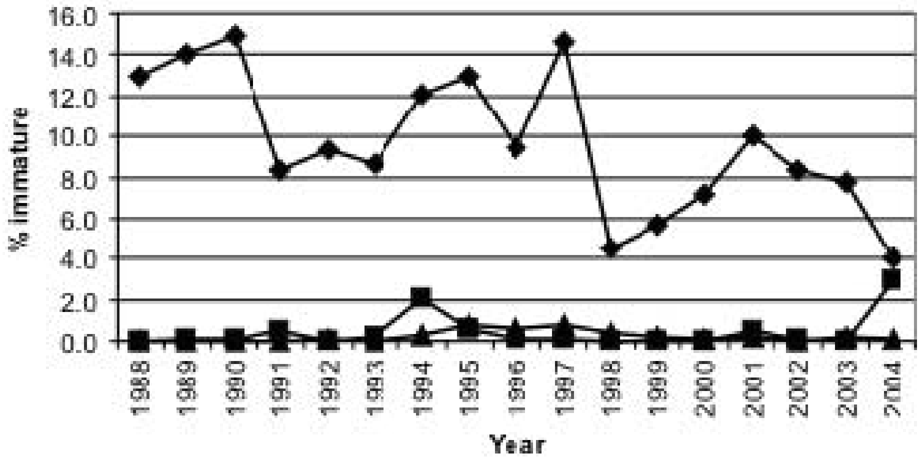
A) Pink snapper



B) Longtail snapper



C) Squirrelfish snapper



D) Hawaiian sea bass

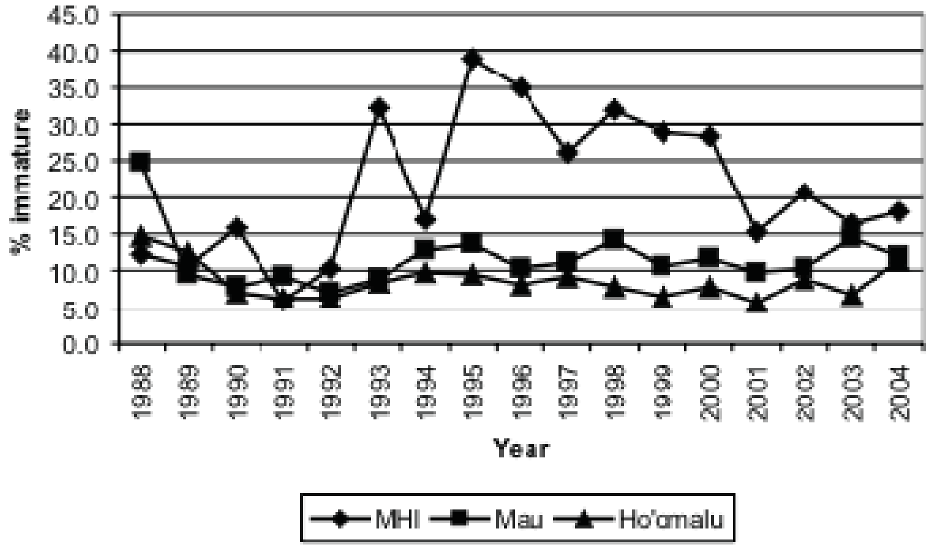


Figure 18: Percent of catch made up of immature fish for A)opakakapa, B)Longtail snapper, C)Squirrelfish snapper and D) Hawaiian sea bass. The MHI is currently the only active fishery, while the Mau and Ho'omalu zones are now closed. From WPRFMC 2007a.

Synthesis

The stock status of the Deep 7 species: Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are considered a moderate conservation concern because the current stock assessment model finds that their biomass is just below B_{MSY} (B/B_{MSY} = 0.92). At this B_{MSY} overfishing is not believed to be occurring at this time. However, because stock assessments are carried out on the complex as a whole, it is impossible to assess the stock status of Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass on an individual basis. Therefore the status of each individual species is uncertain, and it would be ideal if the stock could be assessed on a species by species basis.

