

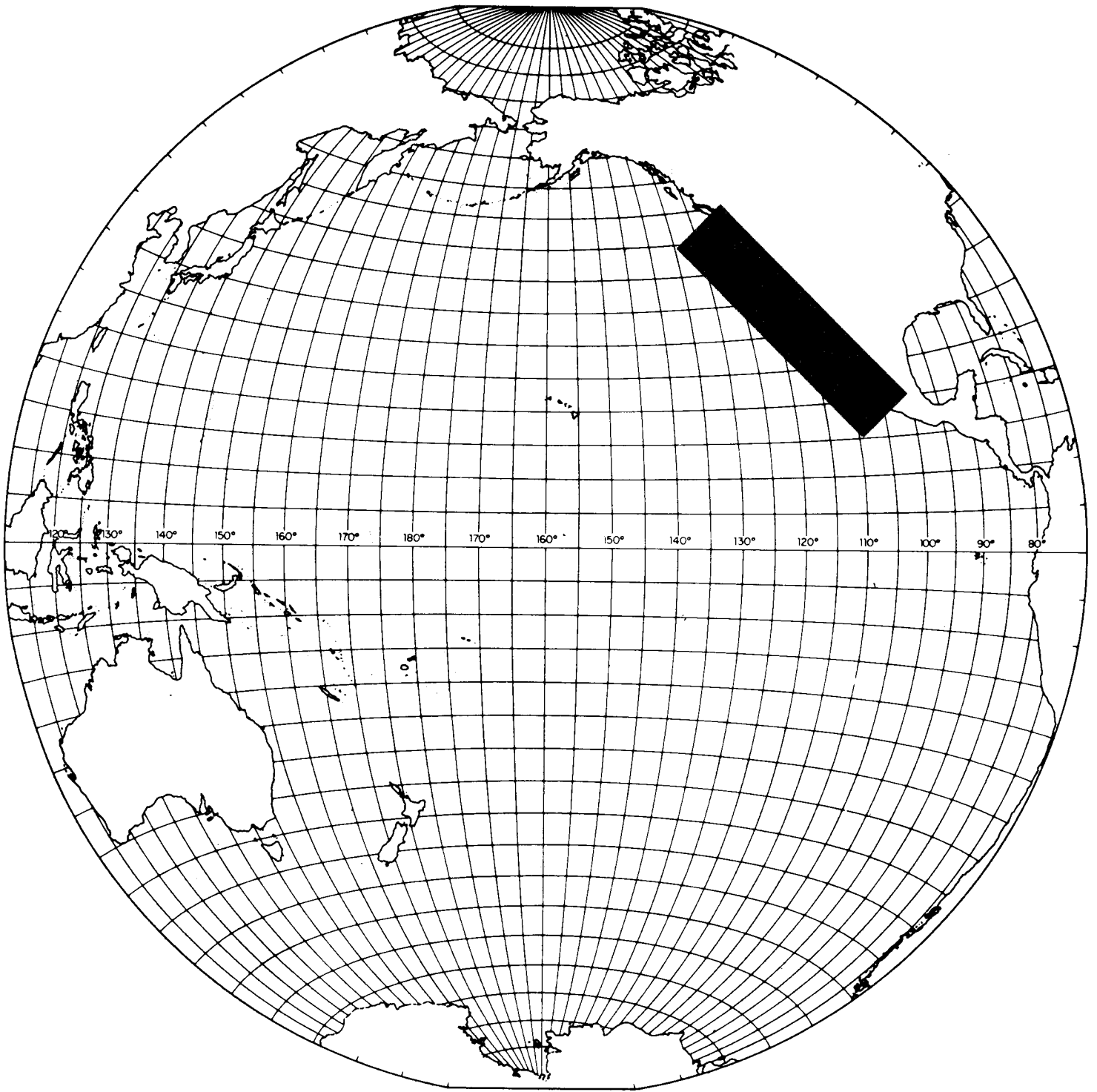


Atlas 31: Moser, H. G., R. L. Charter, P. E. Smith, D. A. Ambrose, S. R. Charter, C. A. Meyer, E. M. Sandknop, and W. Watson. Distributional atlas of fish larvae and eggs in the California Current region: taxa with 1000 or more total larvae, 1951-1984. Published March 1993.

23 May 2007

References to the data, published in annual ichthyoplankton data reports are given in the introduction to the Atlas. In addition, these data are available in PDF format on the SWFSC web site at <http://swfsc.noaa.gov/publications/swcpub/qryPublications.asp>, enter "ichthyoplankton" in the Subject line and "California Cooperative Oceanic Fisheries Investigations" in the Title line. Checking the ALL YEARS button will produce the entire list of available data.

The report for each year usually is published about 7-9 months after the fall cruise, and includes notes about nomenclature changes, etc. The ultimate goal is to update the old ichthyoplankton identifications to current standards; the database is updated as re-identifications for each cruise are completed.



**CALIFORNIA COOPERATIVE OCEANIC
FISHERIES INVESTIGATIONS**

ATLAS No. 31

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 31

Cooperating Agencies:

CALIFORNIA DEPARTMENT OF FISH AND GAME
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE
UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

MARCH, 1993

THE CALCOFI ATLAS SERIES

This is the thirty first in a series of atlases containing data on the hydrography and plankton from the region of the California Current. The field work was carried out by the California Cooperative Oceanic Fisheries Investigations,¹ a program sponsored by the following agencies:

California Department of Fish and Game
National Oceanic and Atmospheric Administration, National Marine Fisheries Service²
University of California, Scripps Institution of Oceanography

CalCOFI atlases³ are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

CalCOFI Atlas Editorial Board:

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CalCOFI Coordinator:

George T. Hemingway

CalCOFI atlases in this series, through March 1993 are:

- No. 1. Anonymous, 1963. CalCOFI atlas of 10-meter temperatures and salinities 1949-1959.
- No. 2. Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region, Part I.
- No. 3. Alvarino, A., 1965. Distributional atlas of Chaetognatha in the California Current region.
- No. 4. Wyllie, J.G. 1966. Geostrophic flow of the California Current at the surface and at 200 meters.
- No. 5. Brinton, E., 1967. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I.
- No. 6. McGowan, J.A., 1967. Distributional atlas of pelagic molluscs in the California Current region.
- No. 7. Fleminger, A., 1967. Distributional atlas of calanoid copepods in the California Current region, Part II.
- No. 8. Berner, L.D., 1967. Distributional atlas of Thaliacea in the California Current region.
- No. 9. Kramer, D. and E.H. Ahlstrom, 1968. Distributional atlas of fish larvae in the California Current region: northern anchovy, *Engraulis mordax* (Girard), 1951-1965.
- No. 10. Isaacs, J.D., A. Fleminger and J.K. Miller, 1969. Distributional atlas of zooplankton biomass in the California Current region: Spring and Fall, 1955-1959.
- No. 11. Ahlstrom, E.H., 1969. Distributional atlas of fish larvae in the California Current region: jack mackerel, *Trachurus symmetricus*, and Pacific hake, *Merluccius productus*, 1951-1966.
- No. 12. Kramer, D., 1970. Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, *Sardinops caerulea* (Girard), 1951-1966.
- No. 13. Smith, P.E., 1971. Distributional atlas of zooplankton volume in the California Current region, 1951-1966.
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¹Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

²Formerly called U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries.

³For citation this issue in the series should be referred to as CalCOFI Atlas No. 31.
Library of Congress Catalog Card Number 67-4238.

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**DISTRIBUTIONAL ATLAS OF FISH LARVAE AND EGGS IN THE CALIFORNIA
CURRENT REGION: TAXA WITH 1000 OR MORE TOTAL LARVAE,
1951 THROUGH 1984**

**H. G. Moser, R. L. Charter, P. E. Smith, D. A. Ambrose, S. R. Charter, C. A. Meyer,
E. M. Sandknop, and W. Watson**

CALCOFI ATLAS NO. 31

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La Jolla, California 92093-0227

March, 1993

**DISTRIBUTIONAL ATLAS OF FISH LARVAE AND EGGS IN THE CALIFORNIA
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Introduction

The California Cooperative Oceanic Fisheries Investigations (CalCOFI) biological-oceanographic survey pattern was designed to encompass the broad spawning ranges of Pacific sardine (*Sardinops sagax*) and northern anchovy (*Engraulis mordax*). As a consequence, the sampling grid overlays three coastal zoogeographic provinces, a coastal upwelling zone, and three oceanic water masses. The taxonomic complexity of the ichthyoplankton samples was recognized by Dr. Elbert Ahlstrom who initiated a vigorous research program to increase the number of identifiable taxa. This has resulted in the most extensive and faunally rich ichthyoplankton time series in the world. The time series has been utilized routinely in biomass

estimations of the principal coastal pelagic fish populations of the region, and continued research effort has produced descriptions of distribution and relative abundance of larvae of many other fish species inhabiting the California Current region (see list of previous CalCOFI Atlases and Smith and Moser, 1988). Recent work on the time series has begun to reveal the nature of the larval fish assemblages of the California Current region and their relation to oceanographic features (Moser et al., 1987; Moser and Smith, in press).

This atlas summarizes the spatial and temporal distributions of the 110 fish taxa with ≥ 1000 total larvae (summed counts per 10 m²) collected on CalCOFI cruises from 1951 through 1984. Also, the atlas includes distributional summaries for the eggs of three species (Northern anchovy, *Engraulis mordax*; Pacific sardine, *Sardinops sagax*; and Pacific saury, *Cololabis saira*) that were routinely identified for the entire 33-year period, and the distributions of total fish larvae and total fish eggs. A second atlas will summarize distributions for all larval taxa with fewer than 1000 total larvae in CalCOFI surveys during 1951-1984.

The overall CalCOFI survey pattern extends from the California-Oregon border to the southern tip of Baja California, Mexico and offshore to a maximum of ca. 400 n. mi. (Figure 1); however, most annual surveys covered a smaller area from San Francisco, California to San Juanico Bay, Baja California and seaward to a

¹Southwest Fisheries Science Center, National Marine Fisheries Service, La Jolla, California.

maximum of ca. 300 n. mi. (Tables 1 and 2). Spatial and temporal coverage was most complete during the early years of the surveys (1951-1960) when multi-vessel cruises occupied much of the >1 million km² survey pattern at monthly intervals. Subsequently, reduced ship availability and funding limitations resulted in a reduction of the number of cruises and in their areal coverage. Annual surveys with quarterly cruises were conducted from 1961 to 1965, while surveys were triennial with monthly coverage from 1966 to 1984.

At each survey station an oblique plankton tow was taken using standard procedures (Kramer et al., 1972). Speed of cable pay-out (50 m per minute) and retrieval (20 m per minute) was constant on all surveys; however, gear and desired depth of tow changed during the 1951-1984 period (Table 3).

The charts and graphs of CalCOFI ichthyoplankton presented in this atlas were derived from a computer data base established during 1983-1988. Complete lists of these data and corresponding station and tow data for all CalCOFI surveys from 1951 to 1984 were published in the following series of reports:

1951-- Ambrose et al. (1987a)
1952-- Sandknop et al. (1987a)
1953-- Stevens et al. (1987a)
1954-- Sumida et al. (1987a)
1955-- Ambrose et al. (1987b)
1956-- Stevens et al. (1987b)
1957-- Sumida et al. (1987b)
1958-- Sandknop et al. (1987b)
1959-- Stevens et al. (1987c)
1960-- Ambrose et al. (1987c)
1961-- Sandknop et al. (1988a)
1962-- Sumida et al. (1988a)
1963-- Ambrose et al. (1988a)
1964-- Sandknop et al. (1988b)
1965-- Stevens et al. (1988a)
1966-- Sumida et al. (1988b)
1967-- Ambrose et al. (1988b)
1968-- Sandknop et al. (1988c)
1969-- Stevens et al. (1988b)

1972-- Sumida et al. (1988c)
1975-- Ambrose et al. (1988c)
1978-- Sandknop et al. (1988d)
1981-- Ambrose et al. (1988d)
1984-- Stevens et al. (1990)

These data reports provide detailed descriptions of station patterns, sampling gear and methods, laboratory procedures, methods used in identifying larvae, and methods of computer entry and editing.

CalCOFI surveys from 1951 through 1984 in the California Current region produced 31,214 plankton tows yielding ca. 12.4 million fish larvae distributed in 249 identified taxa. Larvae were identified to species or were assigned to the lowest taxon possible (genus, family, suborder, order). The number of identifiable taxa increased during the 33-year period as knowledge and competency improved. Data presented in this atlas represent either original identifications or new identifications resulting from reexamination of archived samples during construction of the data base in 1983-1988. All taxa included in the 1951-1984 time series are listed in rank order of abundance (number per 10 m² of sea surface) summed for all occurrences (Table 4) and in rank order of occurrence (Table 5). Seven higher taxa (*Citharichthys* spp., *Mycetophidae*, *Bathylagus* spp., *Diogenichthys* spp., *Hygophum* spp., Pleuronectiformes, *Pleuro-nichthys* spp.) had more than 1000 total larvae for the time series but consisted primarily of small damaged specimens, and were not analyzed. Their distributions are represented in analyses of component taxa.

The distributions are summarized in a series of charts and graphs arranged on two facing pages per taxon. The upper panel on the left page is a map of total abundance (log of summed abundance for all occurrences) for the entire time series. The lower panel is a series of four quarterly maps that show mean abundance in each of 22 CalCOFI regions. The regions used in this atlas (Figure 2) were modified from those established by Smith et al. (in prep.). Region 24 has

an indeterminate area and in this data base is represented by the stations indicated in Figure 2. On the quarterly charts, Region 24 is shown as the area enclosed in the dashed line seaward of Regions 6 and 10. Stations 40.180 and 140.120, each occupied once in the time series (Sumida et al., 1988c), are not shown in Figure 2. The number of station occupancies in each region for each quarter varied considerably, with marked diminution of effort in peripheral regions (Table 6). Regions 3 and 23 were insufficiently sampled to be included in the maps of quarterly mean abundance. On these charts, regions within which no larvae of a subject taxon were captured during a quarter are indicated by a "0", and the region with the highest quarterly mean abundance is marked with a star.

Graphs summarizing interannual, seasonal and onshore-offshore occurrence and abundance are presented on the right-hand page of each taxon description. Calculations of seasonal and interannual mean occurrence and abundance were based on a pool of CalCOFI regions that fell within the principal distribution of the taxon of interest. This was determined by examination of all records in the time series for that taxon. The top-left graph gives annual mean occurrence (percent positive tows) for the selected regional pool. The top-right graph presents mean annual abundance as the number of larvae or eggs per 10m² of surface area for all (including zeros) stations occupied in the regional pool for each year. Mean occurrence and abundance for CalCOFI surveys in 1967 and 1968 were not included because of inadequate seasonal and areal coverage during those years (Table 1). Missing data points on the interannual plots correspond to years when a taxon was not on the list of identifiable taxa. Also, values were not plotted for years when a taxon's selected regional pool was not sampled on CalCOFI surveys; this applies principally to 1984, when no sampling occurred south of CalCOFI line 110 (Table 1). The middle-left graph gives monthly mean occurrence (percent positive tows) for the regional pool and the middle-right graph gives monthly mean abundance (number per 10m² for

all stations occupied). Onshore-offshore occurrence and abundance are shown in the bottom-left and bottom-right graphs, respectively. For these calculations the data base was partitioned into seven alongshore zones (Figure 3): Northern California (N CAL); Central California (C CAL); Southern California (S CAL); Northern Baja California (N BAJA CAL); North Central Baja California (NC BAJA CAL); South Central Baja California (SC BAJA CAL); Southern Baja California (S BAJA CAL). Stations in these zones were further segregated into 14 bins based on distance from the coast (Table 7). For each taxon one or more zones were selected from the core of their north-south range and mean occurrence (percent positive tows) and mean abundance (number per 10 m² of surface area for all stations) were calculated for each bin. These values are plotted in the graphs. Note that the labels on the x-axis refer to the offshore limit of each bin; for example, "5 n. mi." refers to the 0-5 n. mi. bin and "10 n. mi." refers to the 5-10 n. mi. bin. Values were not plotted for onshore-offshore bins represented by fewer than nine tows.

Scientific names used in this atlas generally conform to those used in identification guides of the region (Miller and Lea, 1972; Eschmeyer et al., 1983; Matarese et al., 1989) and ordinal and family nomenclature follow Eschmeyer's (1990) classification. The taxa included in higher systematic categories (genera, families, and orders) changed during the course of the survey period because of refinements in our ability to identify larvae. These changes are documented in the series of CalCOFI ichthyoplankton data reports and, with other interpretive notes, are listed below:

Ichthyococcus spp.-- *I. irregularis* is the common species in the CalCOFI region and all specimens of the genus reexamined to date have been this species

Sternoptychidae-- only larvae of *Argyropelecus* and *Sternoptyx* are included in this category

Scopelarchidae-- includes larvae of all constituent taxa prior to 1972 and, beginning in 1972, only those specimens not identifiable to genus or species

Scopelosaurus spp.-- all specimens reexamined to date have been *S. harryi*

Paralepididae-- includes larvae of all constituent taxa prior to 1961, dominated by *Lestidiops ringens*; beginning in 1961, it includes only those specimens not identifiable to genus or species

Lampanyctus spp.-- includes larvae of all constituent taxa prior to 1954 and, beginning in 1954, larvae of all taxa except those of *L. regalis* and *L. ritteri* larger than ca. 5 mm; larvae of these species > ca. 5 mm were identified to species beginning in 1954

Merluccius productus-- the extremely high mean abundance in Region 20 in the first quarter of the year resulted from a single tow (Cruise 5601, Sta. 143.30) containing an estimated 30,942 *M. productus* larvae per 10m²

Ophidiiformes-- includes larvae of all constituent taxa except those of *Ophidion scrippsae* and *Chilara taylori* which were separated during a reexamination of all ophidiiform larvae in the time series

Sebastes spp.-- beginning in 1972, five species of *Sebastes* (*S. aurora*, *S. jordani*, *S. levis*, *S. macdonaldi*, *S. paucispinis*) were identified; data for these species were combined with *Sebastes* spp. for calculating mean values for the genus

Cottidae-- includes larvae of all constituent taxa except those of *Scorpaenichthys marmoratus*, which were separated for the entire time series

Carangidae-- larvae of *Trachurus symmetricus* were separated for the entire time series; prior

to 1954, the family category includes larvae of all other constituent taxa and, beginning in 1954, larvae of all other taxa except those of *Seriola* spp. and *S. lalandi*

Sciaenidae-- includes larvae of all constituent taxa prior to 1981; beginning in 1981, larvae of this family were identified to species; the numerically dominant species in CalCOFI samples, *Genyonemus lineatus*, spawns in the winter and has a comparatively northern distribution from Central California to Central Baja California; other sciaenid species are primarily summer spawners, particularly those with more tropical affinities; to contrast these characteristics, interannual and seasonal values were calculated from northern (Regions 4, 7, 11) and southern (Regions 12, 16, 20) regional pools for 1951-1978

Labridae-- includes all component taxa prior to 1961; beginning in 1961, larvae of *Halichoeres* spp., *Oxyjulis californica*, and *Semicossyphus pulcher* were separated and only small or damaged unidentifiable specimens were included in the family category

Clinidae-- larvae from the region between Pt. Conception, California and Pt. Baja, Baja California are primarily clinids; records from north of Pt. Conception include some sticheioid larvae and records from south of Pt. Baja are mostly labrisomids

Trichiuridae-- includes larvae of all constituent taxa prior to 1972 when larvae of *Lepidopus fitchi*, the dominant trichiurid species in the CalCOFI region, were separated

Citharichthys spp.-- this category was not charted and graphed; during the preparation of the data base, all *Citharichthys* larvae from surveys in 1954-1960 and 1984 were reexamined and identified to species and charts and graphs of *C. fragilis*, *C. sordidus*, *C. stigmaeus*, and *C. xanthostigma*, based on this segment of the time series, are included in this atlas; calcula-

tions for charts and graphs of *C. stigmaeus* also include data from surveys in 1961-1981, however, only *C. stigmaeus* larvae larger than ca. 4.5 mm could be identified during this period

Acknowledgements

This atlas is a result of the dedicated efforts of many people. We are indebted to the founders of the CalCOFI program and the many scientists, technicians, and ships' crews who carried it out. Barbara Sumida MacCall and Elizabeth G. Stevens made valuable contributions during the development of the data base. Barbara Sumida MacCall's discovery of the diagnostic characters of *Citharichthys* larvae enabled us to include these species in the atlas. Roy M. Allen was responsible for drafting most of the charts and graphs. Amy E. Hays assisted with computer programming.

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Table 1. Summary of alongshore and offshore extent of CalCOFI cruises from 1951 through 1984. The northernmost and southernmost CalCOFI lines occupied are listed for each cruise. Below each range the station number of the most seaward station occupied on the cruise is listed in parentheses. Refer to Figure 1 for the location of CalCOFI lines and stations. The month designation for CalCOFI cruises indicates the principal calendar month of the cruise and stations may have been occupied during adjoining calendar months.

Year	Cruise Month											
	01	02	03	04	05	06	07	08	09	10	11	12
1951	60-137 (120)	80-137 (130)	80-157 (130)	60-137 (130)	60-137 (120)	60-157 (130)	40-137 (120)	40-137 (100)	60-157 (100)	60-137 (100)	60-137 (100)	63-123 (90)
1952	80-137 (110)	80-150 (100)	80-137 (90)	60-137 (100)	60-137 (100)	50-137 (100)	40-137 (100)	60-137 (100)	60-137 (110)	60-137 (110)	60-137 (110)	-
1953	80-150 (100)	80-137 (80)	80-137 (100)	60-137 (160)	60-137 (160)	60-137 (100)	60-137 (100)	60-137 (100)	81.8-121.5 (60)	82.3-137 (90)	81.8-87 (60)	81.8-137 (90)
1954	77-150 (140)	77-137 (80)	77-137 (90)	60-137 (100)	60-137 (100)	50-137 (100)	60-137 (100)	60-137 (100)	-	77-137 (90)	-	80-157 (90)
1955	80-157 (100)	80-157 (100)	80-157 (100)	80-137 (90)	63-137 (95)	60-137 (90)	63-137 (90)	-	-	60-137 (90)	-	80-150 (90)
1956	80-157 (90)	80-157 (90)	80-137 (90)	60-157 (90)	40-137 (100)	40-137 (90)	60-137 (90)	110-137 (45)	110-137 (45)	80-97 (90)	80-97 (90)	80-97 (90)
1957	100-137 (70)	80-157 (90)	80-150 (90)	80-157 (90)	60-137 (90)	60-157 (90)	60-137 (90)	110-137 (45)	110-137 (45)	80-137 (90)	70-97 (80)	80-110 (90)
1958	60-157 (90)	80-150 (90)	70-150 (90)	47-137 (145)	60-137 (90)	50-137 (90)	40-137 (100)	110-137 (45)	90-137 (70)	60-153 (100)	80-100 (80)	80-100 (80)
1959	90-157 (90)	73-137 (90)	83-137 (90)	60-147 (90)	60-137 (145)	77-137 (90)	50-137 (90)	77-153 (90)	90-137 (120)	43-137 (90)	77-93 (80)	77-93 (100)
1960	40-157 (100)	73-137 (100)	73-137 (100)	40-153 (100)	73-137 (100)	73-137 (100)	50-137 (200)	83-143 (100)	103-121 (40)	60-137 (200)	-	-
1961	60-137 (200)	-	-	60-137 (200)	-	-	60-137 (200)	-	-	60-140 (200)	-	-
1962	60-140 (200)	-	60-140 (200)	-	-	-	80-130 (200)	-	-	60-140 (200)	-	-

Table 1. (Cont.)

Year	01	02	03	04	05	06	07	08	09	10	11	12
1963	60-140 (200)	-	-	60-140 (200)	-	-	80-137 (90)	-	-	80-137 (90)	-	-
1964	60-140 (200)	-	-	60-137 (100)	-	-	60-140 (200)	-	-	80-137 (100)	-	-
1965	60-140 (200)	-	-	63-137 (100)	-	-	60-140 (200)	-	80-137 (90)	-	-	-
1966	60-137 (100)	80-120 (100)	-	60-137 (100)	80-137 (90)	60-103 (90)	60-137 (100)	80-137 (90)	80-120 (90)	60-137 (120)	97-153 (60)	60-137 (140)
1967	-	-	-	-	-	80-130 (140)	-	-	-	-	-	107-137 (80)
1968	60-103 (100)	-	-	117-140 (95)	-	60-113 (90)	-	-	-	-	-	-
1969	60-120 (140)	40-137 (120)	-	77-137 (140)	60-93 (110)	97-137 (90)	60-137 (140)	60-93 (110)	93-137 (90)	60-137 (140)	-	60-137 (100)
1972	63-137 (90)	40-157 (120)	60-137 (90)	-	40-157 (140)	-	43-137 (120)	-	-	40-157 (180)	-	-
1974	-	-	-	-	-	-	-	-	-	-	-	60-137 (100)
1975	60-137 (100)	-	60-130 (90)	-	70-120 (90)	-	60-137 (90)	-	-	97-137 (90)	60-95 (90)	83-93 (60)
1977	-	-	-	-	-	-	-	-	-	-	-	83-113 (90)
1978	60-137 (100)	-	60-137 (100)	60-113 (200)	60-113 (90)	-	60-137 (200)	60-137 (180)	-	-	-	-
1980	-	-	-	-	-	-	-	-	-	-	-	63-137 (90)
1981	60-110 (90)	60-130 (90)	-	60-133 (90)	60-110 (100)	-	60-93 (90)	97-123 (90)	-	-	-	-
1984	60-110 (100)	60-110 (100)	60-110 (70)	60-110 (100)	60-87 (100)	90-110 (100)	60-110 (100)	-	-	60-110 (100)	-	60-110 (100)

Table 2. Sampling effort in relation to distance from coast for north-south segments of the CalCOFI sampling pattern and for the entire pattern ("All"). Within each zone the percentage of total (31,214) station occupancies from stations 60, 70, 80, 90, 100, 110, and 120 to the coast is listed. See Figure 3 for map of the north-south segments.

CalCOFI Station	Distance from coast (n. mi.)	CalCOFI Lines							
		40-57	60-77	80-97	100-110	113-120	123-137	140-157	All
60	32-199	0.8	6.8	21.4	13.5	12.0	14.2	2.9	71.6
70	72-239	1.1	9.2	25.2	15.9	13.8	14.9	3.0	83.1
80	112-279	1.2	10.6	28.1	17.8	14.9	15.3	3.0	90.9
90	152-319	1.3	11.8	30.7	19.0	15.5	15.4	3.0	96.7
100	192-359	1.4	12.2	31.4	19.3	15.6	15.4	3.1	98.2
110	232-399	1.4	12.2	31.5	19.3	15.6	15.4	3.1	98.5
120	272-439	1.4	12.4	31.8	19.4	15.6	15.5	3.1	99.1

Table 3. Changes in plankton net type and standard maximum haul depth during CalCOFI surveys, 1951-1984.

Years	Net Frame	Net Material	Mesh Size (mm)	Desired Haul Depth (m)	Mean Volume Filtered per m depth (m ³)
1951-1968	1-m ring	silk bolting cloth	0.55	140	3.6 (N=23551)
1969-1975	1-m ring	nylon	0.505	210	3.3 (N=4520)
1978-1984	0.71-m bongo	nylon	0.505	210	2.0 (N=3137)

Table 4. Ranked abundance of larval fish taxa identified from CalCOFI survey cruises in 1951 through 1984. The total for each taxon or category is the summed count (per 10m² of sea surface, adjusted for percentage of sample sorted) for all occurrences.

Rank	Taxon	Count	Rank	Taxon	Count
1	<i>Engraulis mordax</i>	5772080	42	Gobiidae	11914
2	<i>Merluccius productus</i>	1043952	43	<i>Parophrys vetulus</i>	11411
3	<i>Vinciguerria lucetia</i>	956790	44	<i>Lyopsetta exilis</i>	10127
4	<i>Sebastes</i> spp.	710358	45	<i>Hygophum atratum</i>	9865
5	<i>Leuroglossus stilbius</i>	456743	46	<i>Paralichthys californicus</i>	9527
6	<i>Triphoturus mexicanus</i>	404359	47	<i>Bathylagus</i> spp.	9213
7	<i>Stenobranchius leucopsarus</i>	326318	48	<i>Sebastes paucispinis</i>	9057
8	<i>Sardinops sagax</i>	219964	49	<i>Chauliodus macouni</i>	9047
9	<i>Trachurus symmetricus</i>	208085	50	<i>Peprilus simillimus</i>	8700
10	<i>Citharichthys</i> spp.	195518	51	Ophidiiformes	8229
11	<i>Diogenichthys laternatus</i>	116308	52	<i>Genyonemus lineatus</i>	8013
12	<i>Bathylagus wesethi</i>	95075	53	<i>Chromis punctipinnis</i>	7912
13	<i>Bathylagus ochotensis</i>	83812	54	<i>Tetragonurus cuvieri</i>	7722
14	Sciaenidae	74820	55	Labridae	7456
15	<i>Cyclothone</i> spp.	68413	56	<i>Diogenichthys</i> spp.	7057
16	<i>Protomyctophum crockeri</i>	61020	57	<i>Gonichthys tenuiculus</i>	6930
17	<i>Tarletonbeania crenularis</i>	53379	58	<i>Hypsoblennius</i> spp.	6849
18	<i>Ceratoscopelus townsendi</i>	45387	59	<i>Lestidiops ringens</i>	6796
19	Unidentified fish larvae	44647	60	<i>Scorpaena</i> spp.	6398
20	<i>Lampanyctus</i> spp.	44617	61	Paralepididae	6259
21	<i>Lampanyctus ritteri</i>	42035	62	<i>Pleuronichthys verticalis</i>	6024
22	Disintegrated fish larvae	41066	63	<i>Ophidion scrippsae</i>	5932
23	<i>Diaphus</i> spp.	37571	64	Cottidae	5831
24	<i>Scomber japonicus</i>	33933	65	<i>Oxyjulis californica</i>	5657
25	<i>Citharichthys fragilis</i>	30952	66	<i>Bathylagus pacificus</i>	5309
26	Myctophidae	28662	67	Haemulidae	5207
27	<i>Citharichthys stigmaeus</i>	28584	68	<i>Idiacanthus antrostomus</i>	4906
28	<i>Synodus</i> spp.	26553	69	Clinidae	4791
29	<i>Symbolophorus californiensis</i>	24897	70	<i>Lampadena urophaos</i>	4784
30	<i>Diogenichthys atlanticus</i>	22552	71	Carangidae	4512
31	<i>Citharichthys xanthostigma</i>	22316	72	<i>Notoscopelus resplendens</i>	4228
32	<i>Melamphaes</i> spp.	21180	73	<i>Hippoglossina stomata</i>	3860
33	Sternoptychidae	20739	74	<i>Sebastolobus</i> spp.	3837
34	Serranidae	17108	75	Scopelarchidae	3813
35	<i>Prionotus</i> spp.	16539	76	Trichiuridae	3561
36	<i>Icichthys lockingtoni</i>	16139	77	<i>Nansenia crassa</i>	3543
37	<i>Symphurus</i> spp.	14843	78	<i>Myctophum nitidulum</i>	3463
38	<i>Stomias atriventer</i>	14736	78	<i>Nansenia candida</i>	3463
39	<i>Argentina sialis</i>	13313	80	<i>Citharichthys sordidus</i>	3419
40	<i>Sebastes jordani</i>	12278	81	<i>Sphyræna argentea</i>	3338
41	<i>Etrumeus teres</i>	12092	82	<i>Microstoma</i> sp.	3089

Table 4. (Cont.)

Rank	Taxon	Count	Rank	Taxon	Count
83	Chiasmodontidae	3026	126	<i>Tactostoma macropus</i>	809
84	<i>Lampanyctus regalis</i>	2985	127	<i>Loweina rara</i>	799
85	<i>Halichoeres</i> spp.	2883	128	<i>Sebastes levis</i>	765
86	<i>Microstomus pacificus</i>	2842	129	<i>Medialuna californiensis</i>	737
87	<i>Cololabis saira</i>	2649	130	<i>Bathylagus milleri</i>	722
88	Trachipteridae	2583	131	Osmeridae	706
89	<i>Sarda chiliensis</i>	2528	132	Stomiiformes	668
90	<i>Hygophum reinhardtii</i>	2356	133	Atherinidae	638
91	<i>Hygophum</i> spp.	2228	134	<i>Pleuronichthys coenosus</i>	633
92	Pleuronectiformes	2161	135	<i>Myctophum aurolaternatum</i>	630
93	<i>Seriola lalandi</i>	2152	136	<i>Scopelarchus</i> spp.	615
94	Anguilliformes	2111	137	<i>Notolepis risso</i>	610
95	<i>Glyptocephalus zachirus</i>	2084	138	<i>Lepidopus fitchi</i>	608
96	<i>Poromitra</i> spp.	1964	139	<i>Semicossyphus pulcher</i>	607
97	<i>Seriphus politus</i>	1835	140	<i>Electrona risso</i>	591
98	<i>Scopelogadus bispinosus</i>	1733	141	<i>Caulolatilus princeps</i>	588
99	<i>Danaphos oculus</i>	1717	142	<i>Brama</i> spp.	579
100	<i>Notolychnus valdiviae</i>	1707	142	<i>Psettichthys melanostictus</i>	579
101	<i>Auxis</i> spp.	1670	144	Macrouridae	576
102	<i>Ichthyococcus</i> spp.	1668	145	<i>Vinciguerria poweriae</i>	571
103	<i>Bregmaceros</i> spp.	1612	146	<i>Oxylebius pictus</i>	521
104	Gerreidae	1601	147	Blennioidei	509
105	<i>Opisthonema</i> spp.	1525	148	<i>Syngnathus</i> spp.	506
106	Pomacentridae	1493	149	<i>Bathophilus</i> spp.	501
107	<i>Sebastes macdonaldi</i>	1461	150	<i>Etropus</i> spp.	486
108	Gonostomatidae	1398	151	<i>Rosenblattichthys volucris</i>	463
109	<i>Chilara taylori</i>	1311	152	<i>Coryphaena hippurus</i>	457
110	<i>Xystreureys liolepis</i>	1306	153	Gempylidae	426
111	Ceratioidei	1216	154	Exocoetidae	422
111	<i>Diplophos taenia</i>	1216	155	<i>Macroramphosus gracilis</i>	396
113	Gobiesocidae	1184	156	<i>Pleuronichthys decurrens</i>	389
114	<i>Pleuronichthys</i> spp.	1147	157	<i>Platichthys stellatus</i>	314
115	<i>Scopelosaurus</i> spp.	1062	158	<i>Scomberomorus</i> spp.	305
116	Agonidae	1053	159	<i>Girella nigricans</i>	300
117	<i>Brosomphycis marginata</i>	1039	160	<i>Syacium ovale</i>	289
118	<i>Sebastes aurora</i>	1019	161	<i>Hypsopsetta guttulata</i>	288
119	<i>Pleuronichthys ritteri</i>	1015	162	Hexagrammidae	280
120	<i>Scorpaenichthys marmoratus</i>	1007	163	<i>Icosteus aenigmaticus</i>	263
121	<i>Zaniolepis</i> spp.	973	164	<i>Howella brodiei</i>	244
122	Scombridae	965	165	<i>Protomyctophum thompsoni</i>	217
123	Cyclopteridae	861	166	<i>Benthoosema pterota</i>	210
124	<i>Aristostomias scintillans</i>	836	167	Nomeidae	208
125	<i>Hypsypops rubicundus</i>	810	168	<i>Physiculus</i> spp.	198

Table 4. (Cont.)

Rank	Taxon	Count	Rank	Taxon	Count
168	<i>Benthalbella dentata</i>	198	212	<i>Cheilotrema saturnum</i>	15
170	<i>Photonectes</i> spp.	168	213	Tetraodontidae	14
171	Scorpaenidae	156	213	<i>Parvilux ingens</i>	14
172	Moridae	150	213	Myctophiformes	14
173	<i>Scopeloberyx robustus</i>	147	213	Polynemidae	14
174	<i>Bothus</i> spp.	133	217	<i>Euthynnus</i> spp.	11
175	<i>Mugil</i> spp.	130	217	<i>Lobianchia</i> spp.	11
176	<i>Lepidopsetta bilineata</i>	124	217	Astronesthidae	11
177	<i>Scopelarchoides nicholsi</i>	103	219	Microdesmidae	10
178	<i>Stemonosudis macrura</i>	99	219	<i>Anopterus pharao</i>	10
179	<i>Centrobranchus nigroocellatus</i>	98	221	<i>Atractoscion nobilis</i>	9
180	<i>Valenciennellus tripunctulatus</i>	92	221	<i>Roncador stearnsii</i>	9
181	<i>Microgadus proximus</i>	89	221	<i>Seriola</i> spp.	9
182	Evermannellidae	81	221	Antennariidae	9
183	<i>Cubiceps pauciradiatus</i>	76	225	<i>Eopsetta jordani</i>	8
183	<i>Bolinichthys</i> spp.	76	226	<i>Paralichthys</i> spp.	7
185	<i>Psenes pellucidus</i>	73	227	Gadidae	6
186	<i>Isopsetta isolepis</i>	72	227	Alepocephalidae	6
187	<i>Sudis atrox</i>	69	227	Lophiidae	6
188	Carapidae	63	227	<i>Oxyporhamphus micropterus</i>	6
189	Apogonidae	62	227	<i>Chaetodipterus zonatus</i>	6
190	<i>Aulopus</i> spp.	55	232	<i>Hygophum proximum</i>	5
191	<i>Thunnus albacares</i>	49	232	<i>Cubiceps caeruleus</i>	5
192	<i>Ophiodon elongatus</i>	41	232	<i>Taaningichthys minimus</i>	5
193	Mullidae	40	232	Balistidae	5
194	Eutaeniophoridae	38	232	Bothidae	5
195	Hemiramphidae	35	237	<i>Gadus macrocephalus</i>	4
196	<i>Albula</i> sp.	31	237	Merlucciidae	4
197	<i>Triphoturus nigrescens</i>	30	239	<i>Cyclopsetta</i> spp.	3
198	<i>Porichthys</i> spp.	29	239	<i>Dolichopteryx</i> spp.	3
198	Uranoscopidae	29	239	<i>Dolichopteryx longipes</i>	3
198	<i>Bathylagus longirostris</i>	29	239	<i>Bathylchnops exilis</i>	3
201	Engraulidae	26	239	Fistulariidae	3
202	<i>Psenes sio</i>	24	239	<i>Citharichthys platophrys</i>	3
203	<i>Eustomias</i> spp.	22	239	<i>Woodsia nonsuchae</i>	3
204	<i>Anoplopoma fimbria</i>	20	239	<i>Paralepis atlantica</i>	3
205	<i>Leuroglossus schmidti</i>	19	239	Sparidae	3
206	<i>Caristius macropus</i>	18	239	Acanthuridae	3
207	<i>Macropinna microstoma</i>	17	249	Priacanthidae	2
207	<i>Benthalbella</i> spp.	17	249	Soleidae	2
209	<i>Gonostoma</i> spp.	16			
209	Bathymasteridae	16			
209	<i>Hippoglossina</i> spp.	16			

Table 5. Ranked occurrence of larval fish taxa identified from CalCOFI survey cruises in 1951 through 1984. The total for each taxon or category is the sum of all occurrences during the survey period.

Rank	Taxon	Occurrences	Rank	Taxon	Occurrences
1	<i>Engraulis mordax</i>	14486	42	<i>Symphurus</i> spp.	1038
2	<i>Sebastes</i> spp.	12323	43	<i>Tetragonurus cuvieri</i>	1031
3	<i>Triphoturus mexicanus</i>	11968	44	<i>Synodus</i> spp.	1008
4	<i>Vinciguerria lucetia</i>	10510	45	<i>Citharichthys xanthostigma</i>	984
5	<i>Leuroglossus stilbius</i>	8509	46	<i>Parophrys vetulus</i>	953
6	<i>Protomyctophum crockeri</i>	8048	47	Scopelarchidae	944
7	<i>Merluccius productus</i>	7370	48	Labridae	931
8	<i>Stenobranchius leucopsarus</i>	7258	49	<i>Hypsoblennius</i> spp.	910
9	<i>Citharichthys</i> spp.	6322	50	<i>Diogenichthys</i> spp.	909
10	<i>Cyclothone</i> spp.	5869	51	<i>Pleuronichthys verticalis</i>	893
11	Disintegrated fish larvae	5660	52	Ophidiiformes	847
12	<i>Bathylagus wesethi</i>	5593	53	<i>Idiacanthus antrostomus</i>	843
13	<i>Trachurus symmetricus</i>	5589	54	<i>Nansenia crassa</i>	836
14	<i>Lampanyctus</i> spp.	5481	55	<i>Citharichthys fragilis</i>	821
15	<i>Diogenichthys laternatus</i>	5043	56	<i>Myctophum nitidulum</i>	795
16	Unidentified fish larvae	4824	57	Serranidae	759
17	<i>Lampanyctus ritteri</i>	4707	58	<i>Hippoglossina stomata</i>	756
18	<i>Bathylagus ochotensis</i>	4555	59	Chiasmodontidae	726
19	<i>Melanphaes</i> spp.	4065	60	Cottidae	722
20	<i>Tarletonbeania crenularis</i>	4041	60	<i>Lampadena urophaos</i>	722
21	Myctophidae	3806	62	<i>Peprilus simillimus</i>	713
22	<i>Symbolophorus californiensis</i>	3219	63	<i>Microstoma</i> sp.	681
23	<i>Ceratoscopelus townsendi</i>	3058	64	<i>Bathylagus</i> spp.	676
24	<i>Sardinops sagax</i>	2999	65	<i>Notoscopelus resplendens</i>	674
25	Sternoptychidae	2934	66	Trachipteridae	650
26	<i>Citharichthys stigmaeus</i>	2710	67	Clinidae	600
27	<i>Diogenichthys atlanticus</i>	2706	68	Trichiuridae	547
28	<i>Stomias atriventer</i>	2548	69	<i>Chromis punctipinnis</i>	537
29	<i>Diaphus</i> spp.	2119	70	<i>Bathylagus pacificus</i>	536
30	<i>Icichthys lockingtoni</i>	1992	71	<i>Cololabis saira</i>	513
31	Gobiidae	1991	72	<i>Ophidion scrippsae</i>	502
32	Sciaenidae	1973	73	<i>Microstomus pacificus</i>	479
33	<i>Chauliodus macouni</i>	1701	74	<i>Oxyjulis californica</i>	467
34	Paralepididae	1334	75	<i>Sebastolobus</i> spp.	462
35	<i>Hygophum atratum</i>	1309	76	<i>Lampanyctus regalis</i>	455
36	<i>Argentina sialis</i>	1294	77	<i>Poromitra</i> spp.	452
37	<i>Gonichthys tenuiculus</i>	1234	78	<i>Citharichthys sordidus</i>	450
38	<i>Scomber japonicus</i>	1228	79	<i>Etrumeus teres</i>	437
39	<i>Lestidiops ringens</i>	1210	80	<i>Scopelogadus bispinosus</i>	434
40	<i>Lyopsetta exilis</i>	1206	81	<i>Nansenia candida</i>	431
41	<i>Paralichthys californicus</i>	1105	82	<i>Ichthyococcus</i> spp.	426

Table 5. (Cont.)

Rank	Taxon	Occurrences	Rank	Taxon	Occurrences
83	<i>Hygophum reinhardtii</i>	414	126	<i>Coryphaena hippurus</i>	120
84	<i>Hygophum</i> spp.	408	127	<i>Electrona risso</i>	115
85	Anguilliformes	386	128	<i>Bathylagus milleri</i>	106
86	<i>Sebastes paucispinis</i>	372	128	Gerreidae	106
87	<i>Prionotus</i> spp.	363	130	<i>Genyonemus lineatus</i>	104
88	<i>Chilara taylori</i>	306	130	Pomacentridae	104
89	<i>Scorpaena</i> spp.	305	130	<i>Bathophilus</i> spp.	104
90	<i>Sphyræna argentea</i>	301	133	<i>Scopelarchus</i> spp.	102
91	Ceratioidei	297	134	Gempylidae	101
92	<i>Glyptocephalus zachirus</i>	276	134	<i>Bregmaceros</i> spp.	101
93	Gonostomatidae	271	136	<i>Psettichthys melanostictus</i>	96
94	<i>Halichoeres</i> spp.	266	137	<i>Sebastes aurora</i>	91
95	Agonidae	247	138	<i>Caulolatilus princeps</i>	89
96	<i>Notolychnus valdiviae</i>	238	138	<i>Auxis</i> spp.	89
97	<i>Scopelosaurus</i> spp.	236	140	<i>Rosenblattichthys volucris</i>	88
98	<i>Seriola lalandi</i>	233	141	<i>Pleuronichthys decurrens</i>	85
99	<i>Loweina rara</i>	224	142	Scombridae	84
101	<i>Danaphos oculatus</i>	218	143	Exocoetidae	73
102	Pleuronectiformes	217	143	<i>Girella nigricans</i>	73
102	Carangidae	211	145	<i>Macroramphosus gracilis</i>	71
103	<i>Sebastes jordani</i>	209	146	<i>Etropus</i> spp.	70
104	<i>Brosmophycis marginata</i>	208	147	<i>Vinciguerria poweriae</i>	63
105	<i>Zaniolepis</i> spp.	207	147	<i>Sebastes macdonaldi</i>	63
106	<i>Scorpaenichthys marmoratus</i>	206	147	<i>Hypsopsetta guttulata</i>	63
107	Cyclopteridae	203	150	Blennioidei	62
108	<i>Xystreurus liolepis</i>	202	151	Gobiesocidae	60
109	<i>Aristostomias scintillans</i>	196	152	<i>Myctophum aurolaternatum</i>	57
110	<i>Diplophos taenia</i>	192	153	<i>Howella brodiei</i>	53
111	<i>Pleuronichthys</i> spp.	181	154	<i>Syacium ovale</i>	48
112	<i>Brama</i> spp.	166	155	<i>Sebastes levis</i>	44
113	<i>Pleuronichthys ritteri</i>	165	156	<i>Physiculus</i> spp.	42
114	<i>Pleuronichthys coenosus</i>	157	157	<i>Icosteus aenigmaticus</i>	40
115	<i>Syngnathus</i> spp.	154	158	<i>Lepidopus fitchi</i>	39
116	<i>Medialuna californiensis</i>	152	159	<i>Bothus</i> spp.	38
117	<i>Oxylebius pictus</i>	147	160	Hexagrammidae	37
118	Stomiiformes	143	161	<i>Photonectes</i> spp.	34
119	Macrouridae	137	161	Scorpaenidae	34
120	<i>Notolepis risso</i>	136	163	<i>Seriphus politus</i>	31
121	Haemulidae	134	164	<i>Mugil</i> spp.	29
122	<i>Semicossyphus pulcher</i>	129	165	<i>Stemonosudis macrura</i>	28
123	Atherinidae	125	166	<i>Scopeloberyx robustus</i>	27
124	<i>Sarda chiliensis</i>	123	166	<i>Benthalbella dentata</i>	27
125	<i>Tactostoma macropus</i>	121	168	<i>Centrobranchus nigroocellatus</i>	26

Table 5. (Cont.)

Rank	Taxon	Occurrences	Rank	Taxon	Occurrences
169	<i>Opisthonema</i> spp.	25	209	<i>Seriola</i> spp.	3
169	Nomeidae	25	209	<i>Hippoglossina</i> spp.	3
171	<i>Protomyctophum thompsoni</i>	23	209	Antennariidae	3
172	<i>Lepidopsetta bilineata</i>	21	209	<i>Parvilux ingens</i>	3
172	Moridae	21	209	<i>Benthalbella</i> spp.	3
174	<i>Scopelarchoides nicholsi</i>	19	209	<i>Gonostoma</i> spp.	3
174	Carapidae	19	209	<i>Macropinna microstoma</i>	3
174	<i>Scomberomorus</i> spp.	19	209	Astronesthidae	3
174	Evermannellidae	19	220	Lophiidae	2
174	<i>Platichthys stellatus</i>	19	220	Balistidae	2
179	<i>Sudis atrox</i>	17	220	<i>Paralichthys</i> spp.	2
180	<i>Valenciennellus tripunctulatus</i>	16	220	Bathymasteridae	2
180	Apogonidae	16	220	Bothidae	2
180	<i>Hypsypops rubicundus</i>	16	220	<i>Cheilotrema saturnum</i>	2
183	<i>Bolinichthys</i> spp.	14	220	<i>Hygophum proximum</i>	2
184	Osmeridae	13	220	Polynemidae	2
184	<i>Ophiodon elongatus</i>	13	228	Fistulariidae	1
186	<i>Porichthys</i> spp.	12	228	<i>Roncador stearnsii</i>	1
186	<i>Thunnus albacares</i>	12	228	Microdesmidae	1
186	<i>Cubiceps pauciradiatus</i>	12	228	<i>Dolichopteryx</i> spp.	1
186	<i>Benthosea pterota</i>	12	228	<i>Woodsia nonsuchae</i>	1
190	<i>Psenes pellucidus</i>	11	228	Sparidae	1
190	<i>Aulopus</i> spp.	11	228	<i>Chaetodipterus zonatus</i>	1
190	Hemiramphidae	11	228	<i>Dolichopteryx longipes</i>	1
193	<i>Microgadus proximus</i>	9	228	Priacanthidae	1
193	Eutaeniophoridae	9	228	<i>Eopsetta jordani</i>	1
195	Mullidae	8	228	<i>Bathylychnops exilis</i>	1
196	Uranoscopidae	7	228	<i>Atractoscion nobilis</i>	1
196	<i>Triphoturus nigrescens</i>	7	228	<i>Gadus macrocephalus</i>	1
196	<i>Eustomias</i> spp.	7	228	<i>Citharichthys platophrys</i>	1
199	Tetraodontidae	6	228	<i>Paralepis atlantica</i>	1
199	<i>Bathylagus longirostris</i>	6	228	Acanthuridae	1
201	<i>Anoplopoma fimbria</i>	5	228	<i>Lobianchia</i> spp.	1
201	Engraulidae	5	228	<i>Cubiceps caeruleus</i>	1
201	<i>Isopsetta isolepis</i>	5	228	Soleidae	1
201	<i>Albula</i> sp.	5	228	<i>Oxyporhamphus micropterus</i>	1
201	<i>Psenes sio</i>	5	228	<i>Cyclopsetta</i> spp.	1
206	<i>Caristius macropus</i>	4	228	Merlucciidae	1
206	<i>Euthynnus</i> spp.	4	228	<i>Taaningichthys minimus</i>	1
206	Myctophiformes	4	228	Gadidae	1
209	<i>Leuroglossus schmidti</i>	3			
209	Alepocephalidae	3			
209	<i>Anopterus pharao</i>	3			

Table 6. Total number of stations occupied in 24 CalCOFI regions in each quarter during 1951-1984 and the area of each region.

Region	Area (km ²)	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
1	5.61 x 10 ⁴	58	92	80	21
2	11.80 x 10 ⁴	50	42	49	16
3	9.88 x 10 ⁴	15	3	4	4
4	6.10 x 10 ⁴	673	849	518	360
5	9.88 x 10 ⁴	316	453	305	198
6	9.88 x 10 ⁴	57	53	39	20
7	6.90 x 10 ⁴	1534	1593	1101	1145
8	4.12 x 10 ⁴	444	581	357	293
9	9.88 x 10 ⁴	677	979	539	352
10	9.88 x 10 ⁴	107	116	67	43
11	3.17 x 10 ⁴	666	729	514	442
12	3.64 x 10 ⁴	721	736	751	431
13	7.12 x 10 ⁴	762	1020	577	400
14	9.87 x 10 ⁴	530	842	396	257
15	9.88 x 10 ⁴	39	45	20	18
16	4.89 x 10 ⁴	815	752	709	542
17	7.68 x 10 ⁴	679	770	479	363
18	9.88 x 10 ⁴	191	228	167	115
19	9.88 x 10 ⁴	30	18	10	12
20	4.98 x 10 ⁴	258	100	39	70
21	11.52 x 10 ⁴	207	128	31	70
22	9.88 x 10 ⁴	13	19	6	8
23	9.88 x 10 ⁴	1	4	1	4
24	-	66	100	79	31
Total	186.9 x 10 ⁴	8909	10252	6838	5215

Table 7. Total number of stations occupied in 14 onshore-offshore bins for 7 alongshore zones in CalCOFI surveys during 1951-1984. Abbreviations: N CAL = Northern California; C CAL = Central California; S CAL = Southern California; N BAJA CAL = Northern Baja California; NC BAJA CAL = North Central Baja California; SC BAJA CAL = South Central Baja California; S BAJA CAL = Southern Baja California.

Onshore-offshore Bin (n. mi.)	N CAL	C CAL	S CAL	N BAJA CAL	NC BAJA CAL	SC BAJA CAL	S BAJA CAL
0-5	14	411	901	377	72	27	0
5-10	35	106	572	278	297	81	0
10-20	38	535	1078	494	368	483	123
20-30	54	215	262	291	178	297	47
30-40	15	469	706	325	329	198	120
40-50	46	203	339	328	302	606	29
50-100	99	928	2084	1267	1269	1382	332
100-150	58	421	1554	1019	805	1204	162
150-200	35	410	1132	814	726	321	97
200-250	25	88	934	695	355	170	19
250-300	11	40	293	135	151	19	18
300-350	4	2	43	9	23	14	5
350-400	0	14	61	34	20	13	7
> 400	1	59	165	18	0	1	0

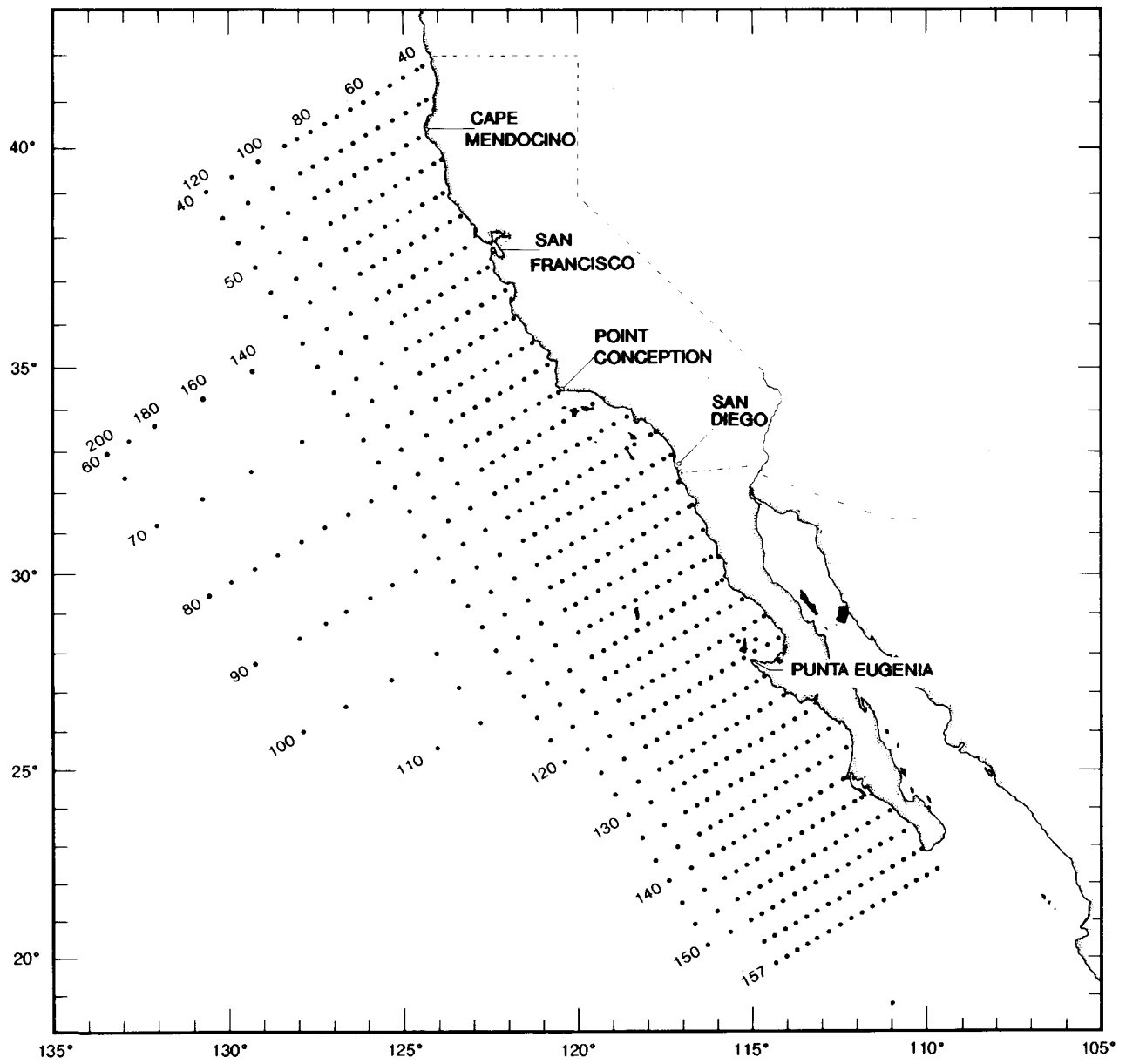


Figure 1. CalCOFI station pattern showing stations represented in the ichthyoplankton data base.

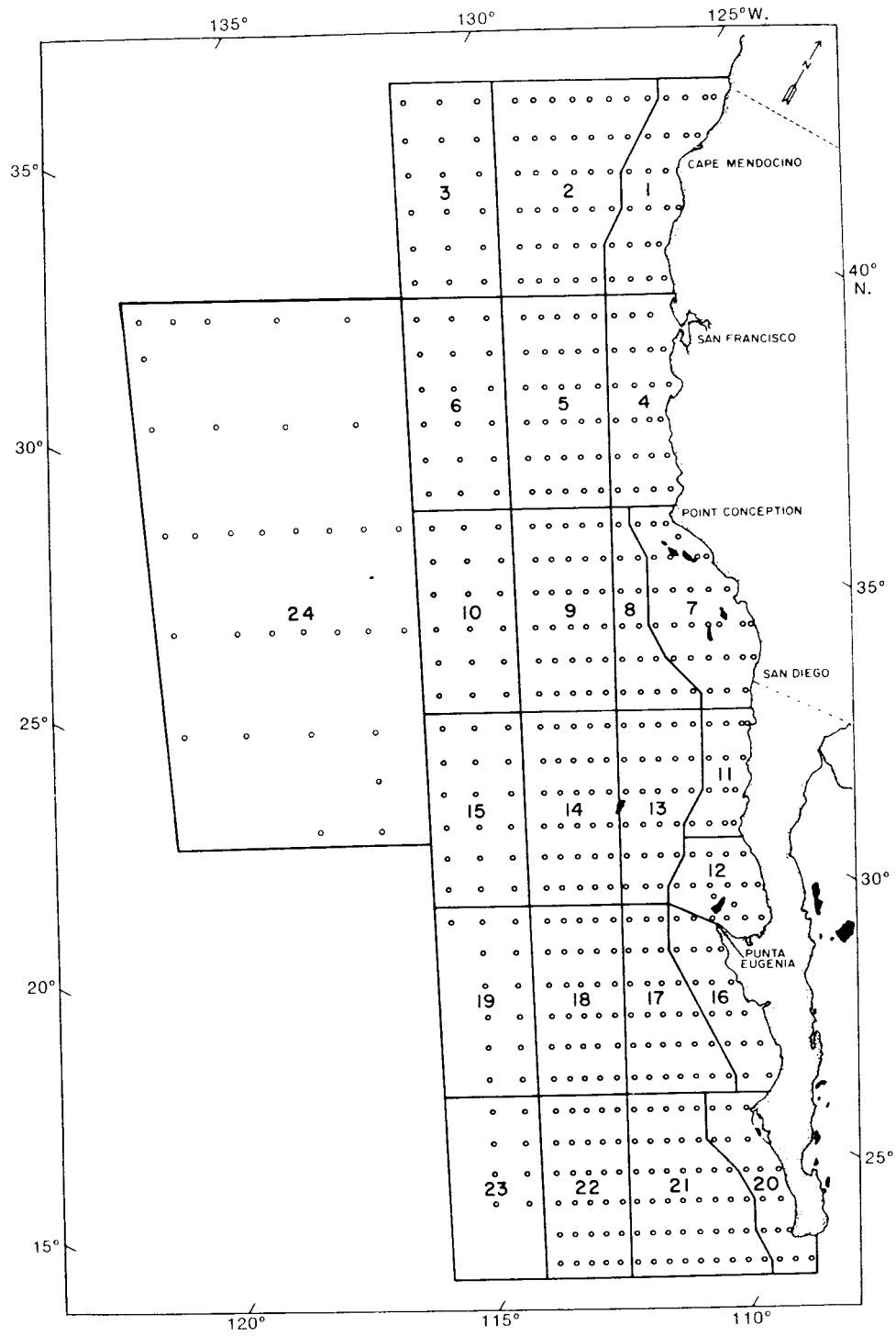


Figure 2. CalCOFI survey pattern showing the regions used in this atlas.

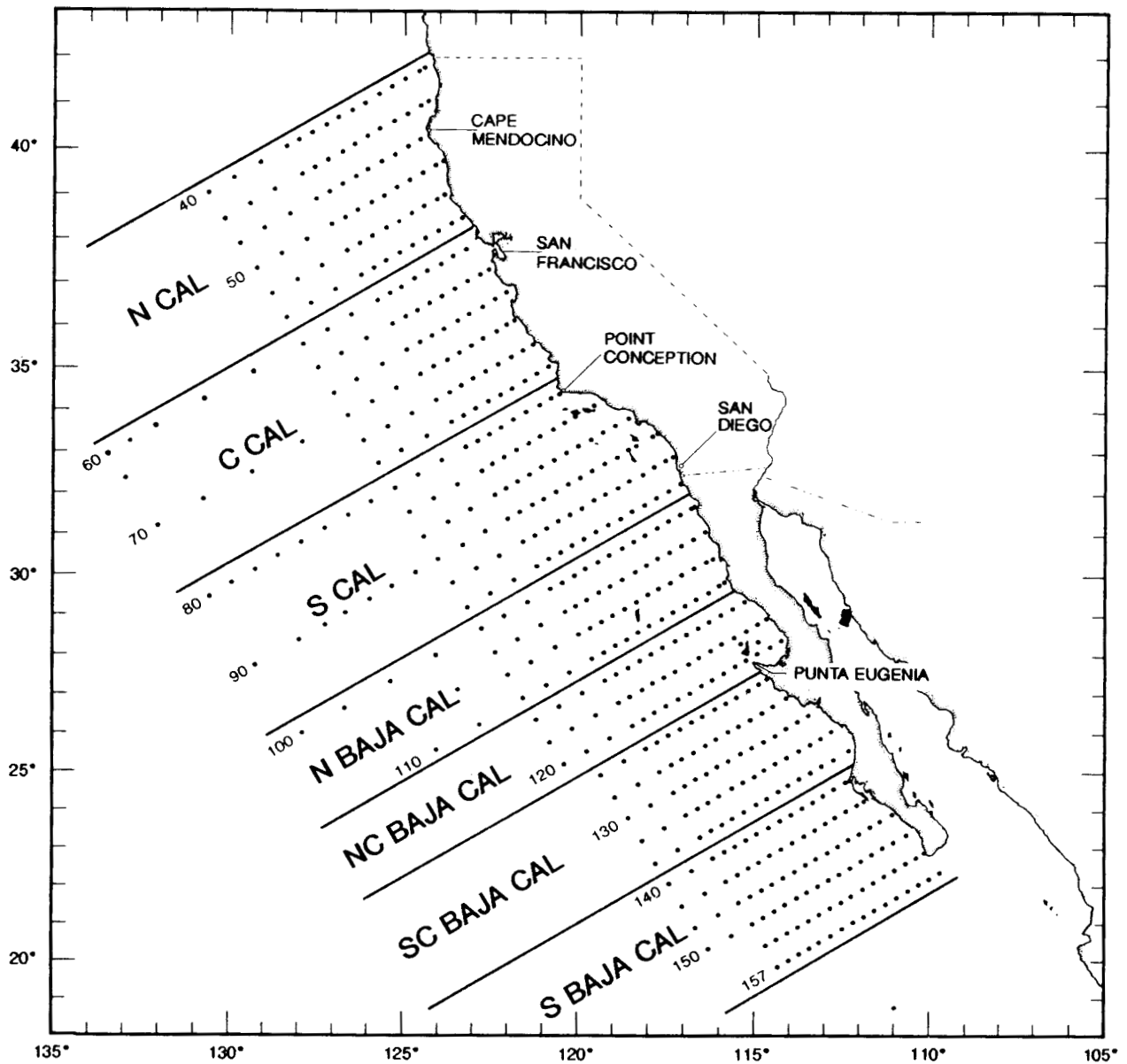


Figure 3. CalCOFI survey pattern showing the seven onshore-offshore zones used in this atlas. Abbreviations: N CAL = Northern California; C CAL = Central California; S CAL = Southern California; N BAJA CAL = Northern Baja California; NC BAJA CAL = North Central Baja California; SC BAJA CAL = South Central Baja California; S BAJA CAL = Southern Baja California.

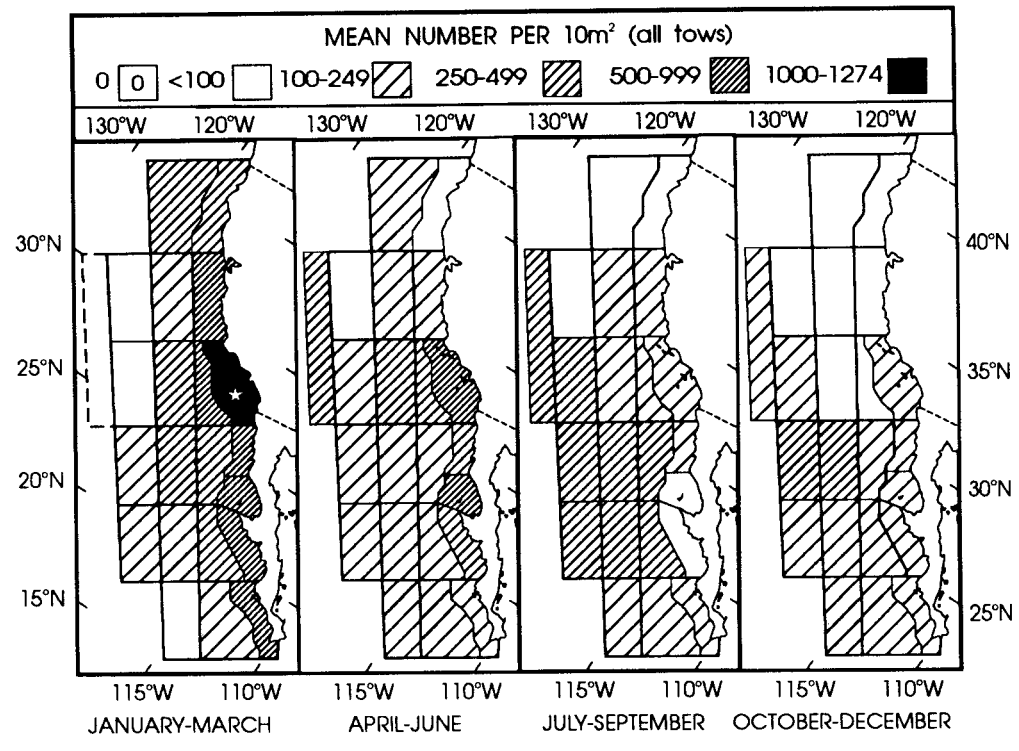
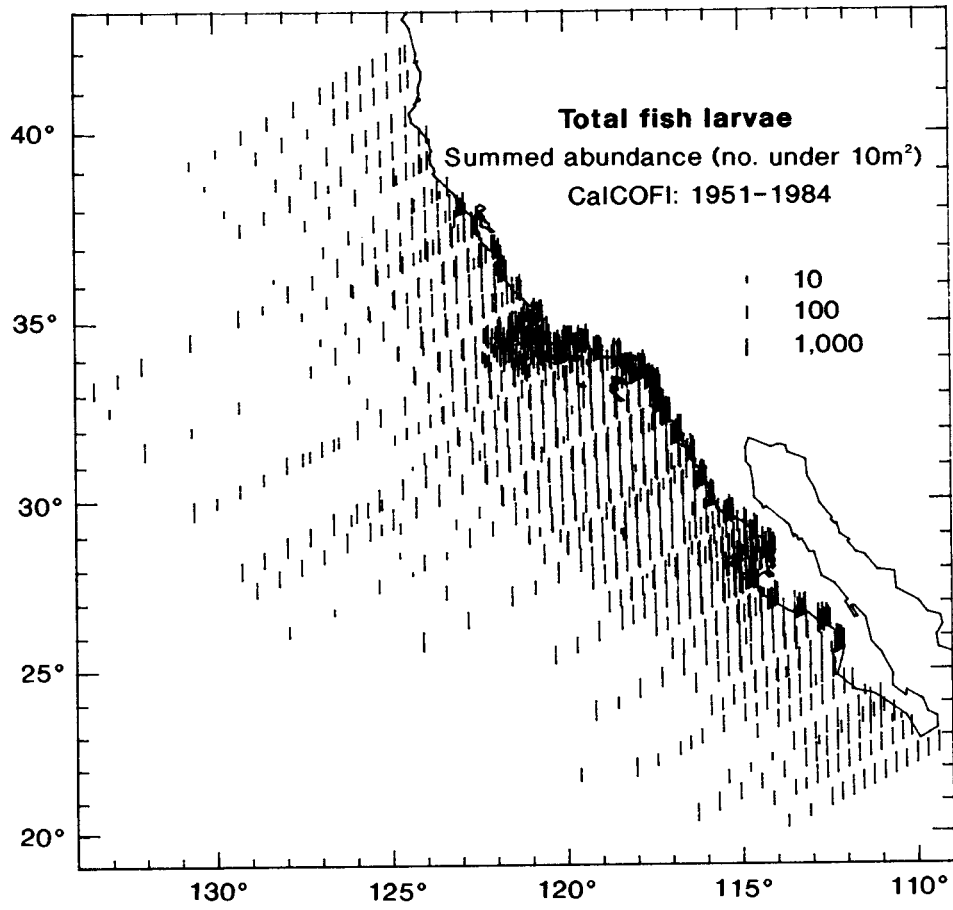
LIST OF TAXA

	Page		Page
Total fish larvae	2	<i>Hygophum atratum</i>	88
Total fish eggs	3	<i>Paralichthys californicus</i>	90
<i>Engraulis mordax</i> larvae	4	<i>Sebastes paucispinis</i>	92
<i>Engraulis mordax</i> eggs	6	<i>Chauliodus macouni</i>	94
<i>Merluccius productus</i>	8	<i>Peprilus simillimus</i>	96
<i>Vinciguerria lucetia</i>	10	Ophidiiformes	98
<i>Sebastes</i> spp.	12	<i>Genyonemus lineatus</i>	100
<i>Leuroglossus stilbius</i>	14	<i>Chromis punctipinnis</i>	102
<i>Triphoturus mexicanus</i>	16	<i>Tetragonurus cuvieri</i>	104
<i>Stenobranchius leucopsarus</i>	18	Labridae	106
<i>Sardinops sagax</i> larvae	20	<i>Gonichthys tenuiculus</i>	108
<i>Sardinops sagax</i> eggs	22	<i>Hypsoblennius</i> spp.	110
<i>Trachurus symmetricus</i>	24	<i>Lestidiops ringens</i>	112
<i>Diogenichthys laternatus</i>	26	<i>Scorpaena</i> spp.	114
<i>Bathylagus wesethi</i>	28	Paralepididae	116
<i>Bathylagus ochotensis</i>	30	<i>Pleuronichthys verticalis</i>	118
Sciaenidae	32	<i>Ophidion scrippsae</i>	120
<i>Cyclothone</i> spp.	34	Cottidae	122
<i>Protomyctophum crockeri</i>	36	<i>Oxyjulis californica</i>	124
<i>Tarletonbeania crenularis</i>	38	<i>Bathylagus pacificus</i>	126
<i>Ceratoscopelus townsendi</i>	40	Haemulidae	128
<i>Lampanyctus</i> spp.	42	<i>Idiacanthus antrostomus</i>	130
<i>Lampanyctus ritteri</i>	44	Clinidae	132
<i>Diaphus</i> spp.	46	<i>Lampadena urophaos</i>	134
<i>Scomber japonicus</i>	48	Carangidae	136
<i>Citharichthys fragilis</i>	50	<i>Notoscopelus resplendens</i>	138
<i>Citharichthys stigmaeus</i>	52	<i>Hippoglossina stomata</i>	140
<i>Synodus</i> spp.	54	<i>Sebastolobus</i> spp.	142
<i>Symbolophorus californiensis</i>	56	Scopelarchidae	144
<i>Diogenichthys atlanticus</i>	58	Trichiuridae	146
<i>Citharichthys xanthostigma</i>	60	<i>Nansenia crassa</i>	148
<i>Melamphaes</i> spp.	62	<i>Myctophum nitidulum</i>	150
Sternoptychidae	64	<i>Nansenia candida</i>	152
Serranidae	66	<i>Citharichthys sordidus</i>	154
<i>Prionotus</i> spp.	68	<i>Sphyræna argentea</i>	156
<i>Icichthys lockingtoni</i>	70	<i>Microstoma</i> sp.	158
<i>Symphurus</i> spp.	72	Chiasmodontidae	160
<i>Stomias atriventer</i>	74	<i>Lampanyctus regalis</i>	162
<i>Argentina sialis</i>	76	<i>Halichoeres</i> spp.	164
<i>Sebastes jordani</i>	78	<i>Microstomus pacificus</i>	166
<i>Etrumeus teres</i>	80	<i>Cololabis saira</i> larvae	168
Gobiidae	82	<i>Cololabis saira</i> eggs	170
<i>Parophrys vetulus</i>	84	Trachipteridae	172
<i>Lyopsetta exilis</i>	86	<i>Sarda chiliensis</i>	174

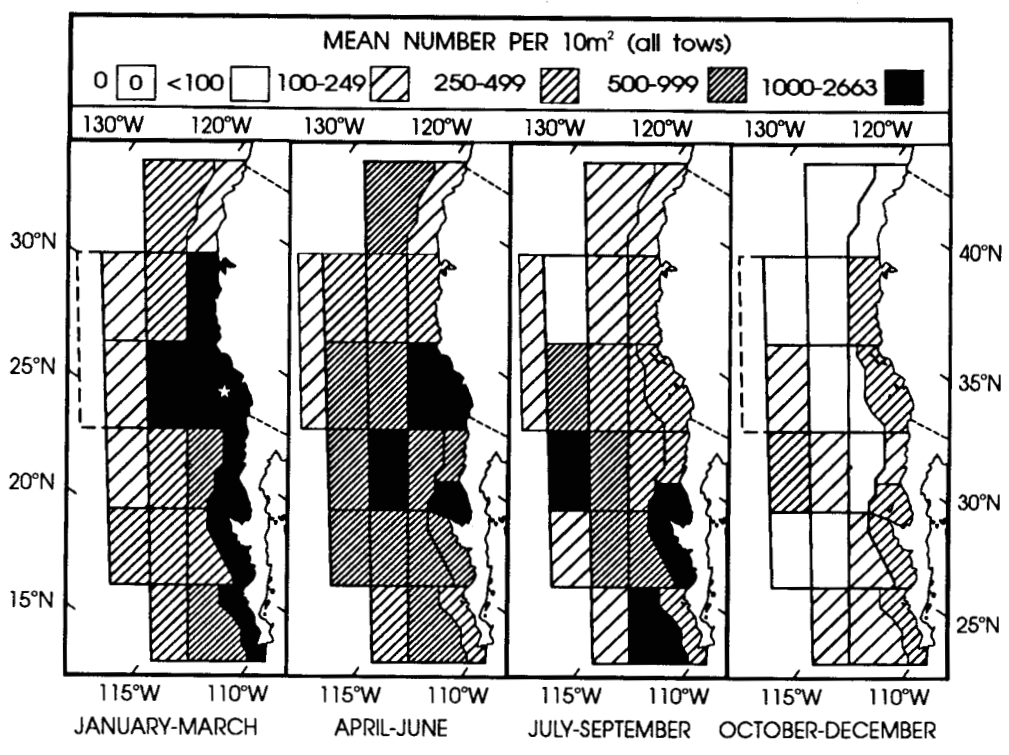
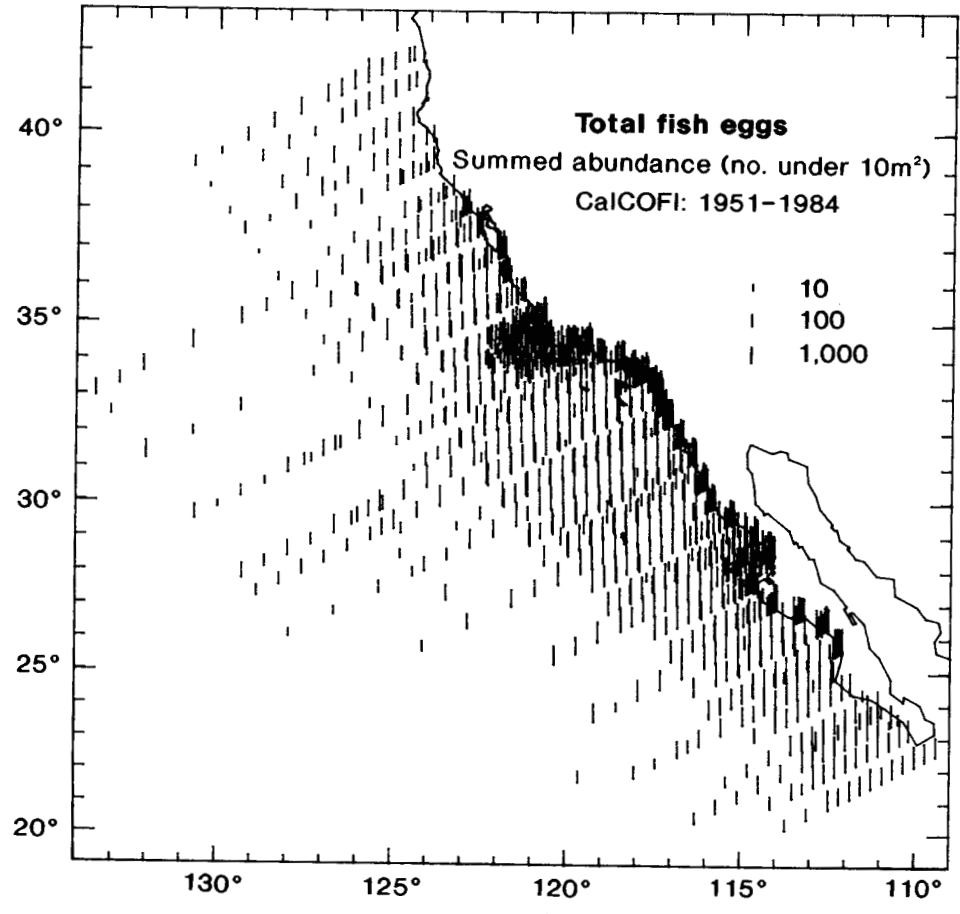
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<i>Notolychnus valdiviae</i>	192
<i>Auxis</i> spp.	194
<i>Ichthyococcus</i> spp.	196
<i>Bregmaceros</i> spp.	198
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<i>Scopelosaurus</i> spp.	218
Agonidae	220
<i>Brosmophycis marginata</i>	222
<i>Sebastes aurora</i>	224
<i>Pleuronichthys ritteri</i>	226
<i>Scorpaenichthys marmoratus</i>	228

CHARTS AND GRAPHS

Total Fish Larvae

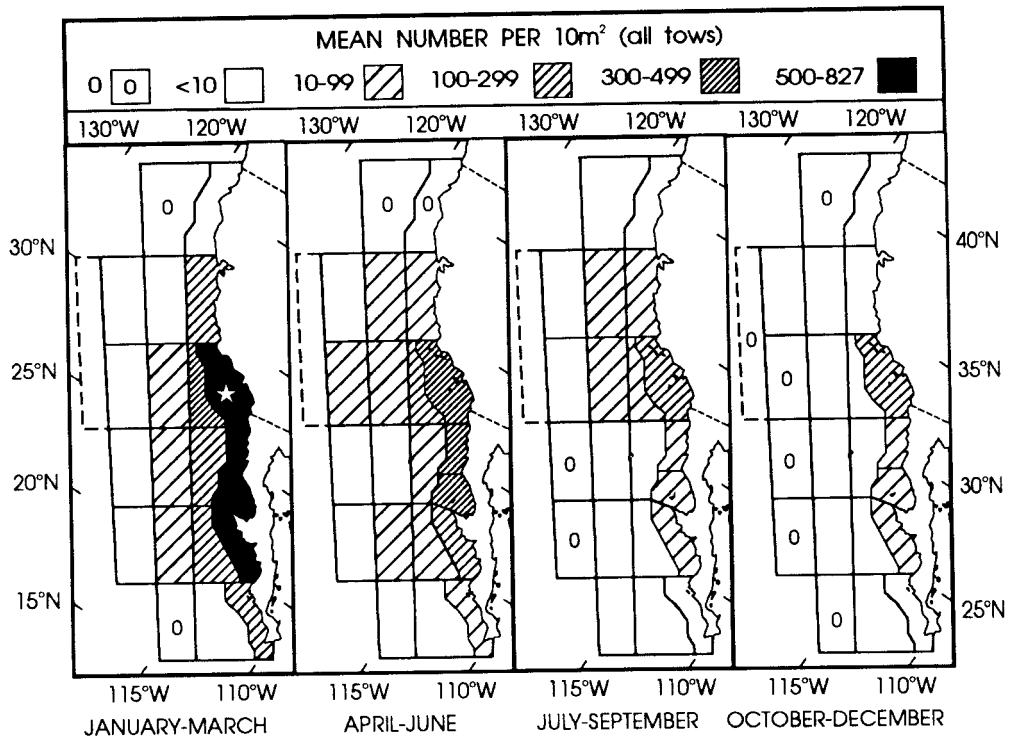
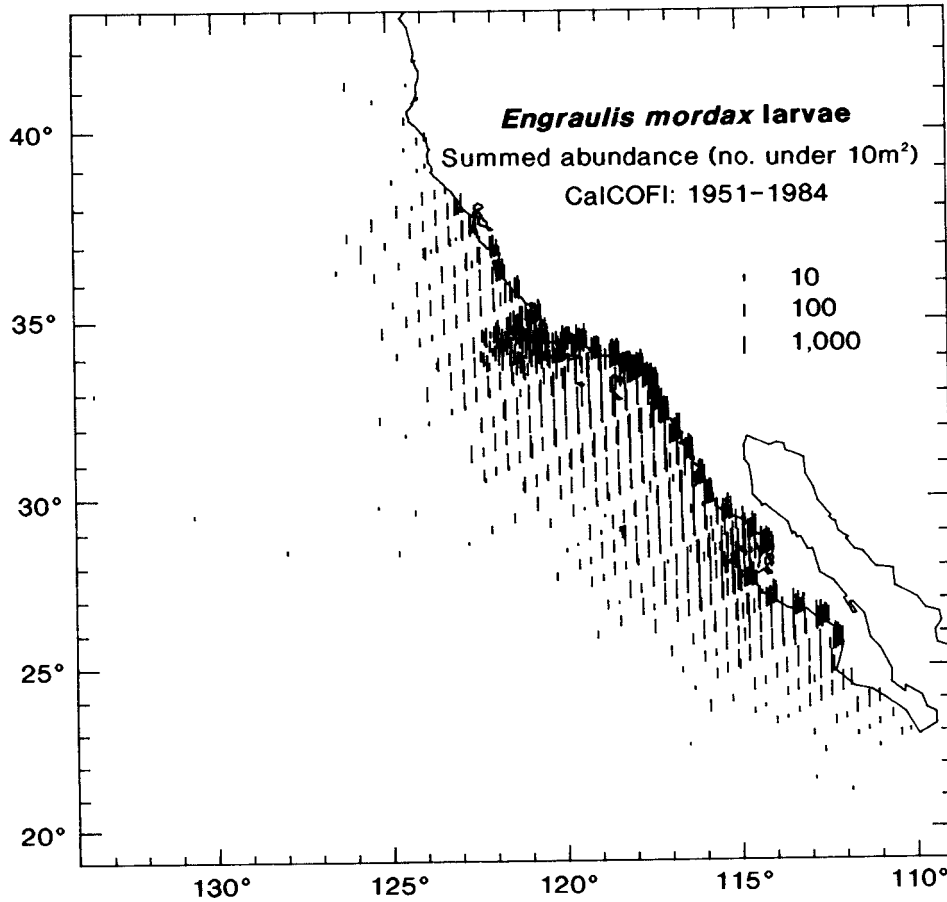


Total Fish Eggs



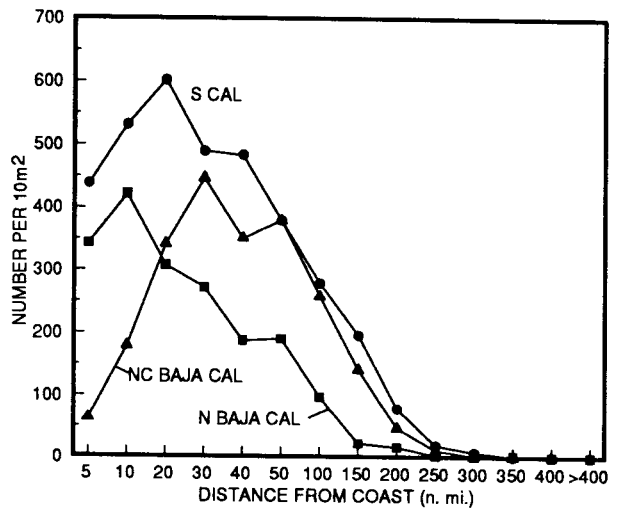
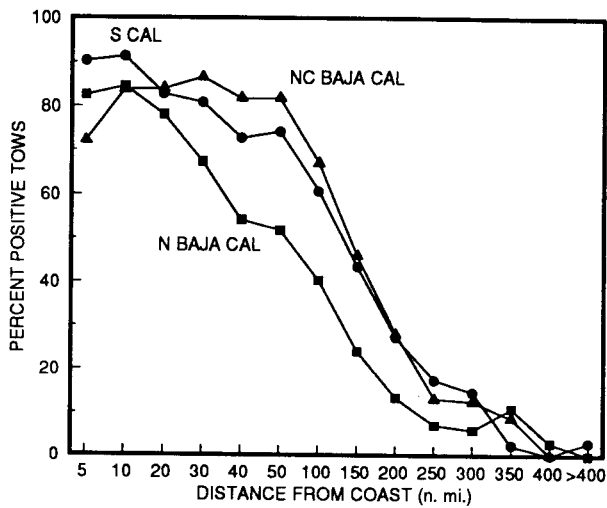
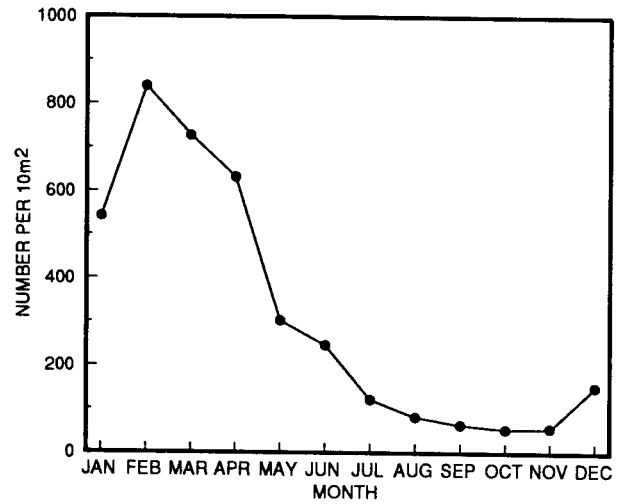
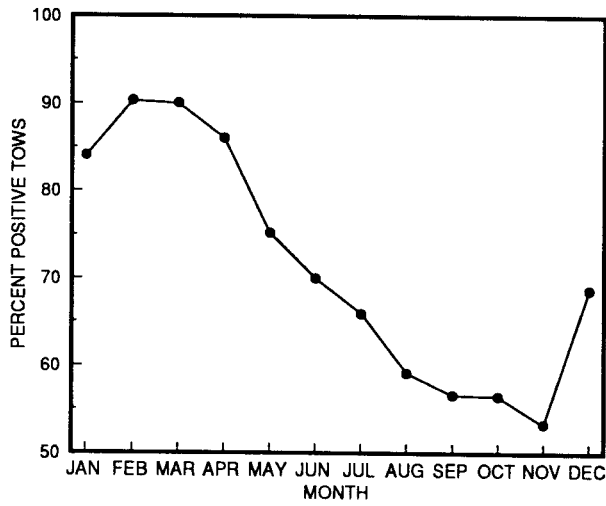
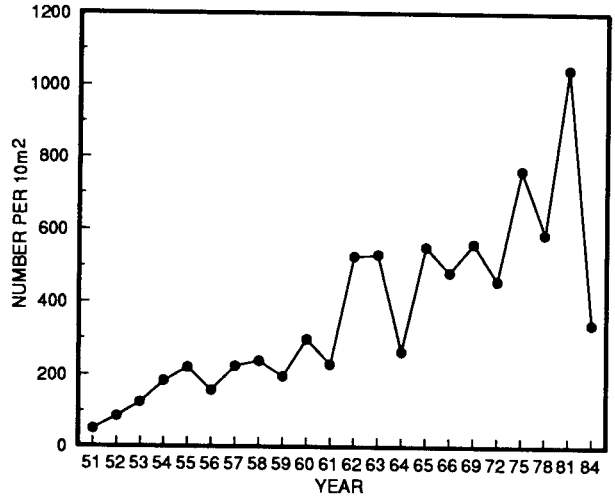
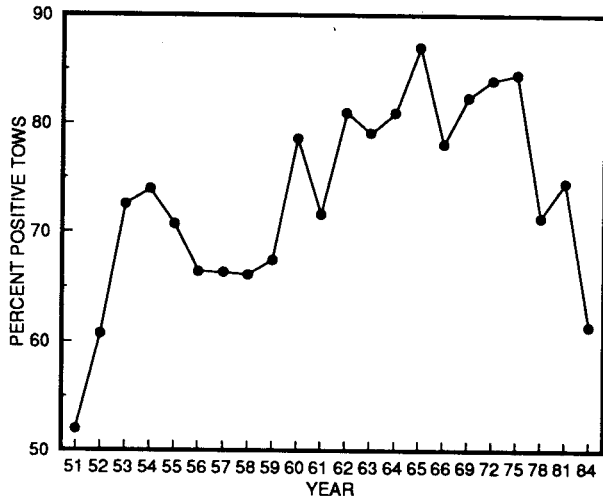
Engraulis mordax larvae

Engraulidae



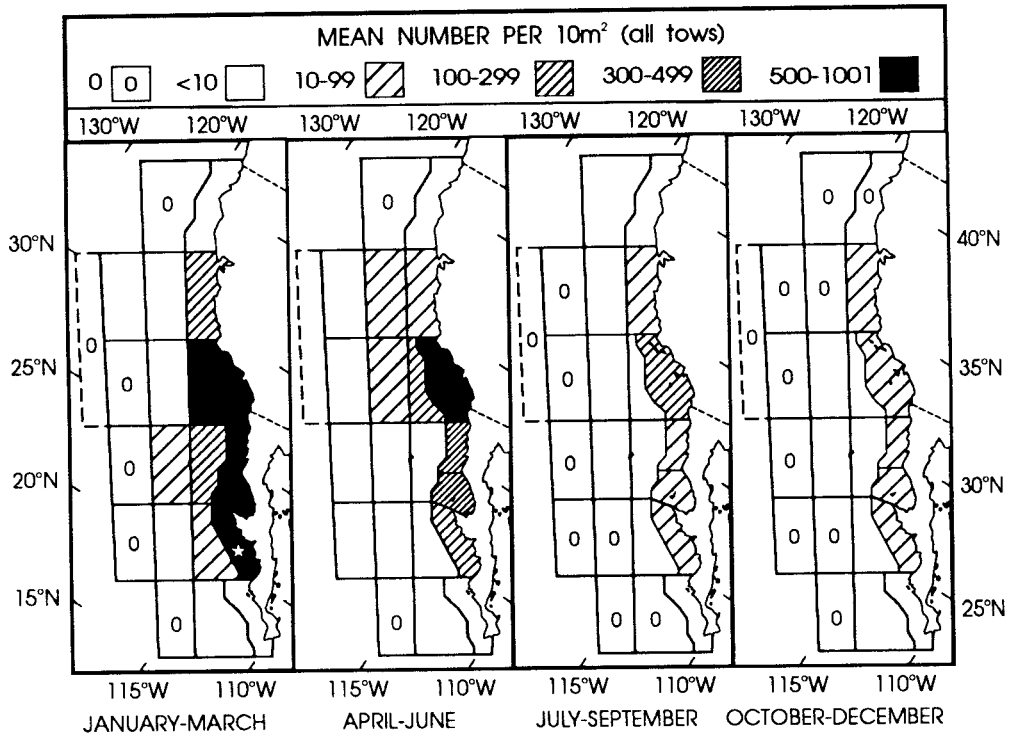
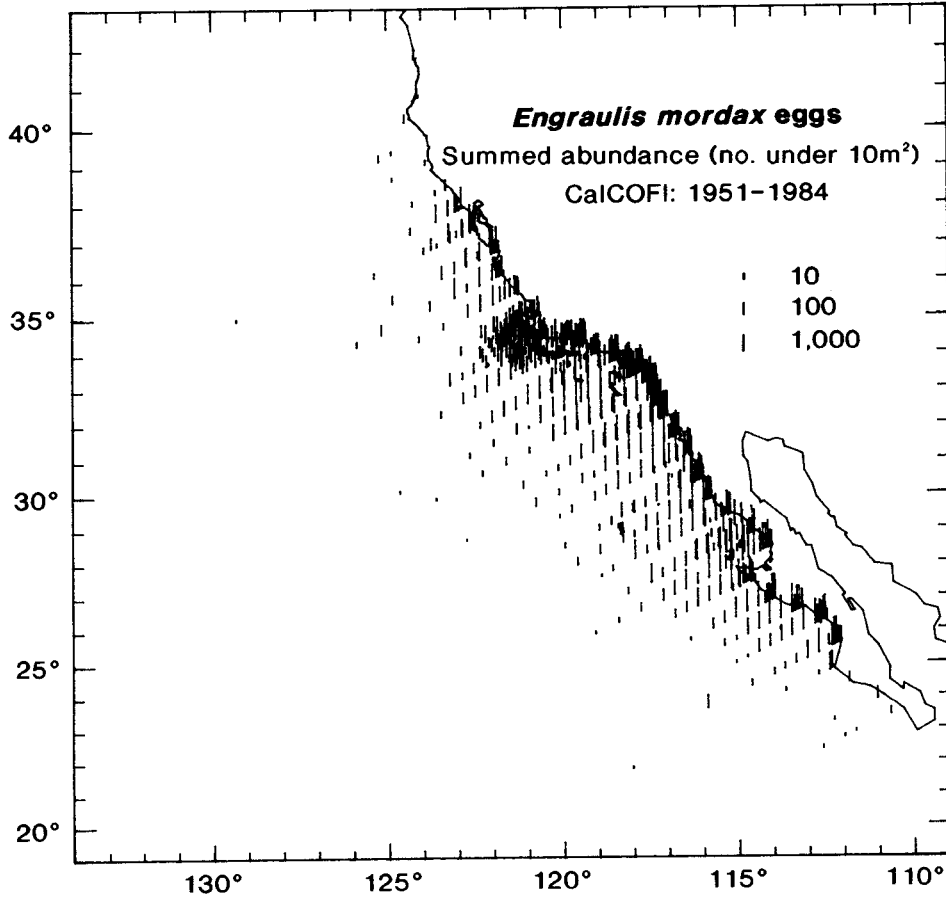
Northern anchovy

Engraulis mordax larvae



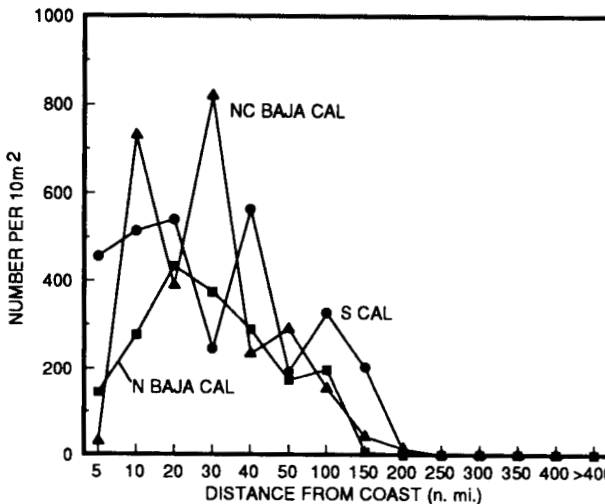
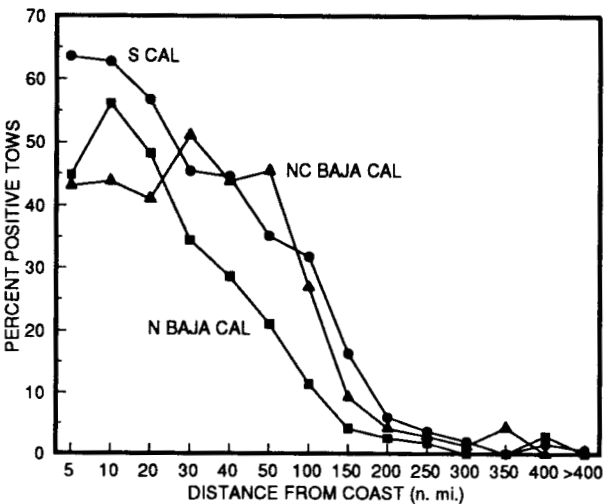
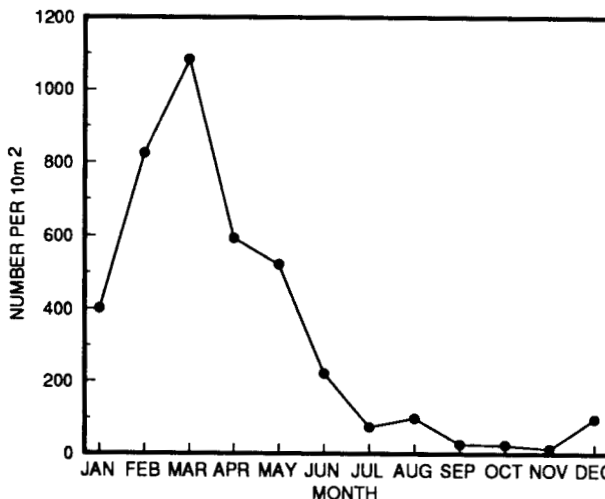
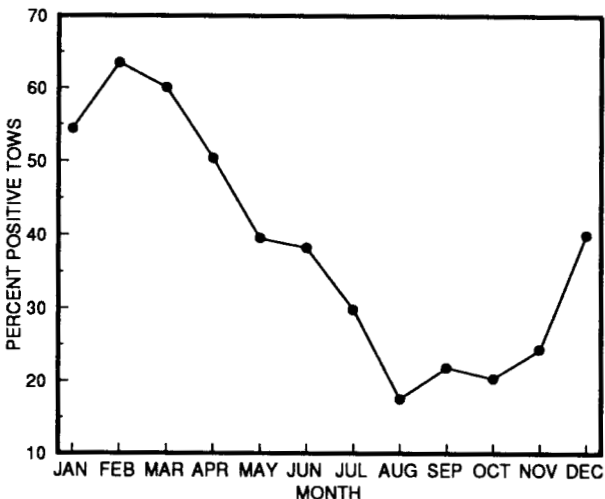
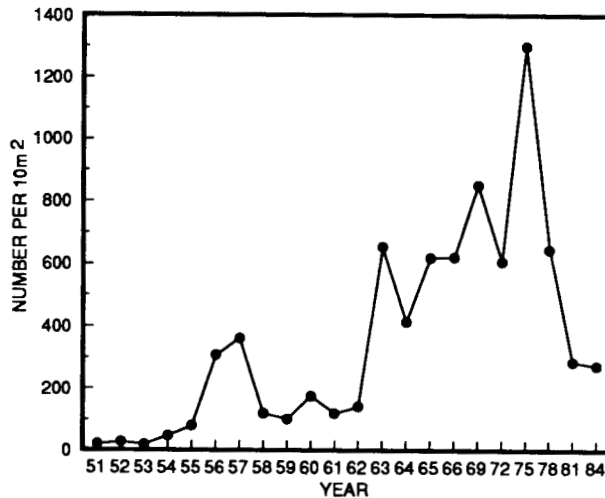
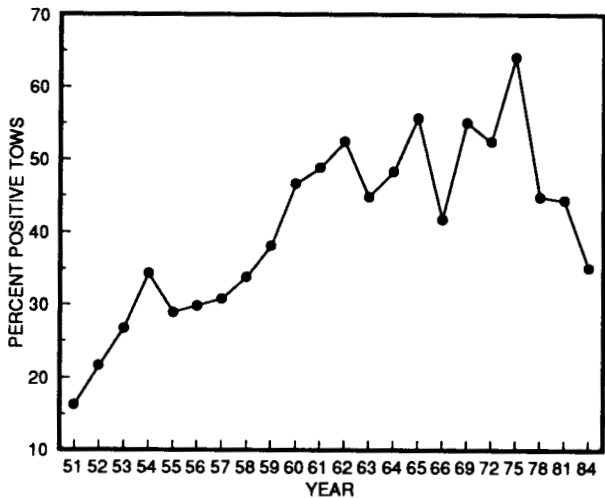
Engraulis mordax eggs

Engraulidae



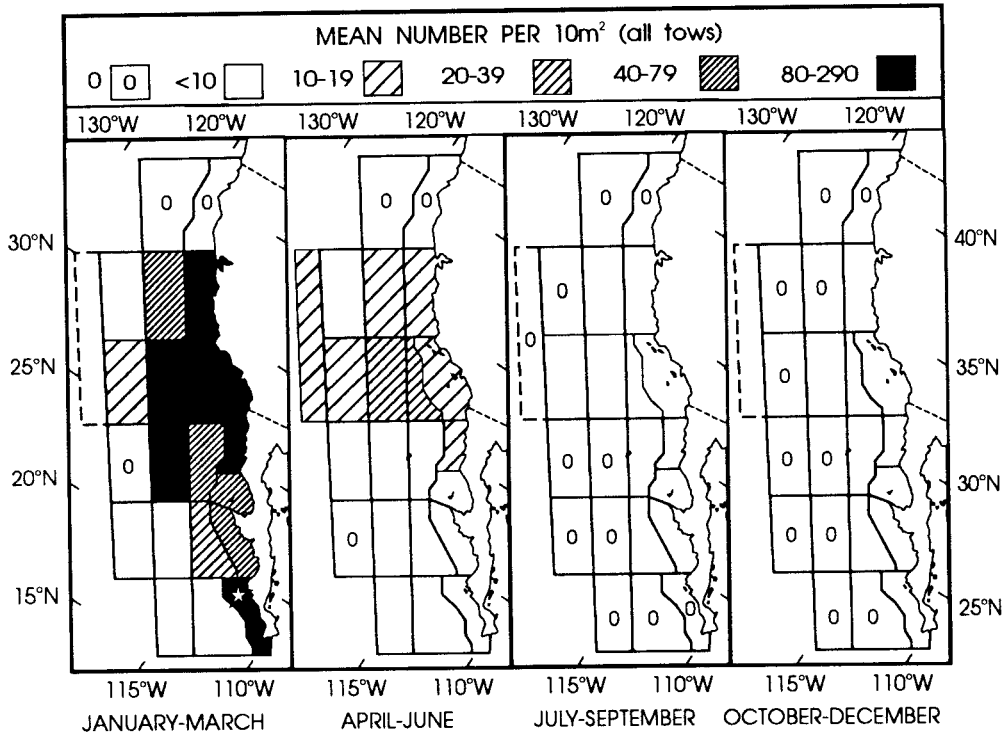
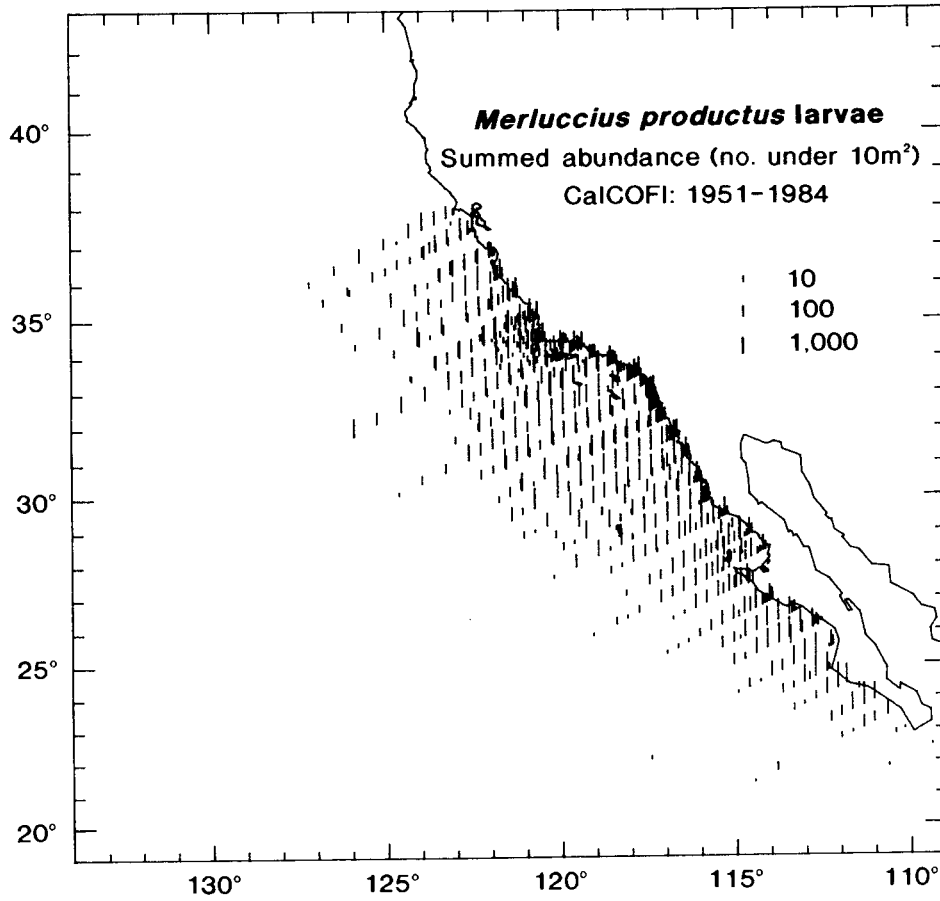
Northern anchovy

Engraulis mordax eggs

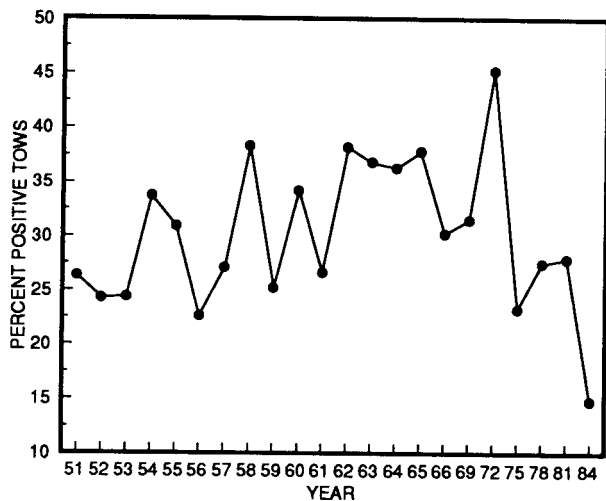


Merluccius productus

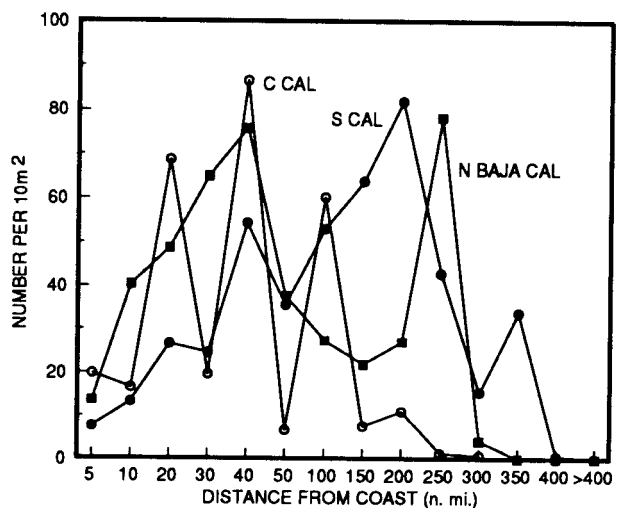
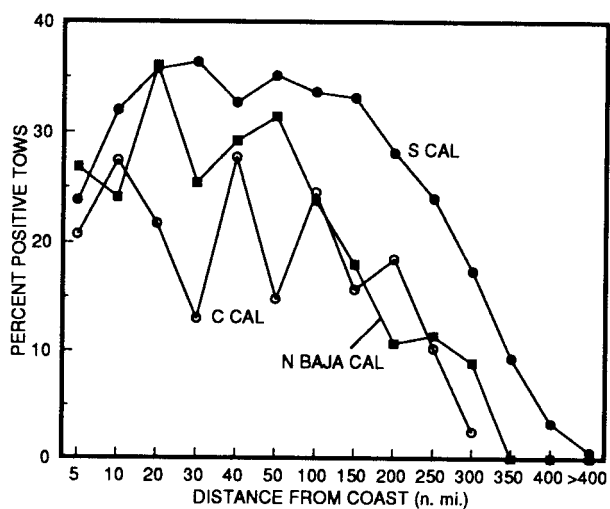
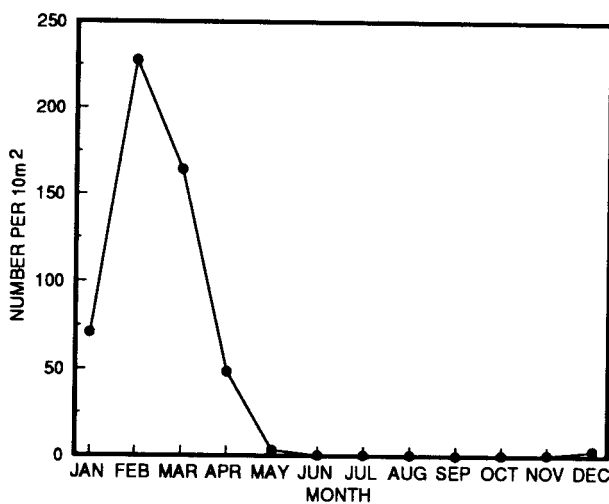
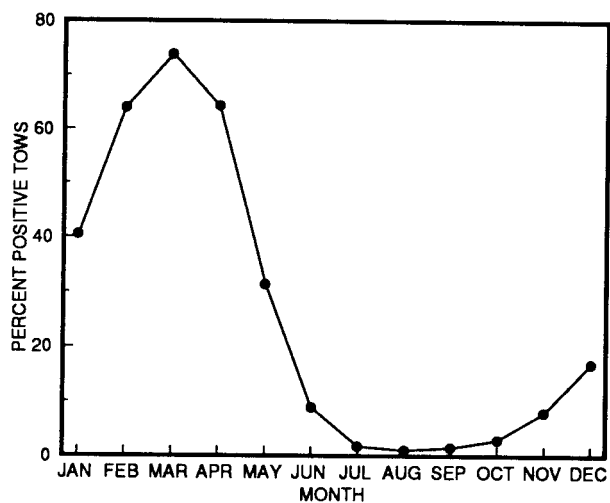
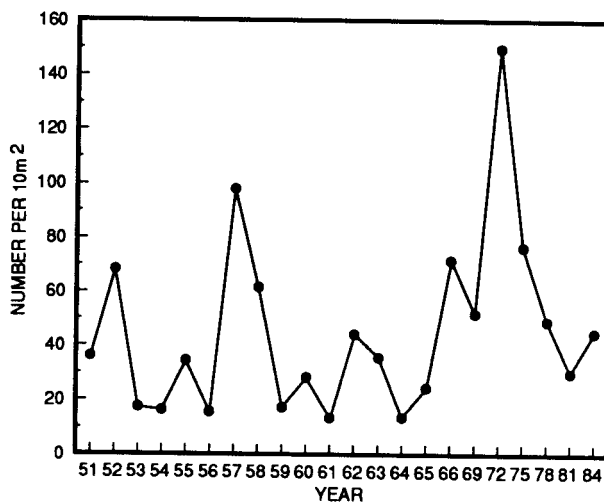
Merlucciidae