Evaluation Guidelines

A "Healthy" Stock:

1) Is underutilized (near virgin biomass)

2) Has a biomass at or above BMSY AND overfishing is not occurring AND distribution parameters are functionally normal AND stock uncertainty is not high

A "Moderate" Stock:

1) Has a biomass at 50%–100% of BMSY AND overfishing is not occurring
2) Is recovering from overfishing AND short-term trend in abundance is up AND overfishing not occurring AND stock uncertainty is low
3) Has an Unknown status because the majority of primary factors are unknown.

A "Poor" Stock:

1) Is fully fished AND trend in abundance is down AND distribution parameters are skewed
2) Is overfished, overexploited or depleted AND trends in abundance and CPUE are up.
3) Overfishing is occurring AND stock is not currently overfished.

A stock is considered a **Critical Conservation Concern** and the species is ranked "Avoid," regardless of other criteria, if it is:

1) Overfished, overexploited or depleted AND trend in abundance is flat or down
2) Overfished AND overfishing is occurring
3) Listed as a "threatened species" or similar proxy by national or international bodies

Conservation Concern: Status of Stocks

- Low (Stock Healthy)
- Moderate (Stock Moderate or Unknown)
- High (Stock Poor)
- Stock Critical

Criterion 3: Nature and Extent of Bycatch

Seafood Watch® defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for and managed in some way.

Guiding Principle: A sustainable wild-caught species is captured using techniques that minimize the catch of unwanted and/or unmarketable species.

Primary Factors to evaluate

Quantity of bycatch, including any species of "special concern" (i.e. those identified as "endangered," "threatened" or "protected" under state, federal or international law)

- Quantity of bycatch is low (< 10% of targeted landings on a per number basis) AND does not regularly include species of special concern
- Quantity of bycatch is moderate (10%–100% of targeted landings on a per number basis) AND does not regularly include species of special concern OR Unknown
- Quantity of bycatch is high (> 100% of targeted landings on a per number basis) OR bycatch regularly includes threatened, endangered or protected species

Key relevant information

Bycatch in this fishery includes targeted species and other species that are not threatened, endangered or protected. Based on the mean rate of return for deep sea handline fisheries in the MHI from 2006 to 2010 (4.8 ± .7 %), bycatch is deemed to be low (pers. comm. Samuel Pooley, PIFSC). The rate of return is the percentage of the catch returned or released to the sea, both alive and dead. The primary bycatch species is *Seriola dumerili* commonly known as kahala or amberjack, and it is generally caught alive, so may also be released alive (pers. comm. Samuel Pooley, PIFSC). This species has not been evaluated for IUCN Red List status, and Seafood Watch has not evaluated its wild populations. The second most common bycatch species is Pink snapper, but its rate of return is low at 0.13 to 2.7 percent (pers. comm. Samuel Pooley, PIFSC). It is thought that Pink snapper released are either undersized or caught during the off season. Overall, the rate of return of Deep 7 species from deep sea handline fisheries in the MHI is low, with a mean of 1.1 ± .6% percent from 2006-2010 (pers. comm. Samuel Pooley, PIFSC).

There have been no reported or observed physical interactions with any species of sea turtles or whales in the bottomfish fishery, but it has been estimated that bottomfishing boats are responsible for the death of two green sea turtles a year from collision. There have been observed interactions with monk seals that take or damage bottom-caught fish, and there have been 7 instances of monk seals getting hooked since 1982 that have been attributed to the bottomfish fishery. These were attributed to the bottomfish fishery because the monk seals were observed (alive) with hooks caught in their mouths (WPRFMC 2009), and the bottomfish fishery is the most prominent demersal hook and line fishery. The fishery is listed as a Category III fishery under the requirements of the Marine Mammal Protection Act, meaning the fishery is responsible for <1% of the species' PBR (Potential Biological Removal—the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population) (NMFS 2011b). Under section 7 of the Endangered Species Act, NMFS has determined that the bottomfish fishery does not adversely impact ESA- listed species or their habitat (WPRFMC 2009).

Reference(s)

NMFS. 2011b. List of Fisheries. Accessed at http://www.nmfs.noaa.gov/pr/interactions/lof/final2011.htm

Personal communication. Samuel Pooley, PIFSC.

Personal communication. WPRFMC.

WPRFMC. 2007a. Amendment 14 to the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Honolulu, Hawaii.

WPRFMC. 2009. Fisheries Ecosystem Plan for the Hawaii Archipelago. Honolulu, Hawaii. http://www.fpir.noaa.gov/Library/PUBDOCs/environmental_impact_statements/FPEIS_FEP/Appendix%20G/FEP%20Hawaii%20(WPRFMC%202009-09-24).pdf

Other notes

Population consequences of bycatch

- Low: Evidence indicates quantity of bycatch has little or no impact on population levels
- Moderate: Conflicting evidence of population consequences of bycatch OR Unknown
- Severe: Evidence indicates quantity of bycatch is a contributing factor in driving one or more bycatch species toward extinction OR is a contributing factor in limiting the recovery of a species of "special concern"

Key relevant information

The population consequences of bycatch in the Deep 7 fishery are unknown, but because the rate of return is low it is thought that the quantity of bycatch has little or no impact on population levels. The FEP, which discusses bycatch, does not mention any evidence of population consequences to any of the bycatch species listed in Figures 19 and 20 above or to other species. (FEP)

Reference(s)

WPRFMC. 2009. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu, Hawaii.

WPRFMC. 2011. Personal communication.

Other notes

Trend in bycatch interaction rates (adjusting for changes in abundance of bycatch species) as a result of management measures (including fishing seasons, protected areas and gear innovations):

- Trend in bycatch interaction rates is down
- Trend in bycatch interaction rates is flat OR Unknown
- Trend in bycatch interaction rates is up
- Not applicable because quantity of bycatch is low

Key relevant information

This is not applicable because the quantity of bycatch is low.

Reference(s)

Other notes

Secondary Factor to evaluate

Evidence that the ecosystem has been or likely will be substantially altered (relative to natural variability) in response to the continued discard of the bycatch species

- Studies show no evidence of ecosystem impacts
- Conflicting evidence of ecosystem impacts OR Unknown
- Studies show evidence of substantial ecosystem impacts

Key relevant information

It is unknown whether or not the ecosystem has or will be altered in response to continued discard of bycatch species. No studies have been carried out that answer this question.

Reference(s)

Other notes

Synthesis

Bycatch is low in the MHI Deep 7 Bottomfish fishery, and likely does not adversely affect habitat or other fish or marine mammals. It is difficult to say whether or not there are additional measures the fishery can take to further reduce bycatch, as the gear used in the fishery specifically targets the desired species. No studies have been carried out that investigate the effects of discards from this fishery.

Evaluation Guidelines

Bycatch is "**Minimal**" if:

1) Quantity of bycatch is <10% of targeted landings AND bycatch has little or no impact on population levels.

Bycatch is "**Moderate**" if:

1) Quantity of bycatch is 10%–100% of targeted landings
2) Bycatch regularly includes species of "special concern" AND bycatch has little or no impact on the bycatch population levels AND the trend in bycatch interaction rates is not up.

Bycatch is "Severe" if:

1) Quantity of bycatch is > 100% of targeted landings
2) Bycatch regularly includes species of "special concern" AND evidence indicates bycatch rate is a contributing factor toward extinction or limiting recovery AND trend in bycatch is down.

Bycatch is considered a **Critical Conservation Concern** and the species is ranked "Avoid," regardless of other criteria, if:

1) Bycatch regularly includes species of special concern AND evidence indicates bycatch rate is a factor contributing to extinction or limiting recovery AND trend in bycatch interaction rates is not down.
2) Quantity of bycatch is high AND studies show evidence of substantial ecosystem impacts.