Pacific hake

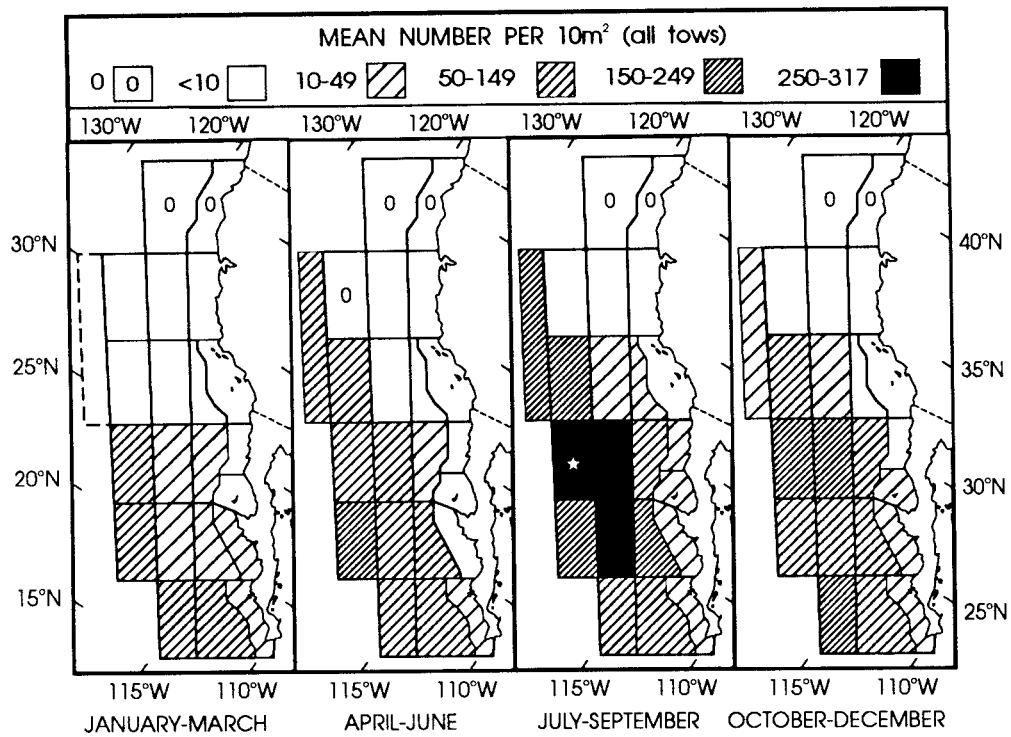
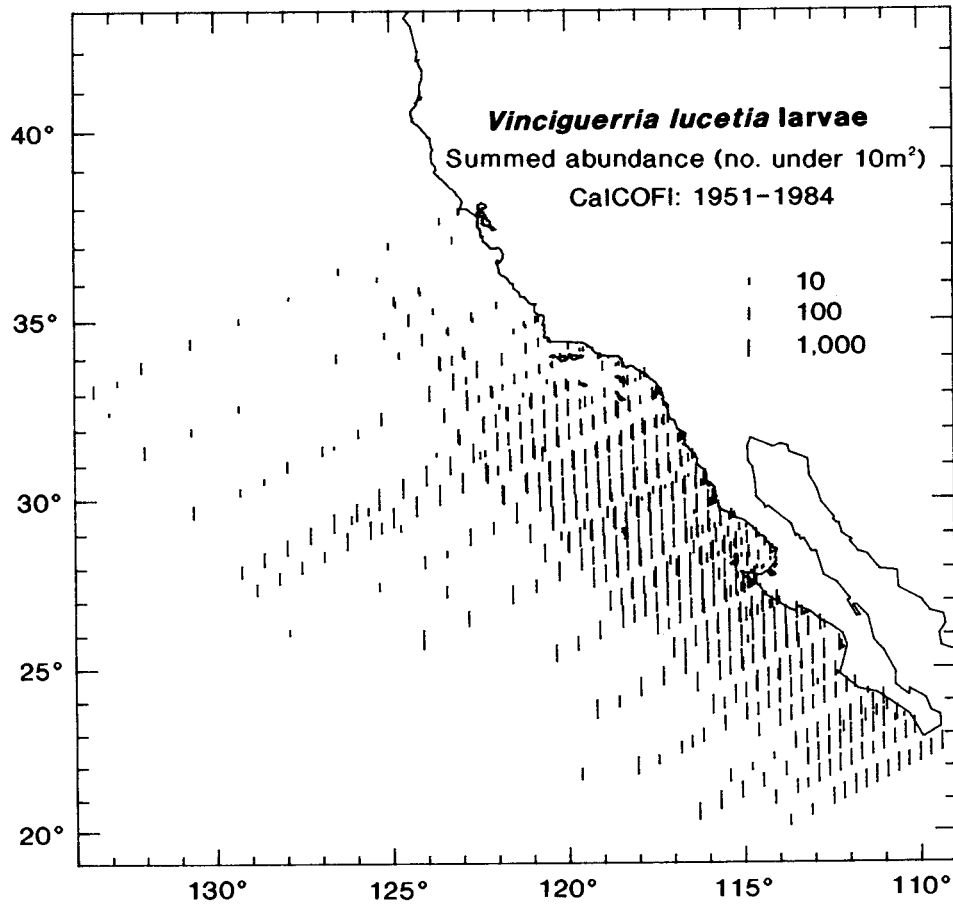


Merluccius productus

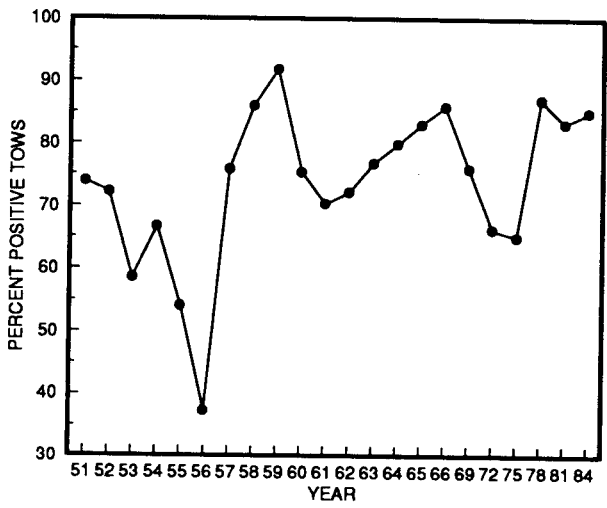


Vinciguerria lucetia

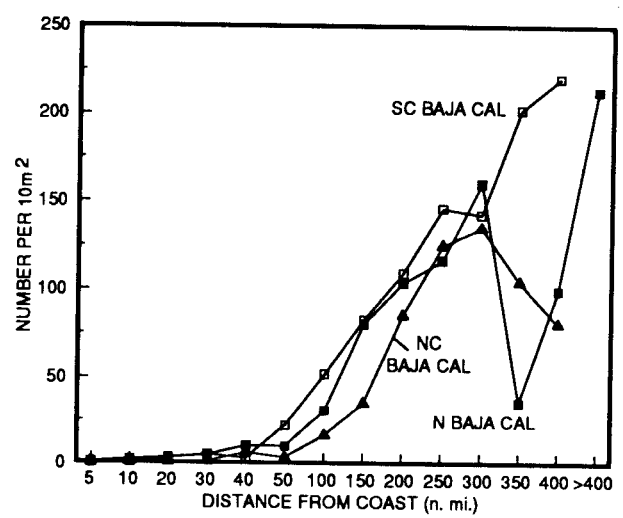
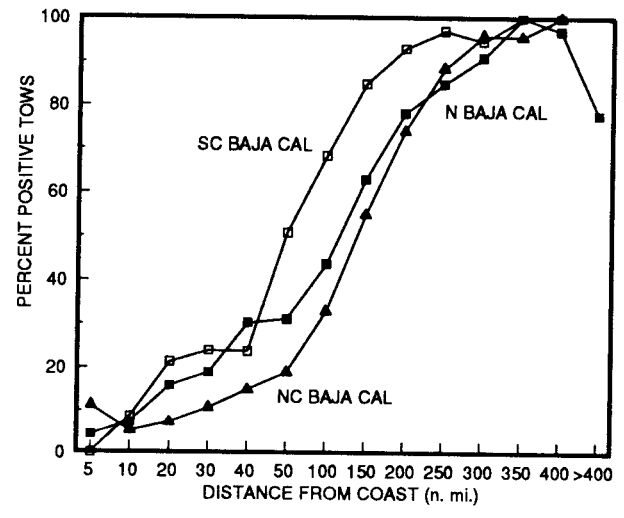
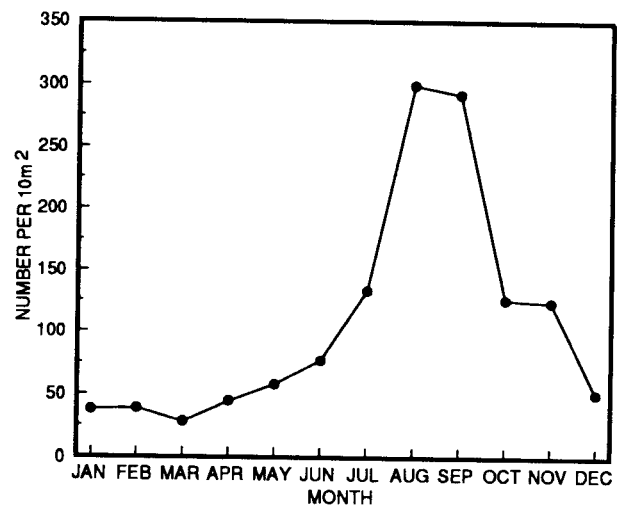
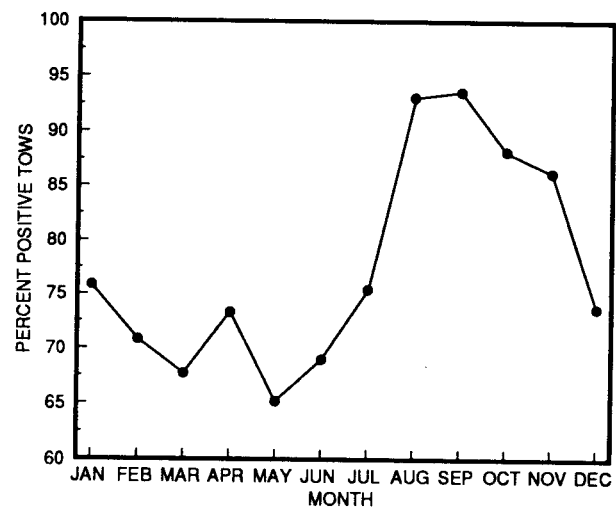
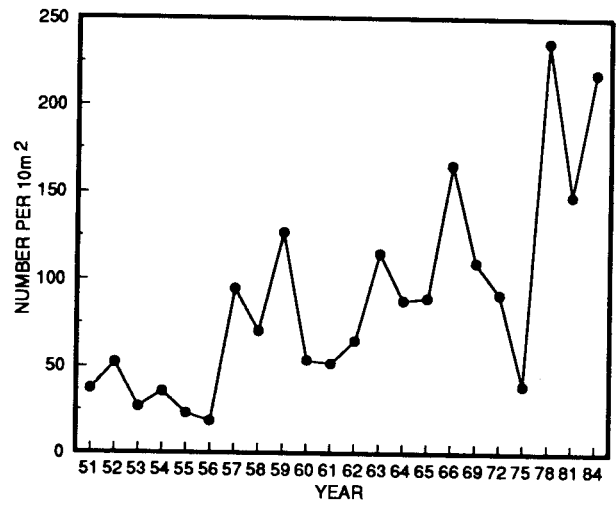
Phosichthyidae



Panama lightfish

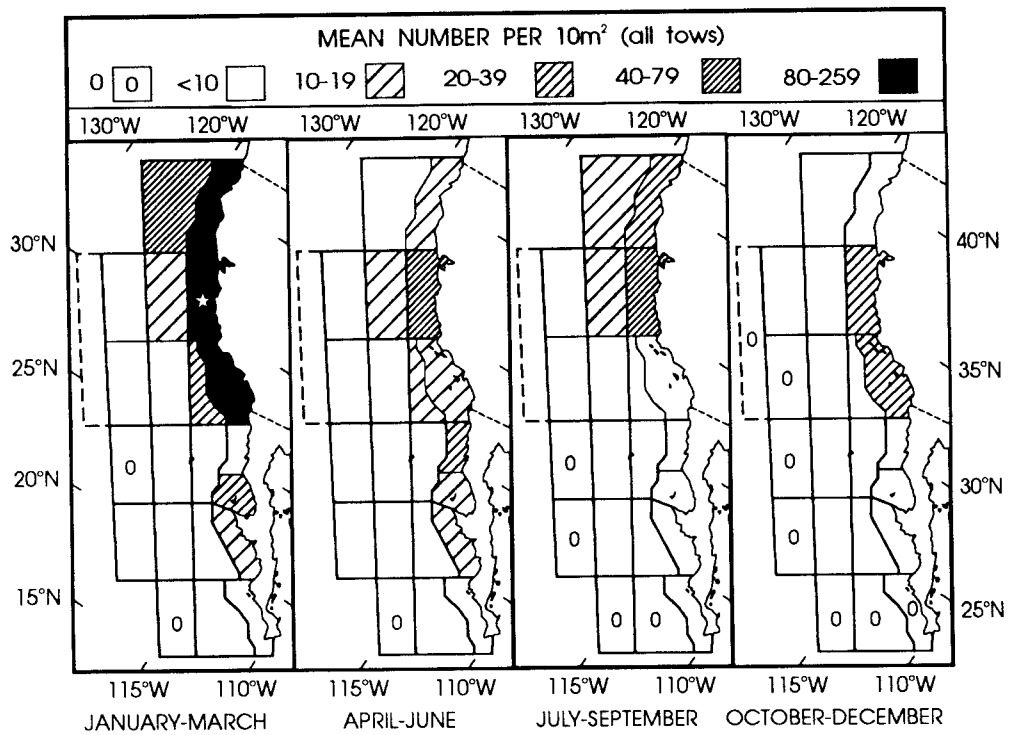
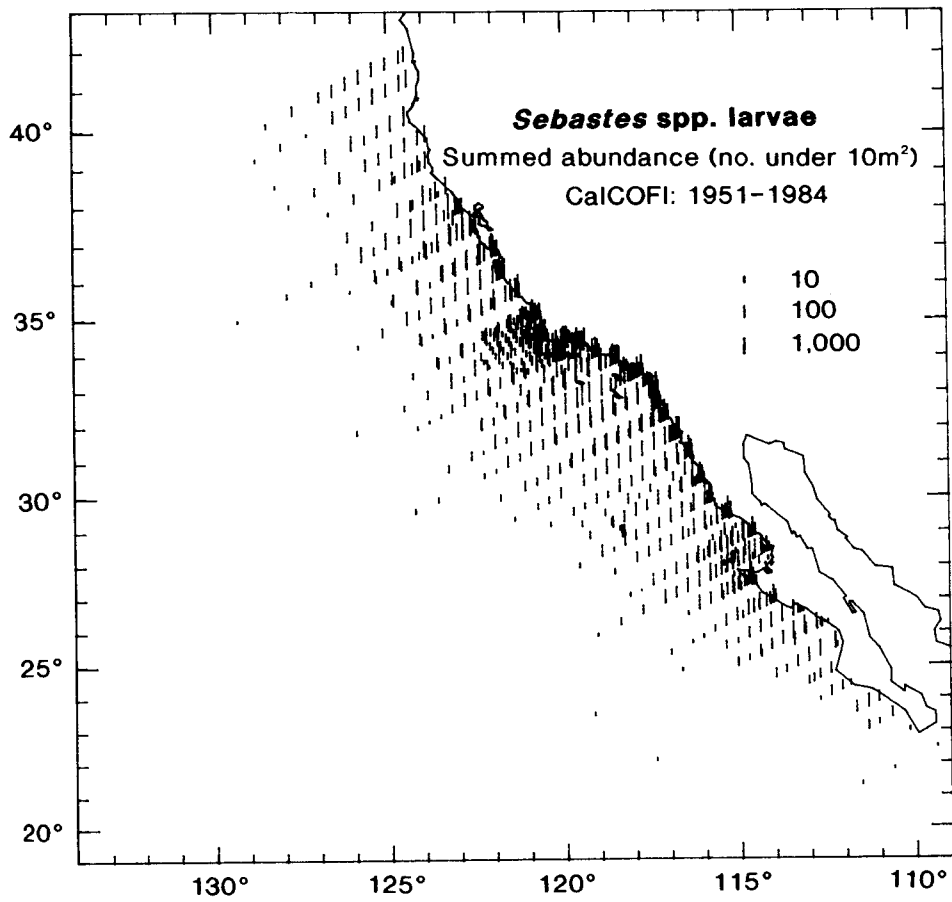


Vinciguerria lucetia

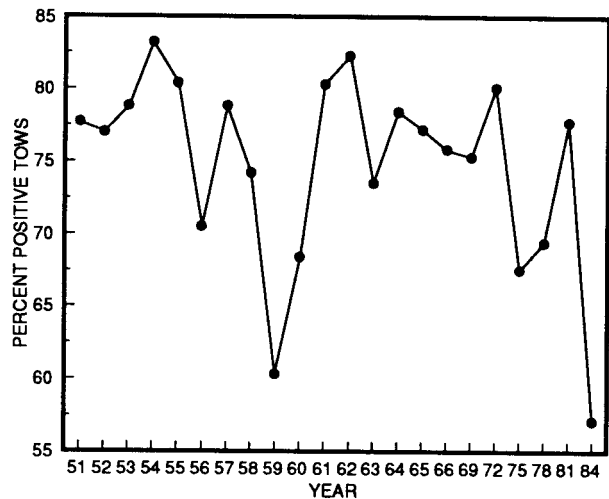


Sebastes spp.

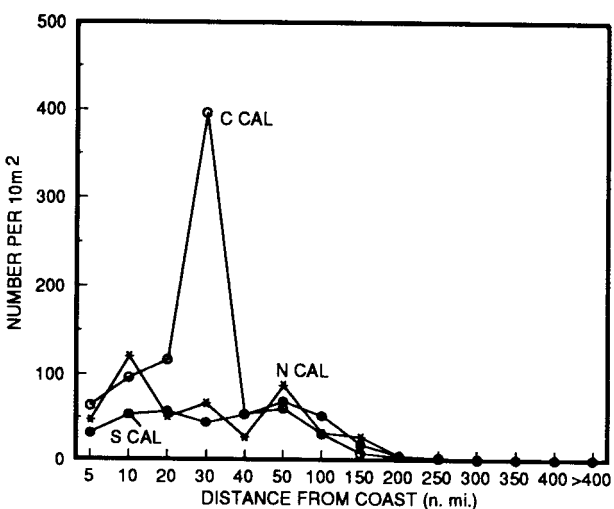
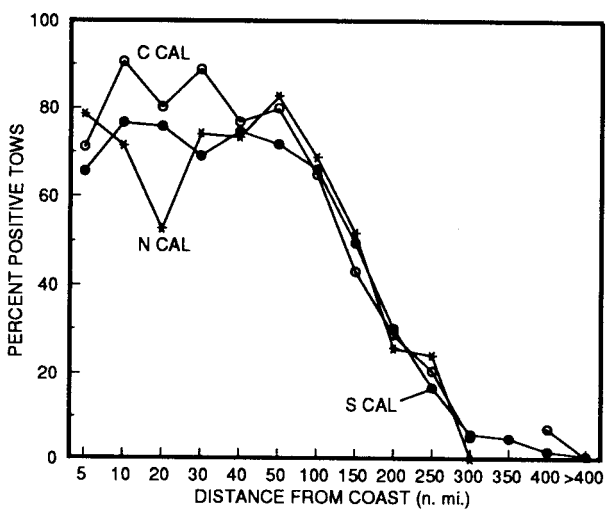
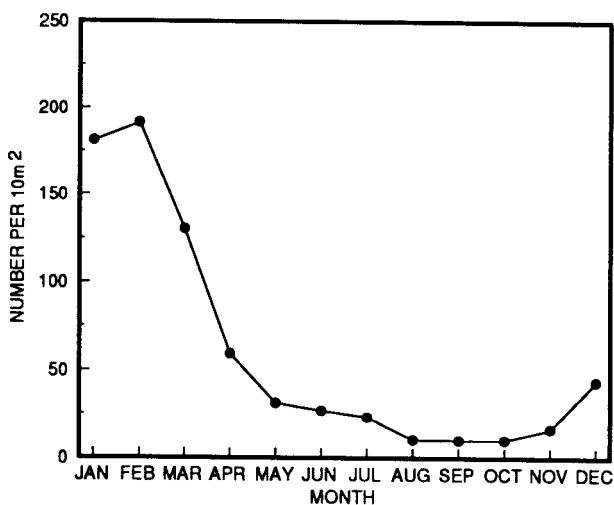
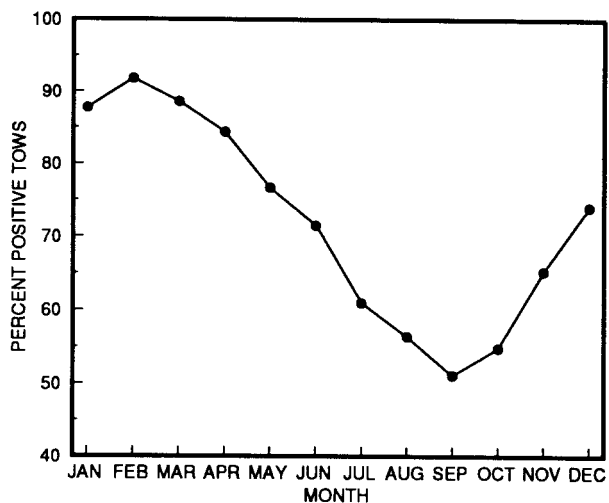
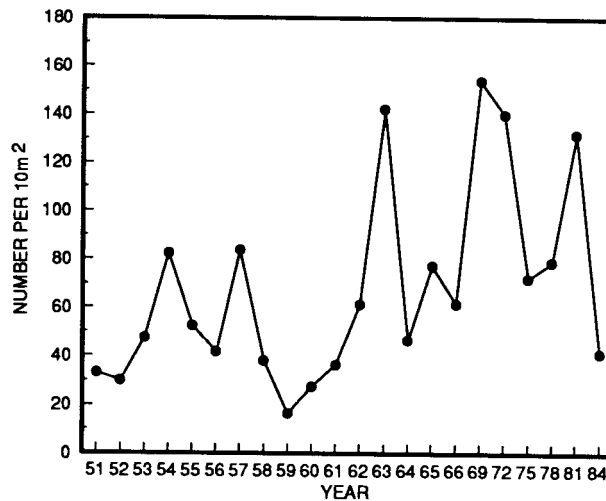
Scorpaenidae



Rockfishes

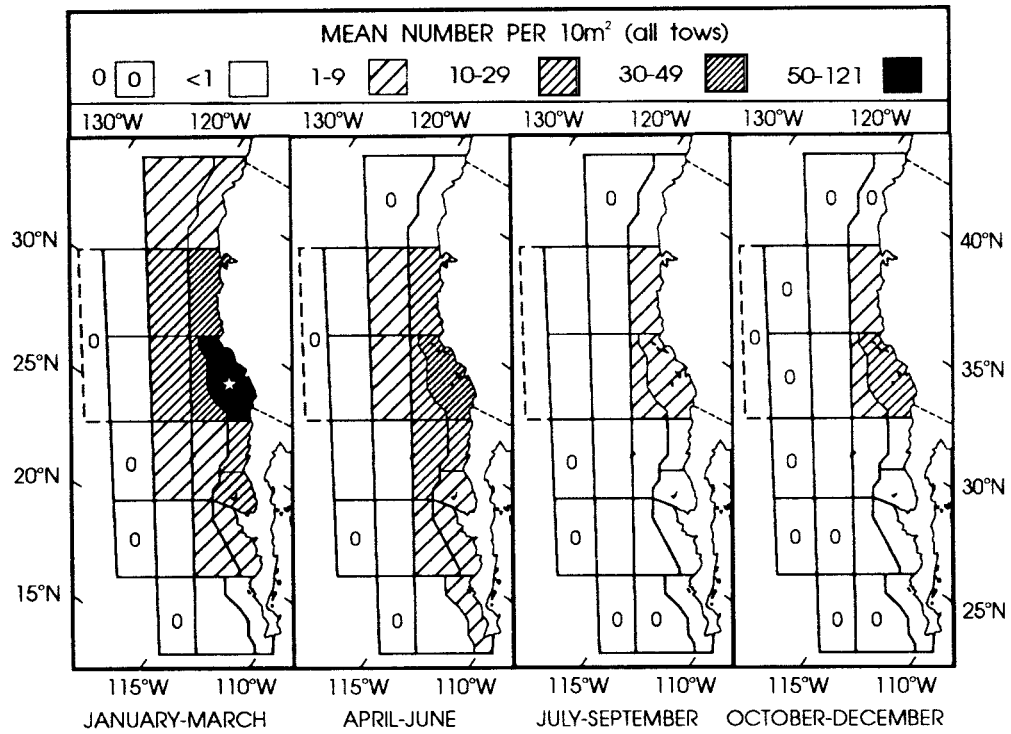
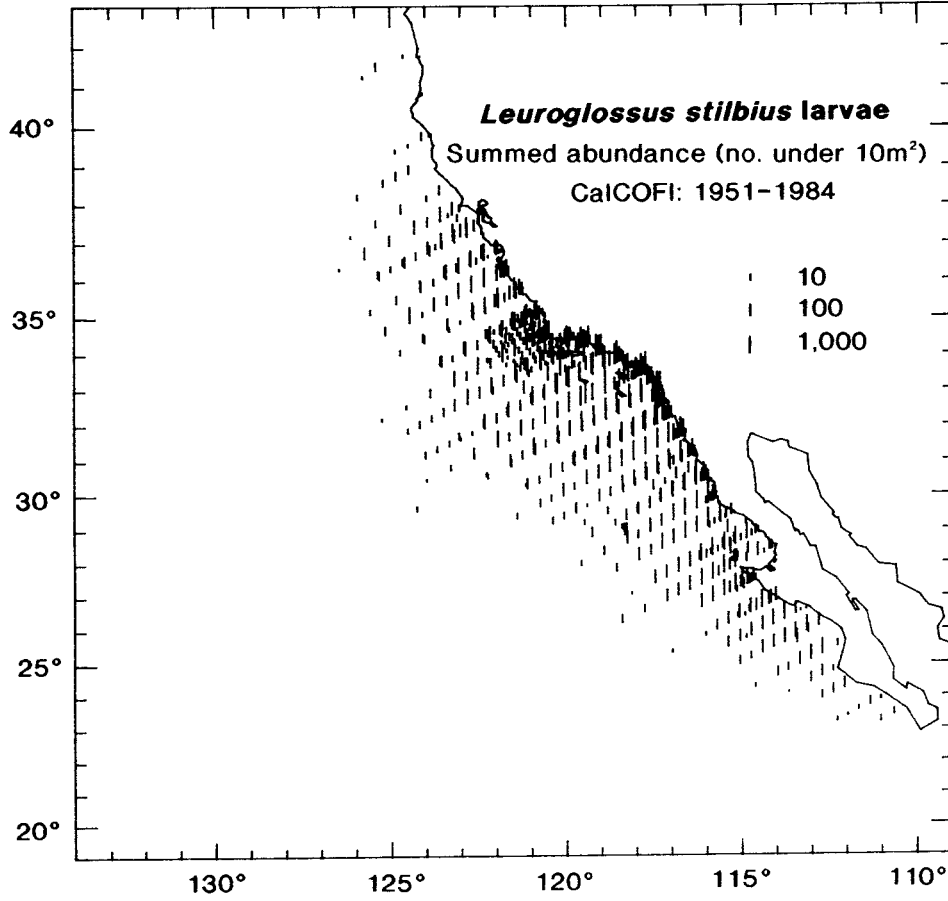


Sebastes spp.



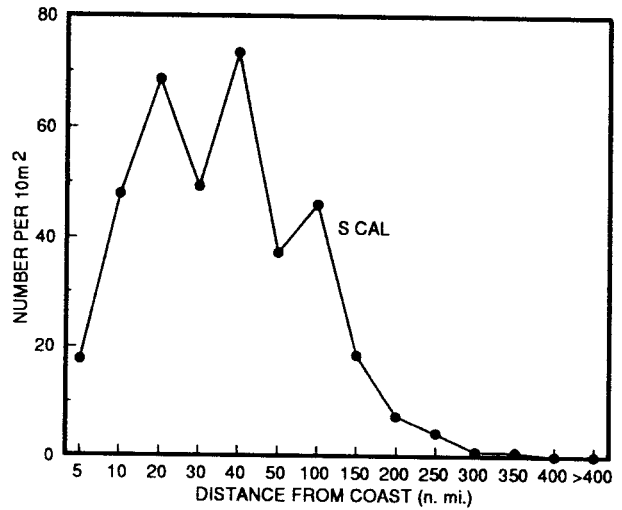
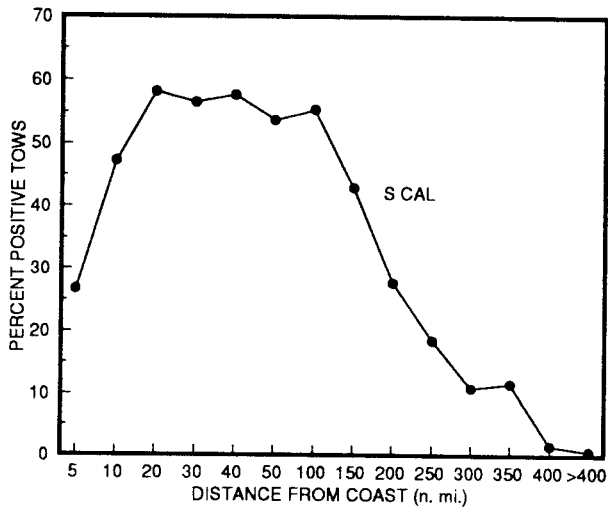
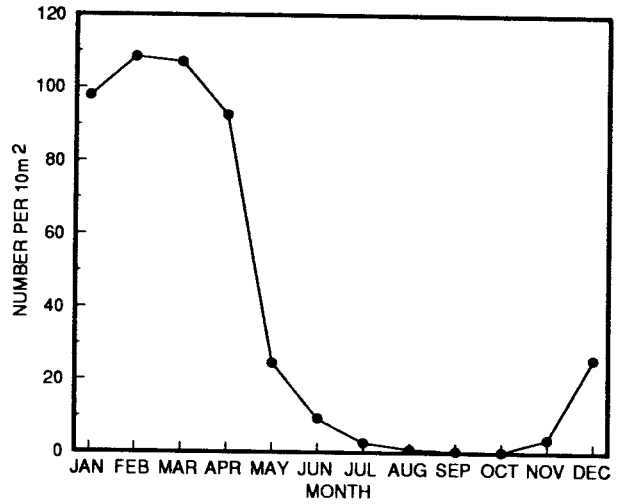
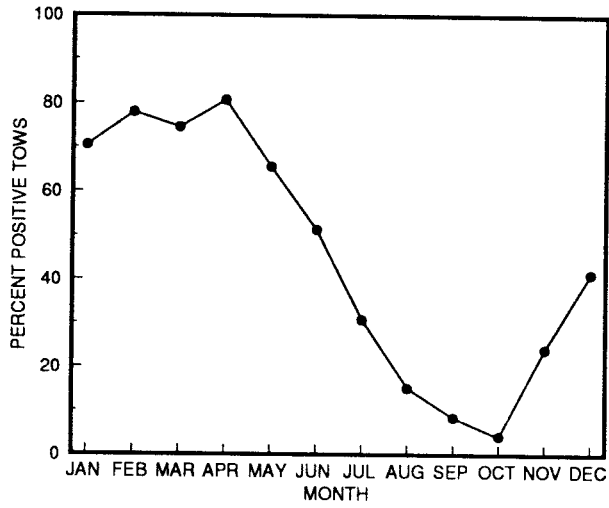
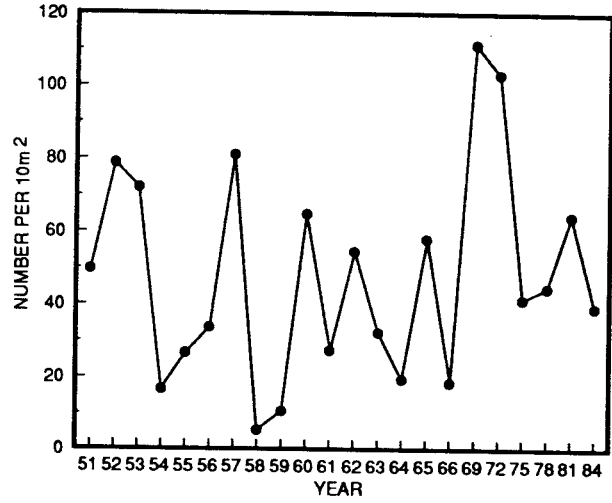
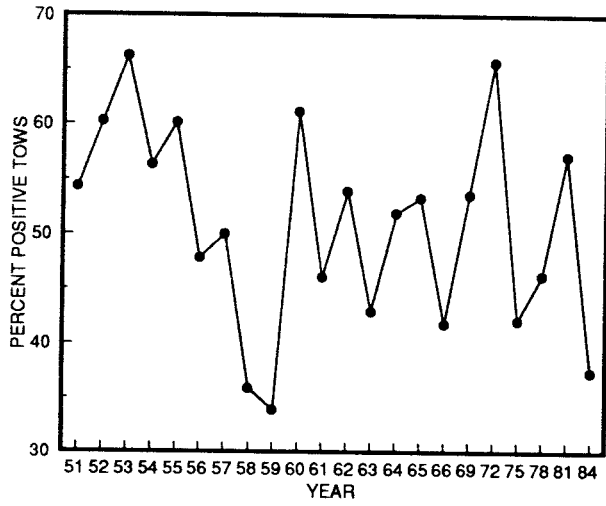
Leuroglossus stilbius

Bathylagidae



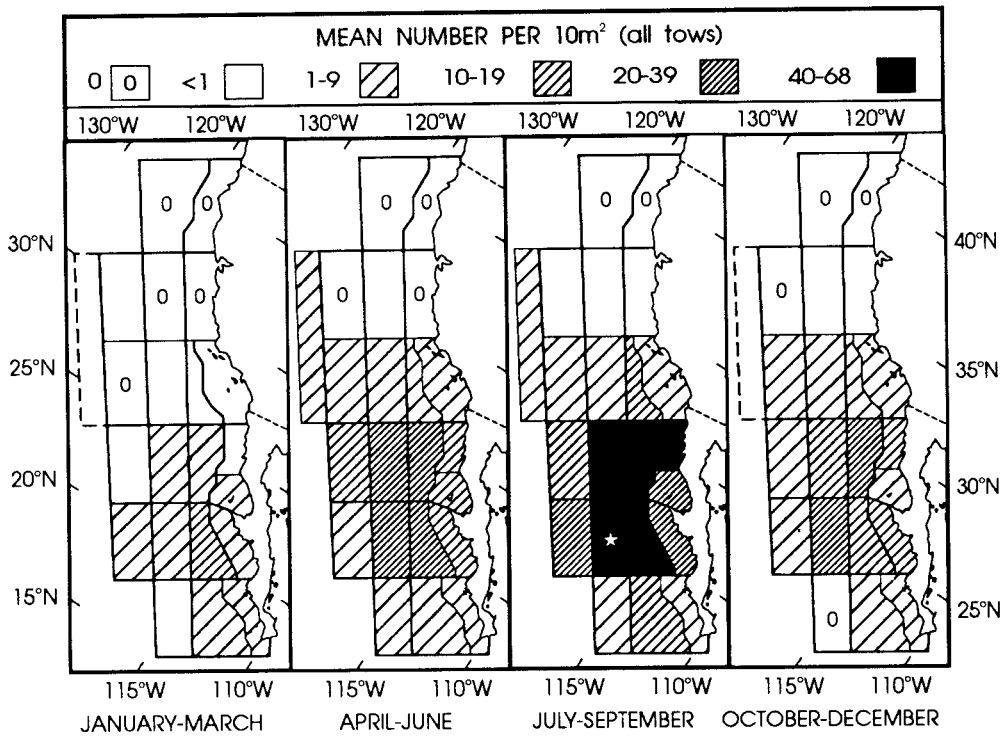
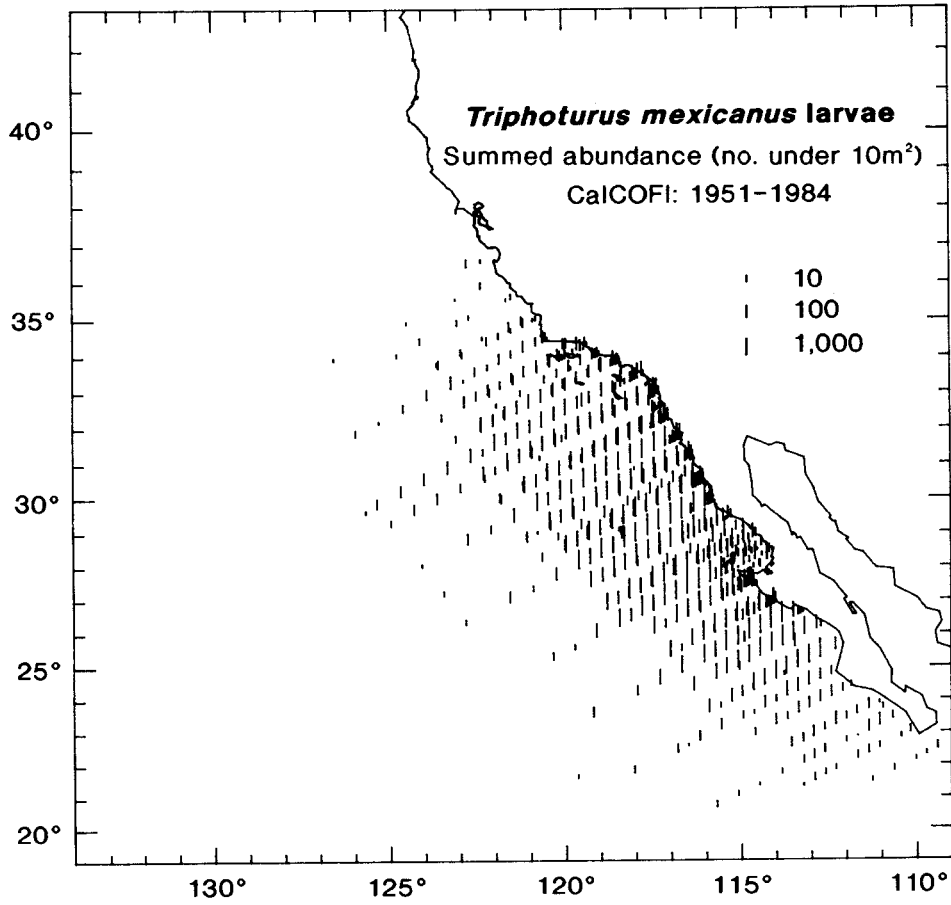
California smoothtongue

Leuroglossus stilbius

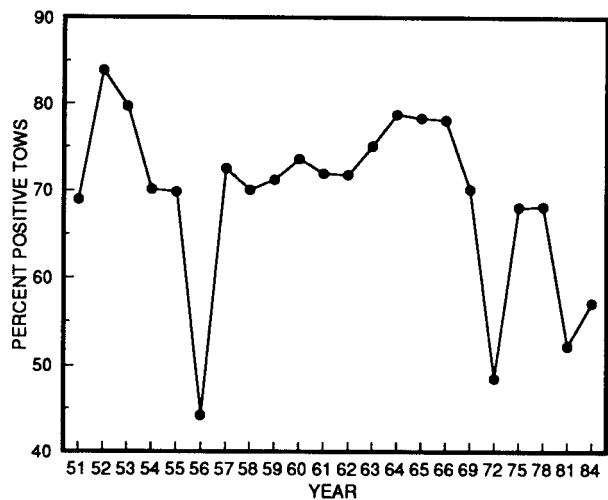


Triphoturus mexicanus

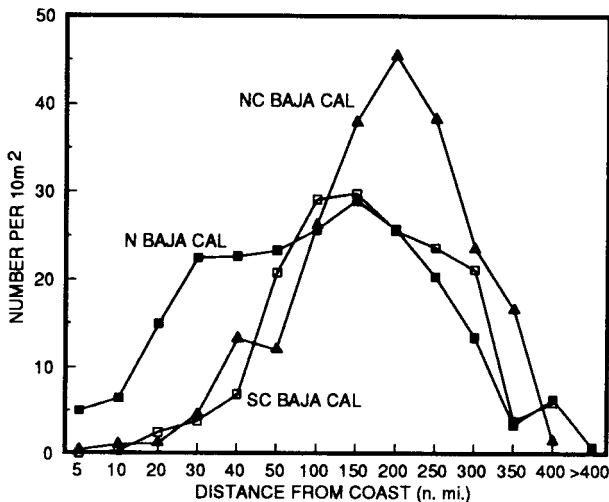
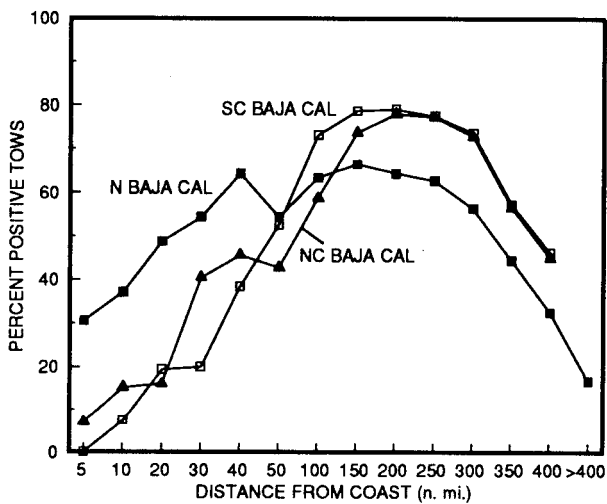
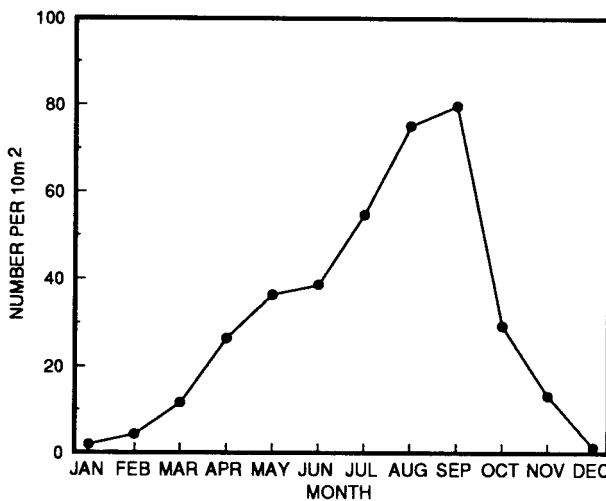
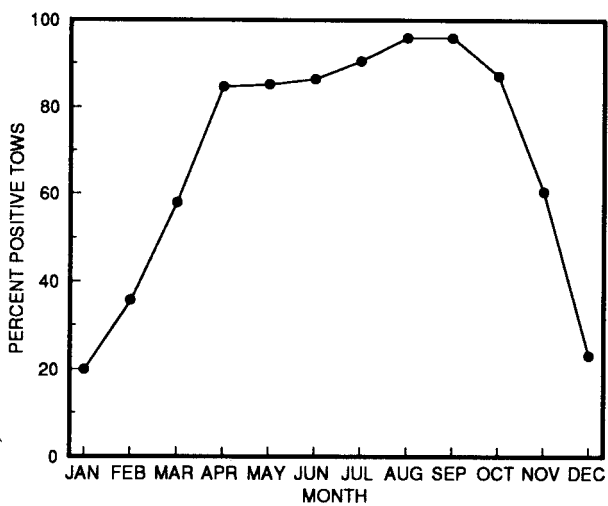
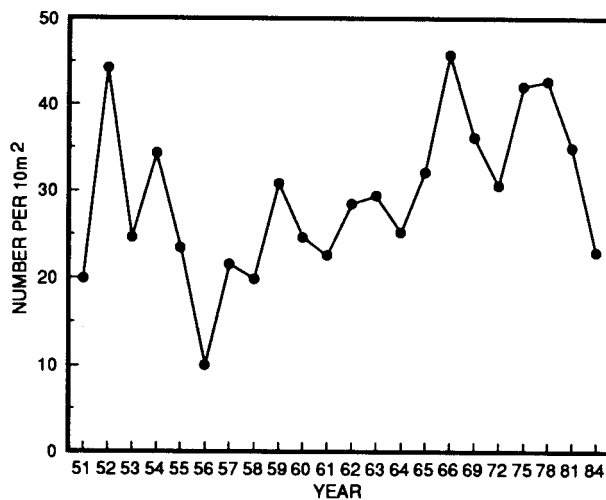
Myctophidae



Mexican lampfish

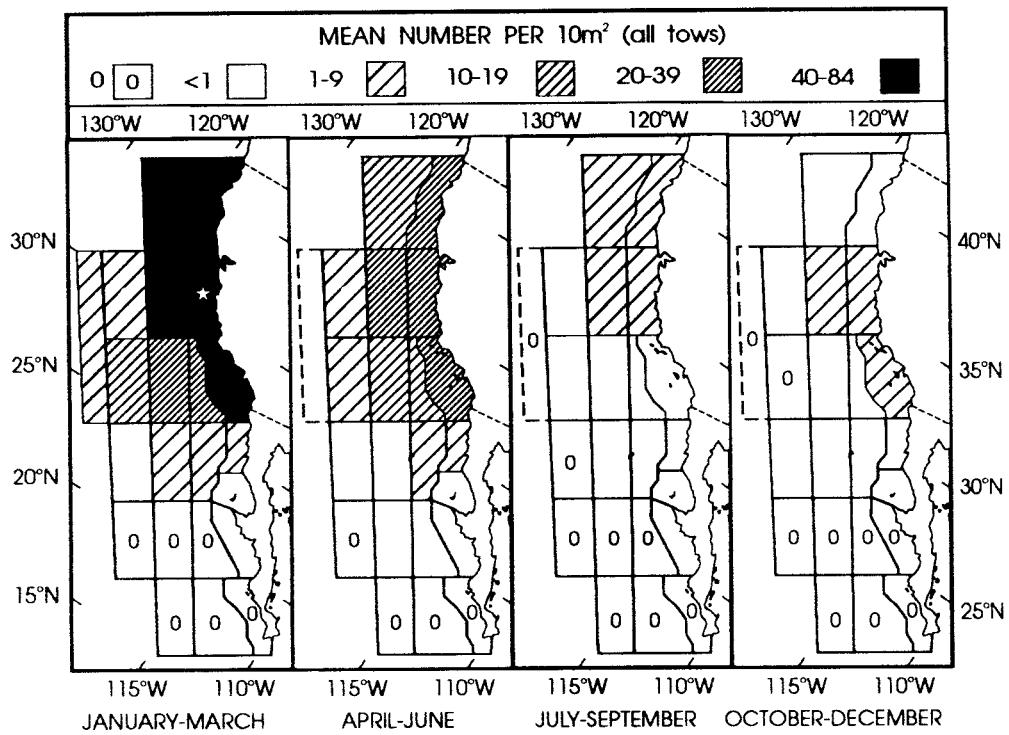
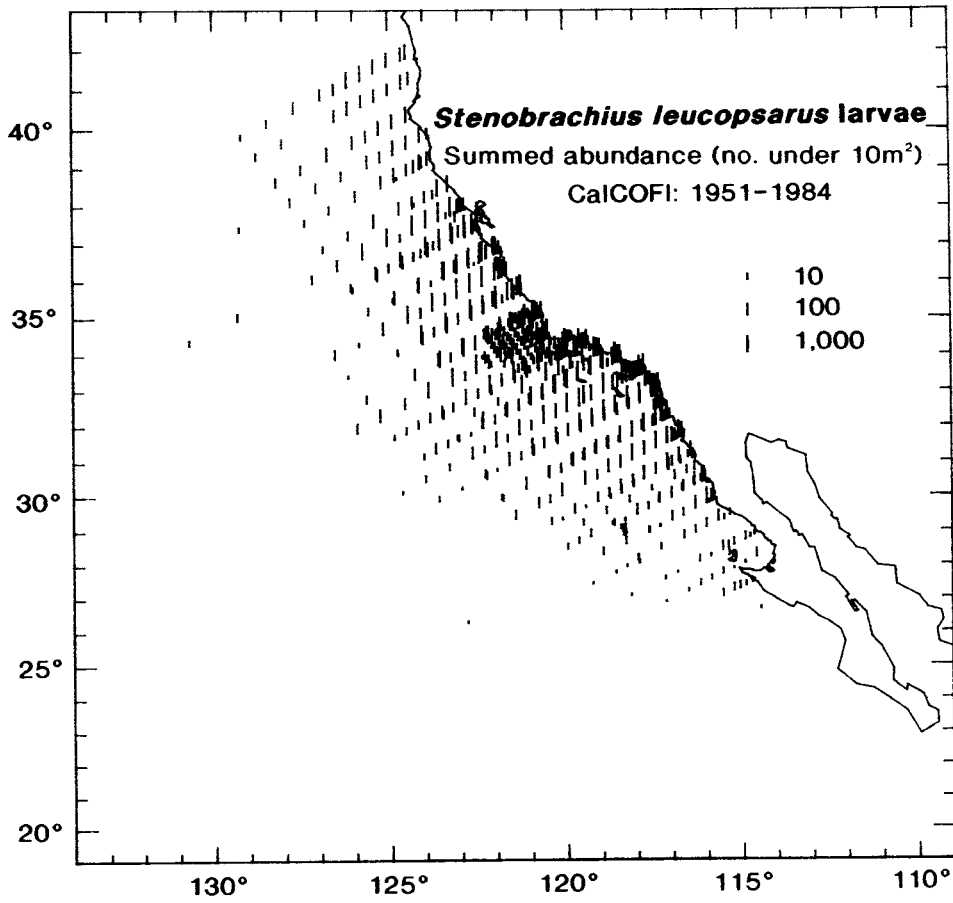


Triphoturus mexicanus

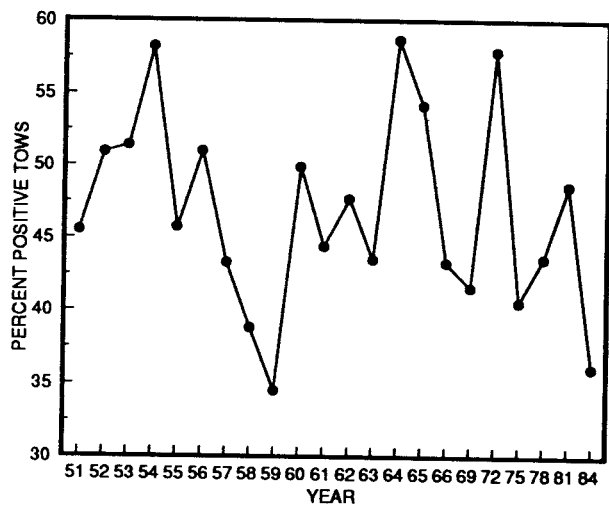


Stenobranchius leucopsarus

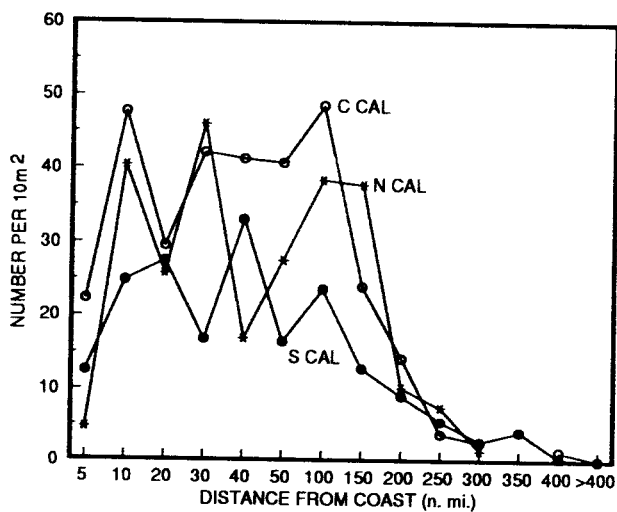
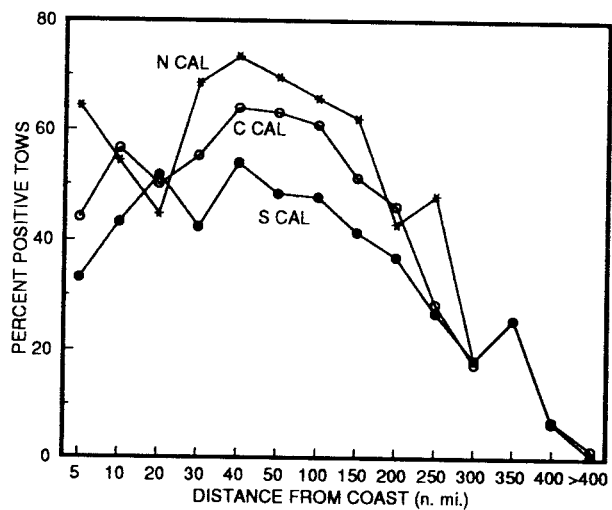
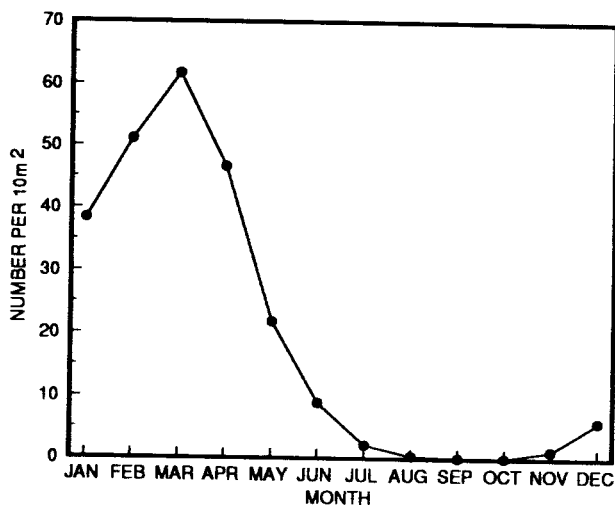
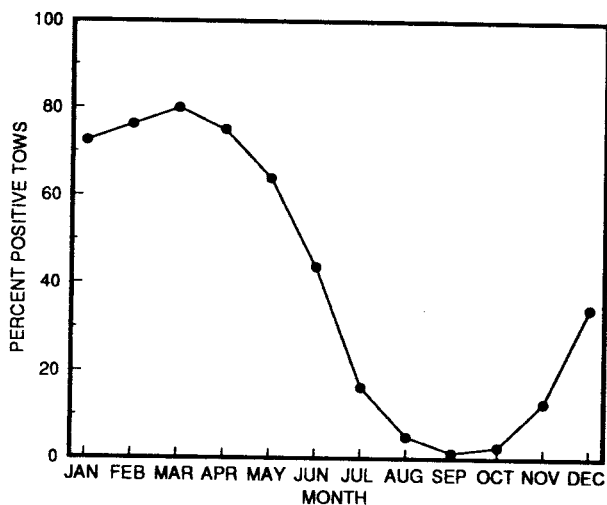
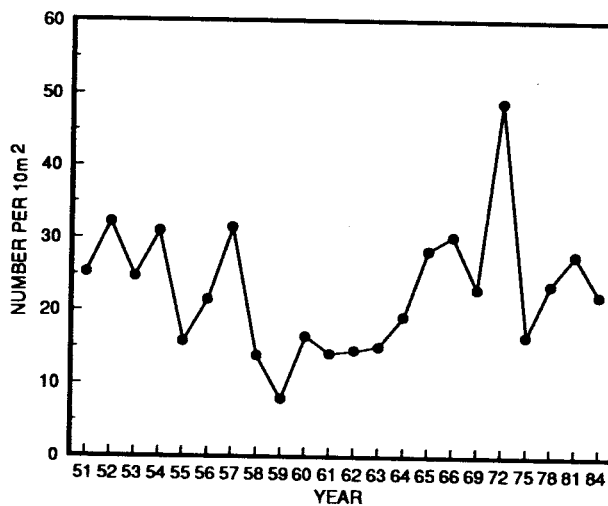
Myctophidae



Northern lampfish

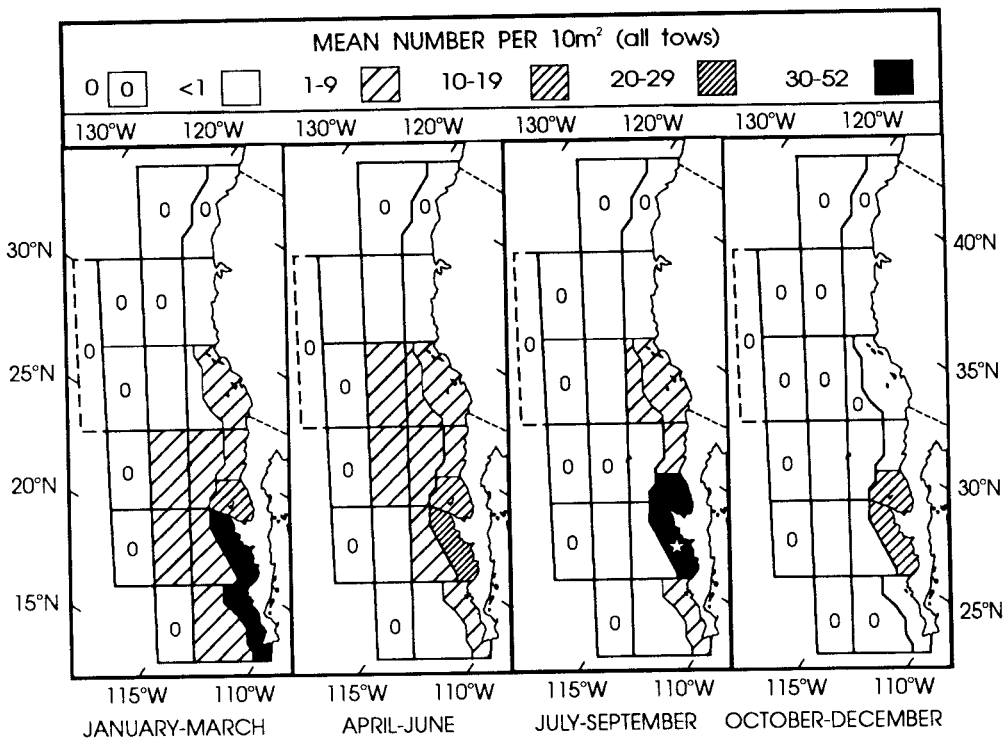
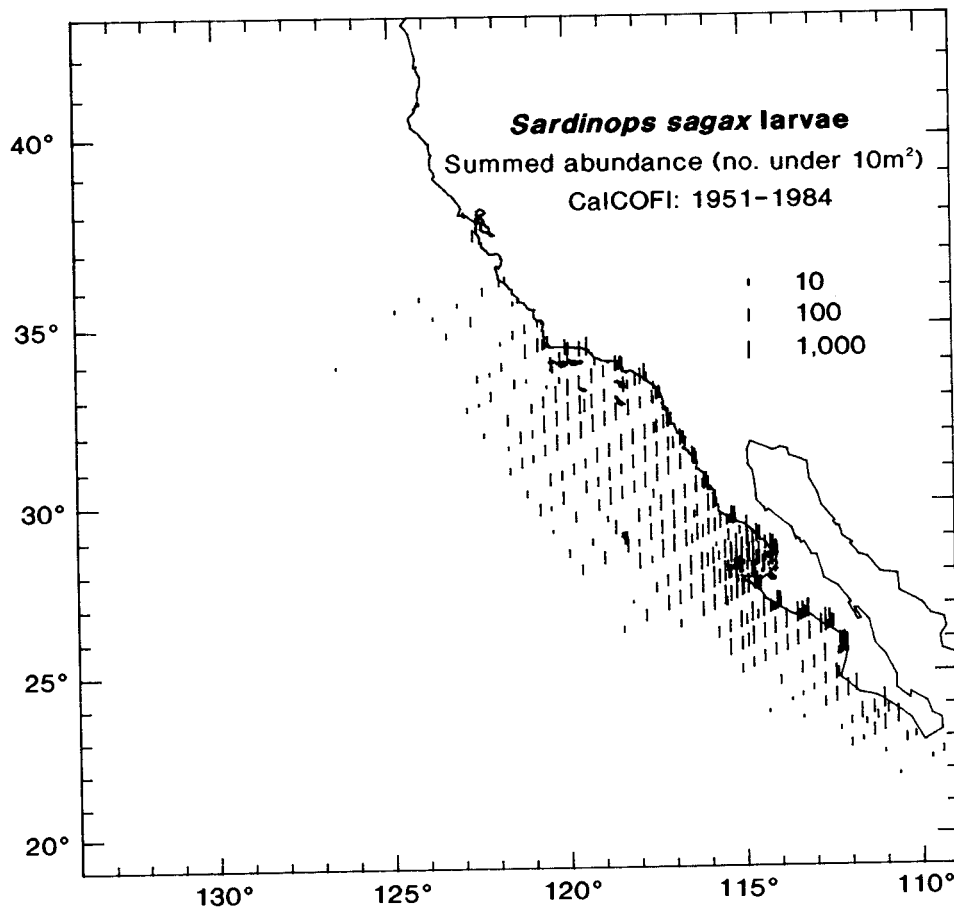


Stenobranchius leucopsarus



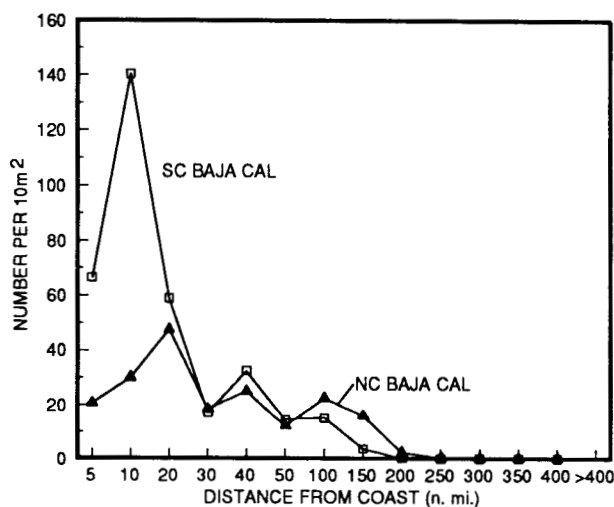
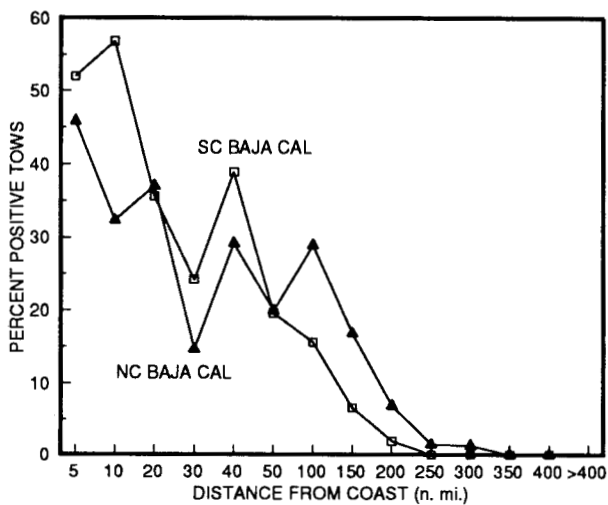
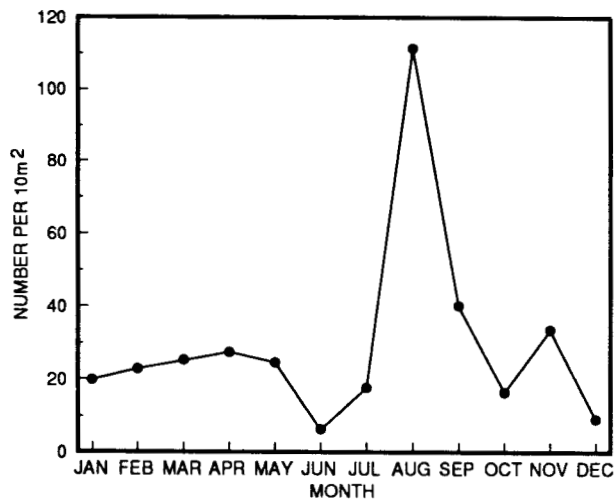
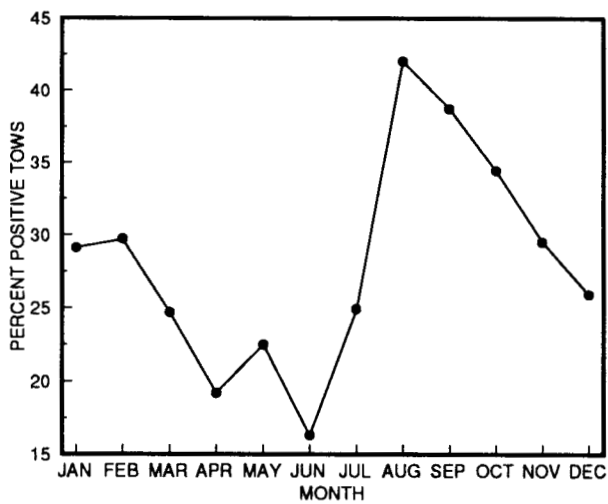
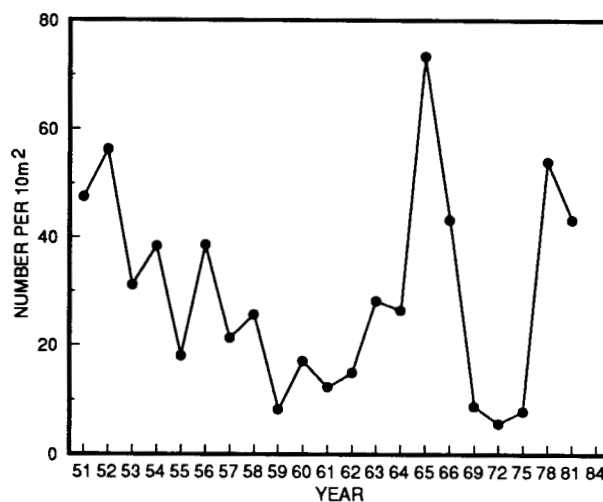
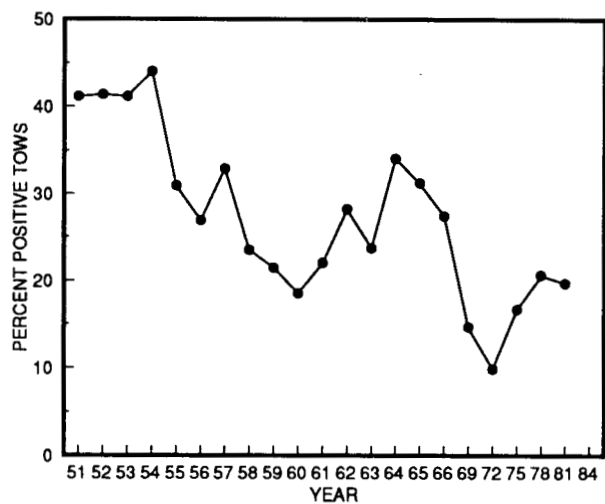
Sardinops sagax larvae

Clupeidae



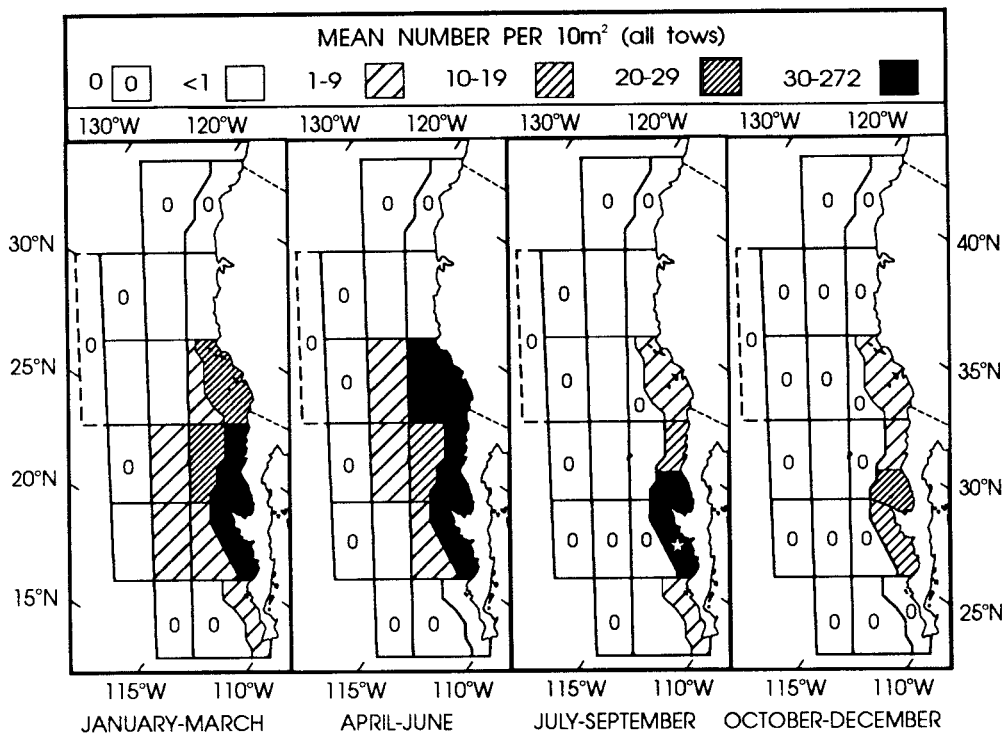
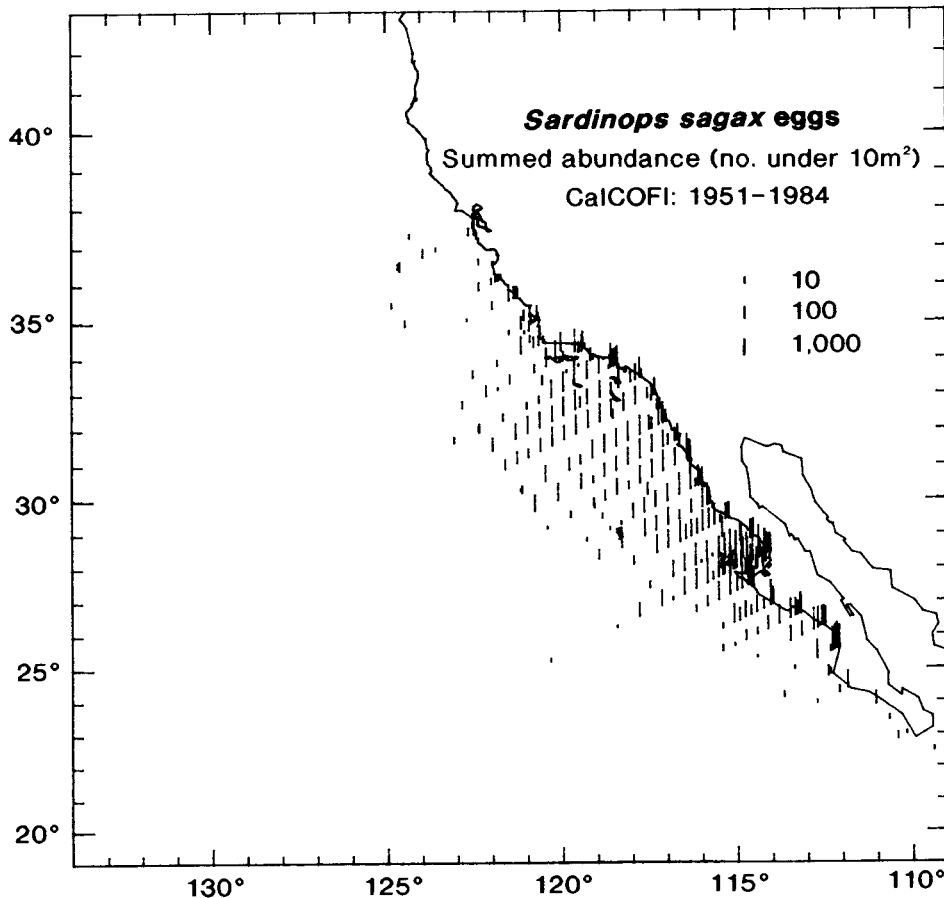
Pacific sardine

Sardinops sagax larvae



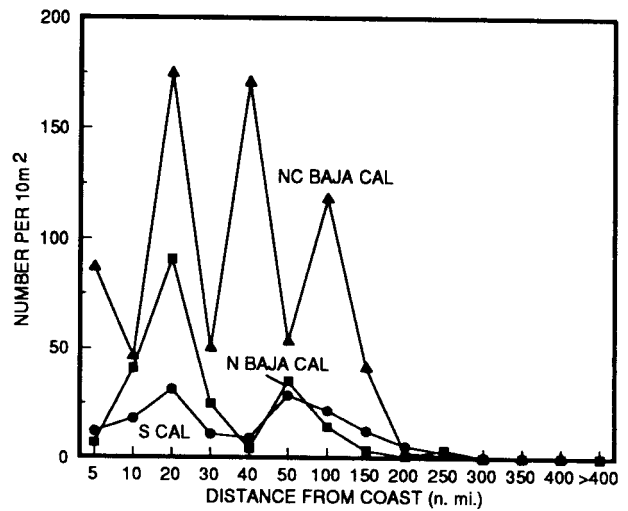
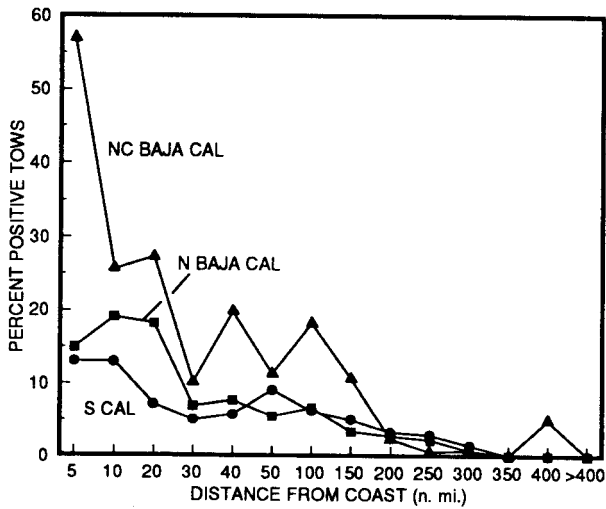
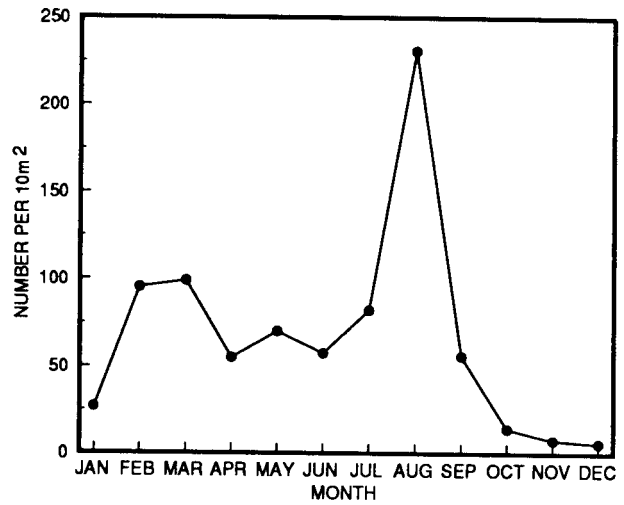
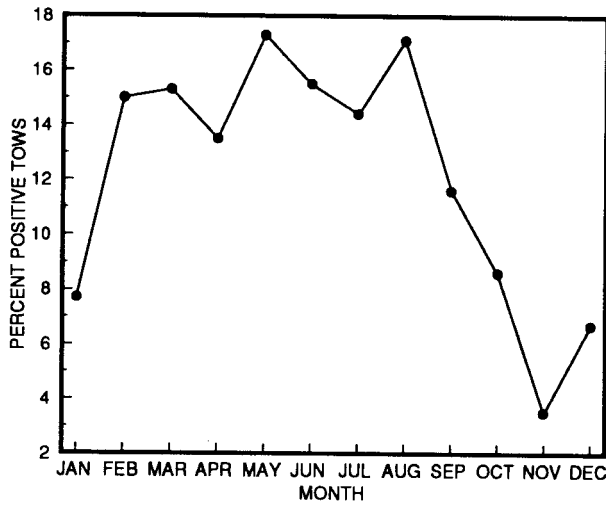
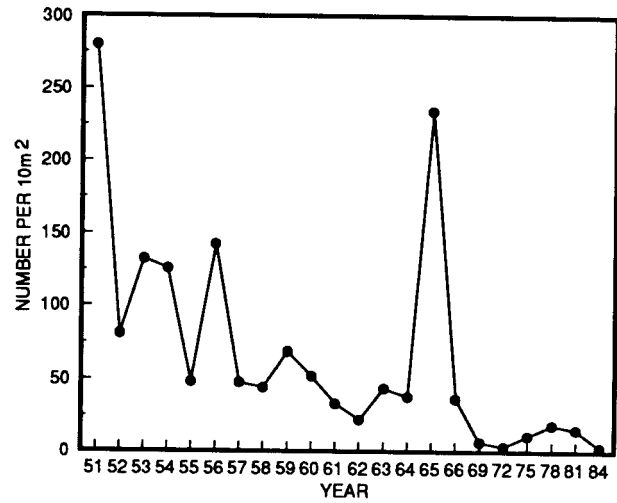
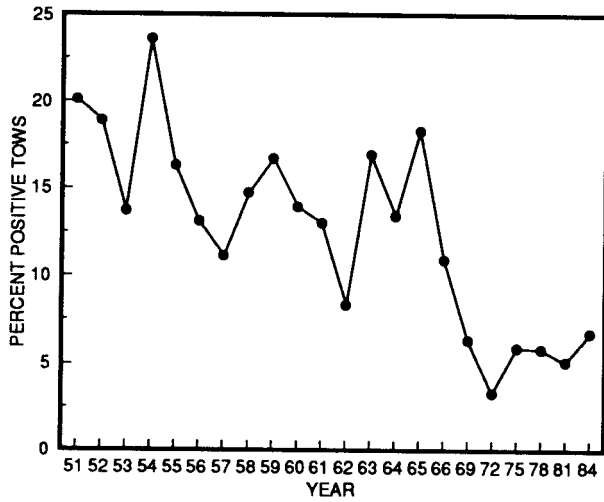
Sardinops sagax eggs

Clupeidae



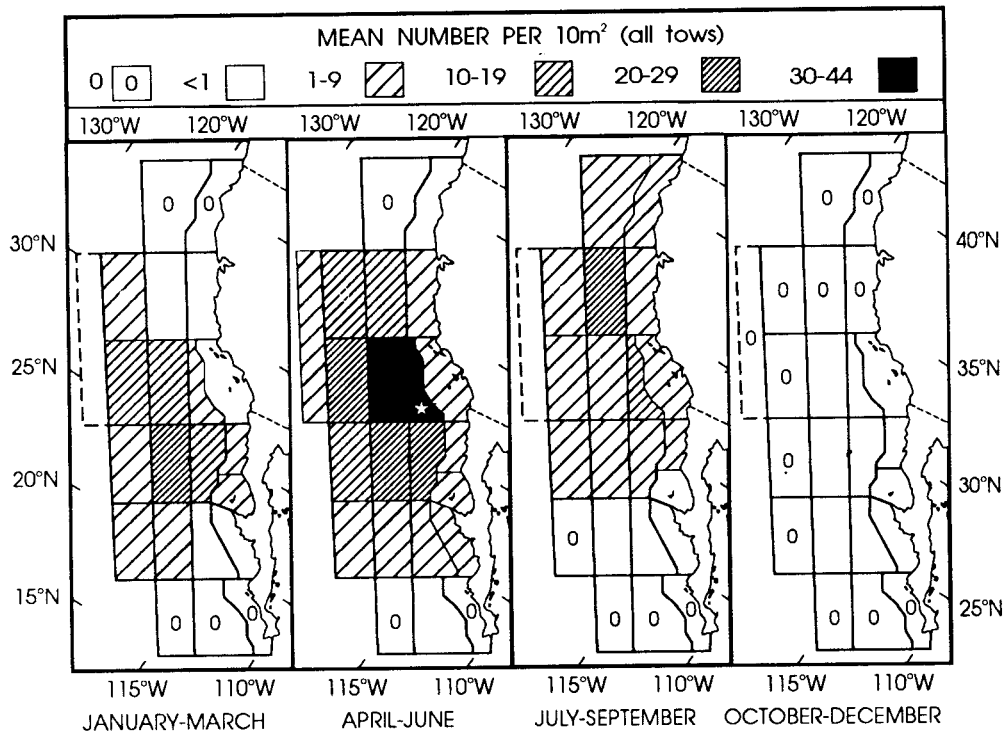
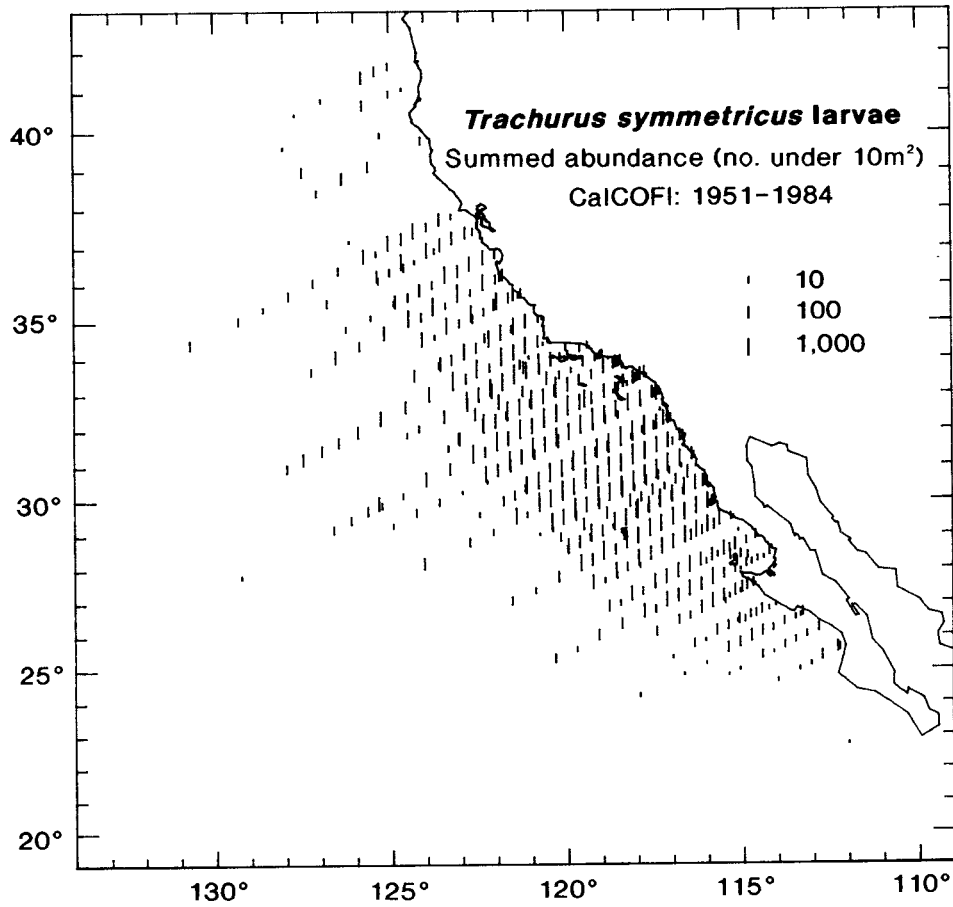
Pacific sardine

Sardinops sagax eggs



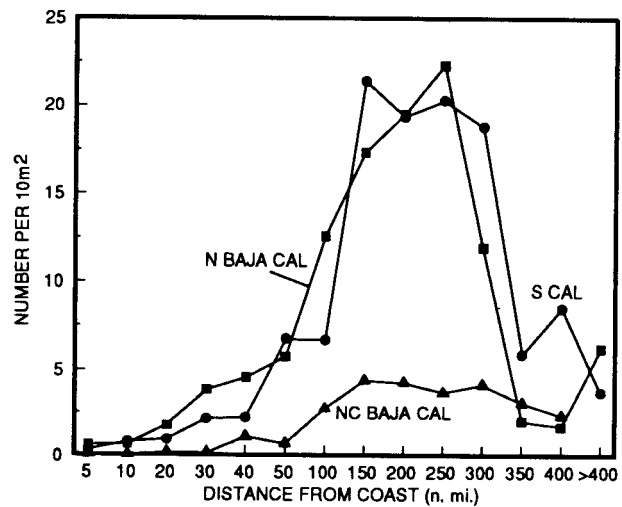
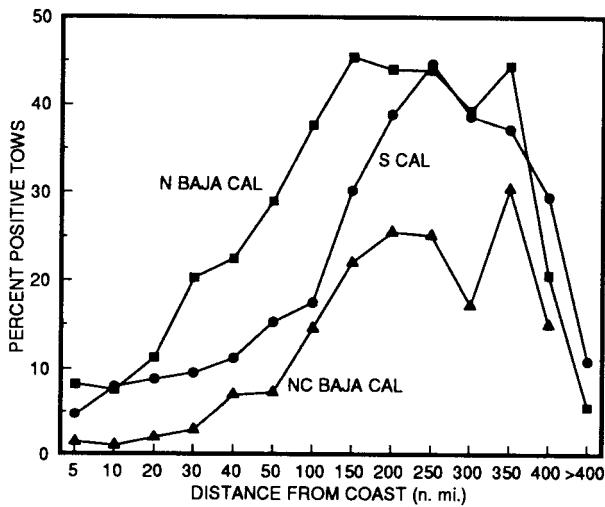
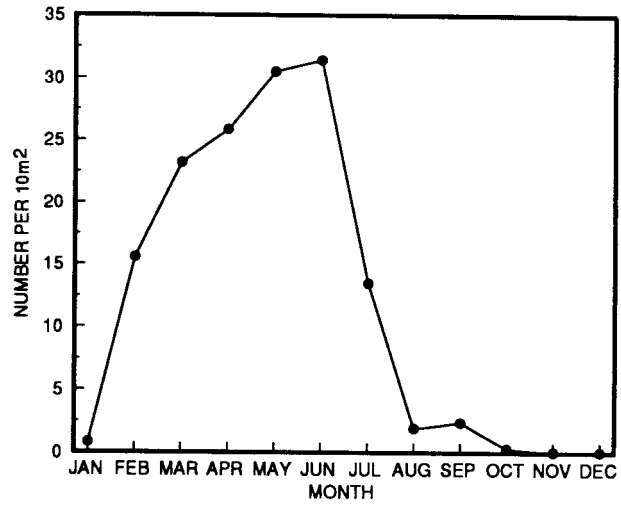
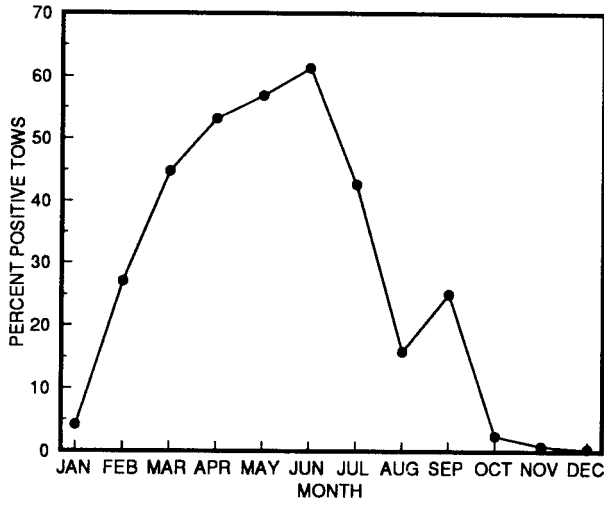
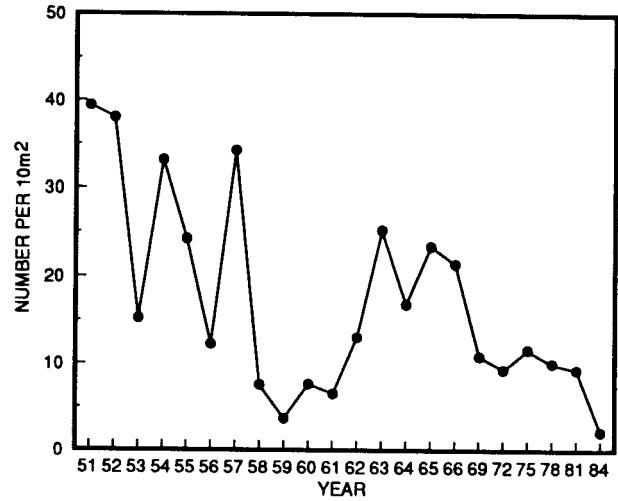
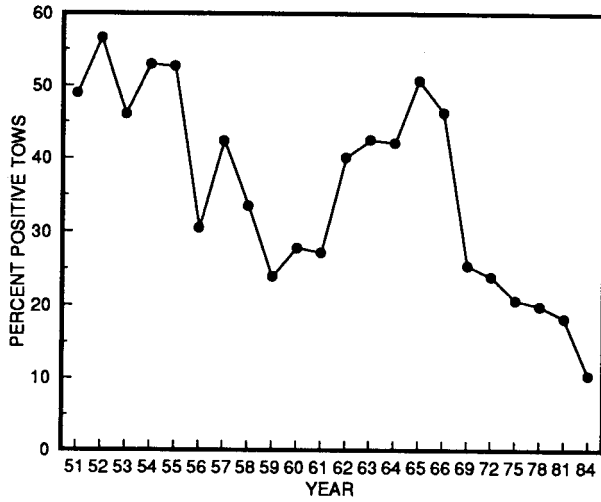
Trachurus symmetricus

Carangidae



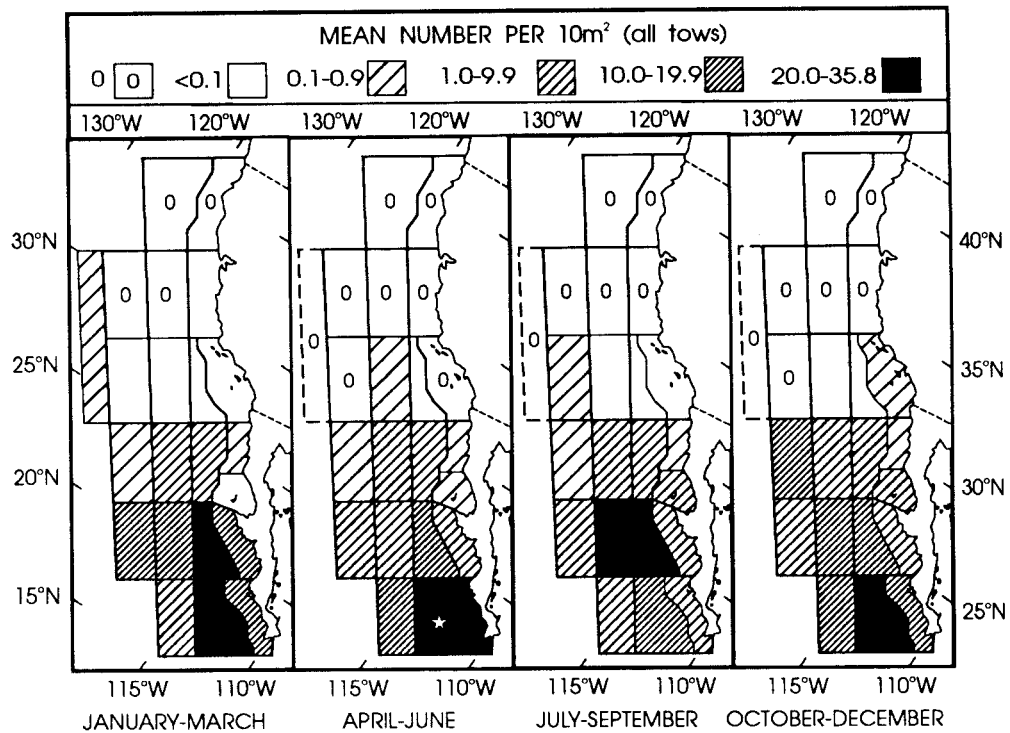
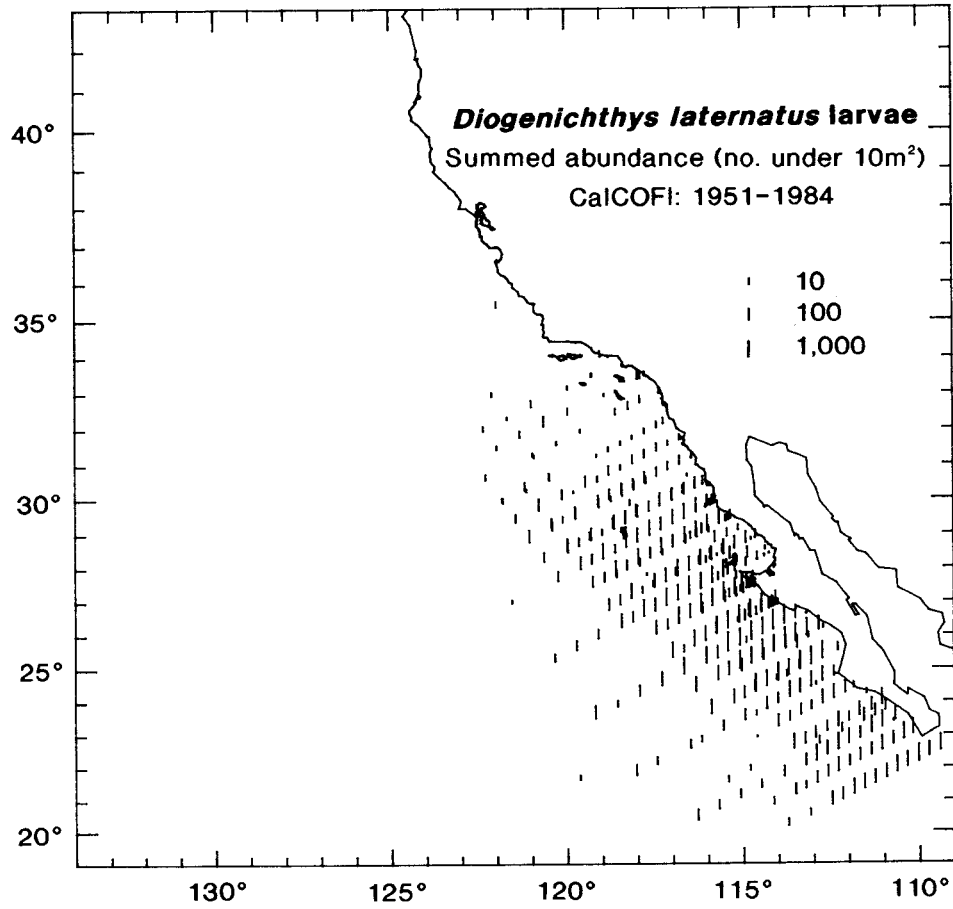
Jack mackerel

Trachurus symmetricus

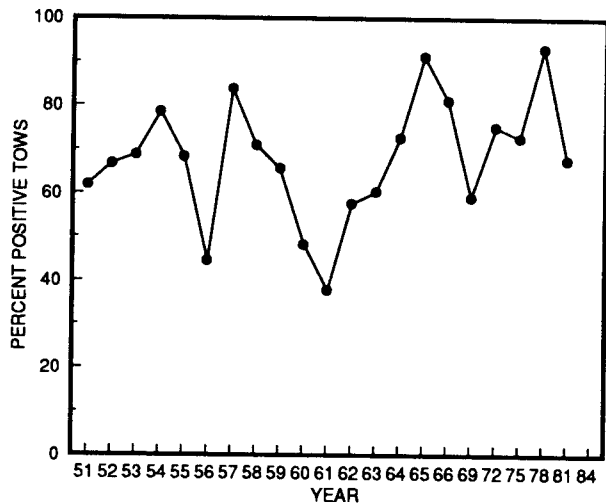


Diogenichthys laternatus

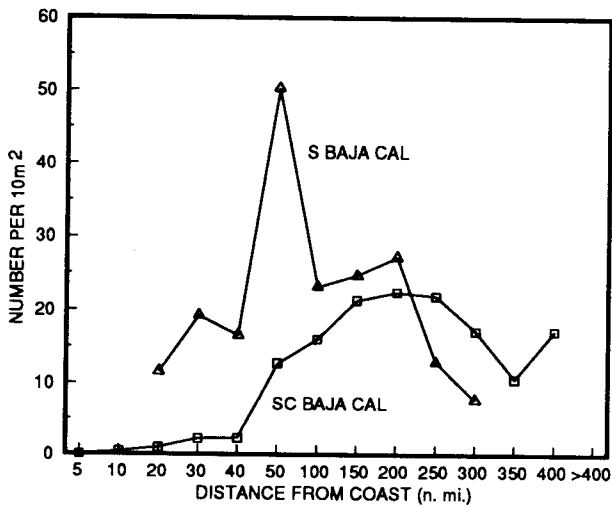
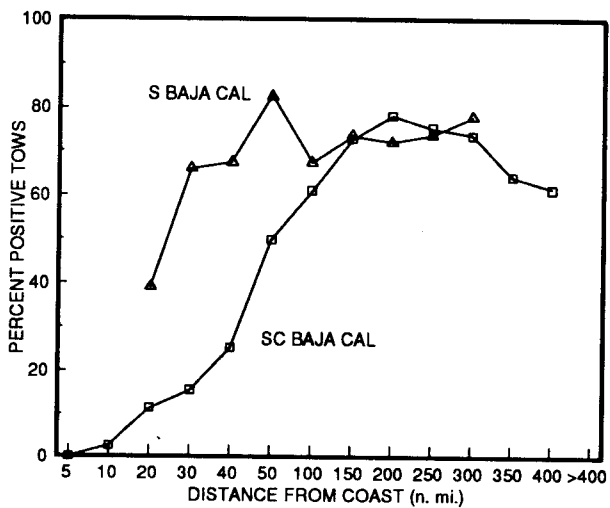
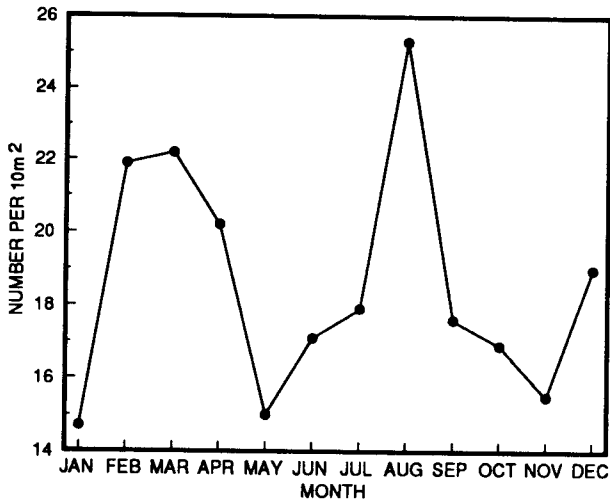
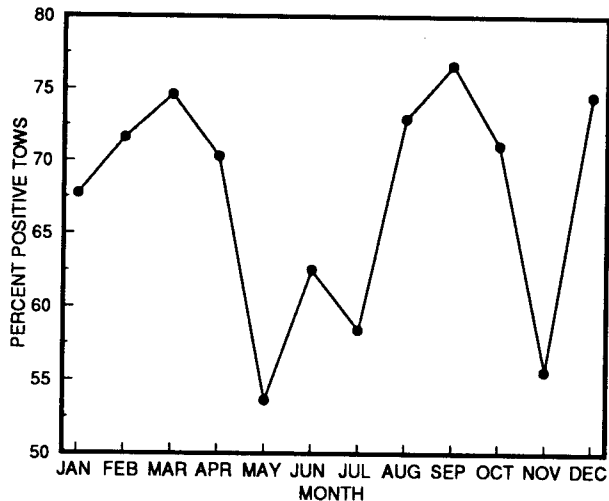
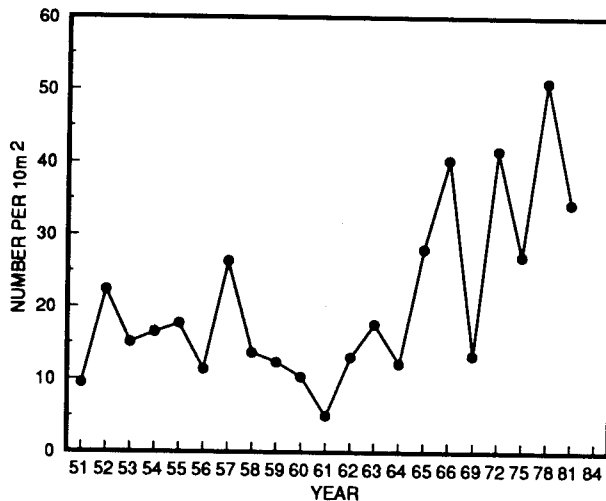
Myctophidae



Diogenes lanternfish

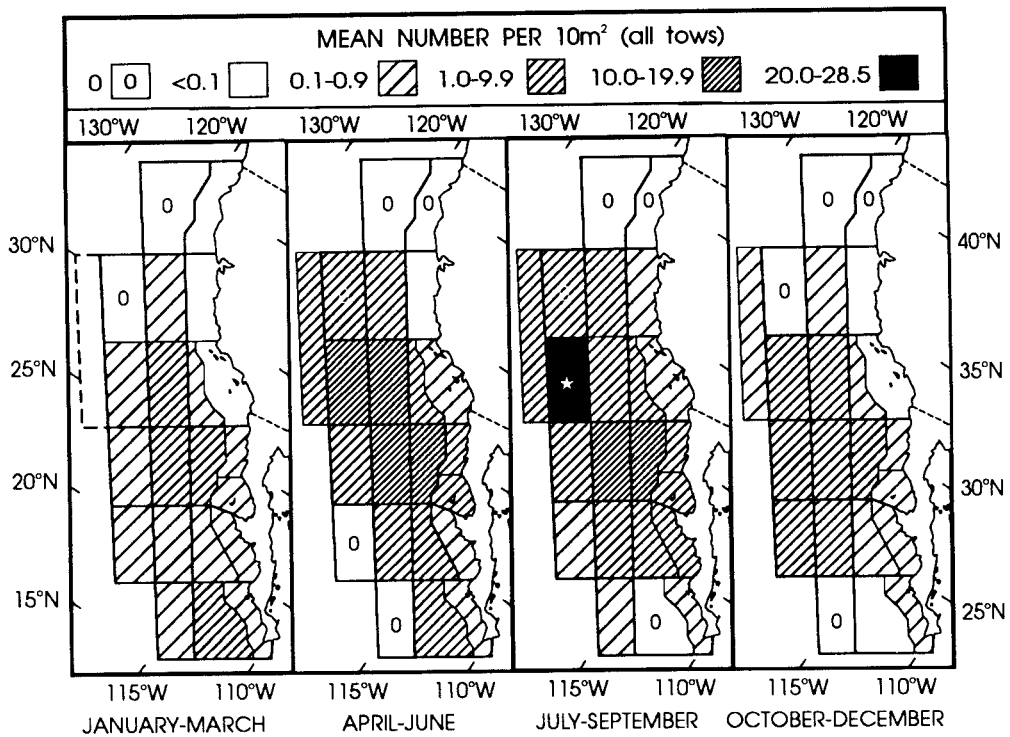
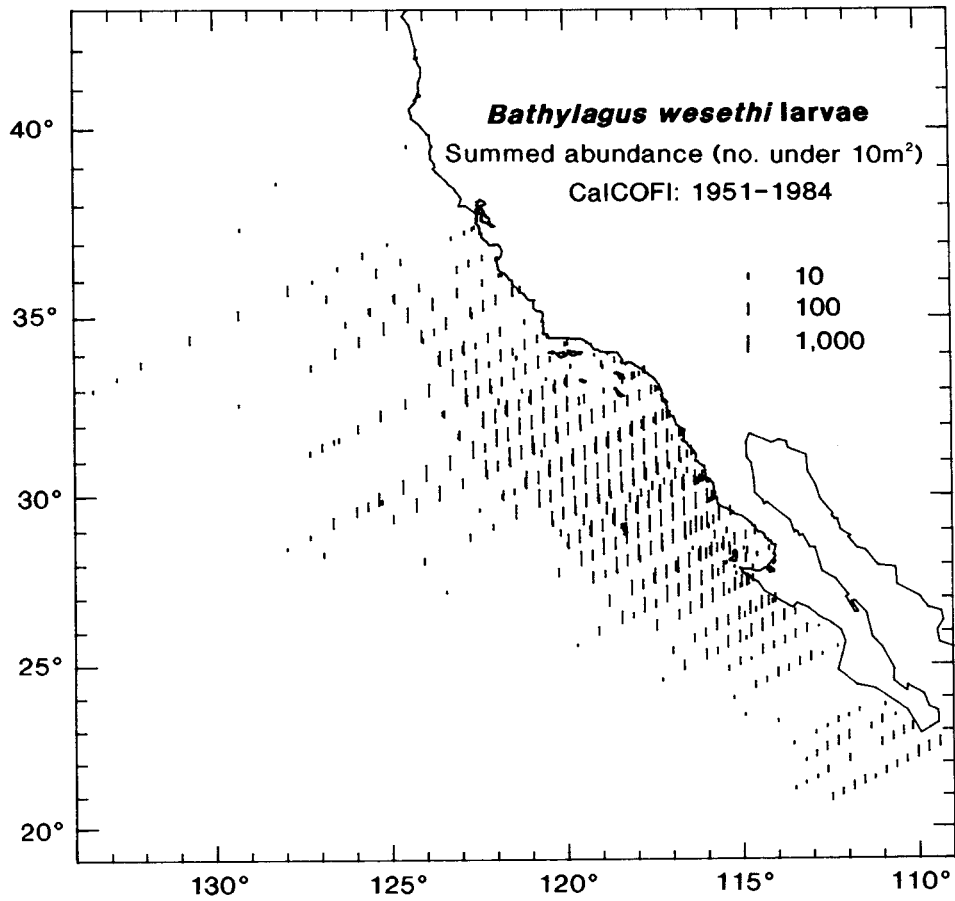


Diogenichthys lanternatus

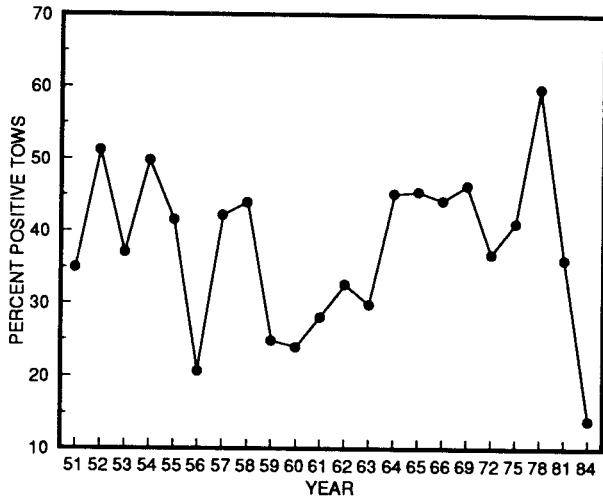


Bathylagus wesethi

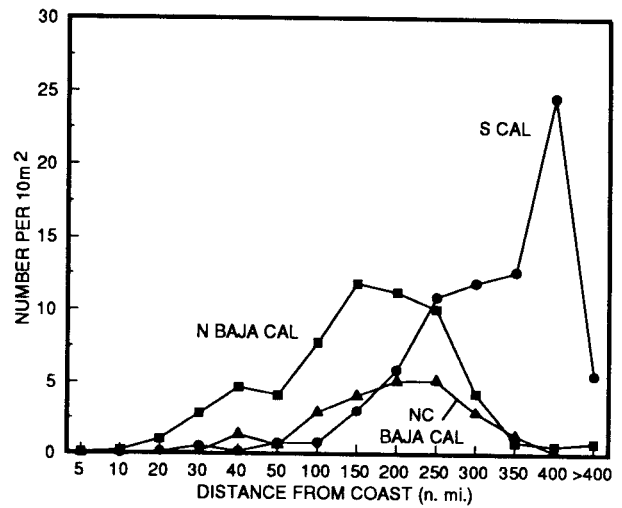
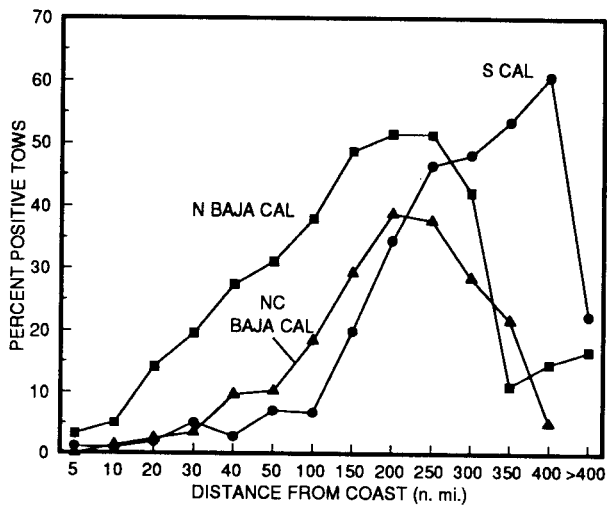
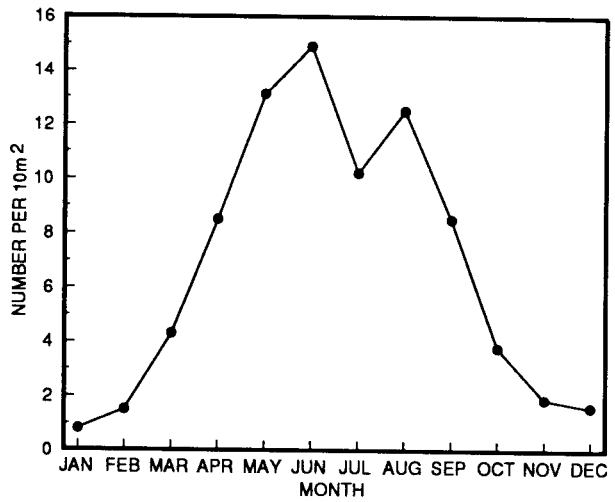
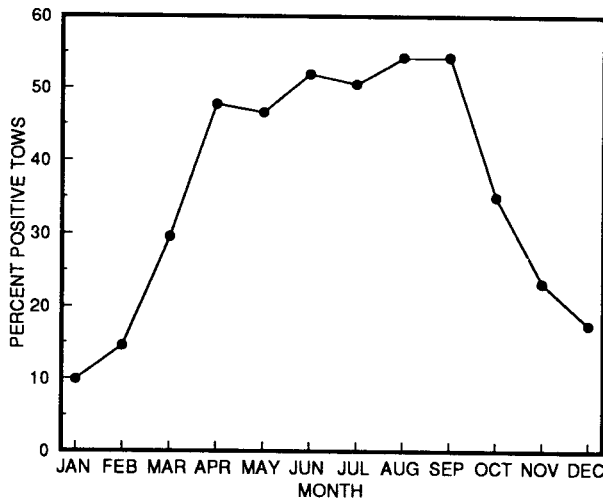
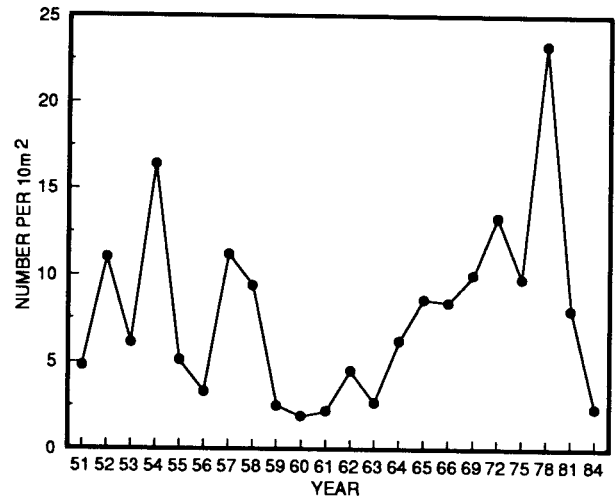
Bathylagidae



Snubnose blacksmelt

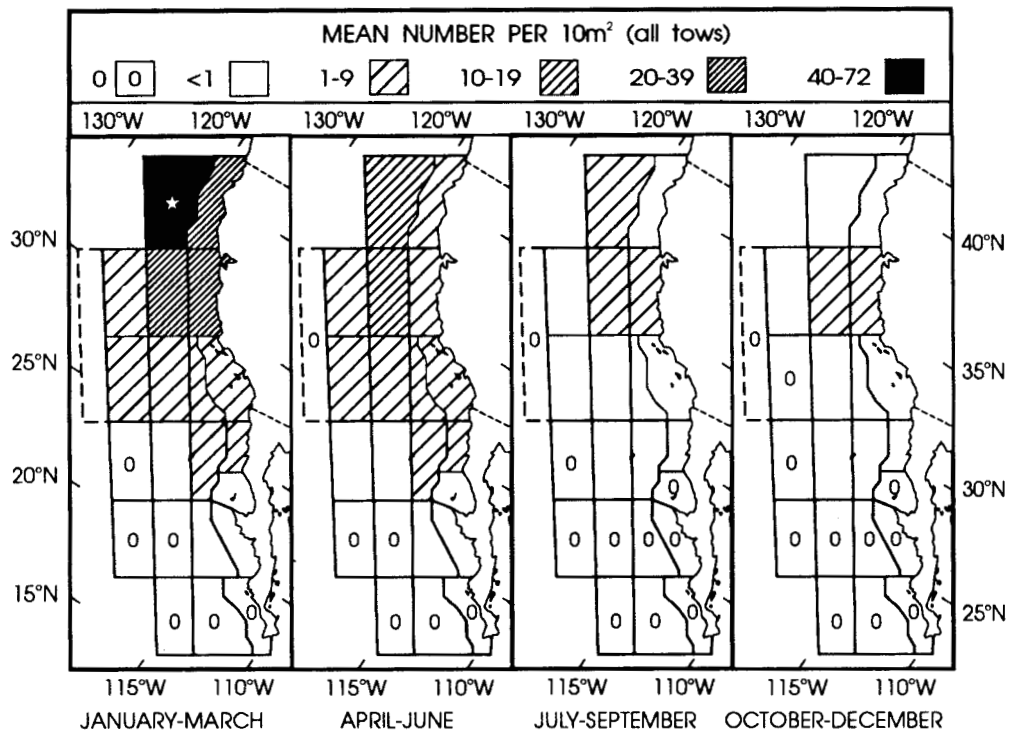
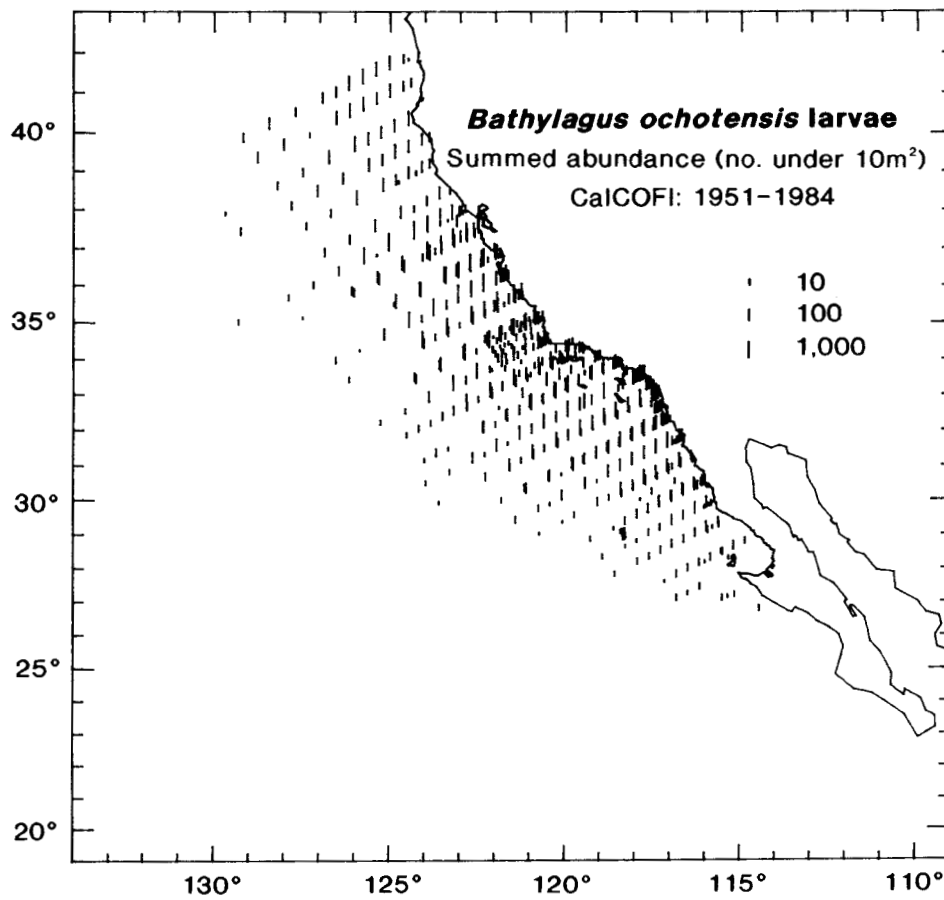


Bathylagus wesethi



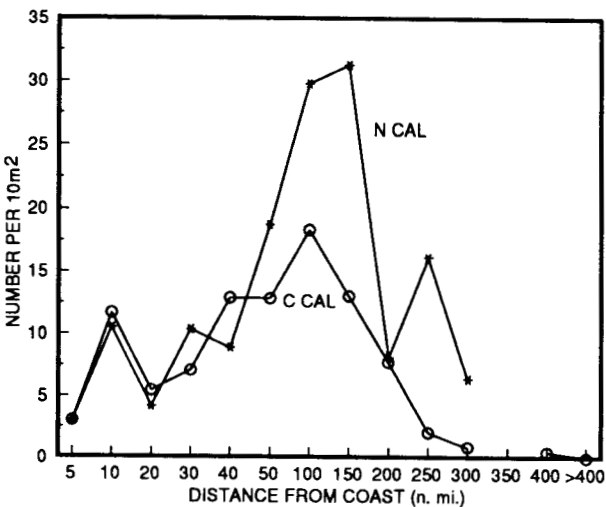
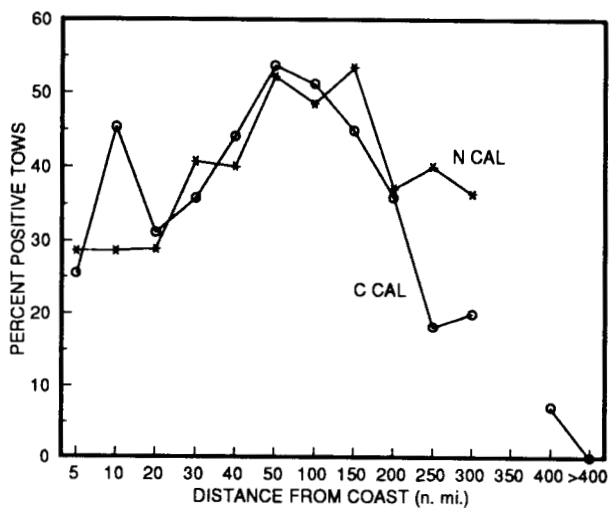
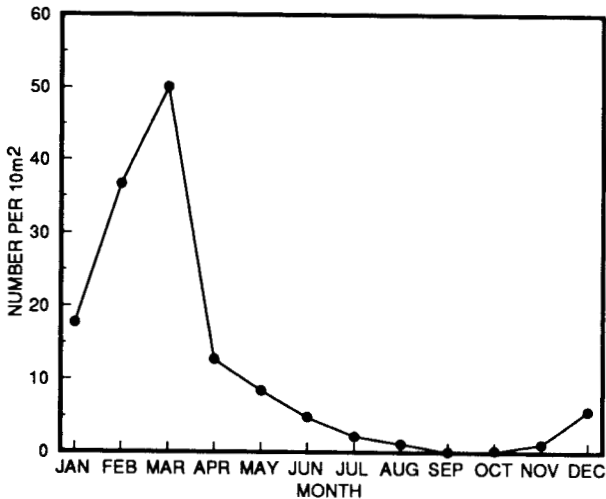
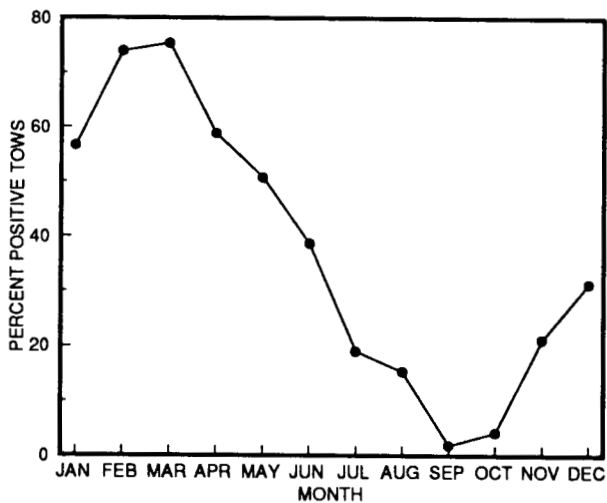
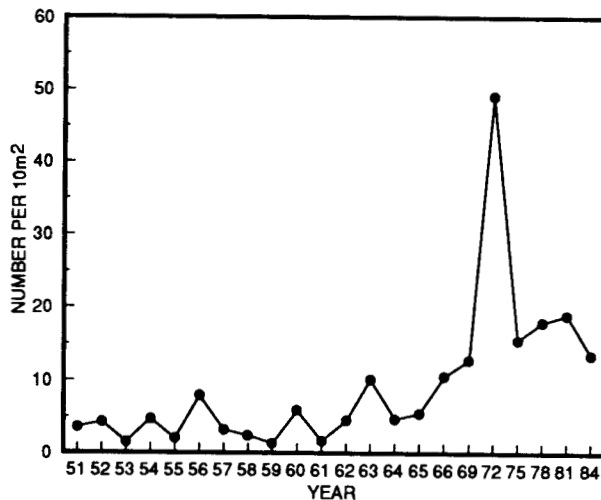
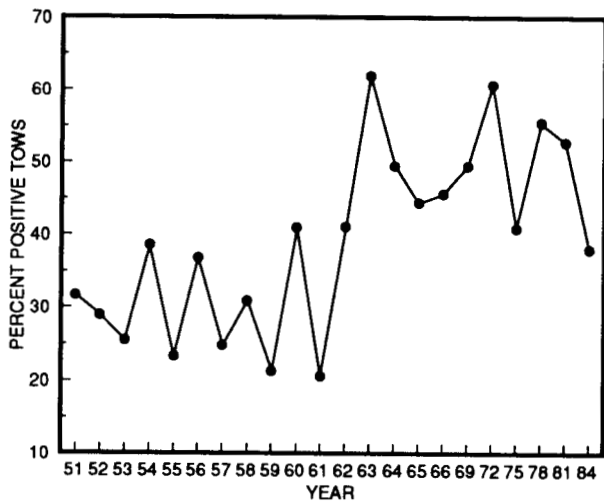
Bathylagus ochotensis

Bathylagidae



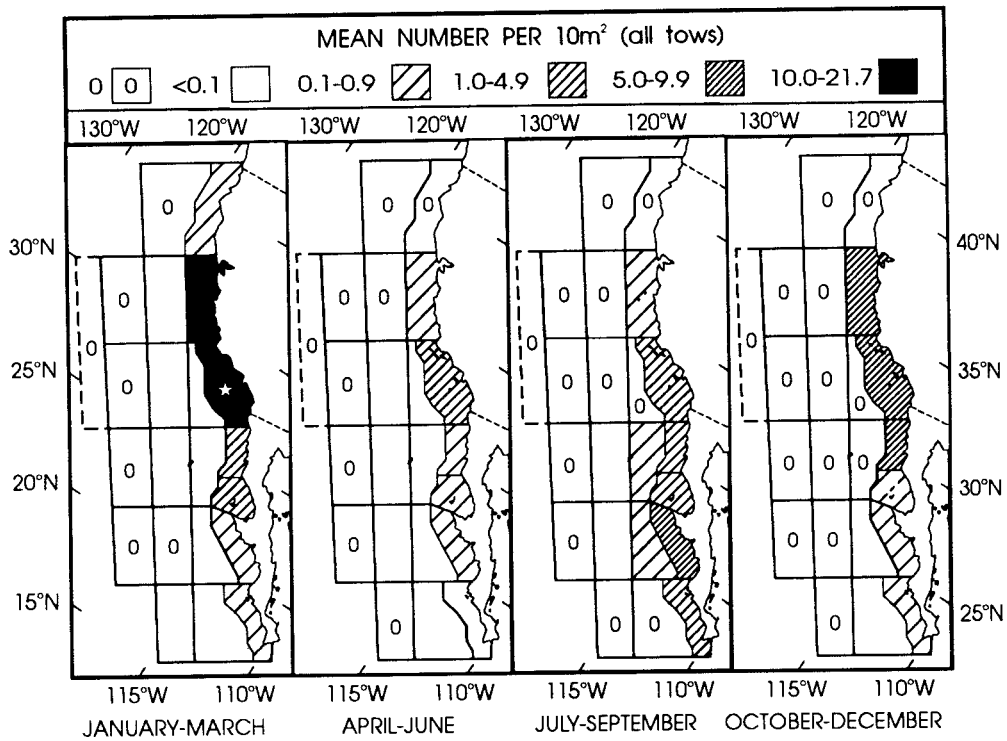
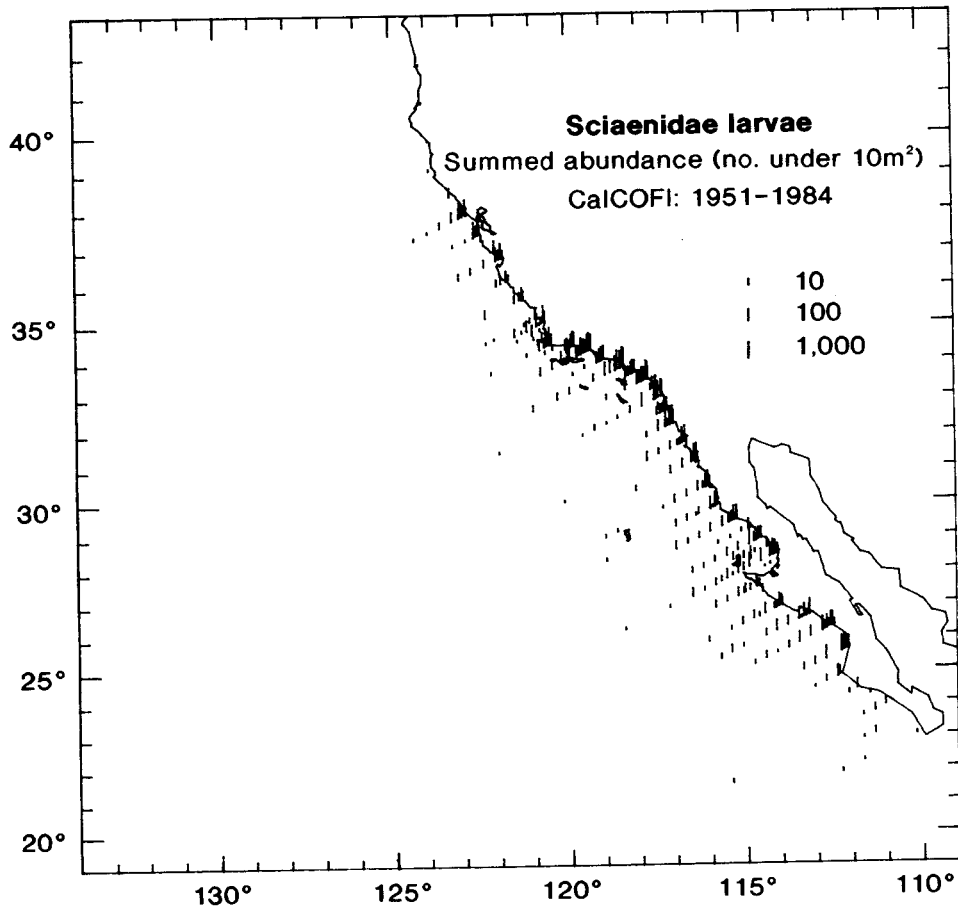
Popeye blacksmelt

Bathylagus ochotensis



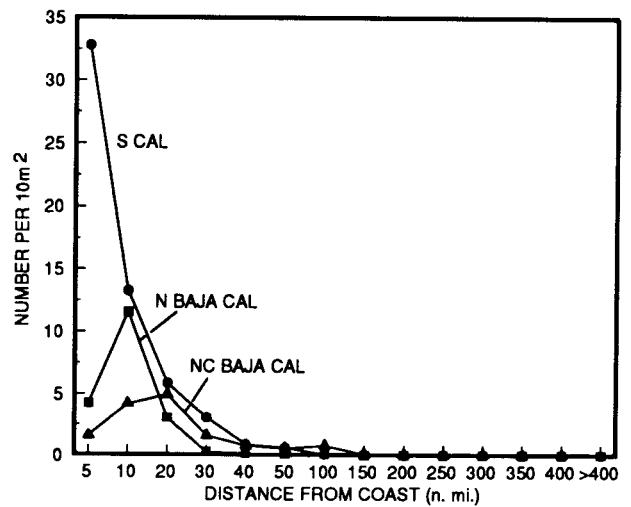
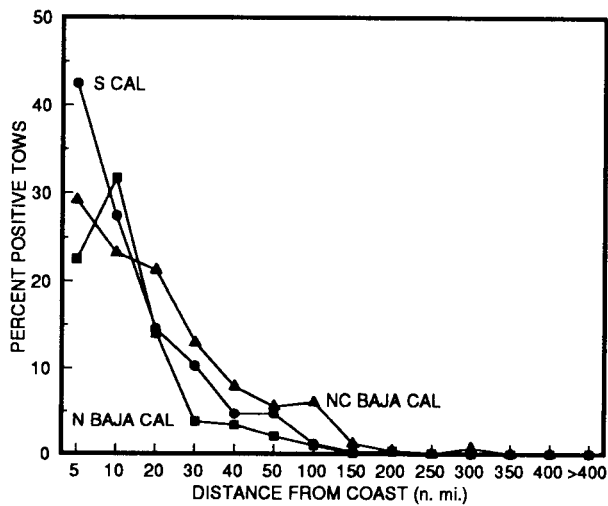
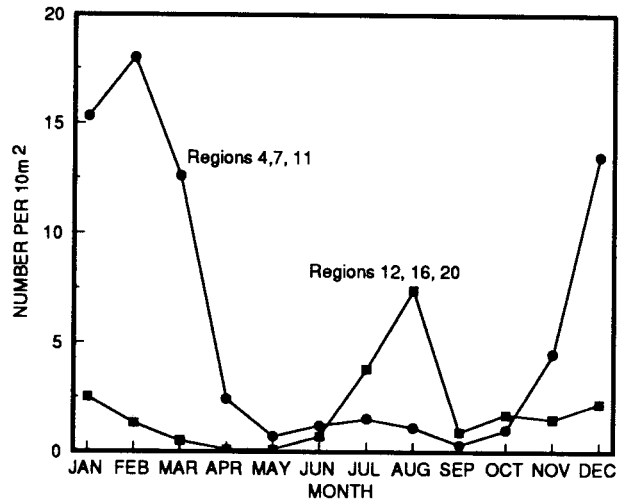
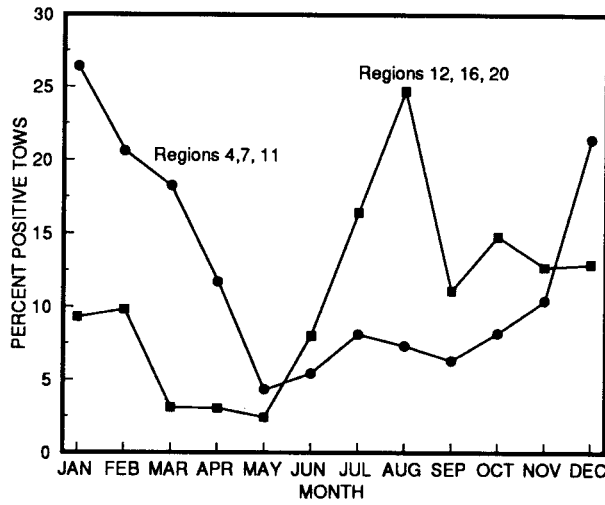
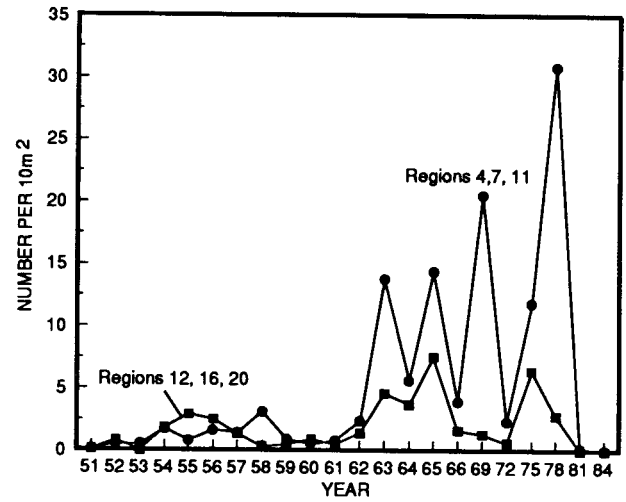
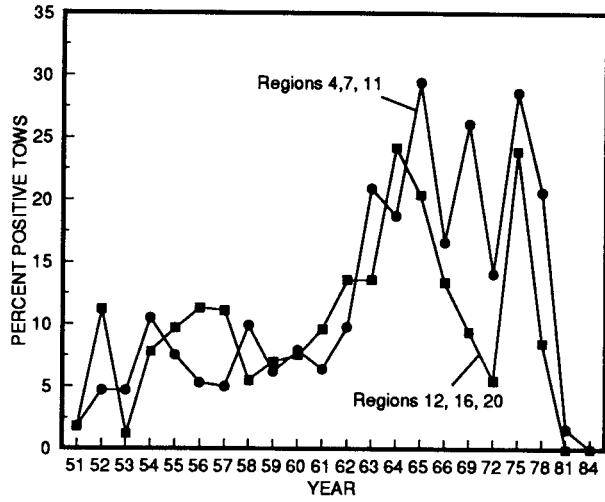
Sciaenidae

Sciaenidae



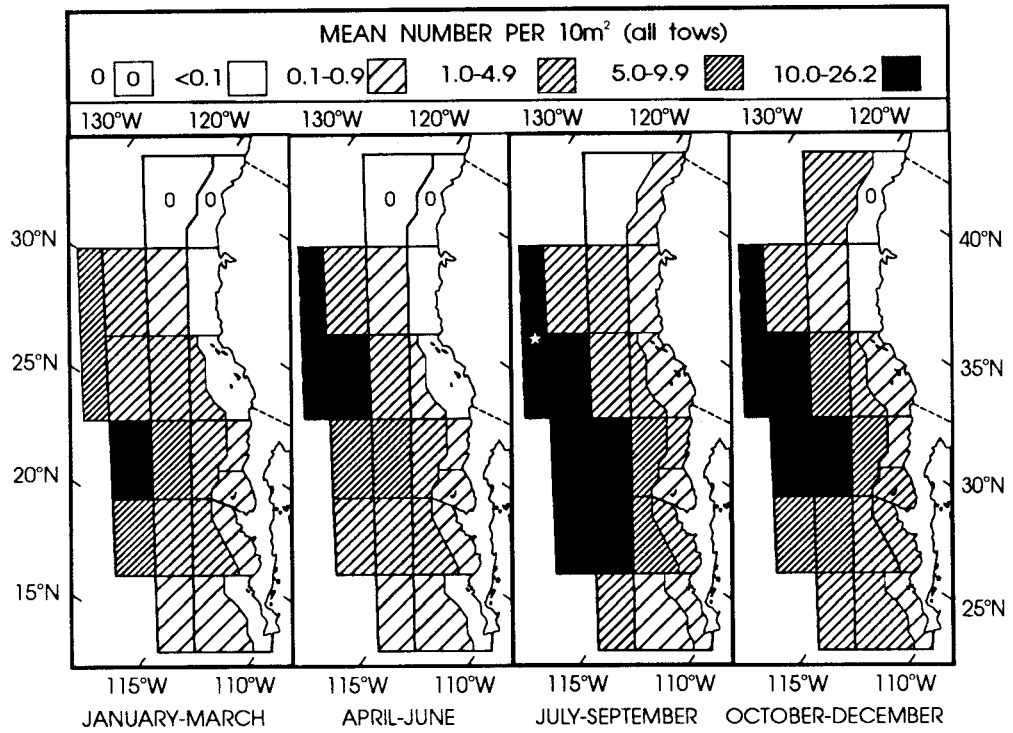
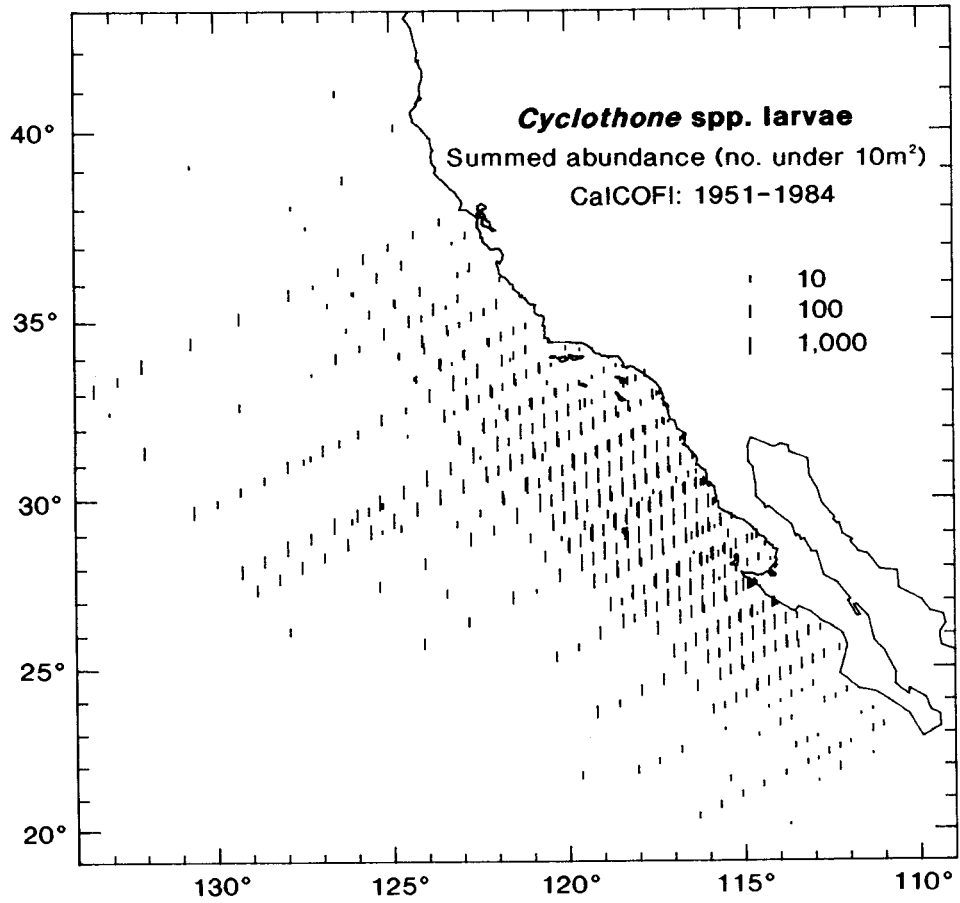
Croakers

Sciaenidae



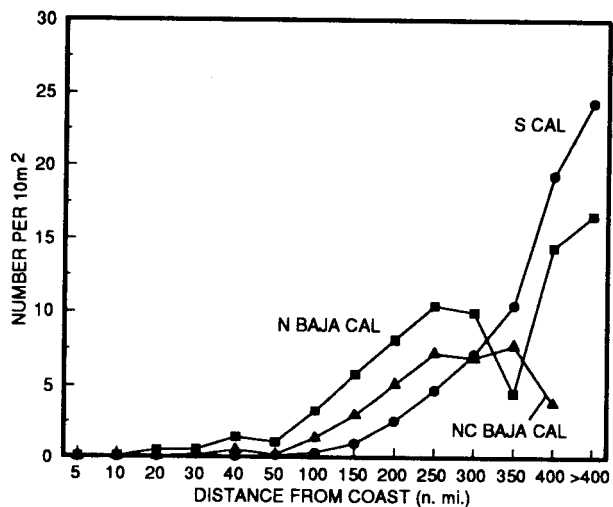
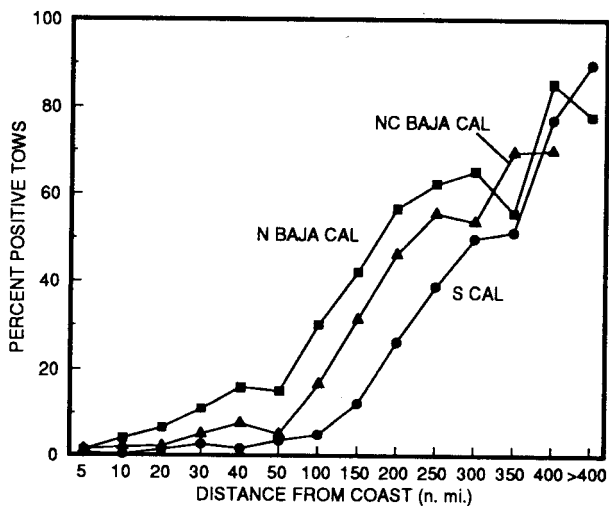
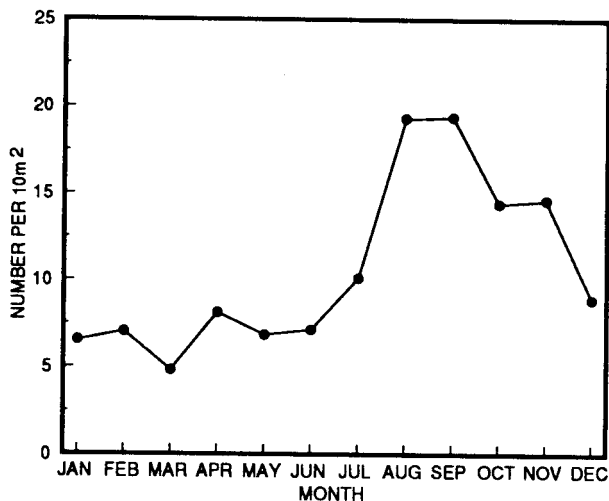
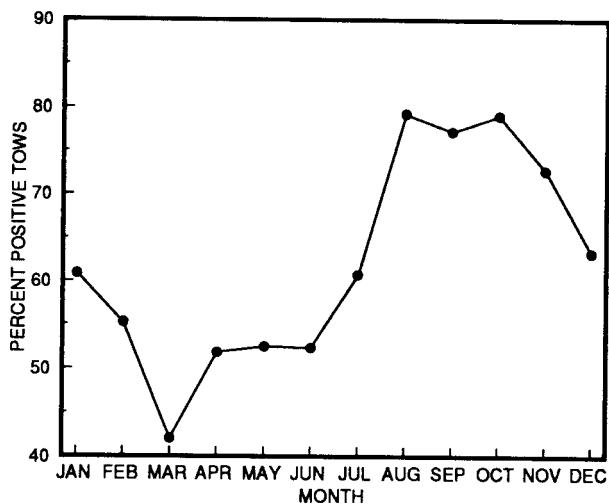
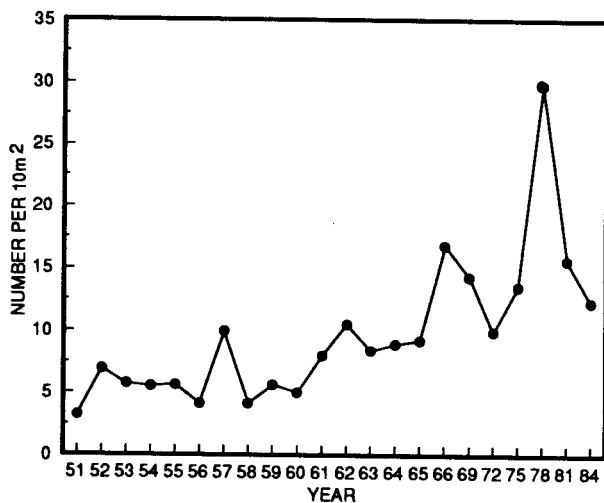
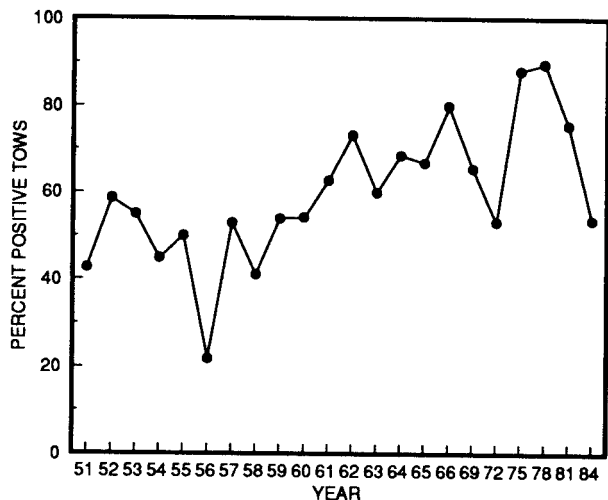
Cyclothone spp.

Gonostomatidae



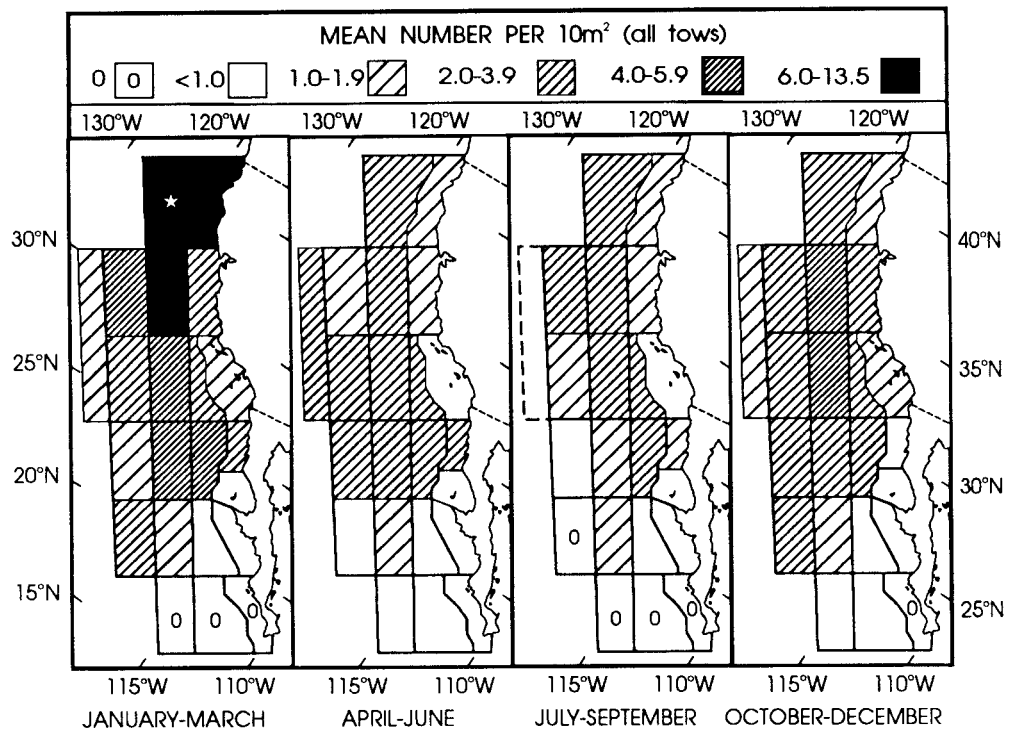
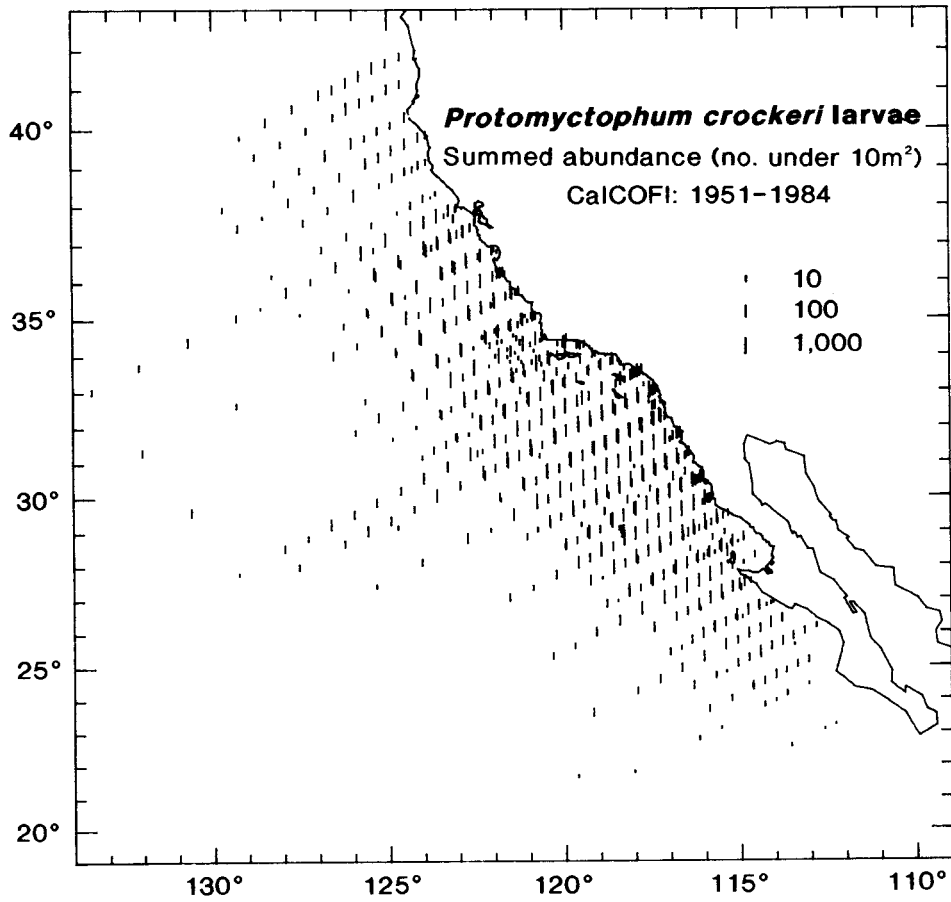
Bristlemouths

Cyclothone spp.

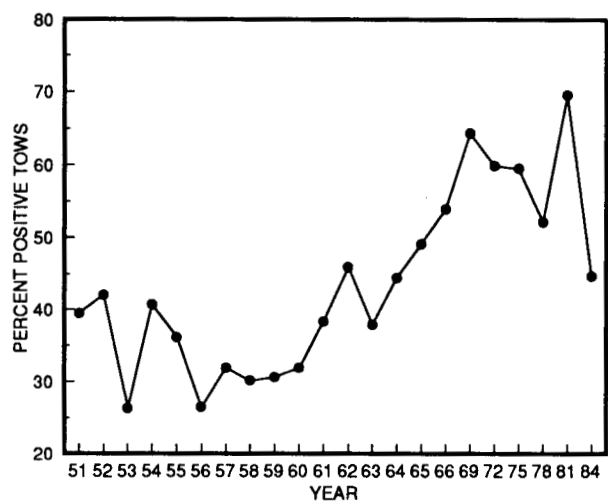
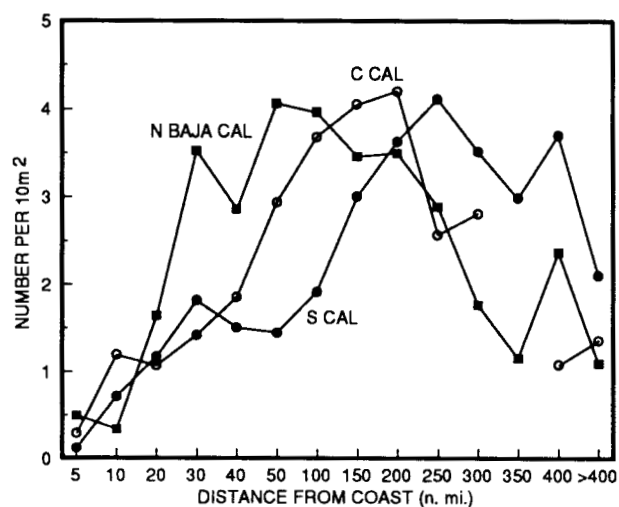
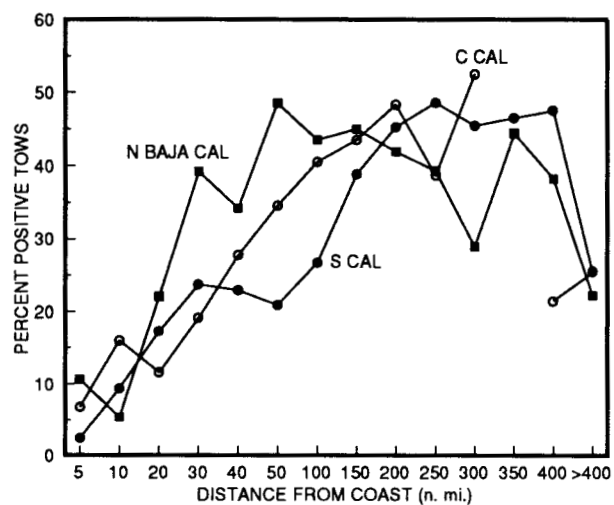
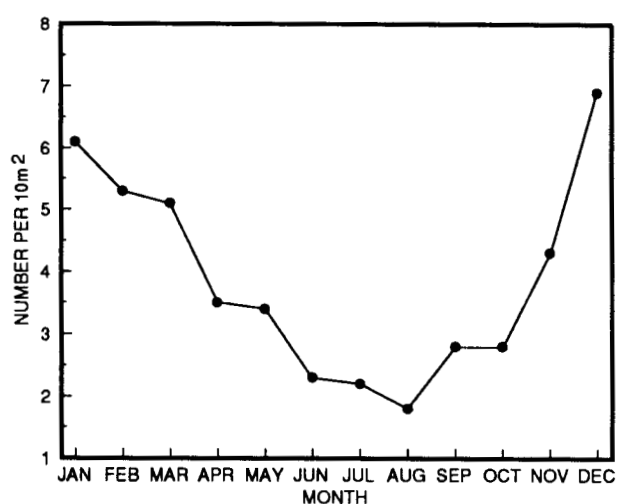
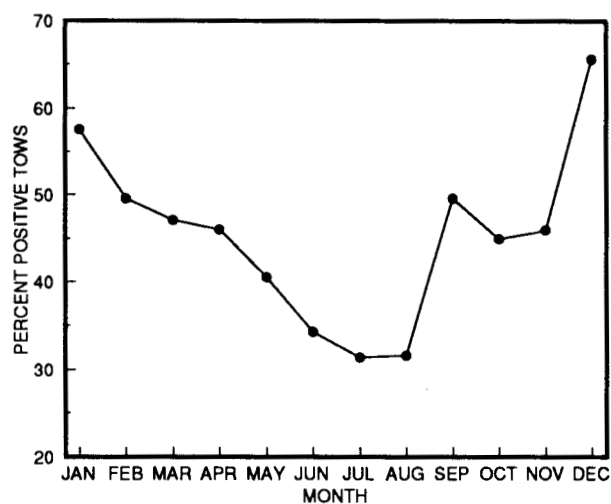
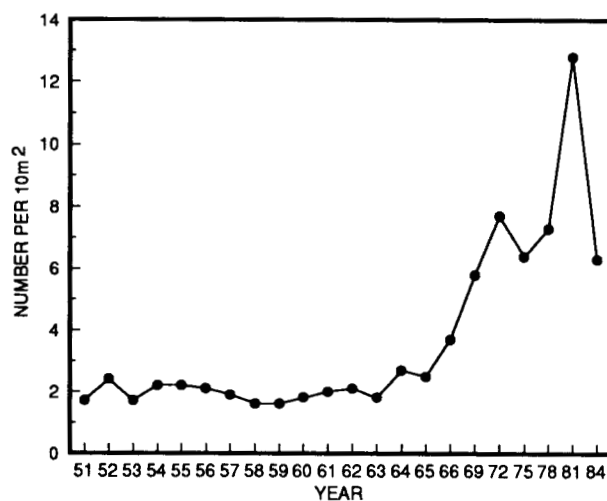


Protomyctophum crockeri

Myctophidae

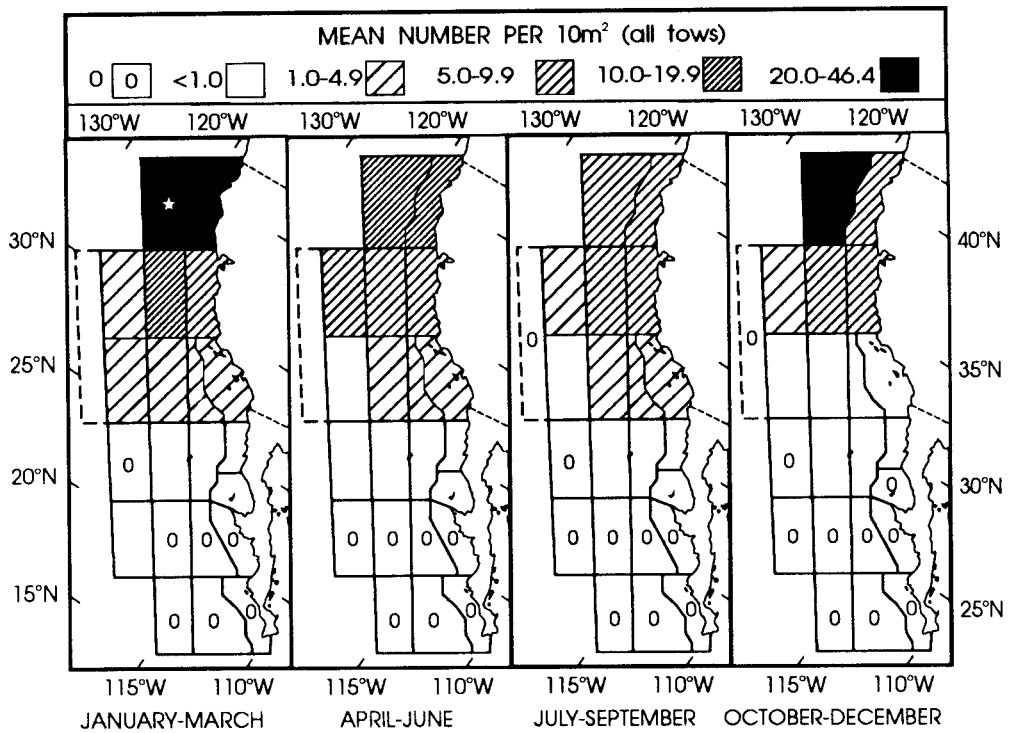
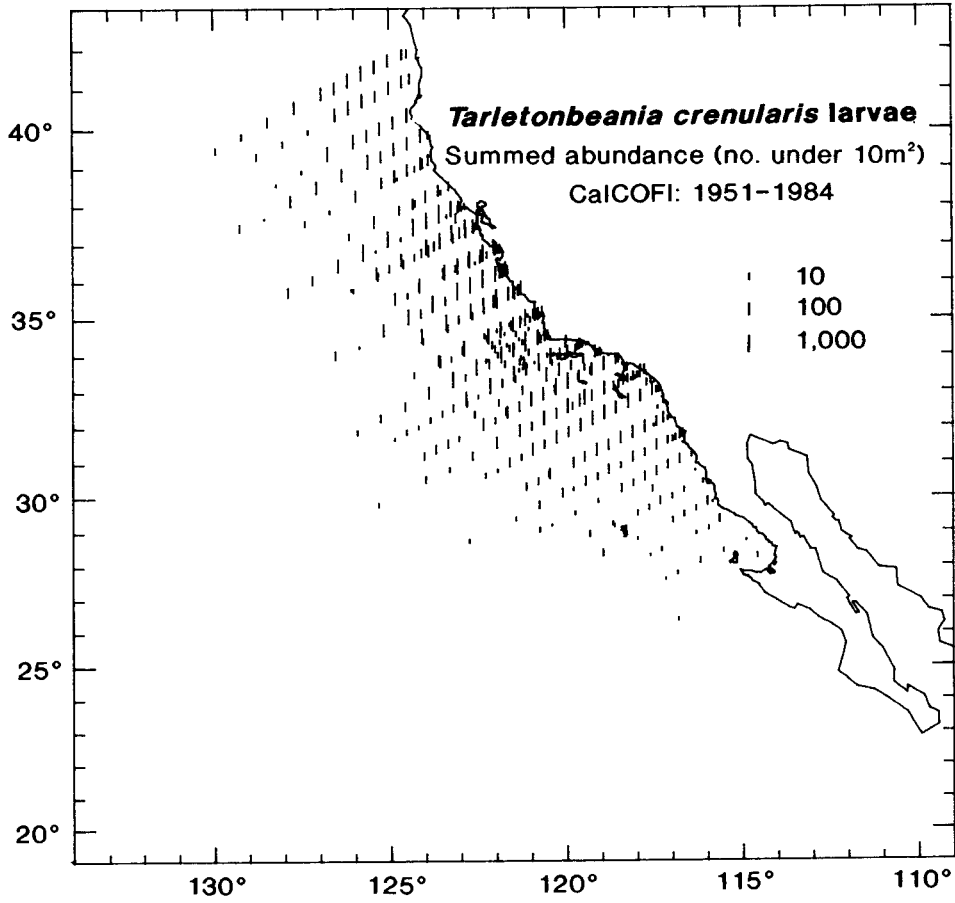


California flashlightfish

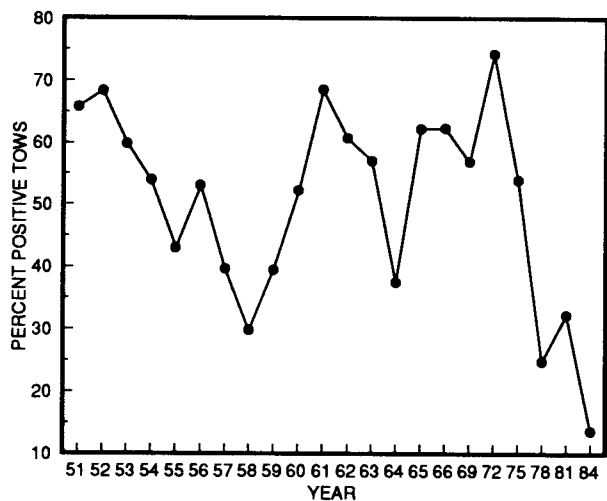
*Protomyctophum crockeri*

Tarletonbeania crenularis

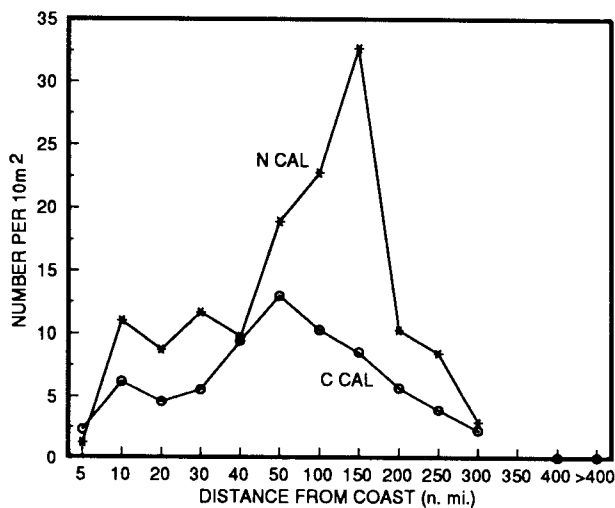
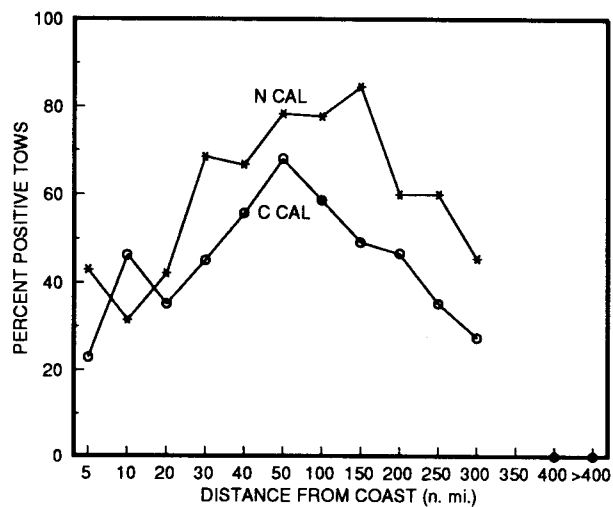
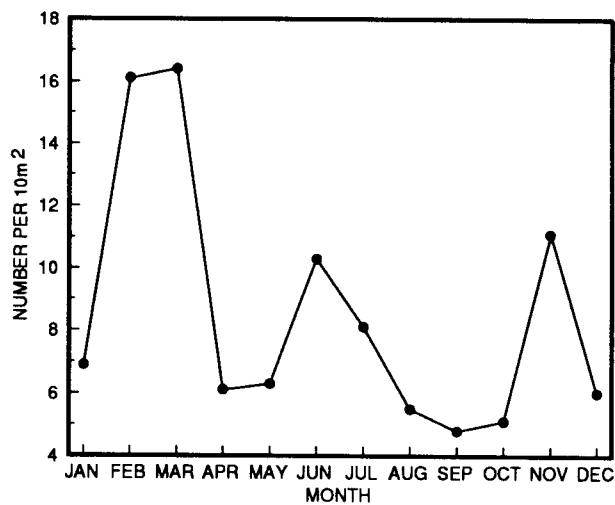
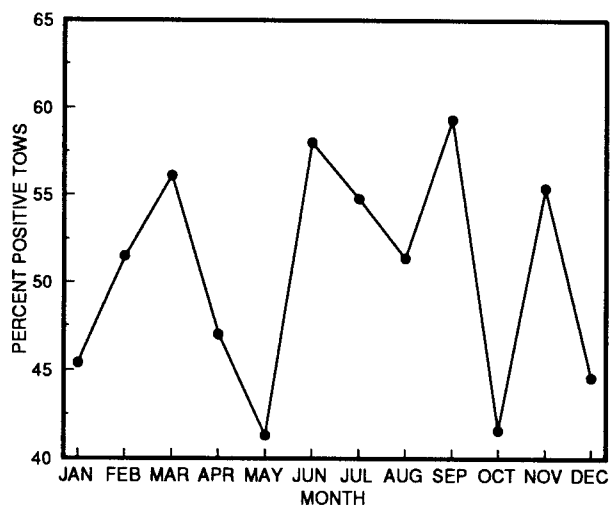
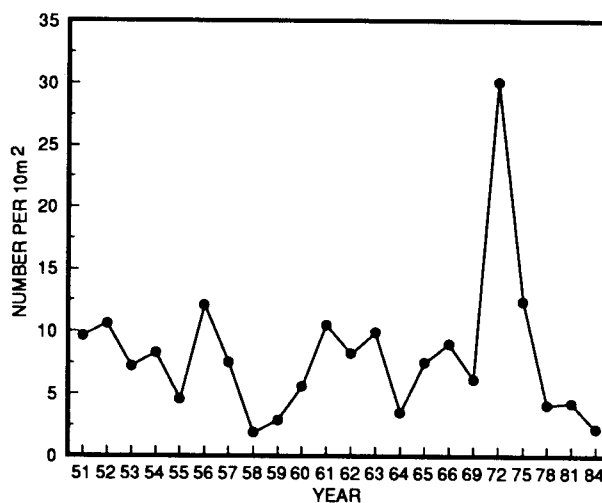
Myctophidae



Blue lanternfish

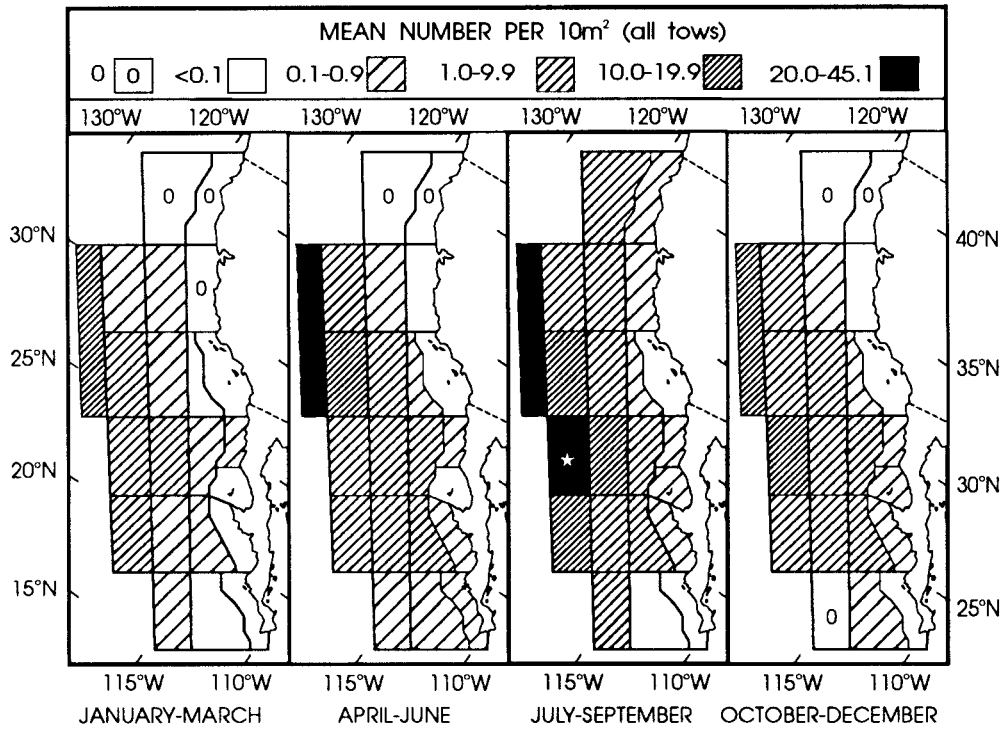
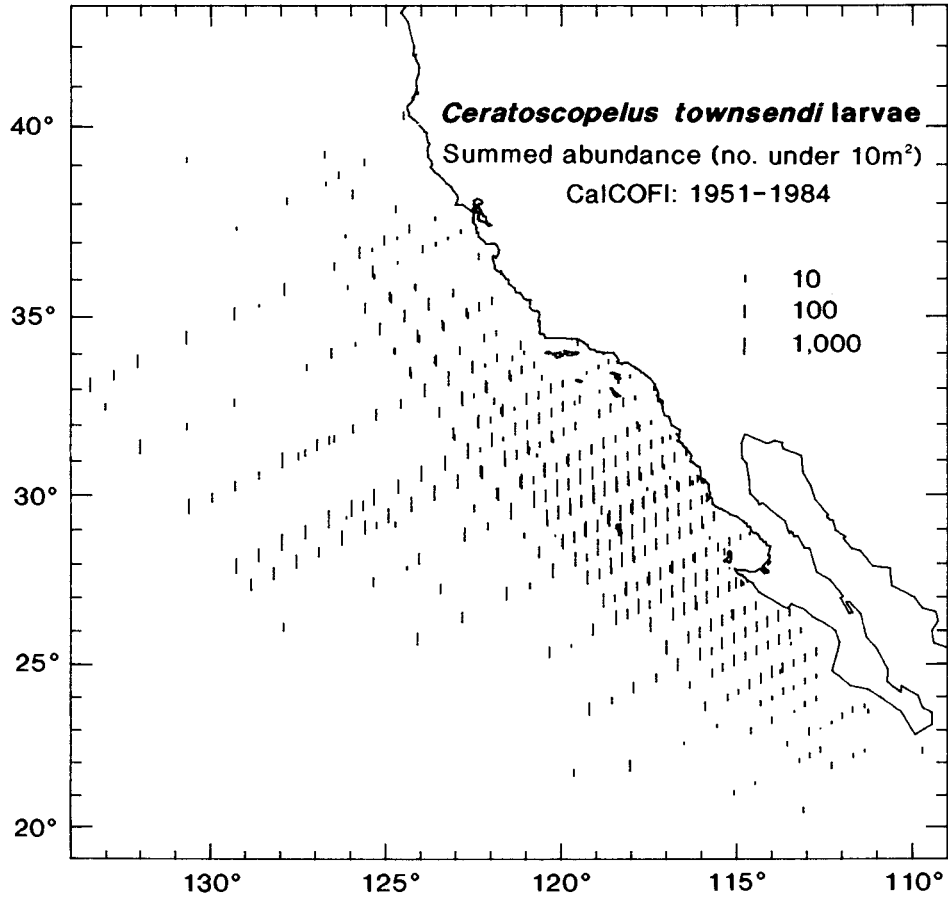


Tarletonbeania crenularis



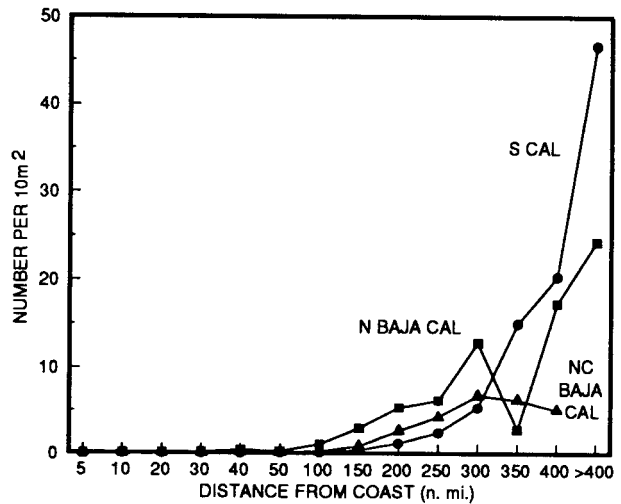
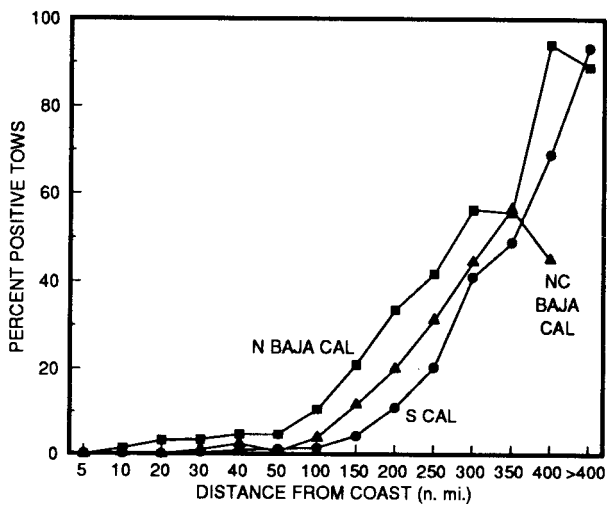
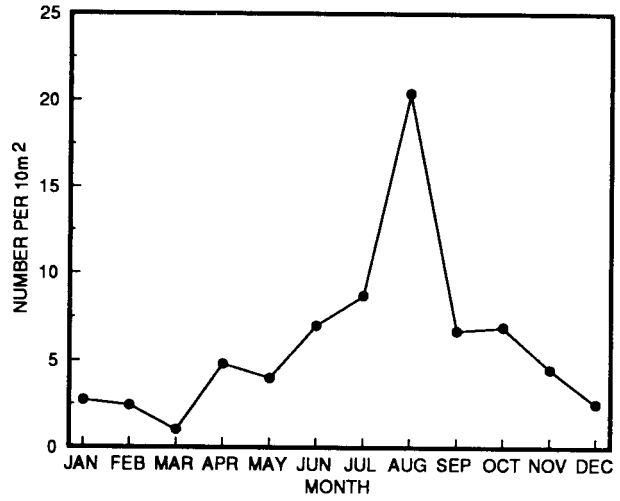
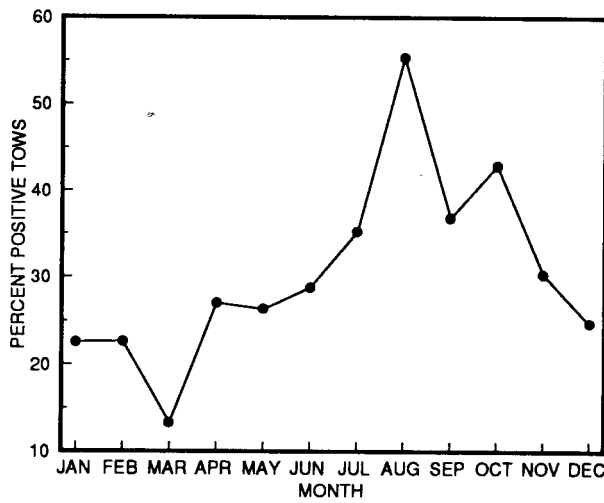
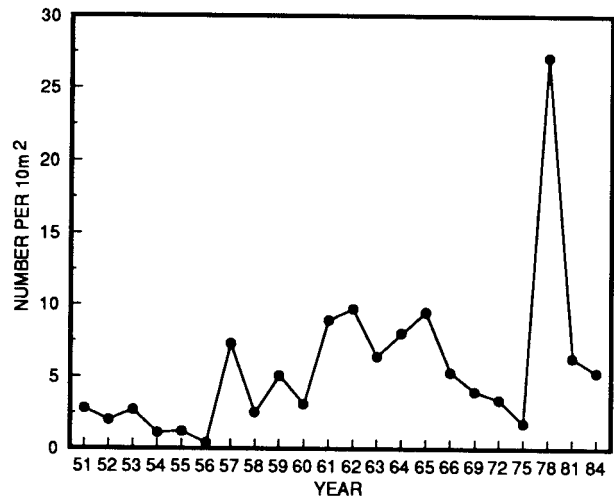
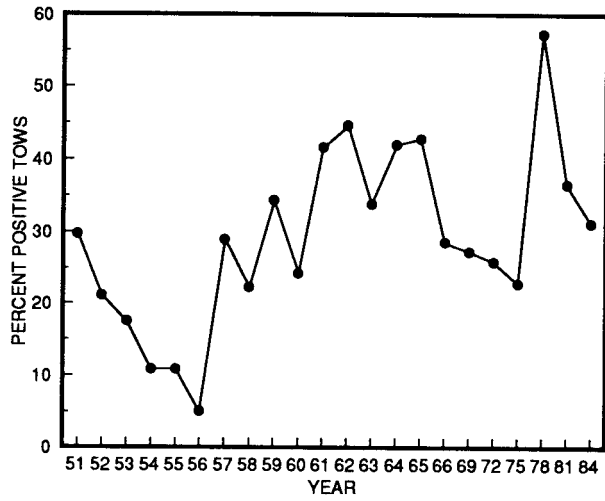
Ceratoscopelus townsendi

Myctophidae



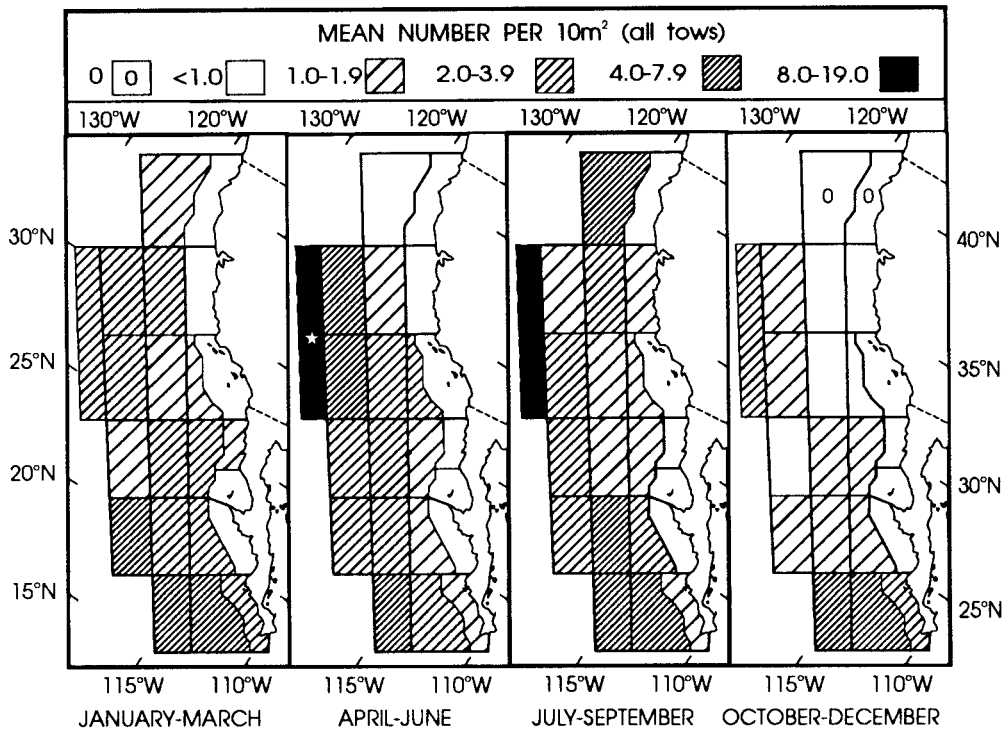
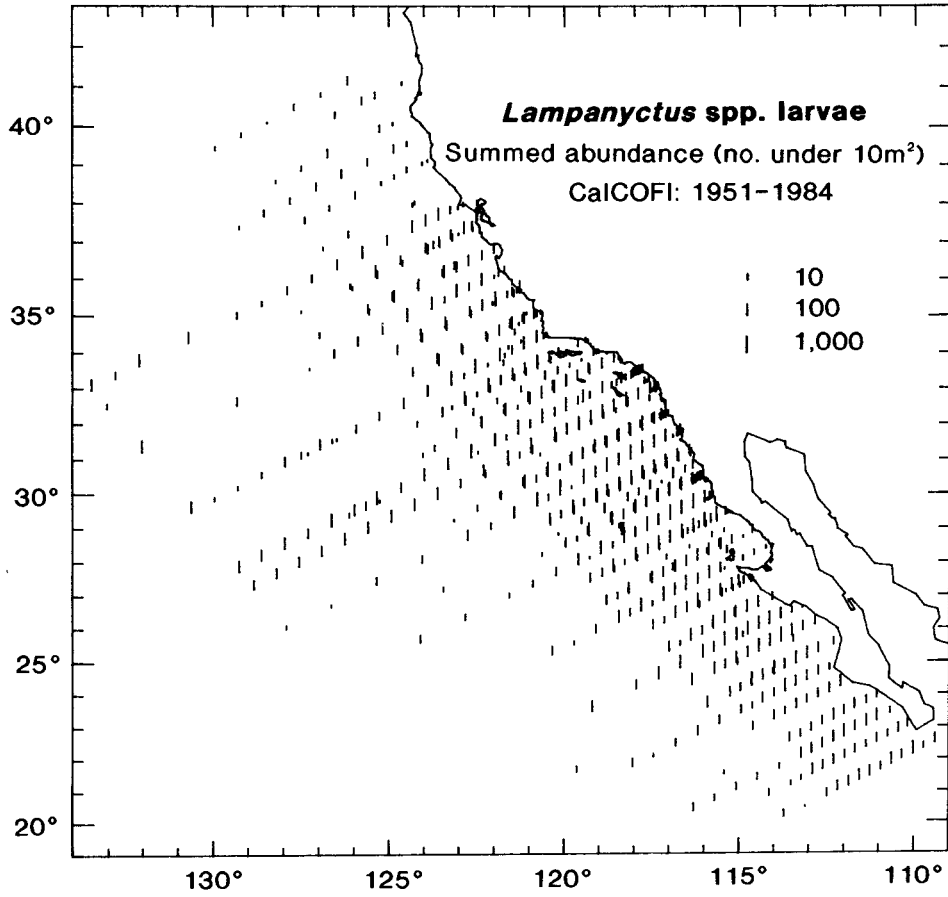
Dogtooth lampfish

Ceratoscopelus townsendi



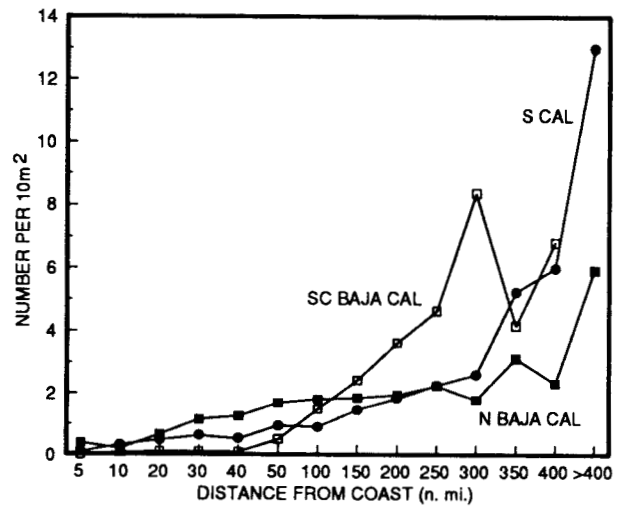
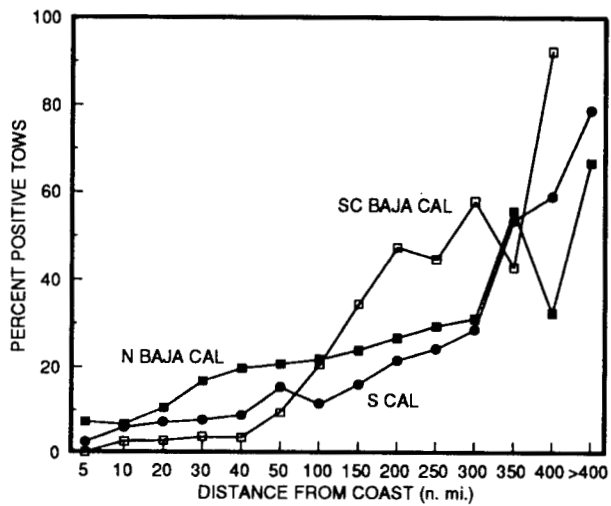
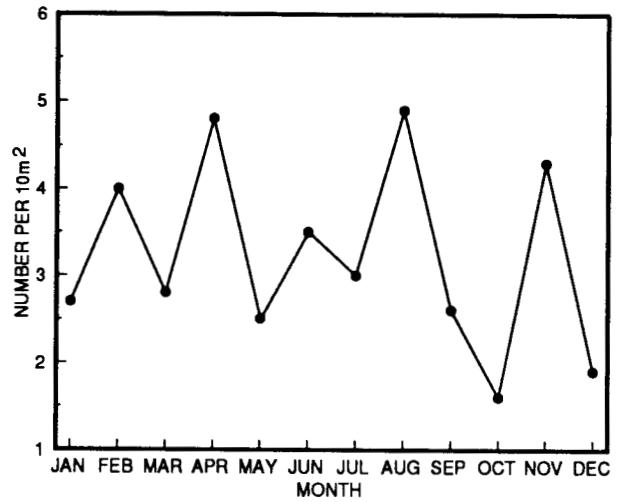
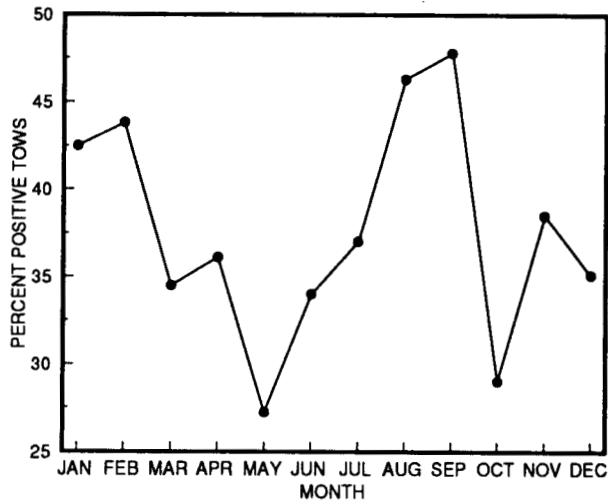
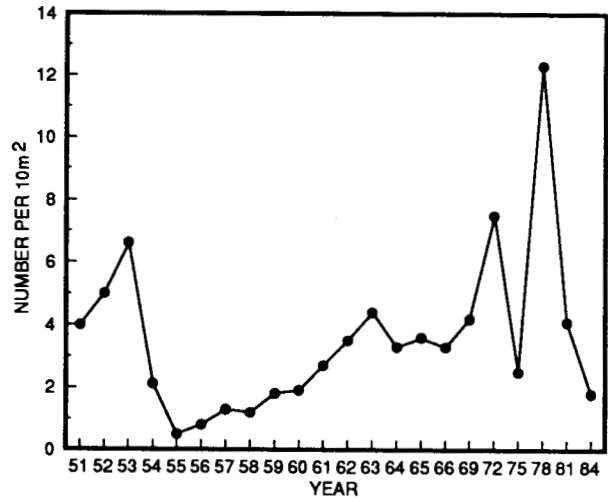
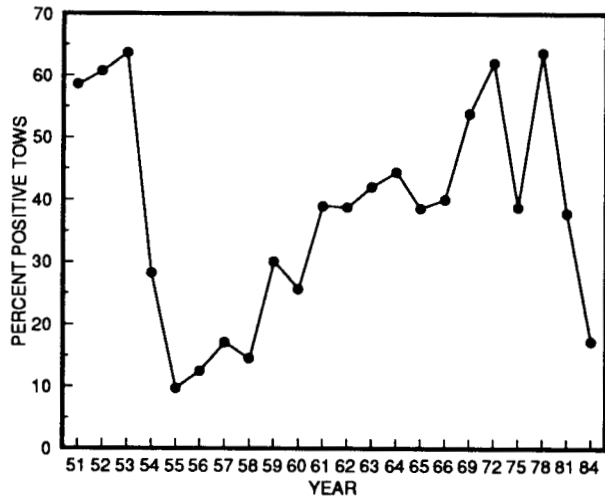
Lampanyctus spp.

Myctophidae



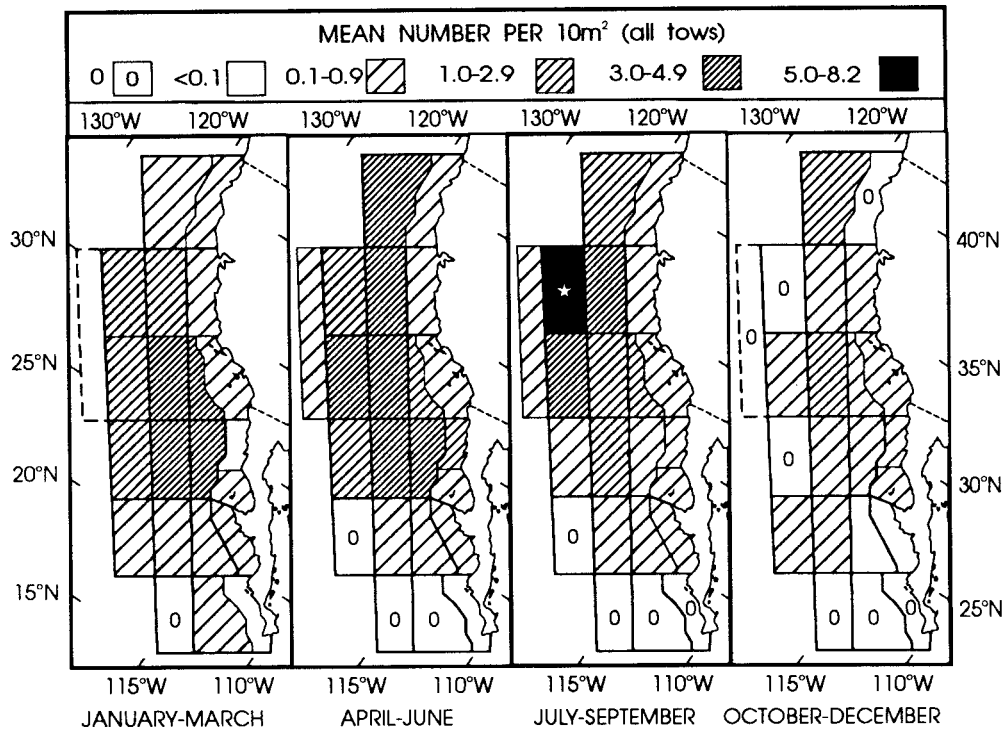
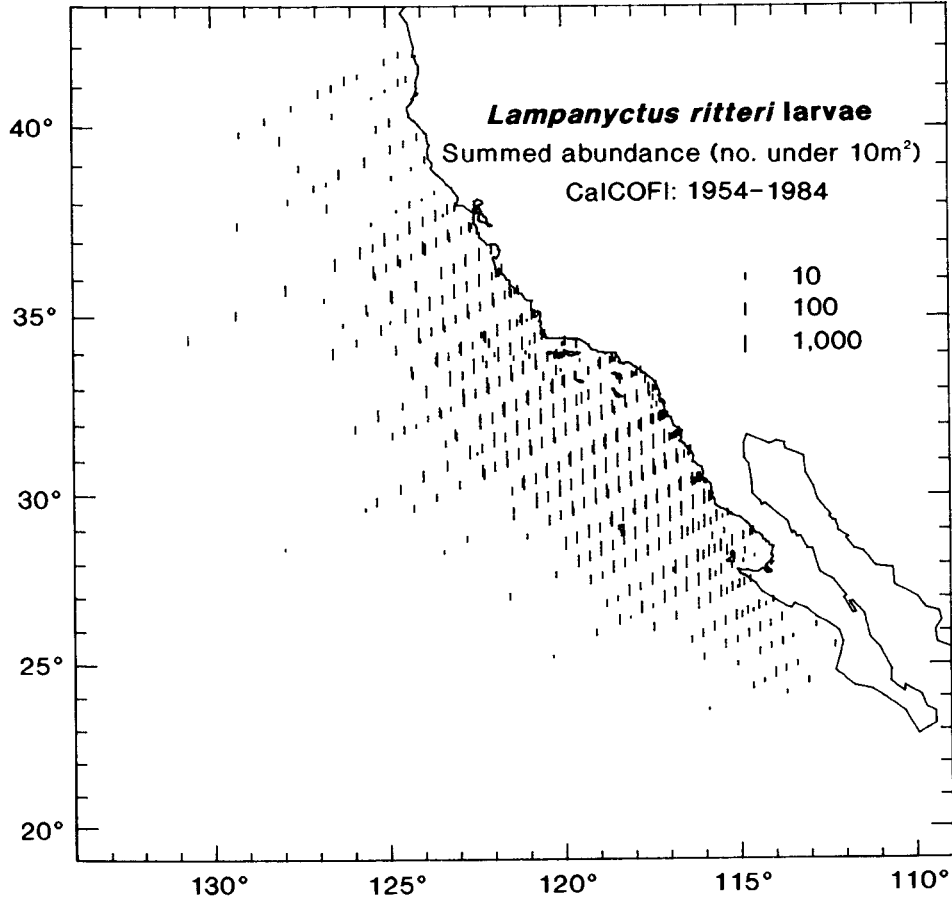
Lampfishes

Lampanyctus spp.

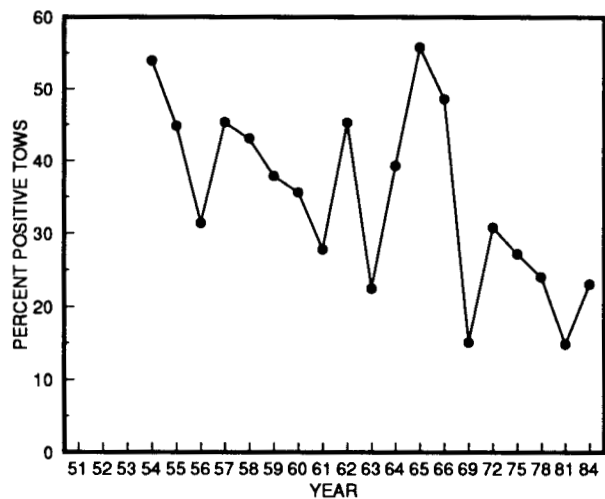


Lampanyctus ritteri

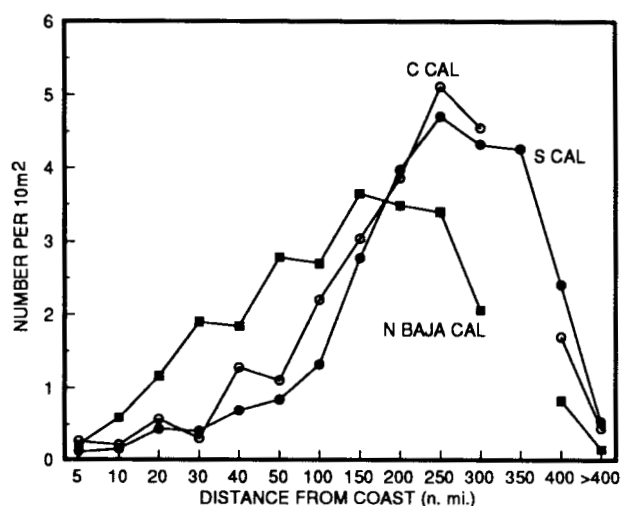
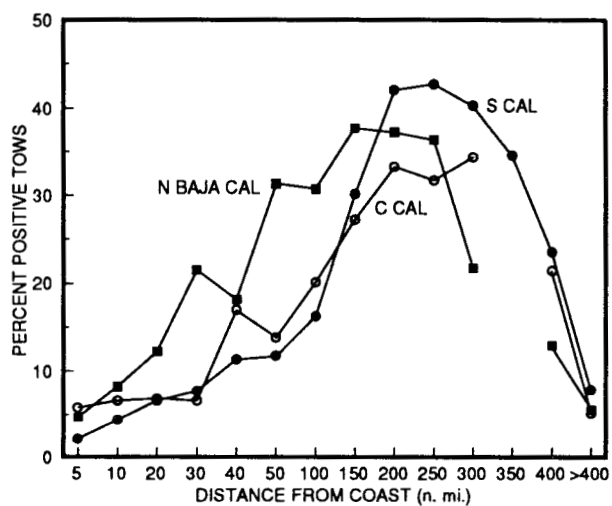
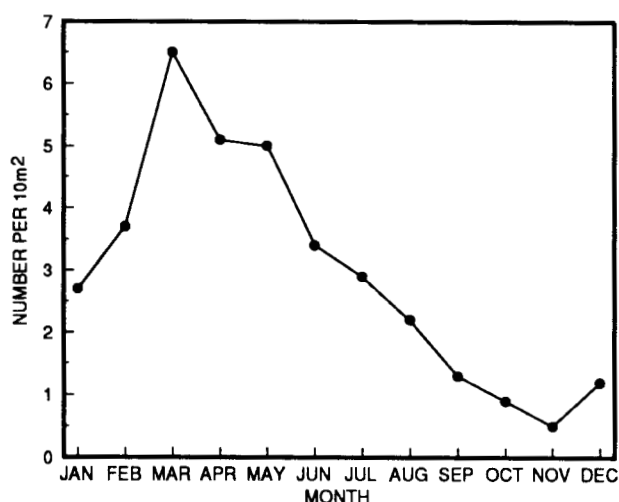
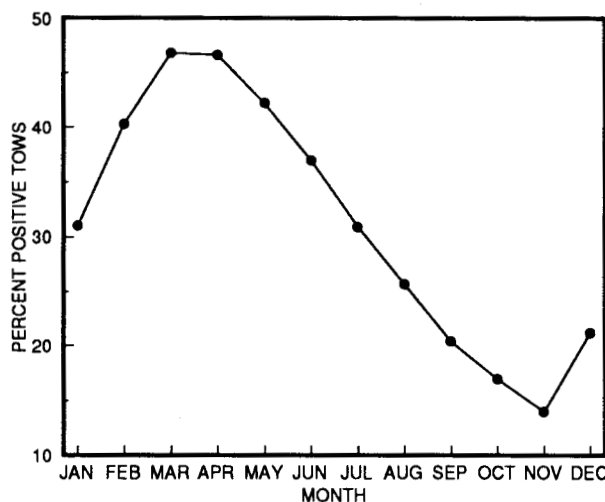
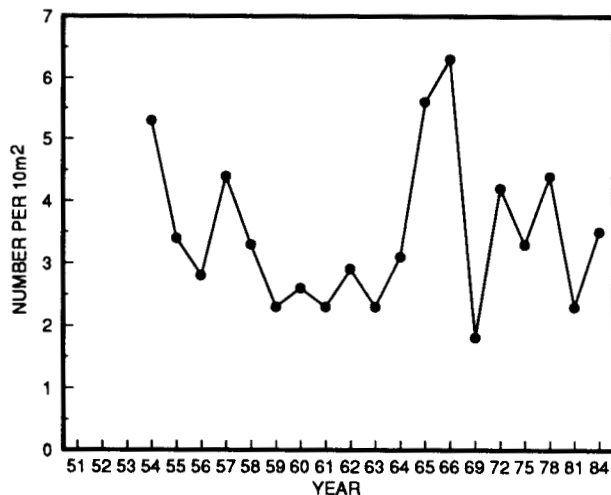
Myctophidae



Broadfin lampfish

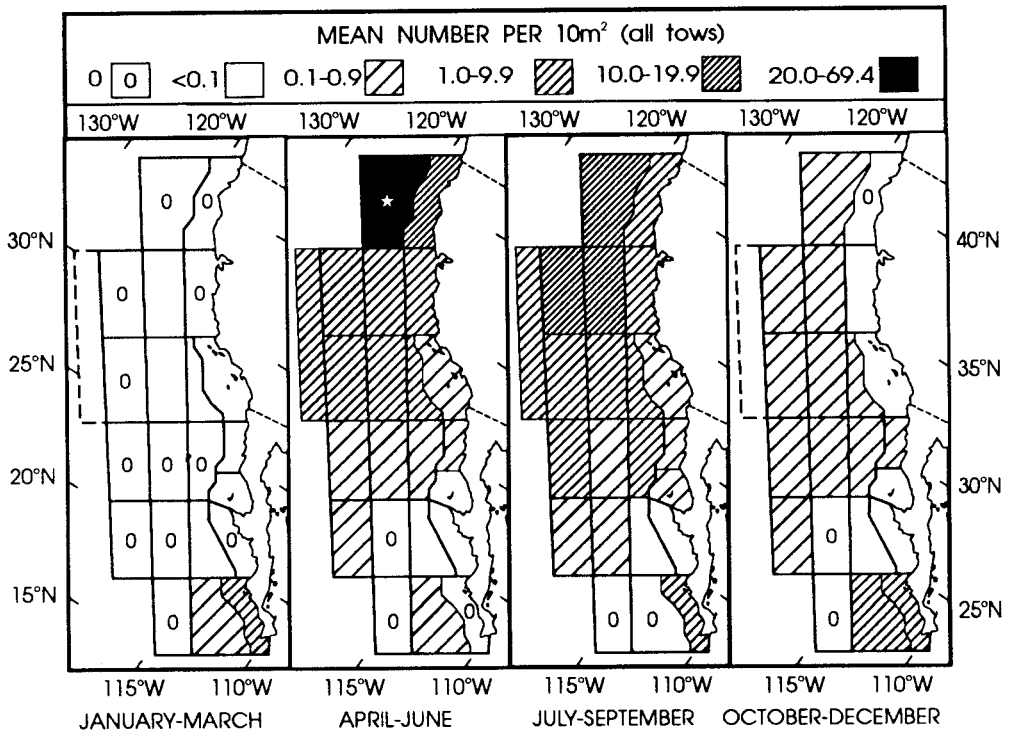
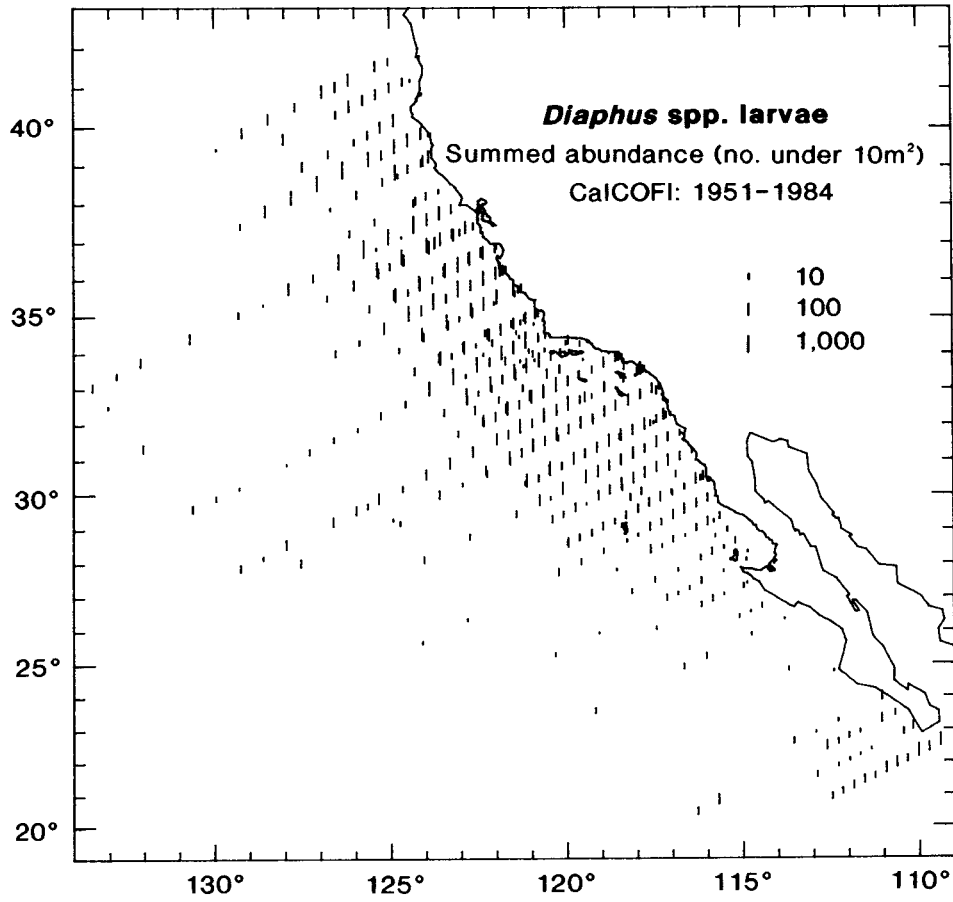


Lampanyctus ritteri



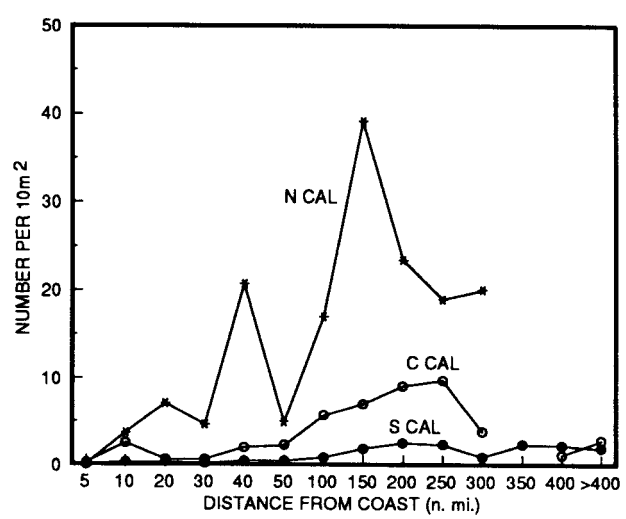
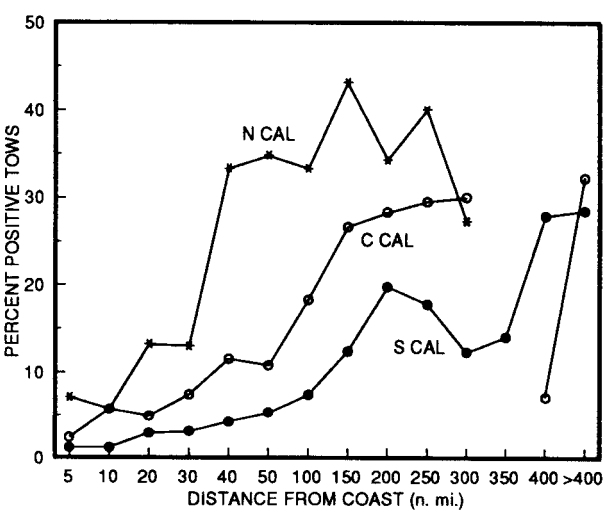
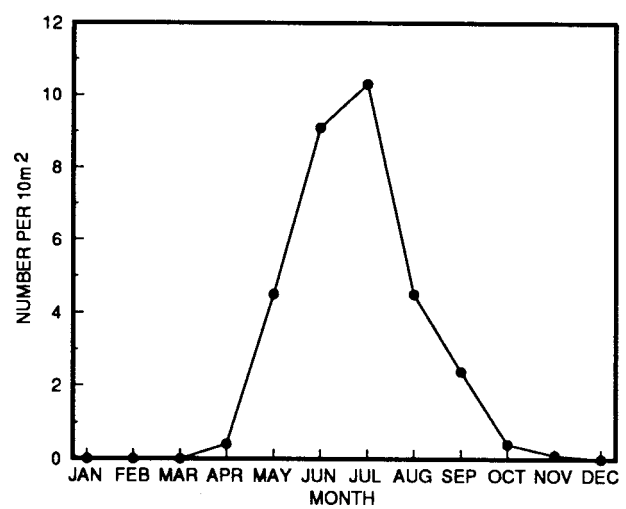
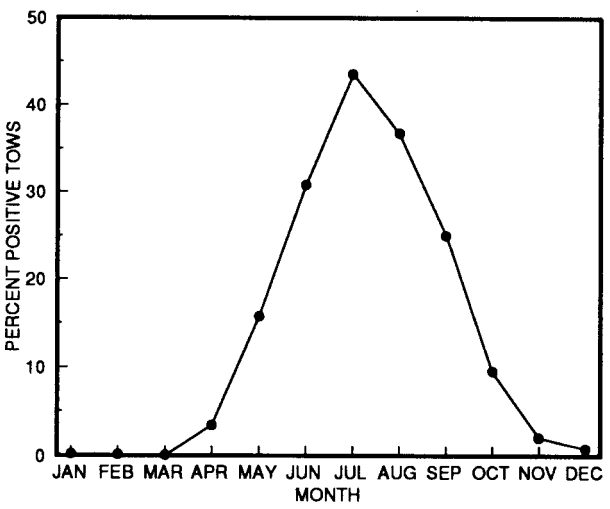
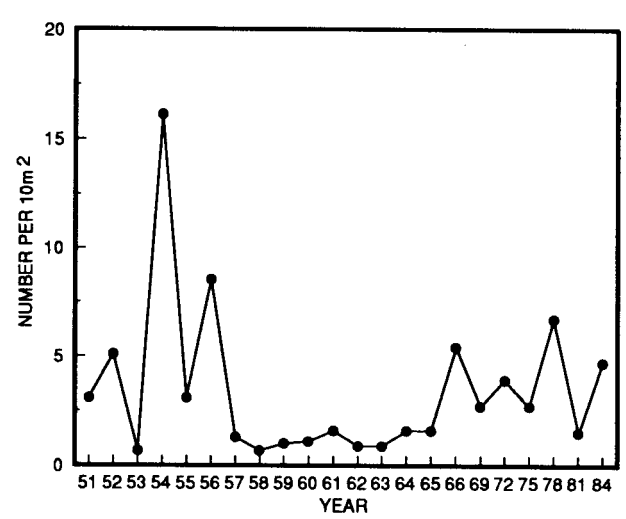
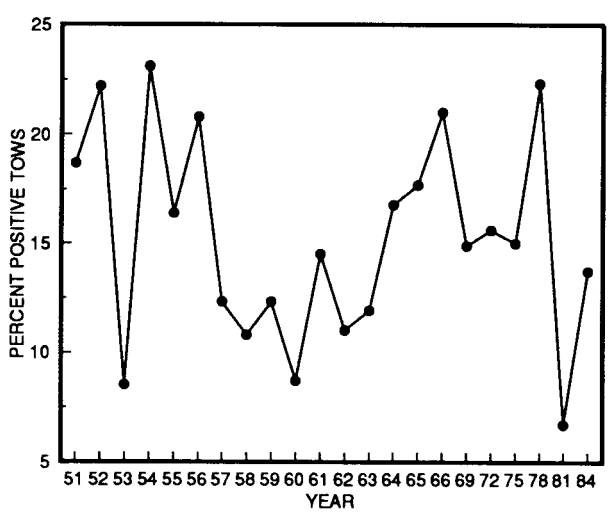
Diaphus spp.

Myctophidae



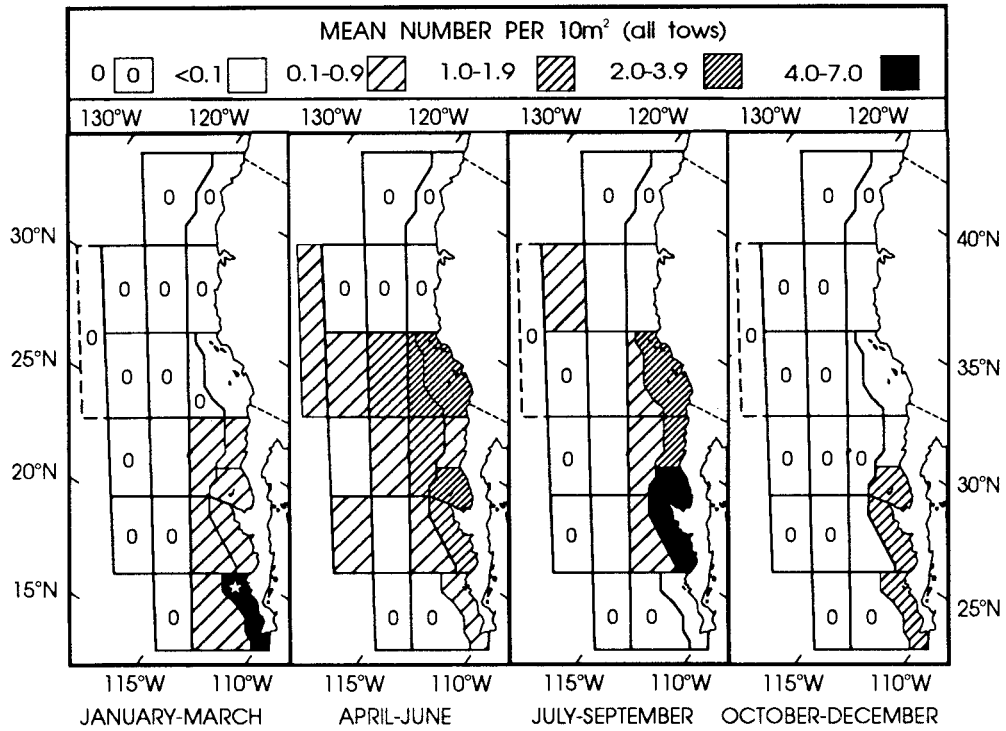
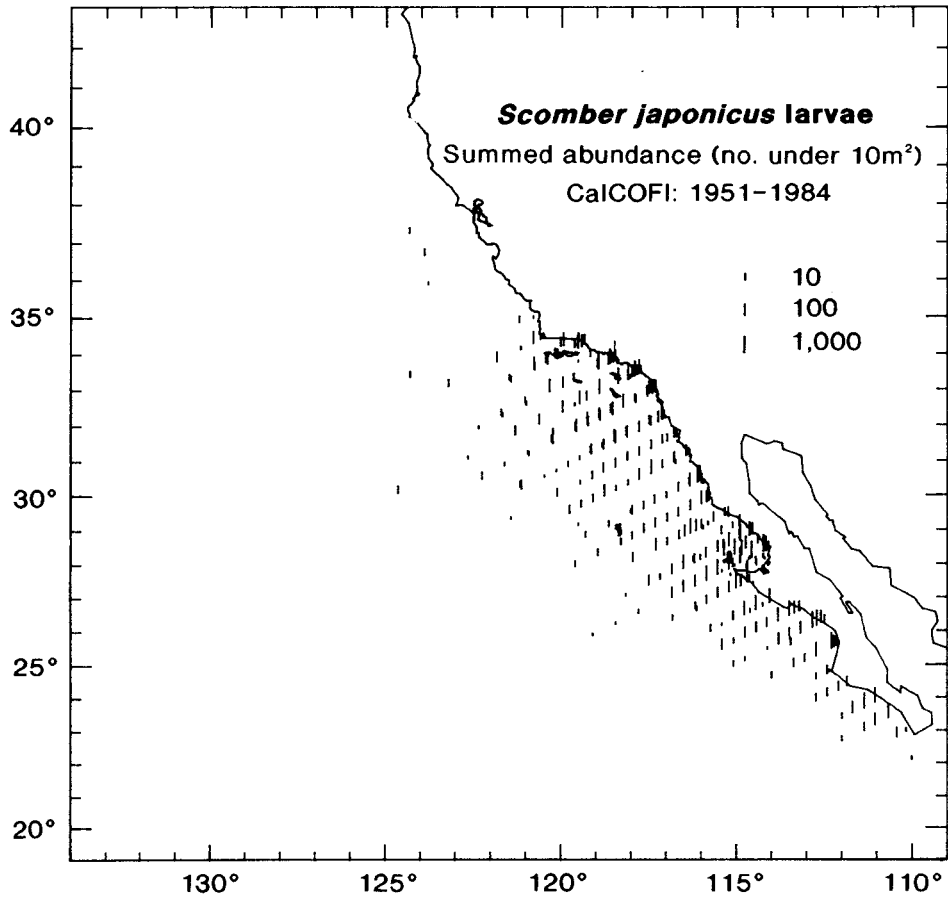
Headlightfishes

Diaphus spp.