Conservation Concern: Nature and Extent of Discarded Bycatch

- Low (Bycatch Minimal)
- Moderate (Bycatch Moderate)
- High (Bycatch Severe)
- Bycatch Critical

Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems

Guiding Principle: Capture of a sustainable wild-caught species maintains natural functional relationships among species in the ecosystem, conserves the diversity and productivity of the surrounding ecosystem, and does not result in irreversible ecosystem state changes.

Primary Habitat Factors to evaluate

Known (or inferred from other studies) effect of fishing gear on physical and biogenic habitats

- Minimal damage (i.e. pelagic longline, midwater gillnet, midwater trawl, purse seine, hook and line, or spear/harpoon)
- Moderate damage (i.e. bottom gillnet, bottom longline or some pots/ traps)
- Great damage (i.e. bottom trawl or dredge)

Key relevant information

All fishing for the Deep 7 species is carried out with weighted and baited hook and line. As stated in the Hawaii administrative rule §13-94-6, it is illegal to use any of the following gears: trap, trawl, bottomfish longline or net (1998). Likewise, the FEP states that bottom trawls, bottom gillnets, explosives and poisons are prohibited. (WPRFMC 2009) Scoop nets may only be used to bring fish onboard that have already been caught with legal gear. It is possible that this gear may have some negative impact on rocky bottoms over which the targeted bottomfish congregate or hide within, as some of these areas are habitat for black coral and other sensitive invertebrate species.

Reference(s)

Hawaii Administrative Rules: §13-94-6 (1998)
WPRFMC. 2009. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu, Hawaii.

Other notes

For specific fishery being evaluated, resilience of physical and biogenic habitats to disturbance by fishing method

- High (e.g. shallow water, sandy habitats)
- Moderate (e.g. shallow or deep water mud bottoms, or deep water sandy habitats)
- Low (e.g. shallow or deep water corals, shallow or deep water rocky bottoms)

- Not applicable because gear damage is minimal

Key relevant information

Fishing for Deep 7 species is carried out over deep rocky bottom. A study carried out in 2006 found that fished sites in the NWHI had minimal fishing debris or damage (Kelley 2006). However, with the new bottom mapping work that is being done in conjunction with delineating Essential Fish Habitat for bottomfish species, it seems that the rocky bottom over which these species congregate or hide within may contain sensitive invertebrate species such as black coral. (O'Conner and Kelly 2008) Black coral is a federally managed fishery under the WPRFMC, and is found on rocky terraces, drop-offs and under ledges. (WPRFMC 2007b) These are similar habitats to those preferred by Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass.

Reference(s)

Kelley, C., W. Ikehara. 2006. The Impacts of Bottomfishing on Raita and West St. Rogaten Banks in the Northwestern Hawaiian Islands. Atoll Research Bulletin. No. 543, 305-318.
O'Conner, R. and C. Kelley (2008). Bottomfish Habitat and Restricted Fishing Area Analysis. PowerPoint presentation. http://www.slideshare.net/higicc/bottomfish-habitat-and-restricted-fishing-area-analysis
WPRFMC. 2007b. Regulatory Amendment: Fishery Management Plan for the Precious Coral Fisheries of the Western Pacific Region. Honolulu, Hawaii.

Other notes

If gear impacts are moderate or great, spatial scale of the impact

- Small scale (e.g. small, artisanal fishery or sensitive habitats are strongly protected)
- Moderate scale (e.g. modern fishery but of limited geographic scope)
- Large scale (e.g. industrialized fishery over large geographic areas)
- Not applicable because gear damage is minimal

Key relevant information

Not applicable because gear damage is minimal.

Reference(s)

Other notes

Primary Ecosystem Factors to evaluate

Evidence that the removal of the targeted species or the removal/deployment of baitfish has or will likely substantially disrupt the food web

- The fishery and its ecosystem have been thoroughly studied, and studies show no evidence of substantial ecosystem impacts
- Conflicting evidence of ecosystem impacts OR Unknown
- Ecosystem impacts of targeted species removal demonstrated

Key relevant information

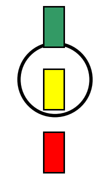
Ecosystem impacts are unknown.