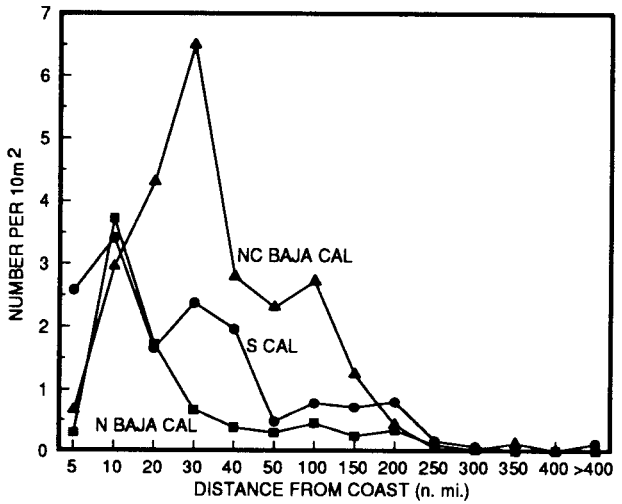
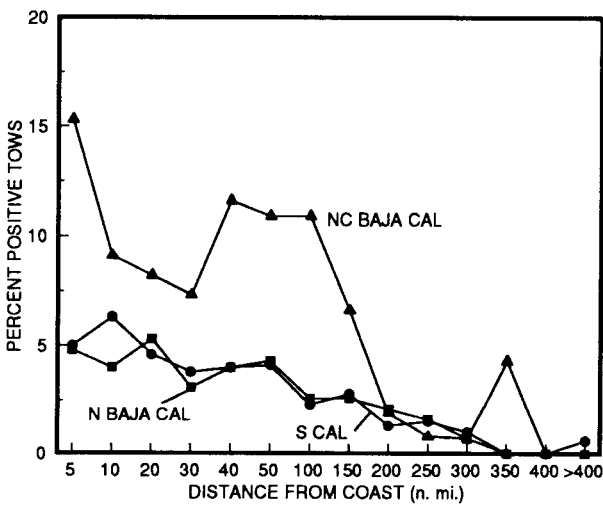
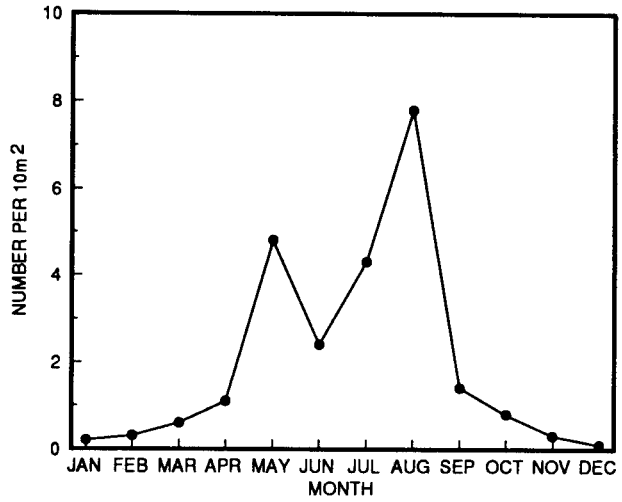
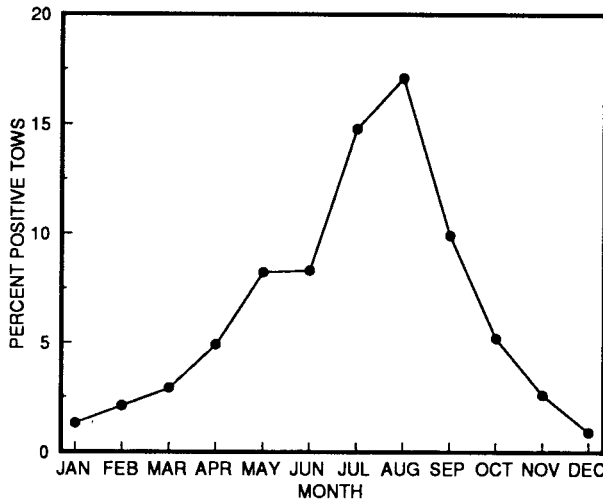
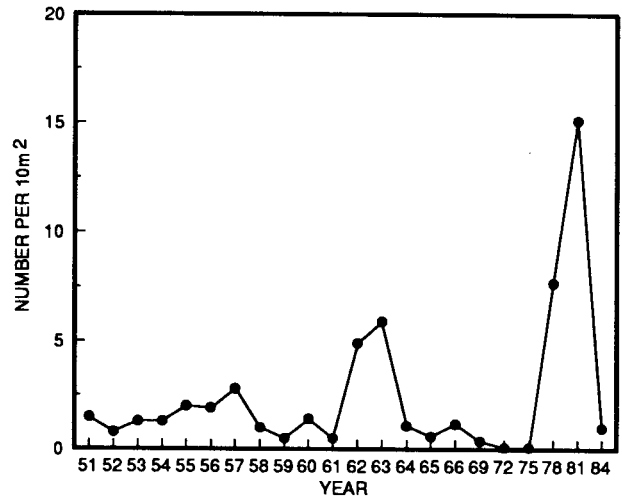
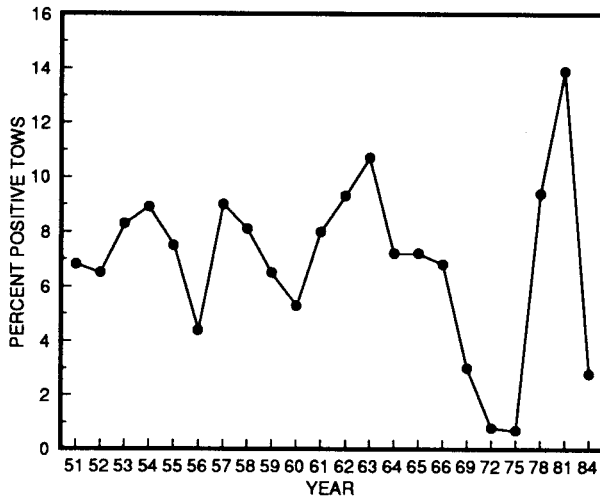
Scomber japonicus

Scombridae



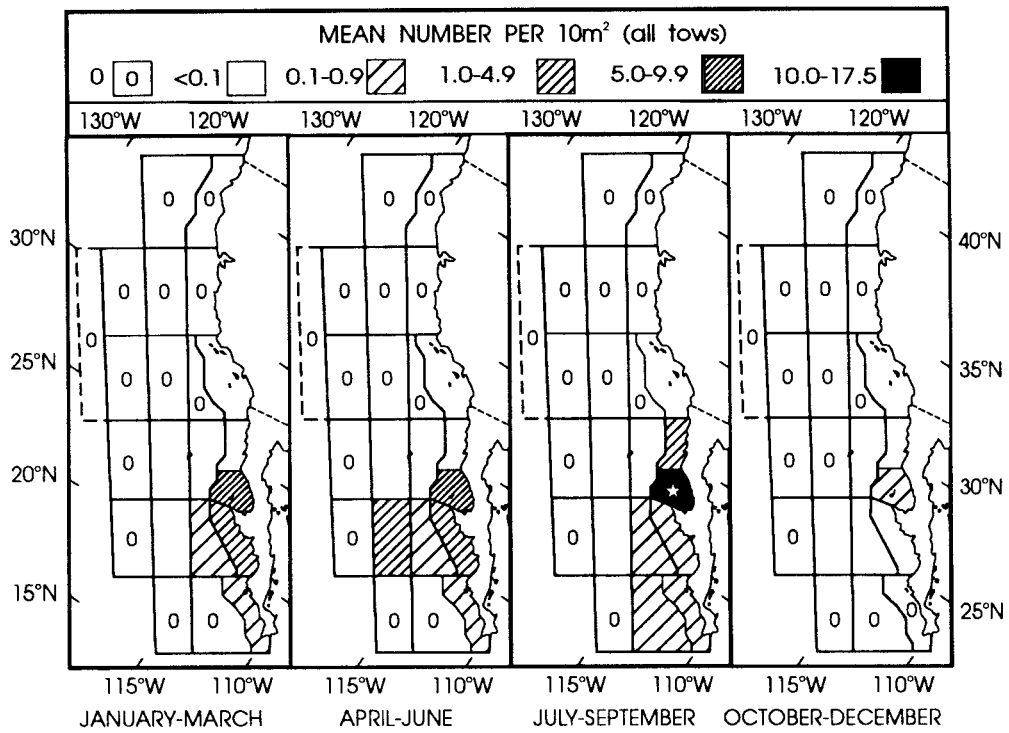
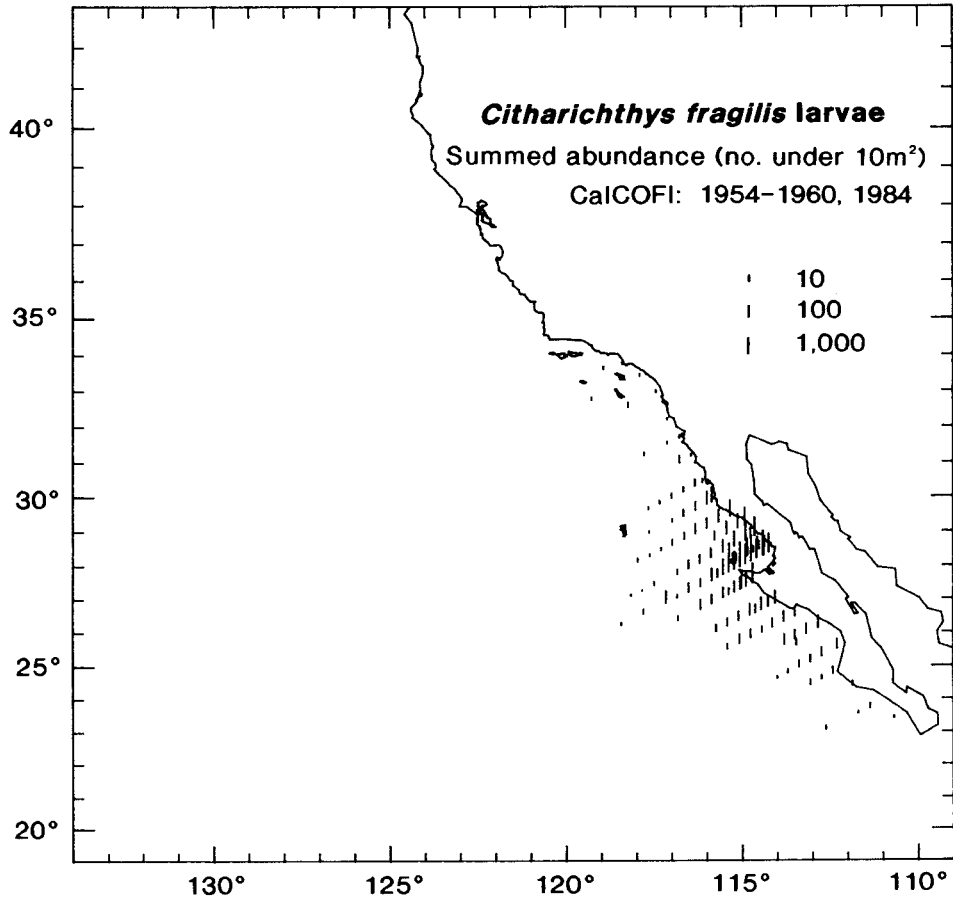
Chub mackerel

Scomber japonicus

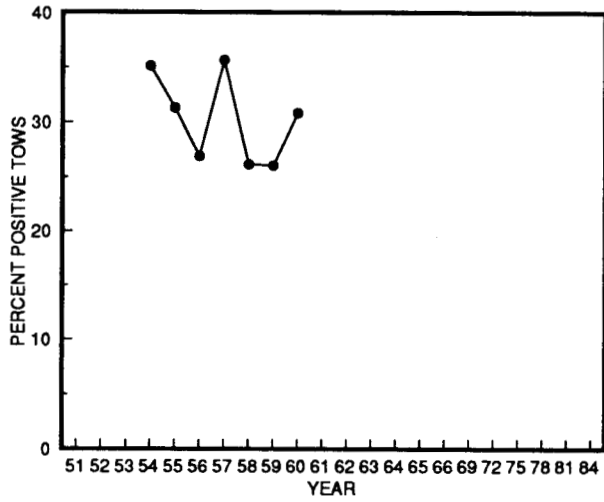


Citharichthys fragilis

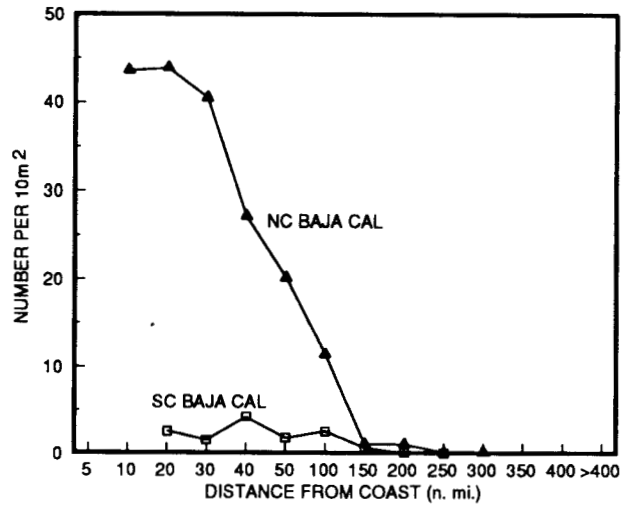
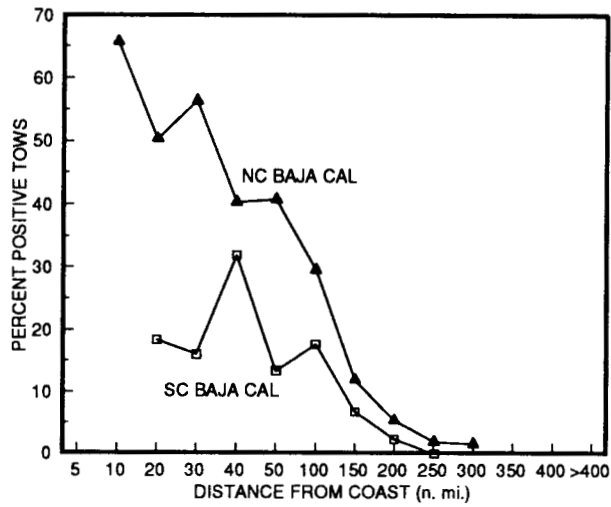
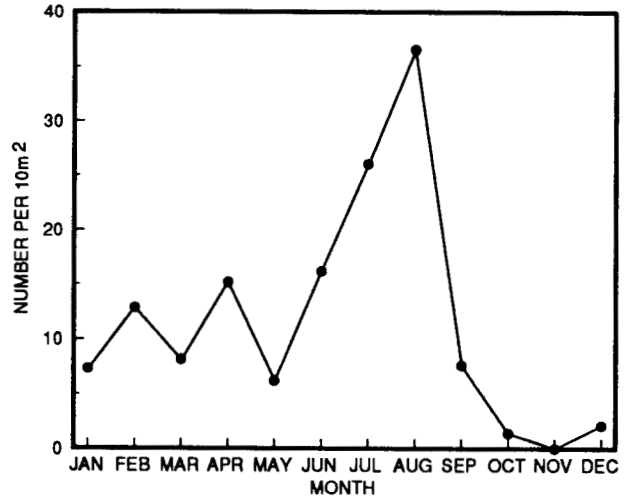
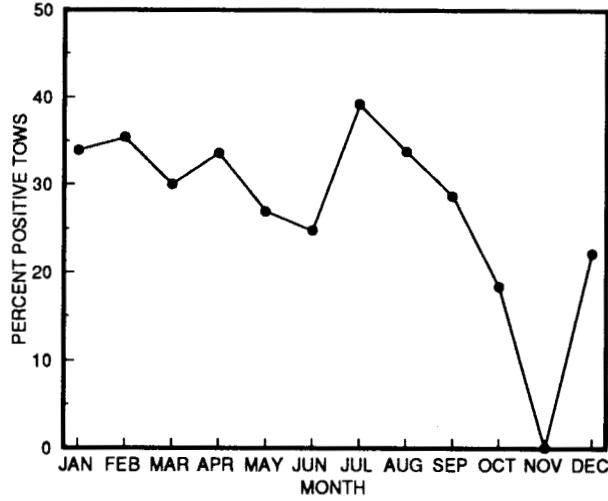
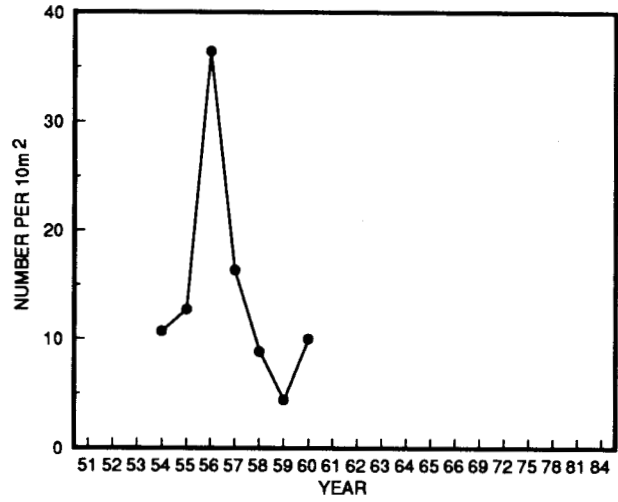
Paralichthyidae



Gulf sanddab

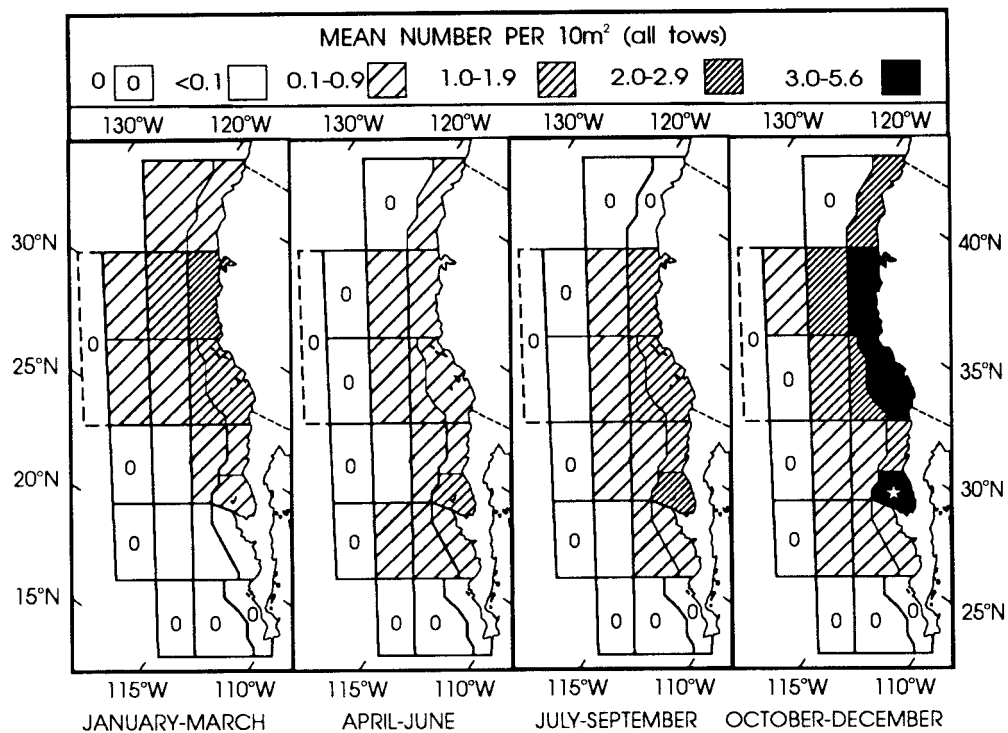
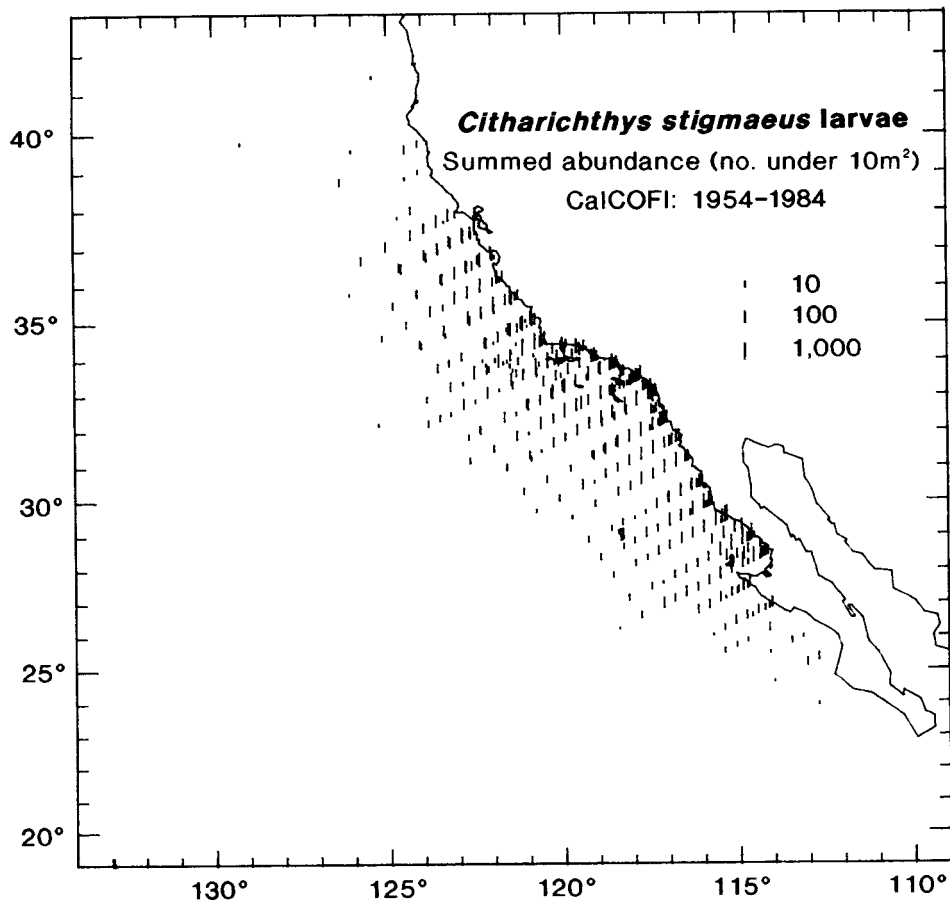


Citharichthys fragilis

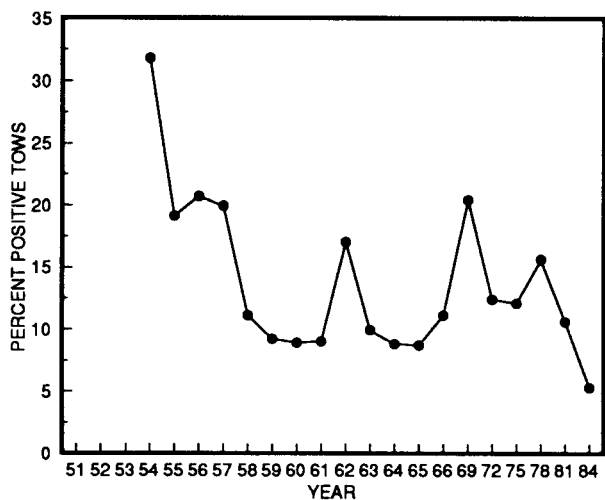
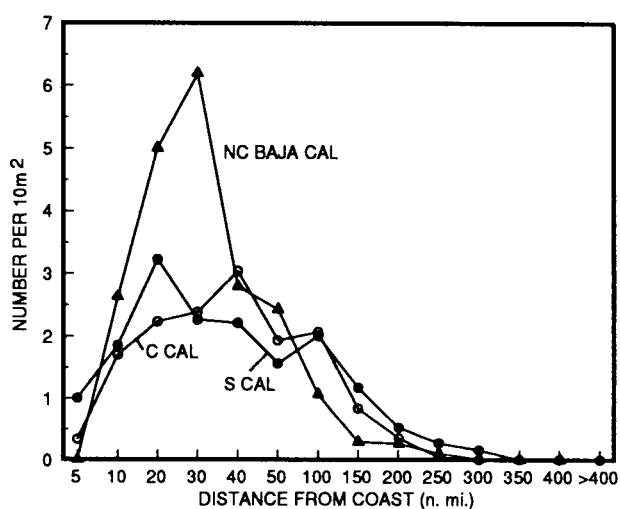
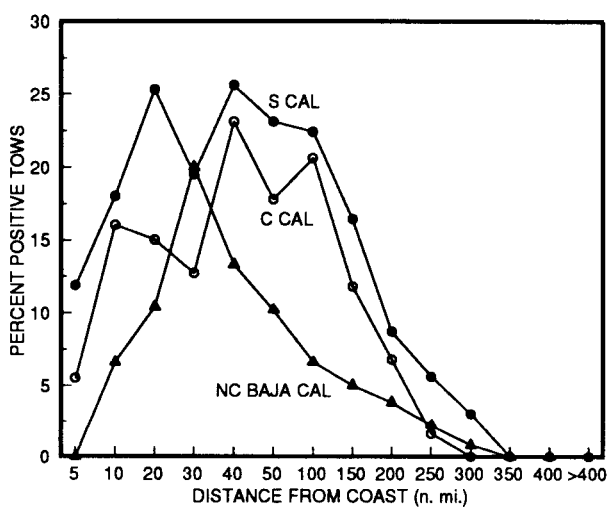
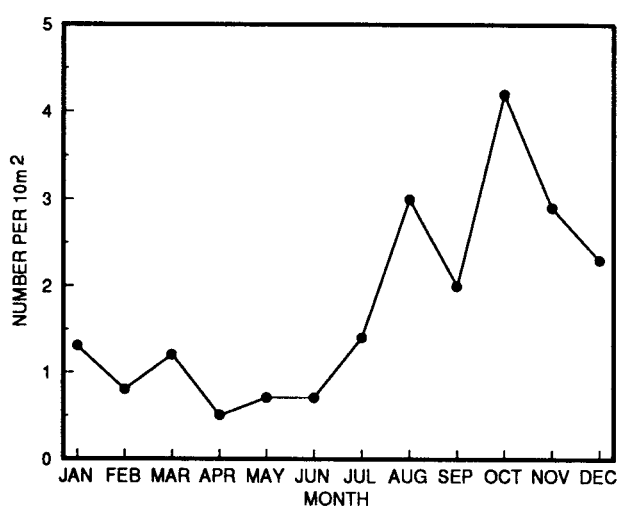
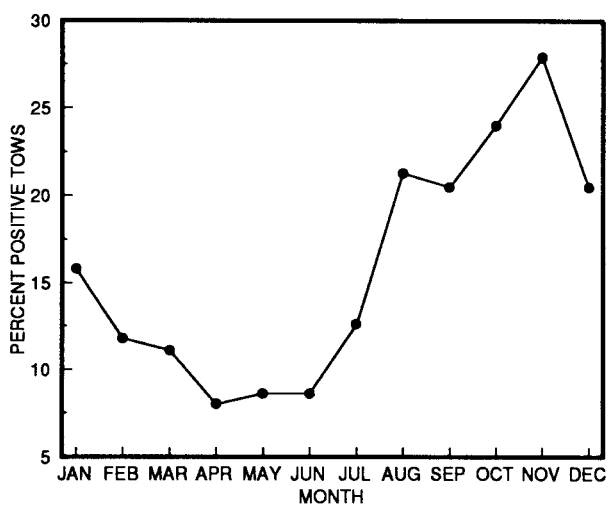
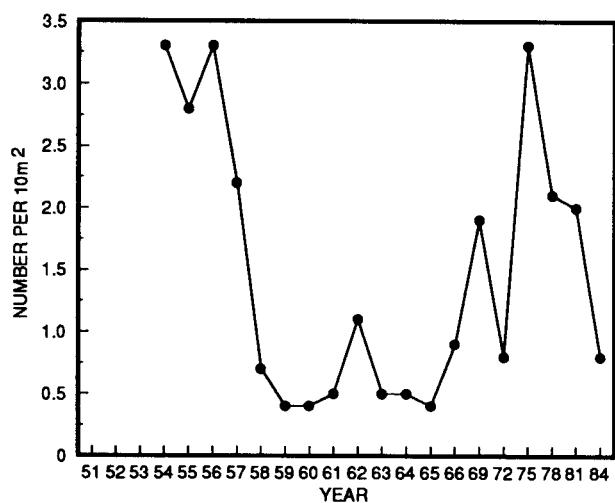


Citharichthys stigmaeus

Paralichthyidae

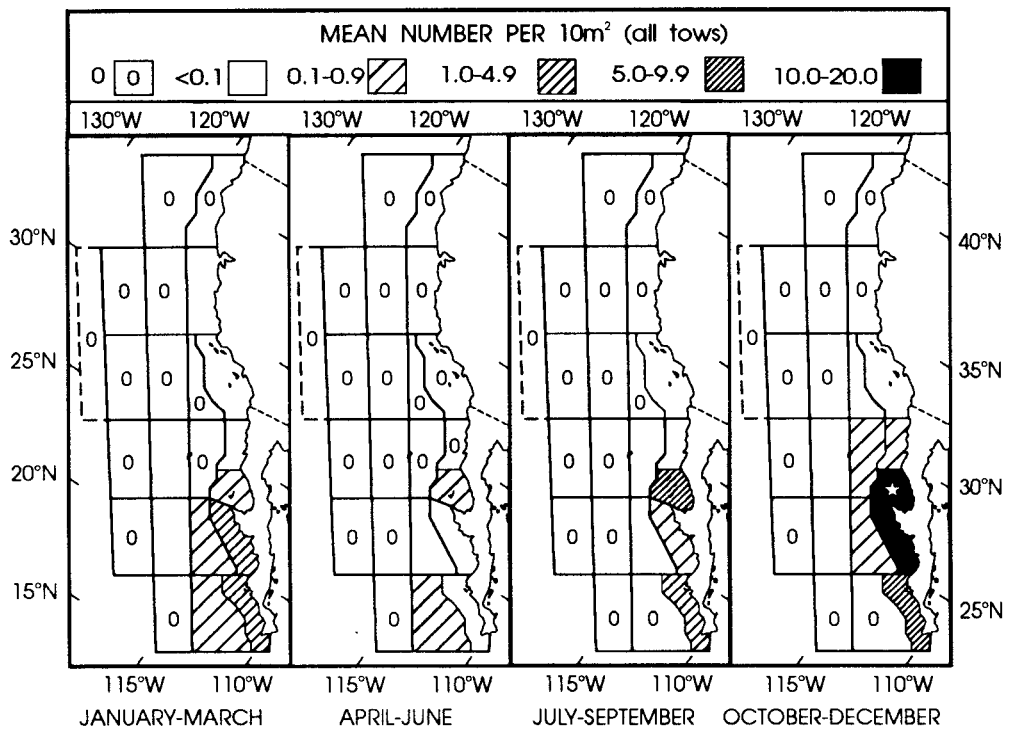
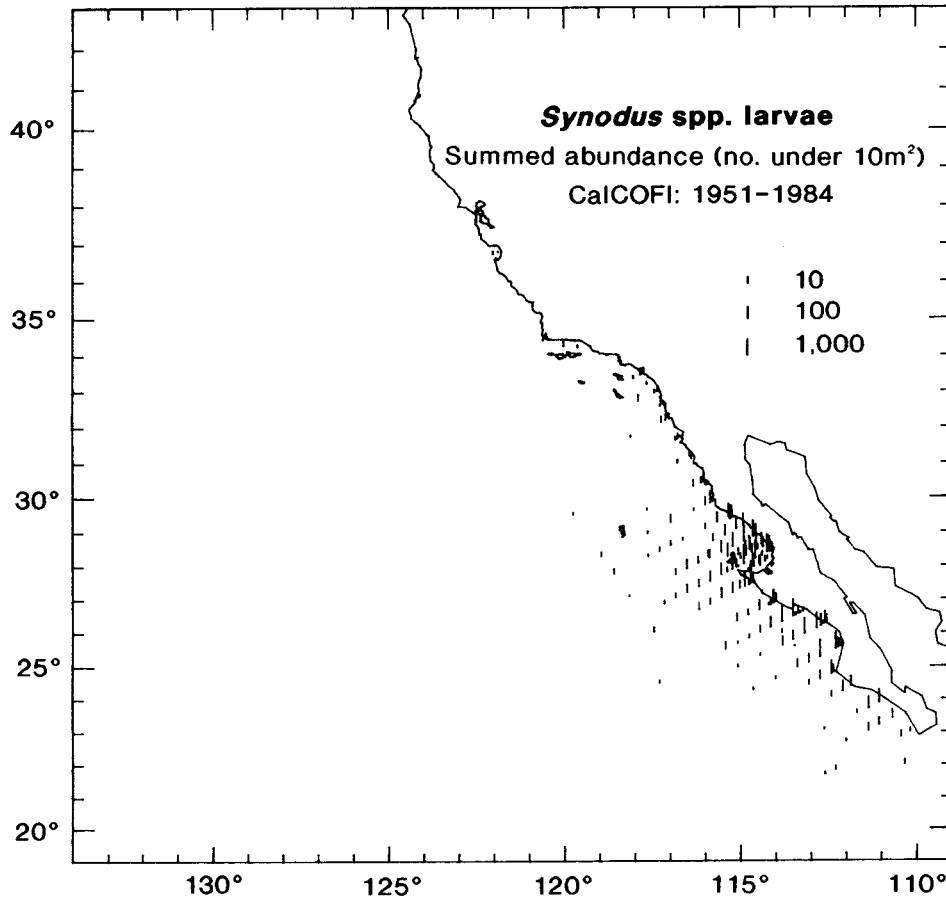


Speckled sanddab

*Citharichthys stigmaeus*

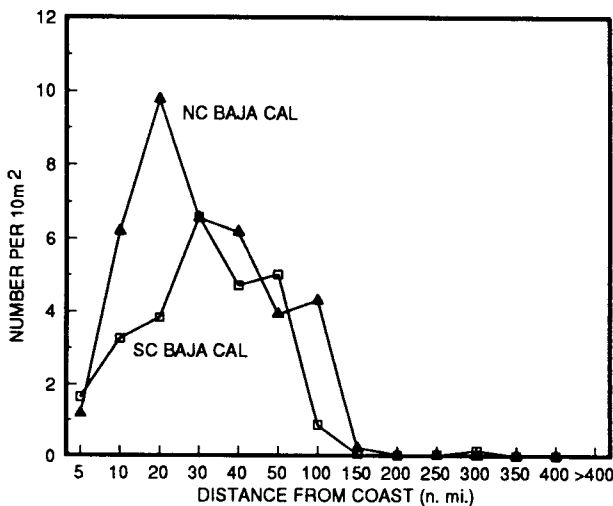
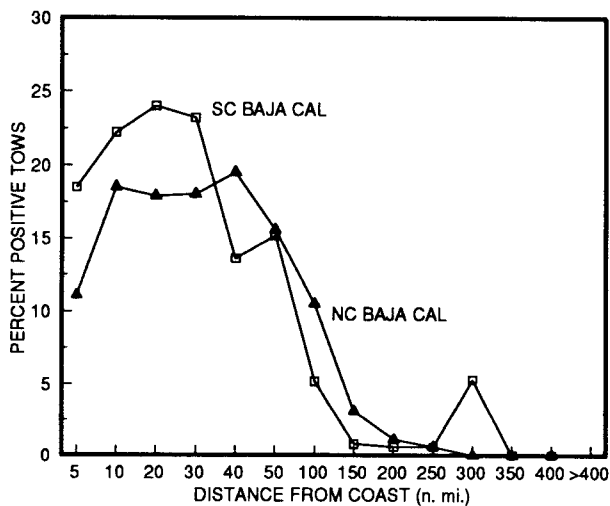
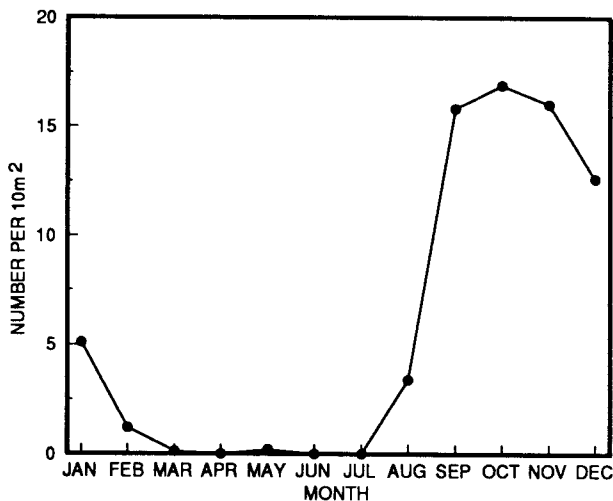
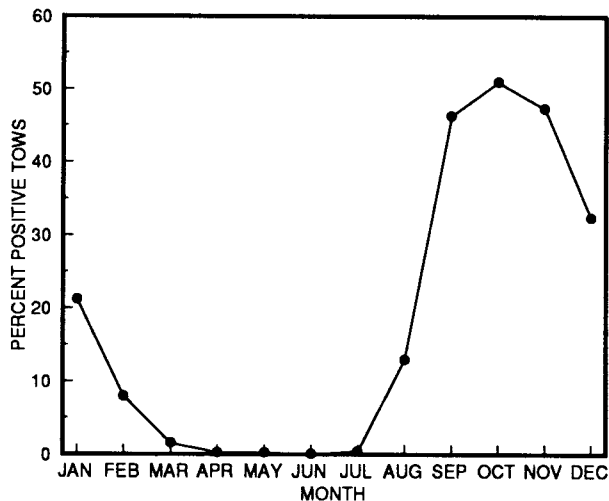
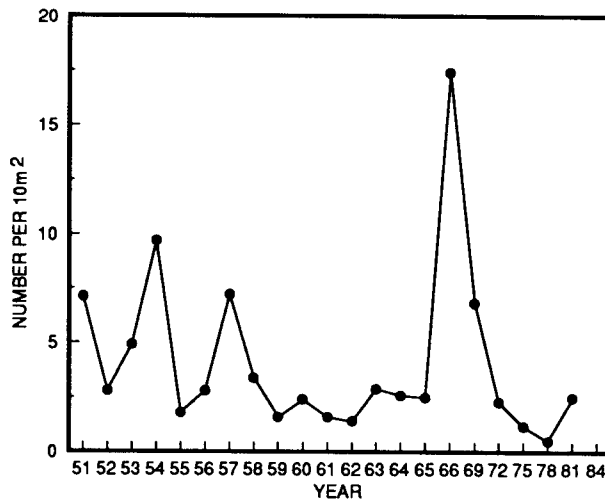
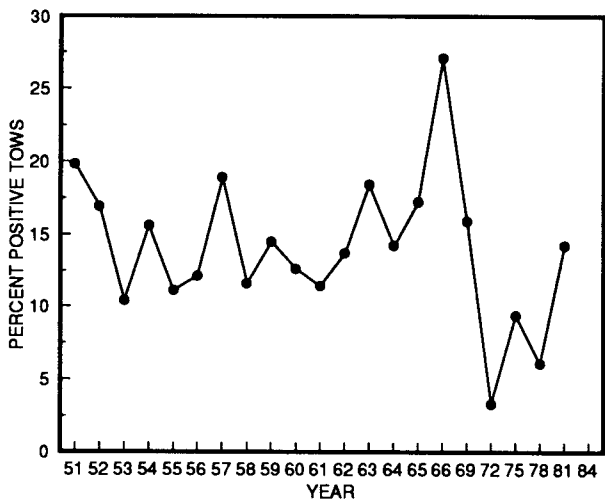
Synodus spp.

Synodontidae



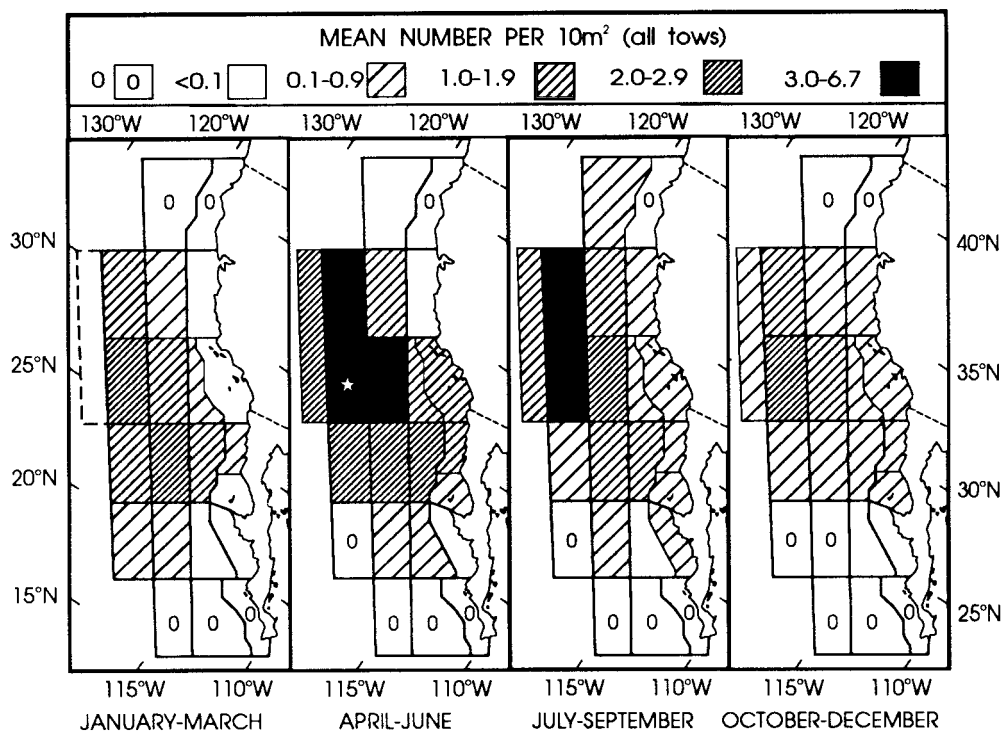
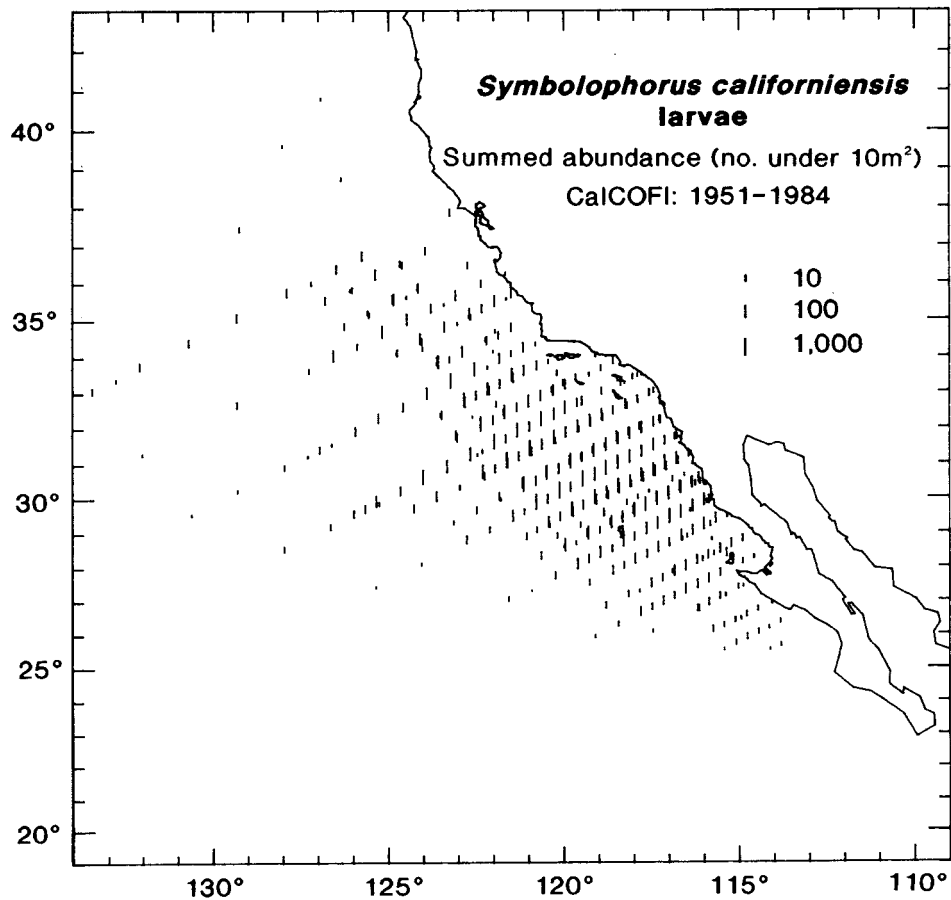
Lizardfishes

Synodus spp.

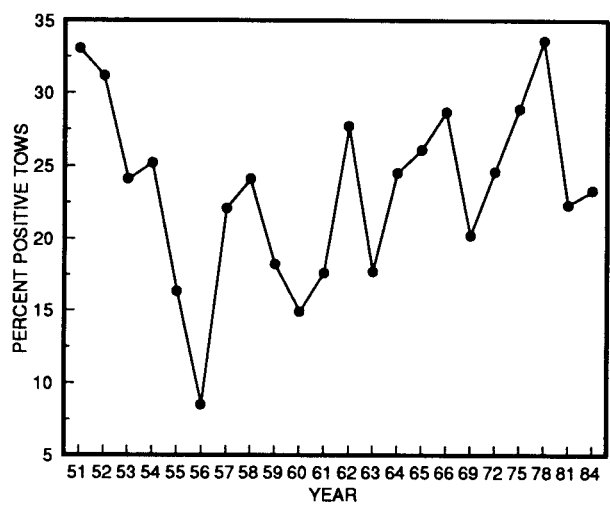


Symbolophorus californiensis

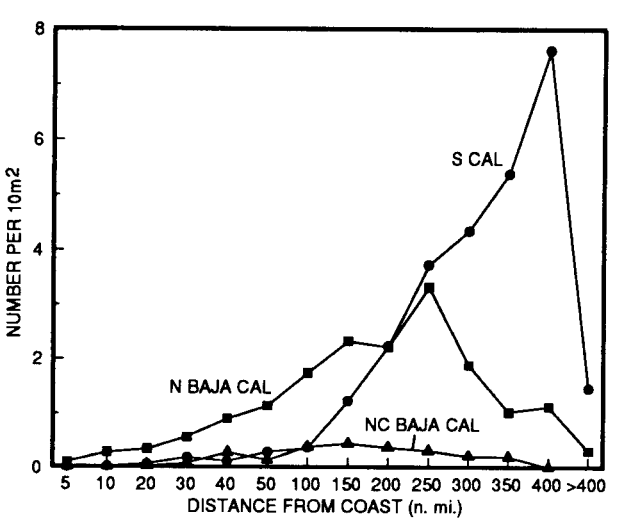
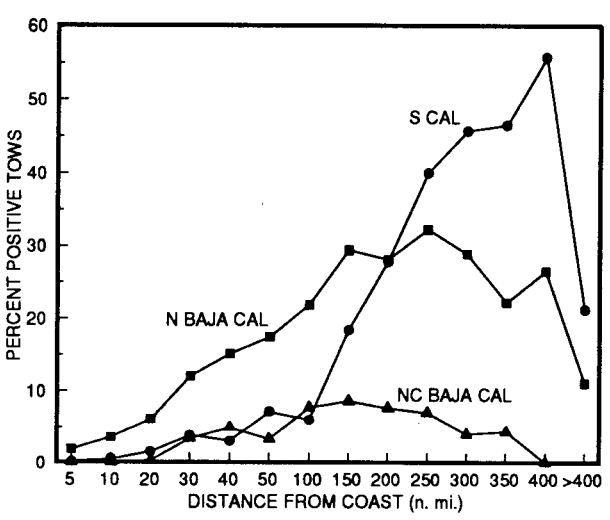
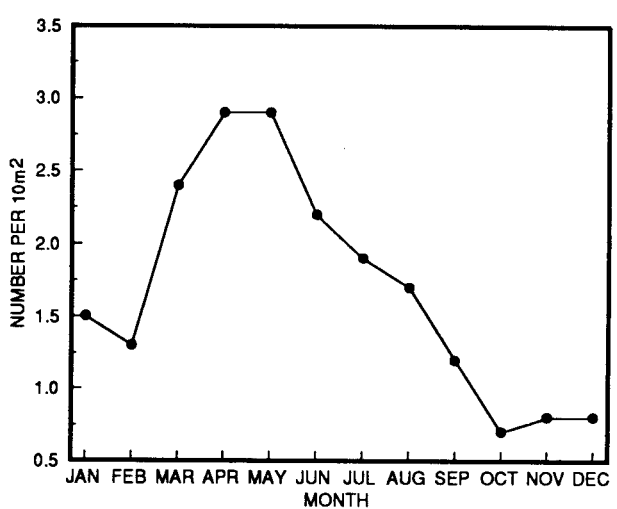
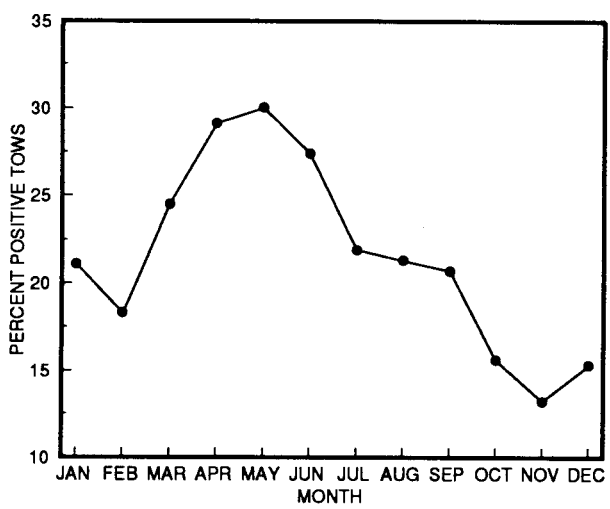
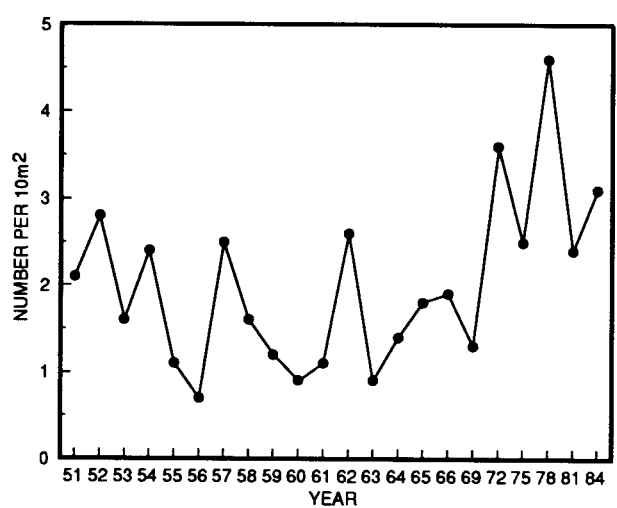
Myctophidae



California lanternfish

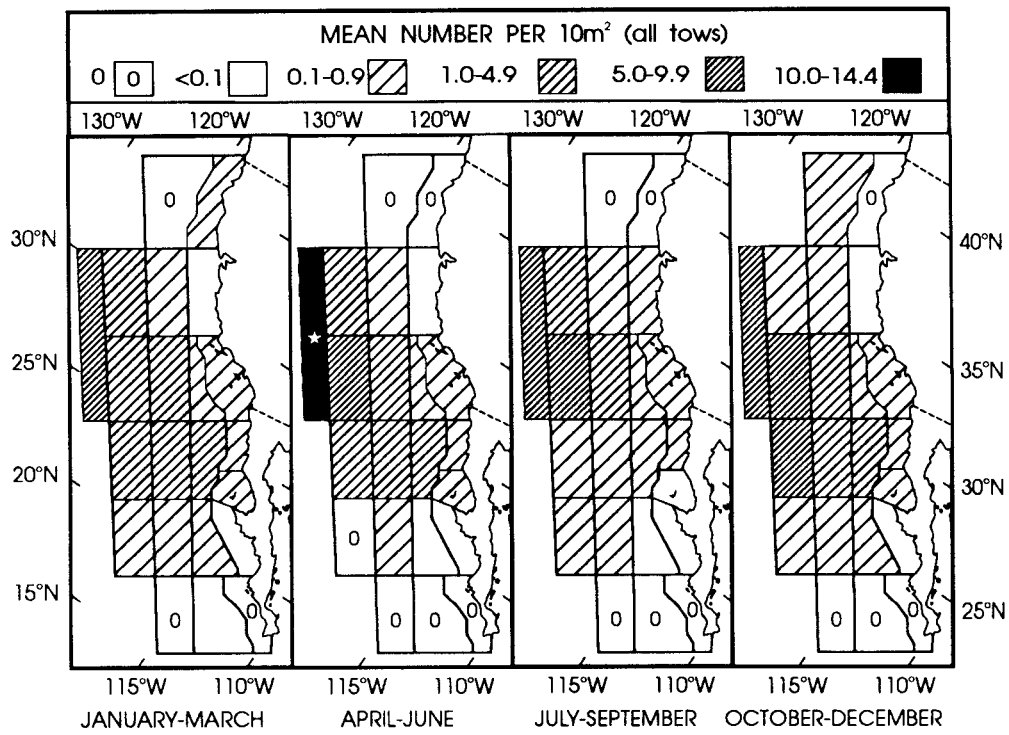
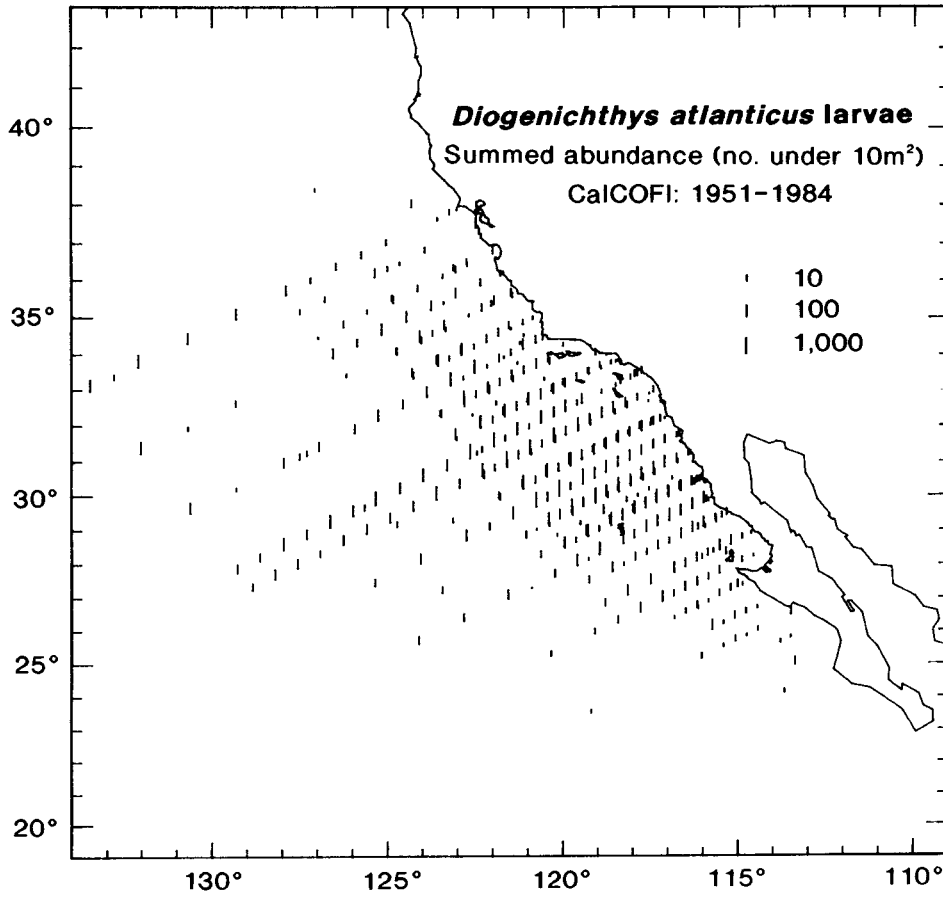


Symbolophorus californiensis

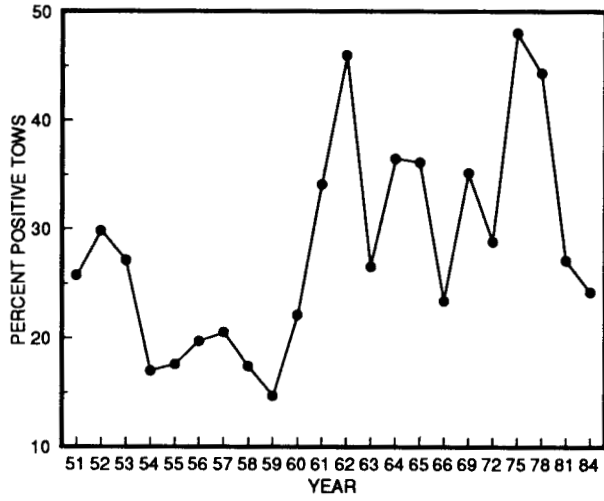


Diogenichthys atlanticus

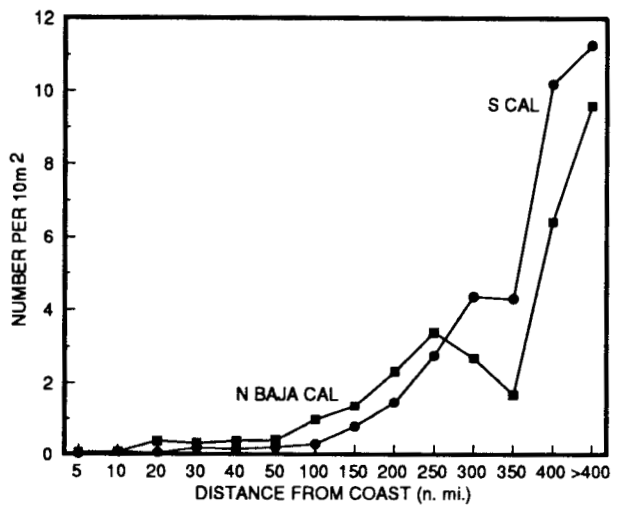
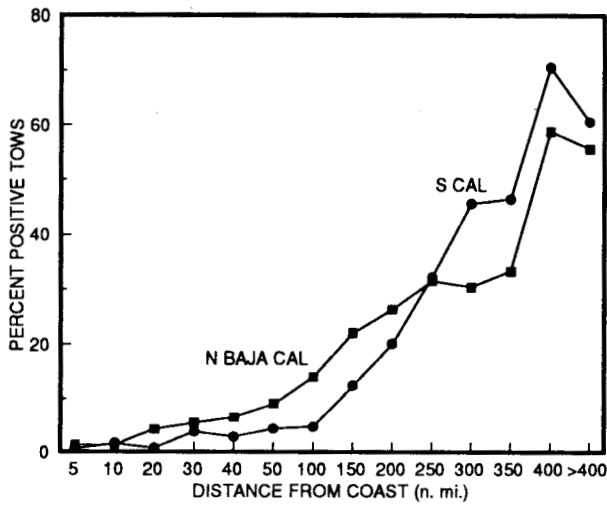
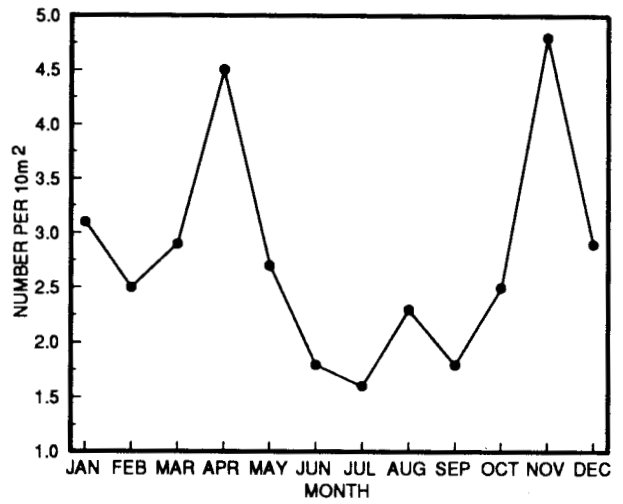
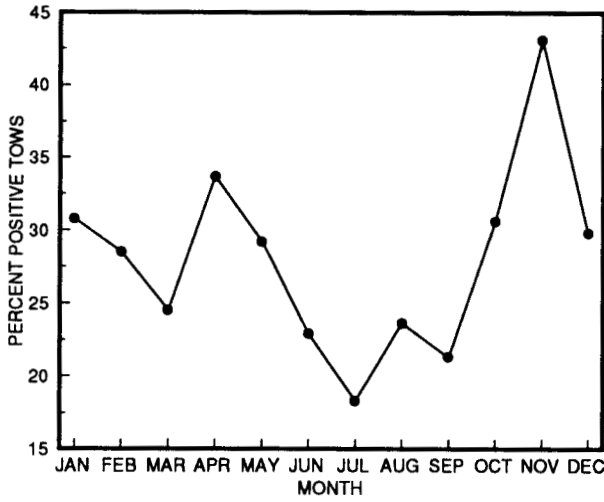
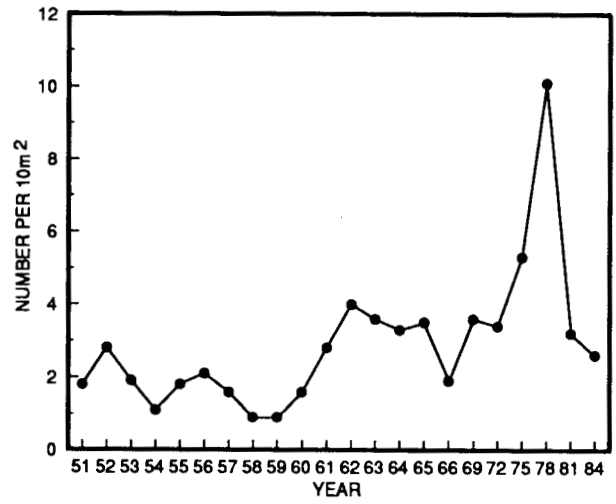
Myctophidae



Longfin lanternfish

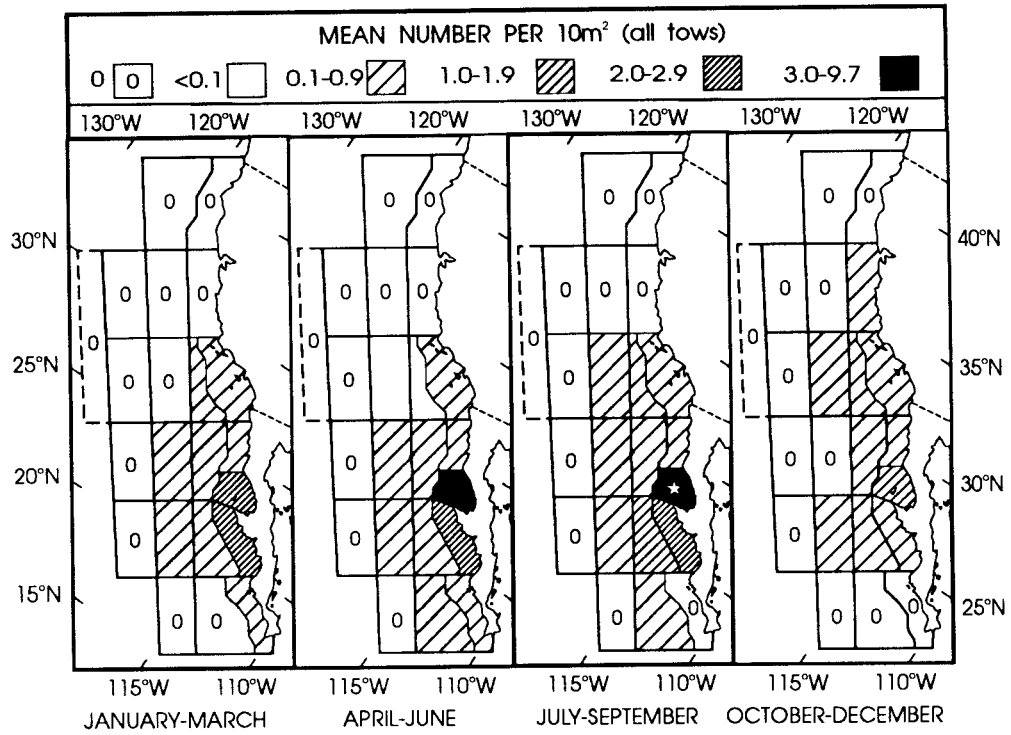
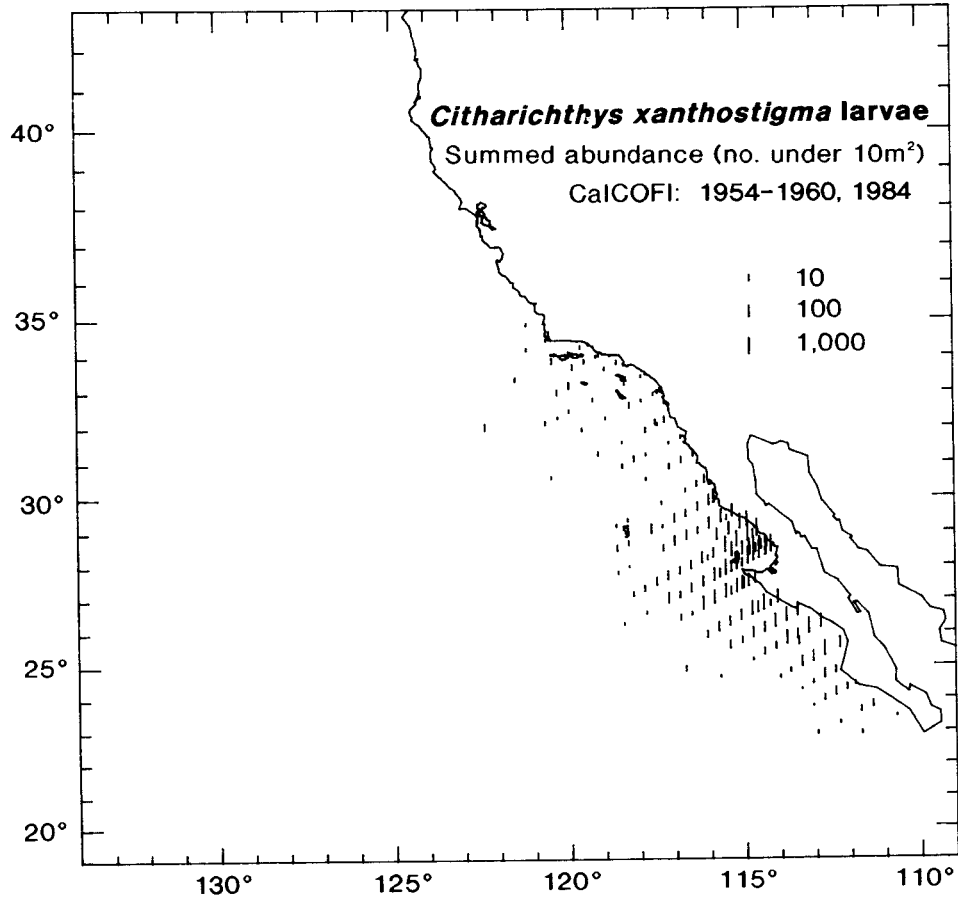


Diogenichthys atlanticus

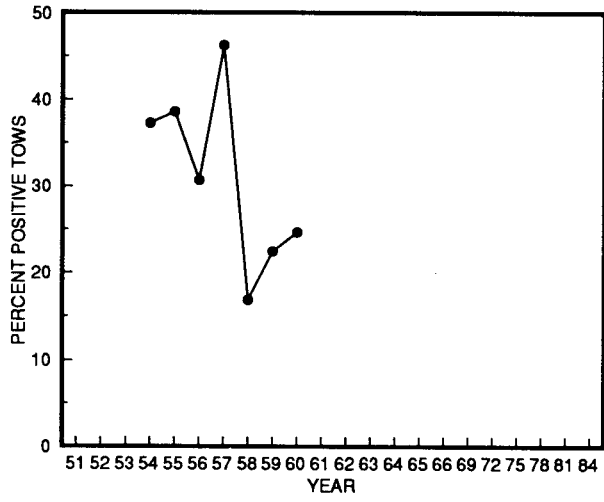


Citharichthys xanhostigma

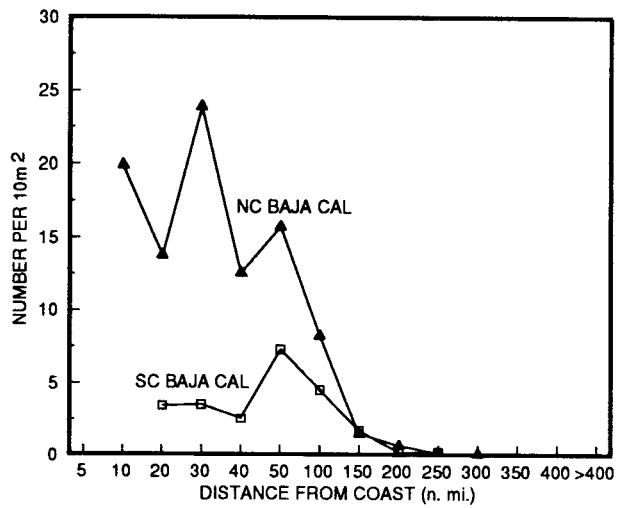
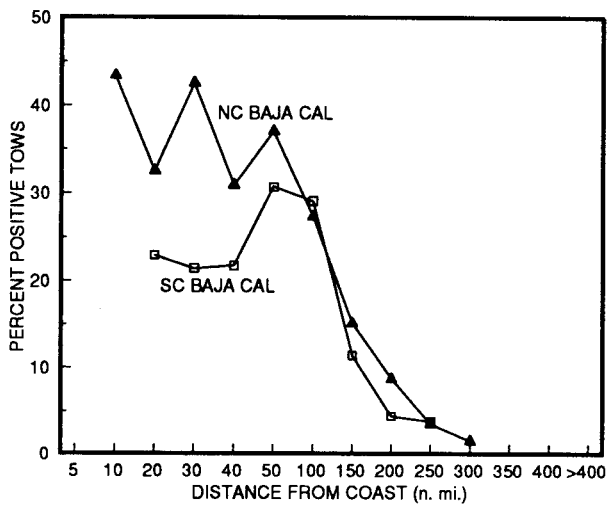
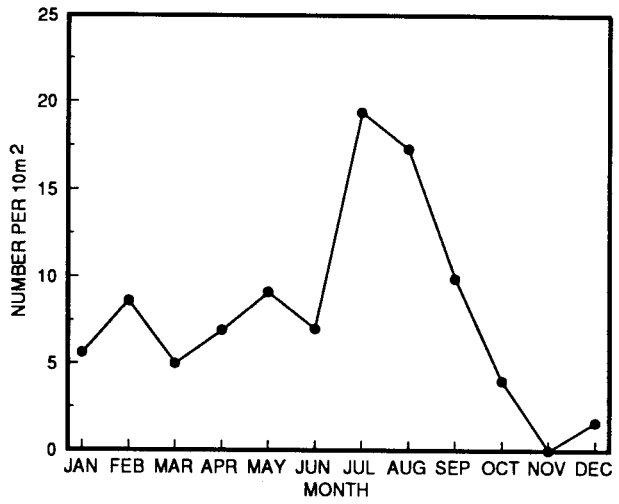
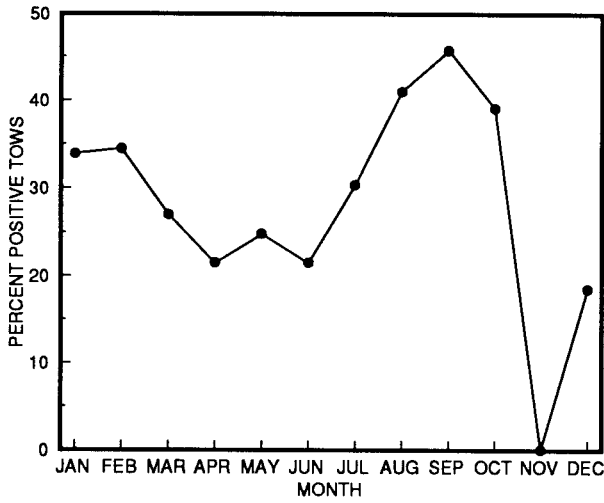
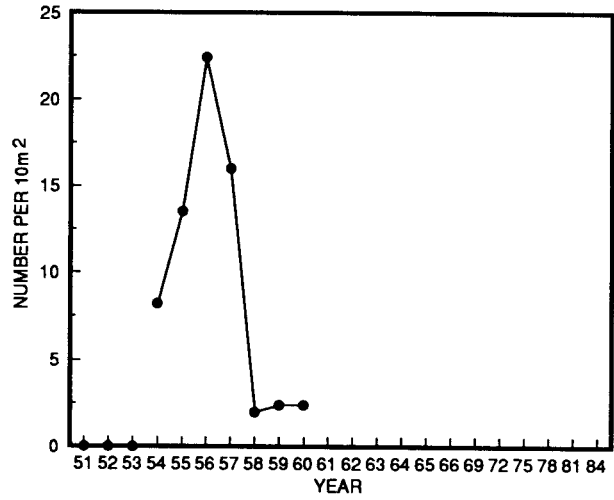
Paralichthyidae



Longfin sanddab

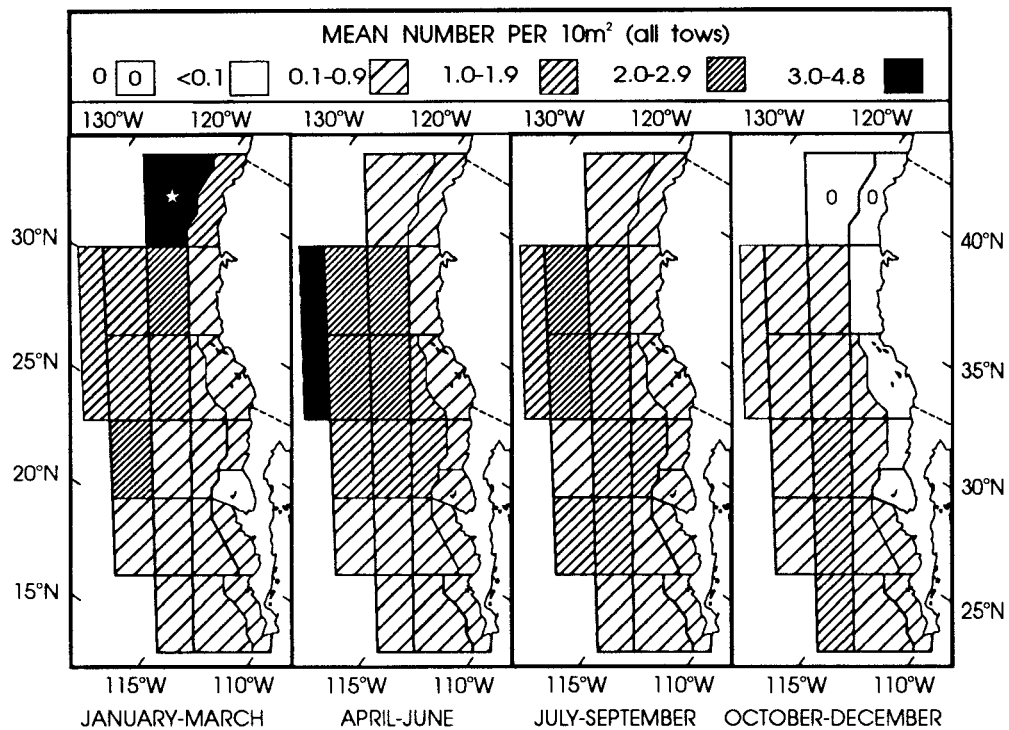
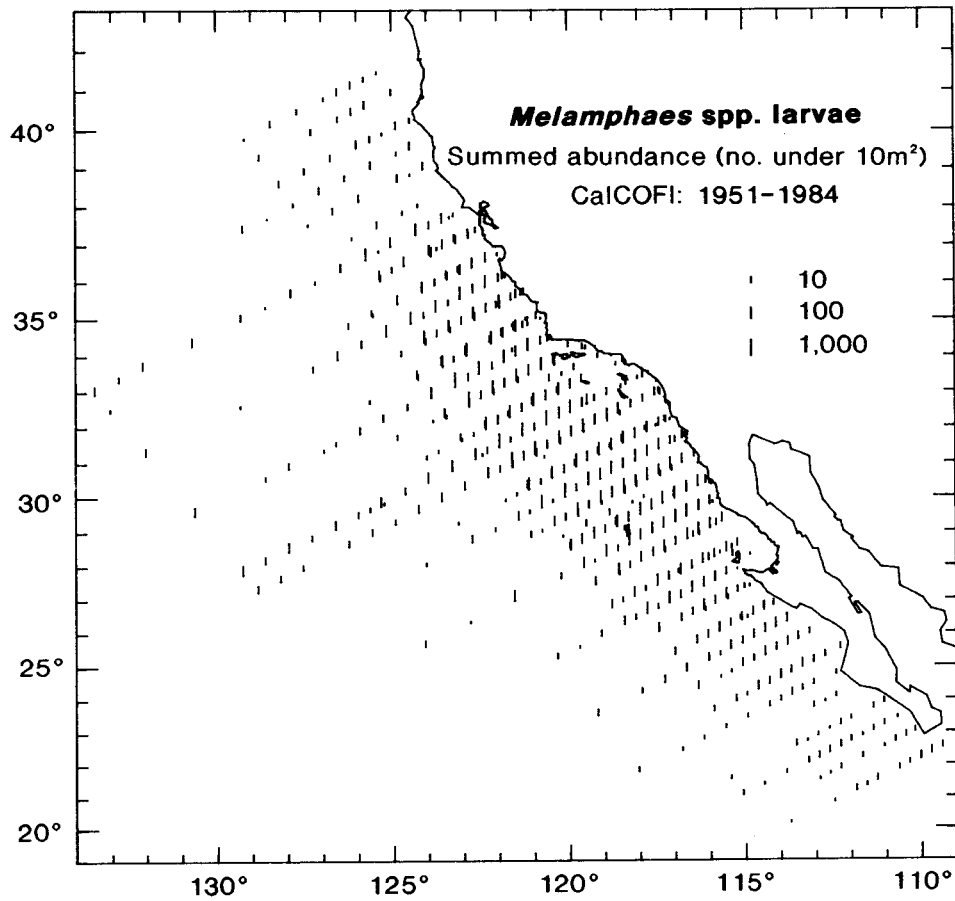


Citharichthys xanhostigma

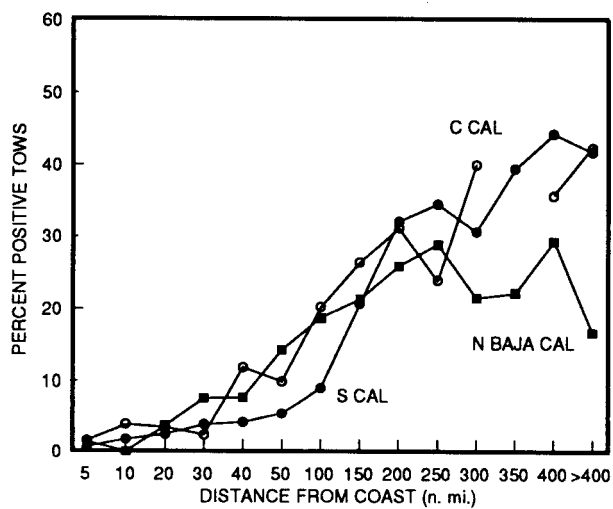
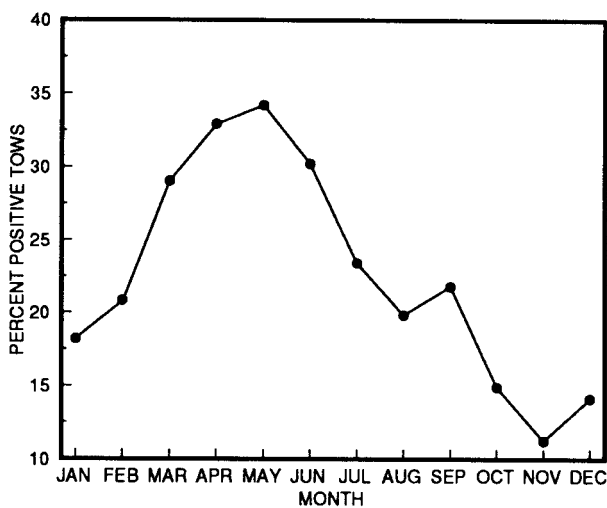
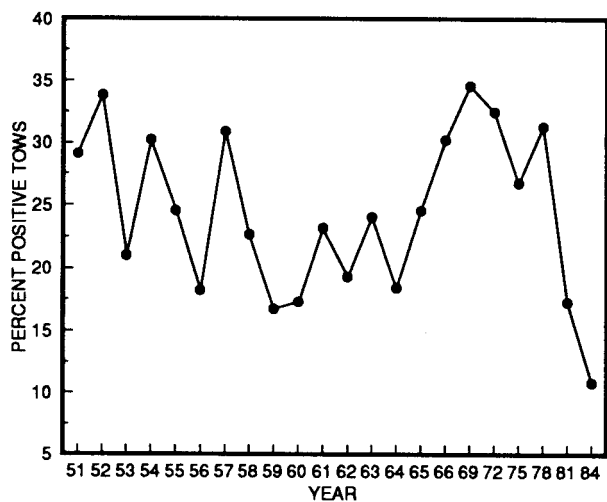
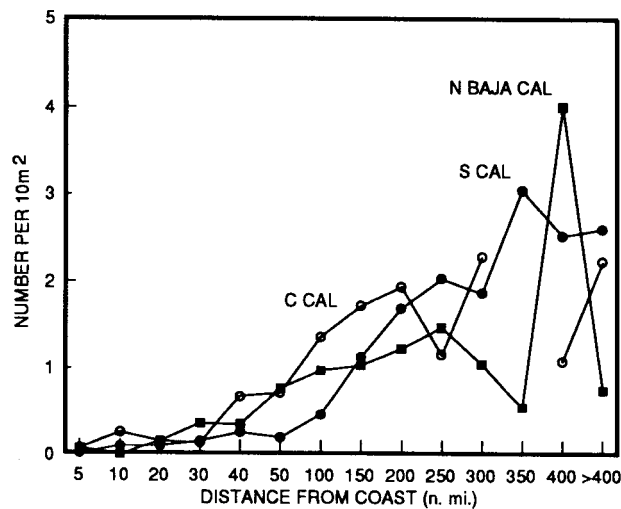
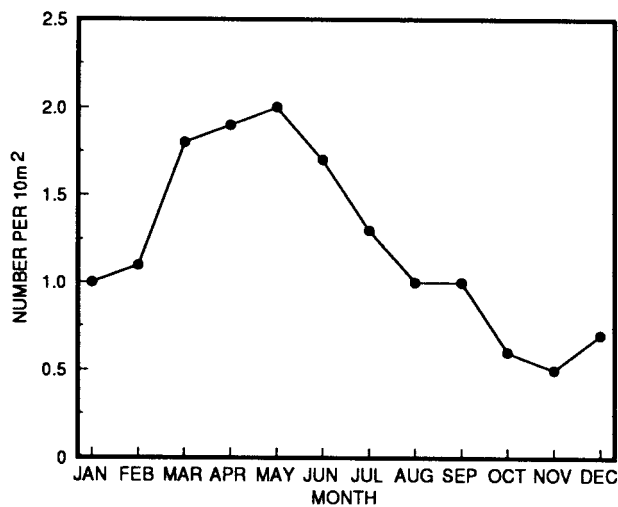
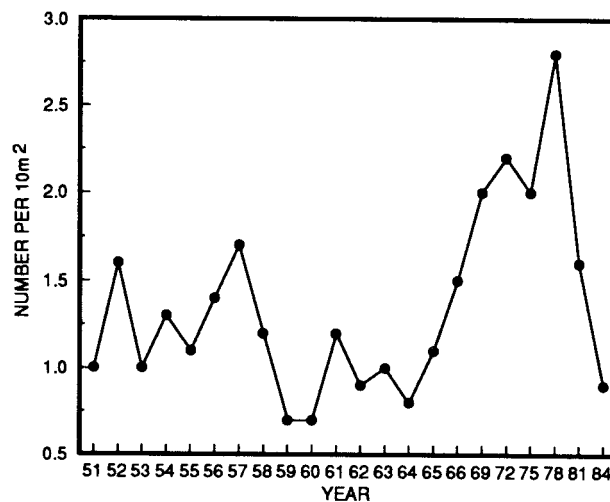


Melamphaes spp.

Melamphaidae

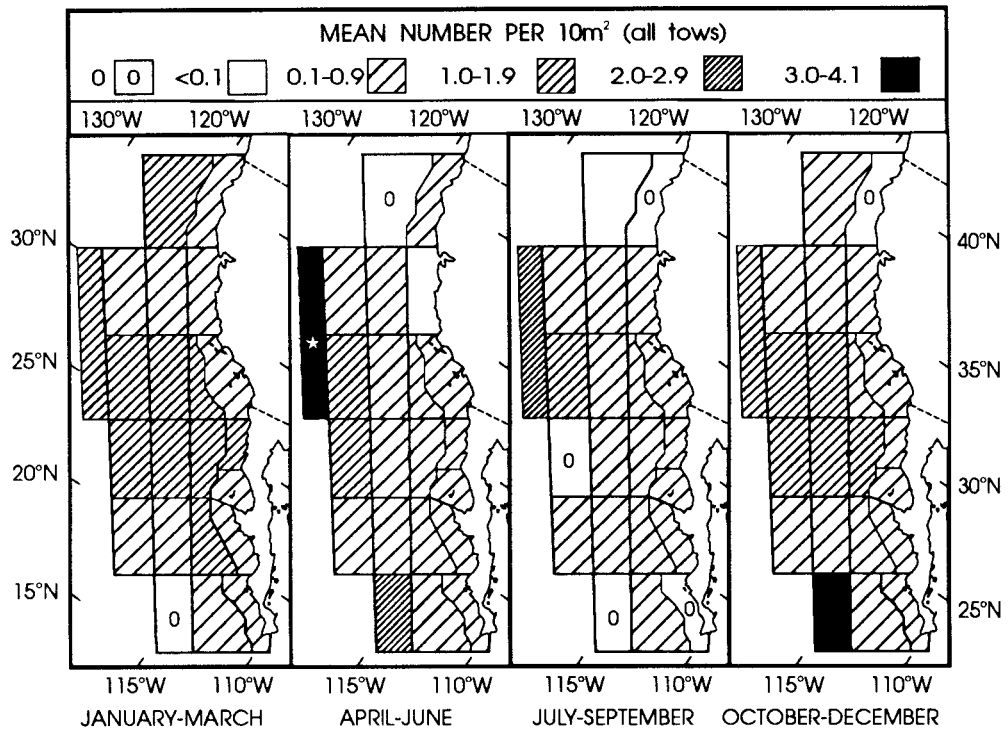
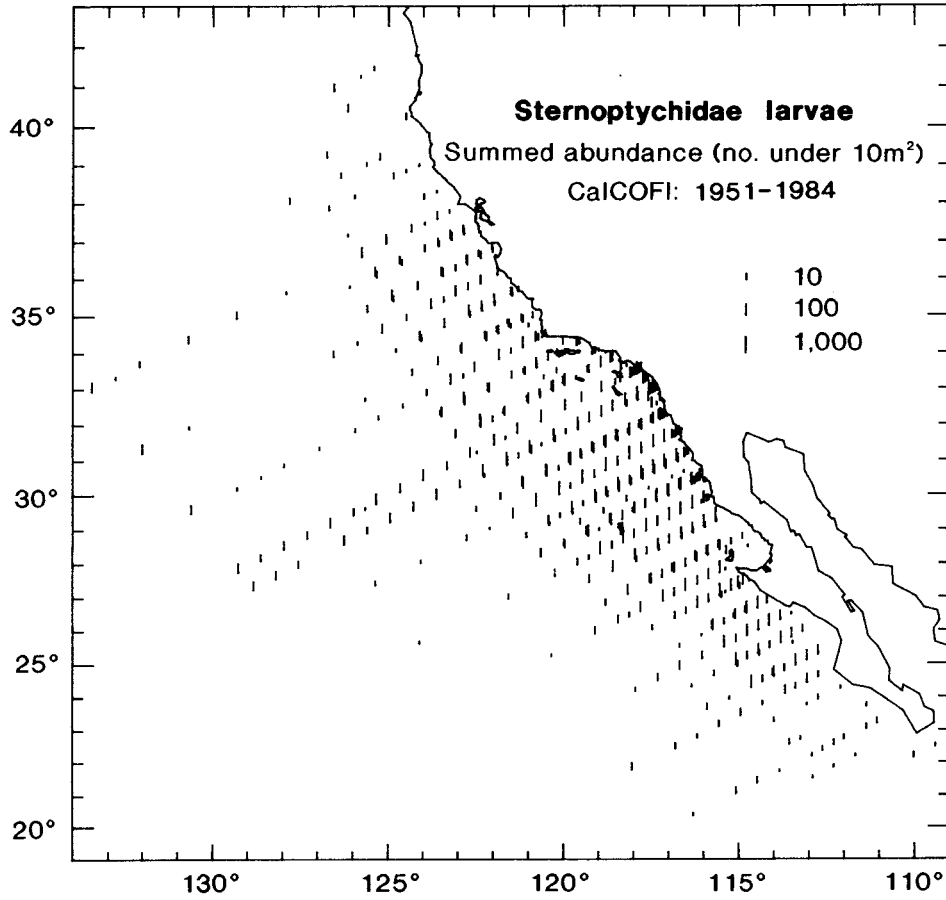


Bigscapes

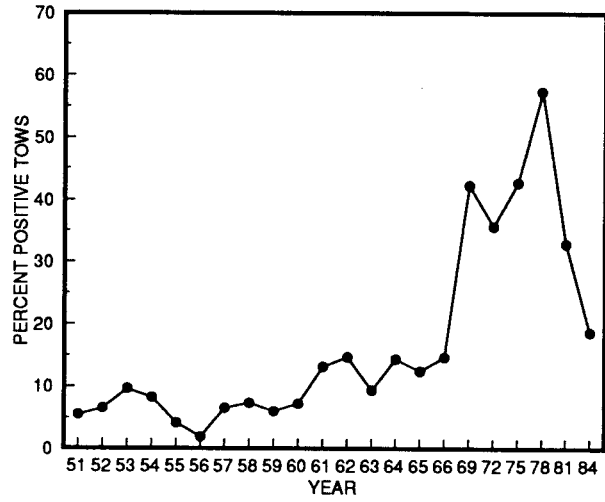
*Melamphaes* spp.

Sternoptychidae

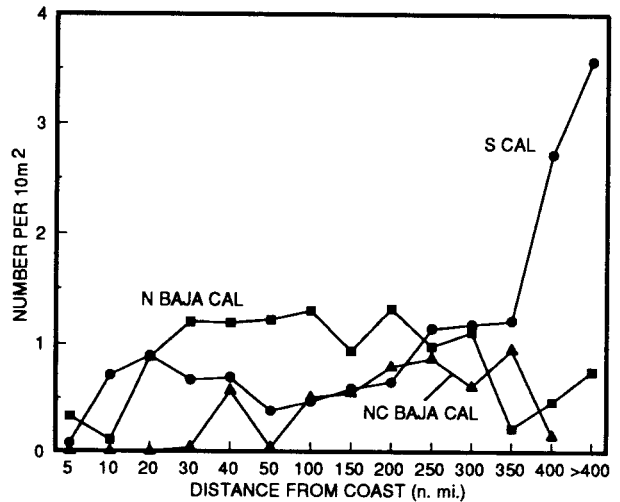
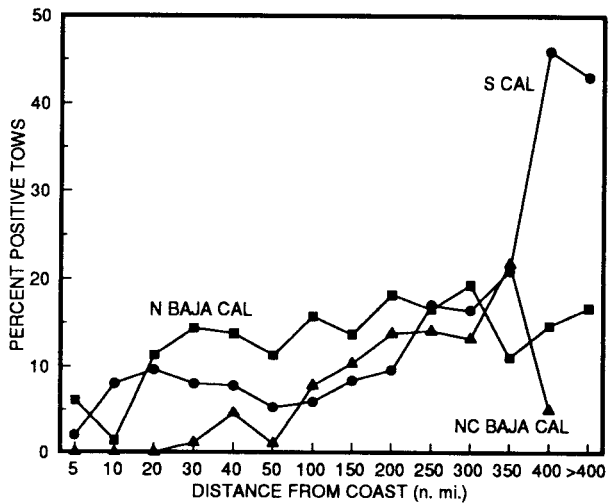
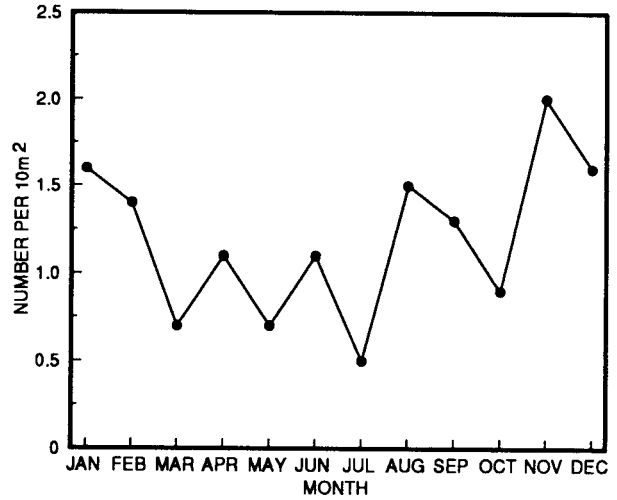
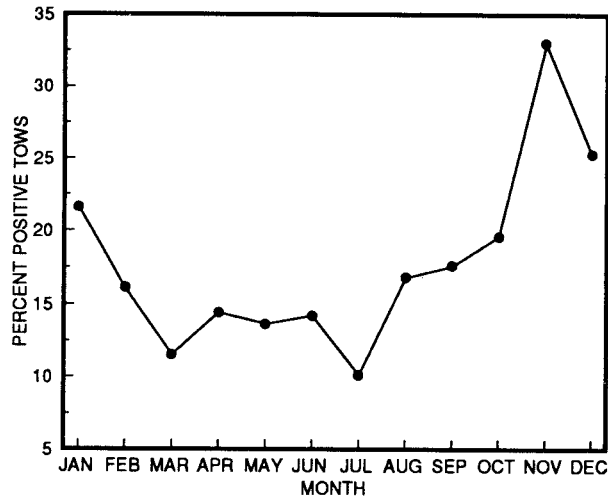
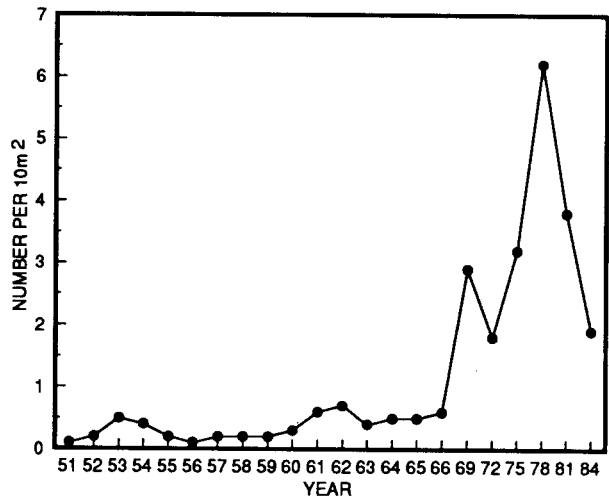
Sternoptychidae



Hatchetfishes

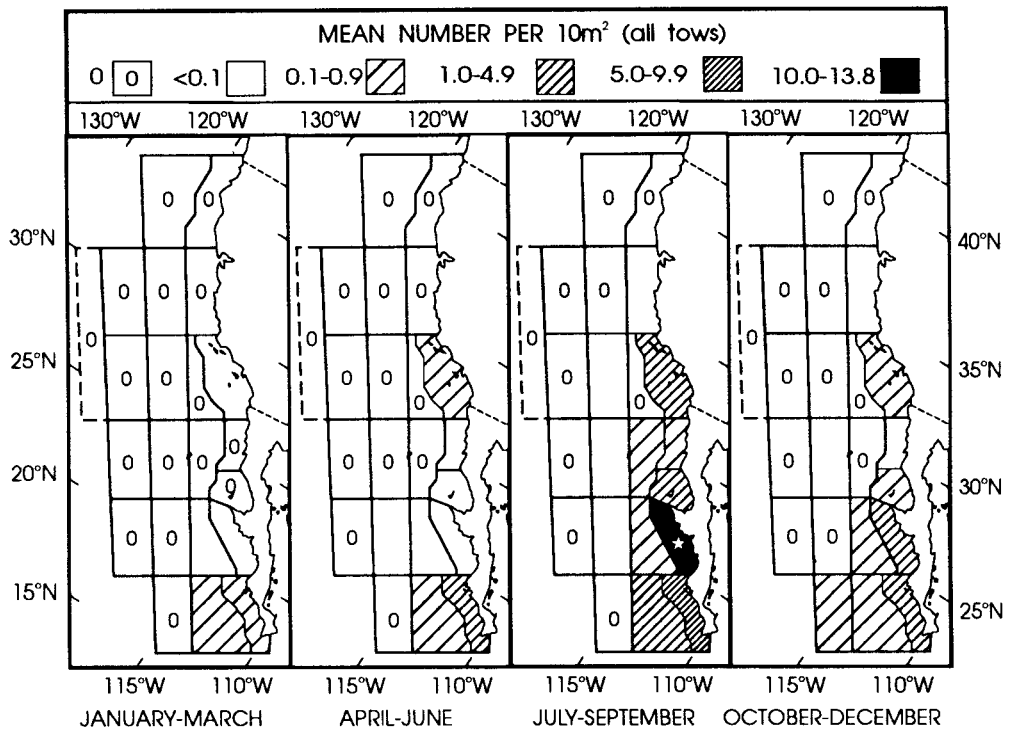
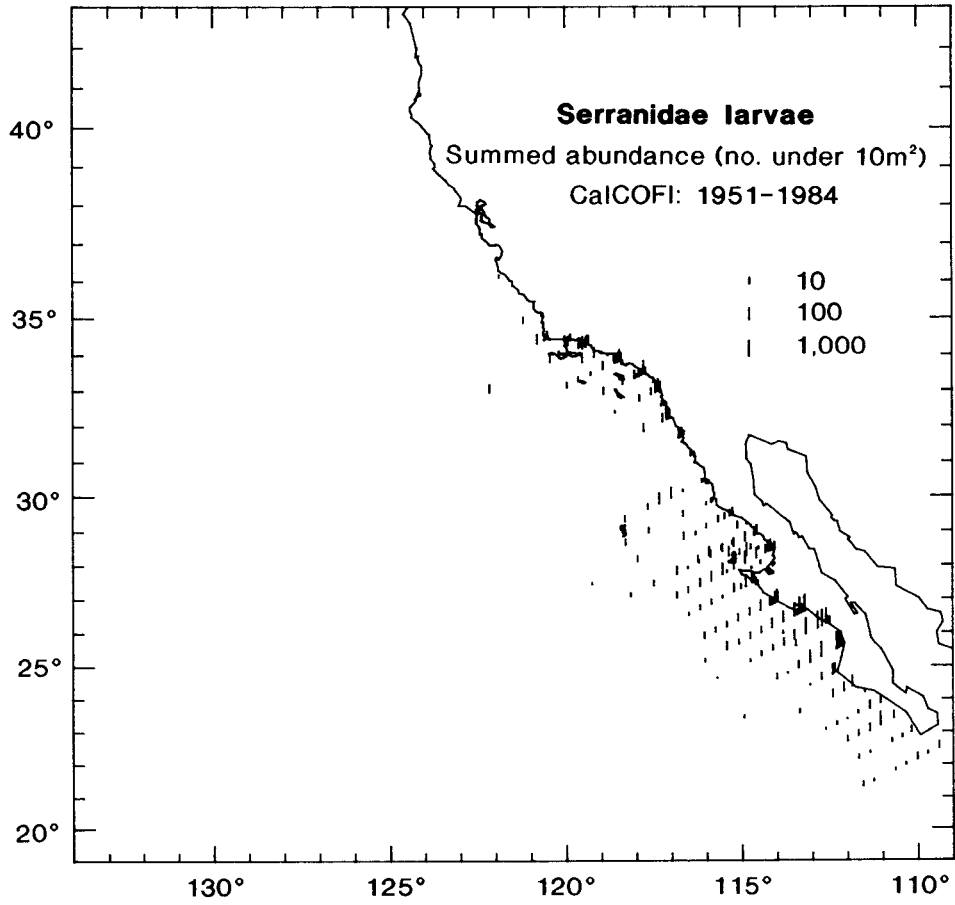


Sternoptychidae

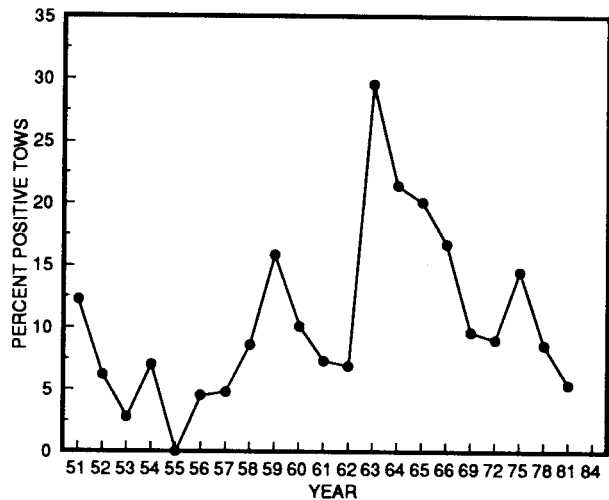


Serranidae

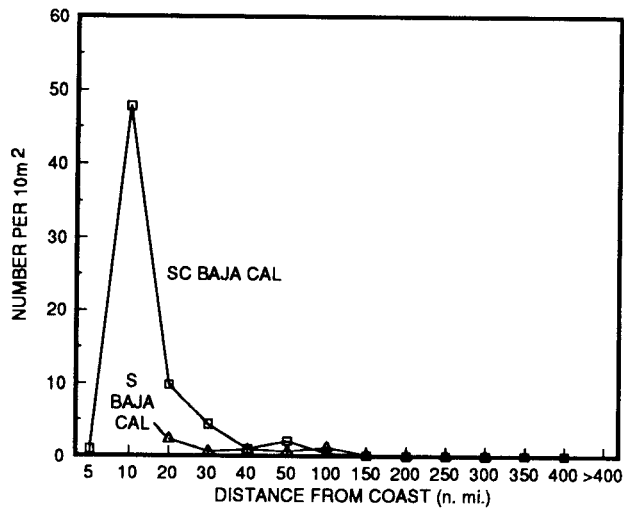
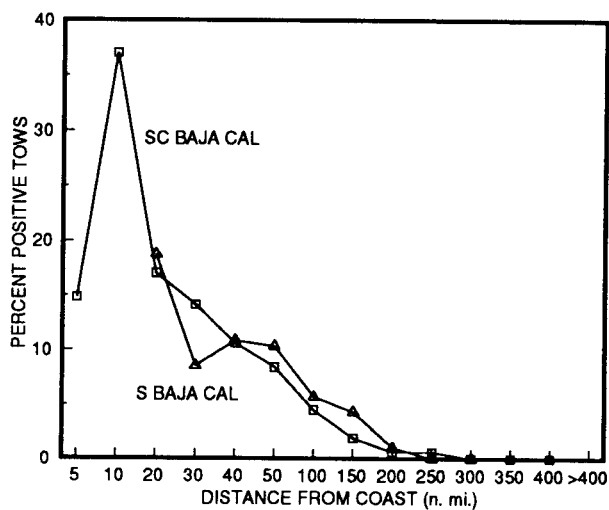
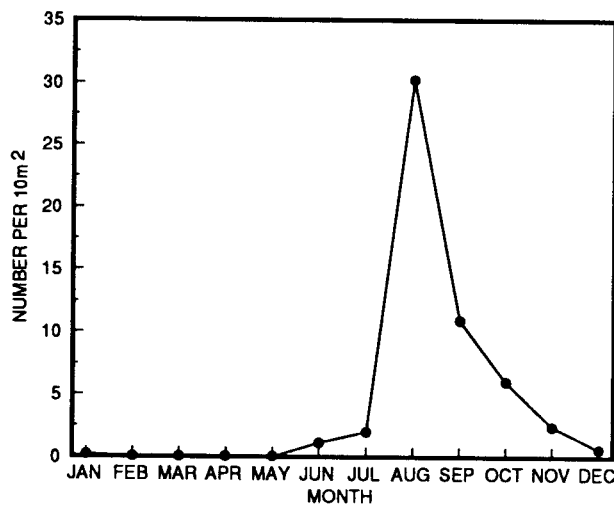
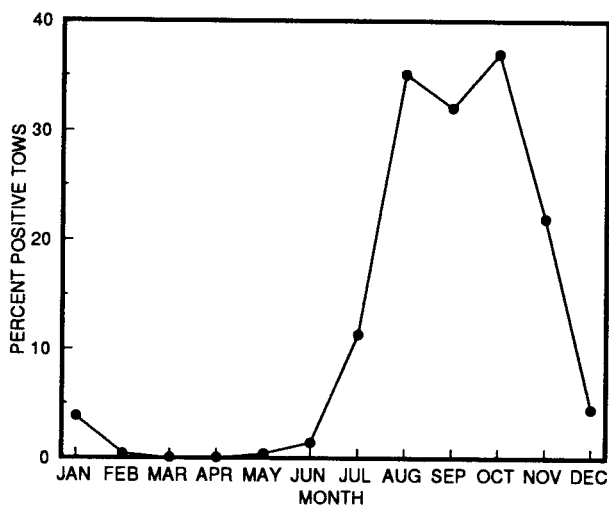
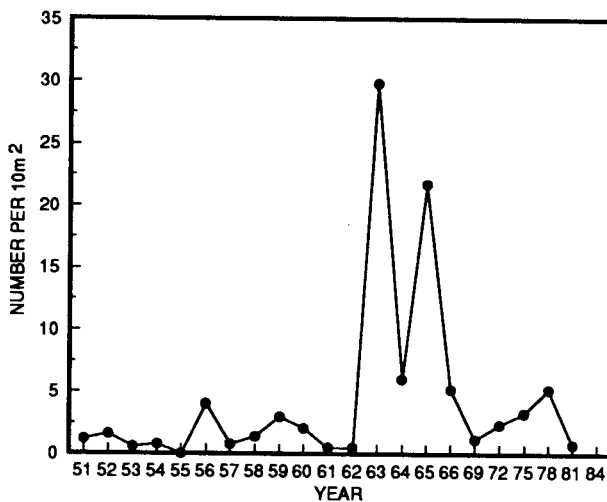
Serranidae



Sea basses

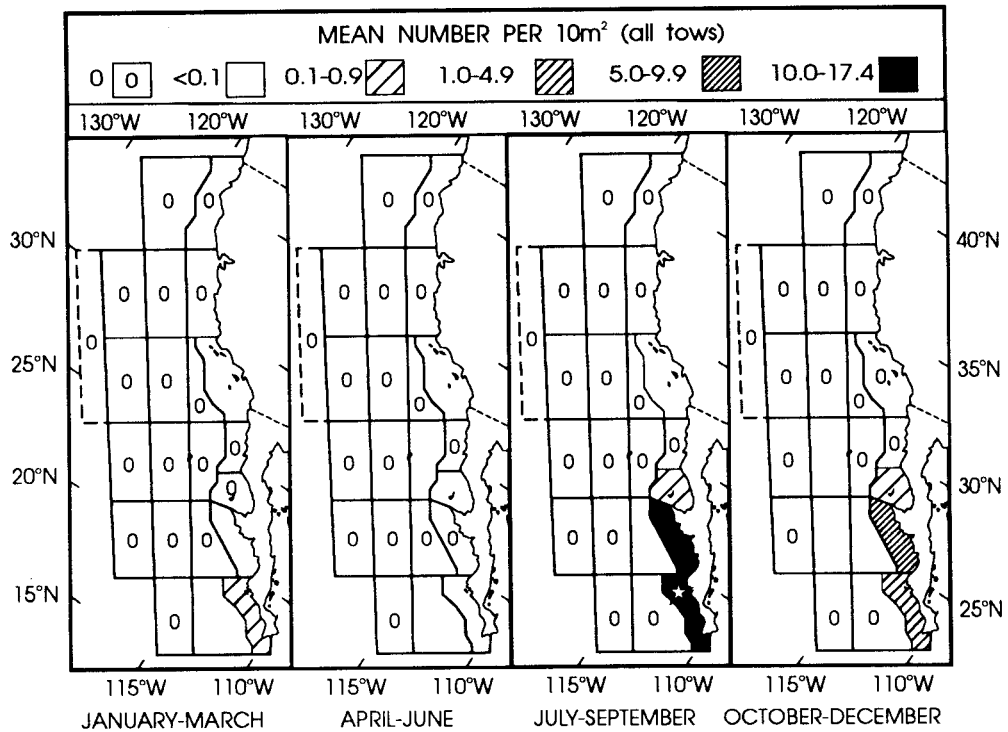
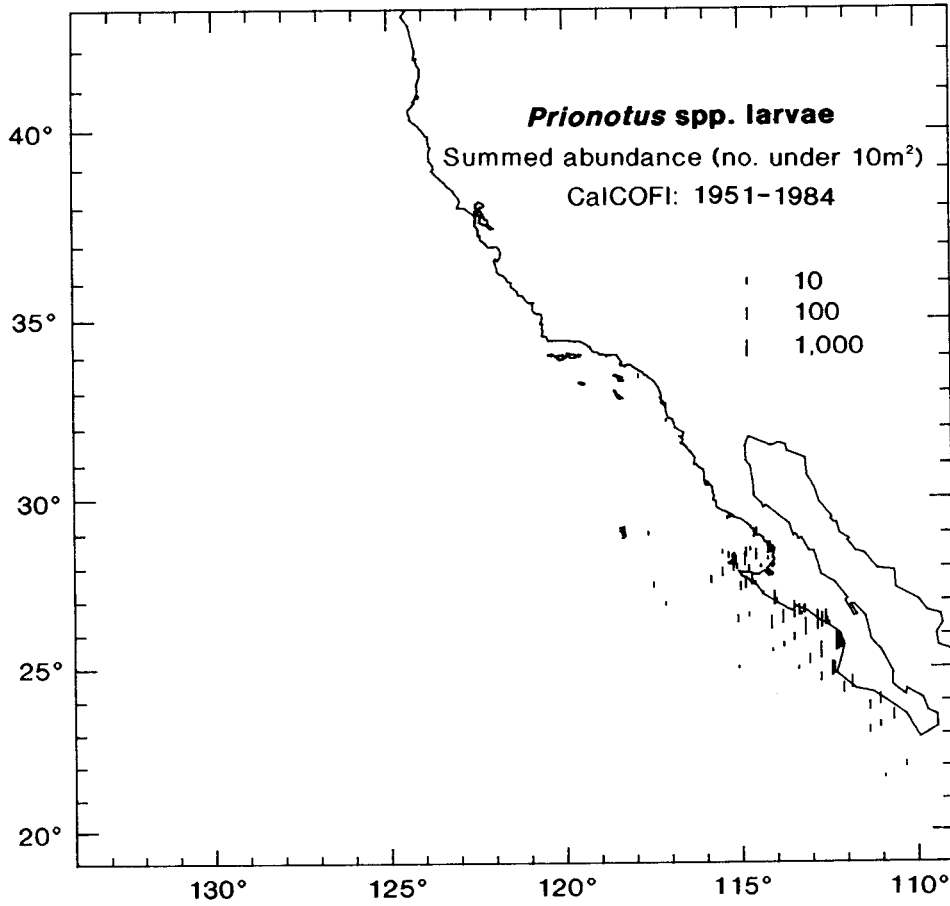


Serranidae



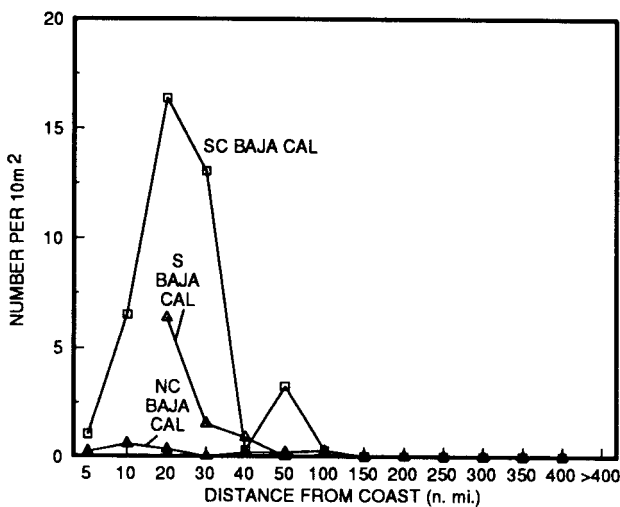
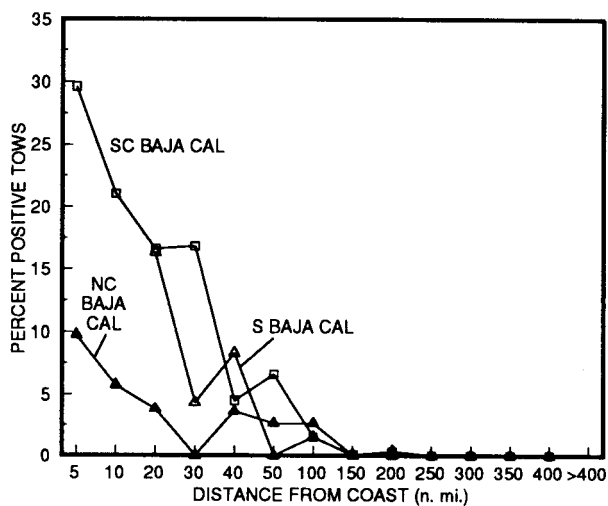
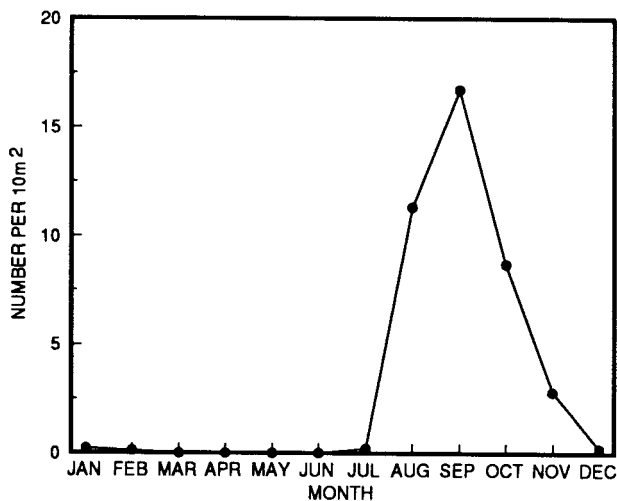
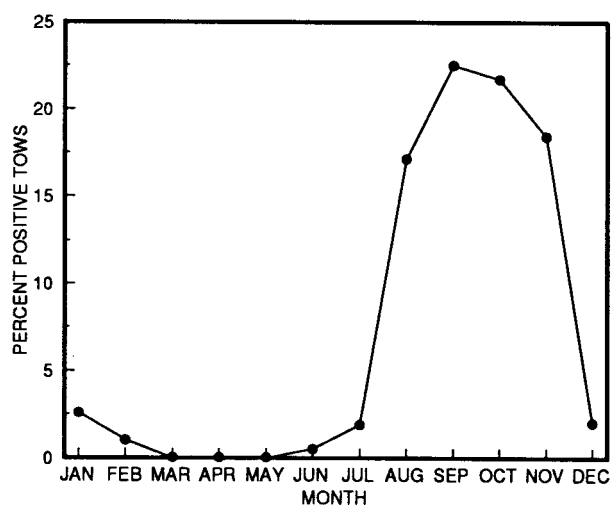
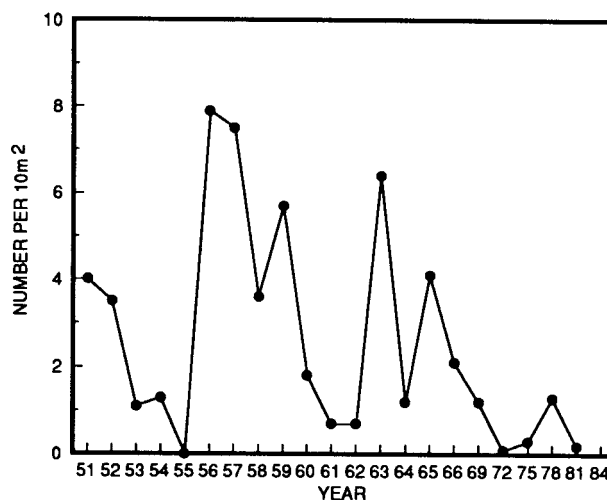
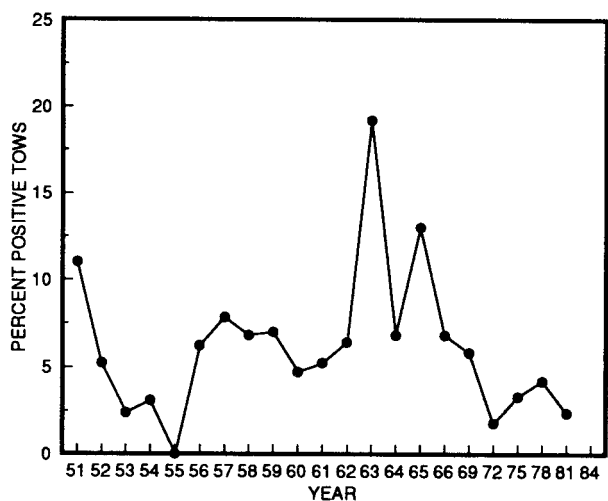
Prionotus spp.