Reference(s)

Other notes

Evidence that the fishing method has caused or is likely to cause substantial ecosystem state changes, including alternate stable states

- ➢ The fishery and its ecosystem have been thoroughly studied, and studies show no evidence of substantial ecosystem impacts
- ➢ Conflicting evidence of ecosystem impacts OR Unknown
- ➢ Ecosystem impacts from fishing method demonstrated



Key relevant information

Ecosystem impacts are unknown.

Reference(s)

Other notes

Synthesis

Gear used in the Deep 7 bottomfish fishery appears to have minimal impacts on the rocky bottom over which it is deployed. However, as new information about the habitat these fish live in is gained through new mapping efforts, and until actual observations of gear interactions with the benthos are made, it is impossible to state that fishing gears effects on the benthos are completely benign, particularly because the fishery is known to occur over highly sensitive habitat like black coral. It is difficult to view gear interactions with the rocky bottom without a submersible due to its deep deployment (100–450 meters).

Evaluation Guidelines

The effect of fishing practices is **"Benign"** if:

1) Damage from gear is minimal AND resilience to disturbance is high AND neither Ecosystem Factor is red.

The effect of fishing practices is "**Moderate**" if:

1) Gear effects are moderate AND resilience to disturbance is moderate or high AND neither Ecosystem Factor is red.

2) Gear results in great damage AND resilience to disturbance is high OR impacts are small scale AND neither Ecosystem Factor is red.
3) Damage from gear is minimal and one Ecosystem factor is red.

The effect of fishing practices **is "Severe"** if:

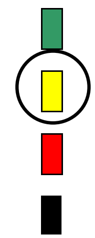
1) Gear results in great damage AND the resilience of physical and biogenic habitats to disturbance is moderate or low.
2) Both Ecosystem Factors are red.

Habitat effects are considered a **Critical Conservation Concern** and a species receives a recommendation of "**Avoid,**" regardless of other criteria if:

- Four or more of the Habitat and Ecosystem factors rank red.

Conservation Concern: Effect of Fishing Practices on Habitats and Ecosystems

- Low (Fishing Effects Benign)
- Moderate (Fishing Effects Moderate)
- High (Fishing Effects Severe)
- Critical Fishing Effects



Criterion 5: Effectiveness of the Management Regime

Guiding Principle: The management regime of a sustainable wild-caught species implements and enforces all local, national and international laws and utilizes a precautionary approach to ensure the long-term productivity of the resource and integrity of the ecosystem.

Primary Factors to evaluate

Stock Status: Management process utilizes an independent scientific stock assessment that seeks knowledge related to the status of the stock

- Stock assessment complete and robust
- Stock assessment is planned or underway but is incomplete OR stock assessment complete but out-of-date or otherwise uncertain
- No stock assessment available now and none is planned in the near future

Key relevant information
Stock assessments for bottomfish were carried out in 2006 (for 2004), 2008 (updated in 2009) and 2011 by the Pacific Islands Fisheries Science Center (a division of the National Marine Fisheries Service). The most recent stock assessment represents an advance over past assessments because it considers only the Deep 7 species (not all bottomfish species), it includes estimates of unreported commercial and non-commercial catch (which past assessments had been criticized for not including–Zeller et al. 2008), assesses the MHI separately from the NWHI stock and contains revised estimates of bottomfish ages. Given these improvements, there is a large amount of uncertainty in the latest assessment, largely because it evaluates the complex as a whole, rather than evaluating the stock of each individual species. Catch data is the only information available about each individual species in the complex. However, the next assessment is likely to include stock measures for each of the Deep 7 species (pers. comm. Jon Brodziak, PIFSC)

Reference(s)

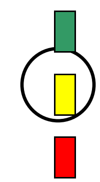
Brodziak, J., R. Moffitt, and G. DiNardo. 2009. Hawaiian bottomfish assessment update for 2008. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. H-09-02, 93 p.