Triglidae



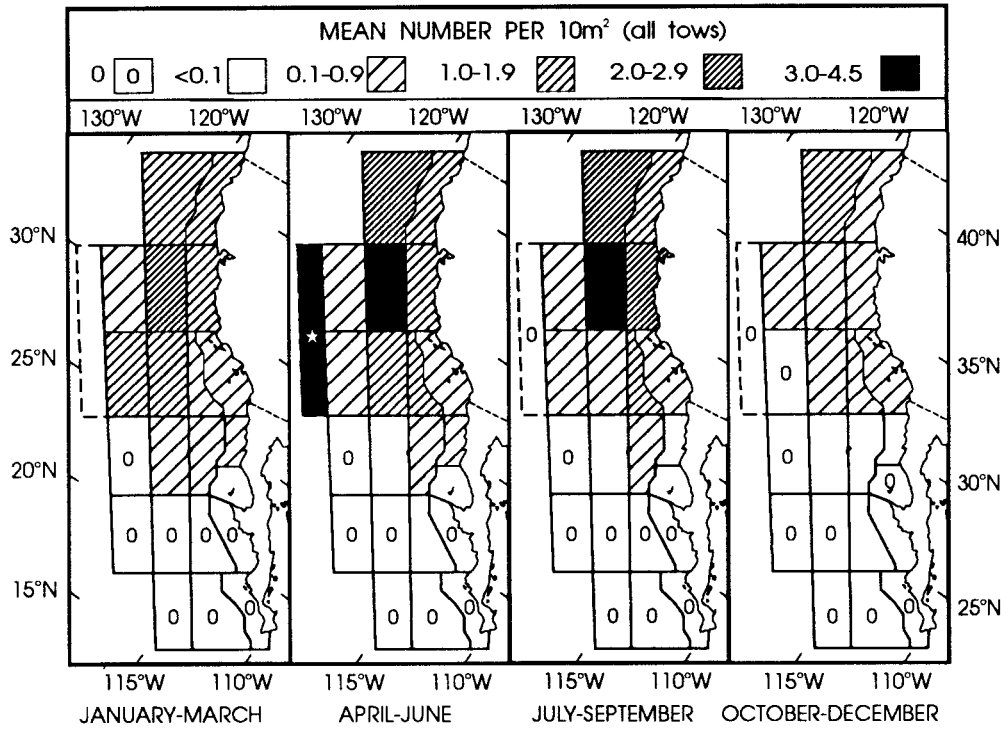
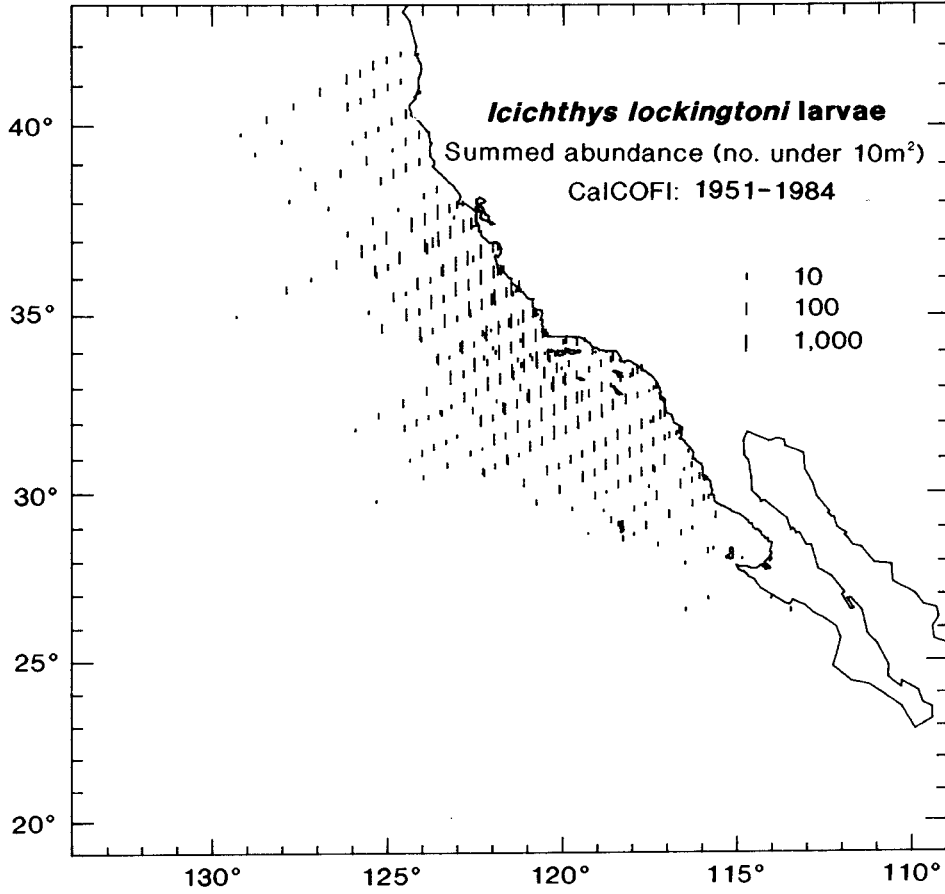
Searobins

Prionotus spp.

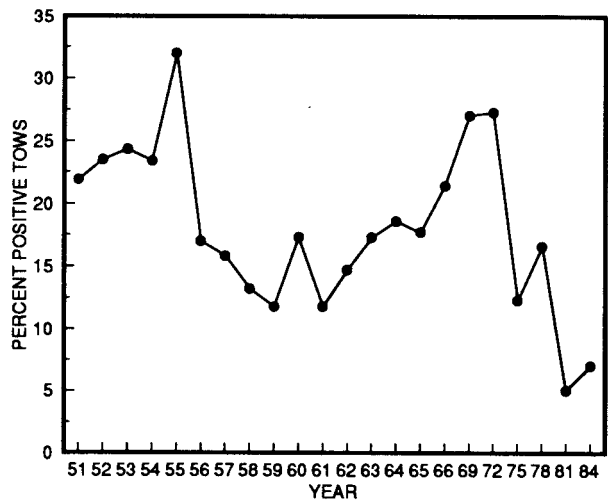


Icichthys lockingtoni

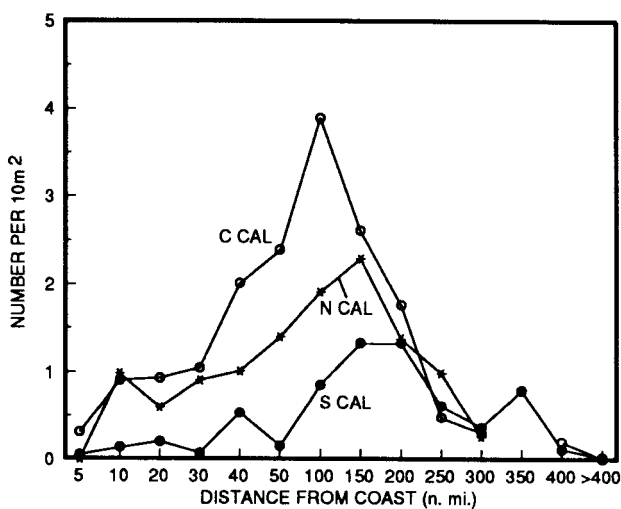
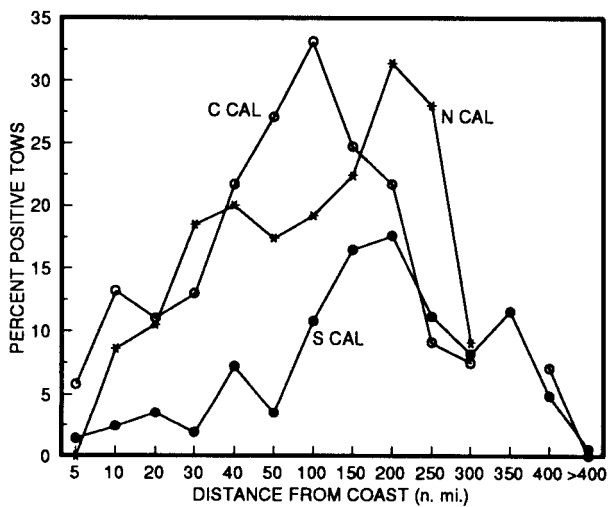
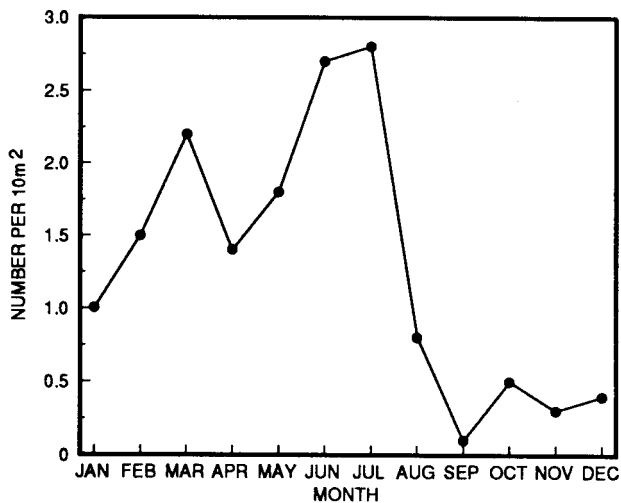
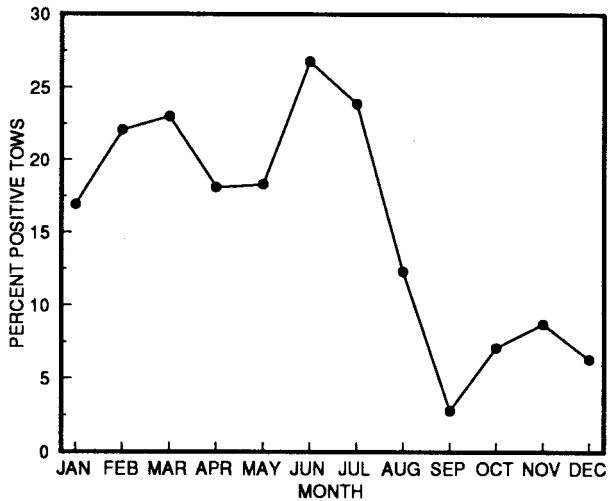
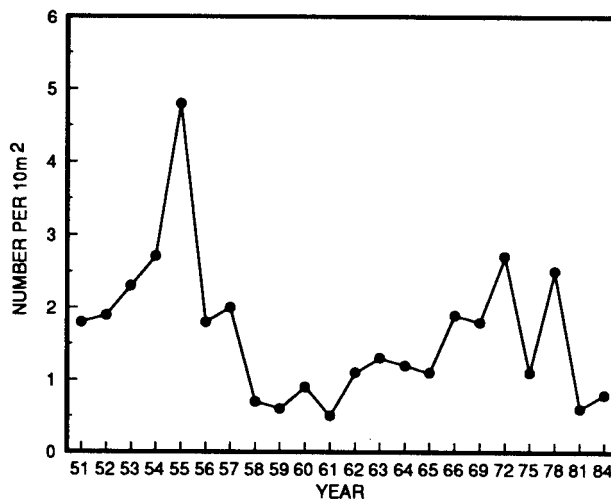
Centrolophidae



Medusafish

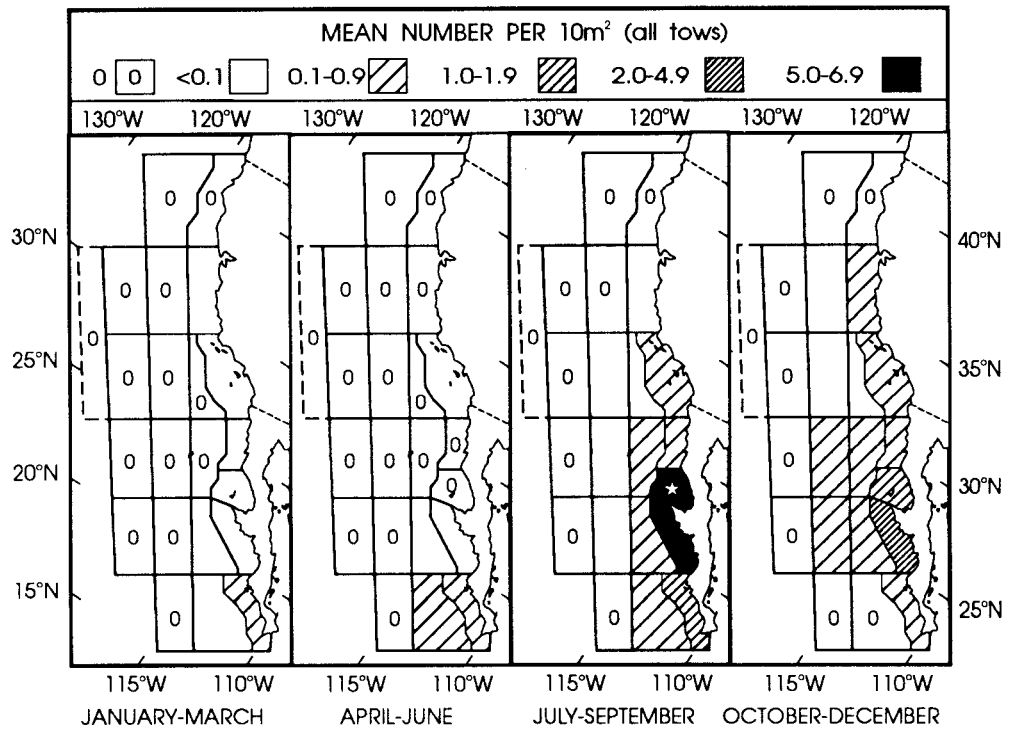
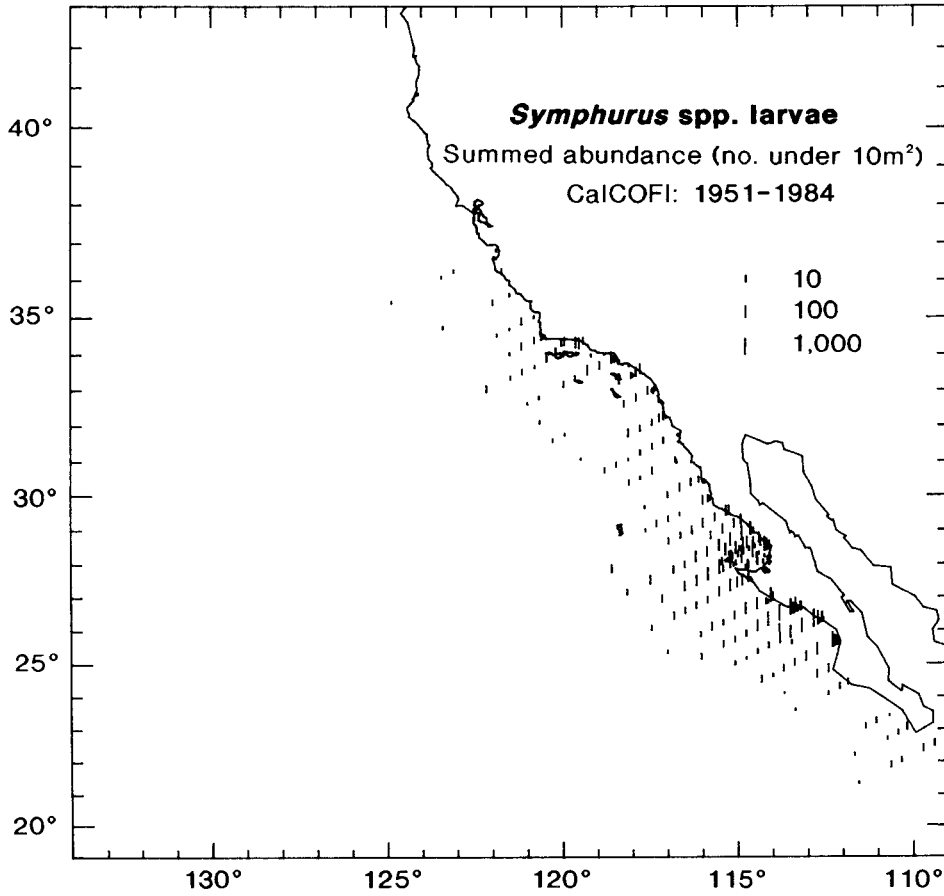


Icichthys lockingtoni



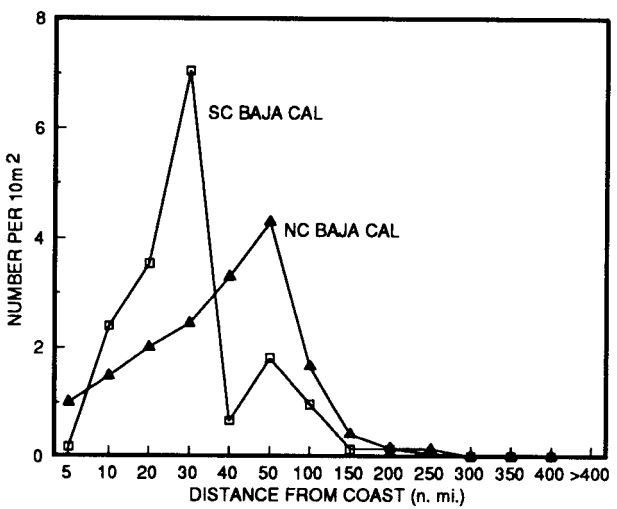
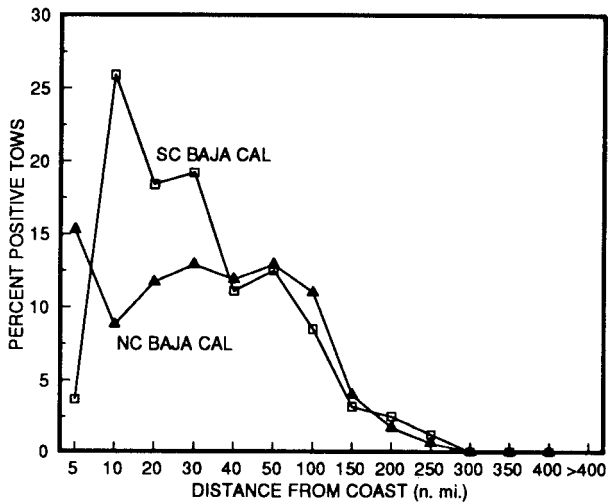
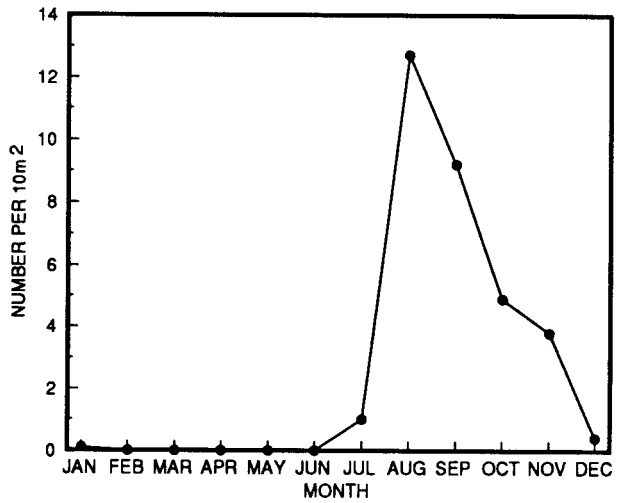
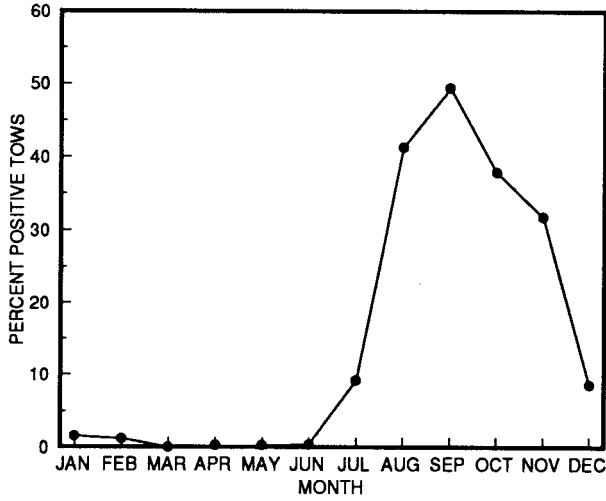
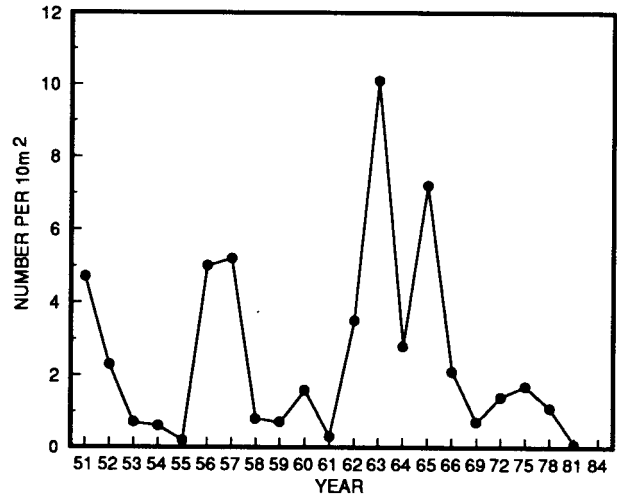
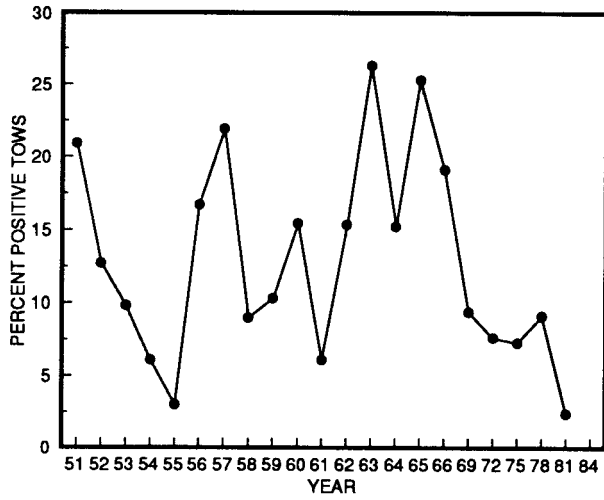
***Symphurus* spp.**

Cynoglossidae



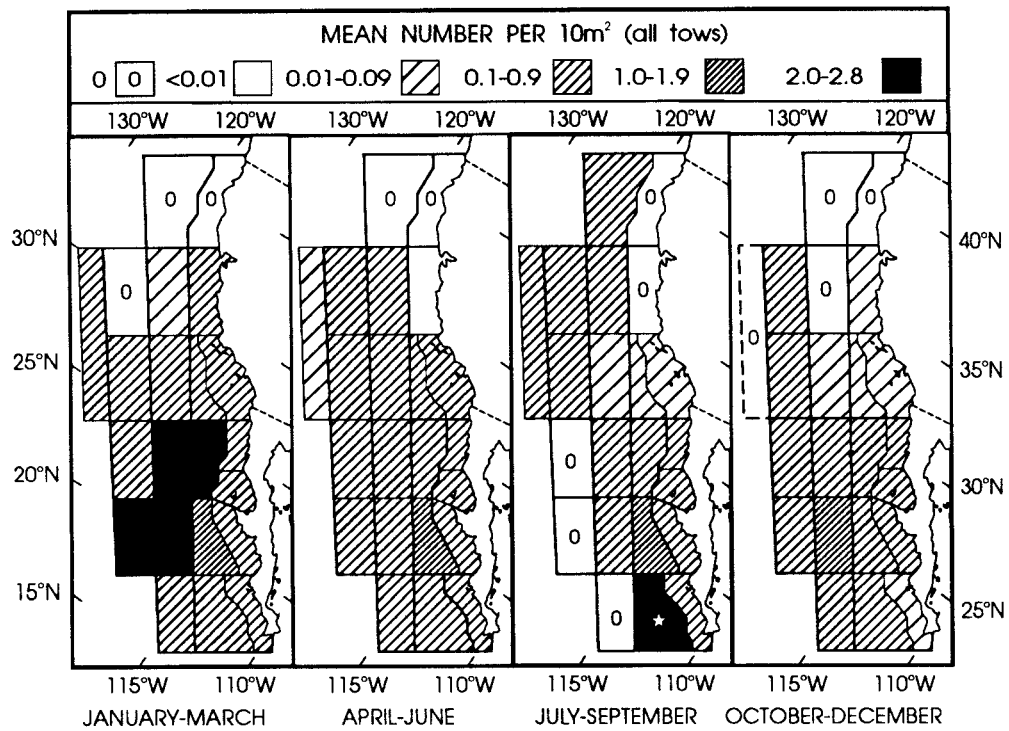
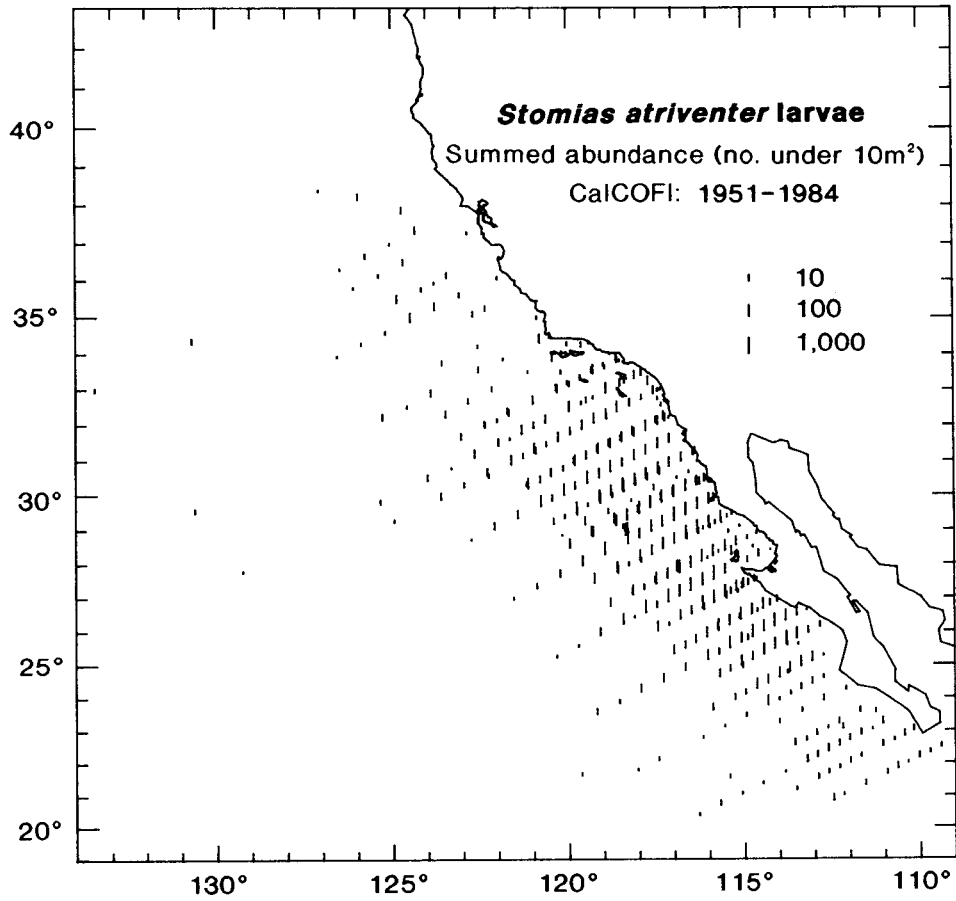
Tonguefishes

Symphurus spp.



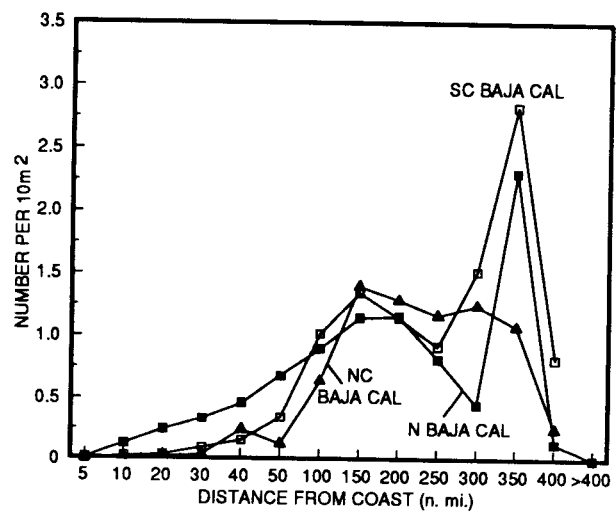
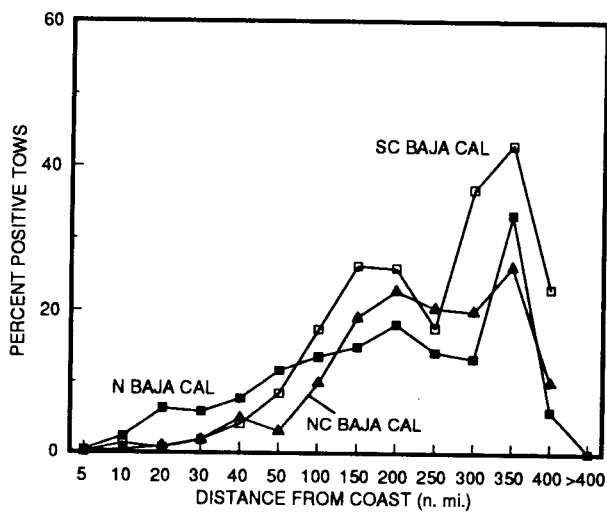
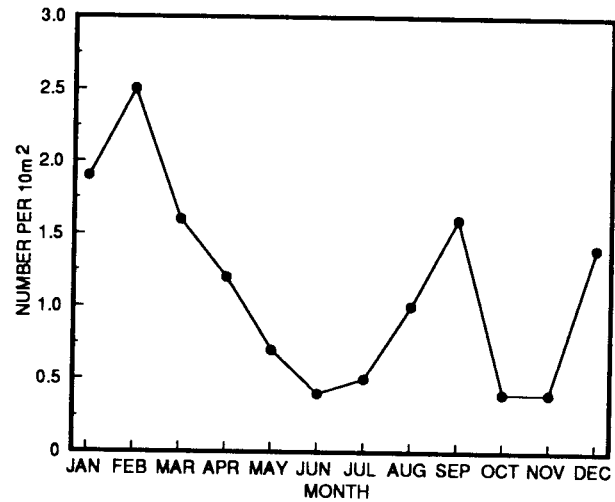
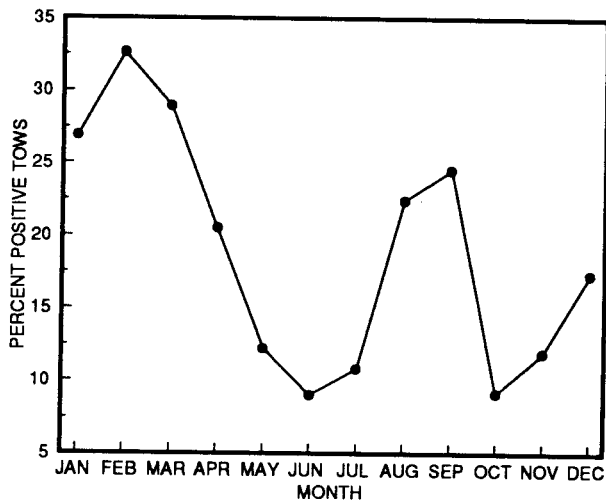
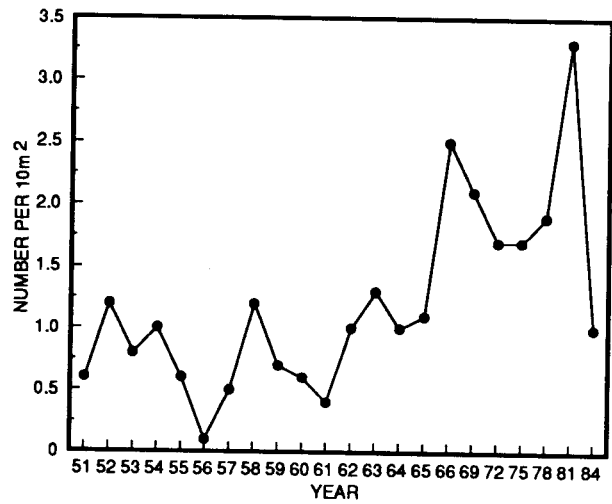
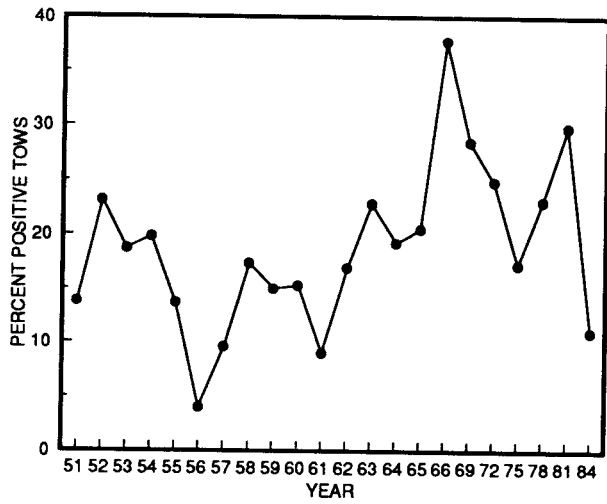
Stomias atriventer

Stomiidae



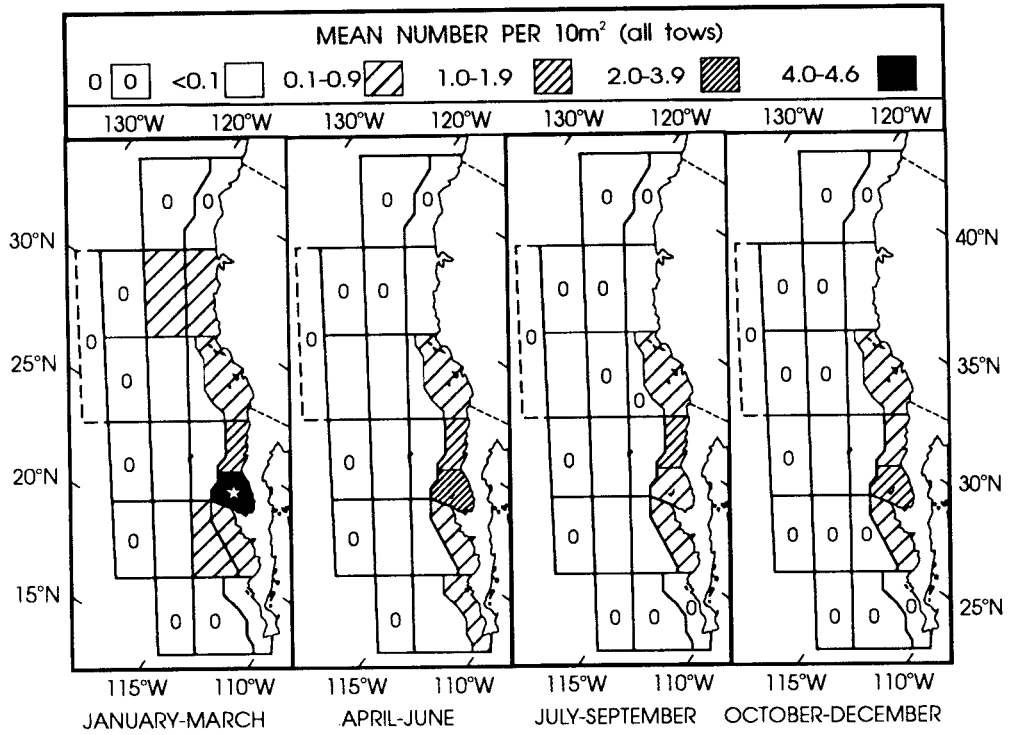
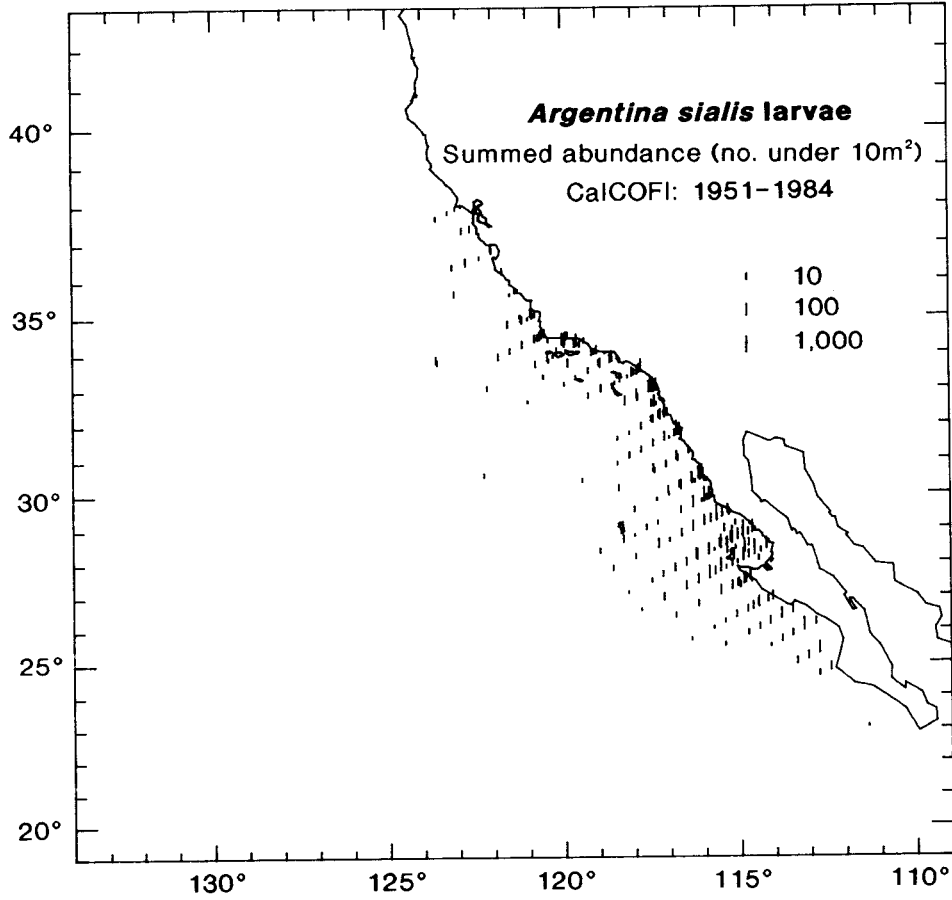
Blackbelly dragonfish

Stomias atriventer



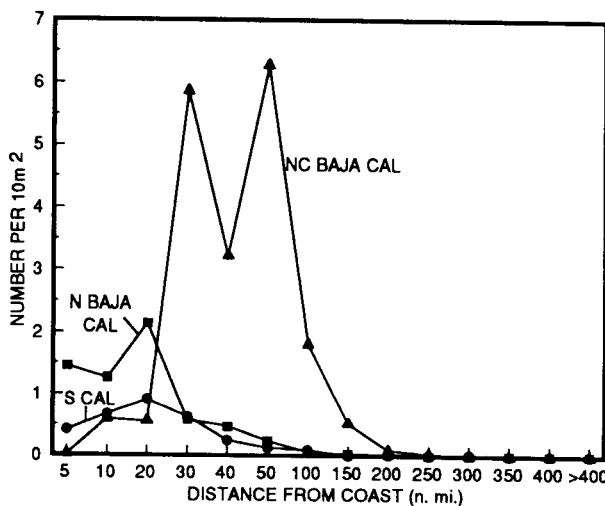
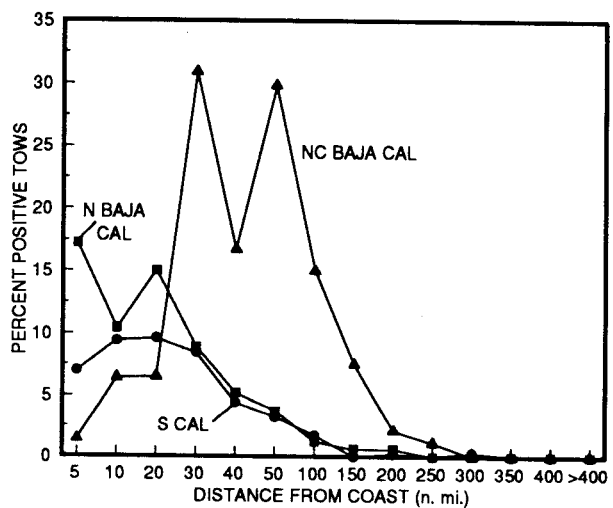
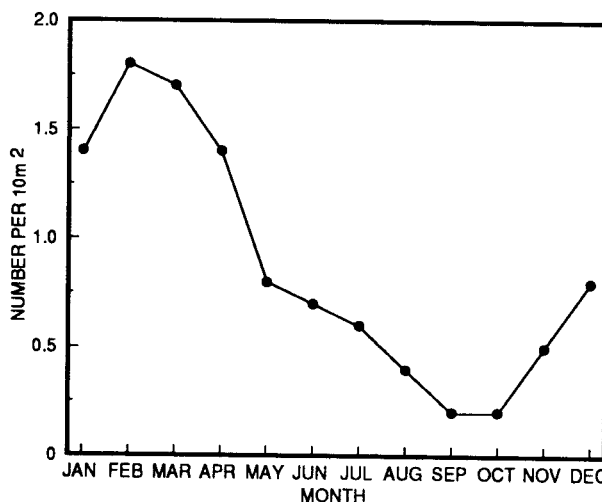
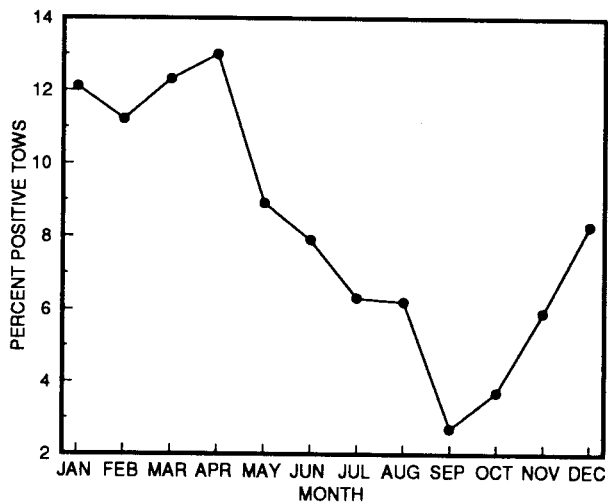
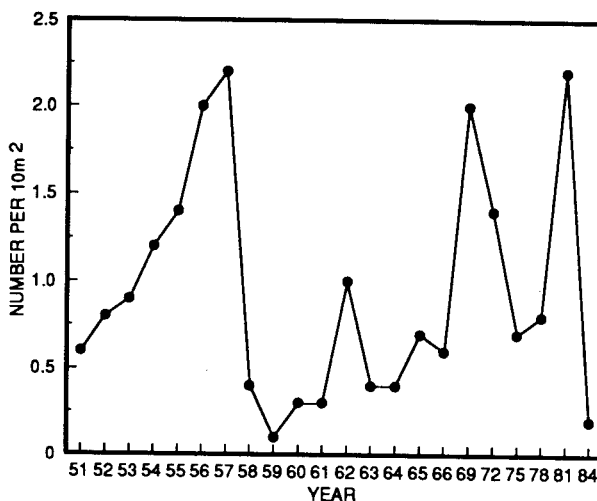
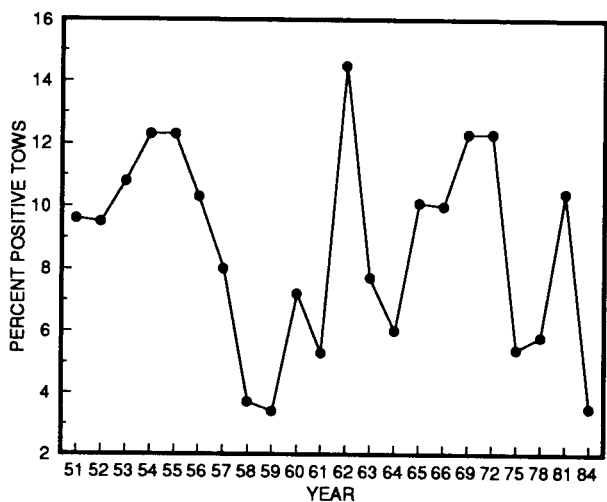
Argentina sialis

Argentinidae



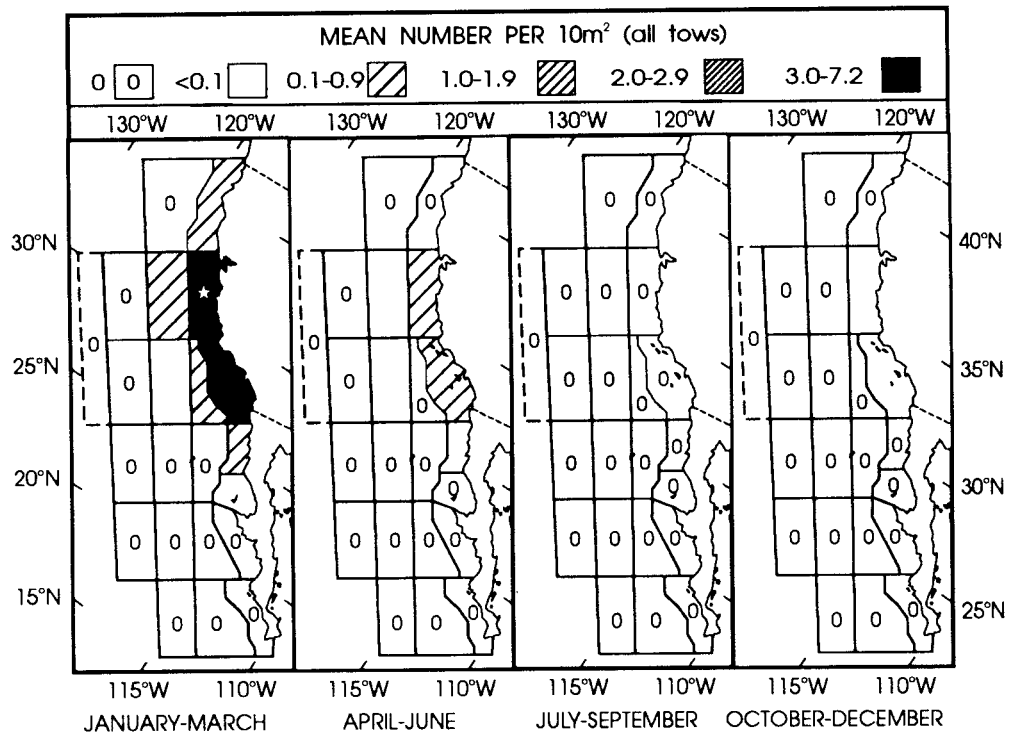
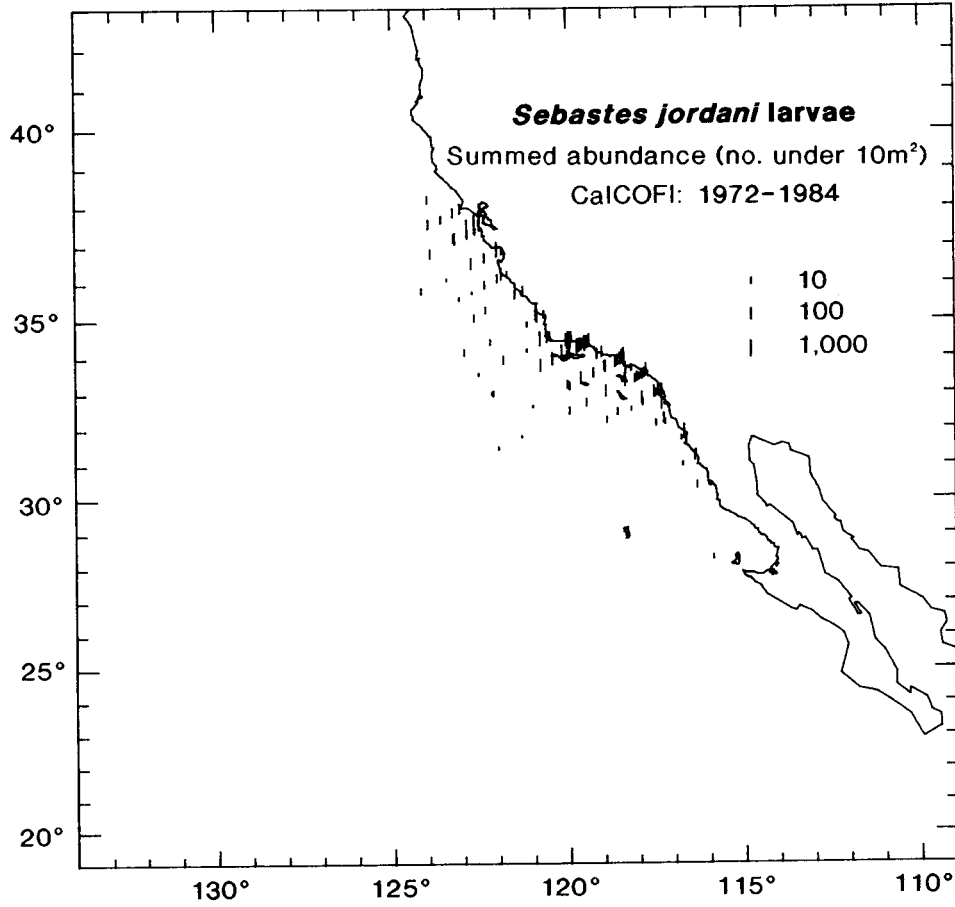
Pacific argentine

Argentina sialis



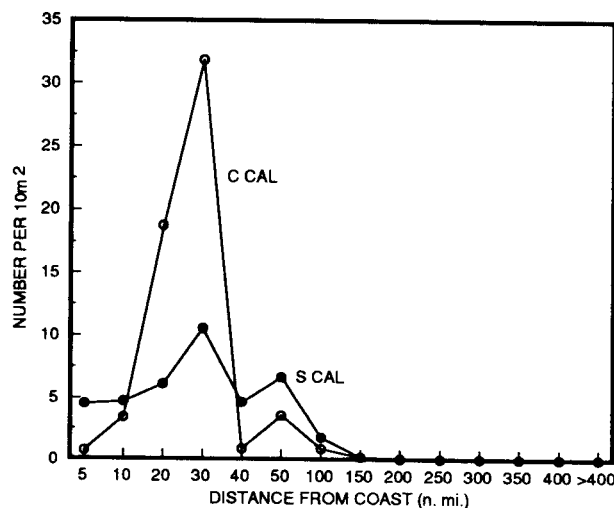
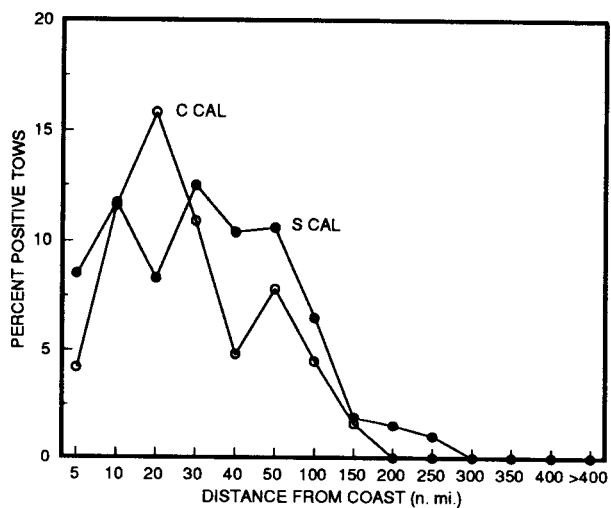
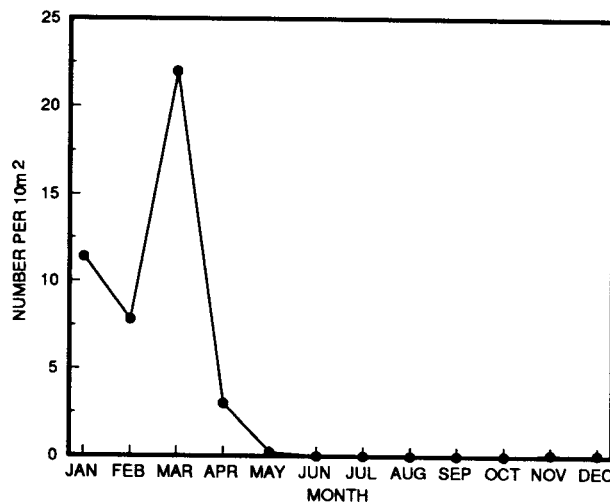
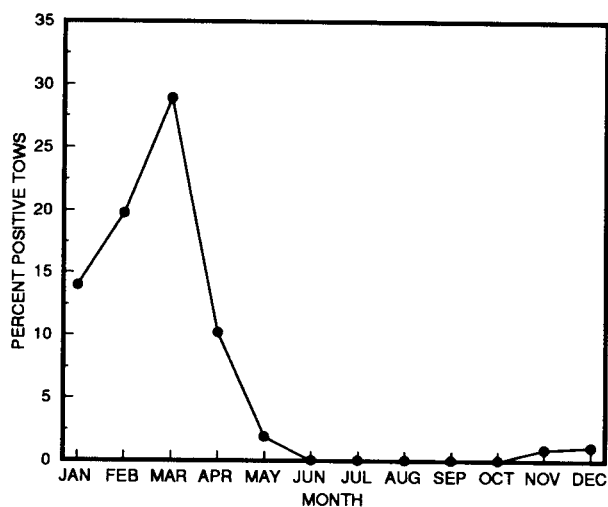
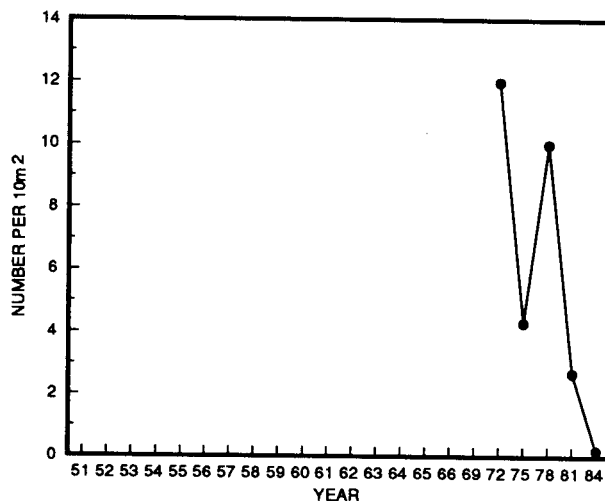
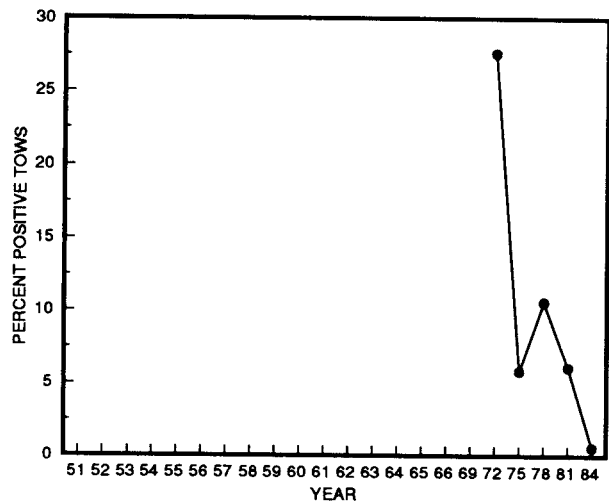
Sebastes jordani

Scorpaenidae



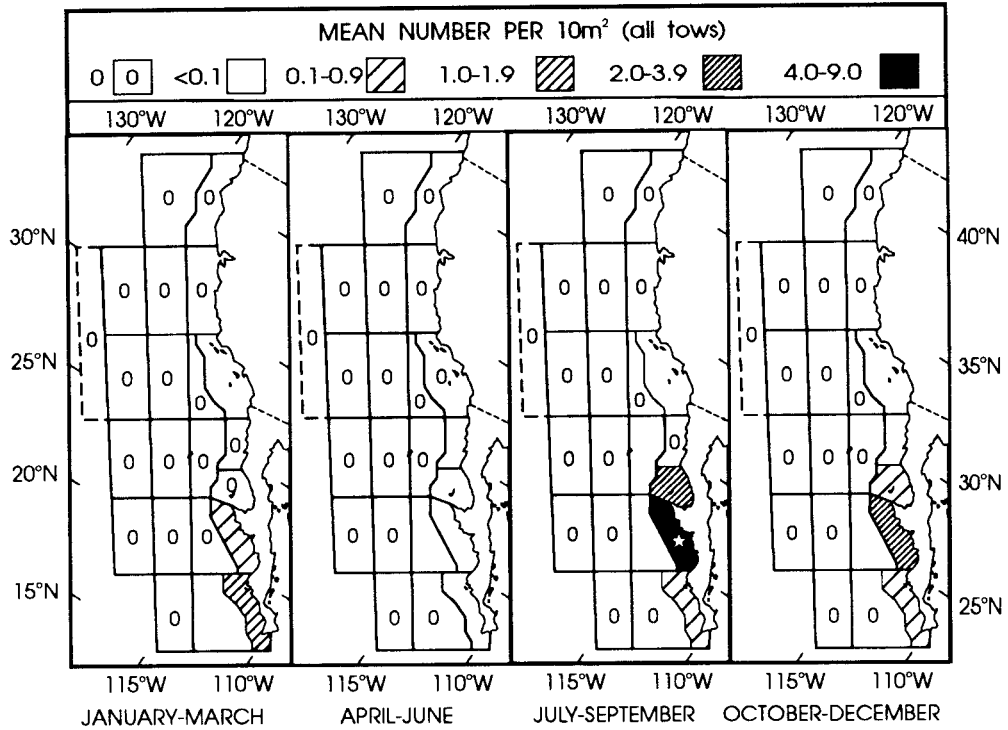
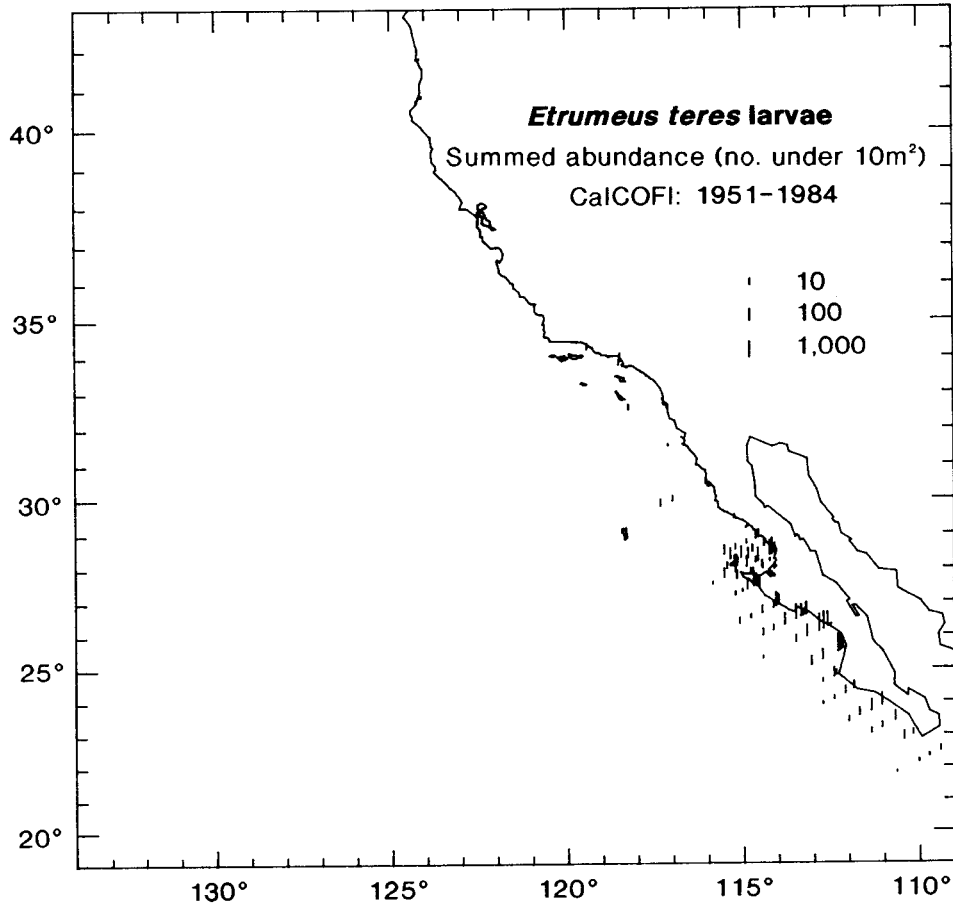
Shortbelly rockfish

Sebastes jordani

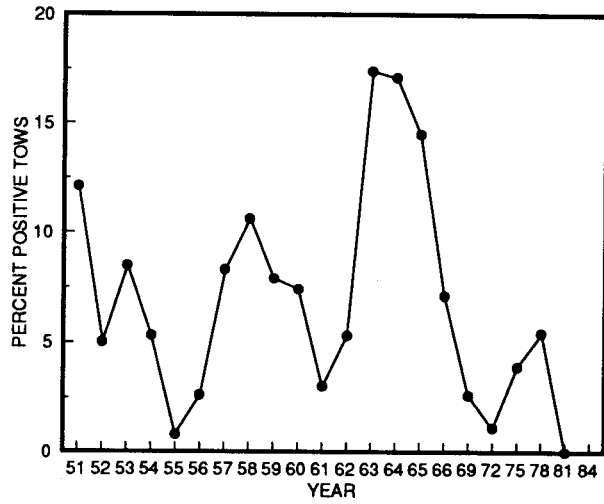


Etrumeus teres

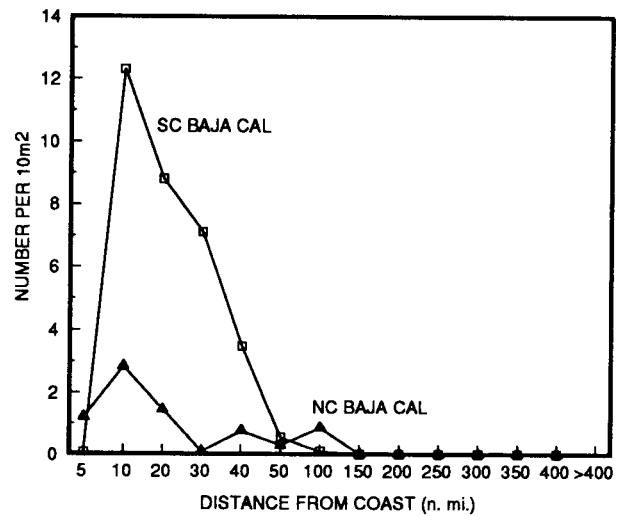
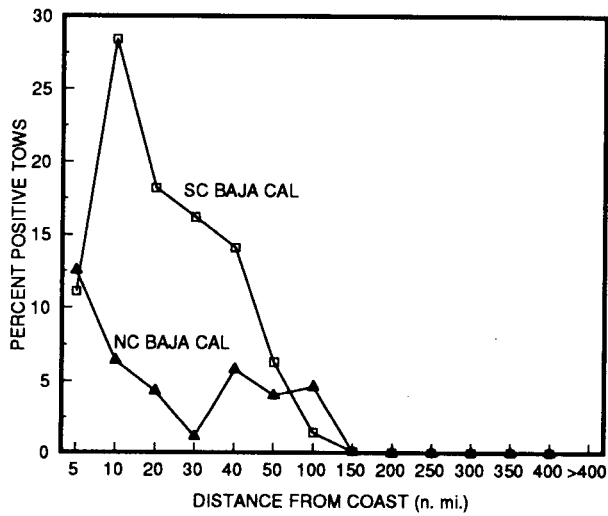
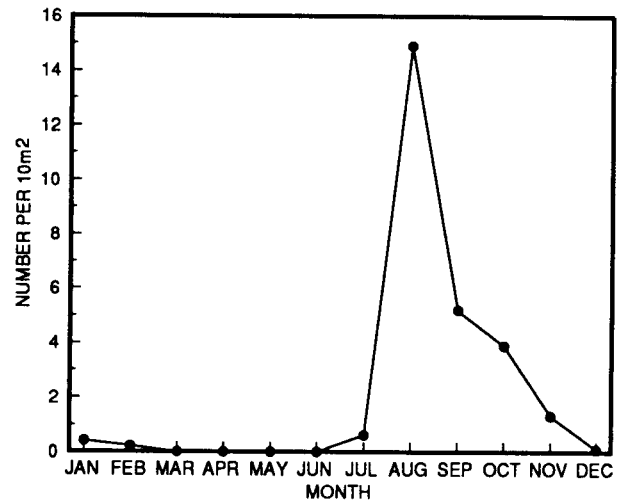
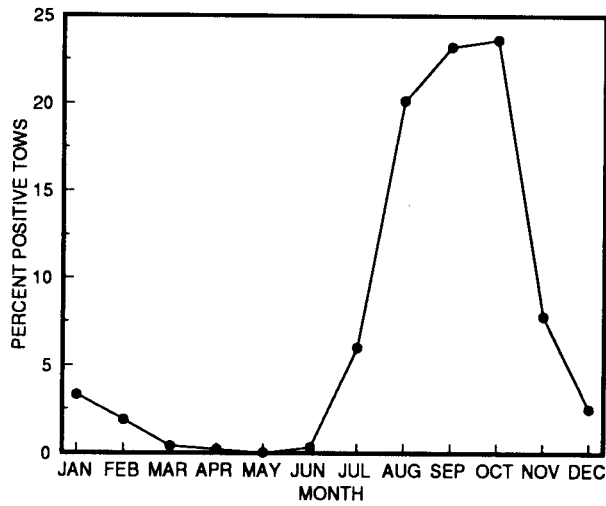
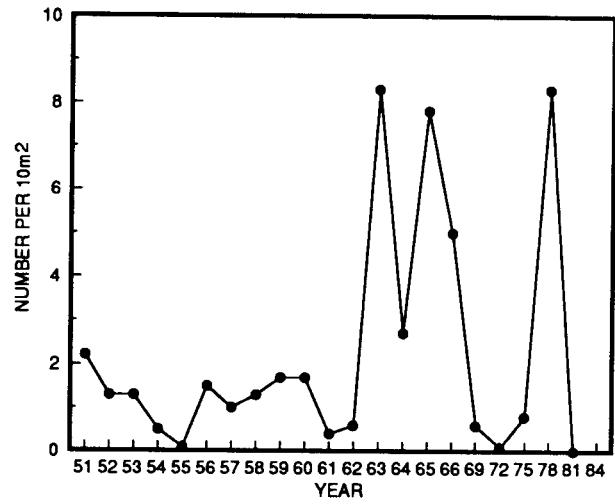
Clupeidae



Round herring

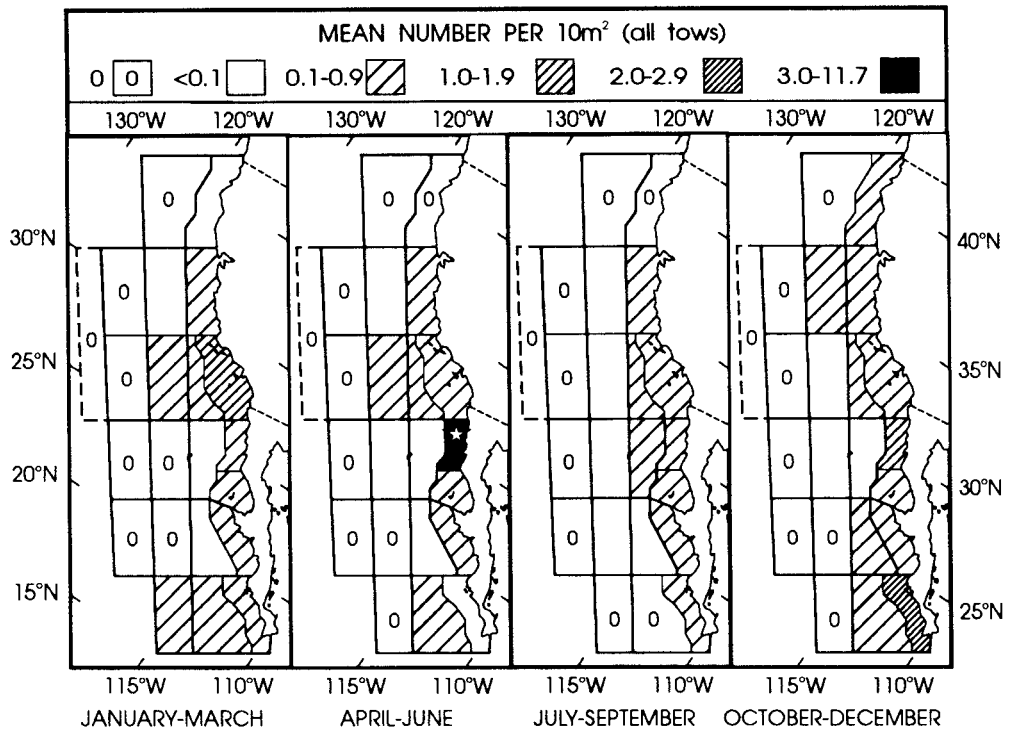
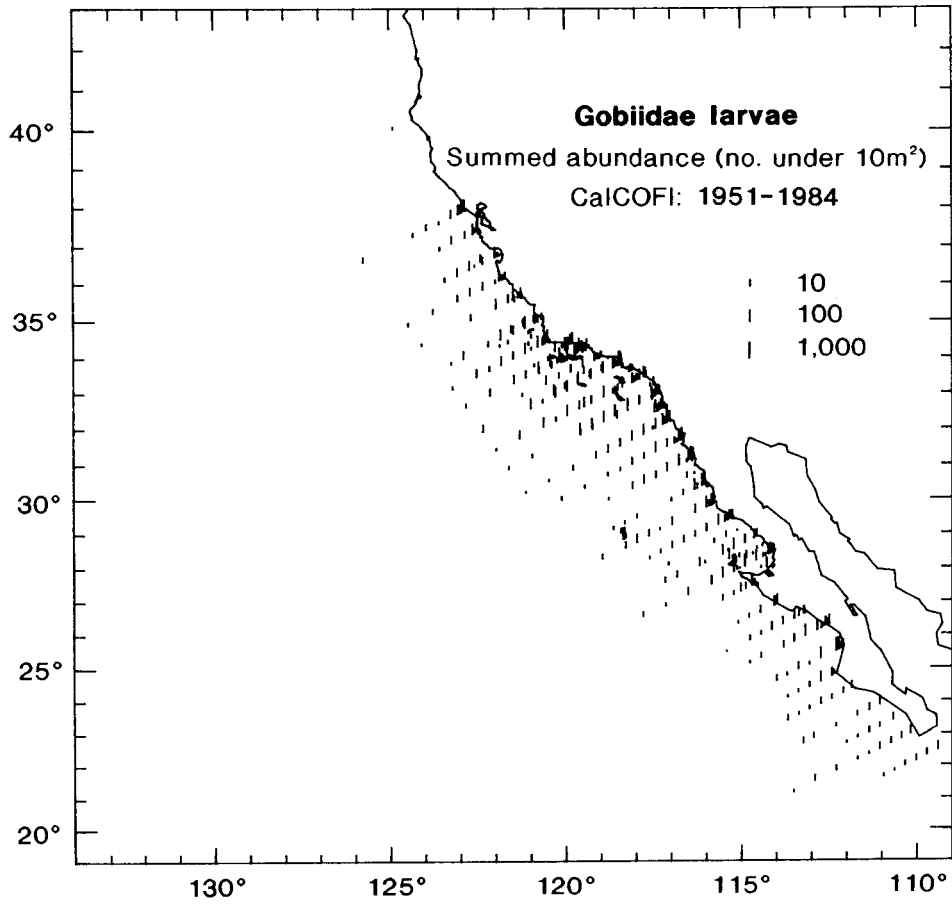


Etrumeus teres



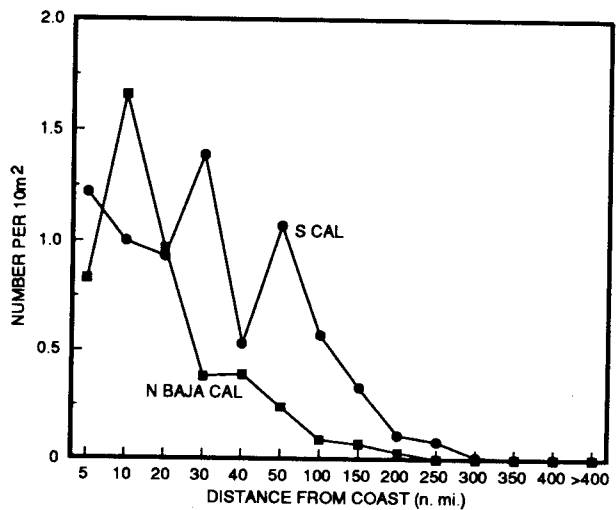
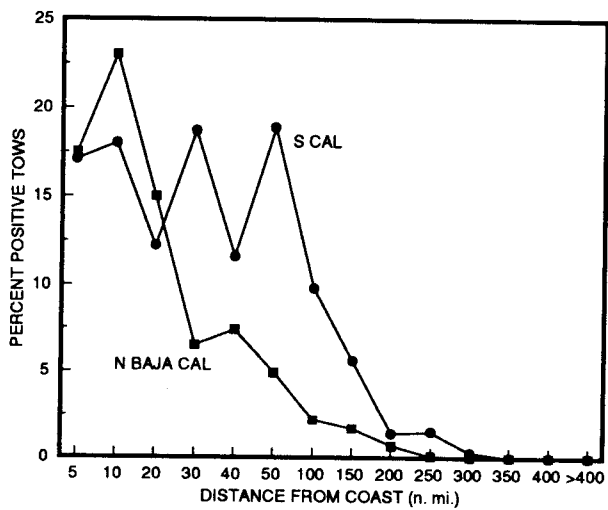
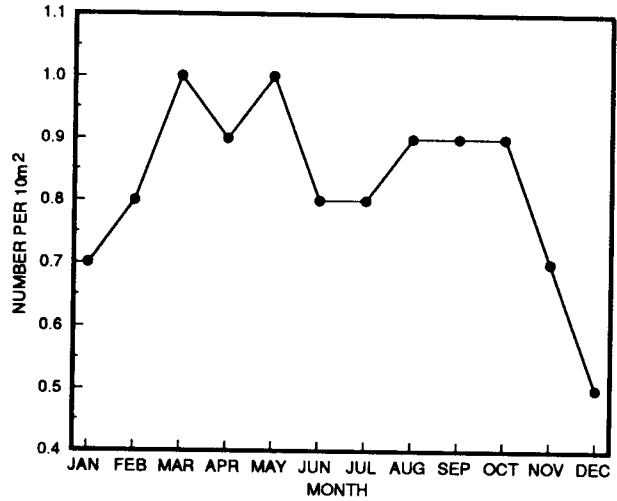
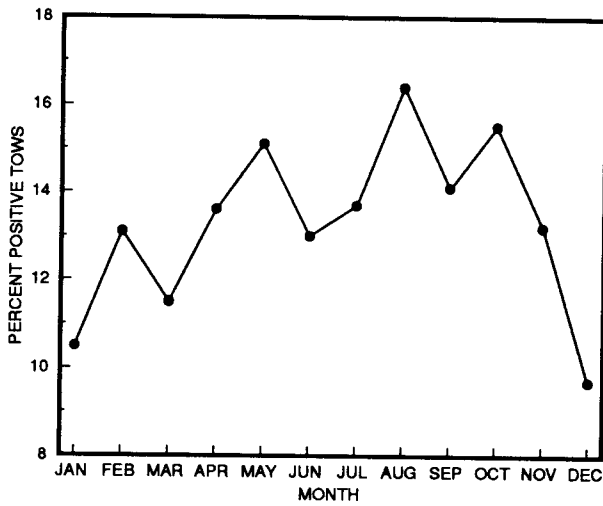
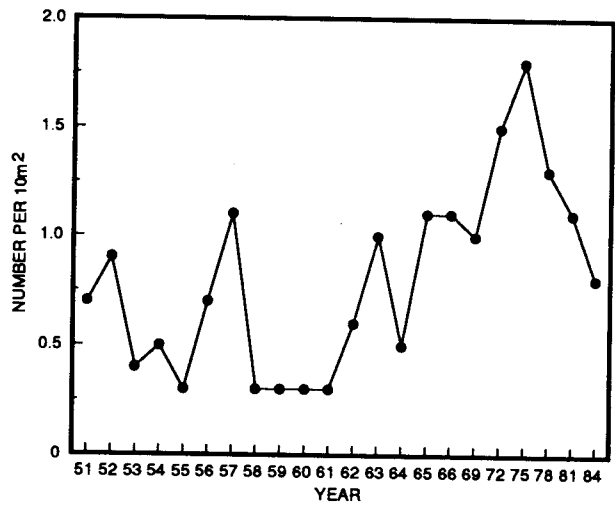
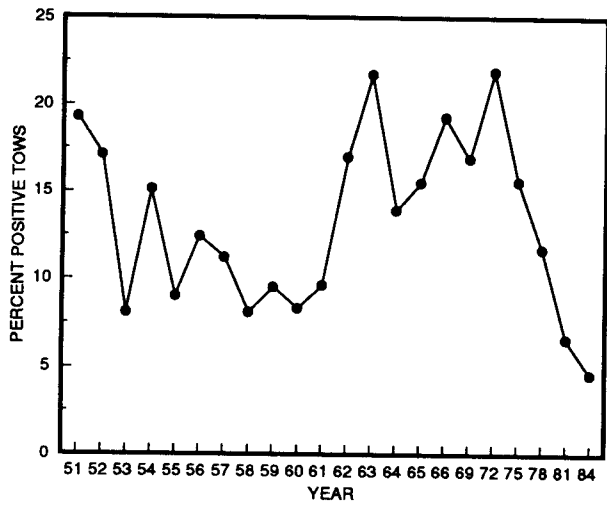
Gobiidae

Gobiidae



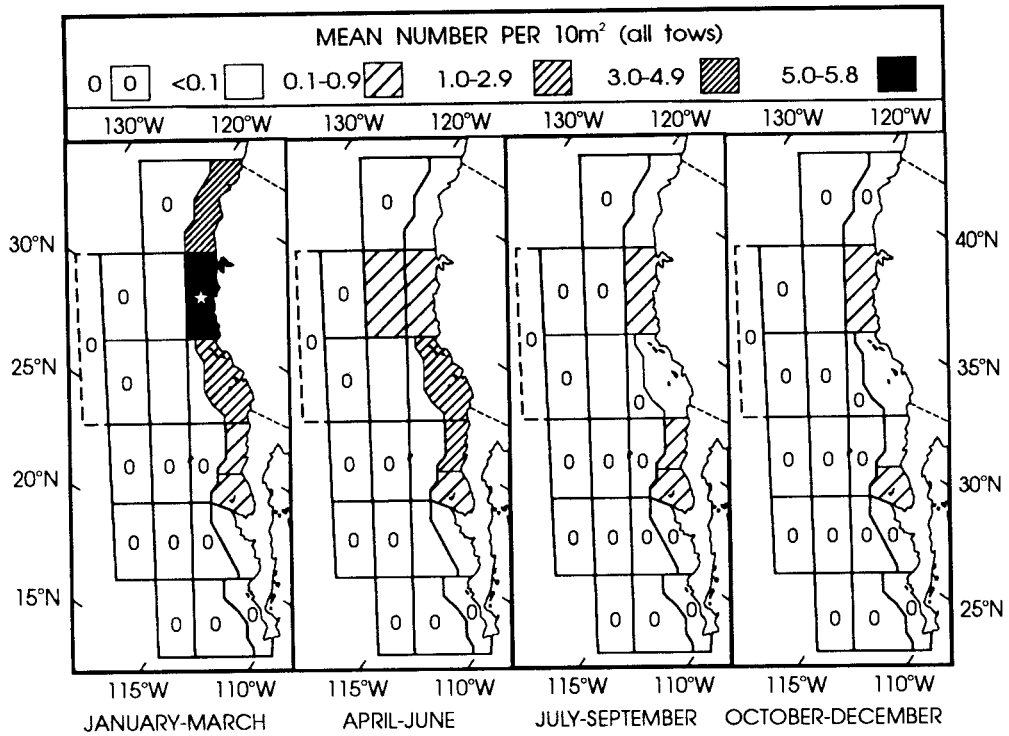
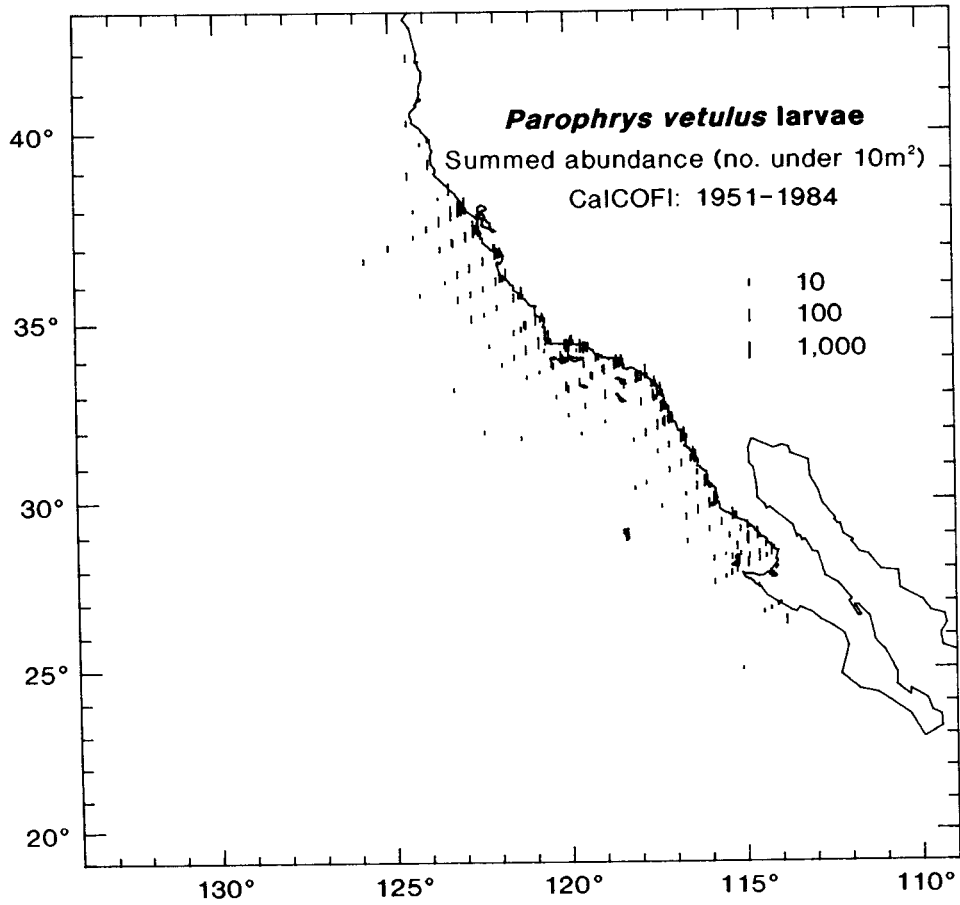
Gobies

Gobiidae

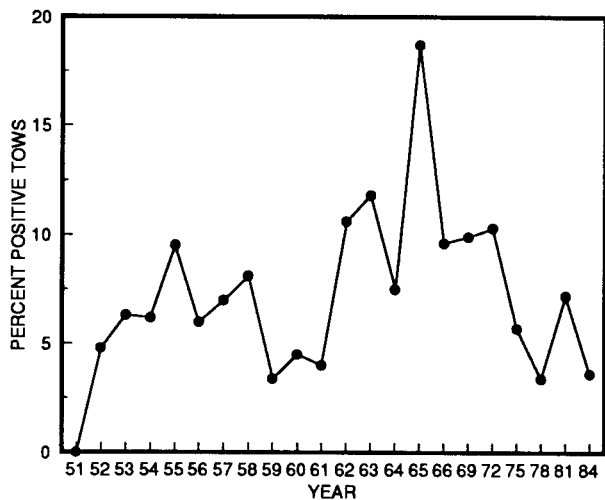


Parophrys vetulus

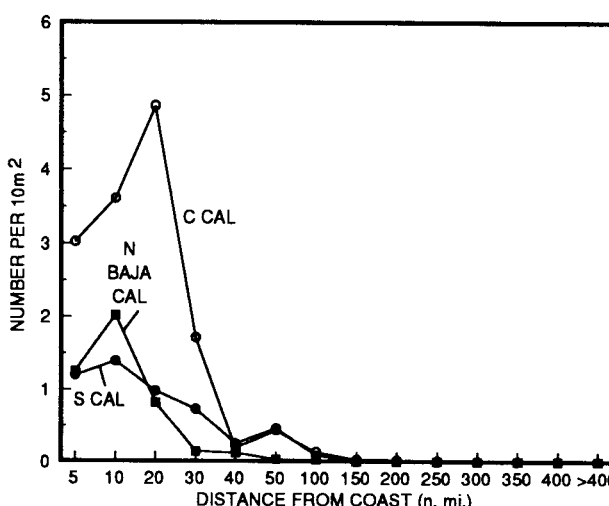
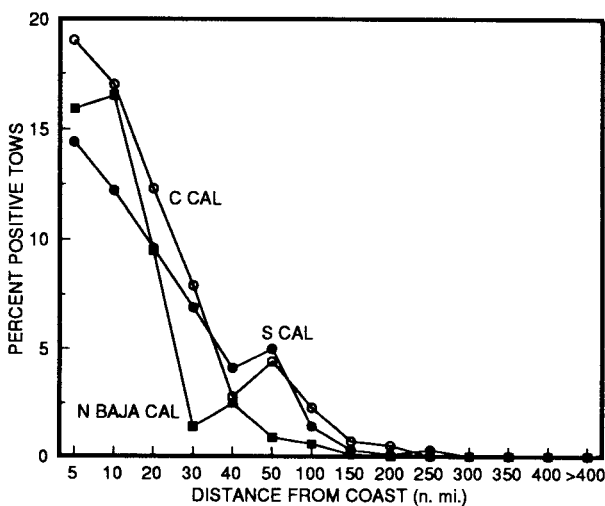
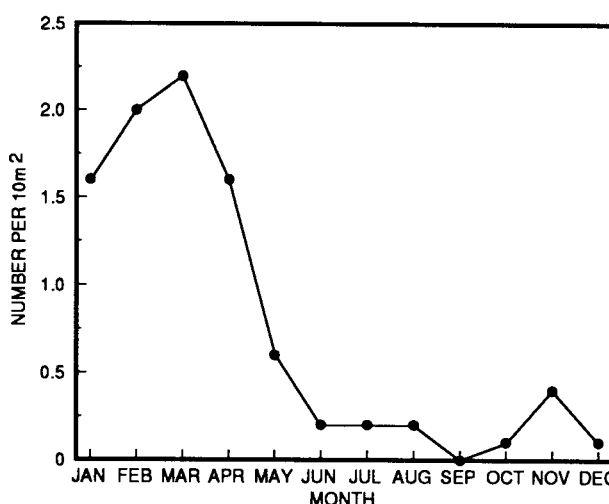
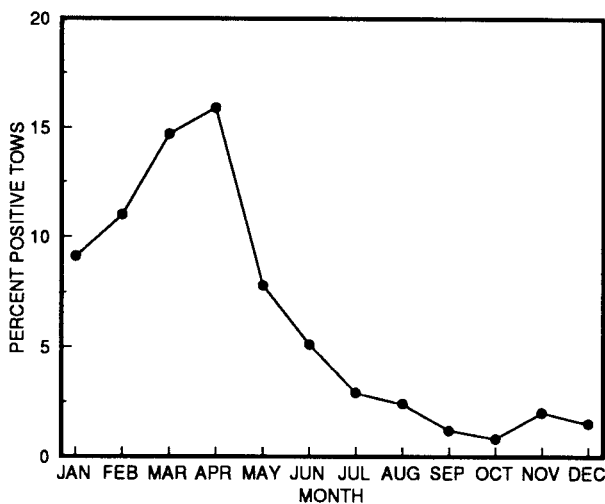
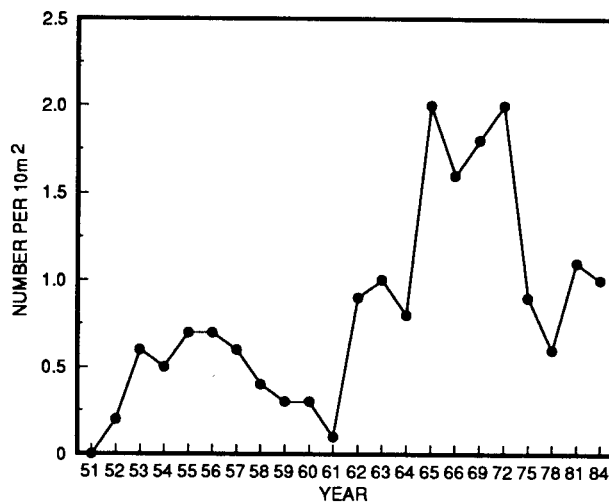
Pleuronectidae



English sole

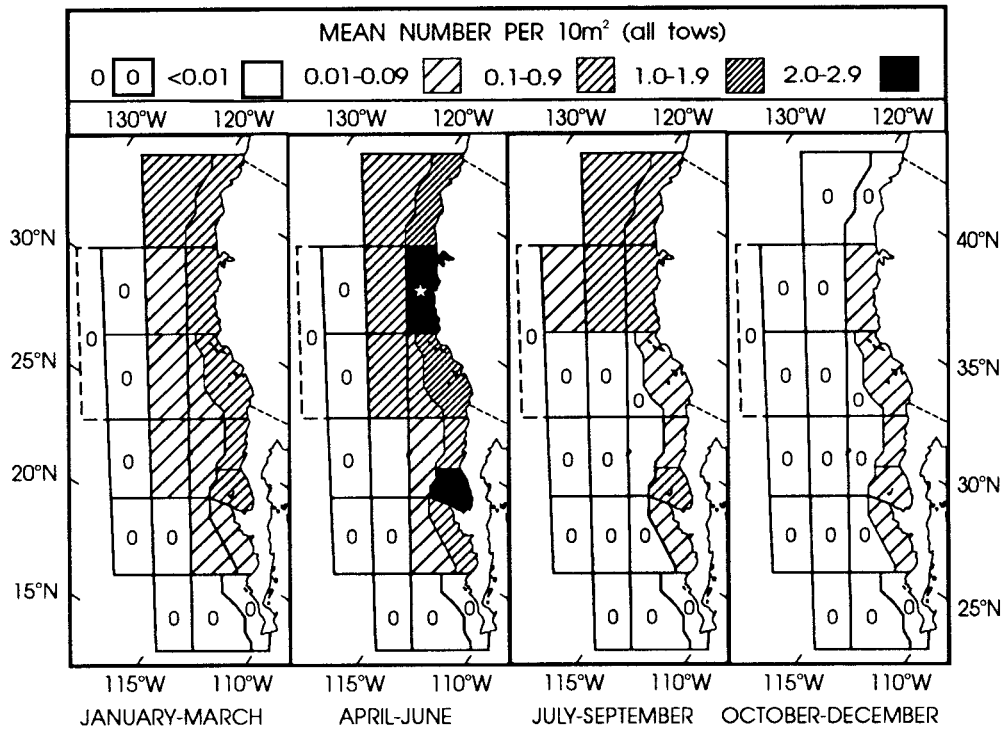
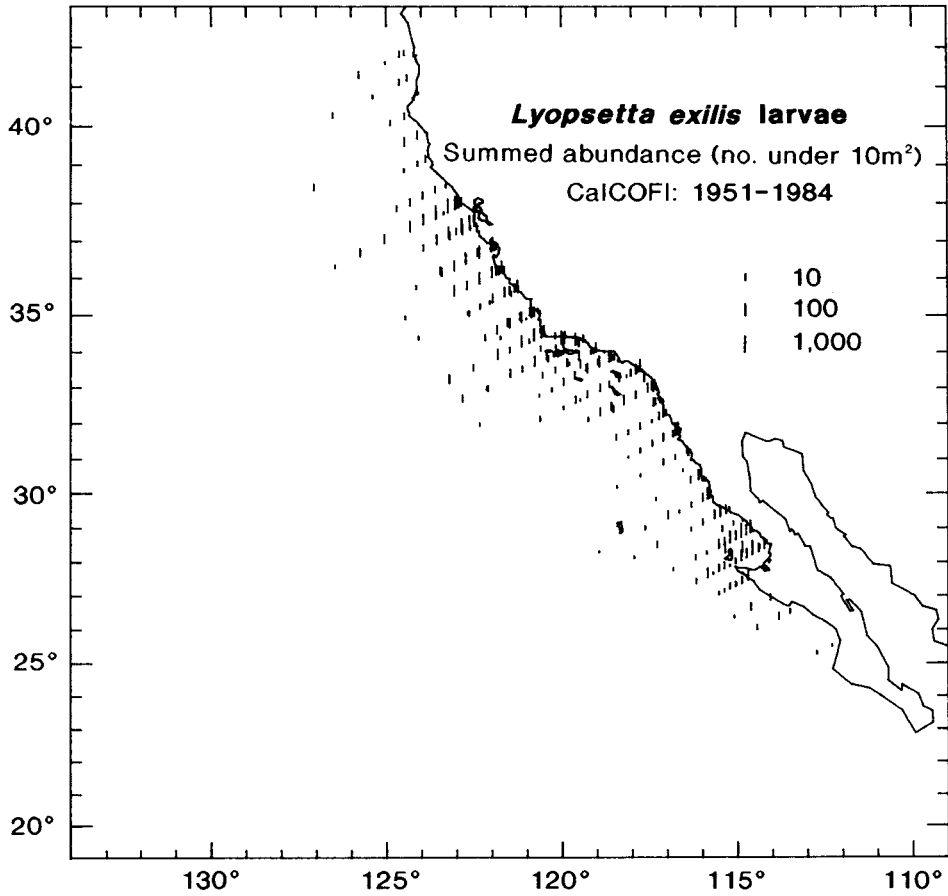


Parophrys vetulus



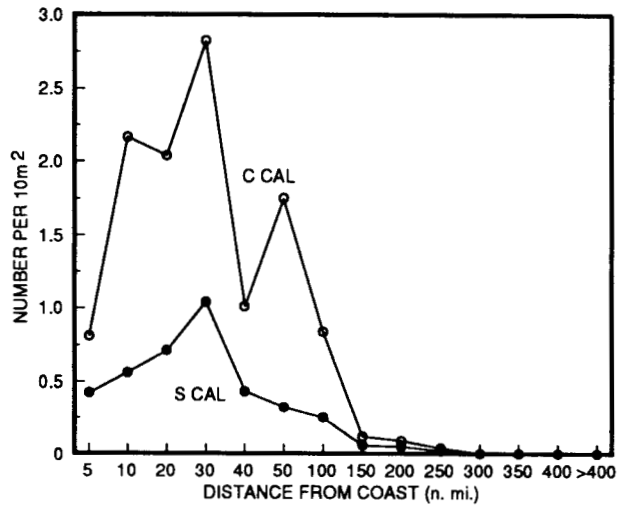
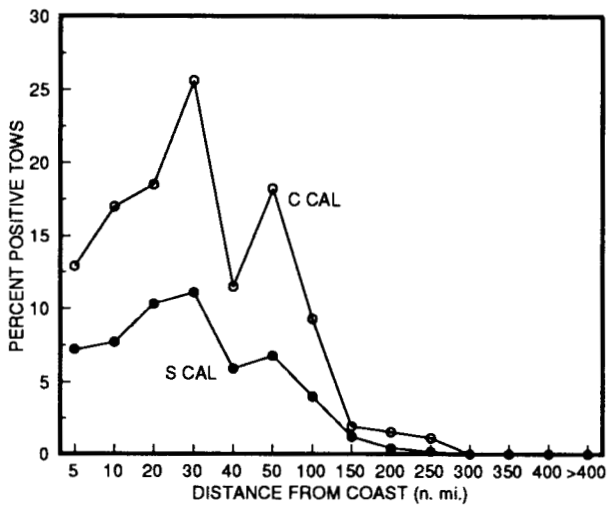
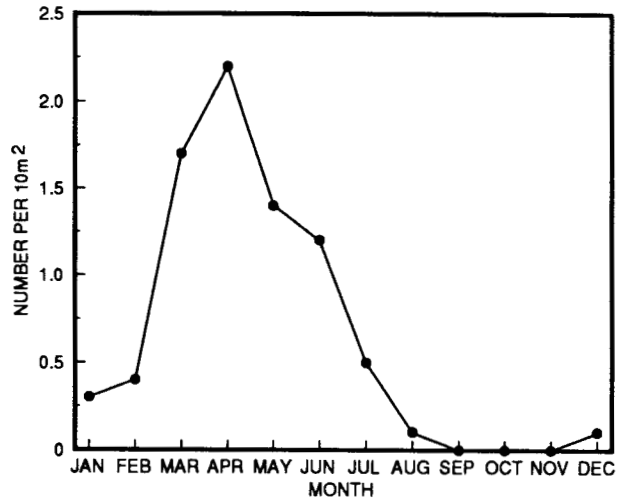
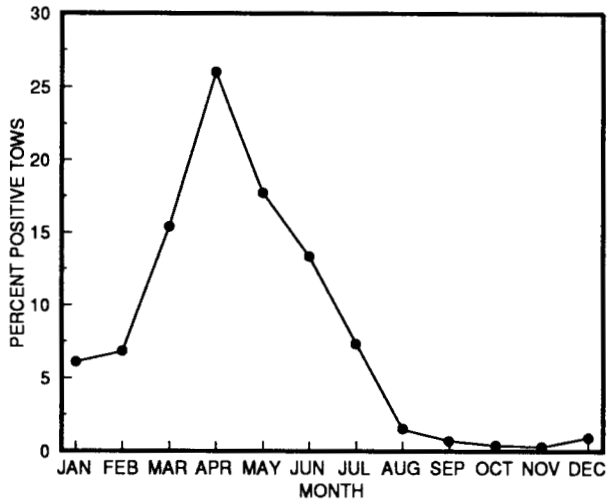
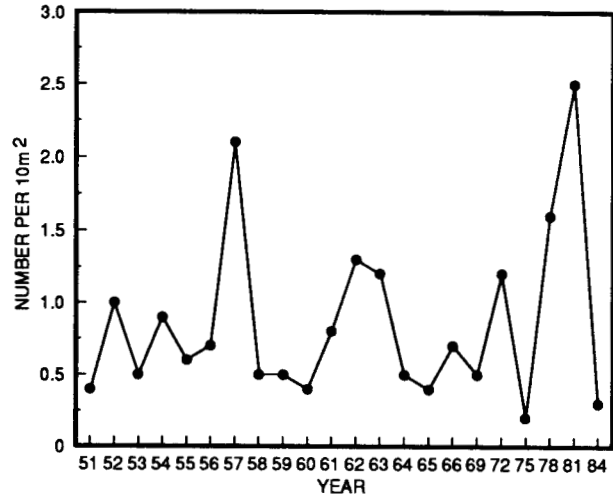
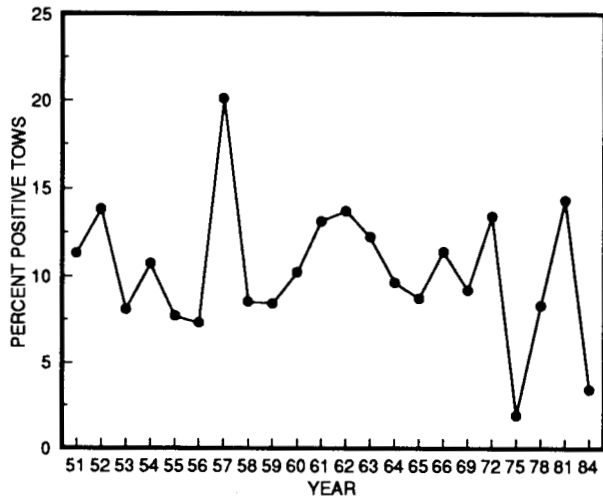
Lyopsetta exilis

Pleuronectidae



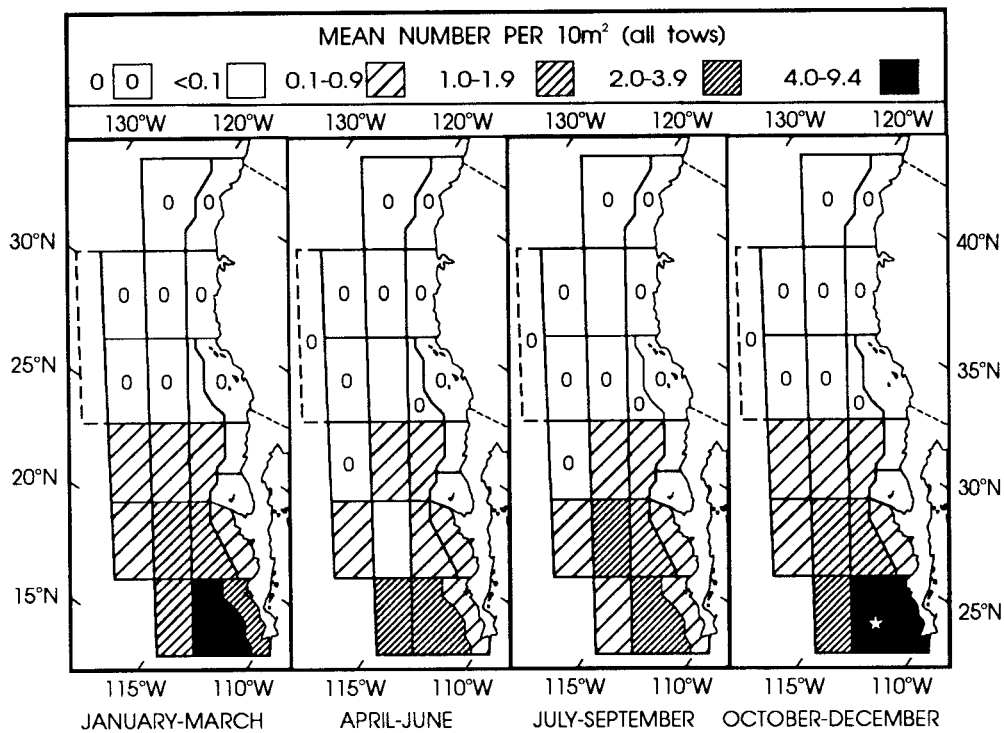
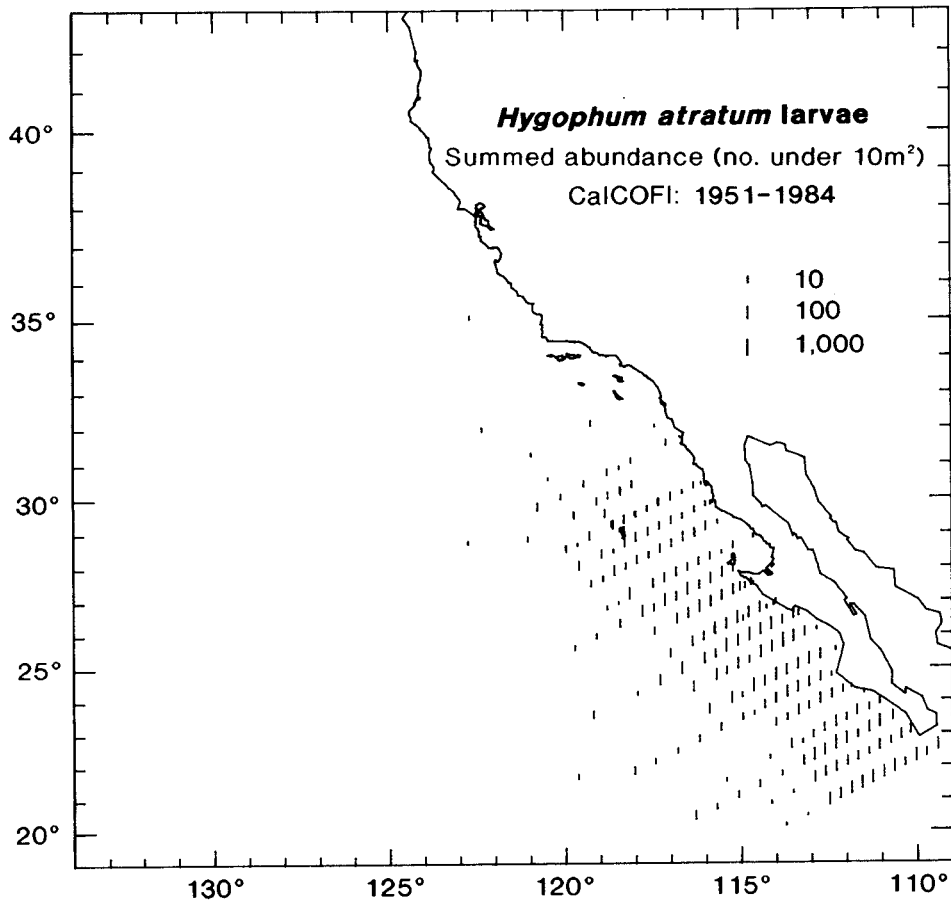
Slender sole

Lyopsetta exilis

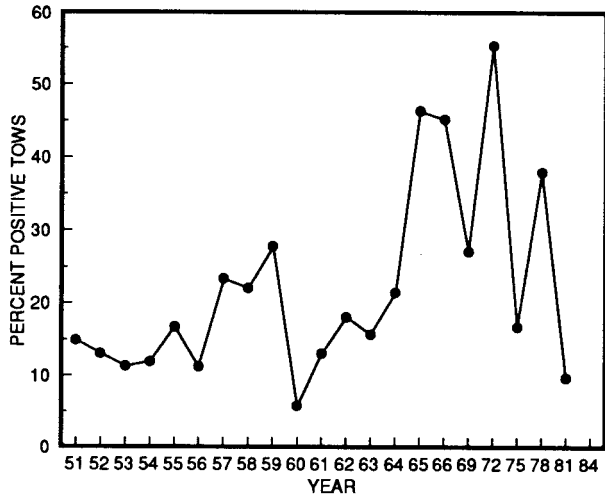


Hygophum atratum

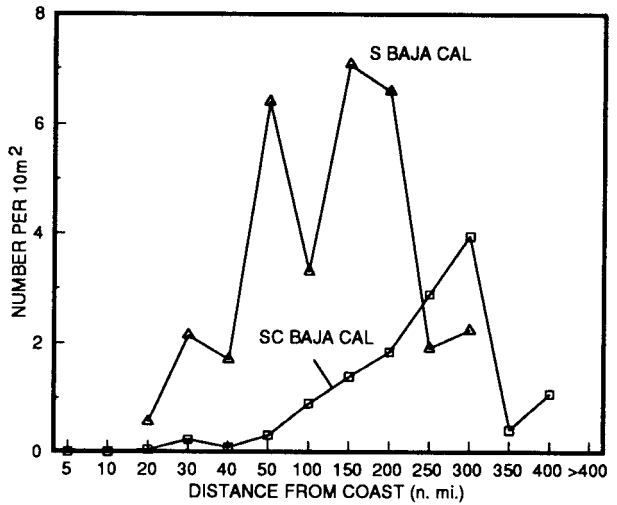
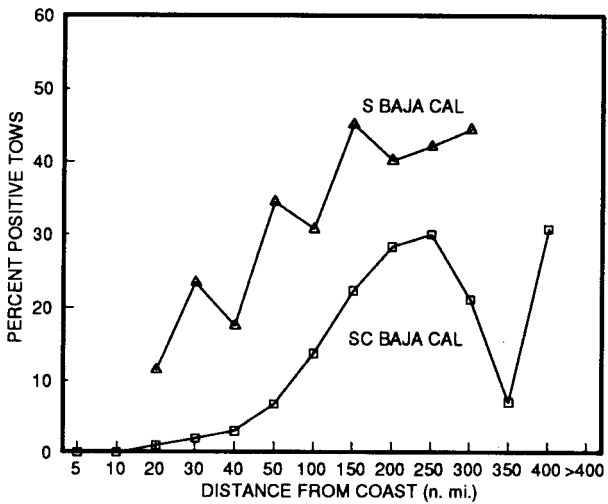
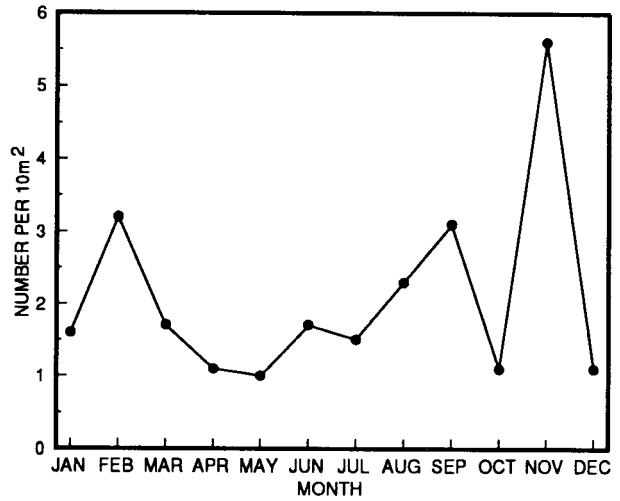
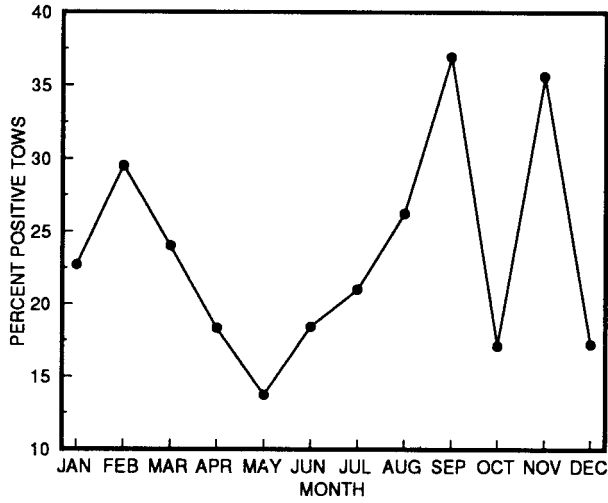
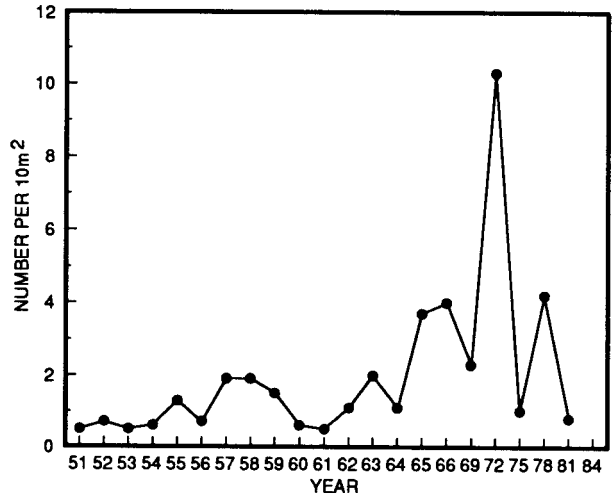
Myctophidae



Thickhead lanternfish

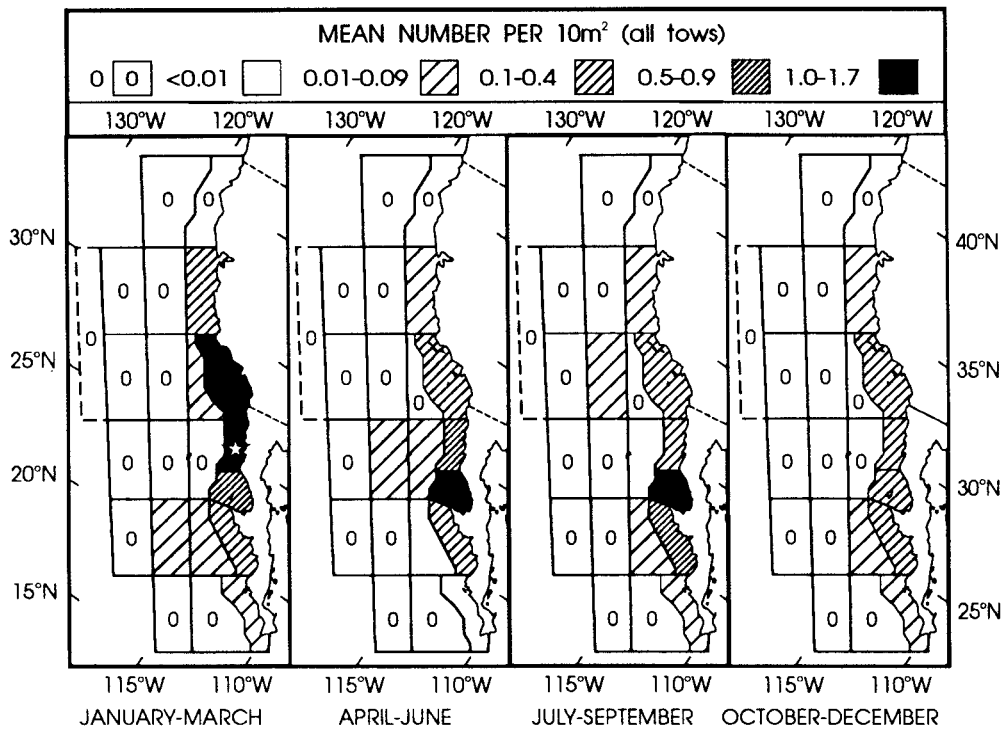
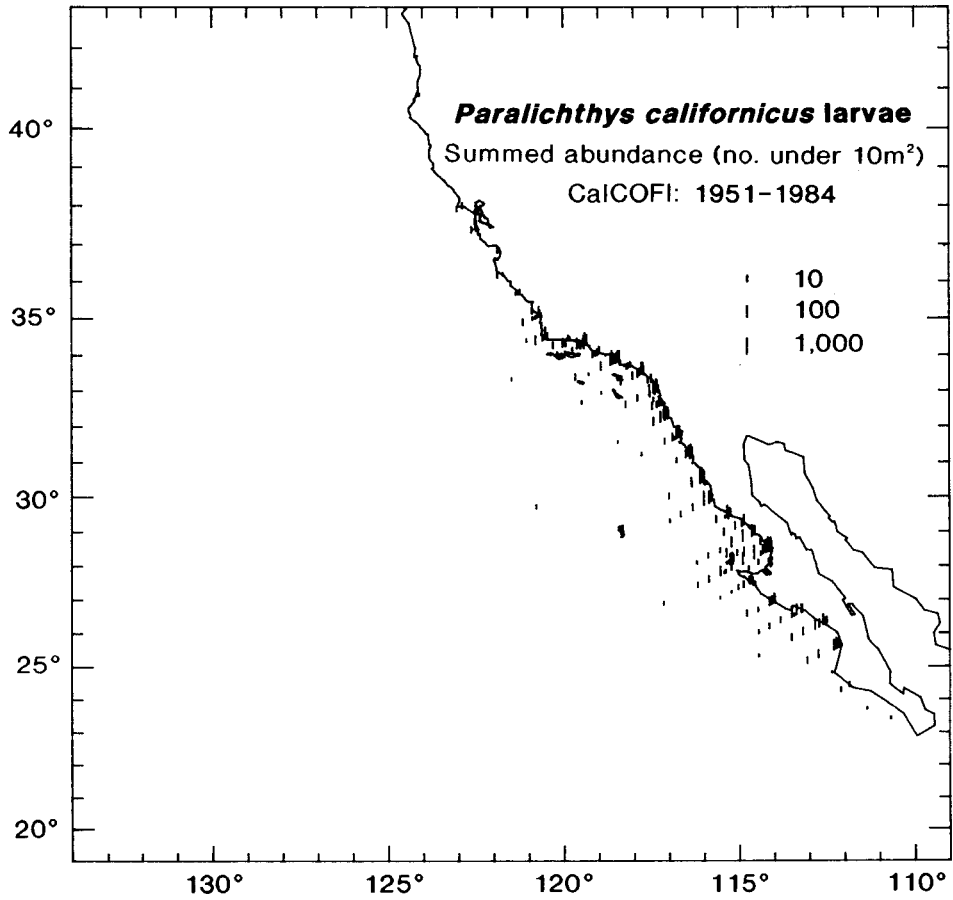


Hygophum atratum



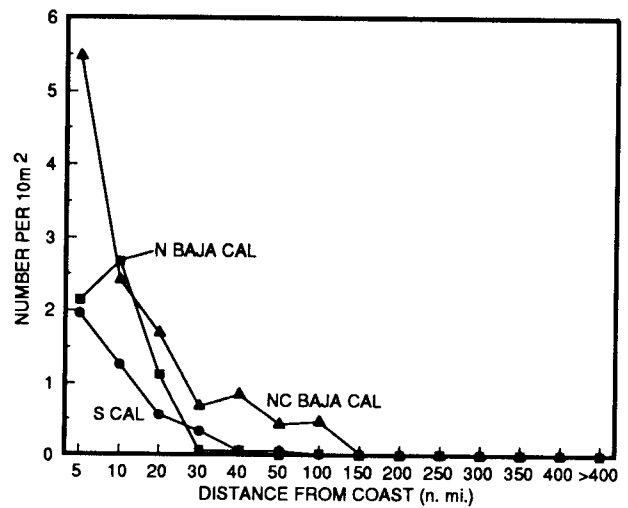
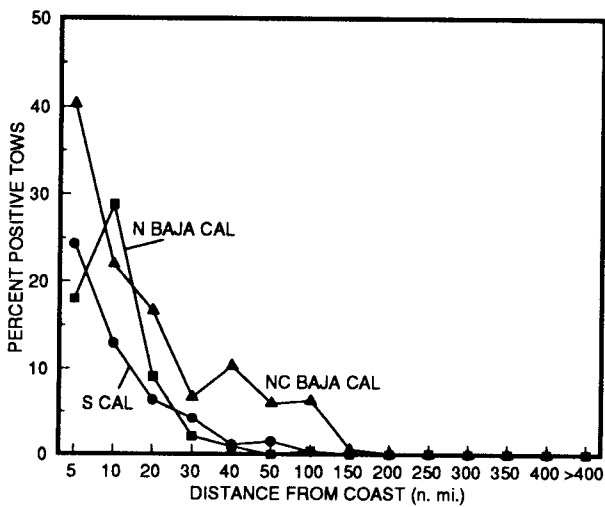
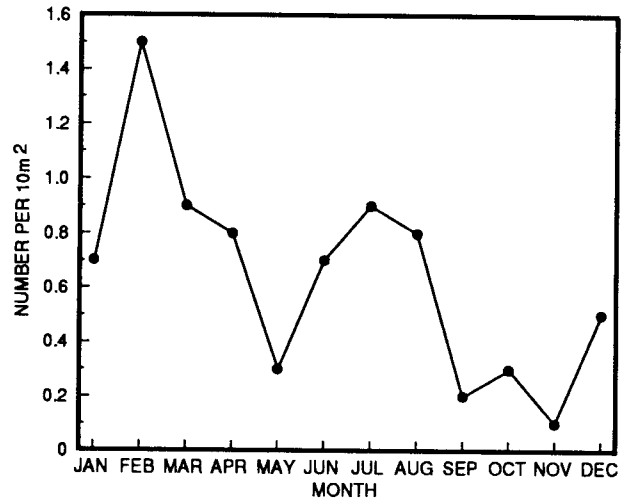
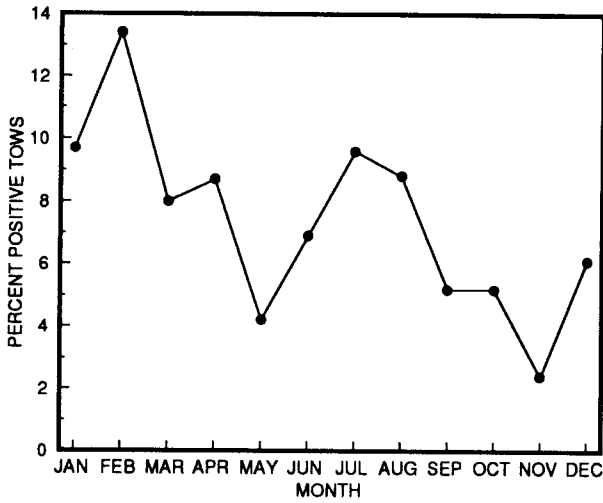
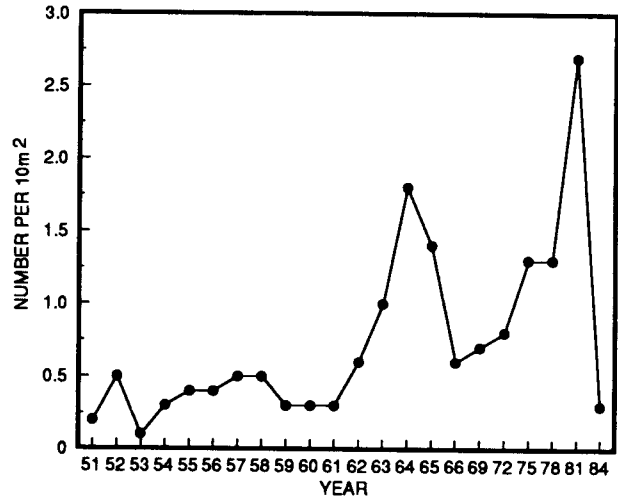
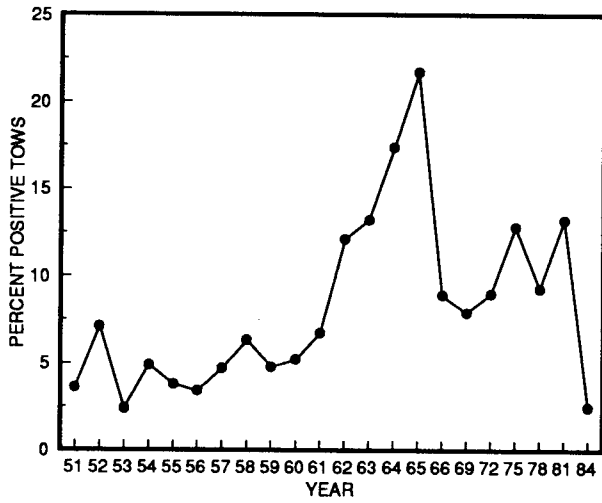
Paralichthys californicus

Paralichthyidae



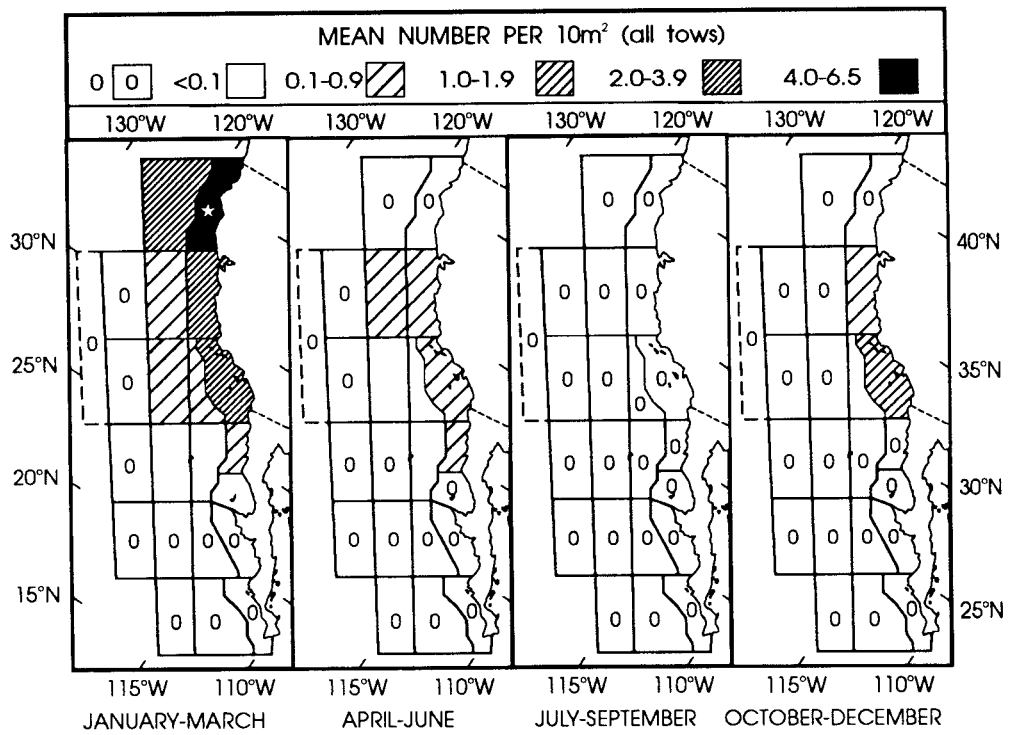
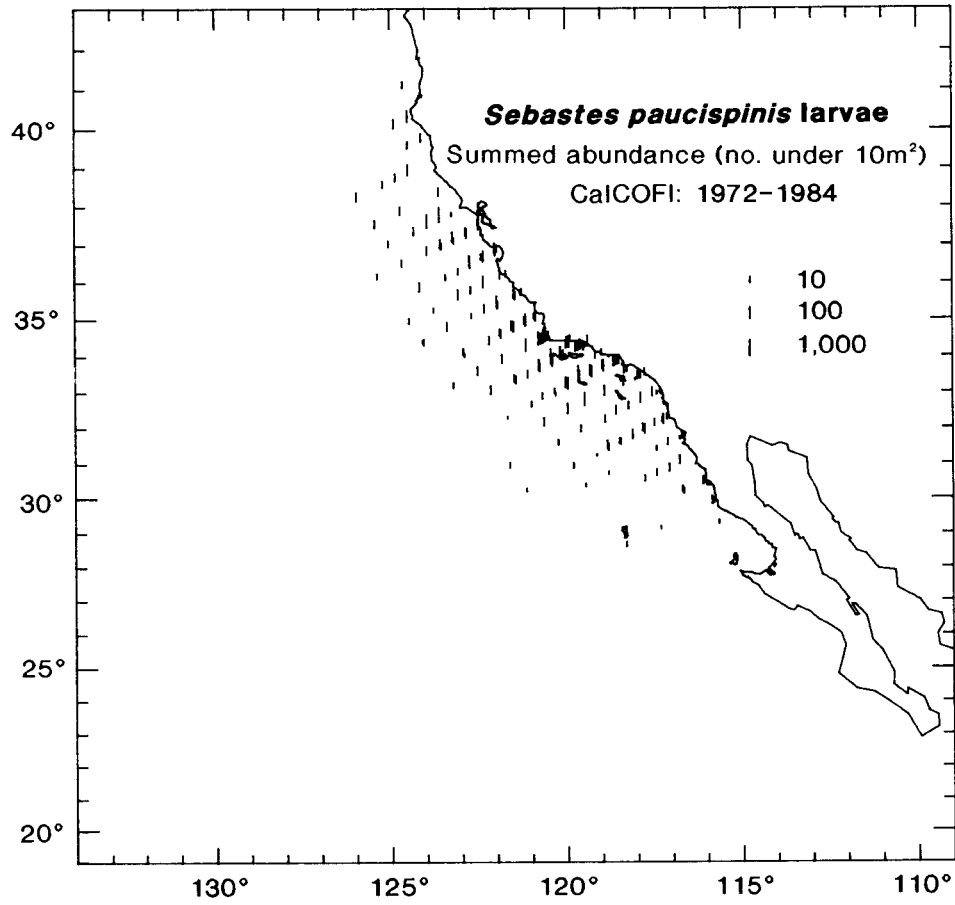
California halibut

Paralichthys californicus

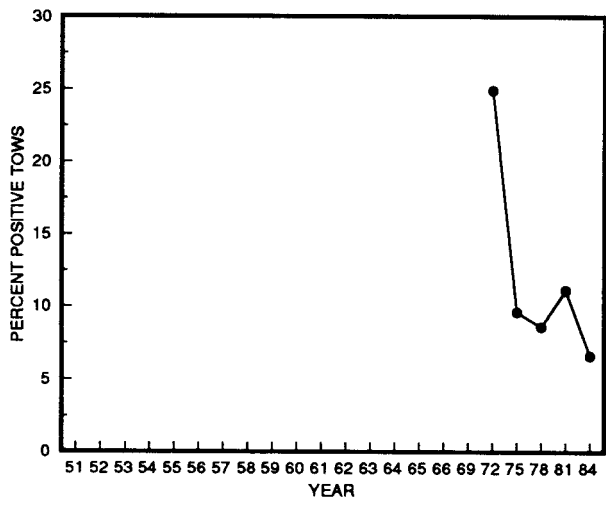


Sebastes paucispinis

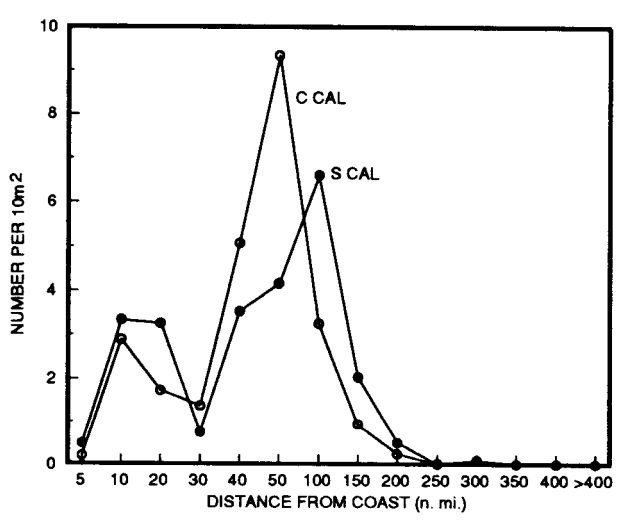
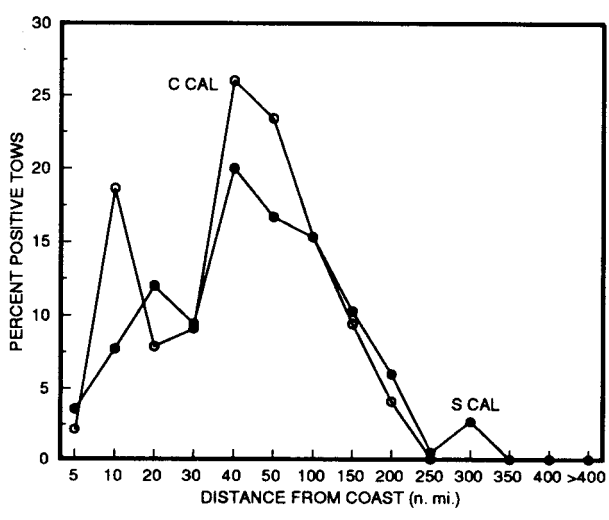
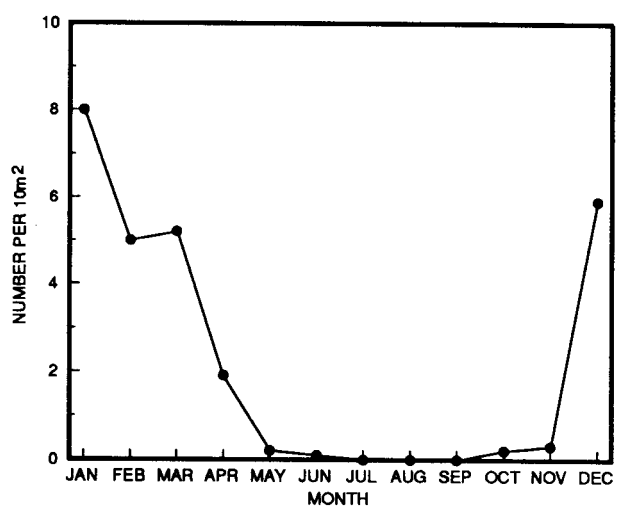
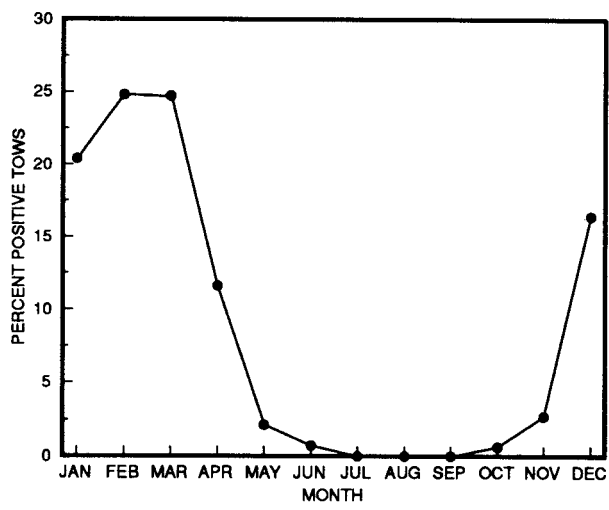
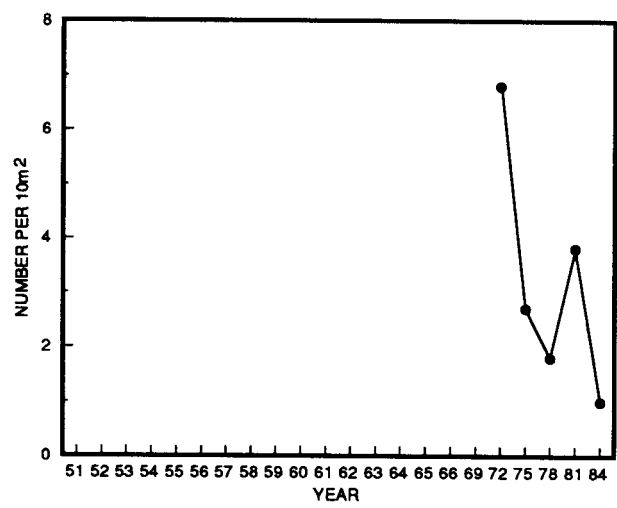
Scorpaenidae



Bocaccio

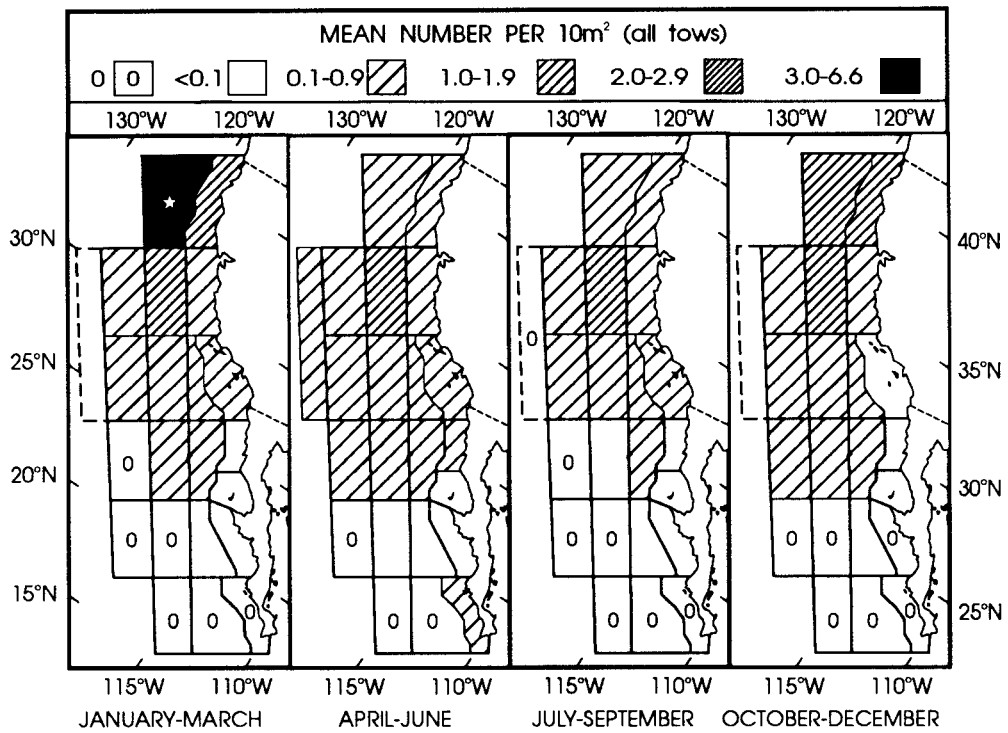
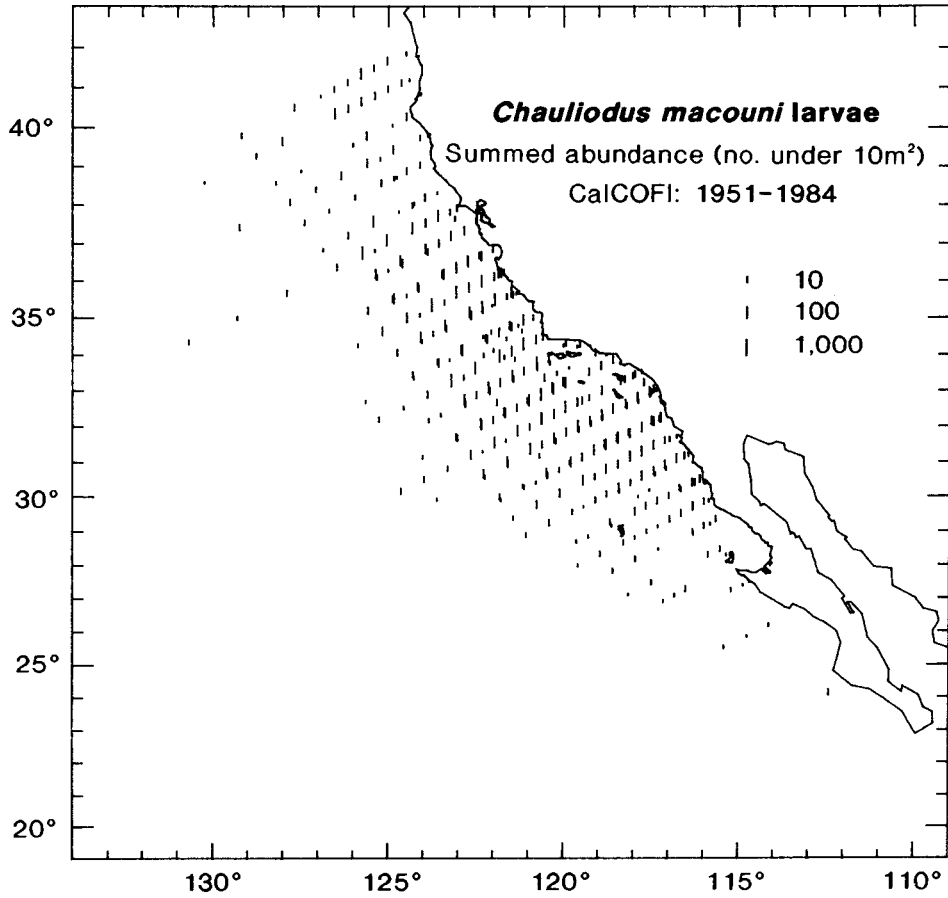


Sebastes paucispinis

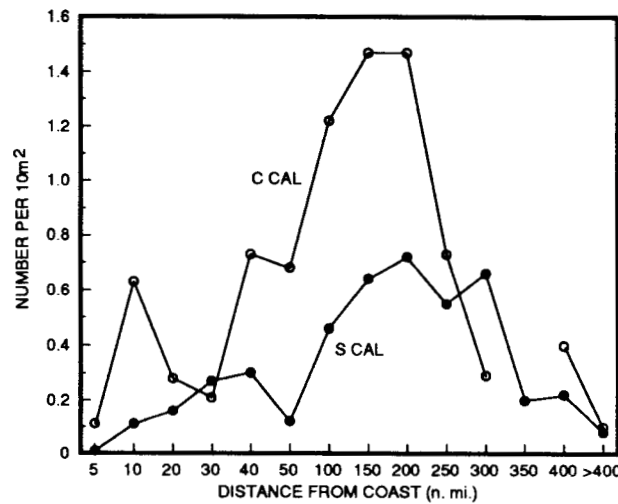
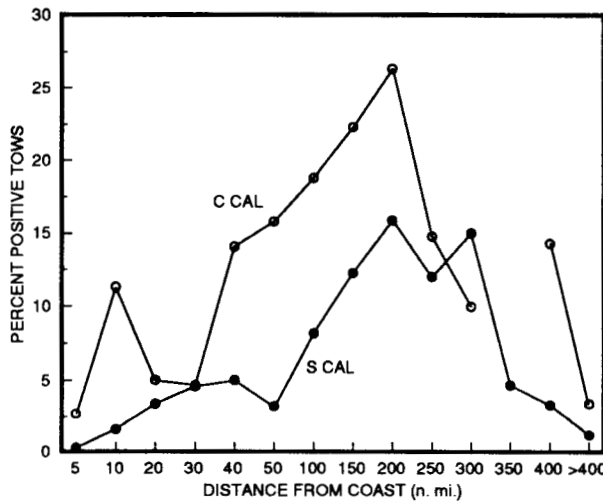
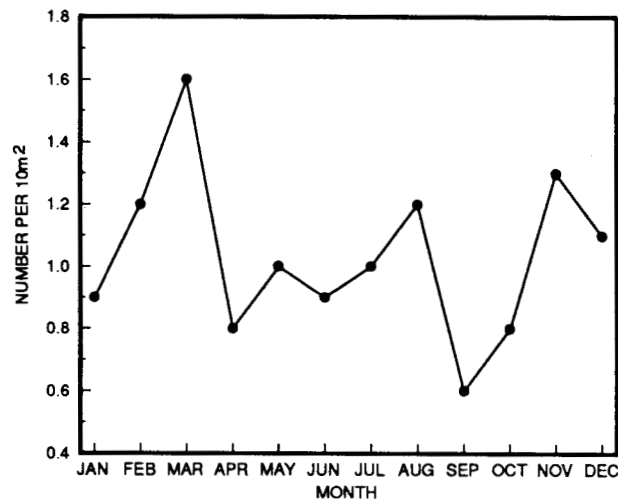
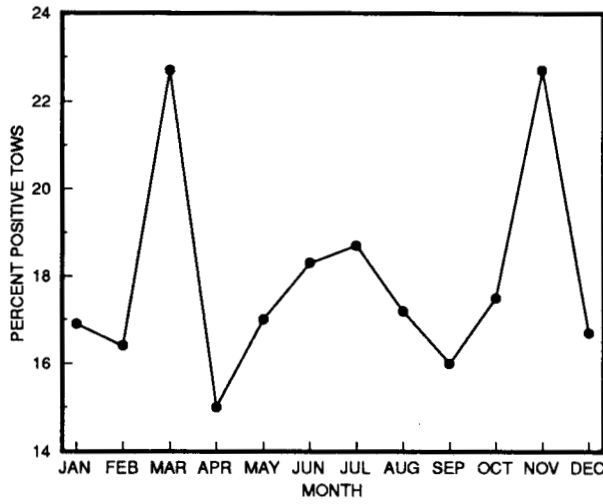
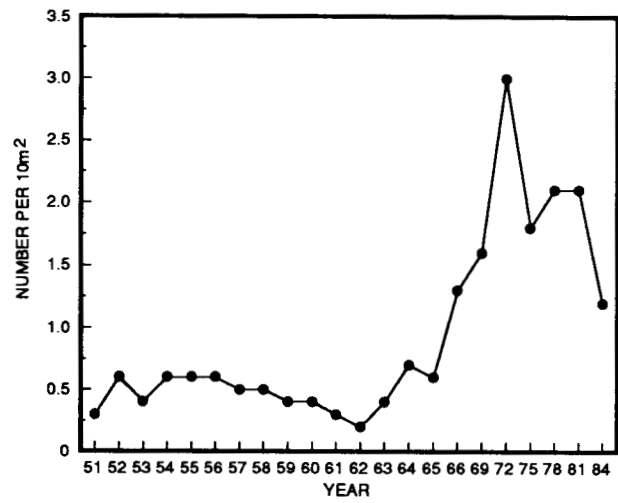
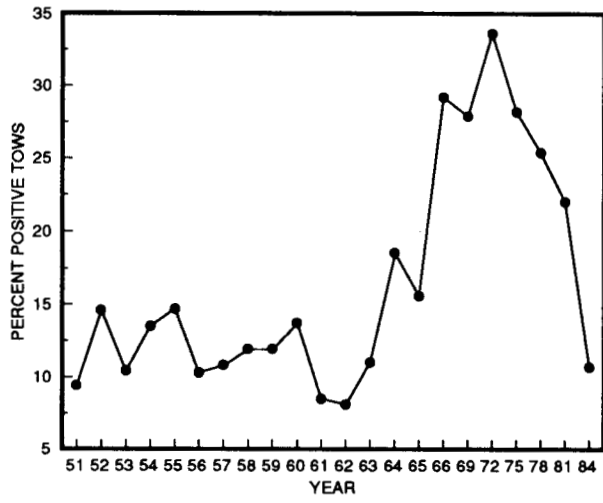


Chauliodus macouni

Chauliodontidae

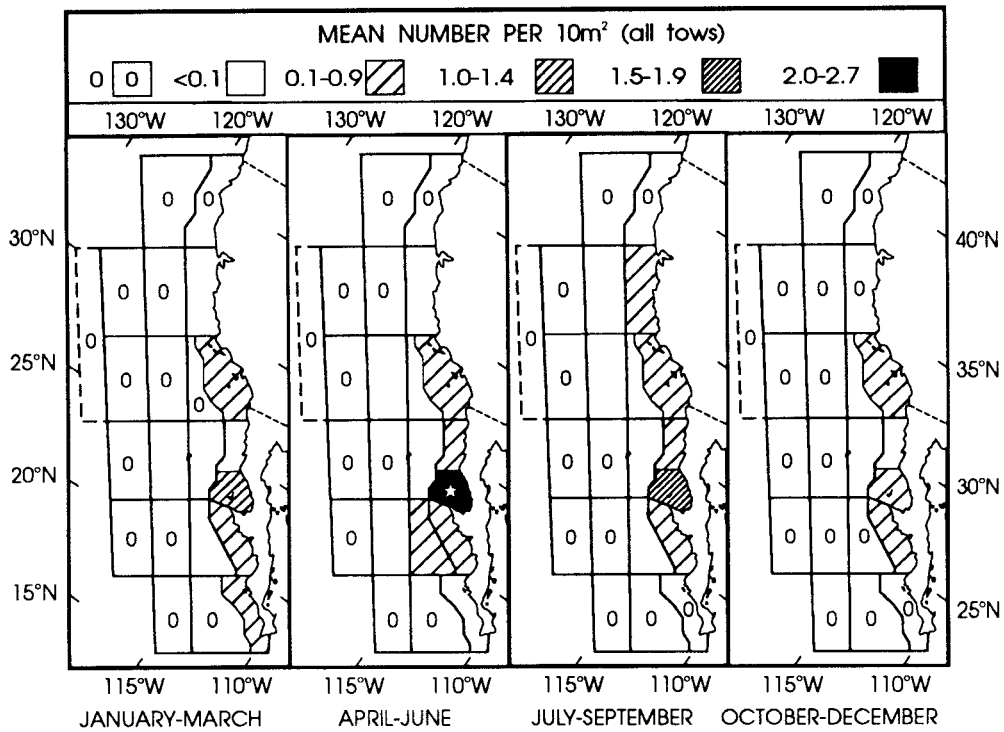
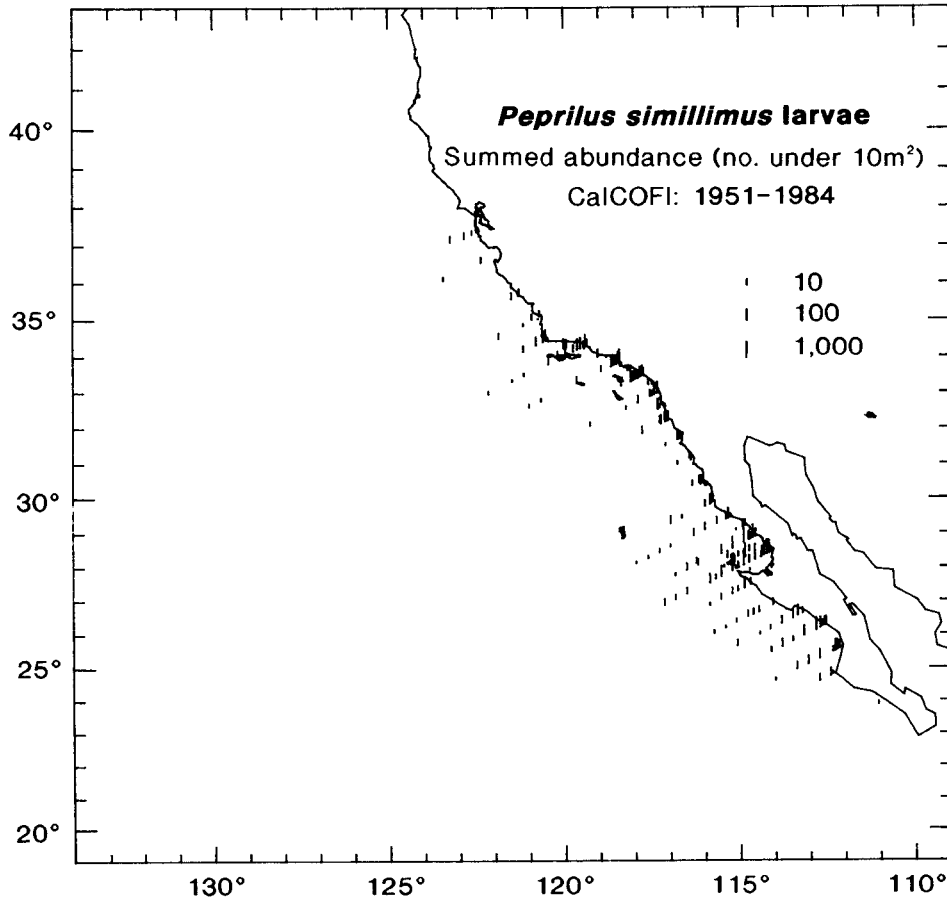


Pacific viperfish



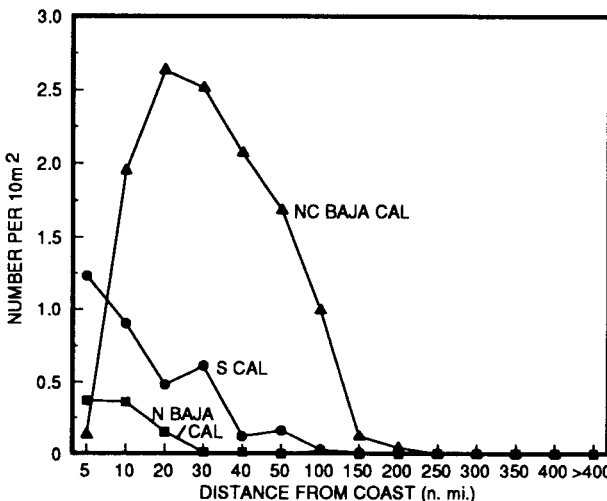
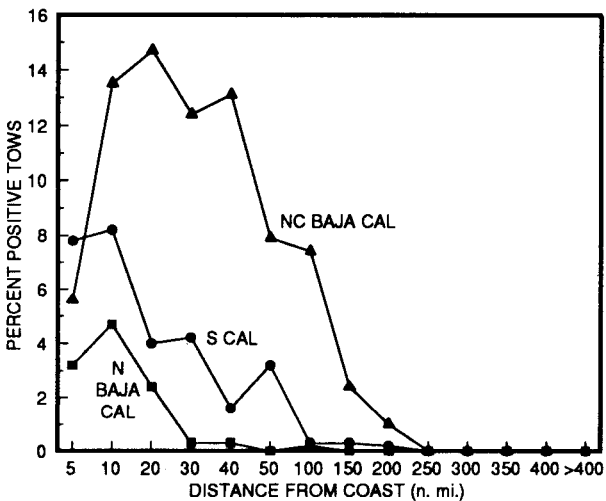
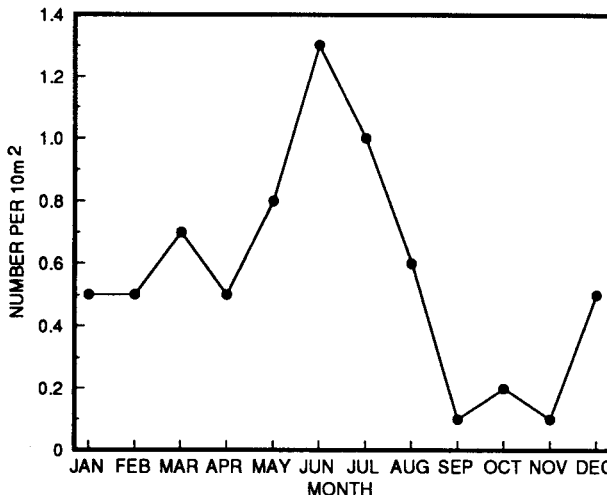
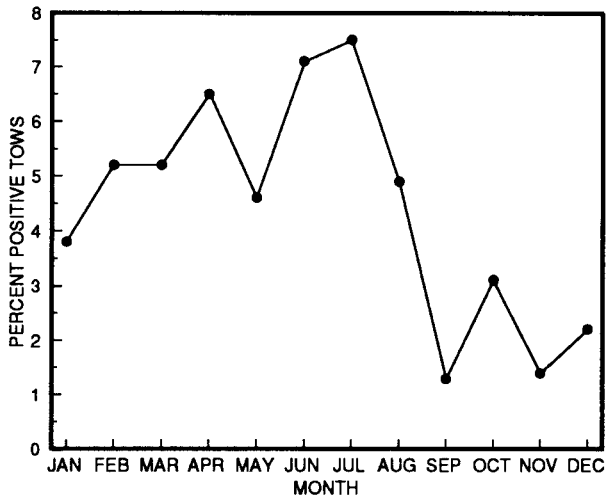
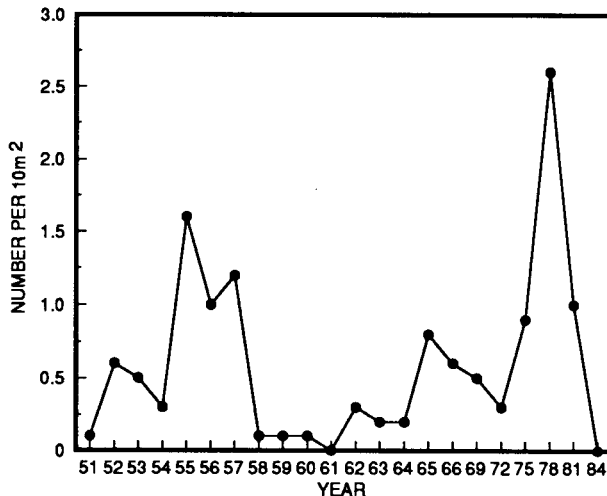
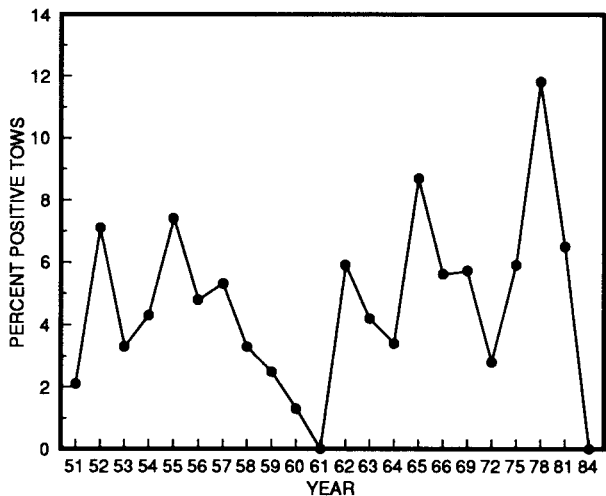
Peprilus simillimus

Stromateidae



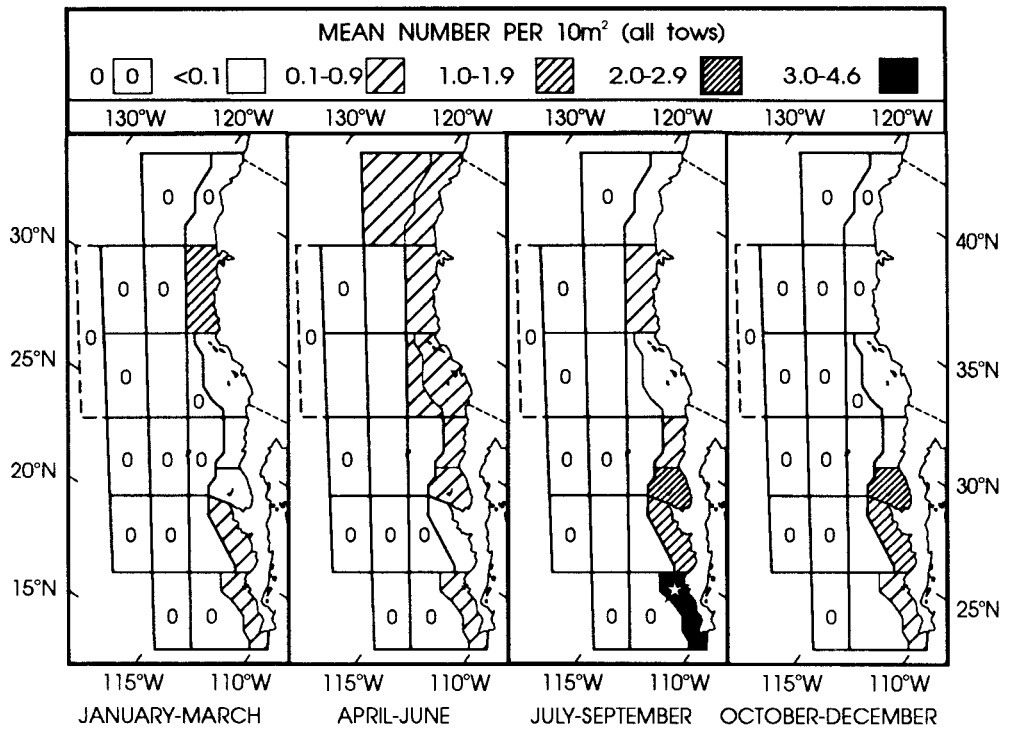
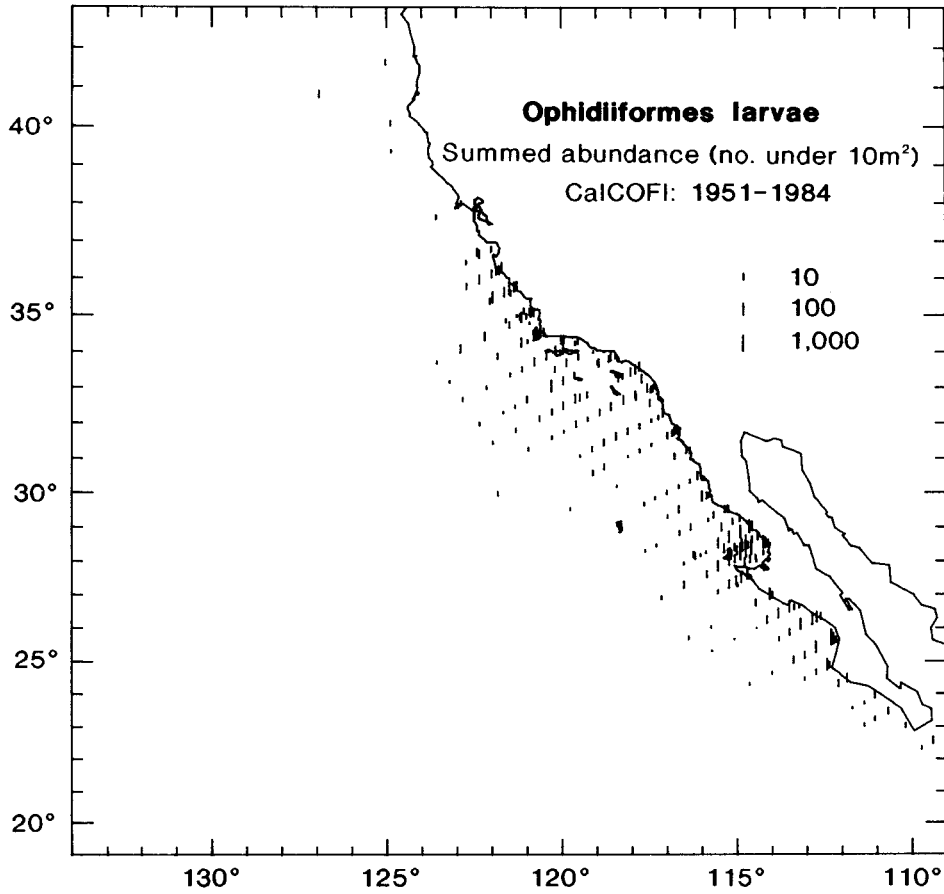
Pacific Butterfish

Peprilus simillimus



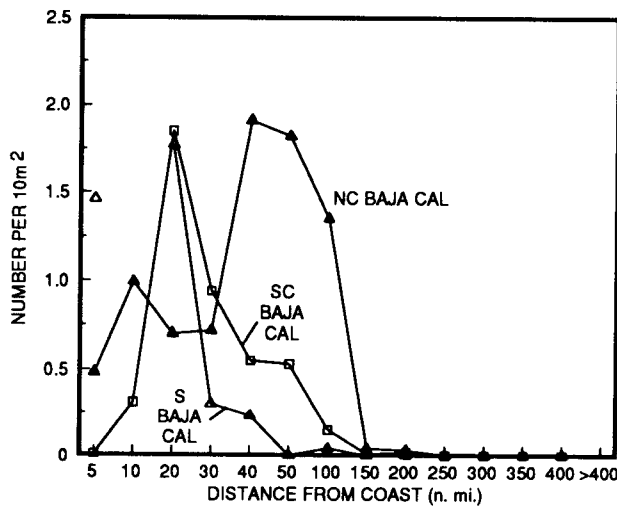
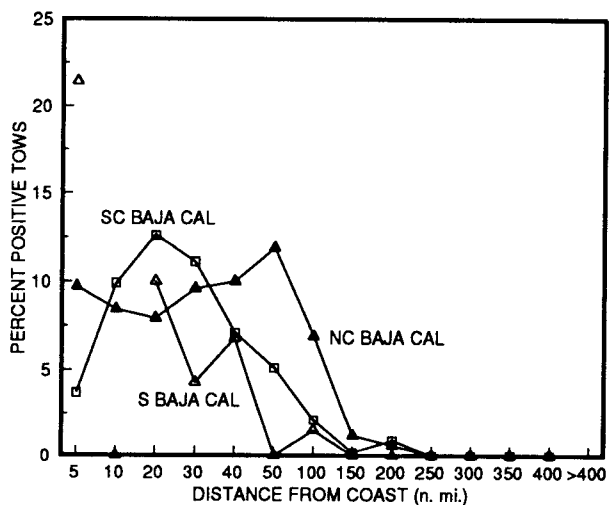
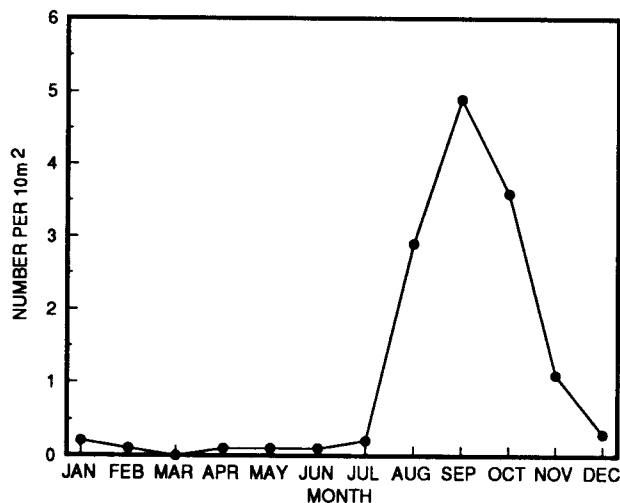
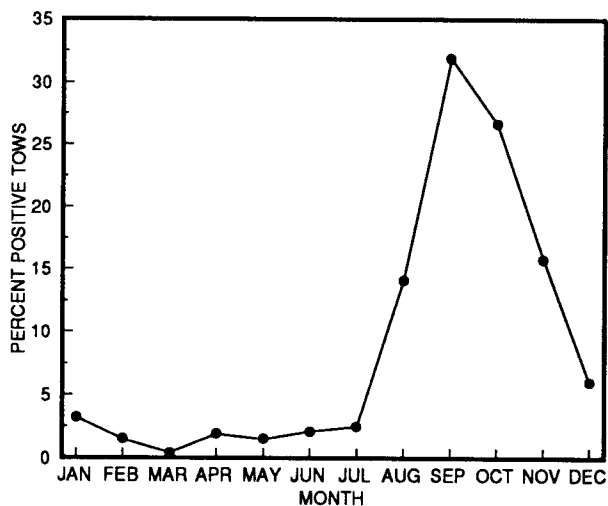
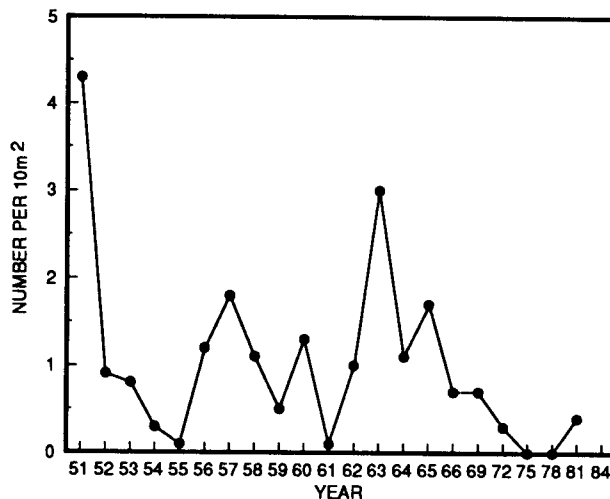
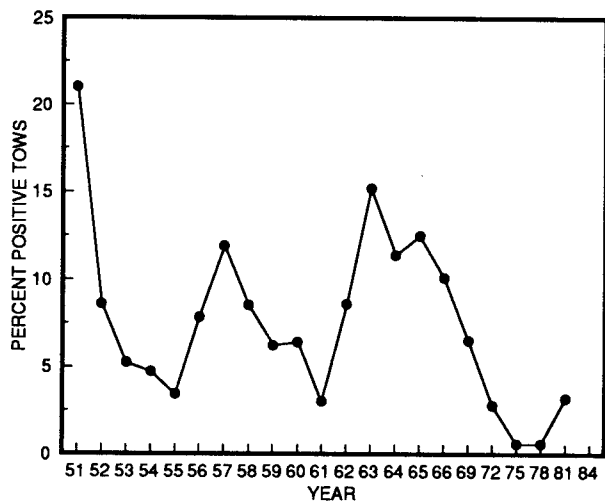
Ophidiiformes

Ophidiiformes



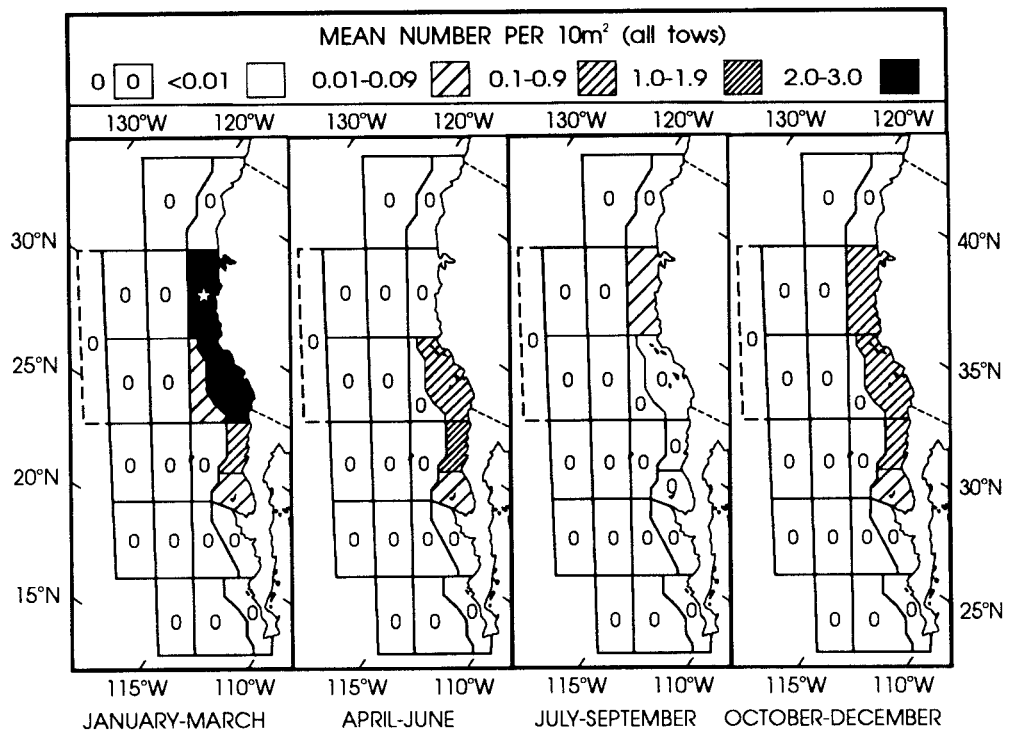
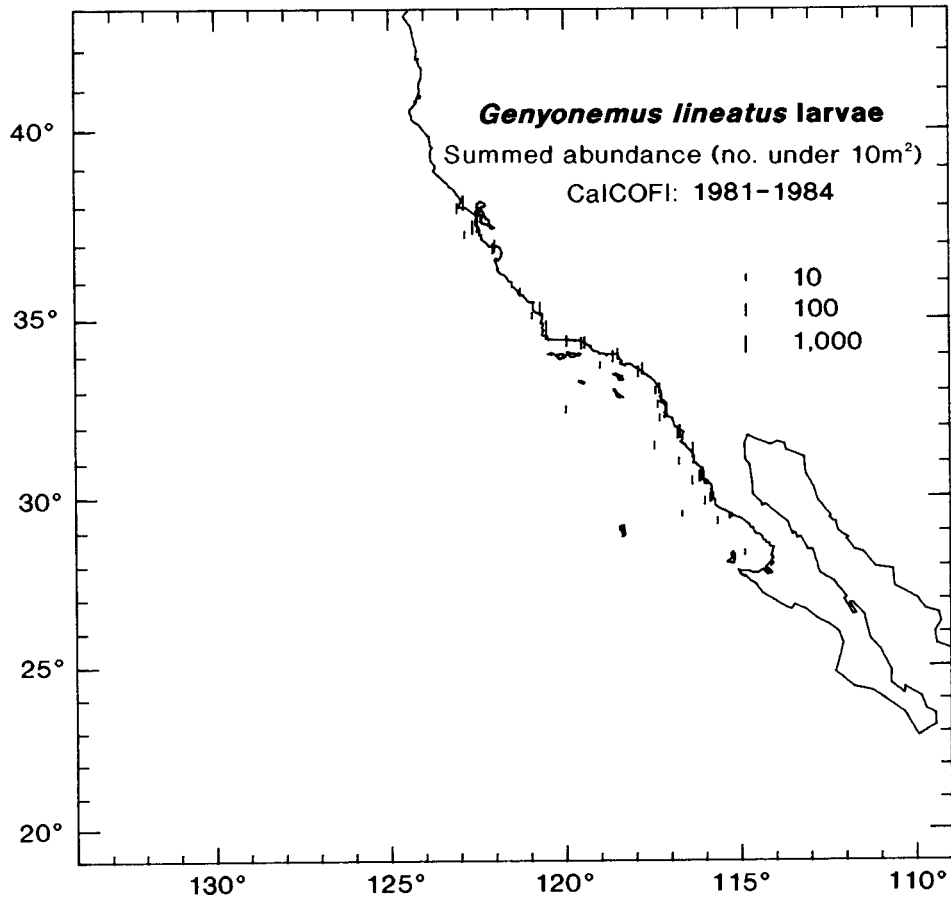
Cusk-eels

Ophidiiformes



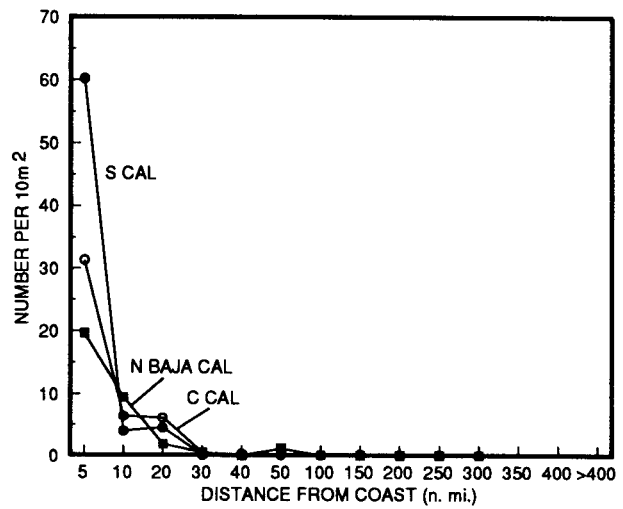
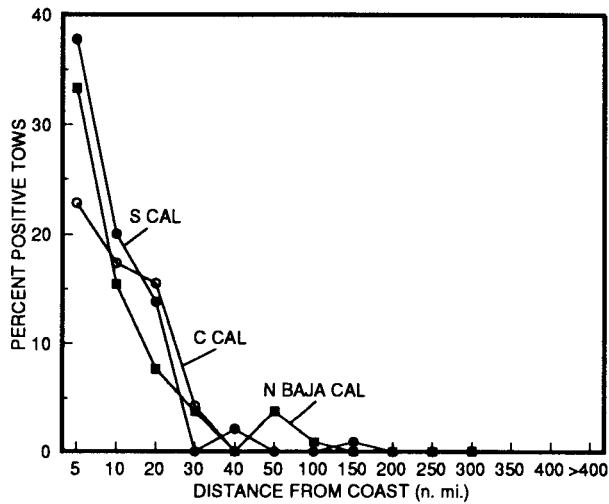
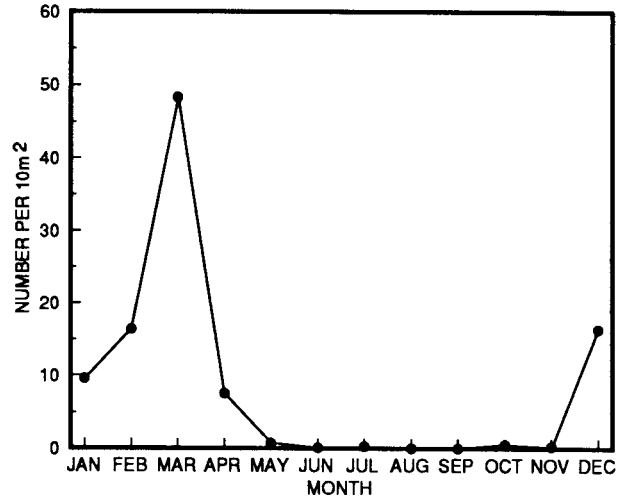
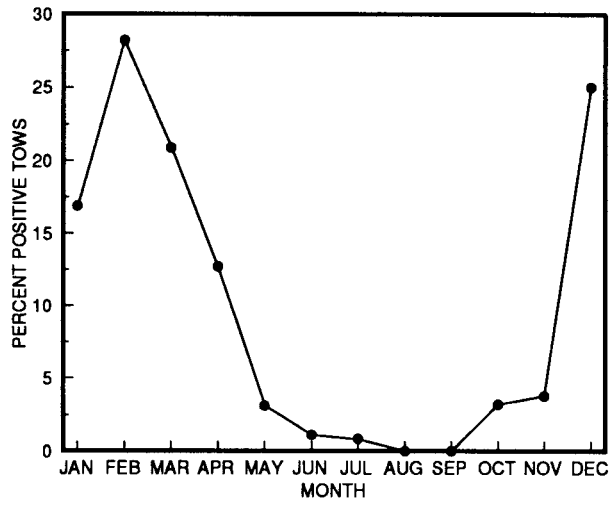
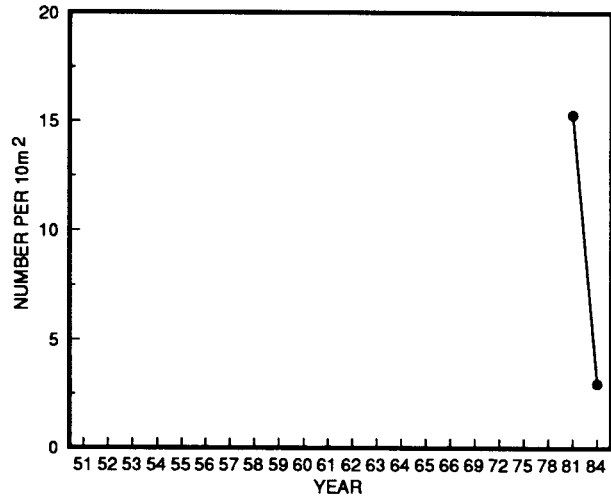
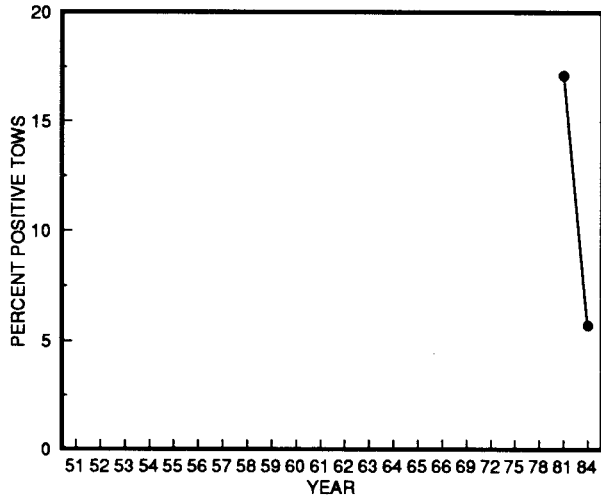
Genyonemus lineatus

Sciaenidae



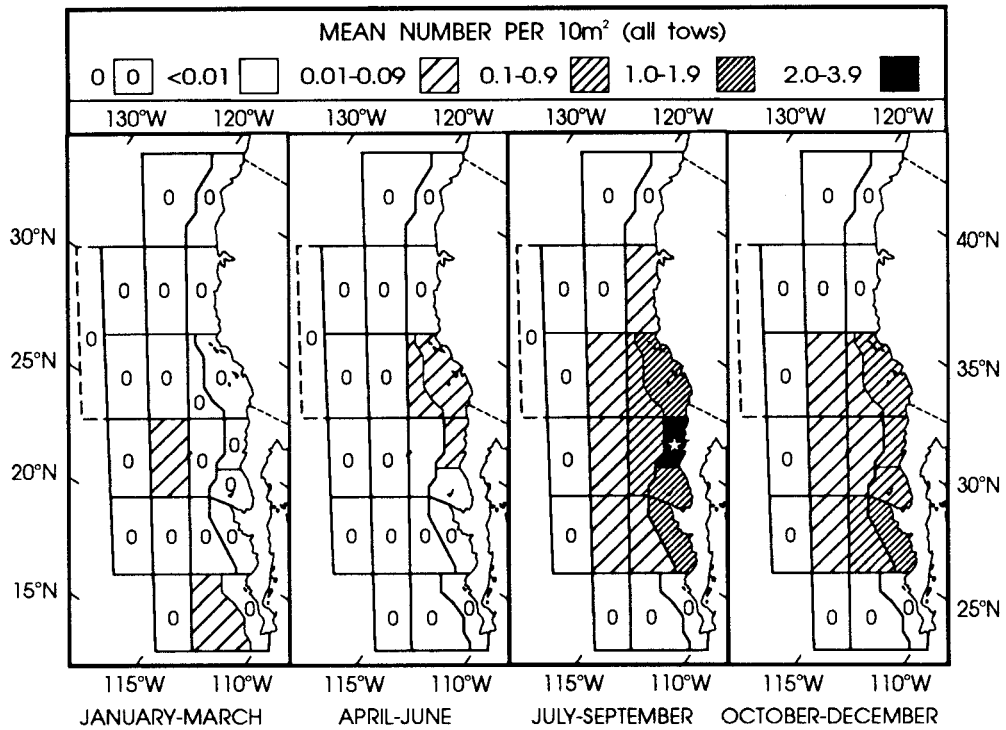
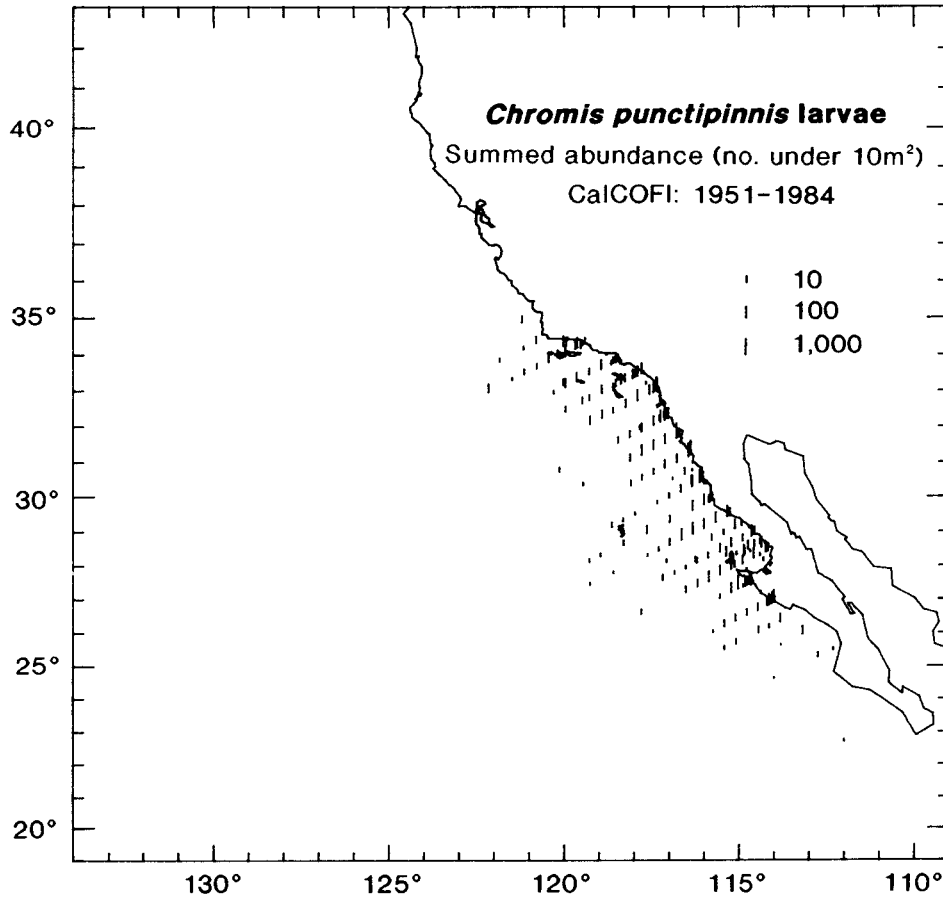
White croaker

Genyonemus lineatus

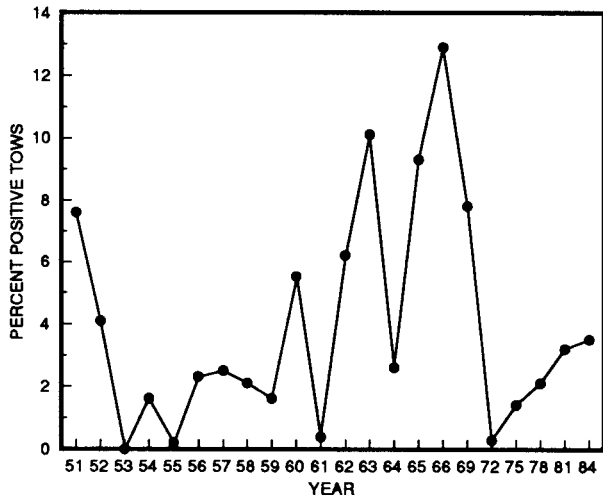


Chromis punctipinnis

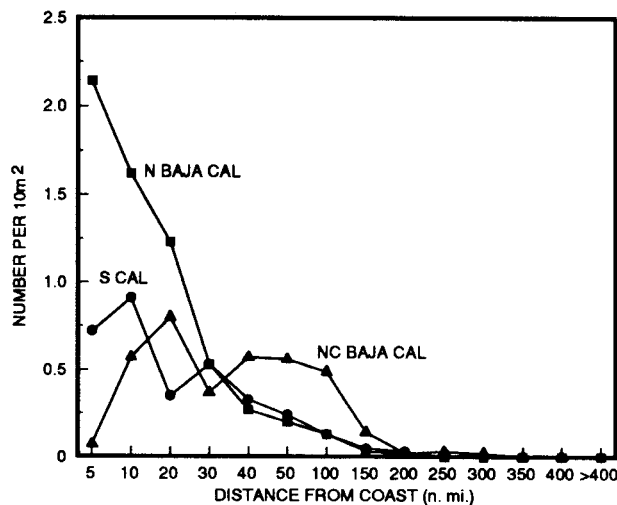
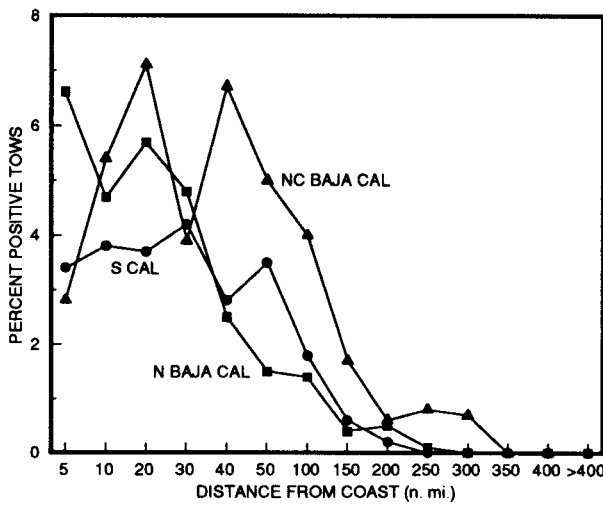
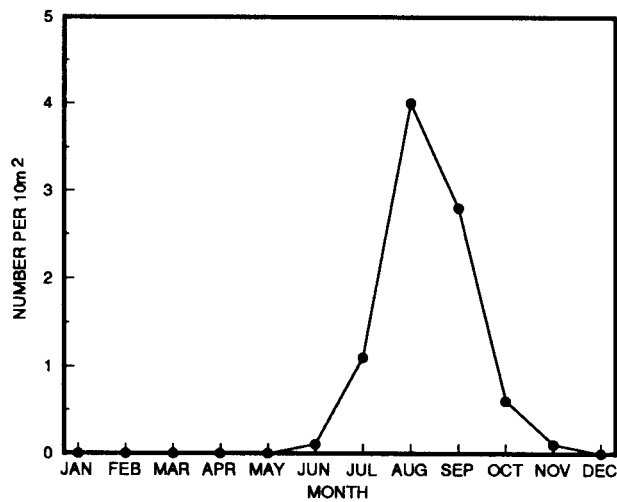
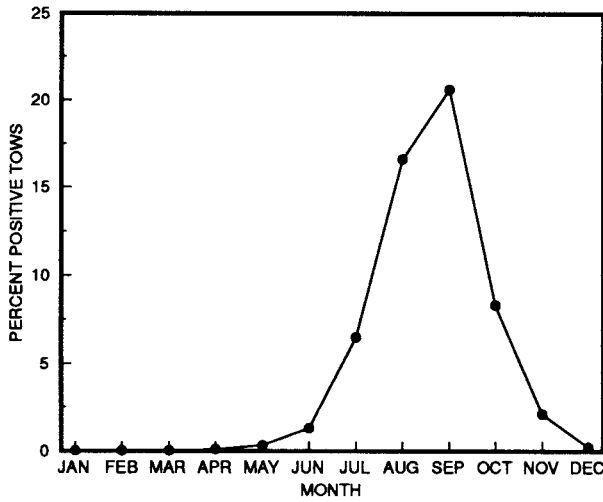
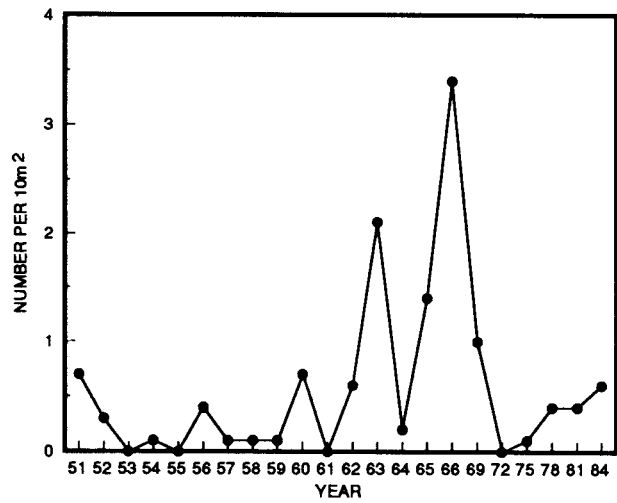
Pomacentridae



Blacksmith

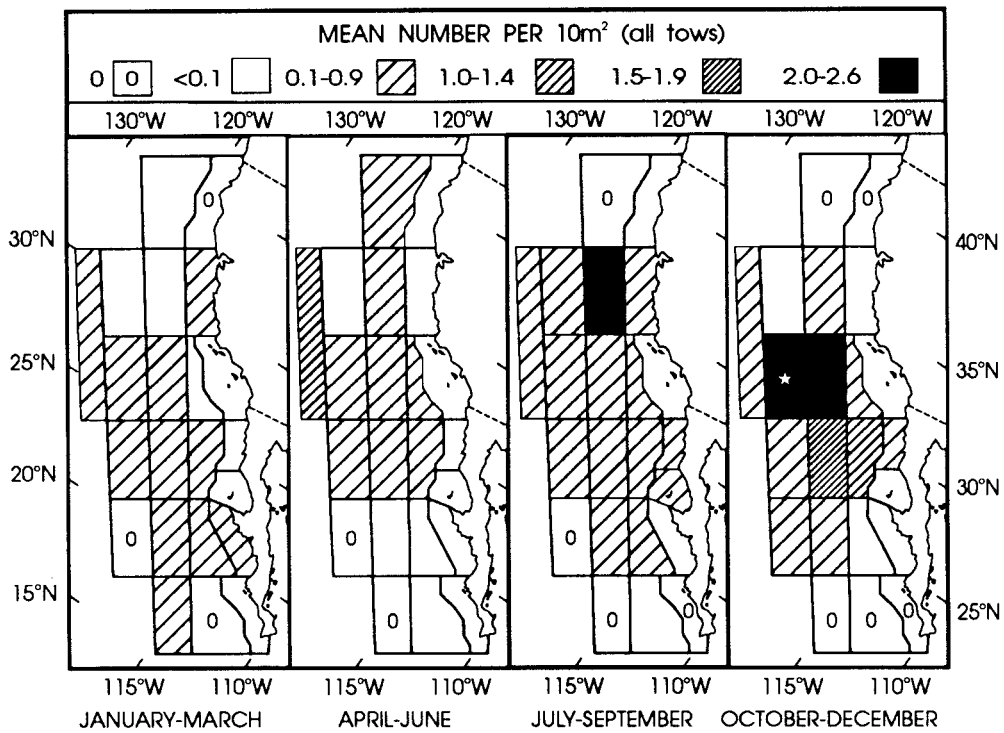
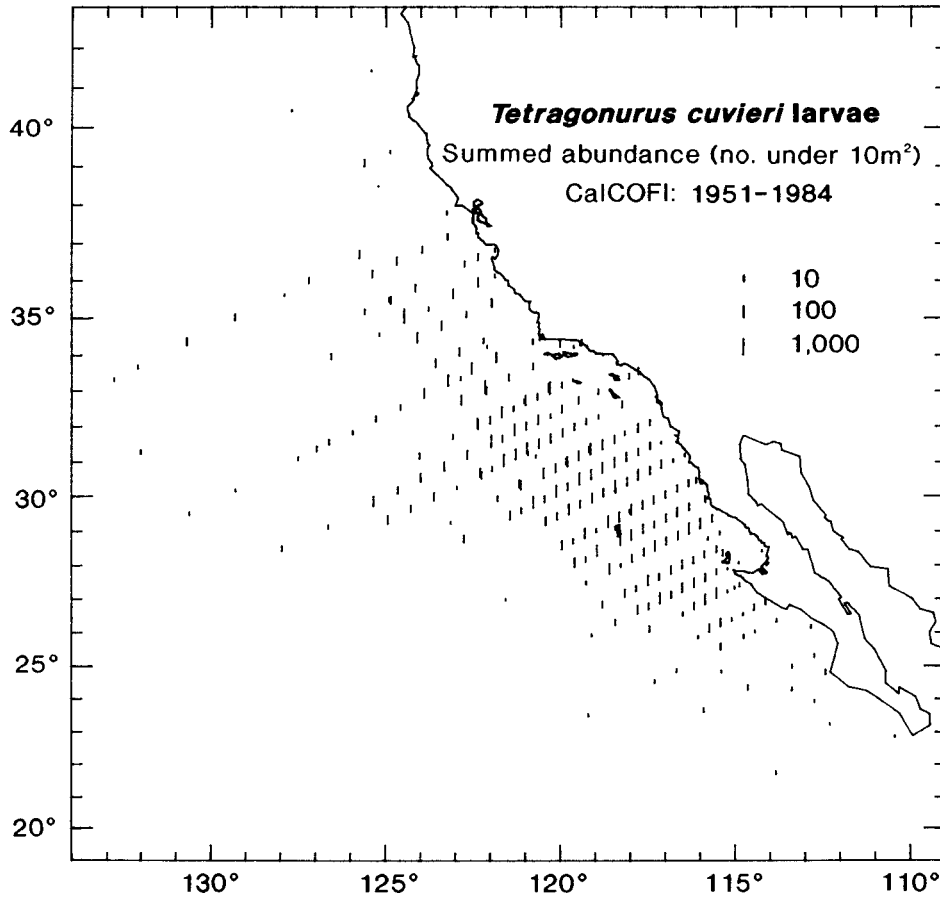


Chromis punctipinnis

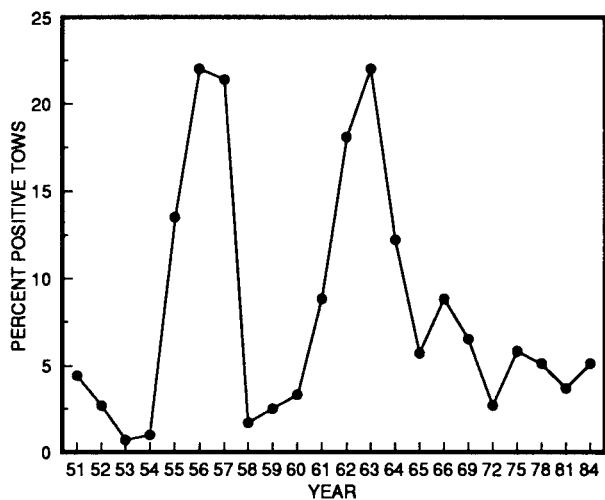


Tetragonurus cuvieri

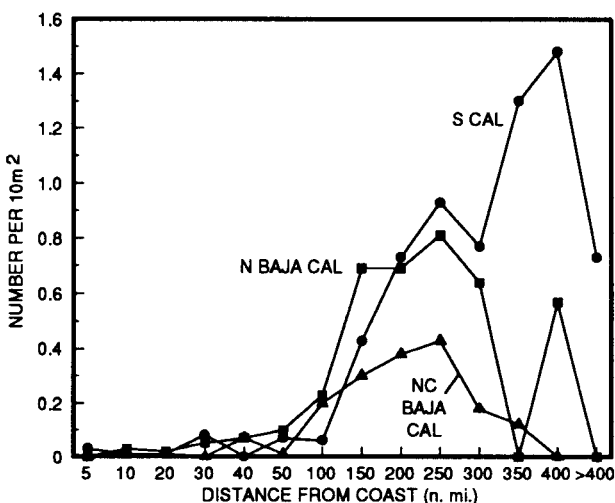
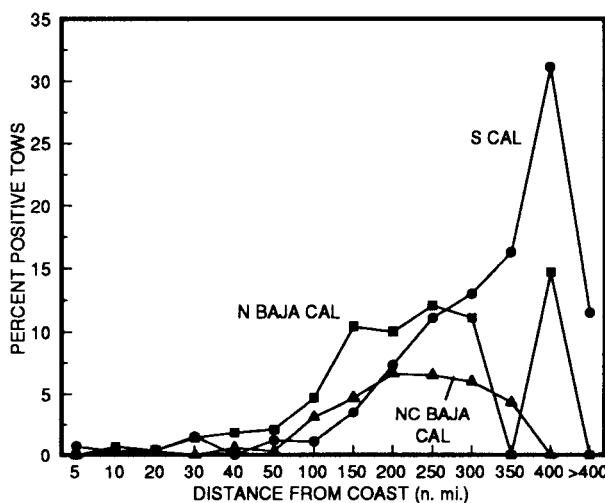
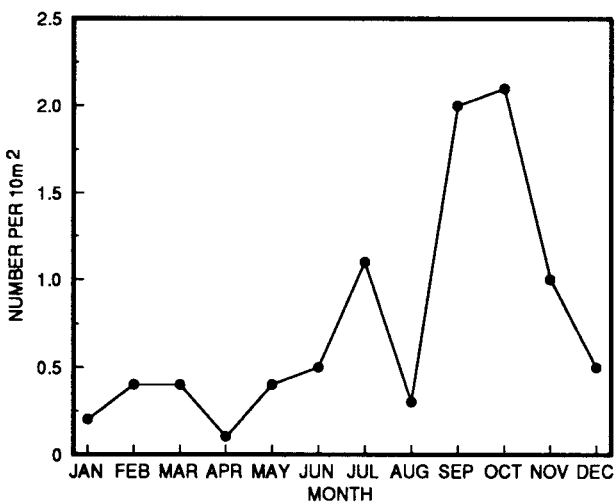
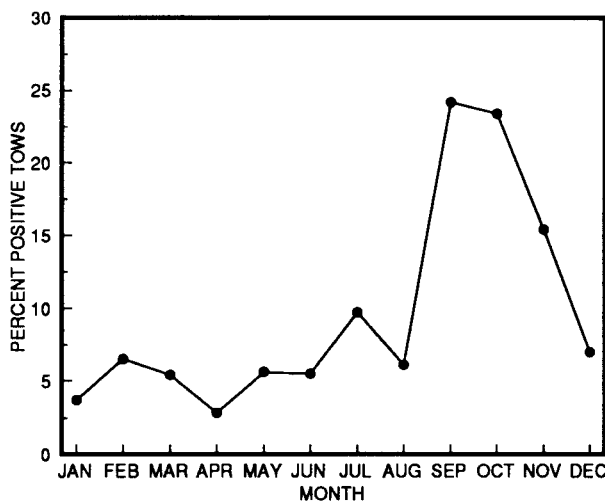
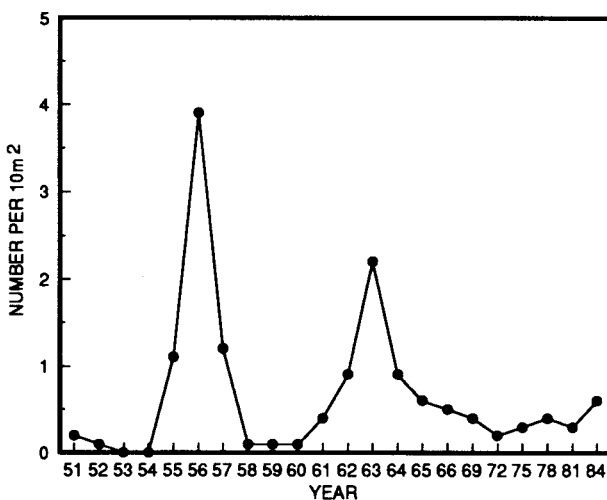
Tetragonuridae



Smalleye squaretail

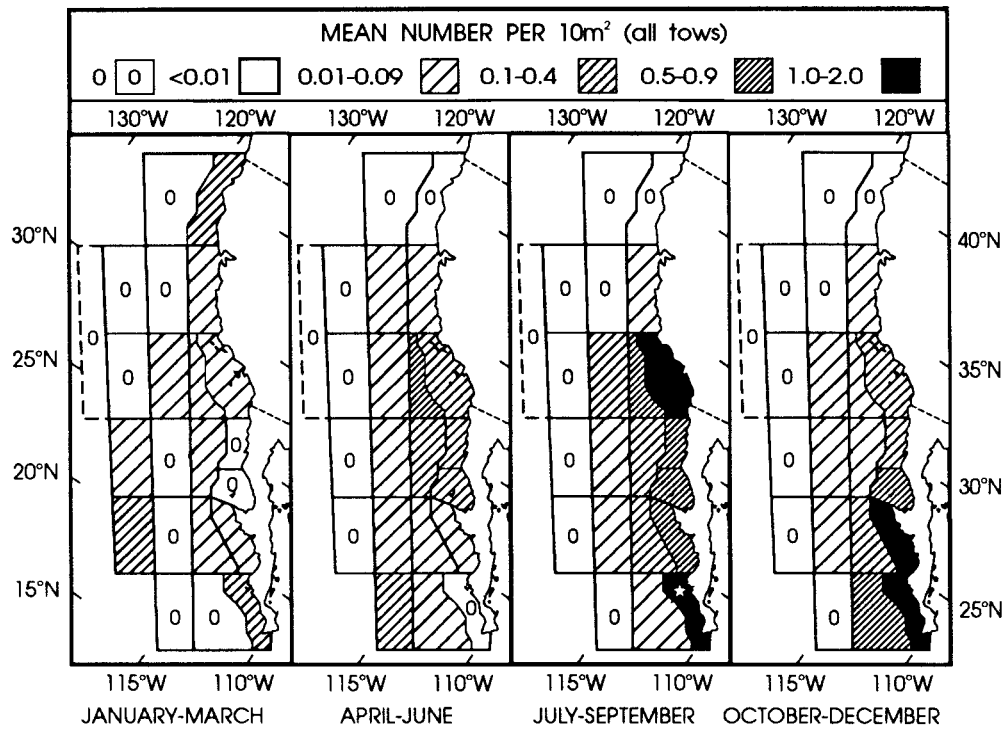
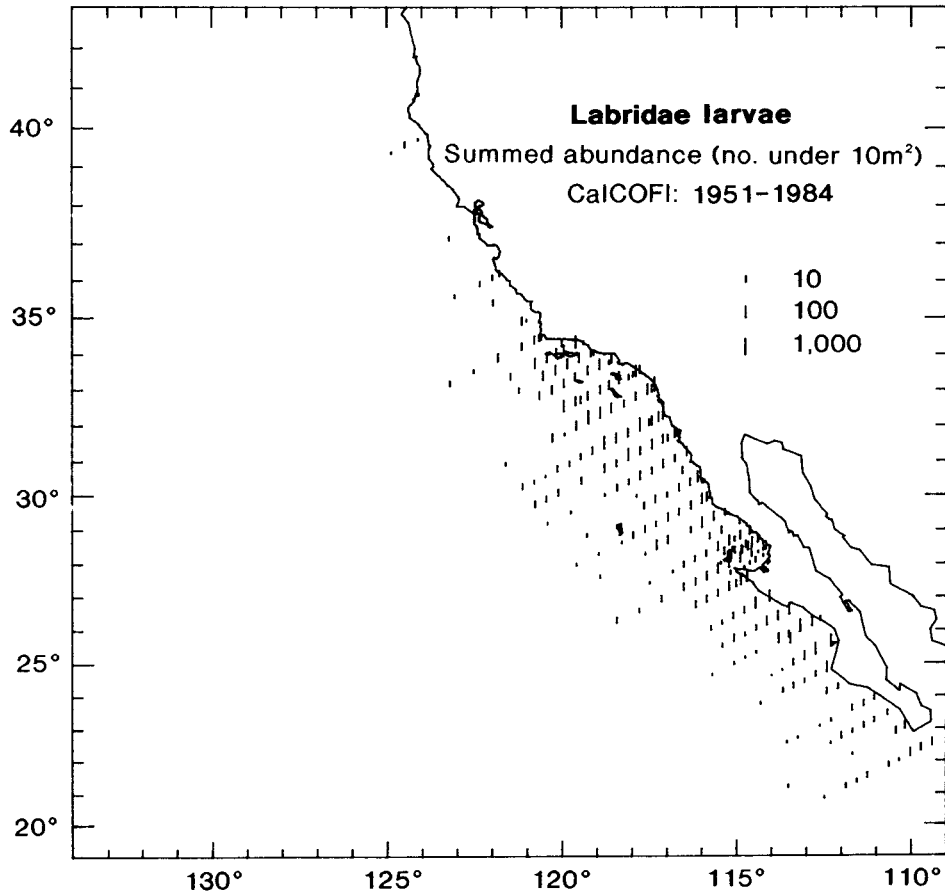


Tetragonurus cuvieri

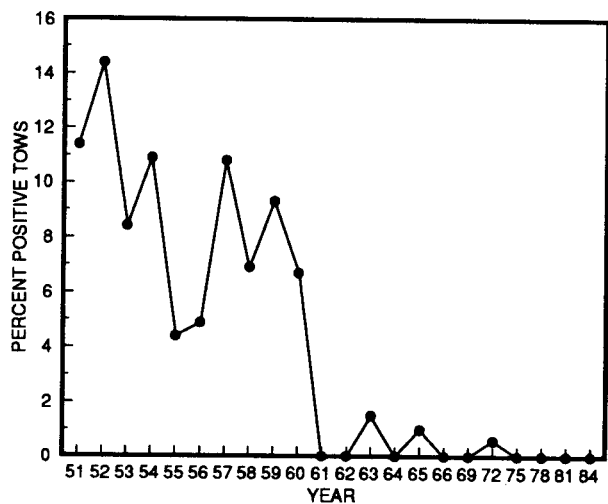


Labridae

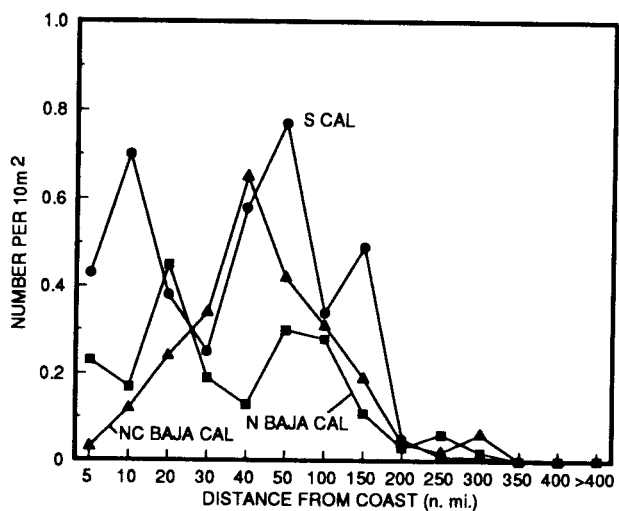
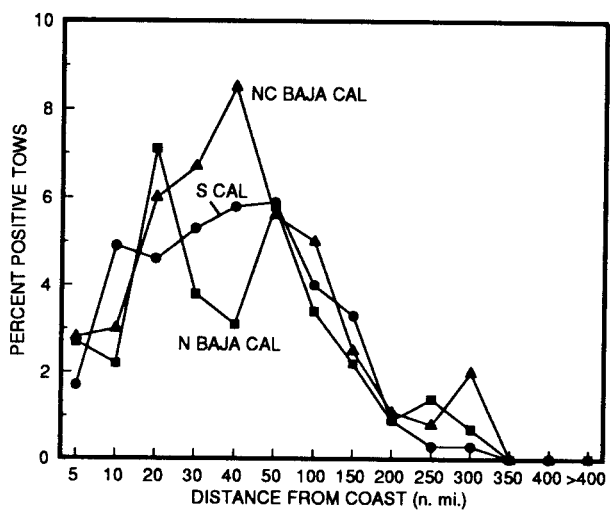
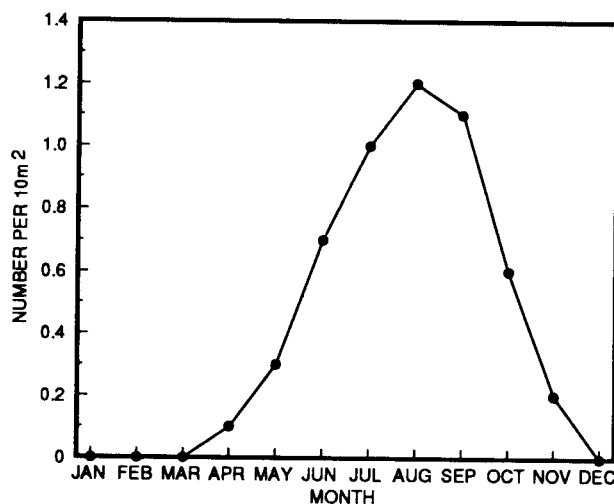
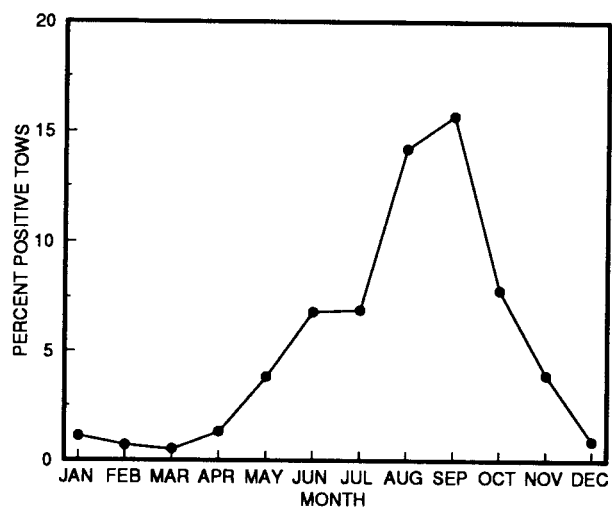
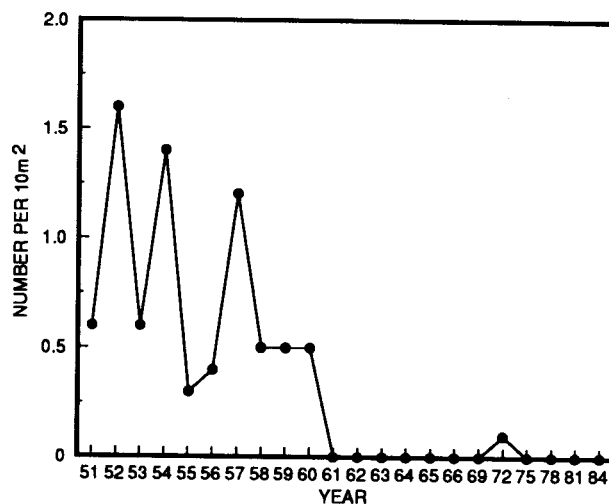
Labridae



Wrasses

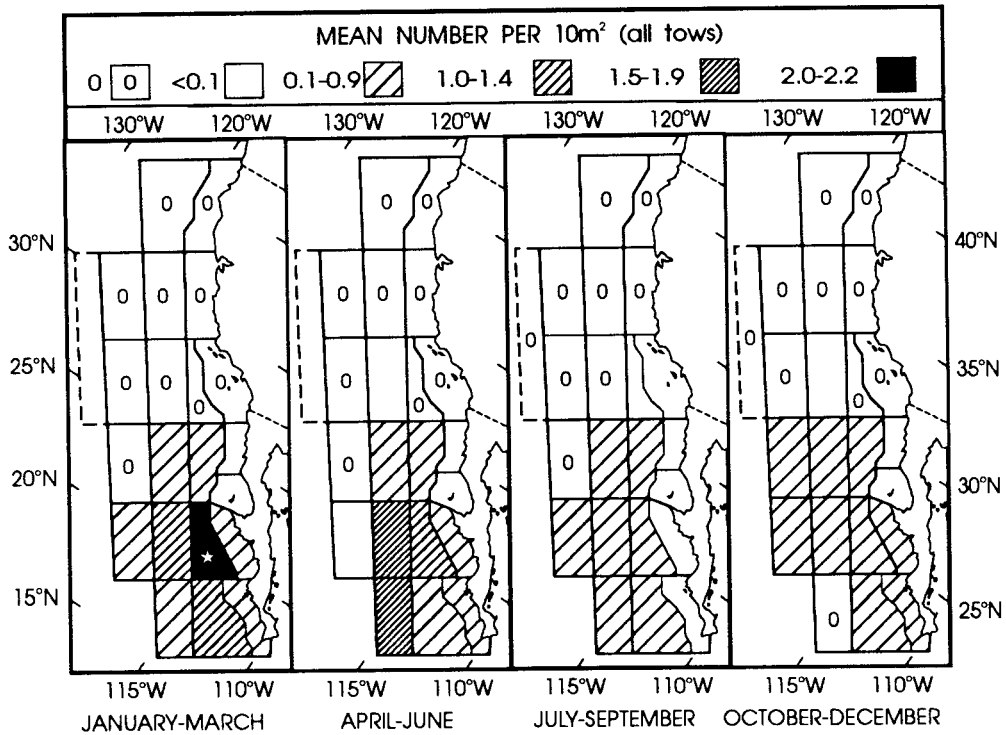
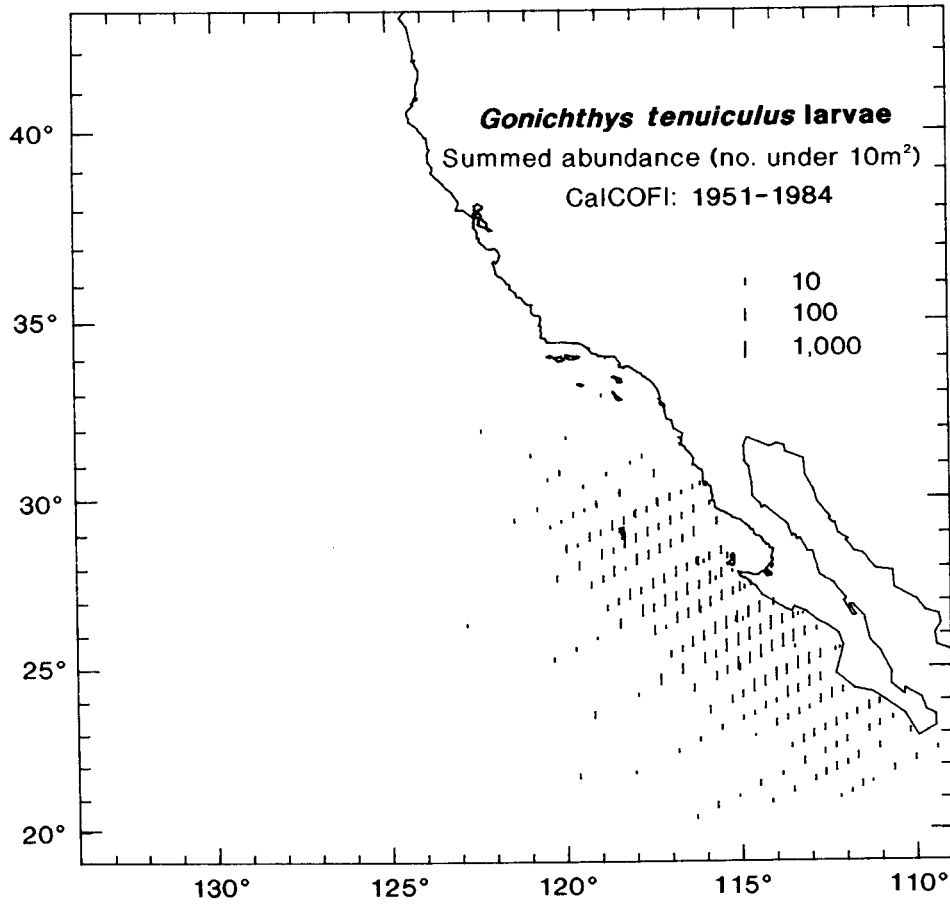


Labridae



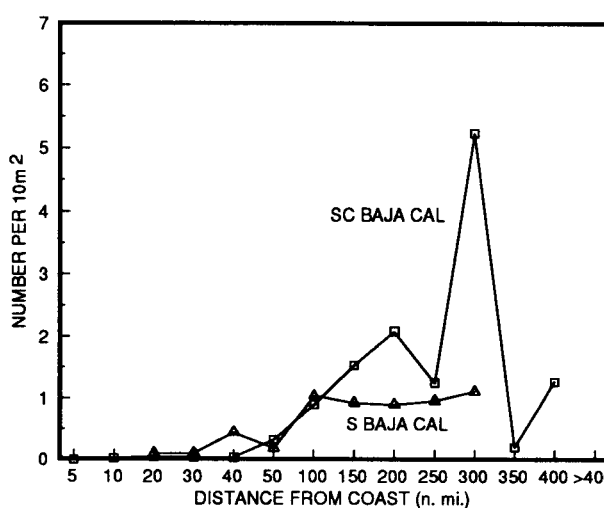
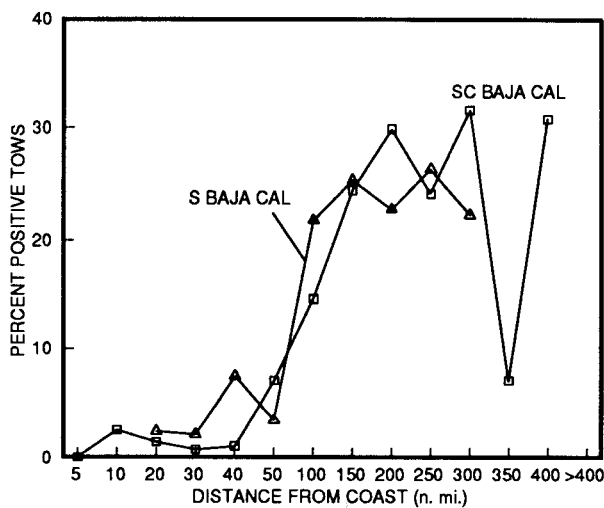
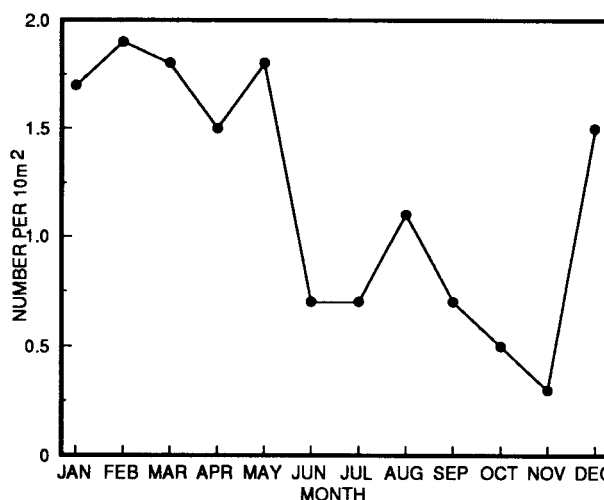
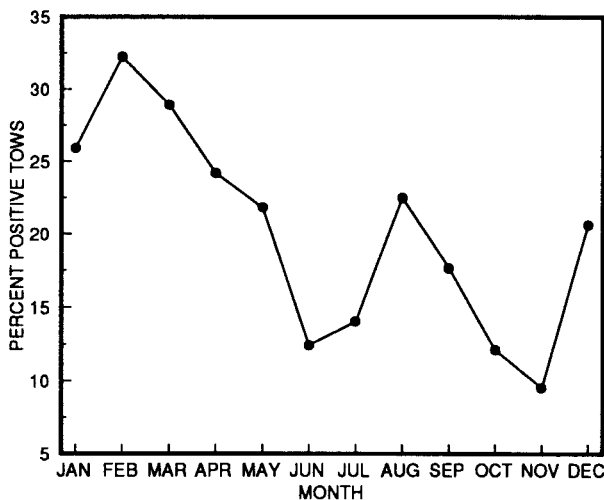
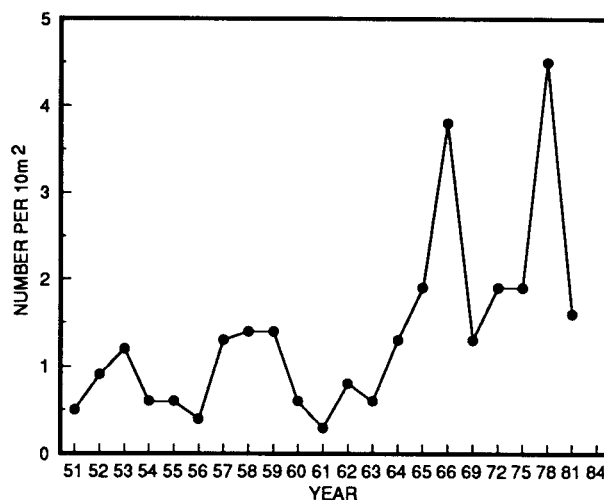
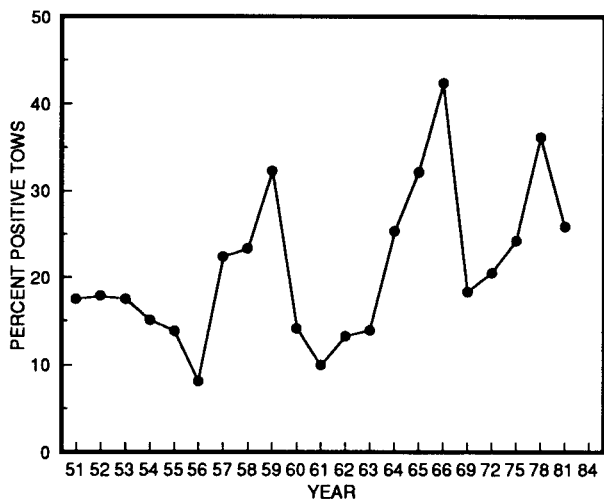
Gonichthys tenuiculus

Myctophidae



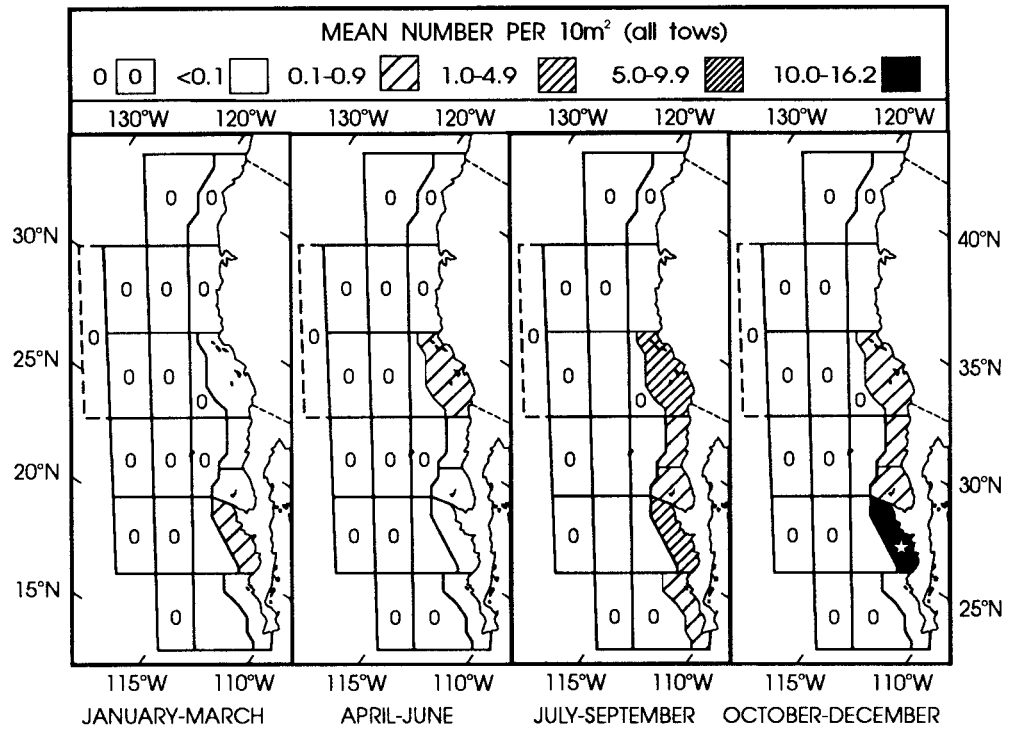
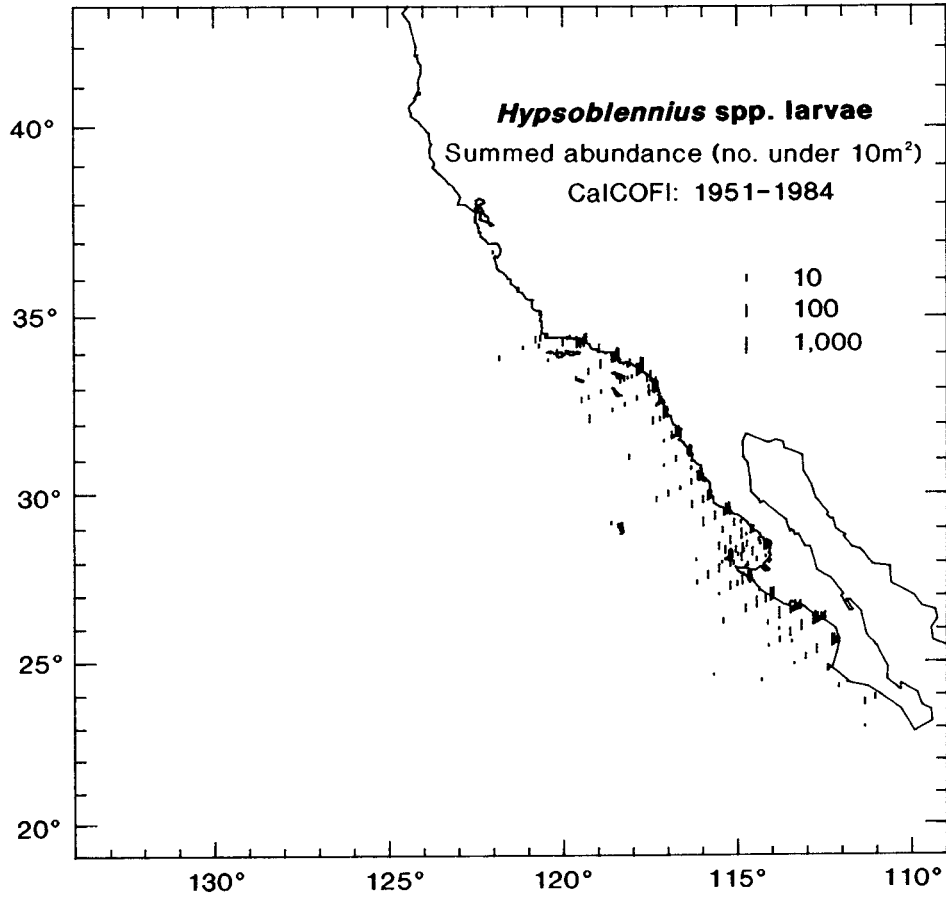
Slendertail lanternfish

Gonichthys tenuiculus

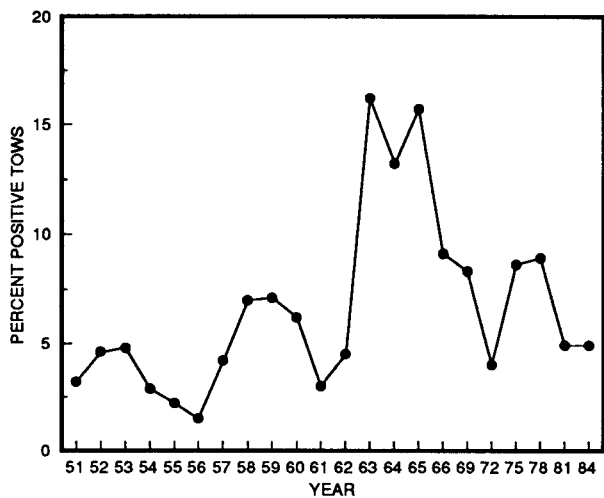


Hypsoblennius spp.