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.
Brodziak, J. 2011. pers comm.
Moffitt, R., D. Kobyashi, and G. DiNardo. 2006. Status of the Hawaiian bottomfish stocks, 2004. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-06-01, 45 p.
Zeller, D., Darcy, M., Booth, S., Lowe, M. K., and S. Martell. 2008. What about recreational catch? Potential impact on stock assessment for Hawaii bottomfish fisheries. Fisheries Research 91:88-97.

Other notes

Scientific Monitoring: Management process involves regular collection and analysis of data with respect to the short and long-term abundance of the stock

- Regular collection and assessment of both fishery-dependent and independent data
- Regular collection of fishery-dependent data only
- No regular collection or analysis of data



Key relevant information

Only fishery dependent data is collected, including catch data and other information from commercial fishermen's logbooks, but it has been inferred that underreporting occurs in the commercial fishery (Zeller et al. 2008). There currently is no reporting requirement for non-commercial fishers in state waters (as of the 2008–2009 season they were required to report catch from Federal waters) (WRPMC 2008), and their catch has been estimated as 2.1 times the size of the commercial catch (Zeller et al. 2008). There have been no bottomfish surveys carried out to measure the actual condition and composition of the stock of Pink snapper, Longtail snapper, Squirrelfish snapper, Hawaiian sea bass or any of the Deep 7 species.

Reference(s)

WPRFMC. 2008. Press Release. Federal Management Council Recommends 35 Percent Increase in Main Hawaiian Islands Bottomfish Harvest for 2008–2009 Season. October 17, 2008.
Zeller, D., Darcy, M., Booth, S., Lowe, M. K., and S. Martell. 2008. What about recreational catch? Potential impact on stock

assessment for Hawaii bottomfish fisheries. Fisheries Research 91:88-97.

Other notes

Scientific Advice: Management has a well-known track record of consistently setting or exceeding catch quotas beyond those recommended by its scientific advisors and other external scientists:

- No
- Yes
- Not enough information available to evaluate OR not applicable because little or no scientific information is collected

Key relevant information

Management (the Western Pacific Regional Fisheries Management Council) has set TACs below those recommended by its Scientific and Statistical Committee (SSC). For example, in 2008–2009 fishing season, WPRFMC instituted a TAC of 241,000 lbs, while its SSC had recommended at TAC of 254,000 (WPRFMC, 2008). For the upcoming 2011 fishing season, NMFS recommended a TAC/ACL of 383,000 lbs (Brodziak et al. 2011), and the Council set the ACL at 325,000 lbs (WPRFMC 2011b). (under Magnuson Stevens all US fisheries must be managed under an ACL by 2011, so the fishery is switching from a TAC).

Reference(s)

Brodziak J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2326. Pacific Islands Fish. Sci. Cent. Admin Rep. Draft, 140p.
WPRFMC. 2008. Press Release. Federal Management Council Recommends 35 Percent Increase in Main Hawaiian Islands Bottomfish Harvest for 2008-2009 Season. October 17, 2008.
WPRFMC. 2011b. Press Release. Federal Fishery Managers Agree on Hawaii 2011-12 Bottomfish Quota, Address Protected Species Issues. June 17, 2011.

Other notes

Bycatch: Management implements an effective bycatch reduction plan

- Bycatch plan in place and reaching its conservation goals (deemed effective)
- Bycatch plan in place but effectiveness is not yet demonstrated or is under debate
- No bycatch plan implemented or bycatch plan implemented but not meeting its conservation goals (deemed ineffective)
- Not applicable because bycatch is "low"

Key relevant information

This factor is not applicable because bycatch in the fishery is low.

Reference(s)

WPRFMC. 2009. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu, Hawaii.

Other notes

Fishing practices: Management addresses the effect of the fishing method(s) on habitats and ecosystems

- Mitigative measures in place and deemed effective
- Mitigative measures in place but effectiveness is not yet demonstrated or is under debate
- No mitigative measures in place or measures in place but deemed ineffective
- Not applicable because fishing method is moderate or benign

Key relevant information

This is not applicable, as the fishing method is benign. However, it should be noted that there are BRFAs which are closed to bottomfishing. These closed areas are currently being updated to reflect the Essential Fish Habitat of bottomfish species (WPRFMC 2011d). BRFAs will have no gear impacts.