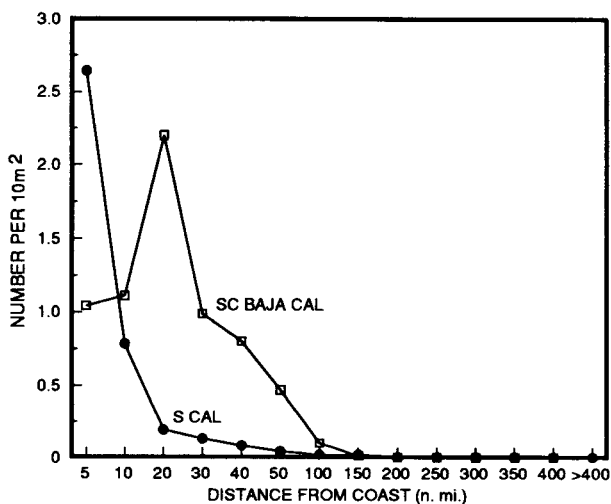
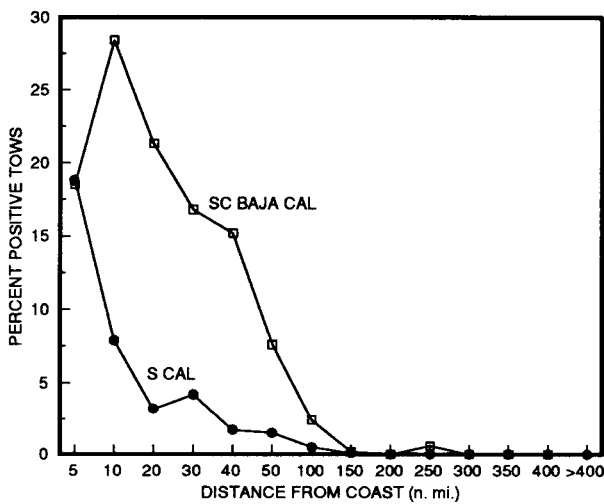
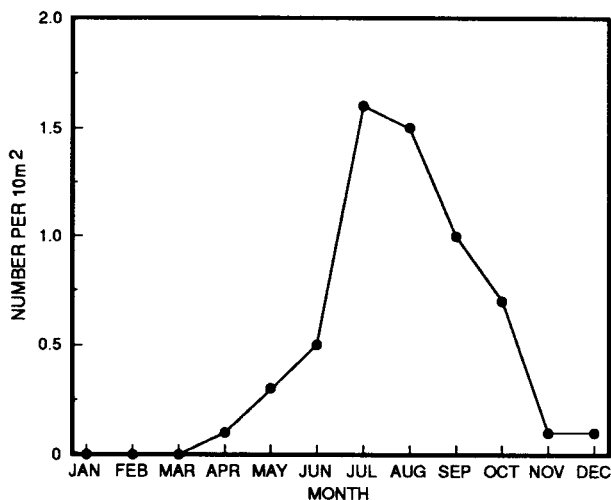
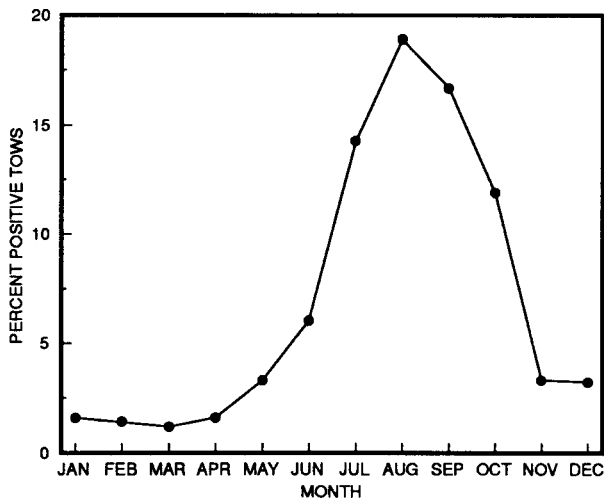
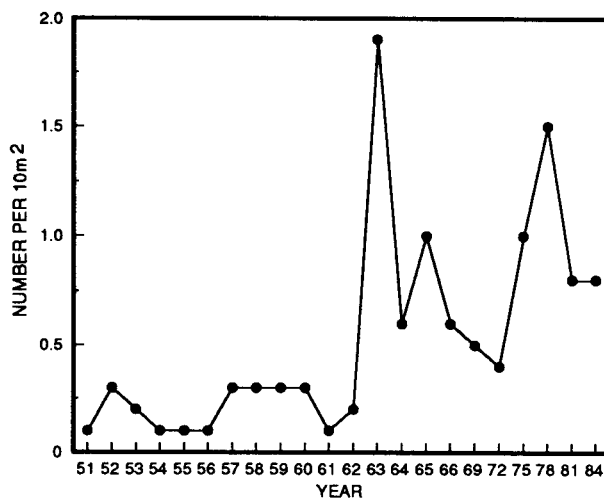
Blenniidae



Combtooth blennies

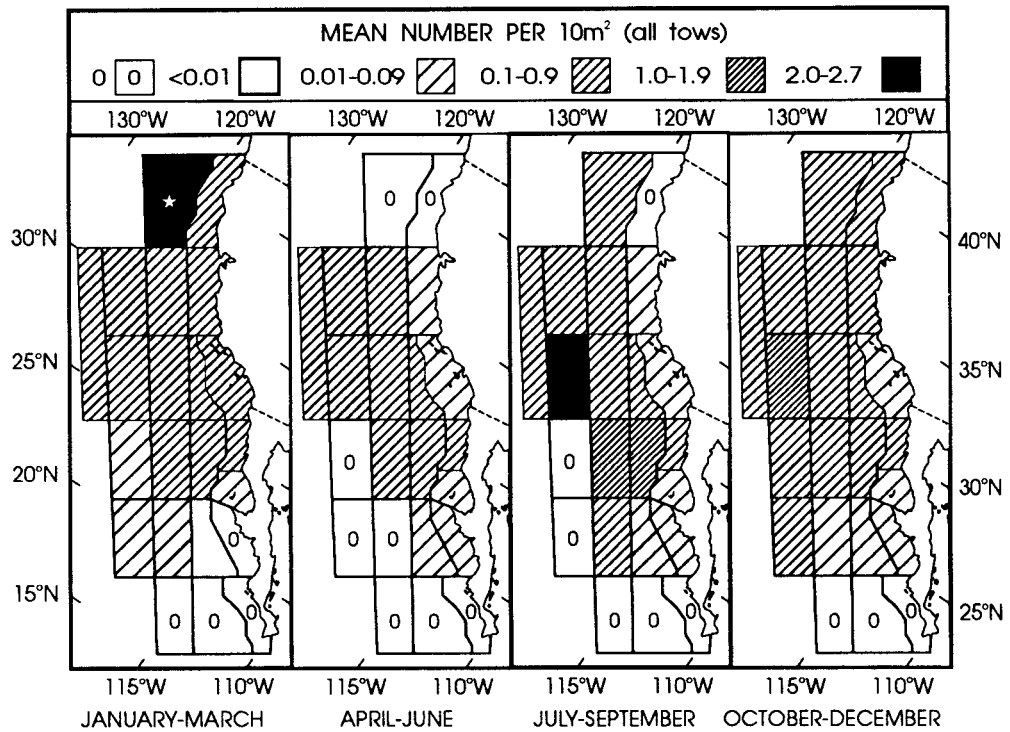
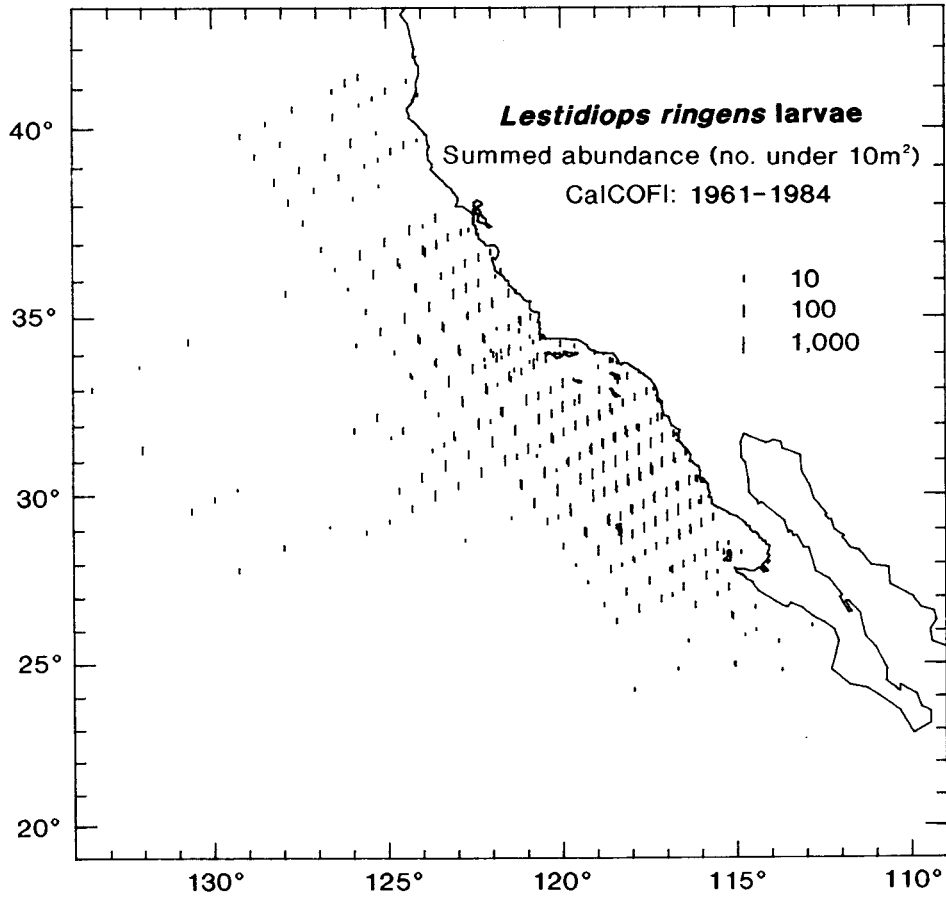


Hypsoblennius spp.

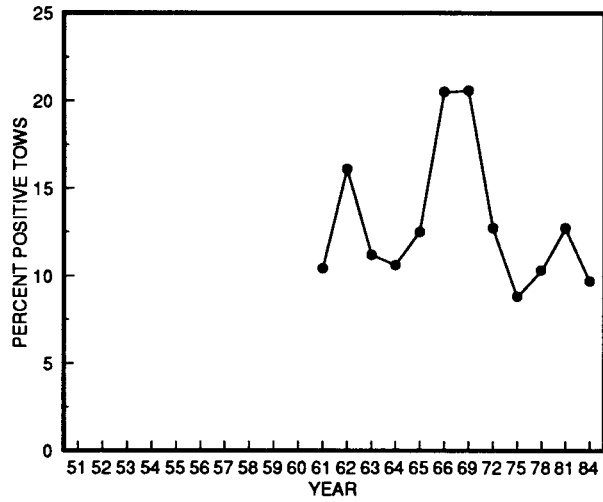


Lestidiops ringens

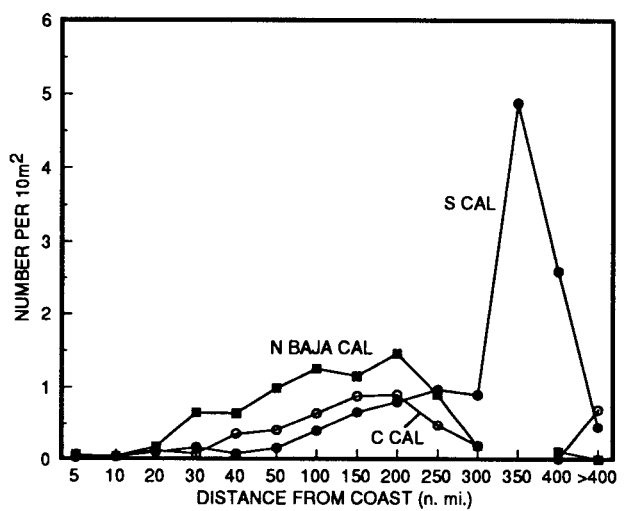
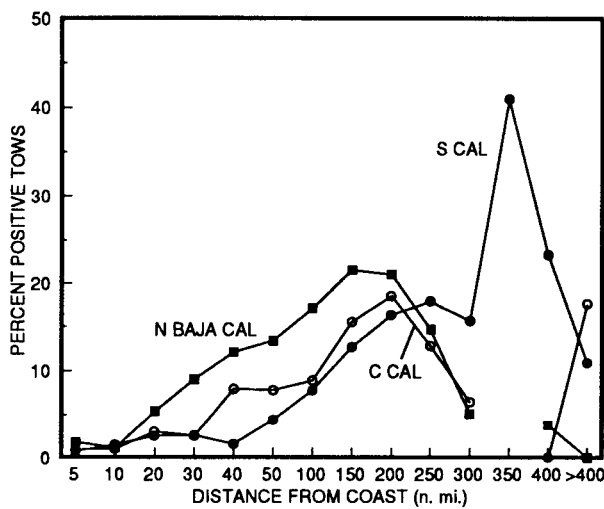
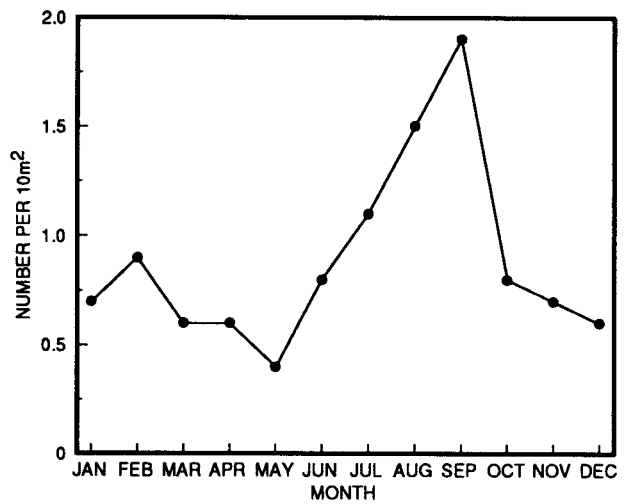
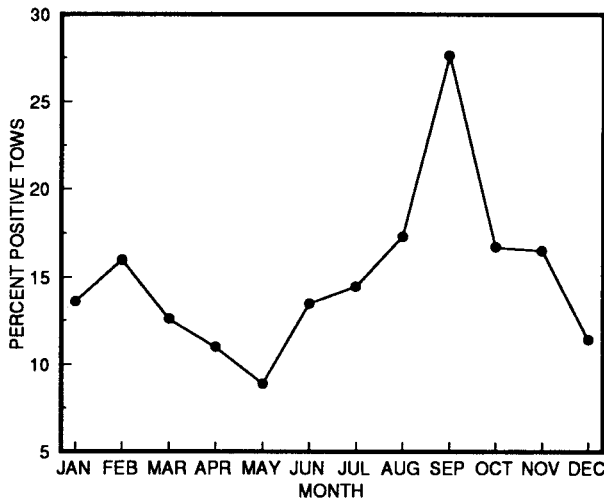
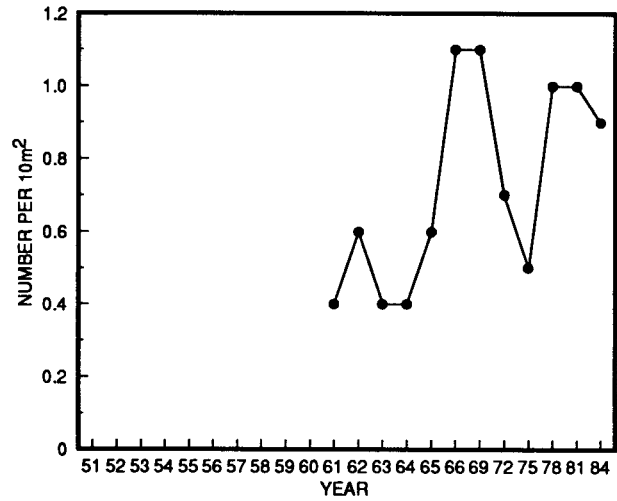
Paralepididae



Slender Barracudina

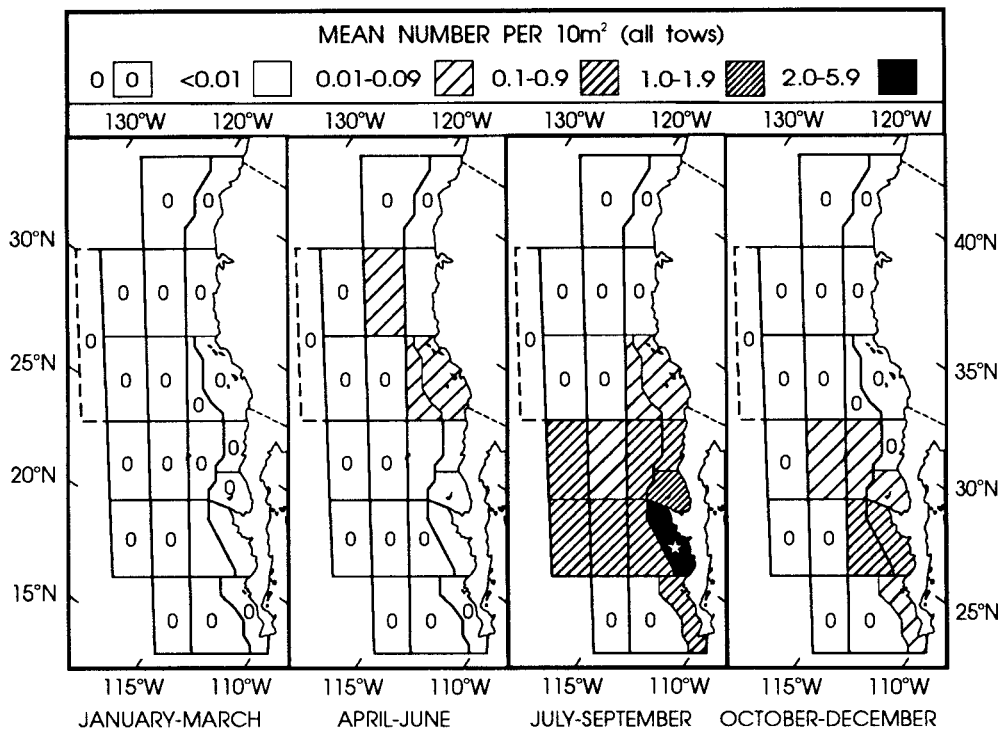
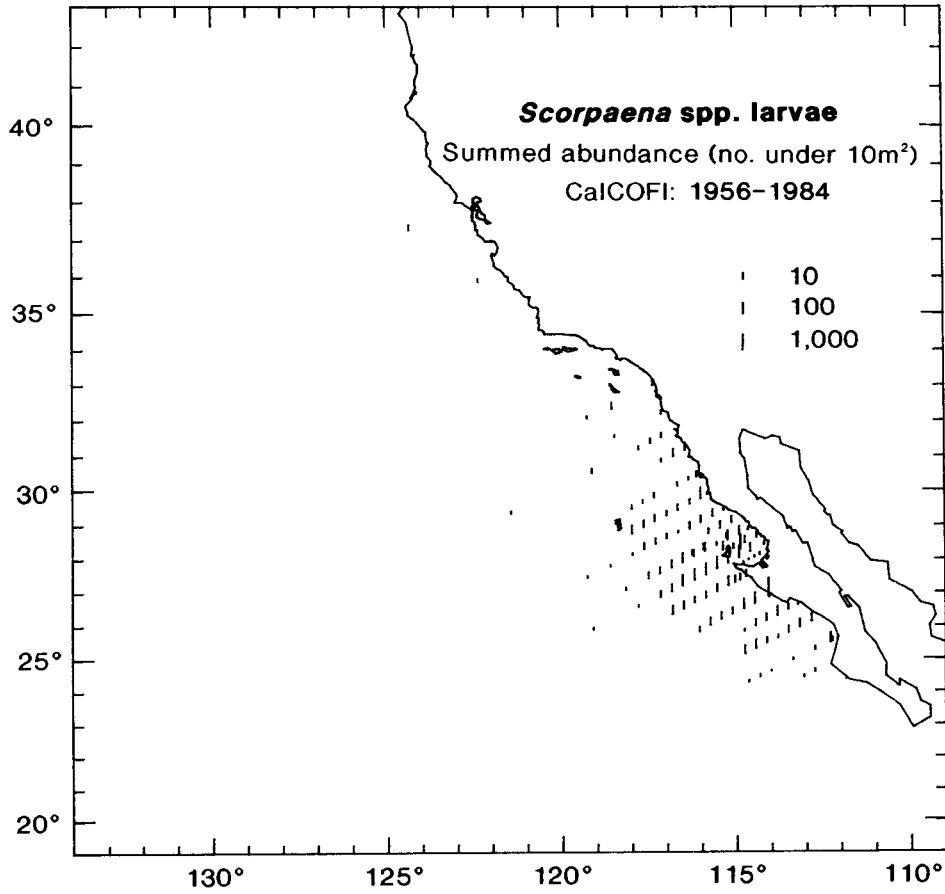


Lestidiops ringens



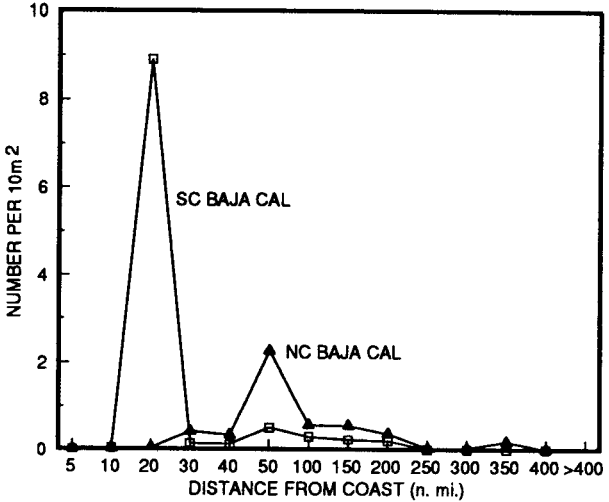
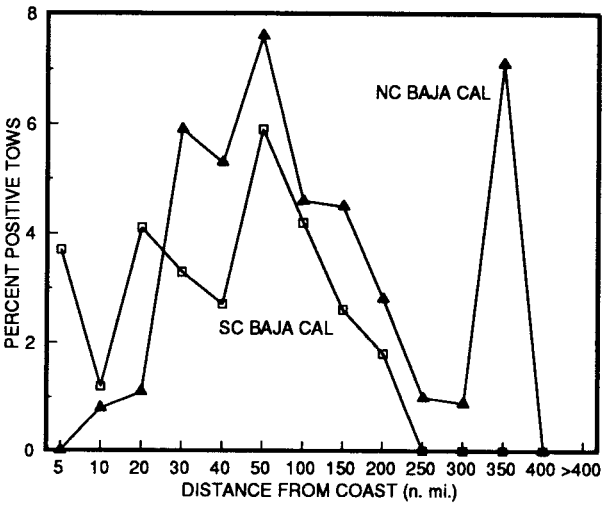
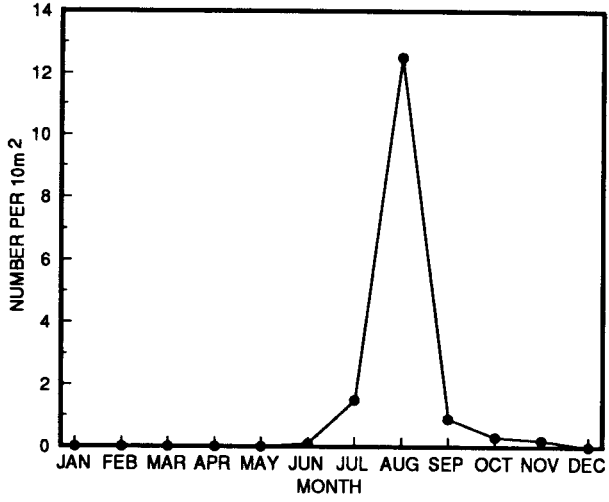
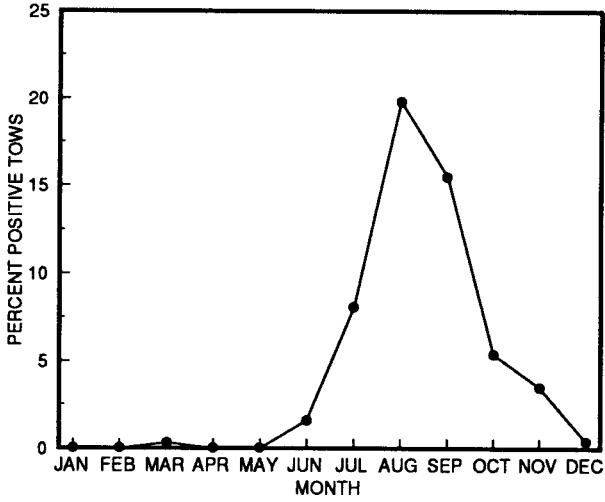
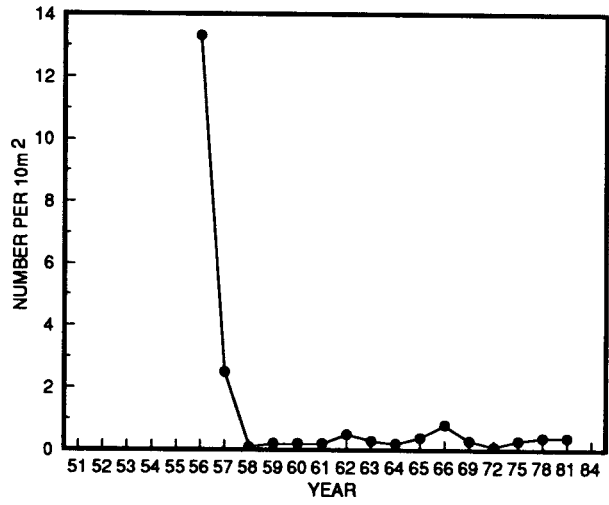
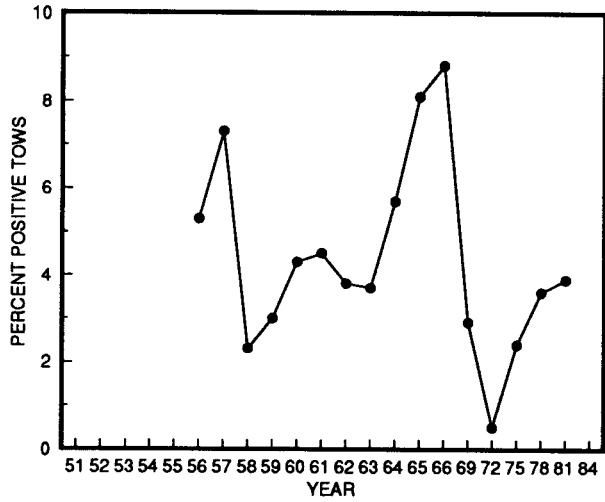
Scorpaena spp.

Scorpaenidae



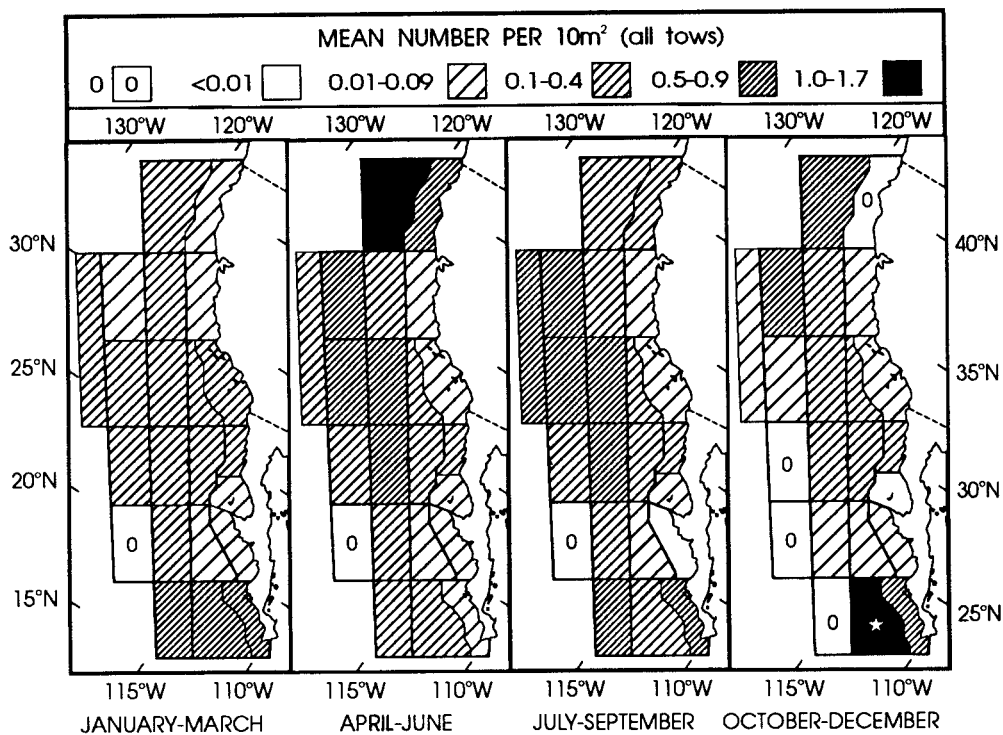
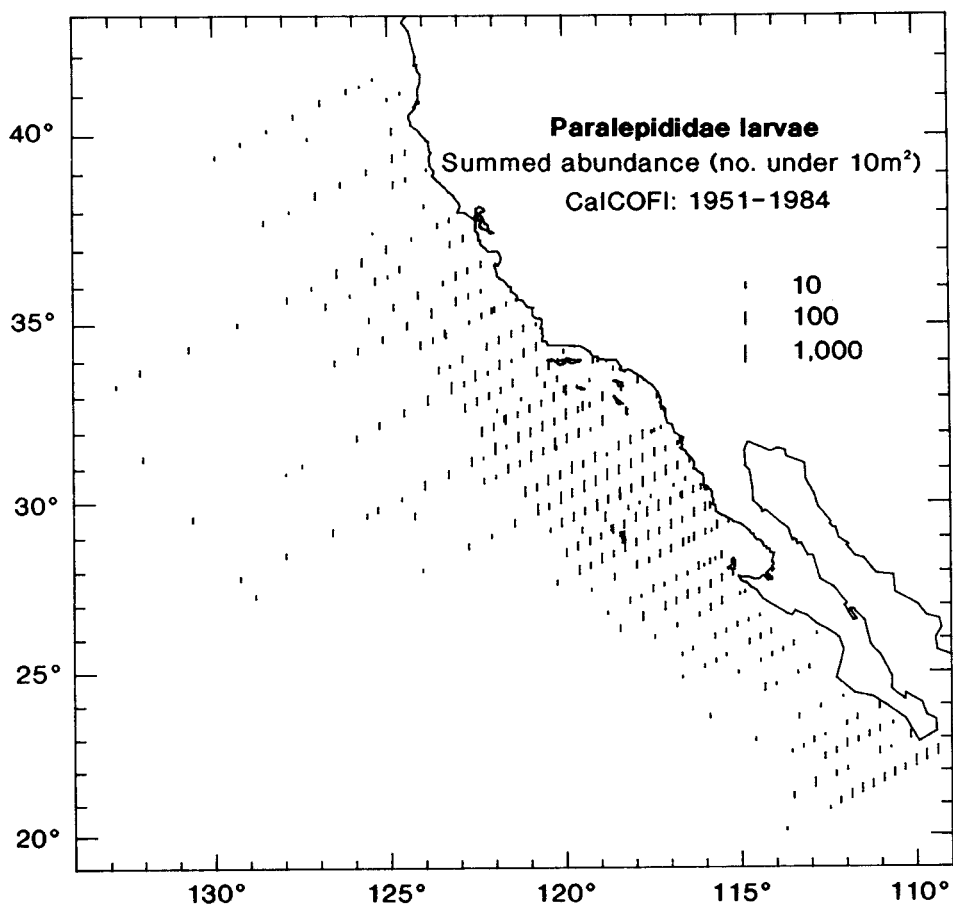
Scorpionfishes

Scorpaena spp.

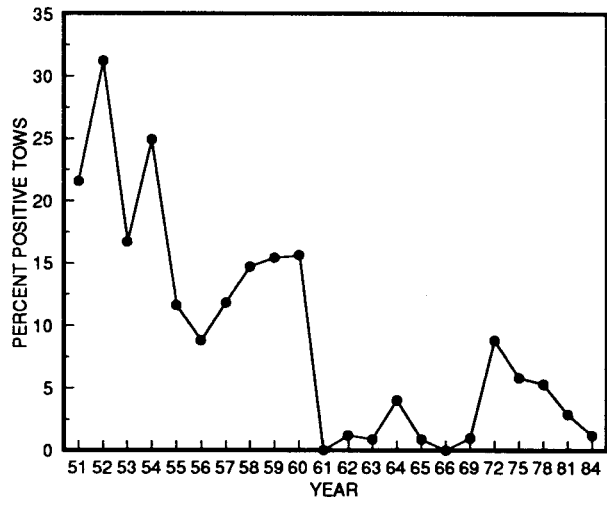


Paralepididae

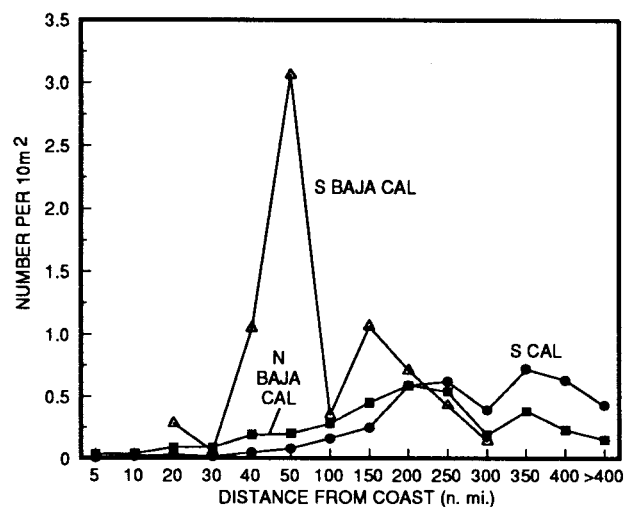
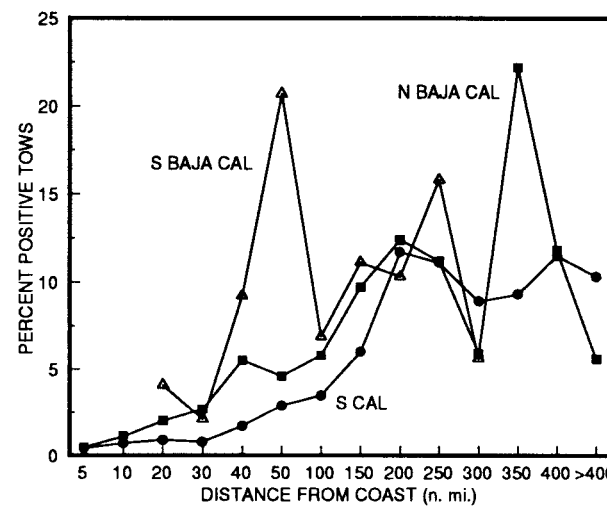
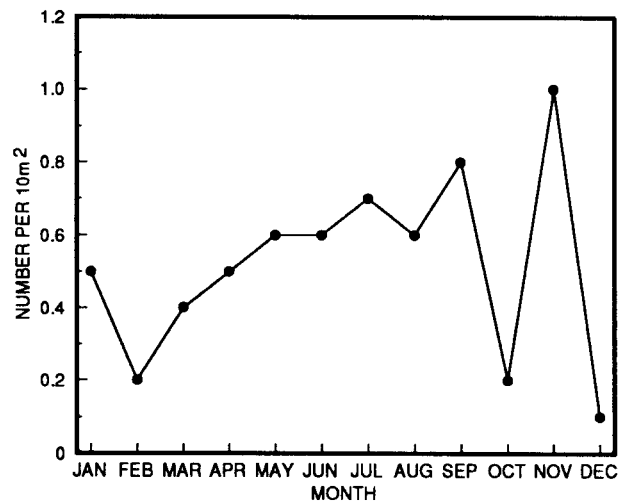
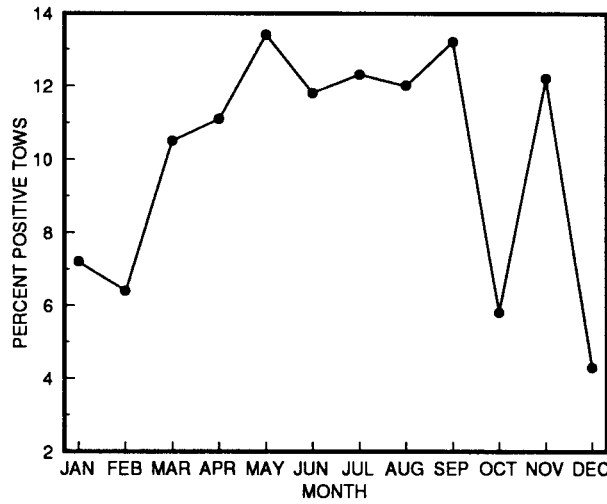
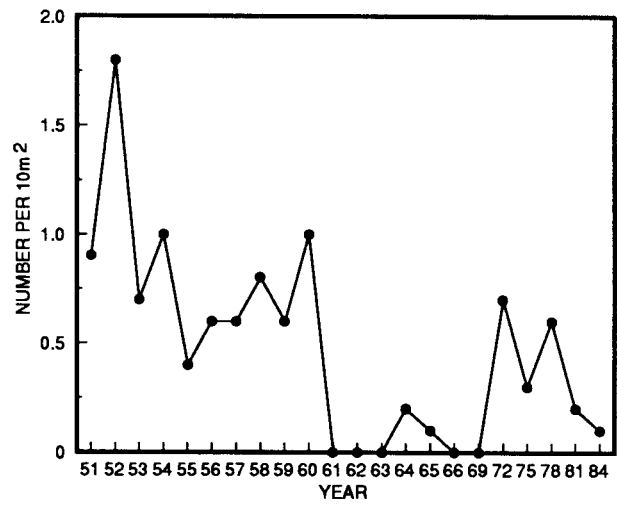
Paralepididae



Barracudinas

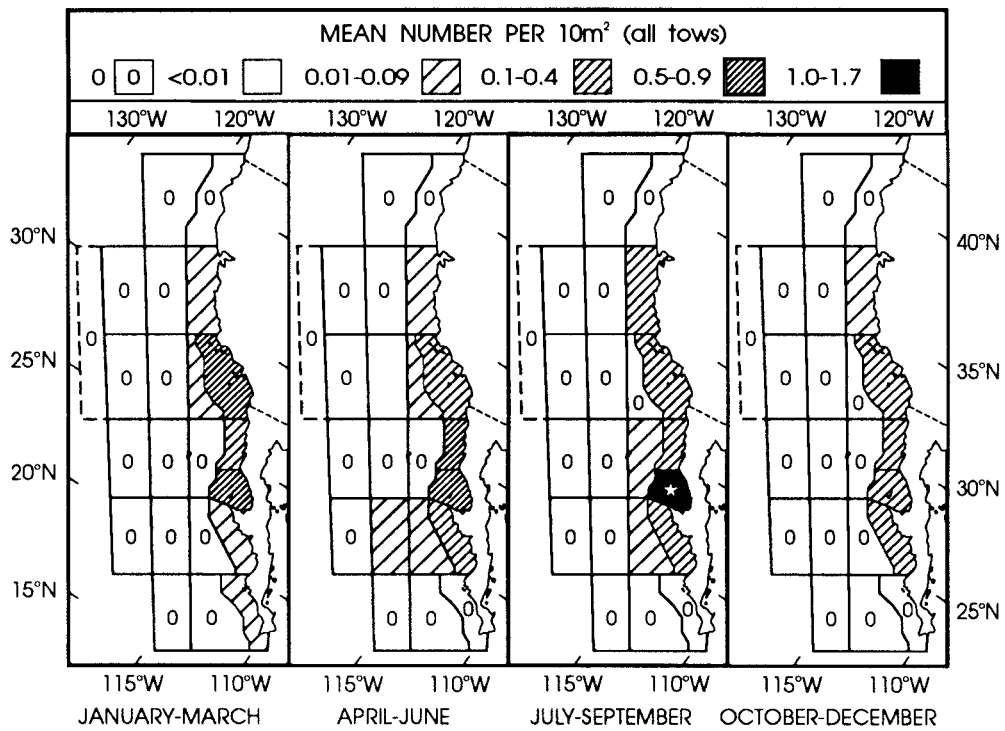
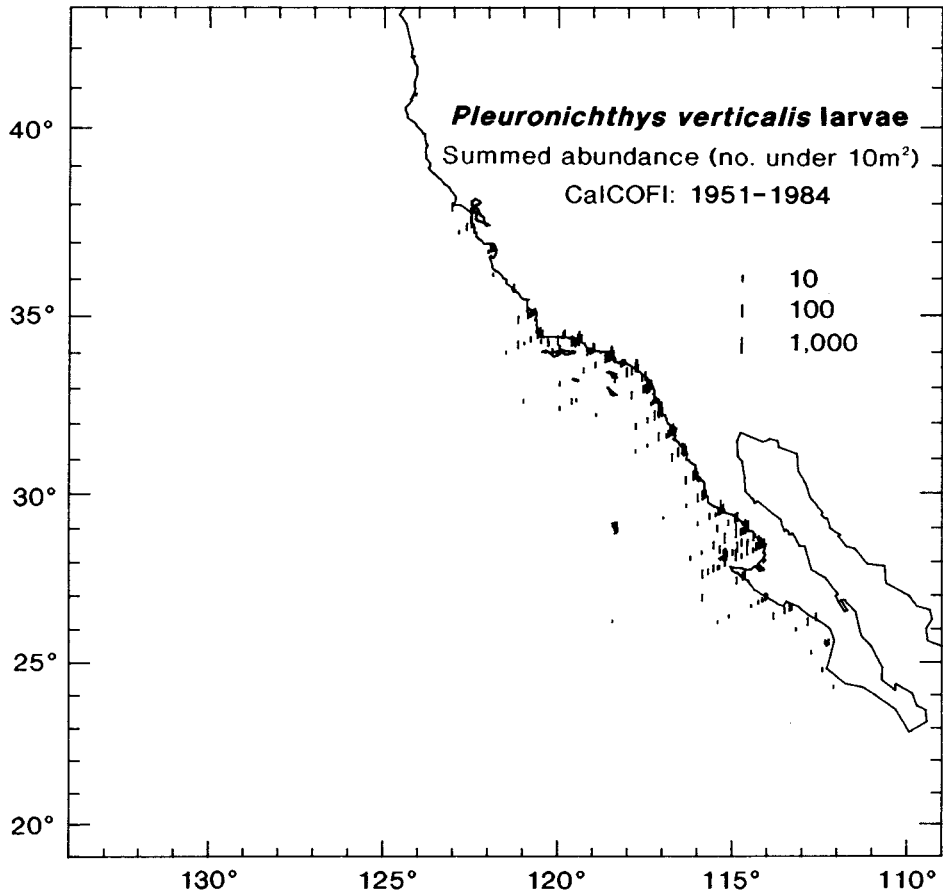


Paralepididae



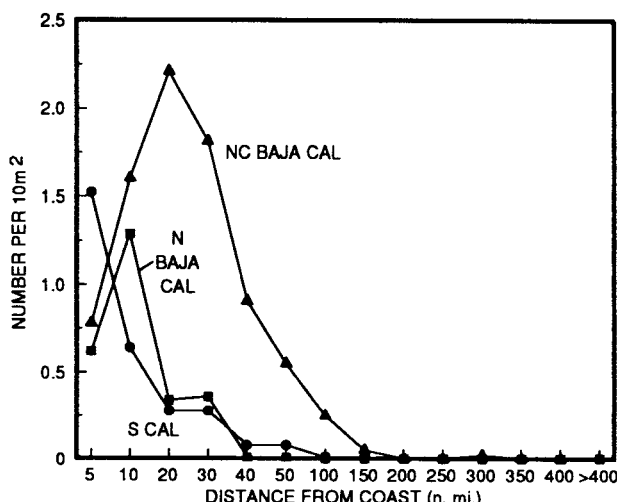
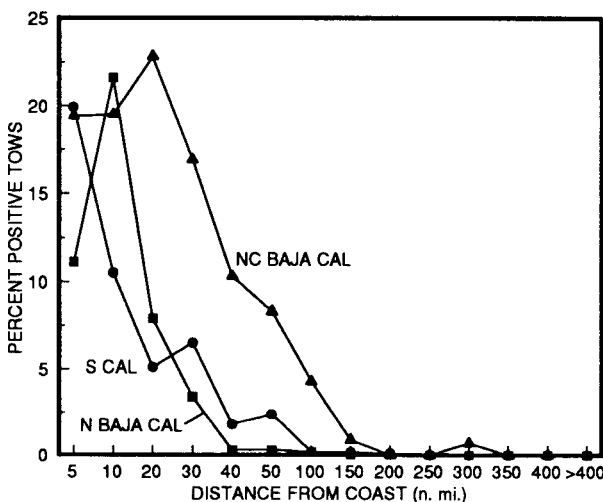
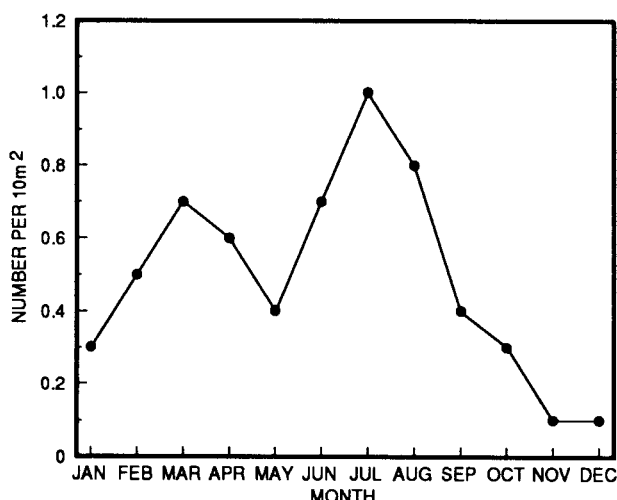
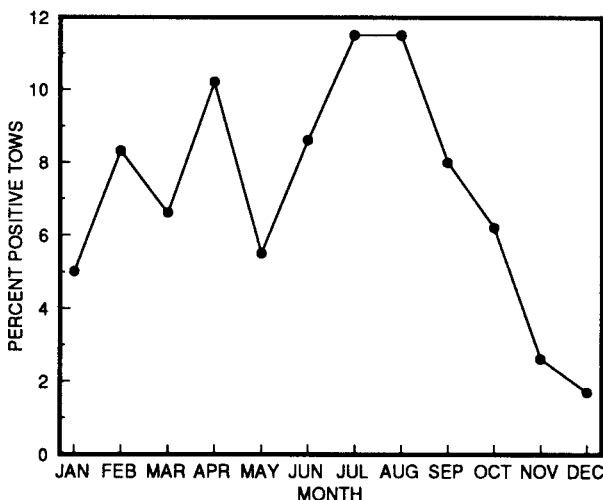
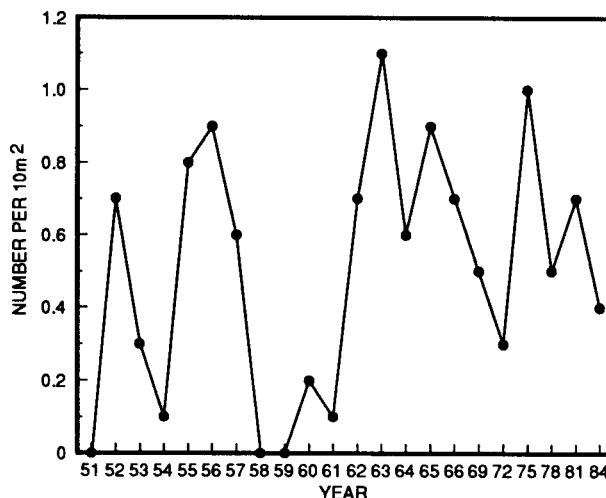
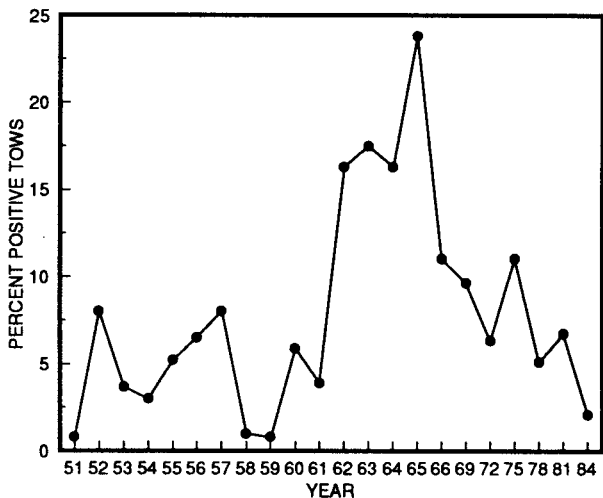
Pleuronichthys verticalis

Pleuronectidae



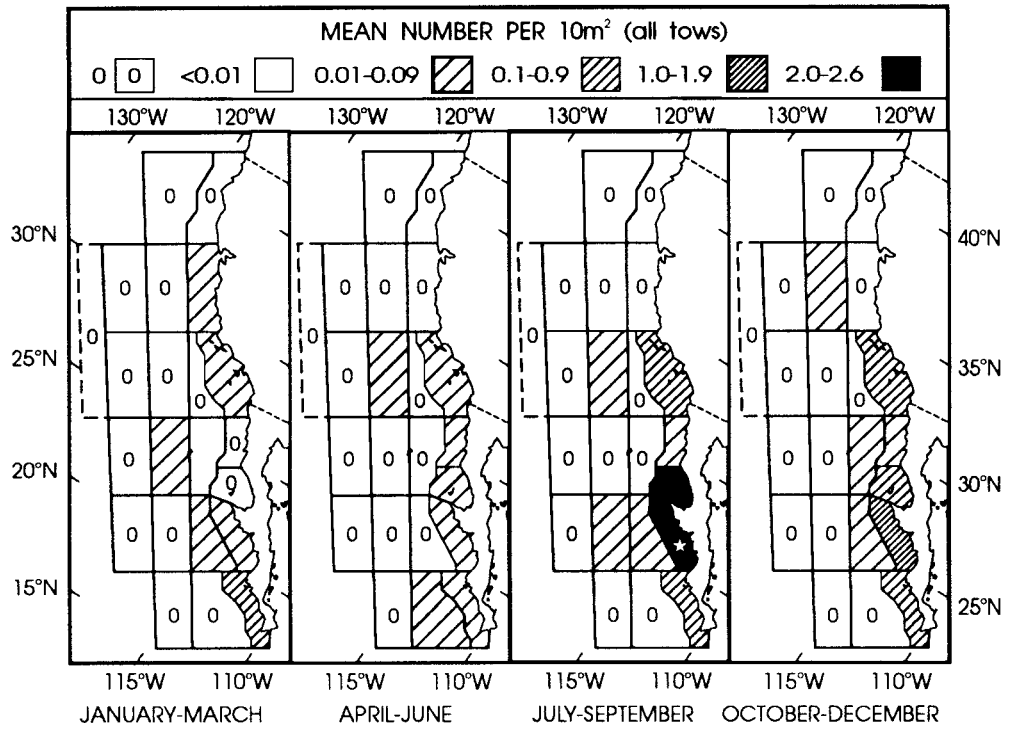
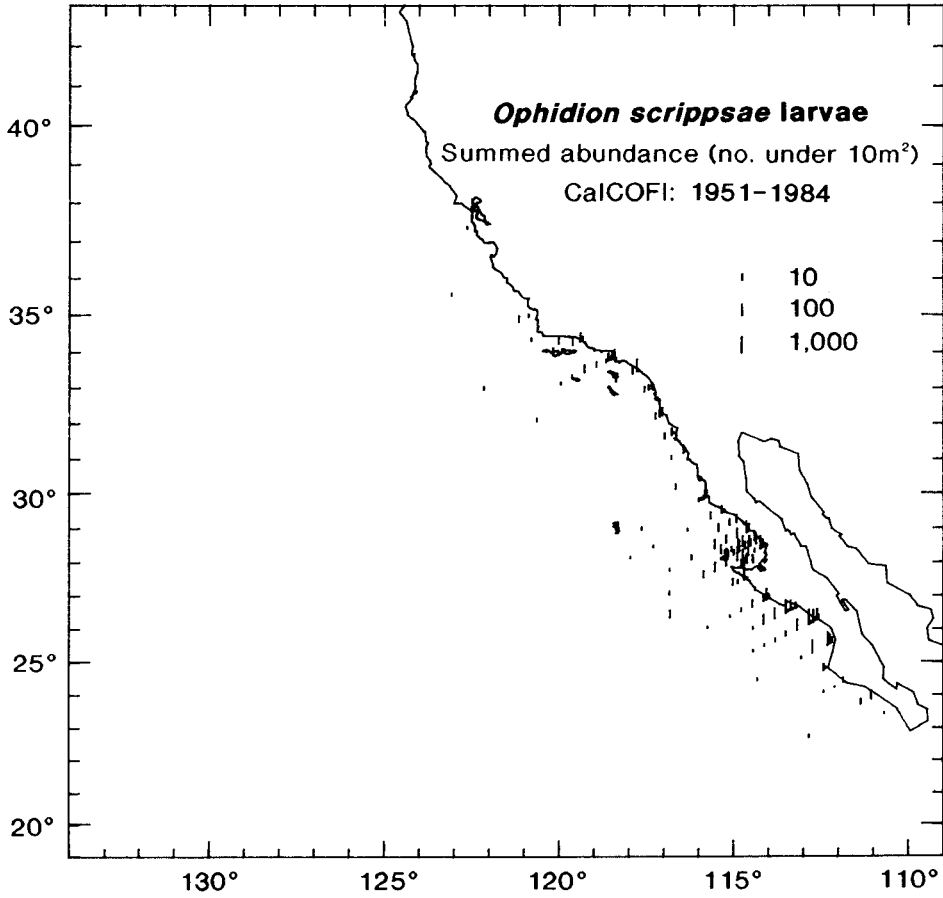
Hornyhead turbot

Pleuronichthys verticalis



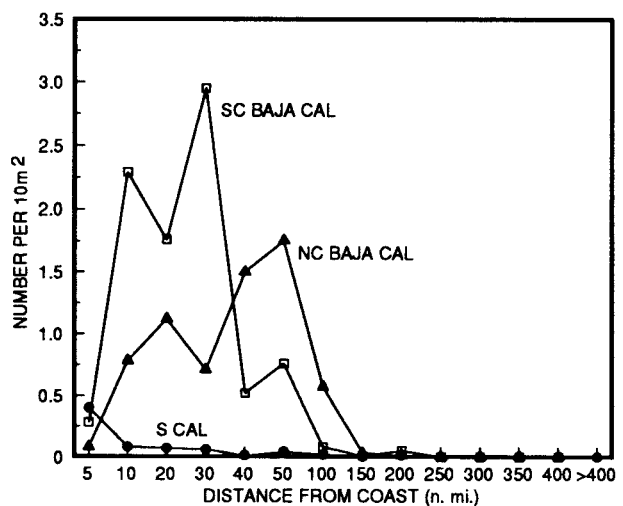
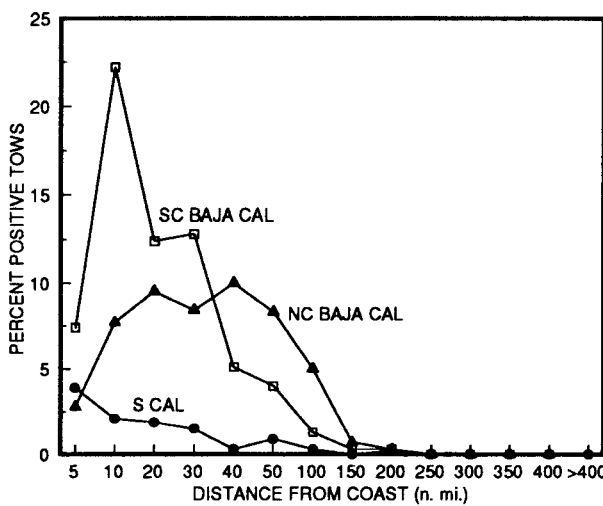
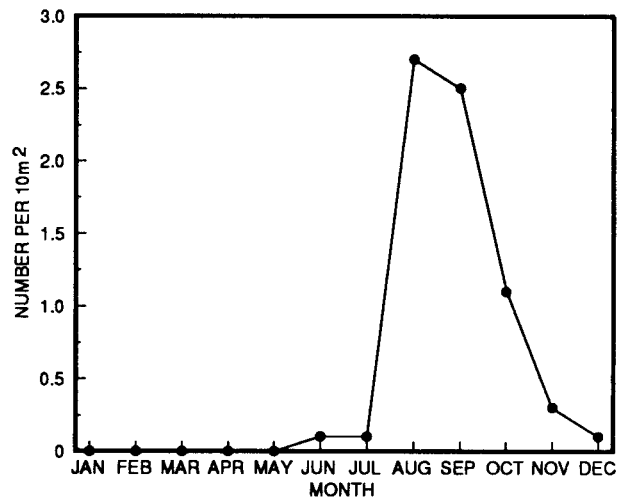
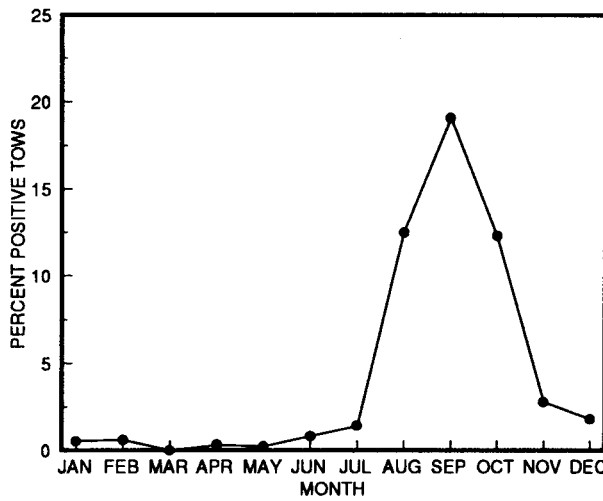
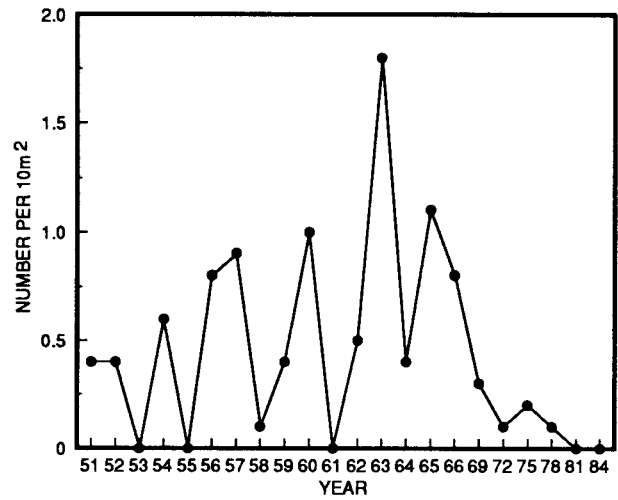
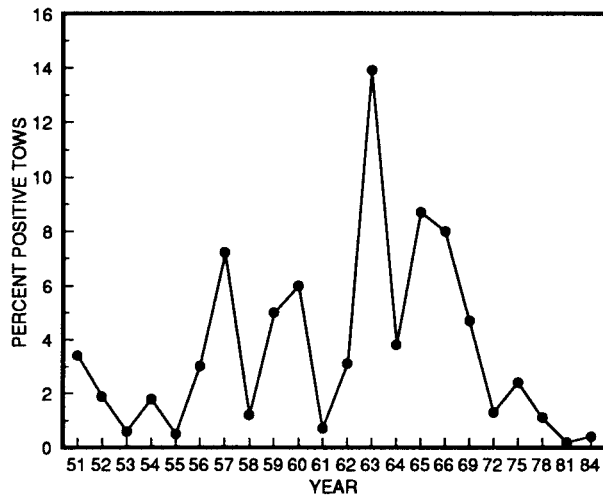
Ophidion scrippsae

Ophidiidae



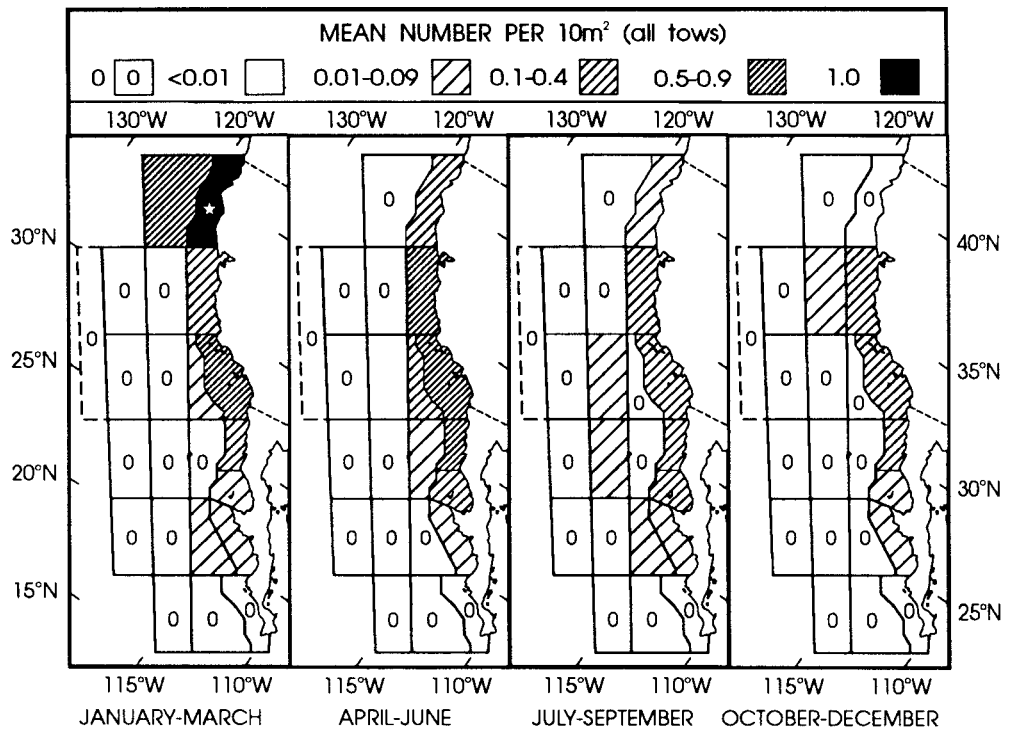
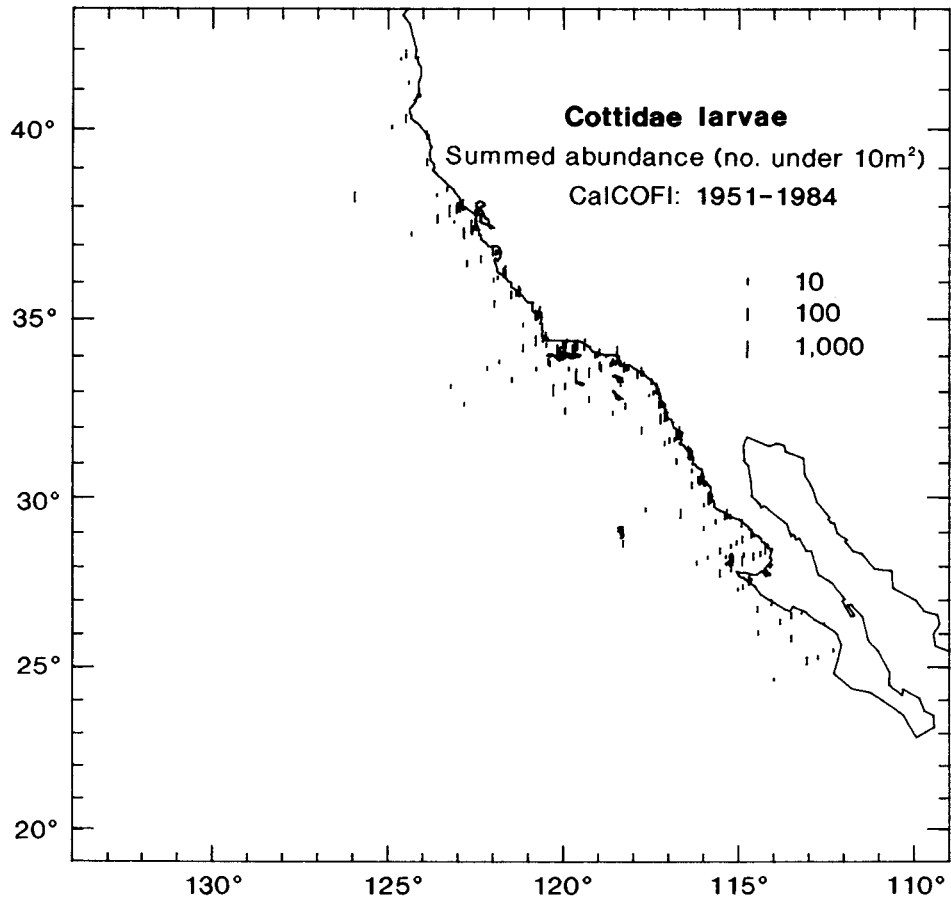
Basketweave cusk-eel

Ophidion scrippsae



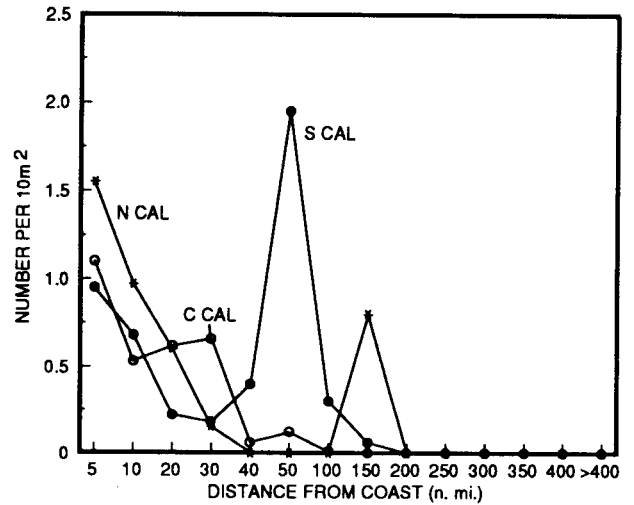
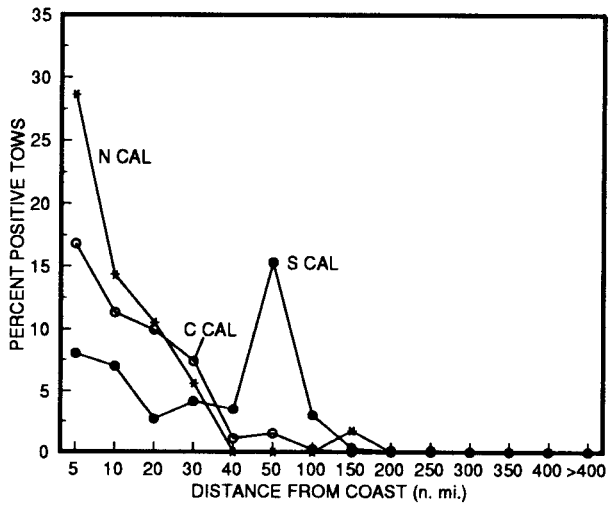
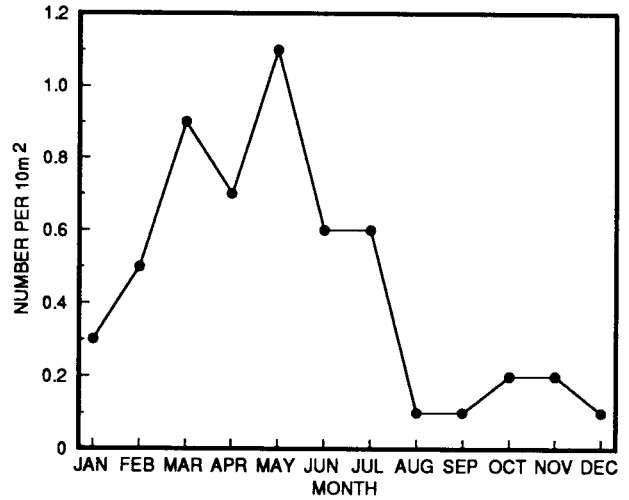
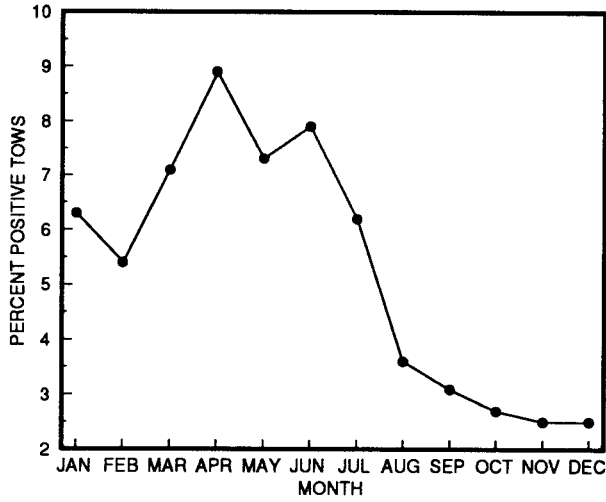
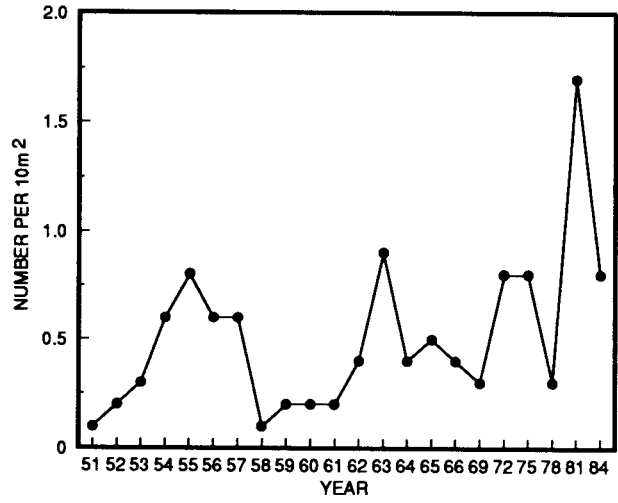
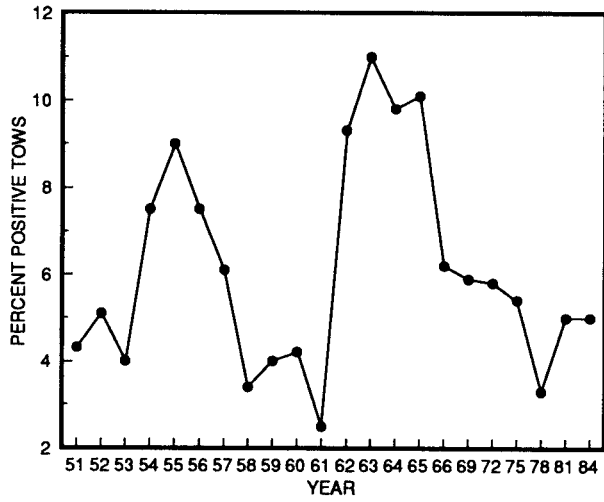
Cottidae

Cottidae



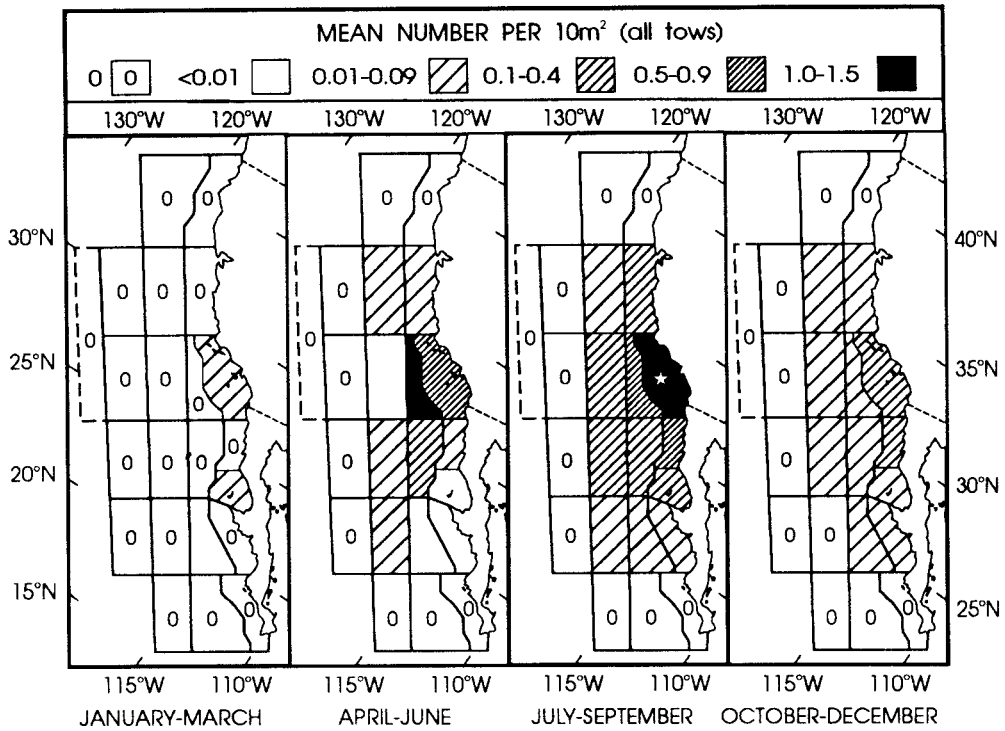
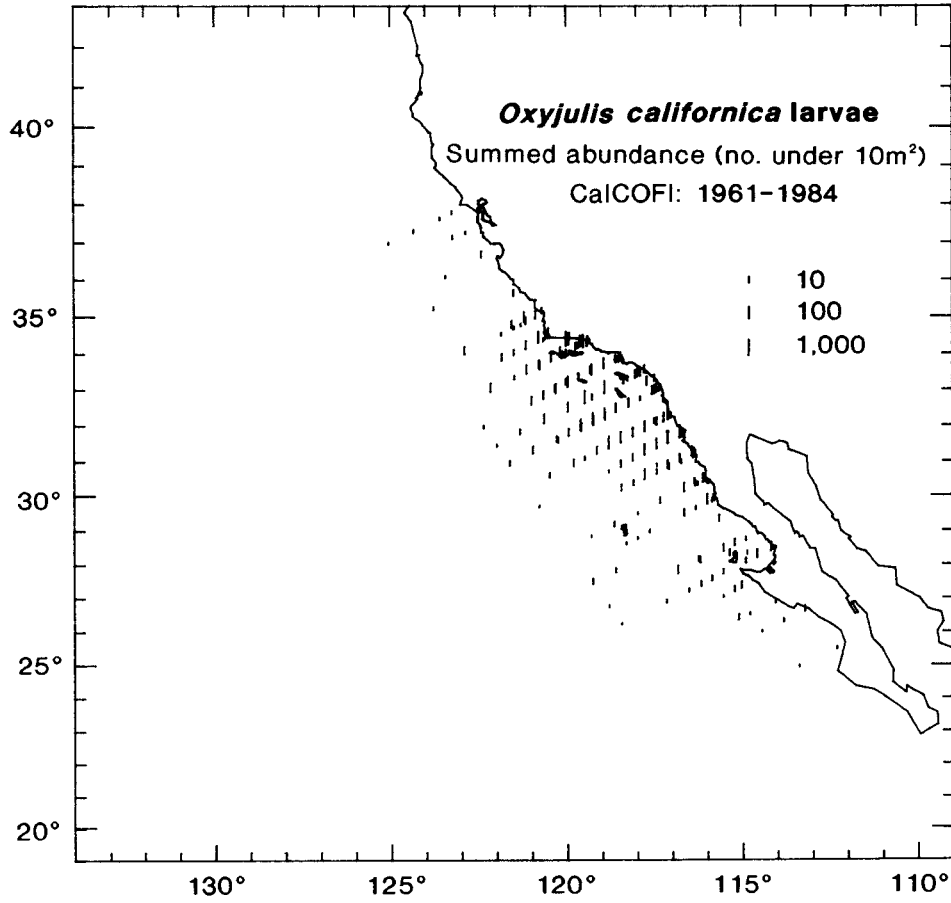
Sculpins

Cottidae

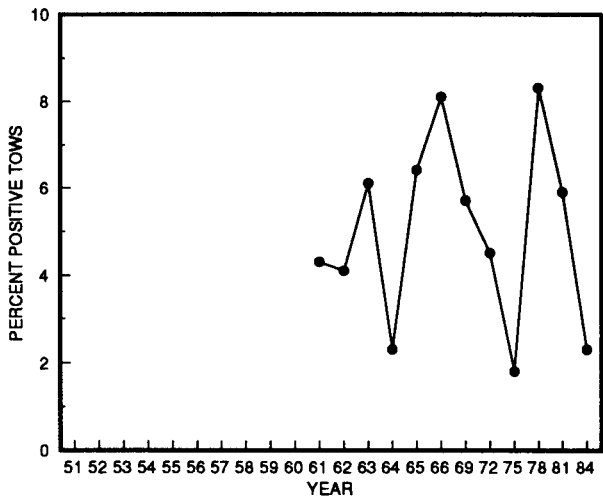


Oxyjulis californica

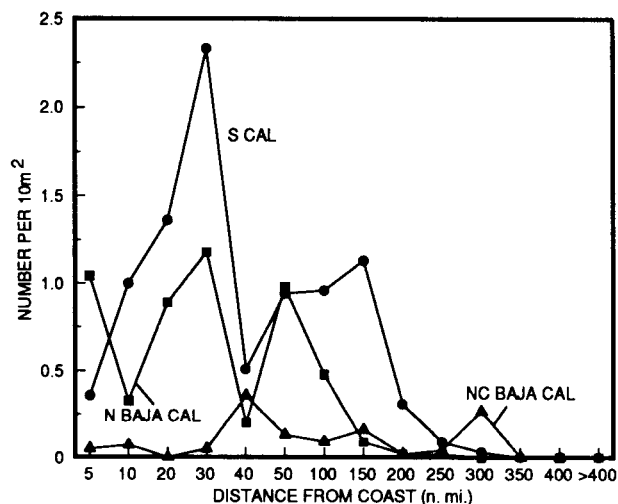
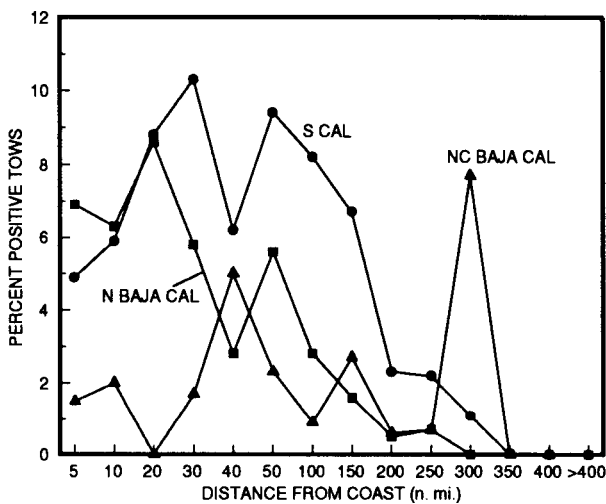
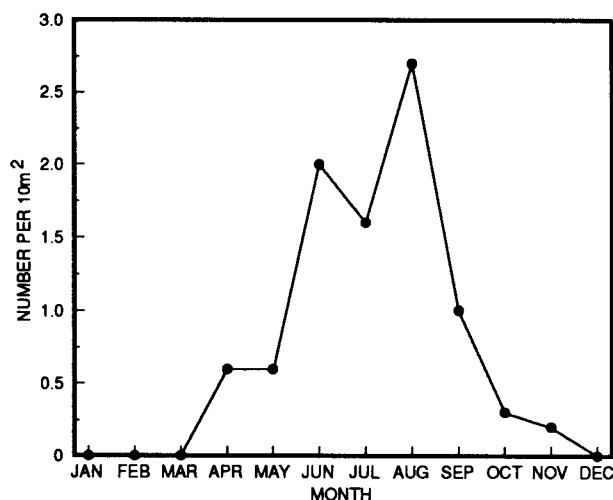
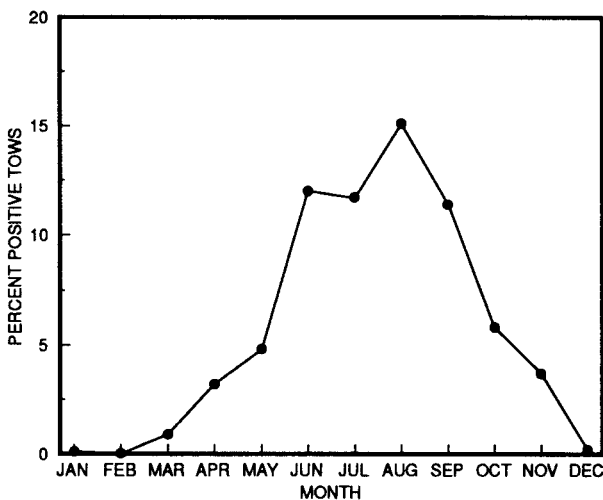
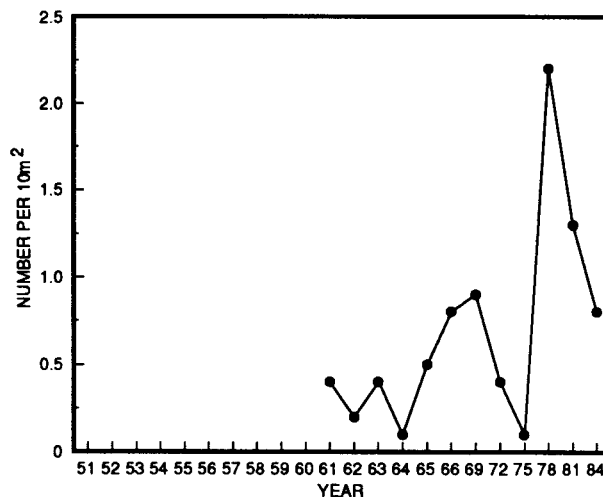
Labridae



Señorita

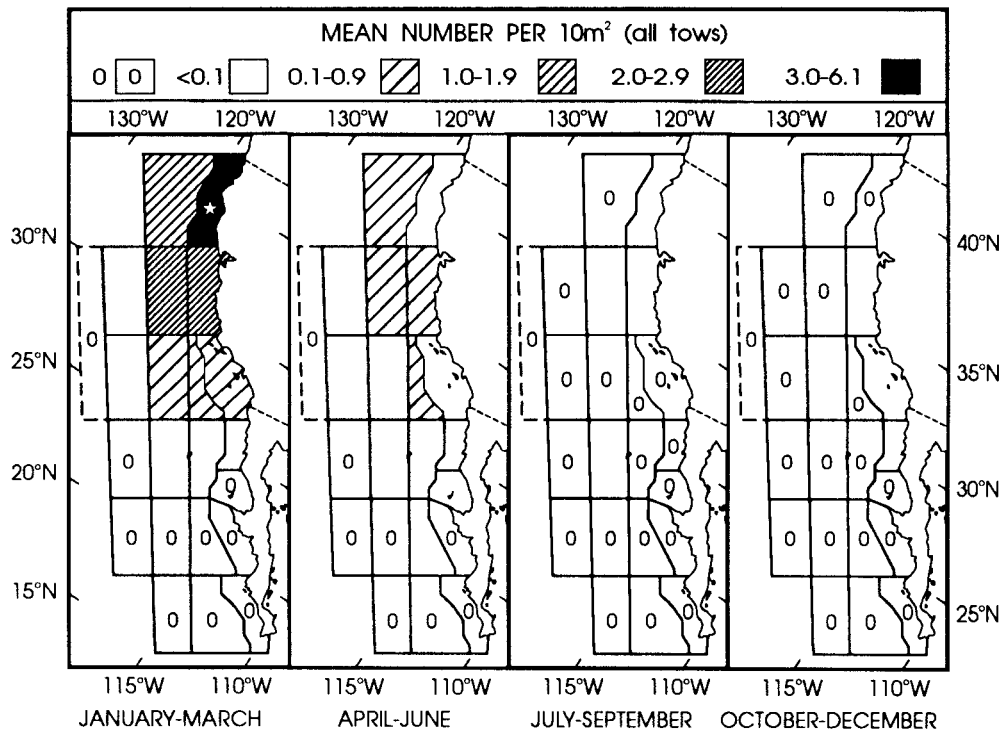
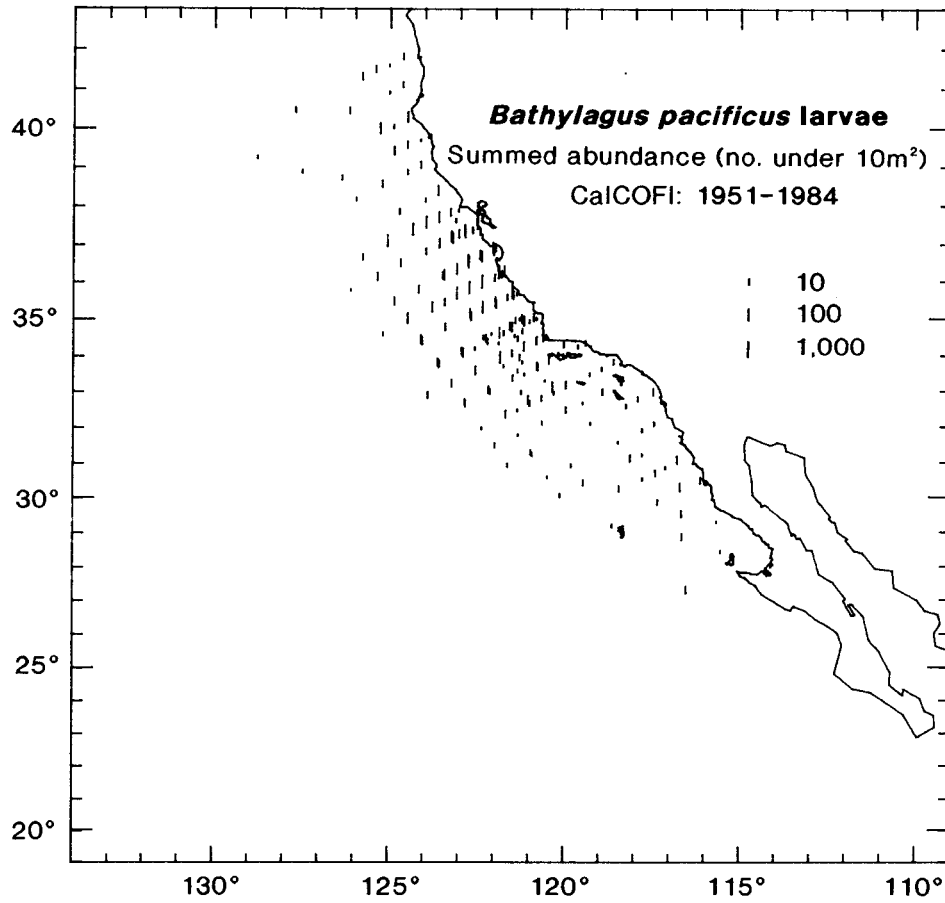


Oxyjulis californica



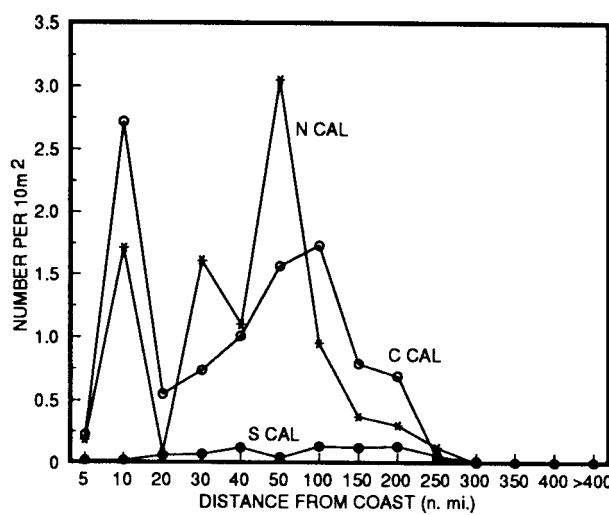
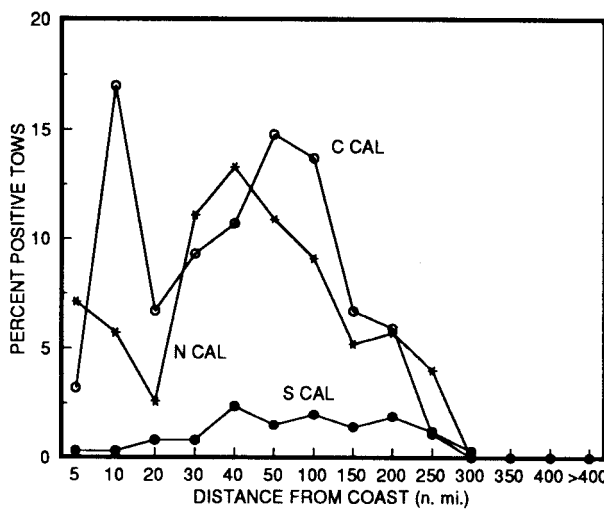
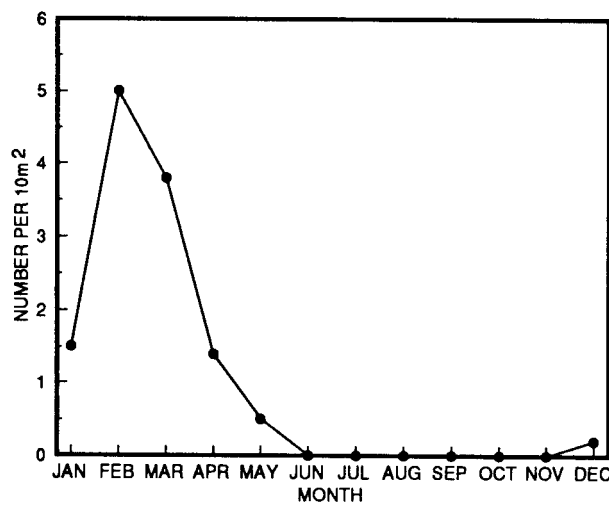
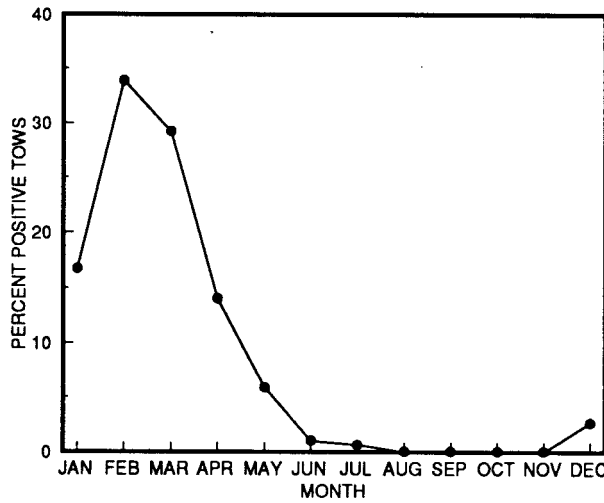
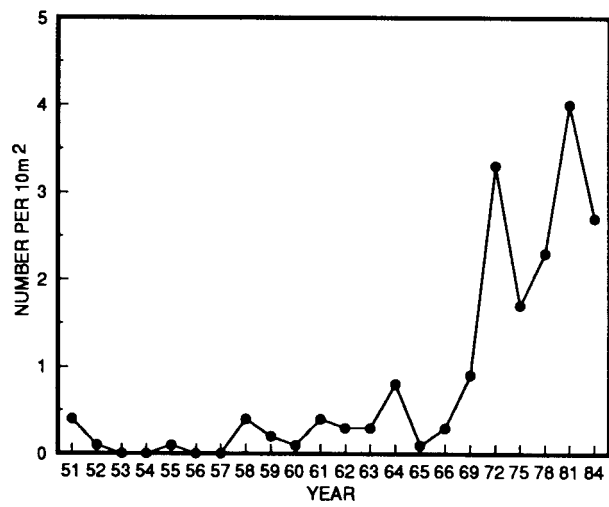
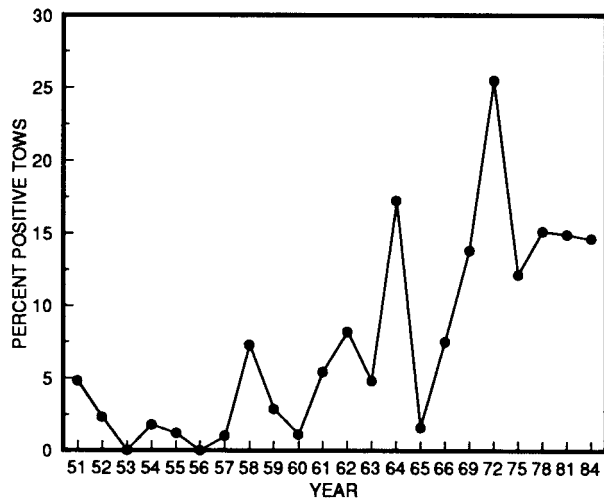
Bathylagus pacificus