Reference(s)

WPRFMC. 2011d. Memorandum. Action item summary for the 151st Council Meeting. May 27, 2011.

Other notes

Enforcement: Management and appropriate government bodies enforce fishery regulations

- Regulations regularly enforced by independent bodies, including logbook reports, observer coverage, dockside monitoring and similar measures
- Regulations enforced by fishing industry or by voluntary/honor system
- Regulations not regularly and consistently enforced

Key relevant information

Commercial and non-commercial fisherman must complete Federal electronic logbooks within 24 hours of each fishing trip and submit them to NMFS PIFSC within 72 hours of each trip (73 FR 41296). All fish caught, bottomfish and non-bottomfish, must be recorded, and it must be stated where fish were caught (either in State or Federal waters) (WPRFMC 2007a). Additionally, there are State forms that fishermen must fill out, but information is not available about these forms. It is not clear if non-commercial fishermen are required to fill out state forms. Commercial and non-commercial fishermen are subject to a seasonal TAC, and NMFS is now able to close the fishery within seven days of the forecasted TAC (76 FR 15222) Non-commercial fishermen are subject to bag limits of 5 Deep 7 bottomfish per trip. (50 CFR § 665.212) Title 50 allows for observer coverage, but it is not clear whether or not an observer program is currently in place for the Deep 7 fishery.

Reference(s)

"Fisheries in the Western Pacific; Bottomfish and Seamount Groundfish Fisheries; Permit and Reporting Requirements in the Main Hawaiian Islands" 73 Federal Register 139 (18 July 2008) pp. 41296–41297.

"Hawaiian Bottomfish and Seamount Groundfish Fisheries; Modifications of Fisheries Closures" 76 Federal Register 54 (26 March 2011) pp. 15222–15223.

WPRFMC. 2007a. Amendment 14 to the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Honolulu, Hawaii.

"Wildlife and Fisheries" Title 50 Code of Federal Regulations § 665.212 Non-commercial bag limits. 2011 ed.

Other notes

Management Track Record: Conservation measures enacted by management have resulted in the long-term maintenance of stock abundance and ecosystem integrity

- Management has maintained stock productivity over time OR has fully recovered the stock from an overfished condition
- Stock productivity has varied and management has responded quickly OR stock has not varied but management has not been in place long enough to evaluate its effectiveness OR Unknown
- Measures have not maintained stock productivity OR were implemented only after significant declines and stock has not yet fully recovered

Key relevant information

It is difficult to evaluate whether Pink snapper, Longtail snapper, Squirrelfish snapper and Hawaiian sea bass are recovering because stock assessments are carried out for the Deep 7 bottomfish complex rather than individual species. No information other than catch data is available on the health of the Pink snapper and Longtail snapper stocks, and their catch has declined as TACs for the complex have risen and continue to rise into the 2011–2012 fishing year as an ACL. Management (WPRFMC) has been responsive to declines in stock of the complex, as illustrated by regular stock assessments carried out by NMFS, caution in setting TACs (and now ACLs), and independent review of stock assessments (Stokes, 2009), and regular meetings. Also, as new information on the benthic habitats used by these species is found, there is work being done to redesign the BRFAs to more successfully cover their Essential Fish Habitat (EFH). (O'Conner and Kelley, 2008) One criticism made by the independent review that has not yet been incorporated into the stock assessments was that stock assessments for individual species may be necessary. However, individual species stocks may be addressed in the next stock assessment (pers. comm. Jon Brodziak, PIFSC). Spawning potential ratios were formerly used to assess the health of individual species of bottomfish, but they are no longer in use.

Reference(s)

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Stokes, K. 2009. Report on the Western Pacific Stock Assessment Review 1 Hawaii Deep Slope Bottomfish (WSPAR 1). Prepared for the Center for Independent Experts.

Other notes

Synthesis
Overall, the Deep 7 fishery has moderately effective management. While subject to overfishing in mid 2000s, the latest draft stock assessment for the Deep 7 complex states that overfishing is no longer occurring and the stock complex is healthy enough to support a larger catch next season than the previous season. This assessment has moderate to high uncertainty levels associated with it because it is based on fishery dependent data (catch data). There is no fishery independent data available on the health of the complex or the health of the individual species in the complex. The WRPFMC did take scientific and management uncertainty into account when deciding the 2011–2012 ACL, which is lower than the level recommended by the 2011 draft stock assessment. There are several management measures in place, such as reporting requirements, a TAC (which will be an ACL next season), closed areas and non-commercial bag limits. Bycatch in this fishery is not well quantified, and there is no current bycatch mitigation plan.

Evaluation Guidelines
Management is deemed to be "**Highly Effective**" if the majority of management factors are green AND the remaining factors are not red.

Management is deemed to be "**Moderately Effective**" if:
1) Management factors "average" to yellow
2) Management factors include one or two red factors

Management is deemed to be "**Ineffective**" if three individual management factors are red, including especially those for Stock Status and Bycatch.

Management is considered a **Critical Conservation Concern** and a species receives a recommendation of "**Avoid,**" regardless of other criteria if:
1) There is no management in place
2) The majority of the management factors rank red.

Conservation Concern: Effectiveness of Management
- Low (Management Highly Effective)
- Moderate (Management Moderately Effective)
- High (Management Ineffective)
- Critical (Management Critically Ineffective)

IV. Overall Evaluation and Seafood Recommendation

Overall Guiding Principle: Sustainable wild-caught seafood originates from sources that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Evaluation Guidelines

A species receives a recommendation of "**Best Choice**" if:
1) It has three or more green criteria and the remaining criteria are not red.

A species receives a recommendation of "**Good Alternative**" if:
1) Criteria "average" to yellow
2) There are four green criteria and one red criteria
3) Stock Status and Management criteria are both ranked yellow and remaining criteria are not red.

A species receives a recommendation of "**Avoid**" if:
1) It has a total of two or more red criteria
2) It has one or more Critical Conservation Concerns.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks		√		
Nature of Bycatch	√			
Habitat & Ecosystem Effects		√		
Management Effectiveness		√		

<u>Overall Seafood Recommendation:</u>

Best Choice	Good Alternative	Avoid

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Seafood Watch thanks Dirk Zeller of the Fisheries Centre at the University of British Columbia and an anonymous reviewer for graciously reviewing this report for scientific accuracy

Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

V. References

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VI. **Appendix I.** Updates to the Longtail snapper, Squirrelfish snapper, hapu'up'u and Pink snapper recommendations

This report is a complete update, superseding the 2003 reports and 2005 updates for Longtail snapper, Squirrelfish snapper and hapu'up'u and the 2007 update for Pink snapper. Since these updates,

1) Several major management changes have occurred in this fishery to address overfishing, including the emergency closure of the fishery in 2007, and the switch to managing by a TAC, which will be replaced by an Allowable Catch Limit (ACL) for the 2011–2012 fishing season.
2) Status of the stocks has improved from depleted with overfishing occurring to slightly below target level biomass with no overfishing occurring
3) It is increasingly recognized that unreported catches from non-commercial sources make up a high percentage of the catch. These unreported catches are not factored into the TAC for previous years, but are factored into the ACL for the 2011–2012 fishing season.
4) New information regarding the Deep 7 species complex habitat requirement is emerging, which will form the basis for new Bottomfish Restricted Fishing Areas (BRFAs) for this and other Deep 7 Bottomfish species.
5) The NWHI waters are now closed to all bottomfishing, restricting Deep 7 catch to the MHI.
6) As the number of Deep 7 bottomfish caught declined beginning in the early 2000s (at the time of the first report), it has been increasingly substituted within the Hawaiian Islands with imported snapper species from the Western Pacific. This shift changed the dynamics in local supply and demand for locally caught fish such that their price was decoupled from availability.

As a result of these changes, the recommendations for all four species from the Main Hawaiian Islands have been upgraded to Good Alternative.