Bathylagidae



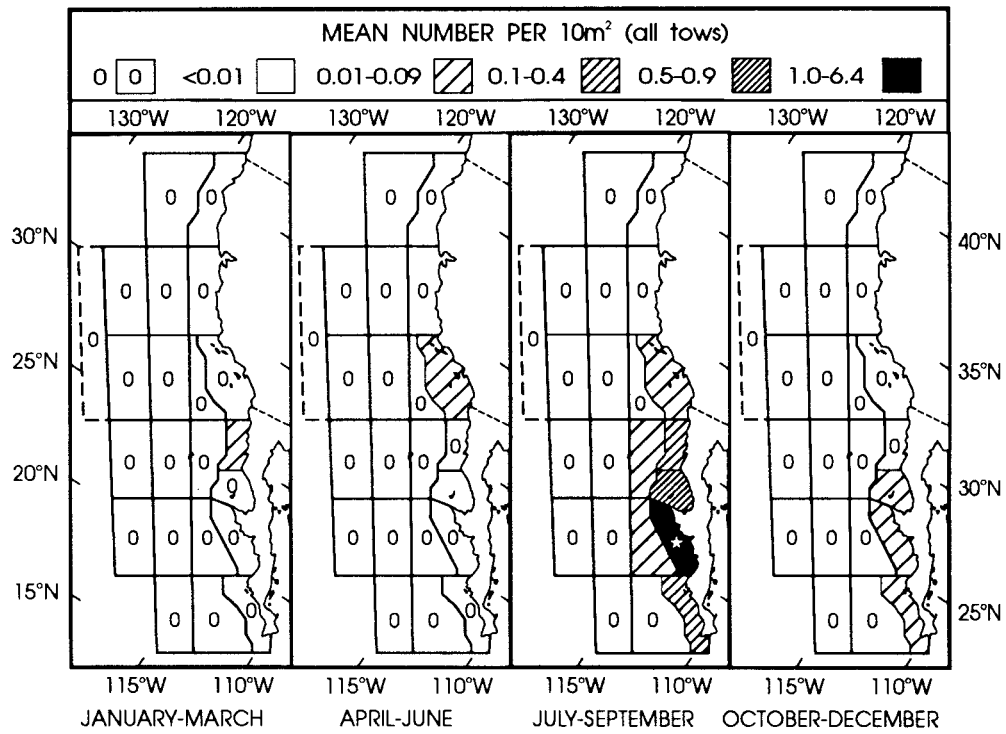
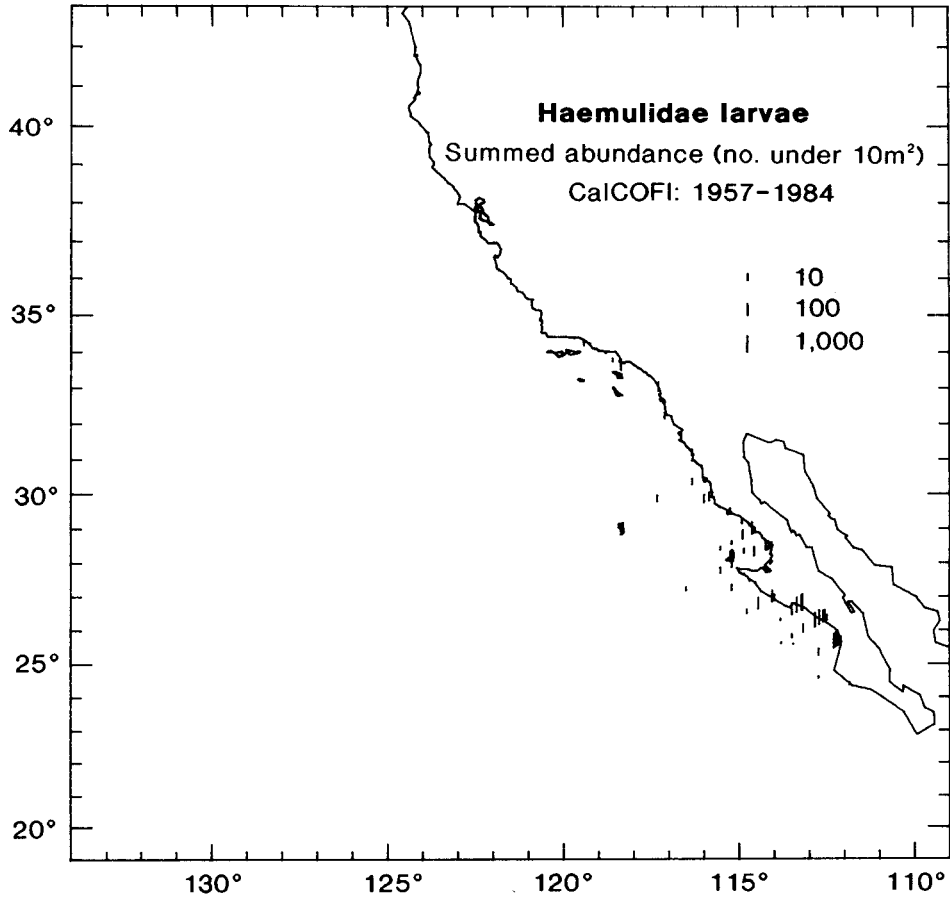
Pacific blacksmelt

Bathylagus pacificus

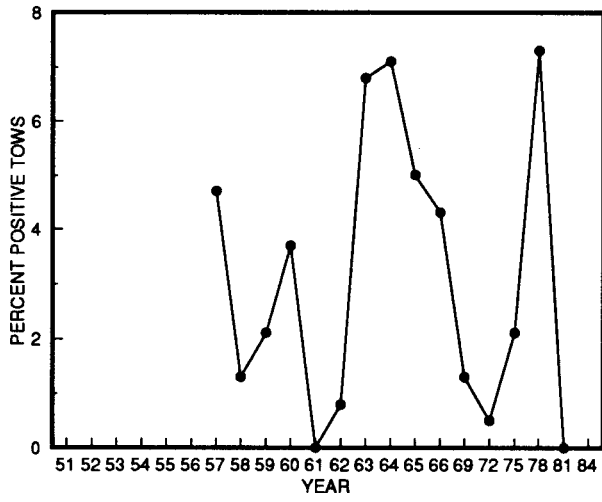


Haemulidae

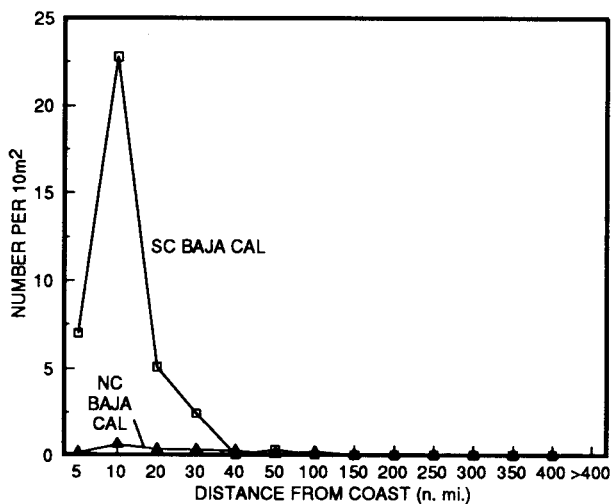
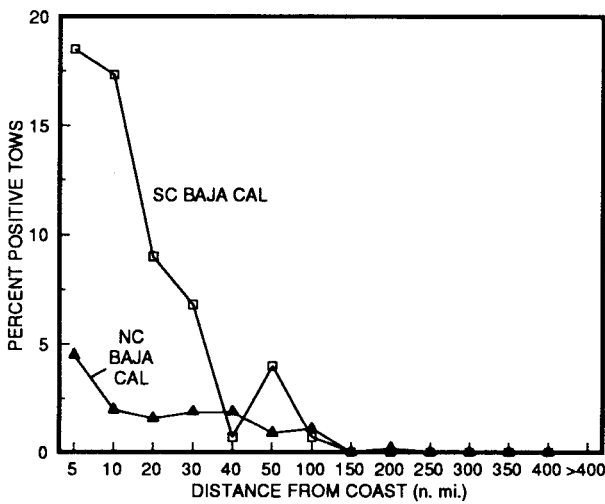
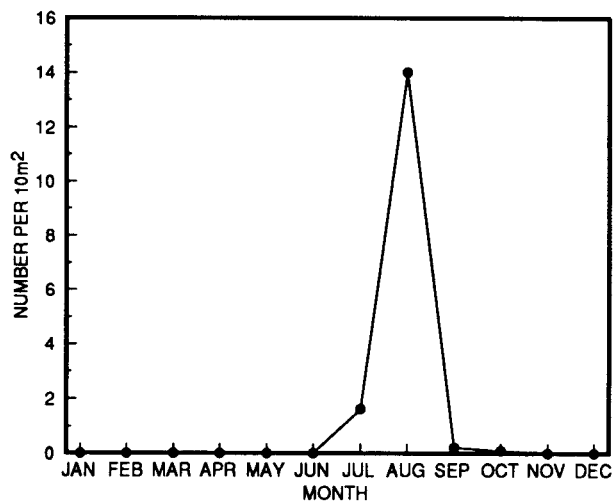
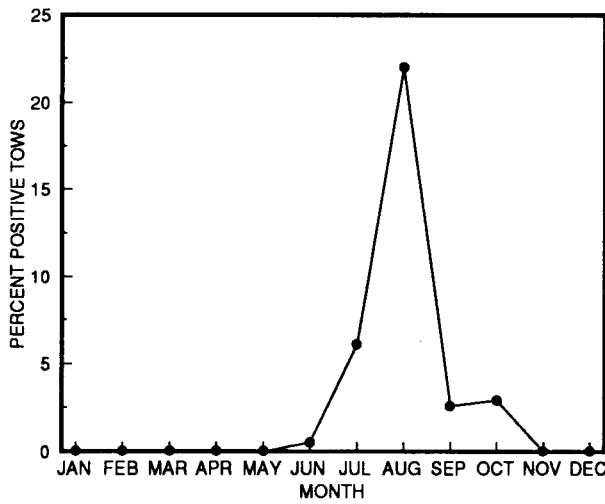
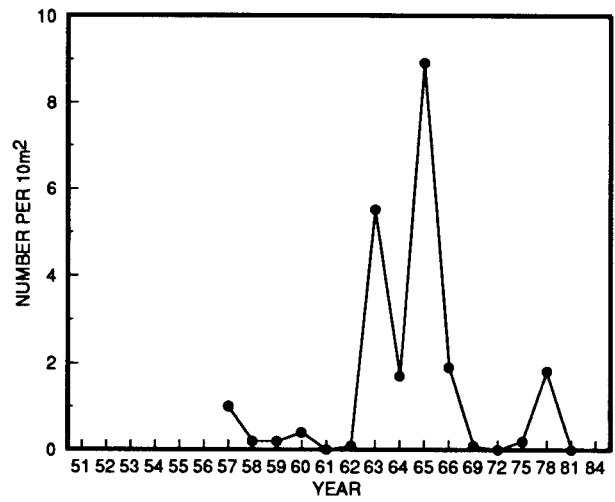
Haemulidae



Grunts

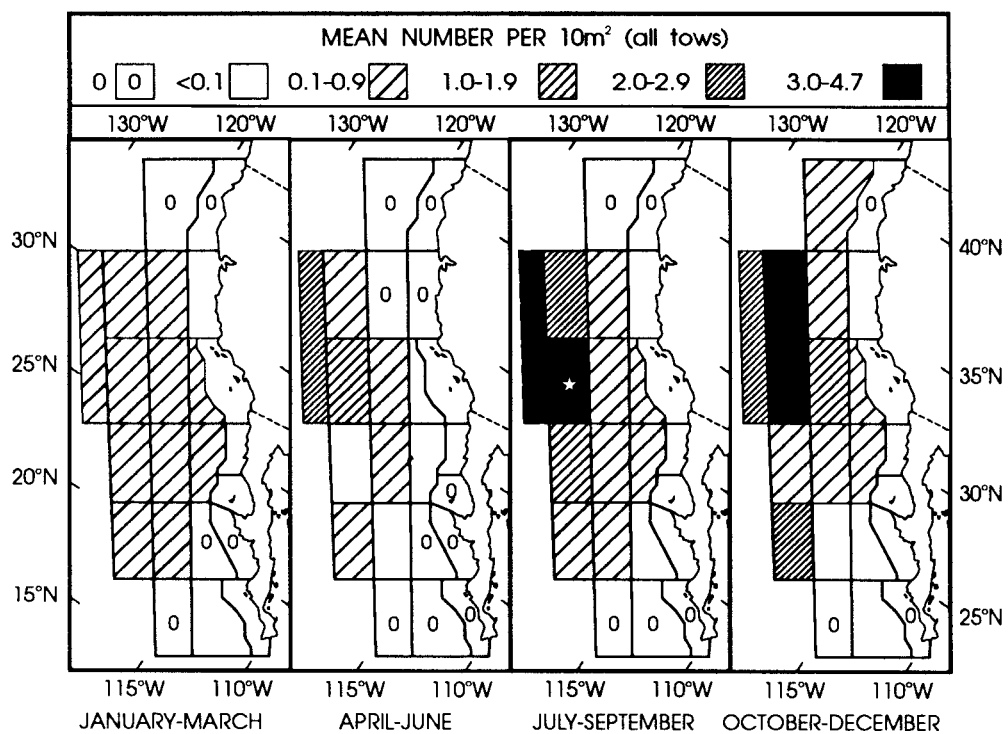
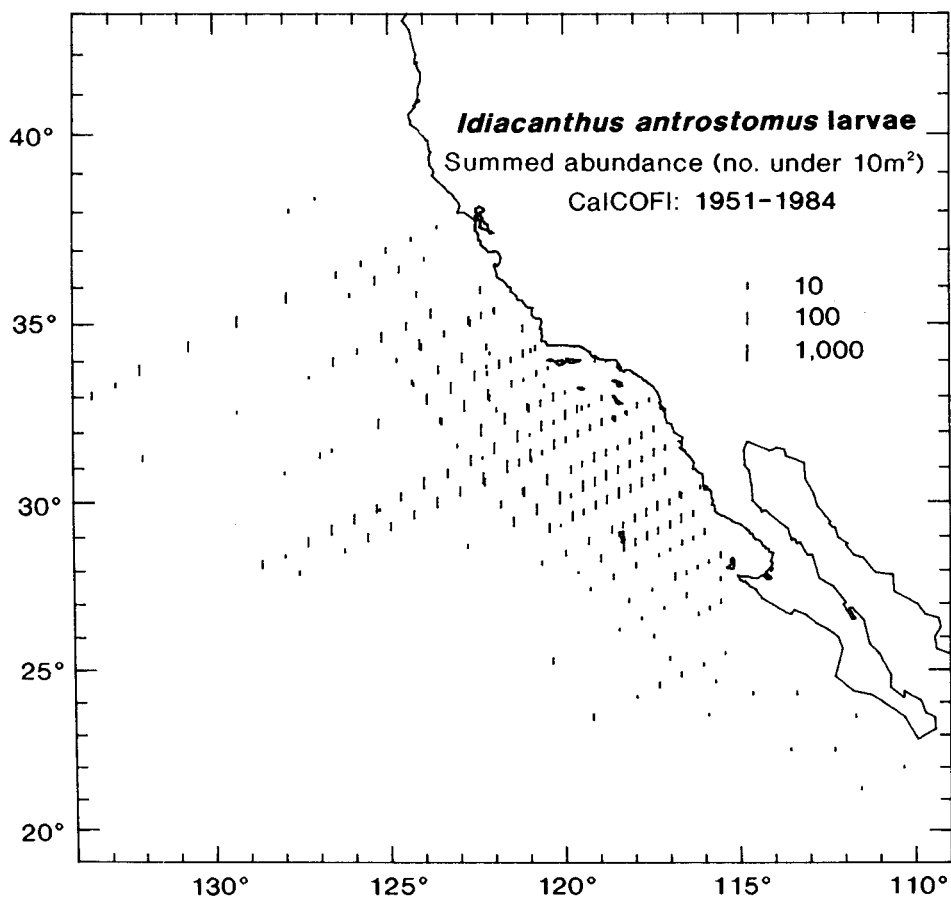


Haemulidae



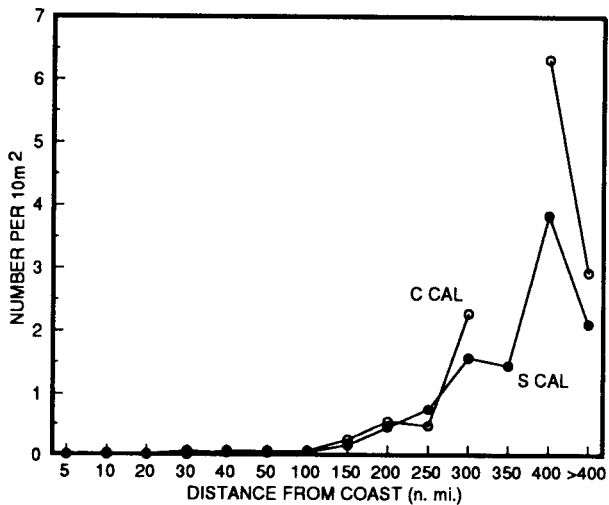
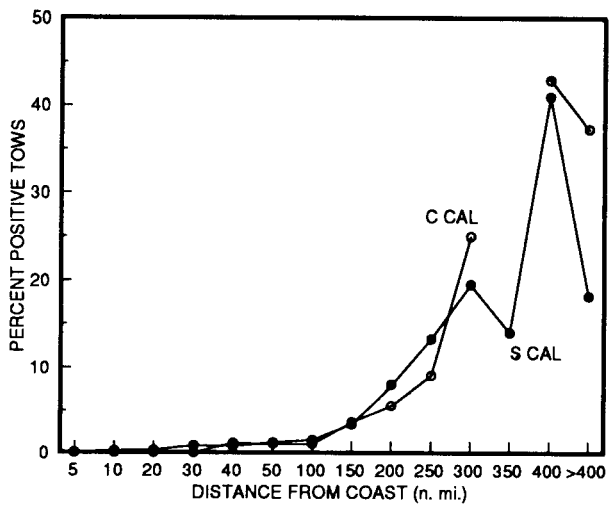
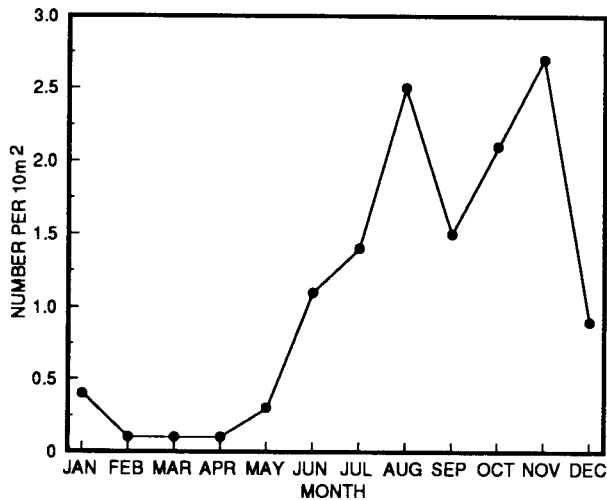
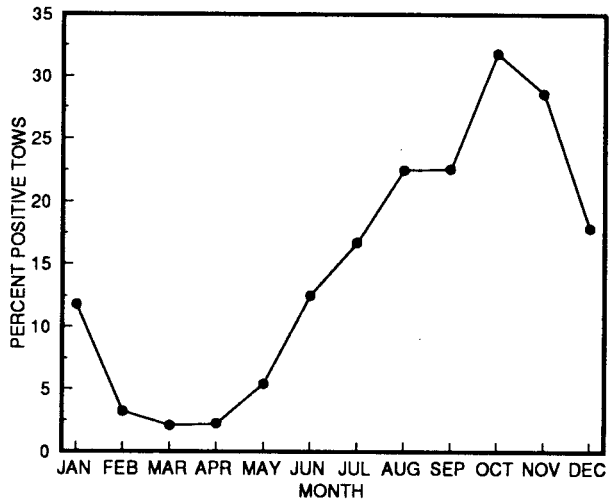
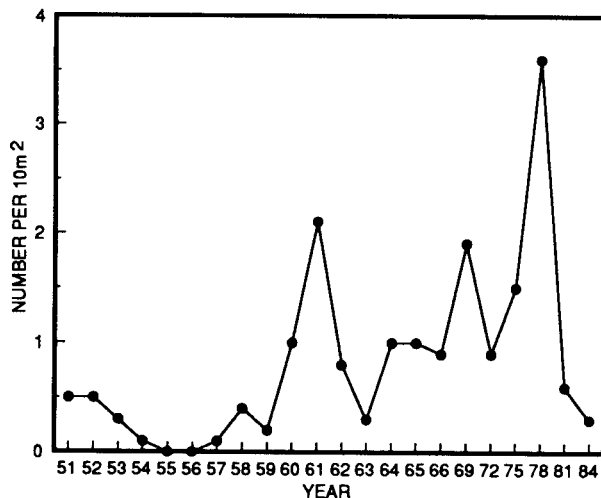
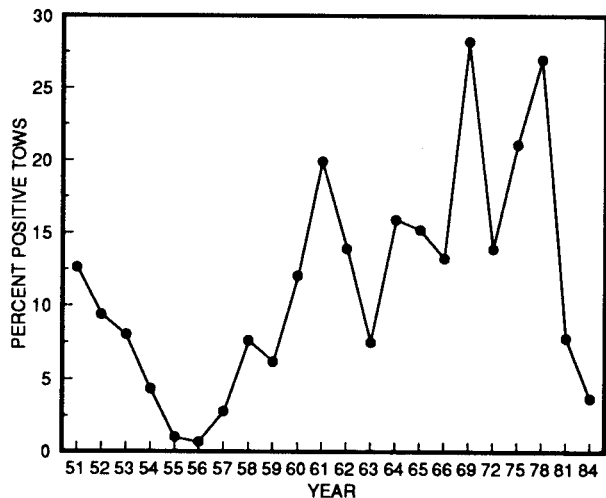
Idiacanthus antrostomus

Idiacanthidae



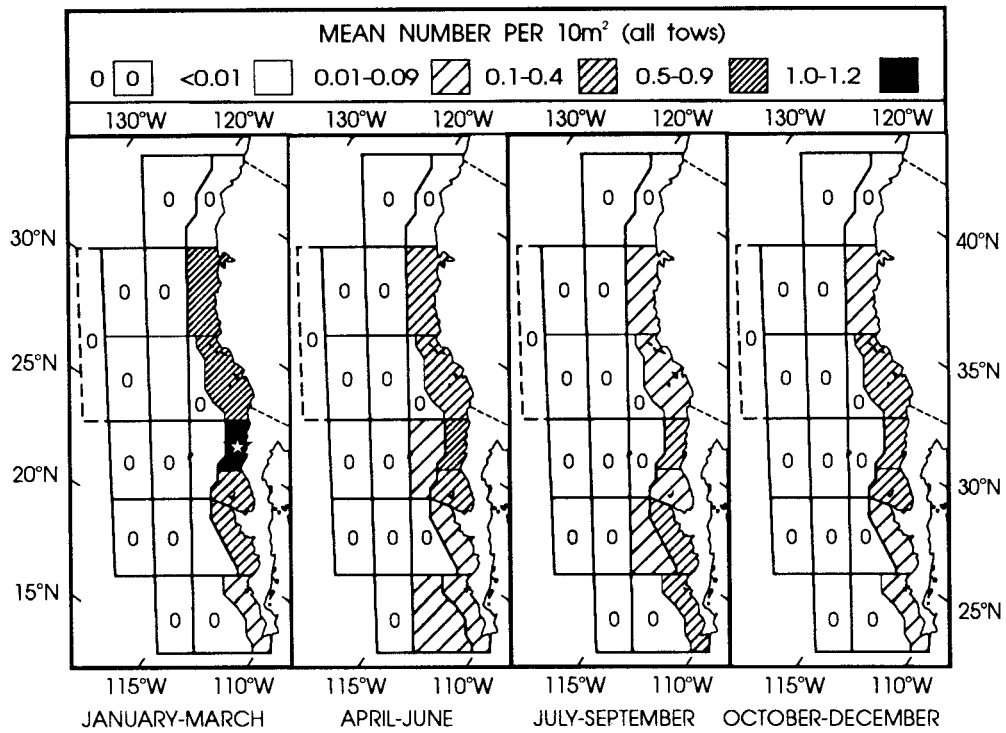
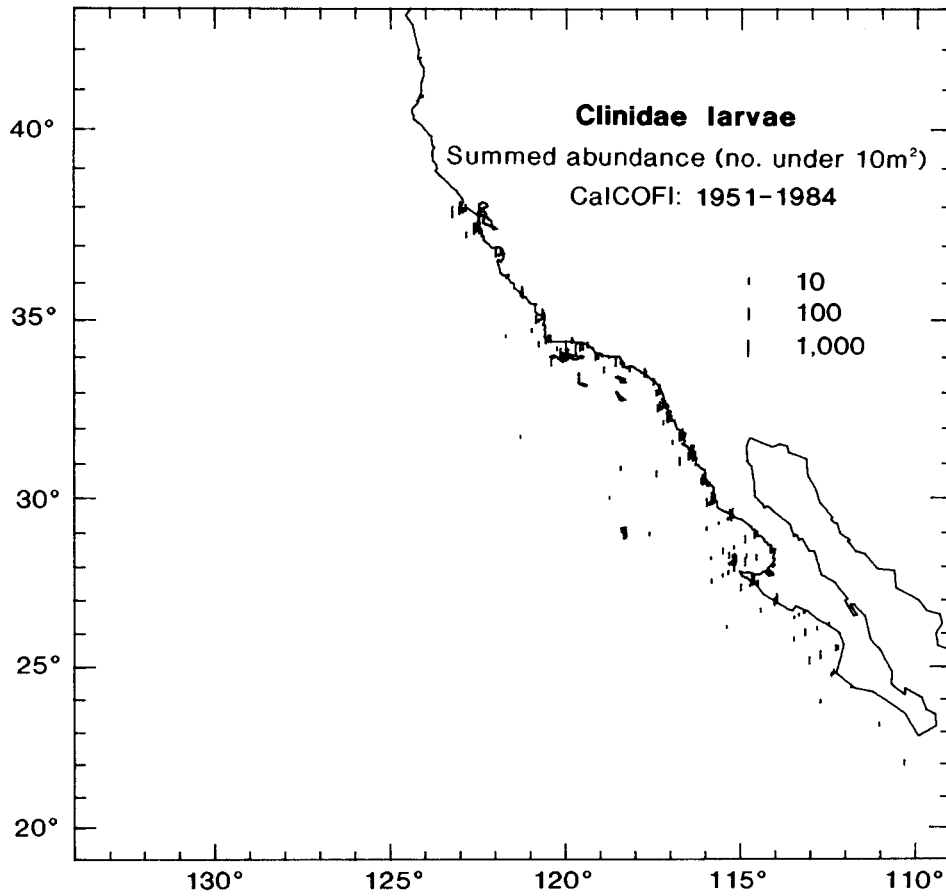
Pacific blackdragon

Idiacanthus antrostomus



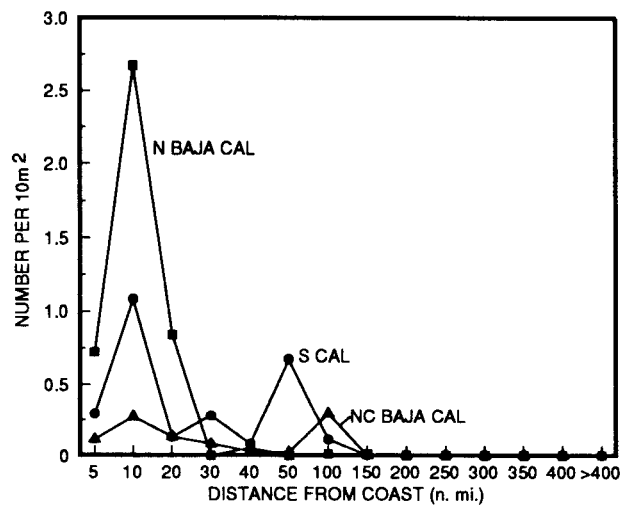
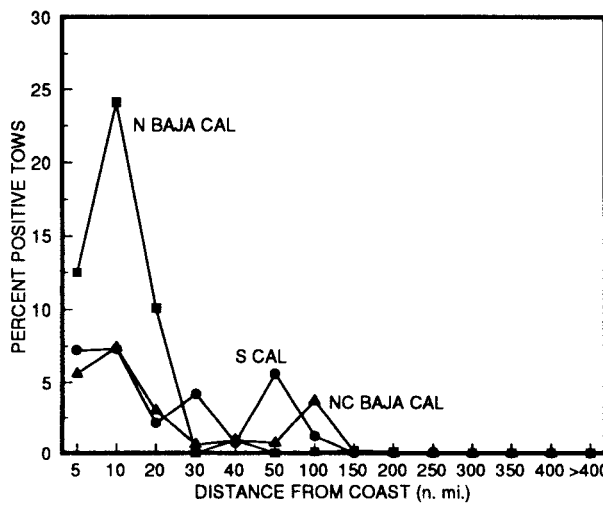
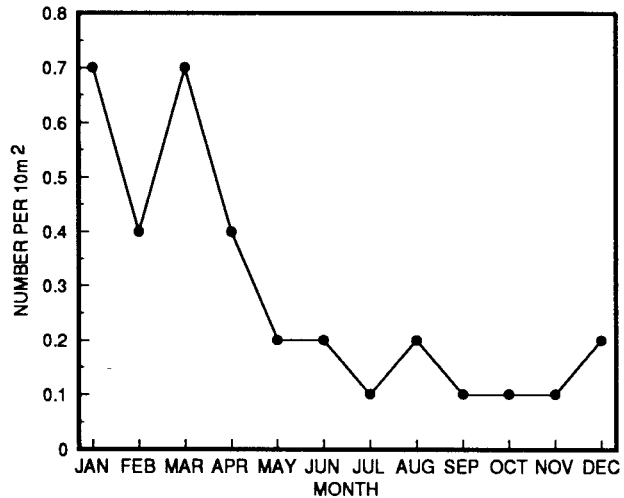
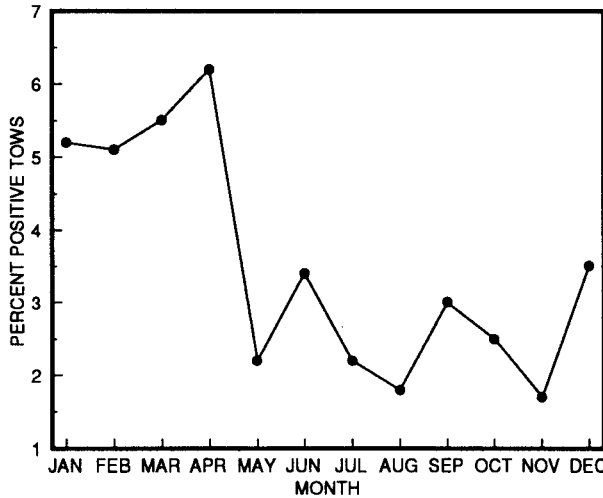
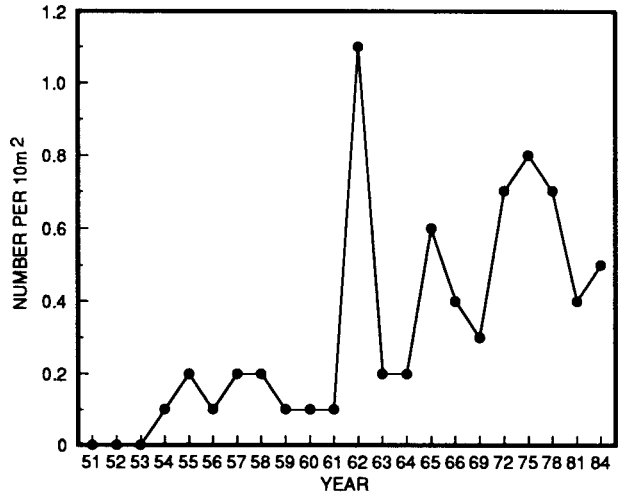
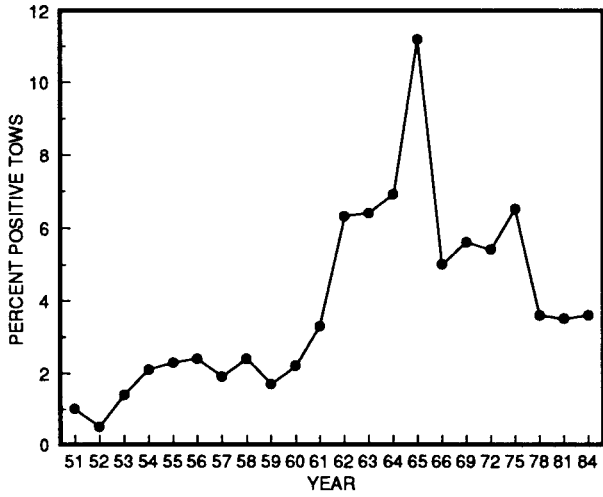
Clinidae

Clinidae



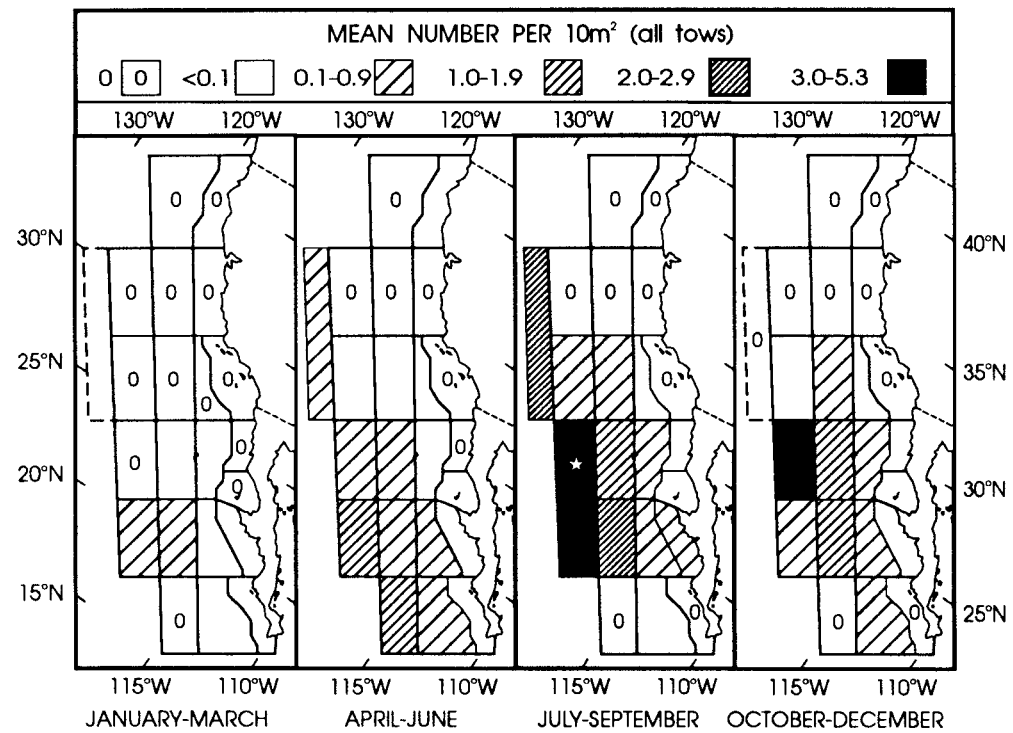
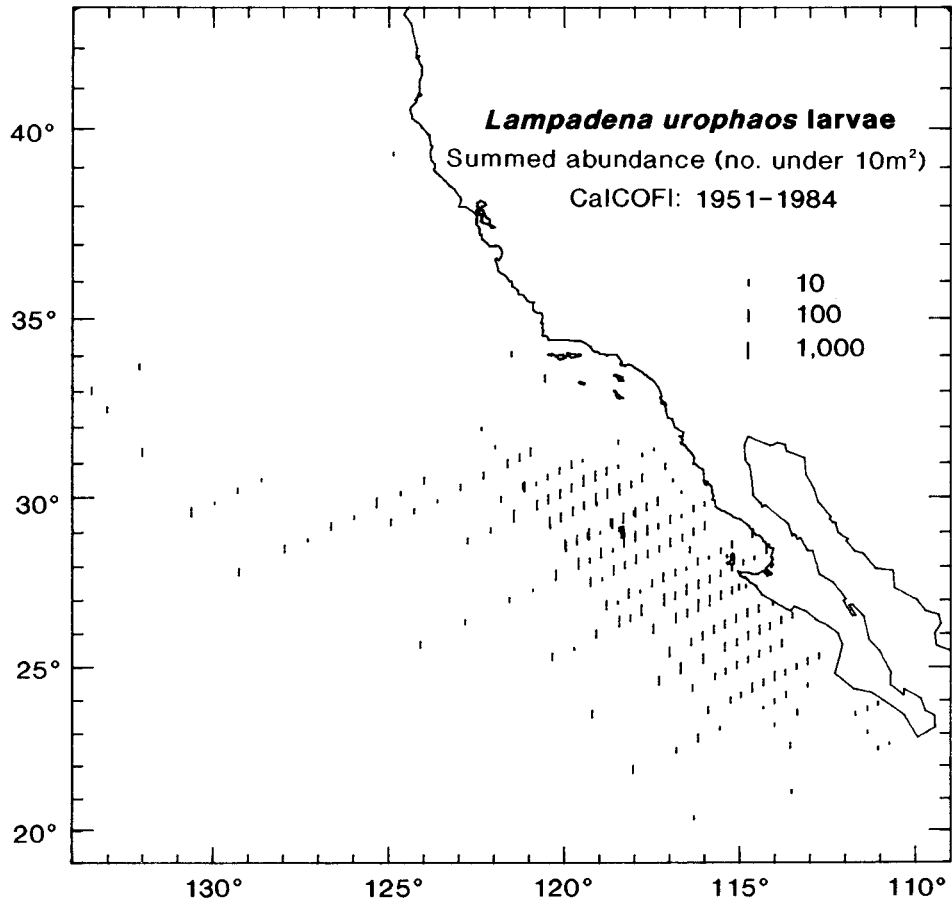
Kelpfishes

Clinidae

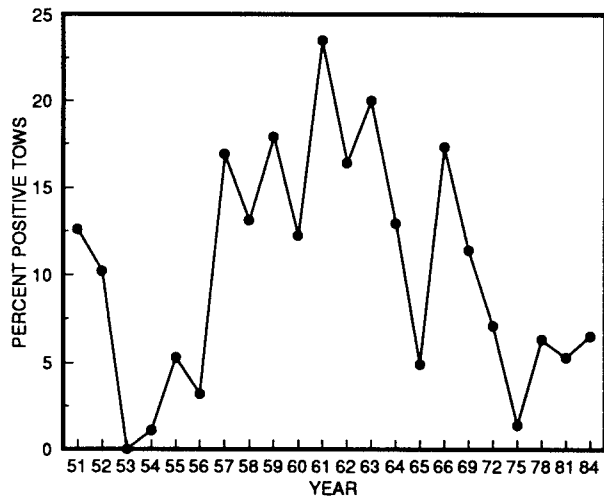


Lampadena urophaos

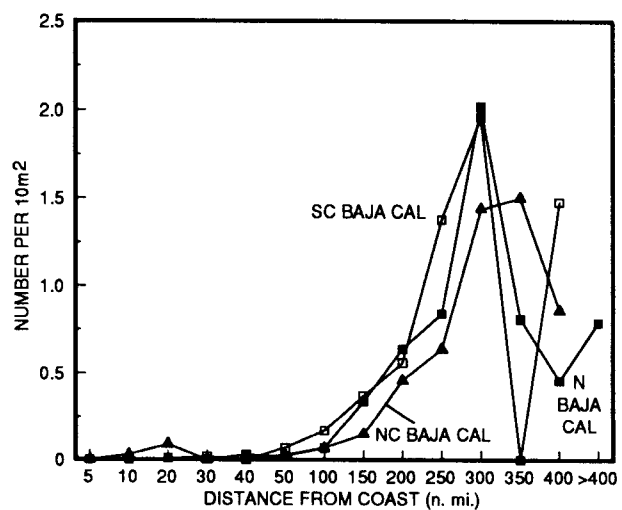
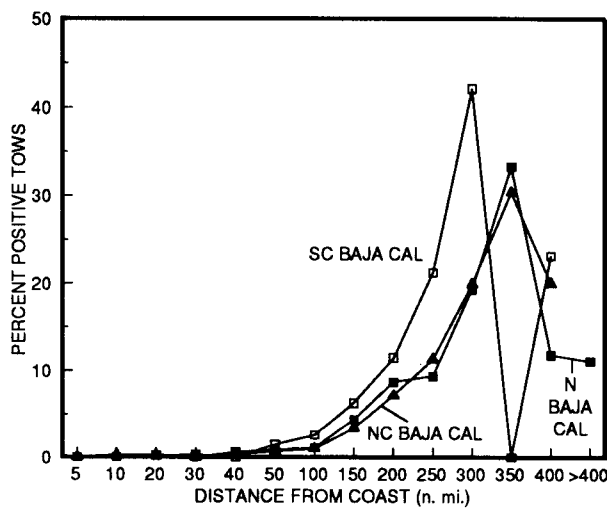
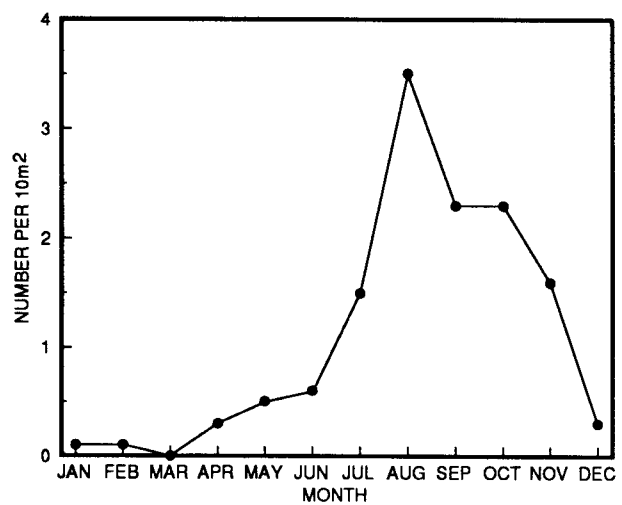
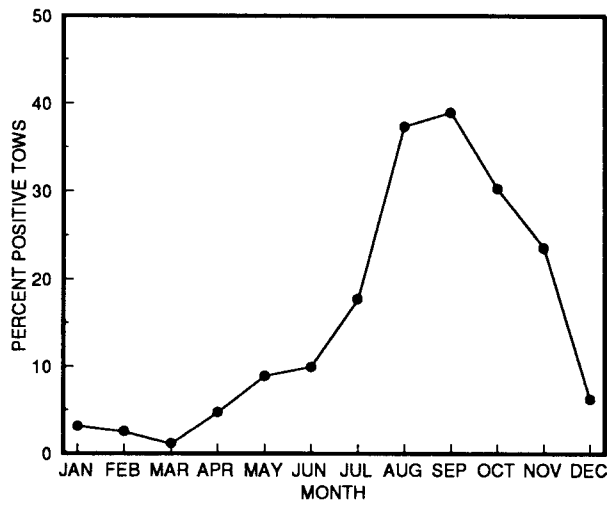
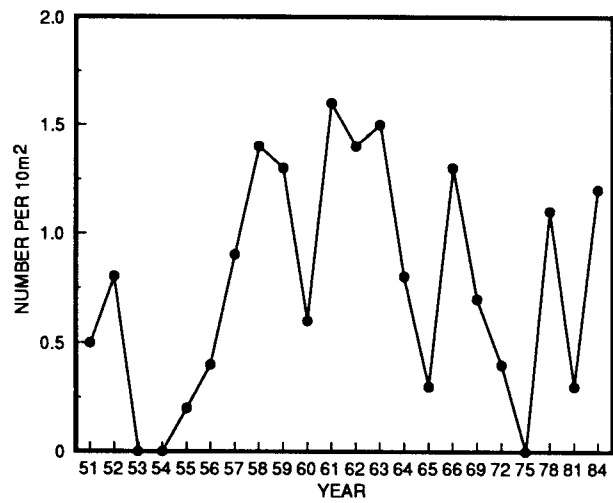
Myctophidae



Sunbeam lampfish

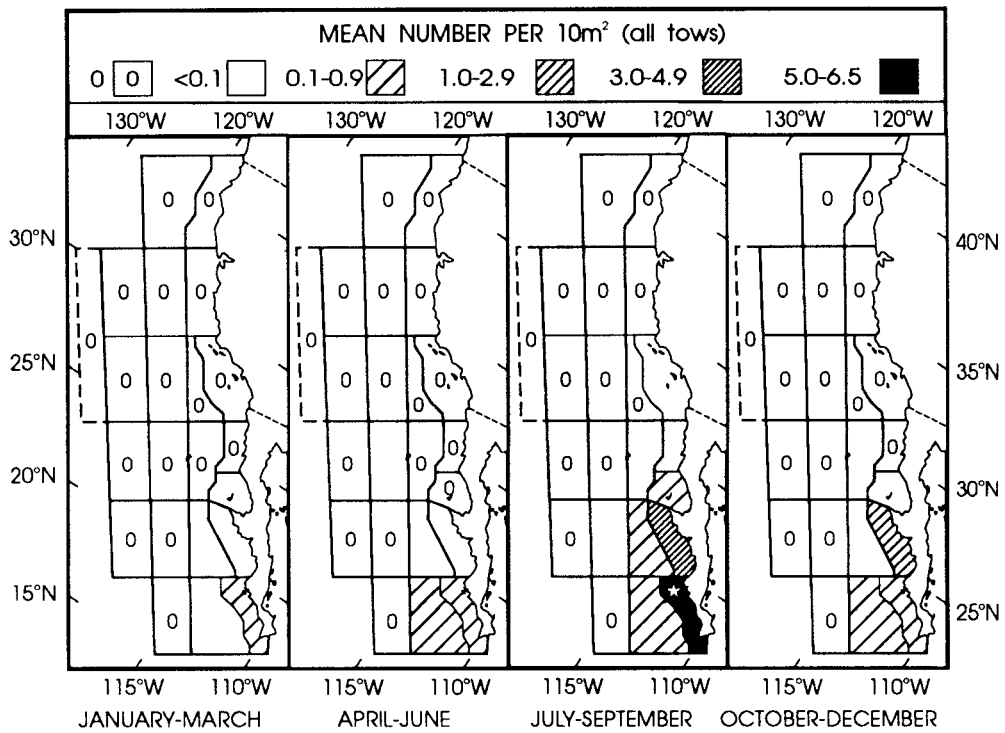
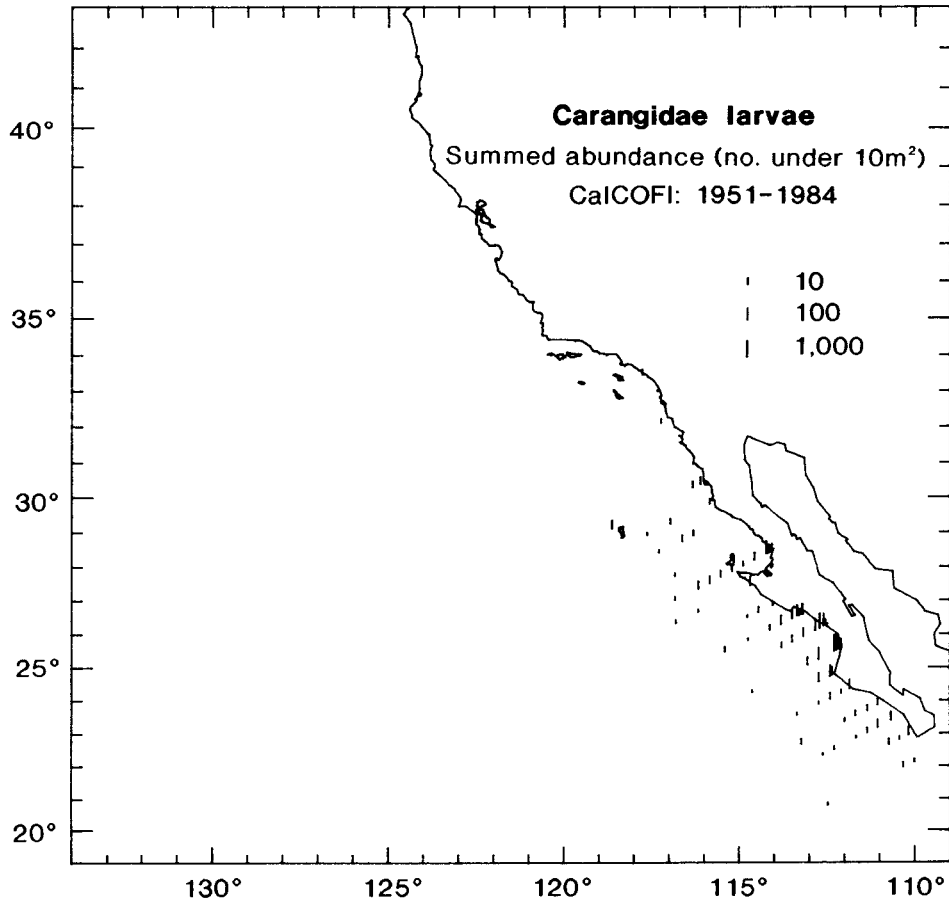


Lampadena urophaos



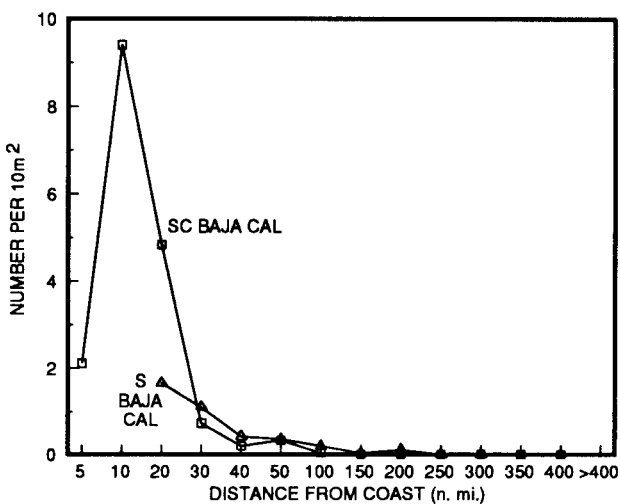
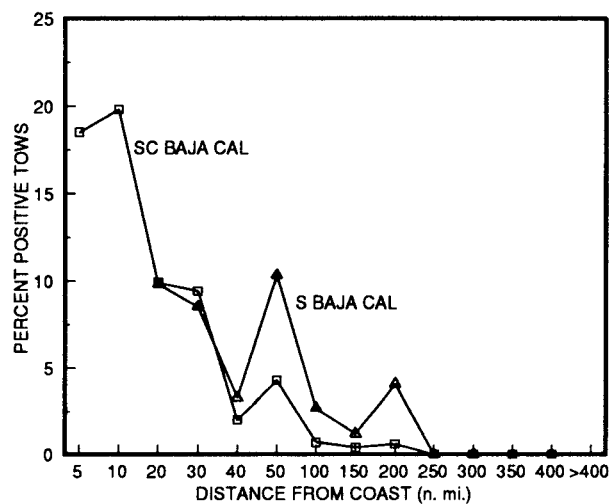
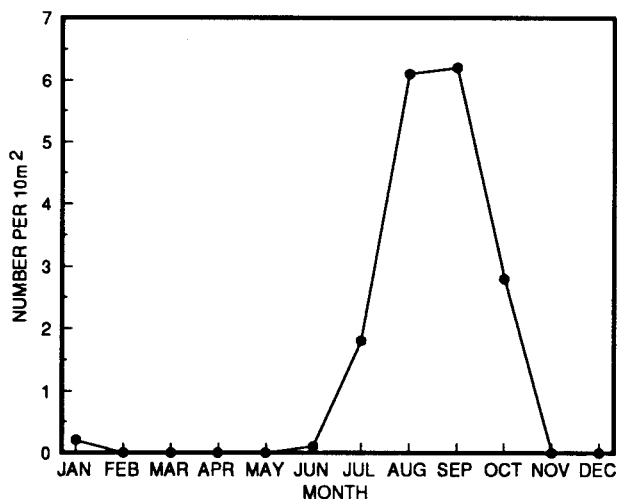
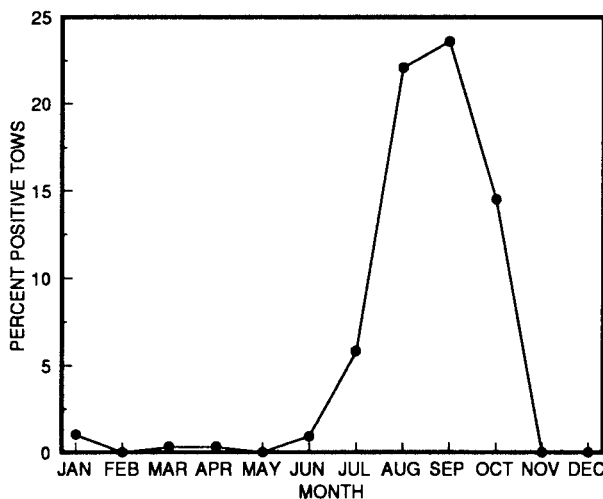
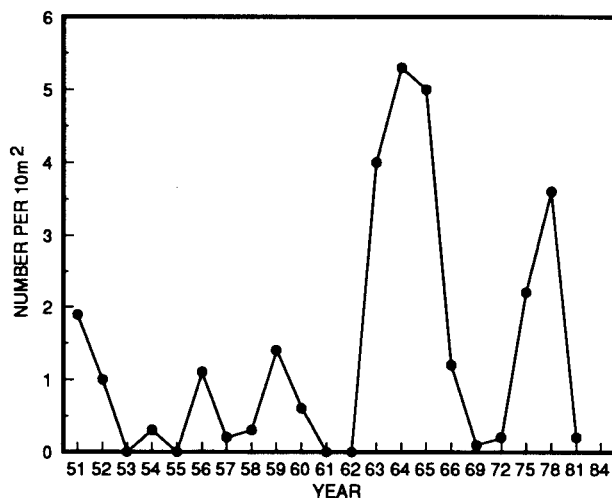
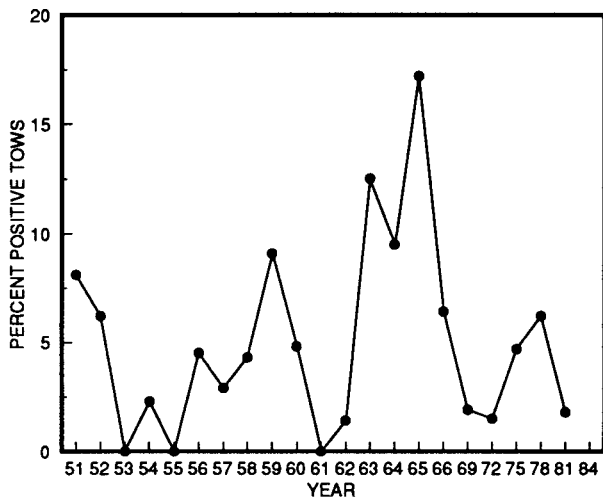
Carangidae

Carangidae



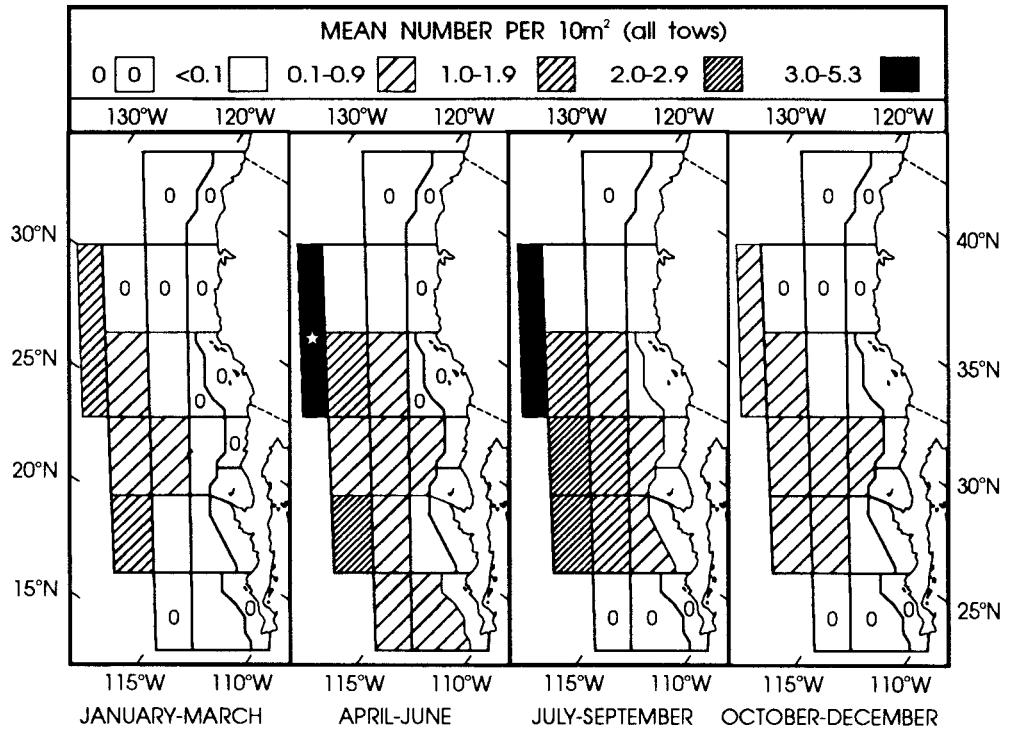
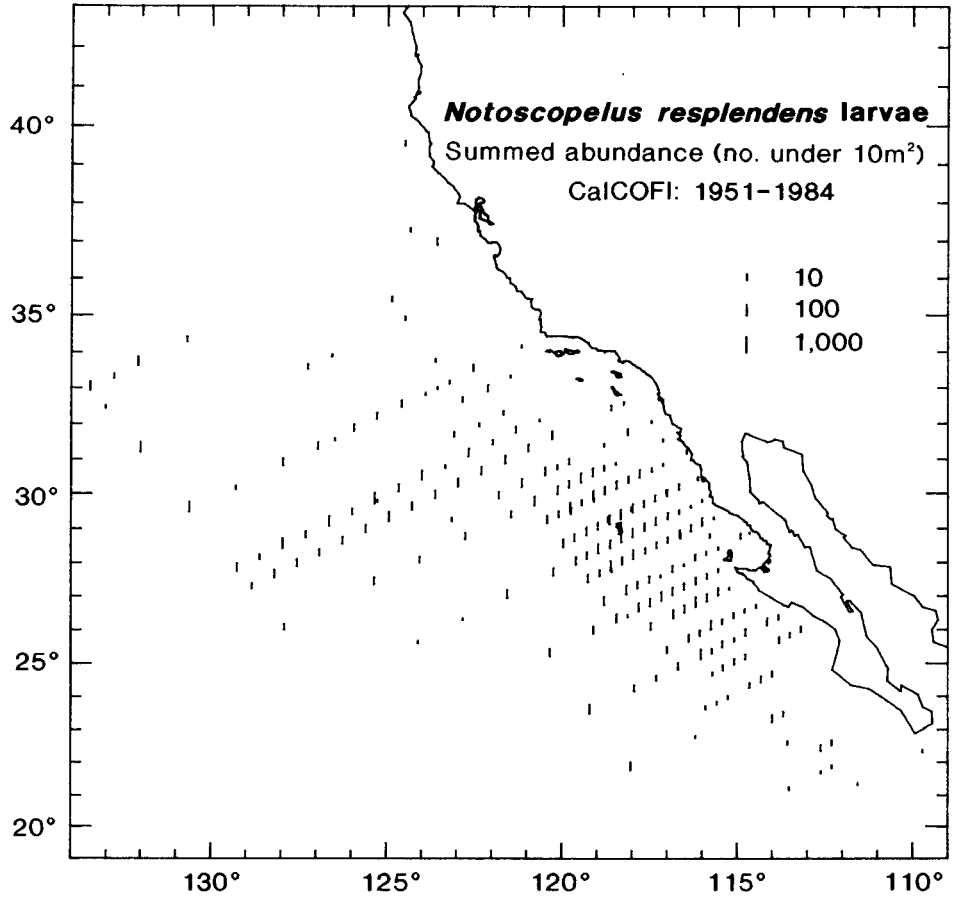
Jacks

Carangidae

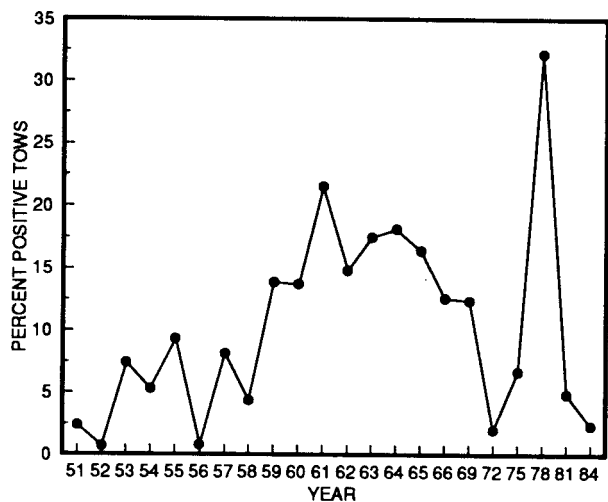


Notoscopelus resplendens

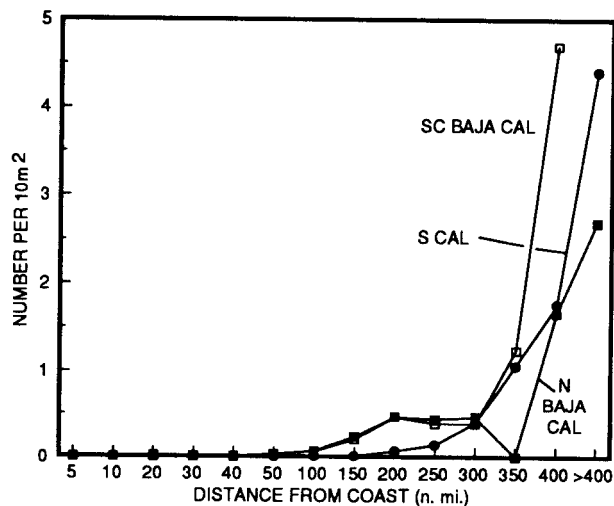
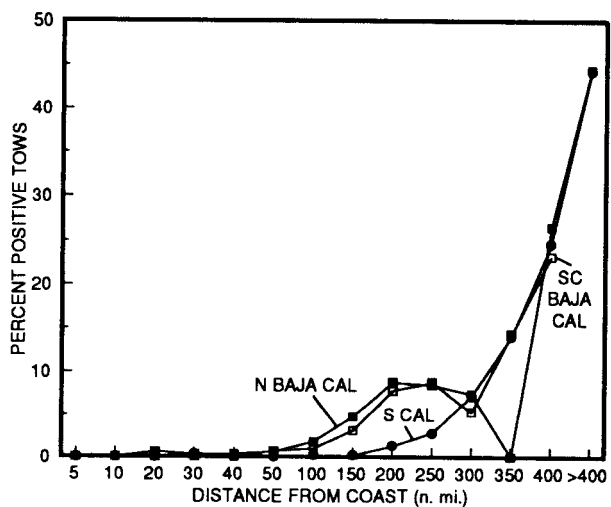
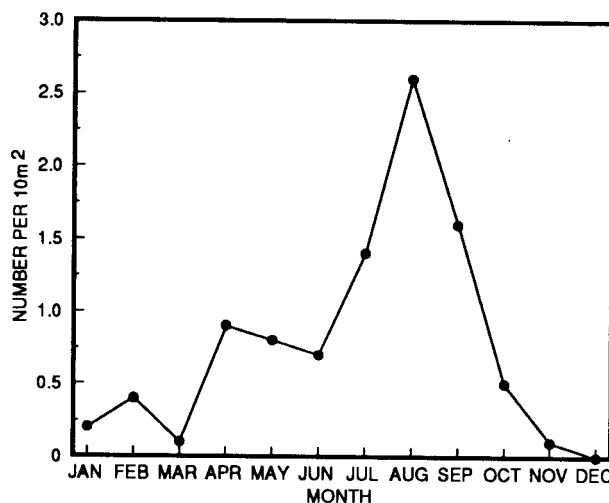
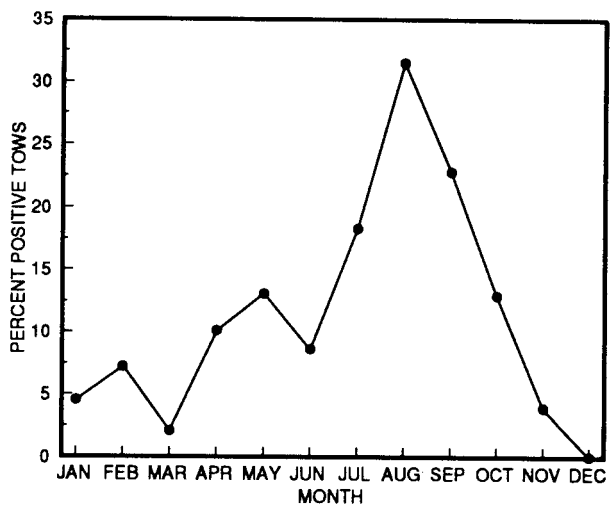
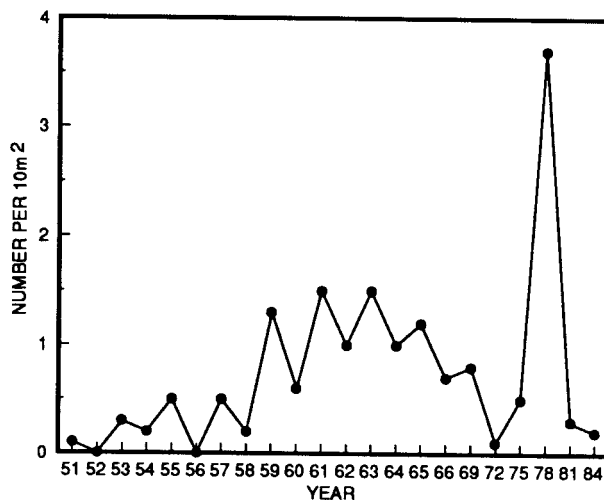
Myctophidae



Patchwork lampfish

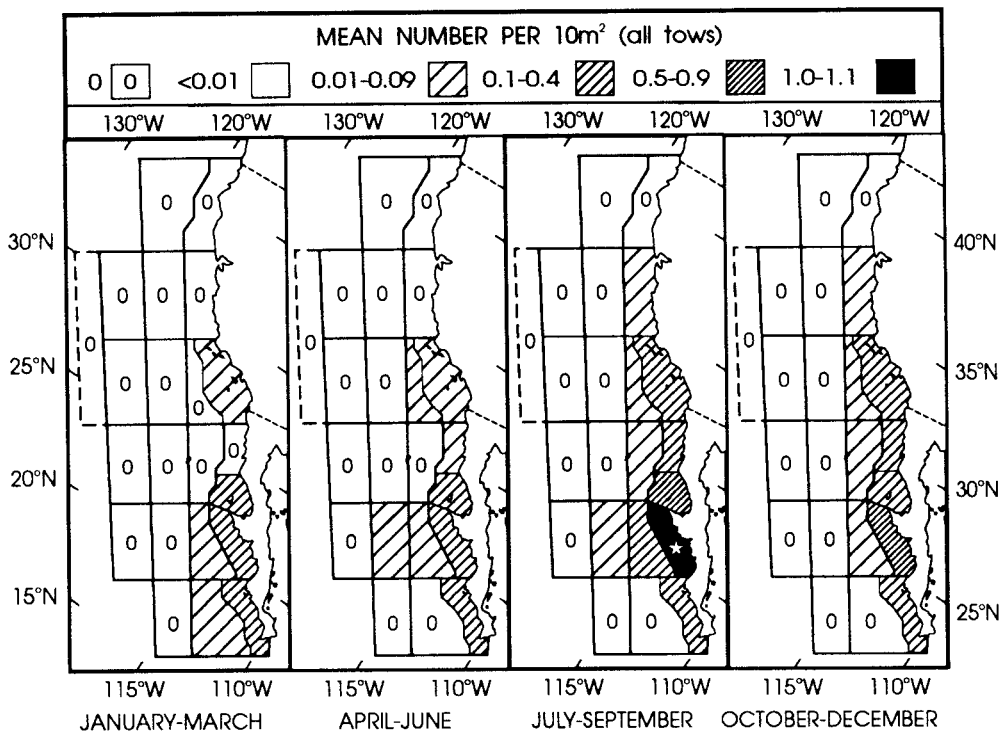
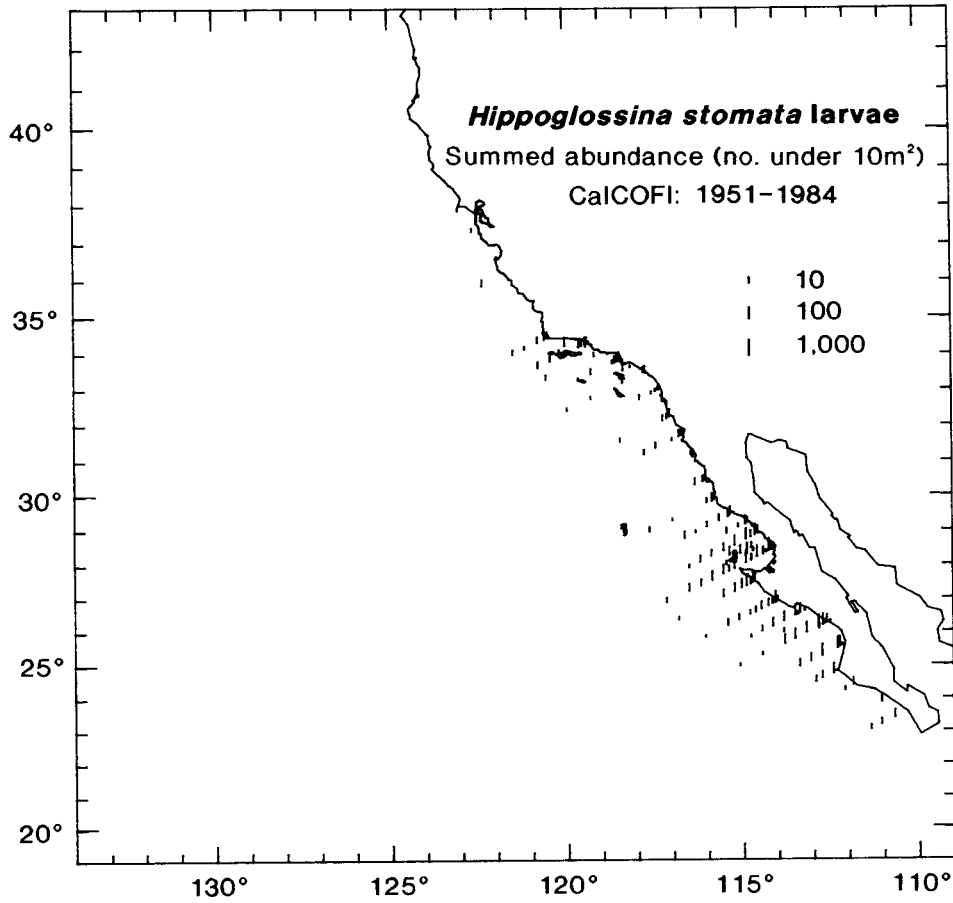


Notoscopelus resplendens



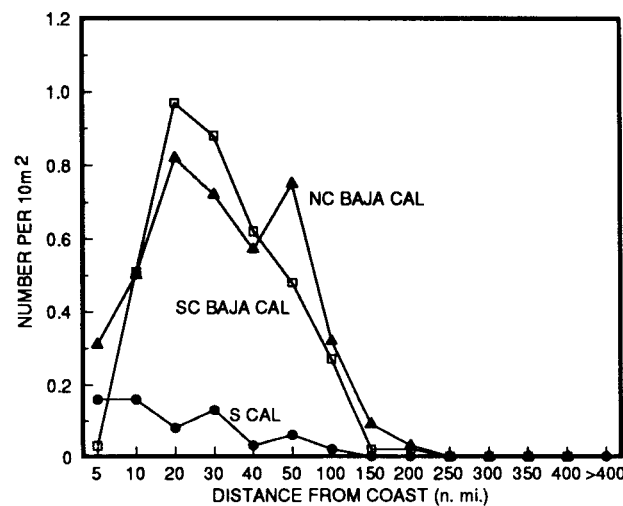
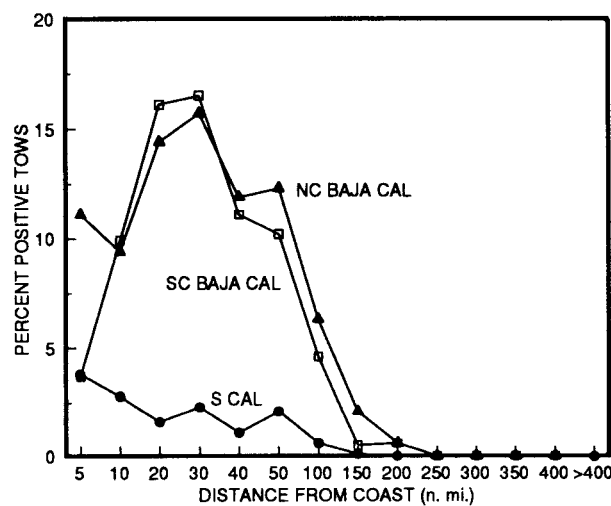
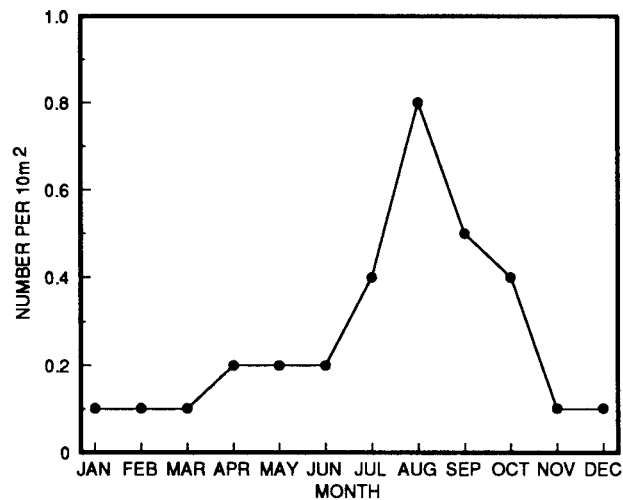
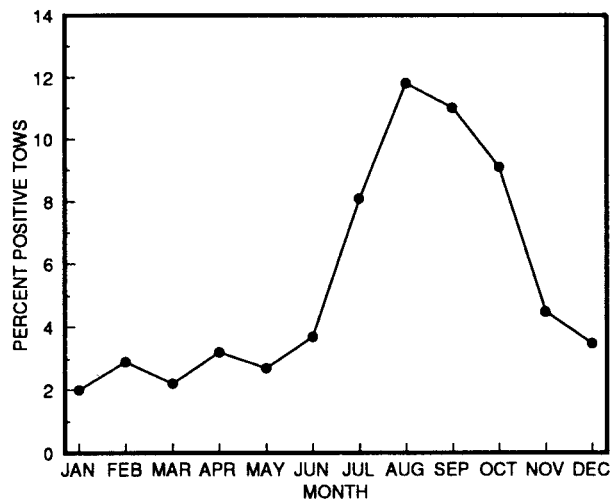
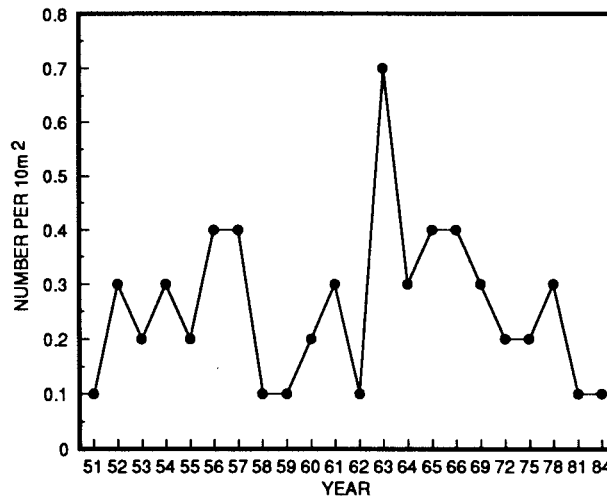
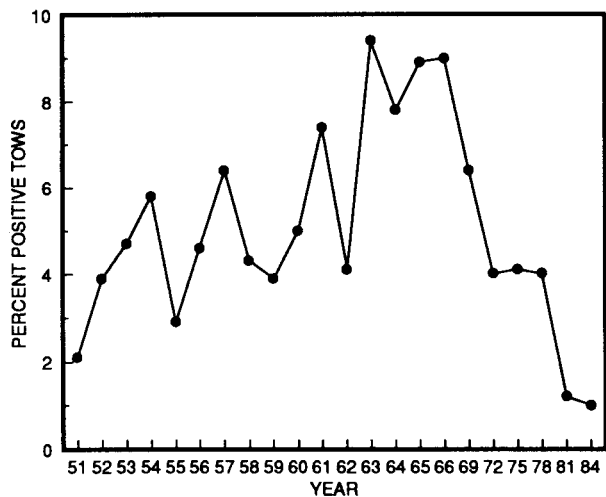
Hippoglossina stomata

Paralichthyidae



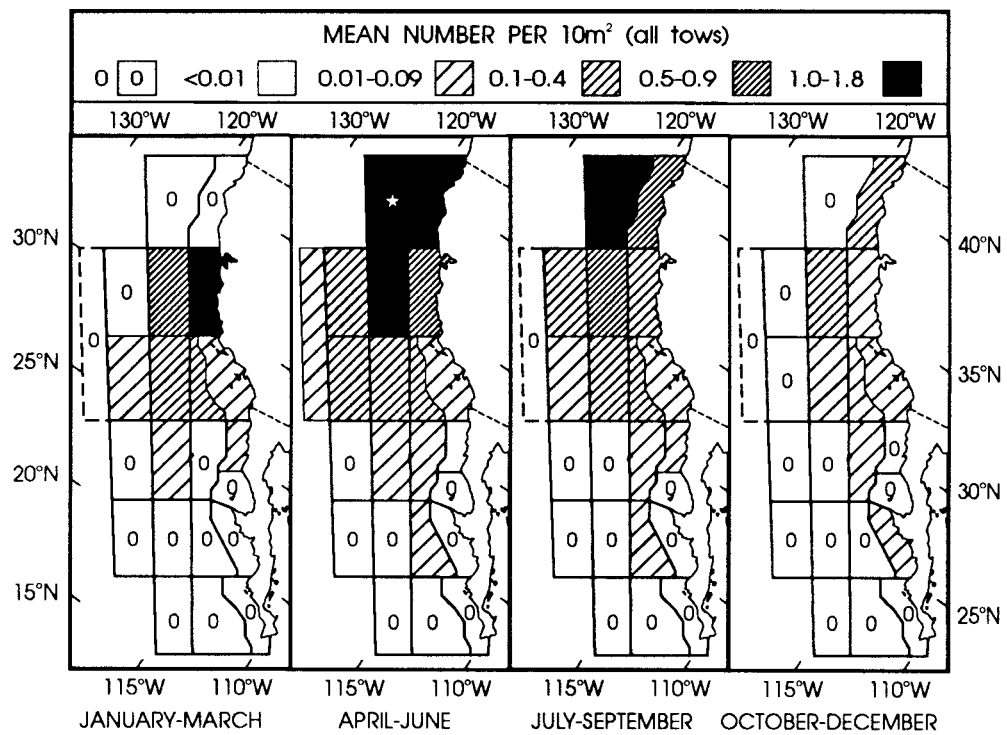
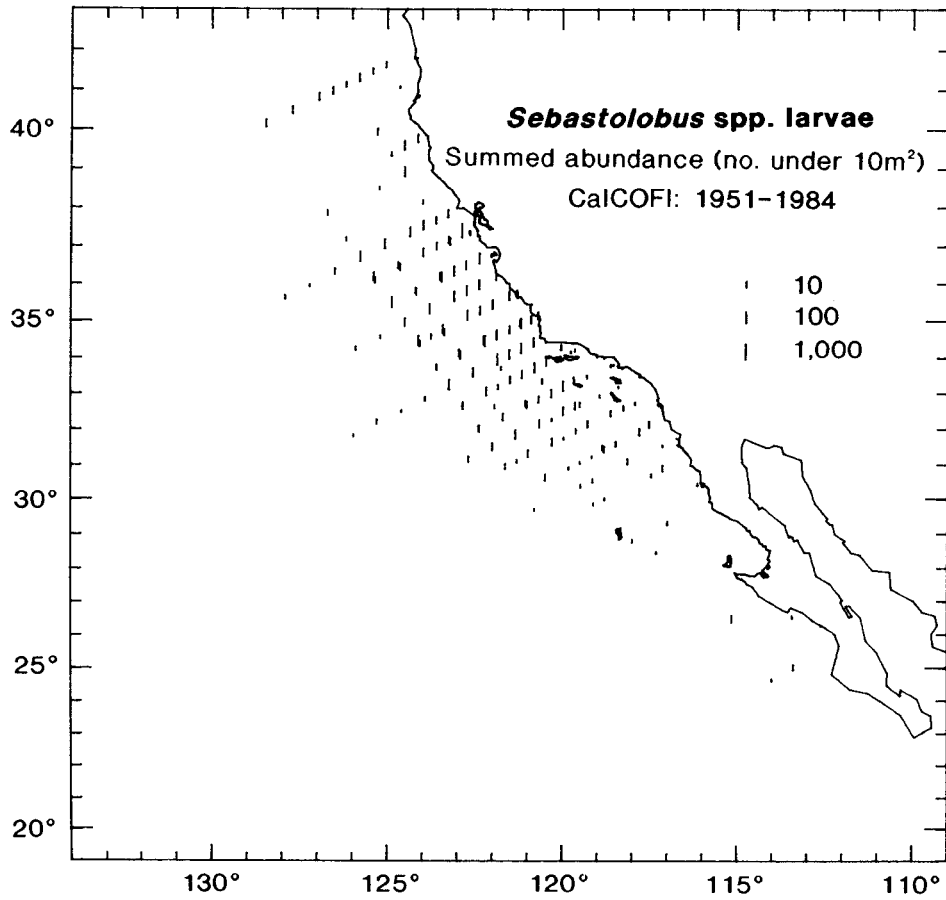
Bigmouth sole

Hippoglossina stomata

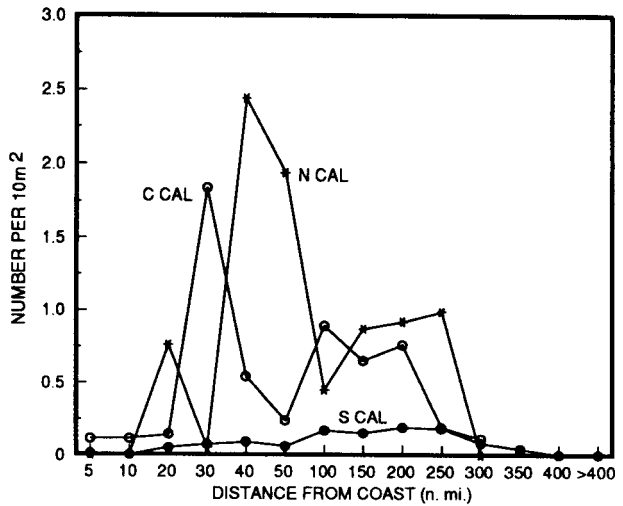
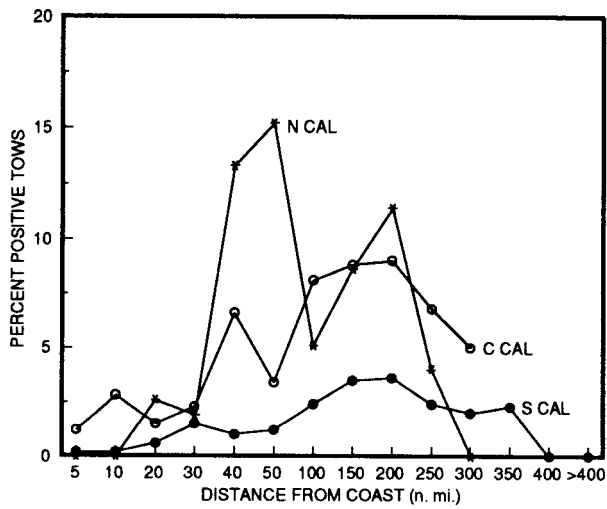
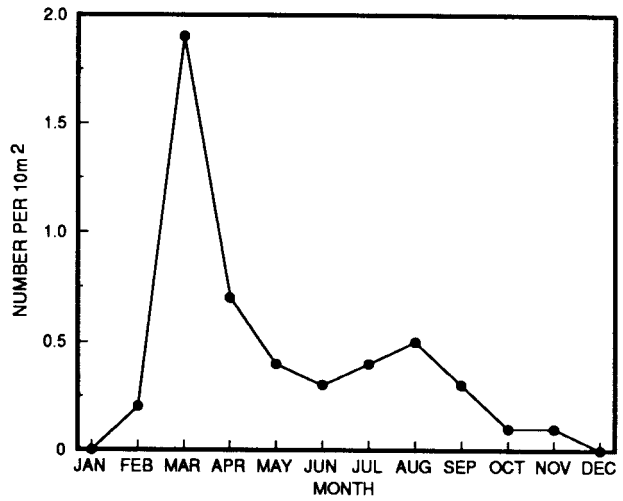
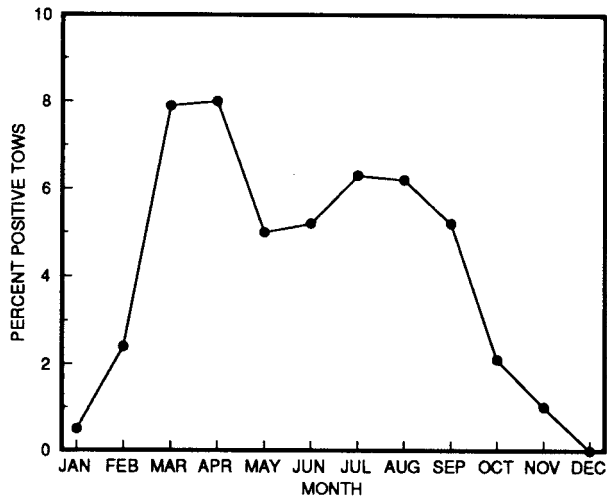
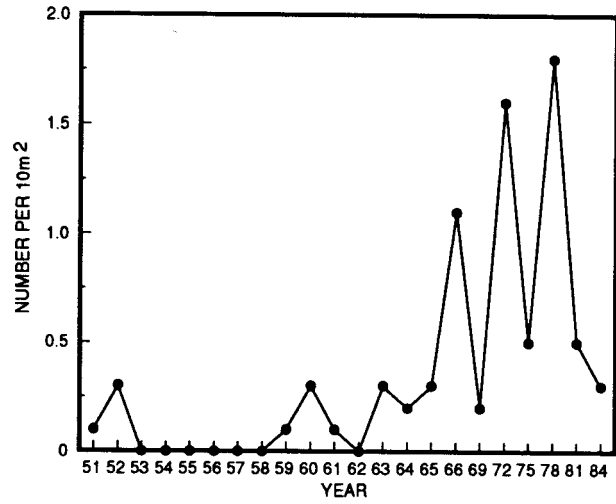
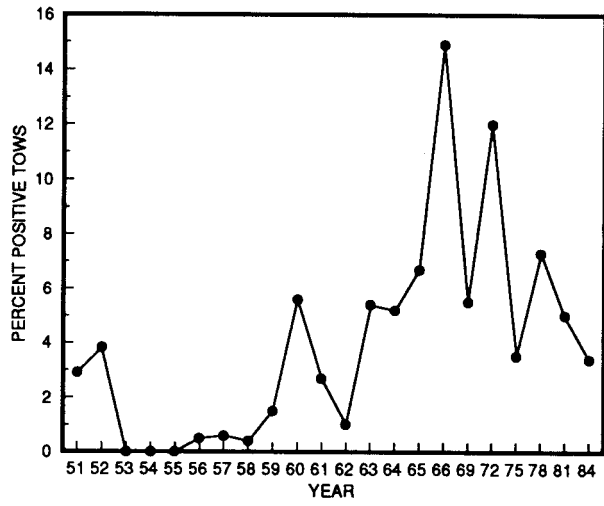


Sebastolobus spp.

Scorpaenidae

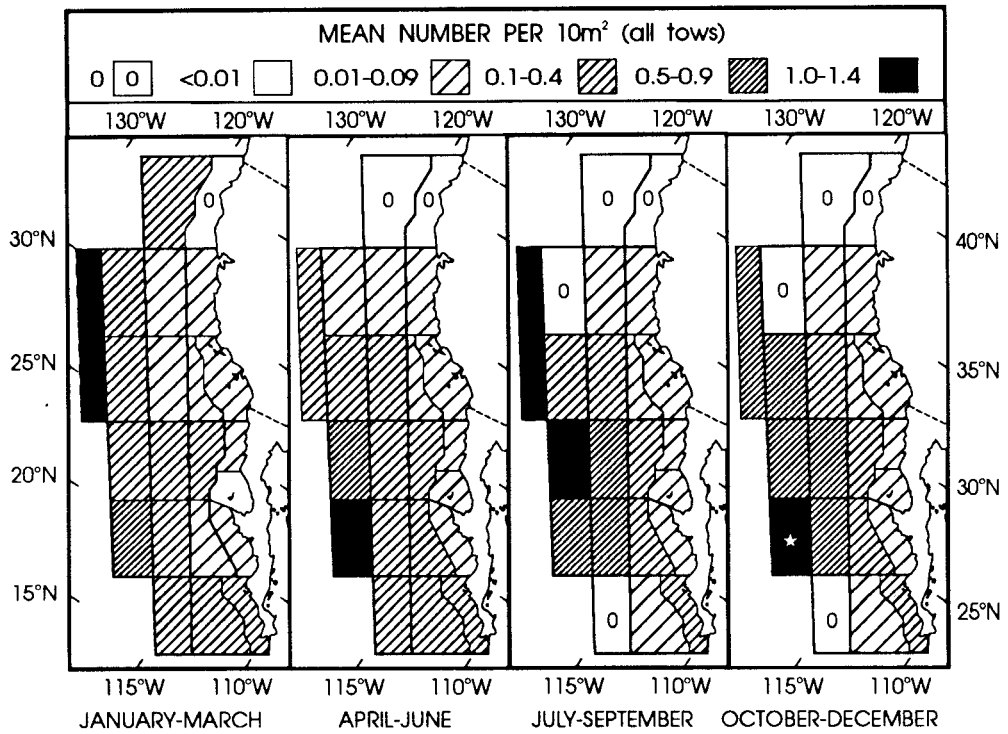
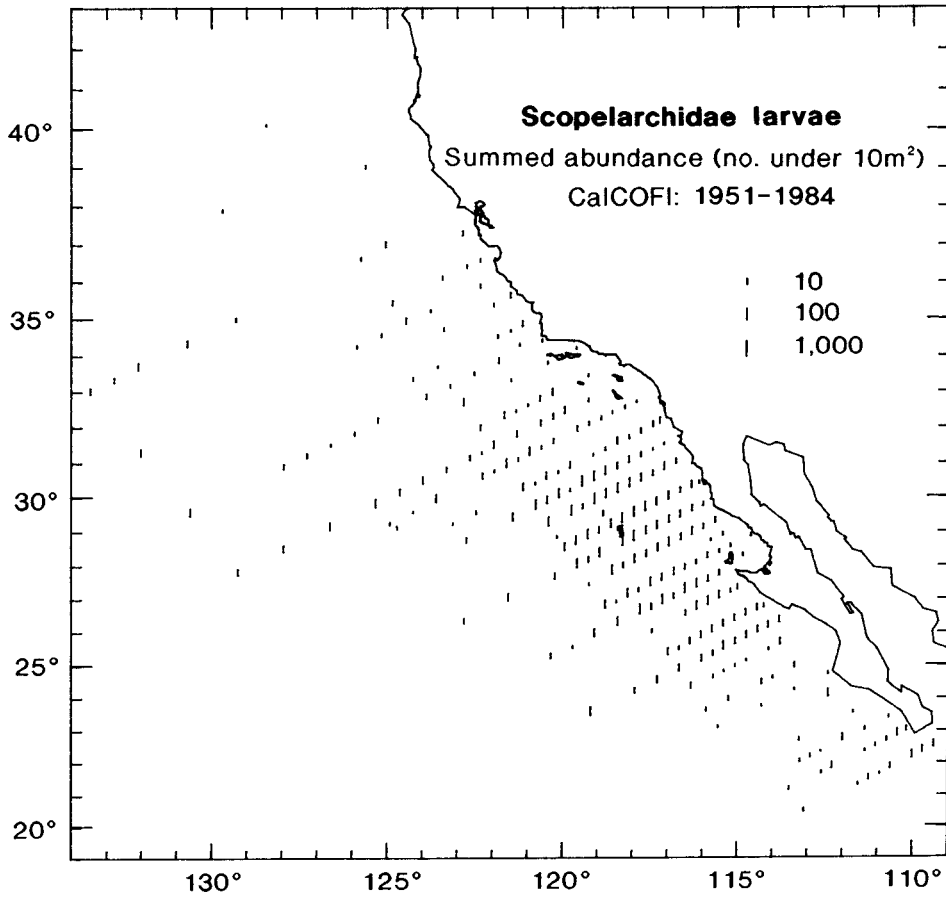


Thornyheads

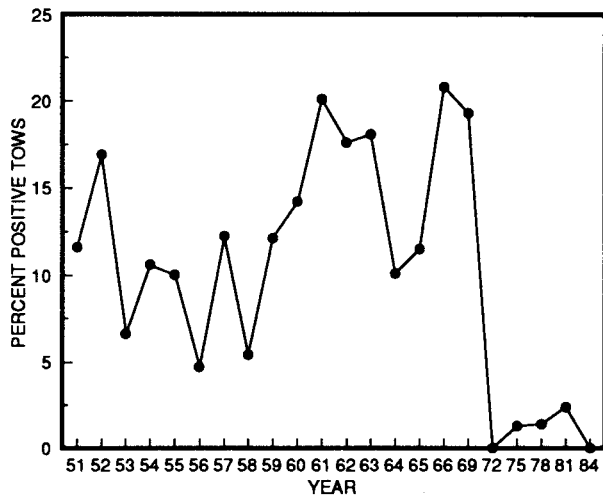


Scopelarchidae

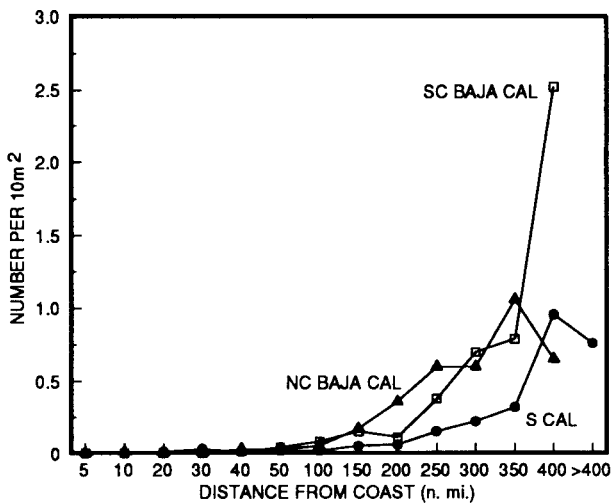
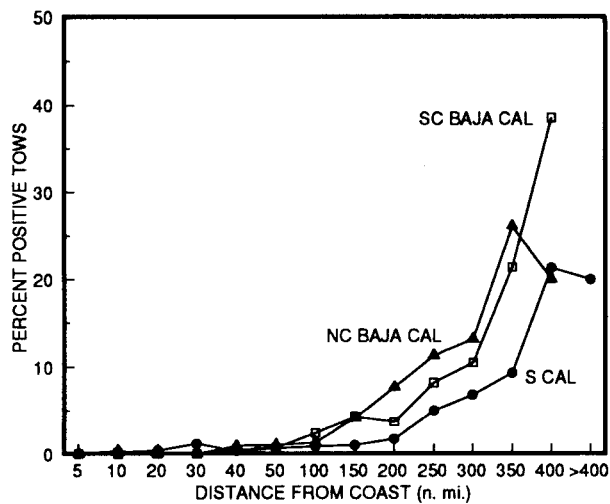
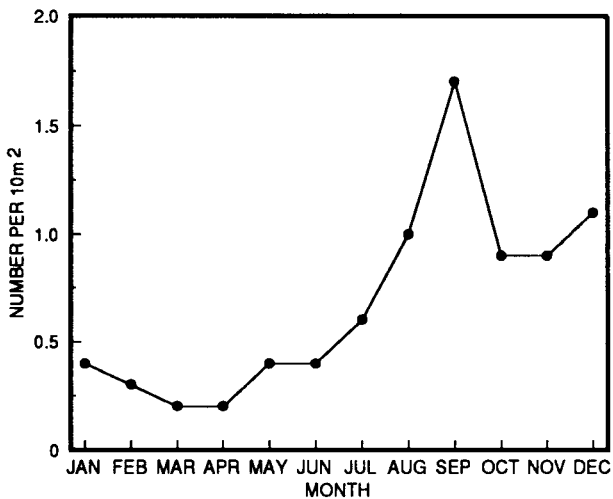
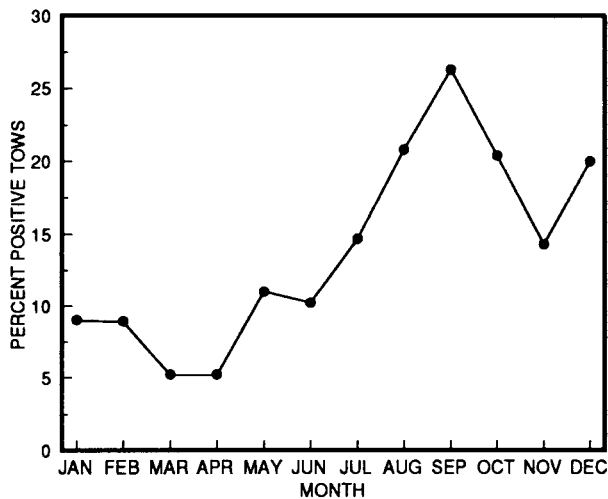
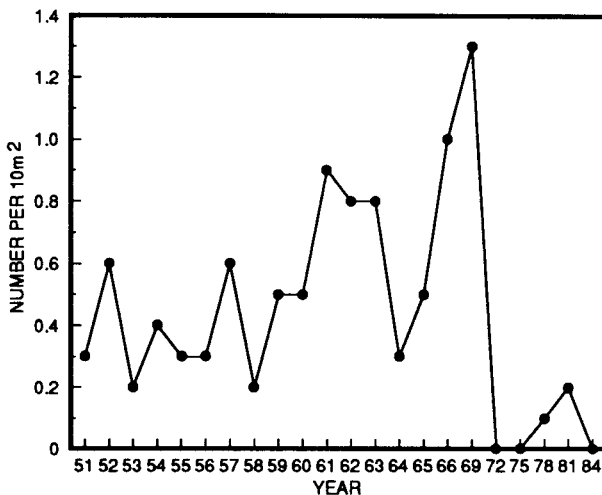
Scopelarchidae



Pearleyes

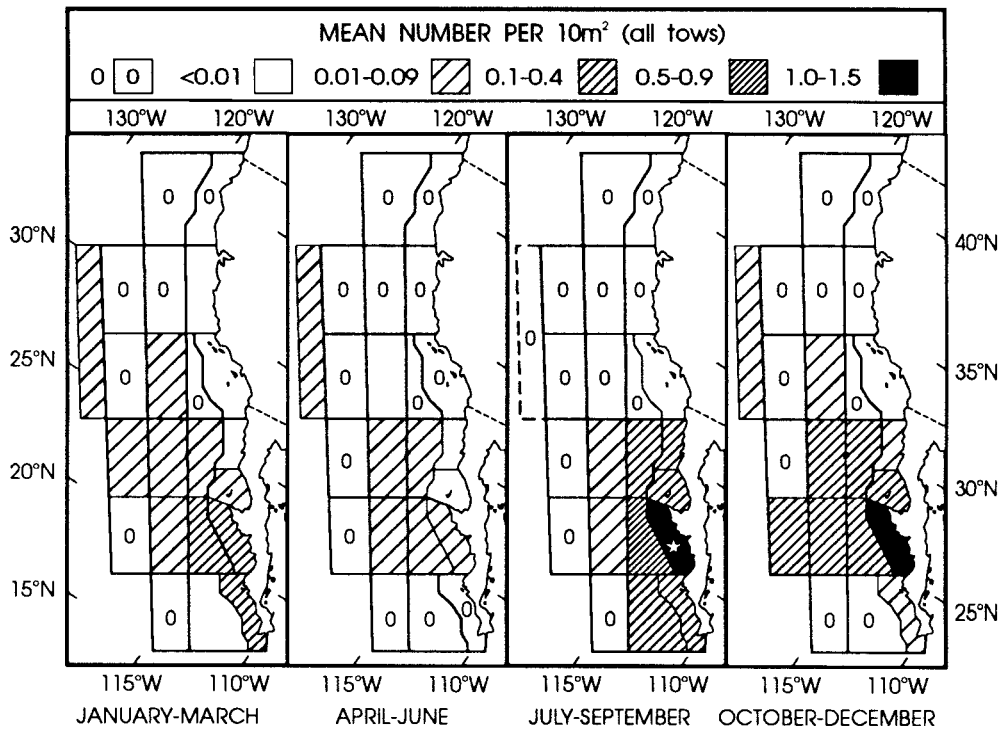
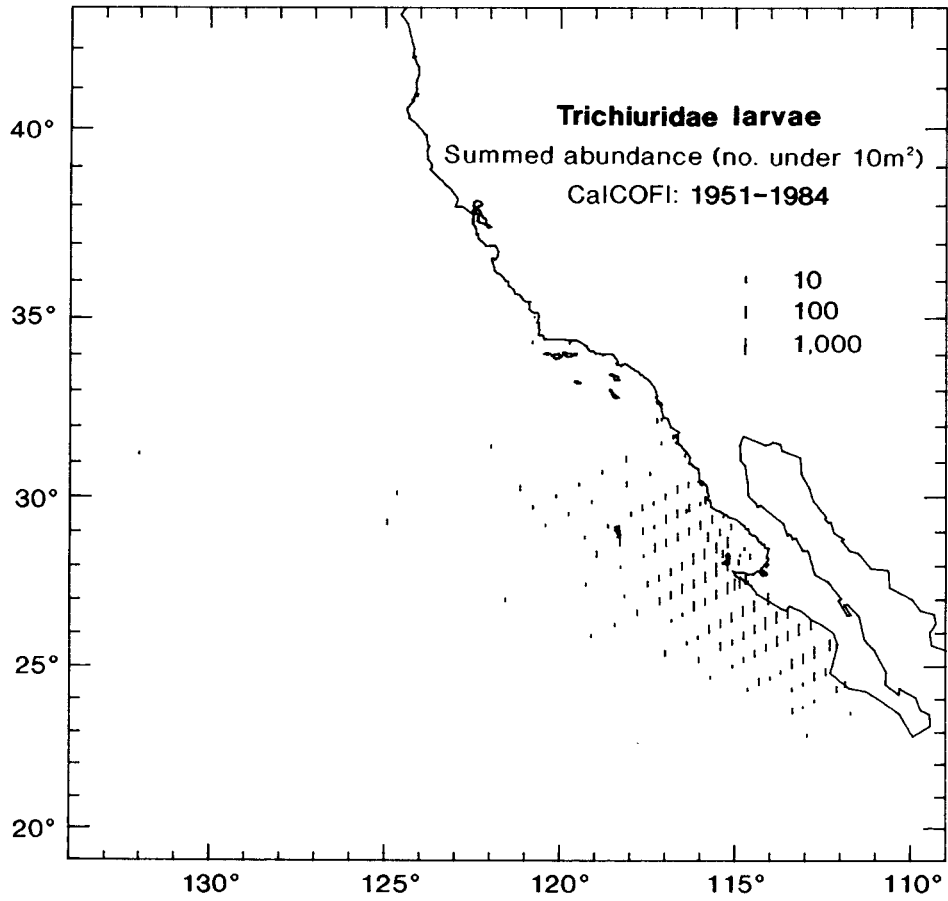


Scopelarchidae



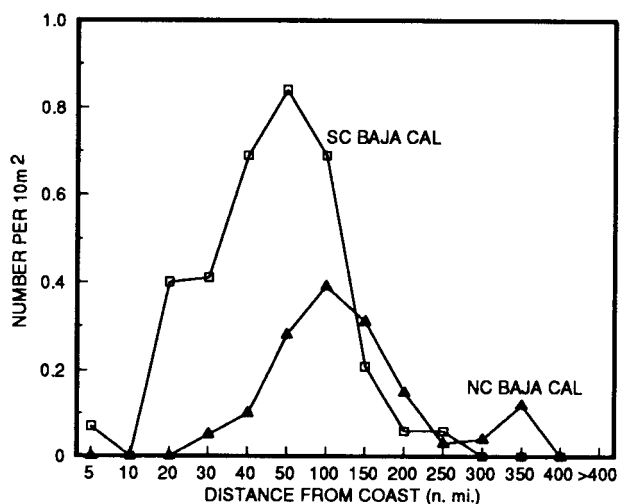
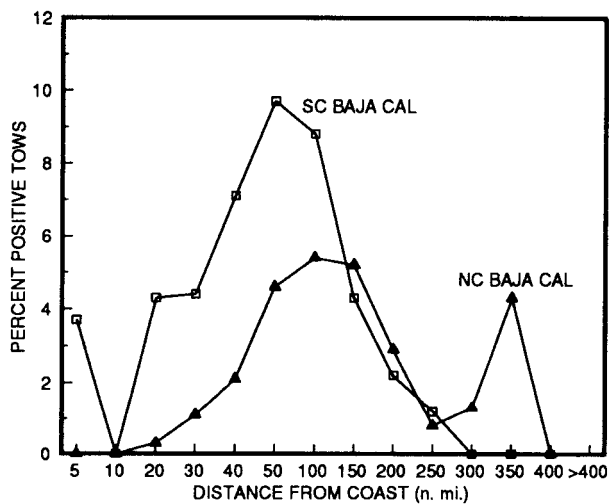
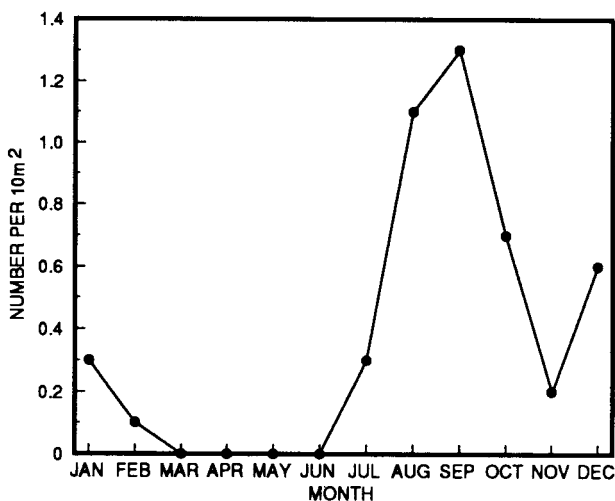
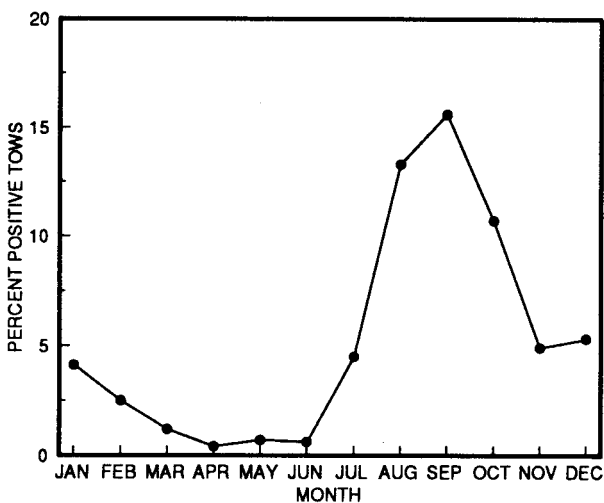
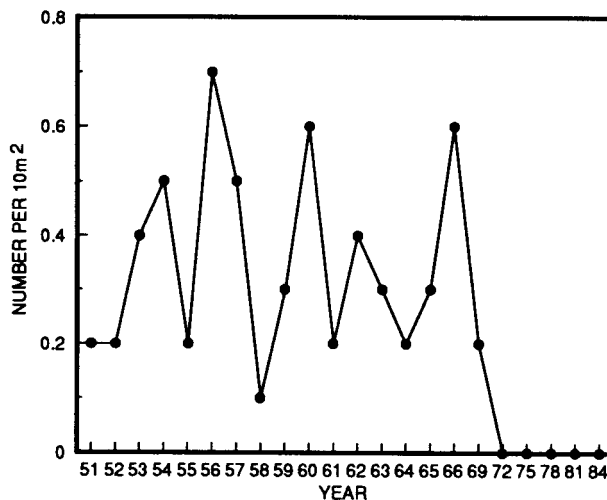
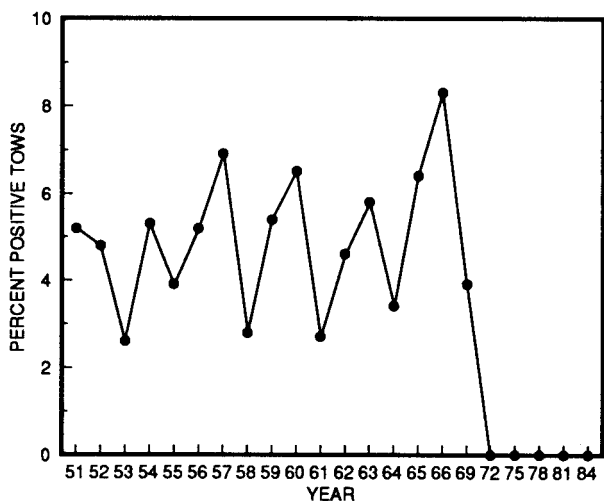
Trichiuridae

Trichiuridae



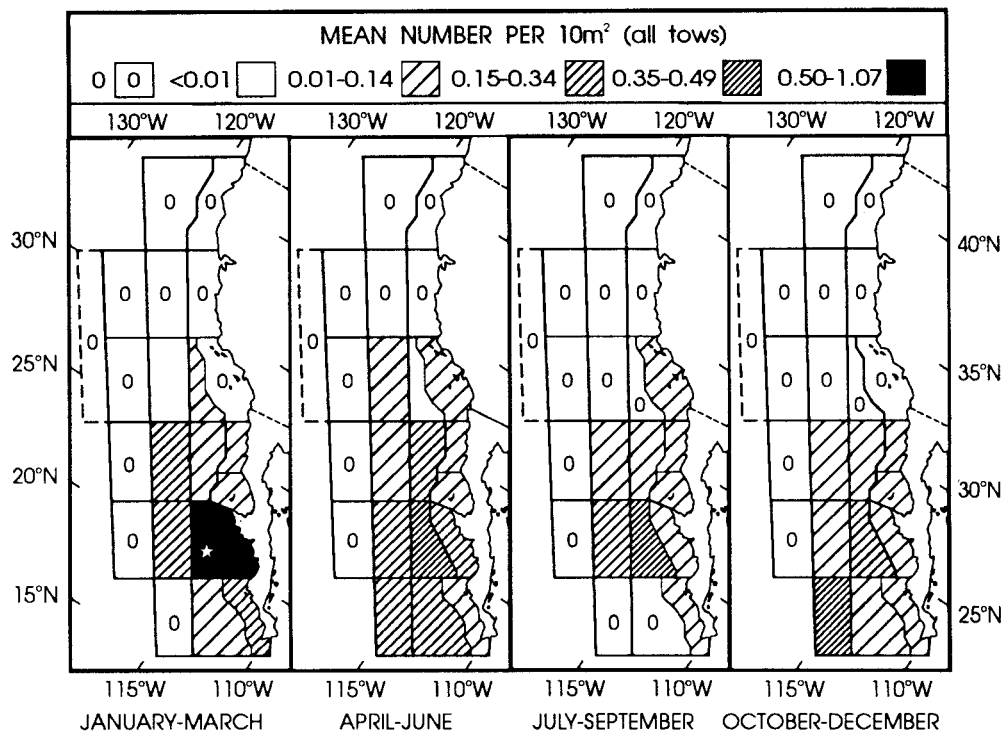
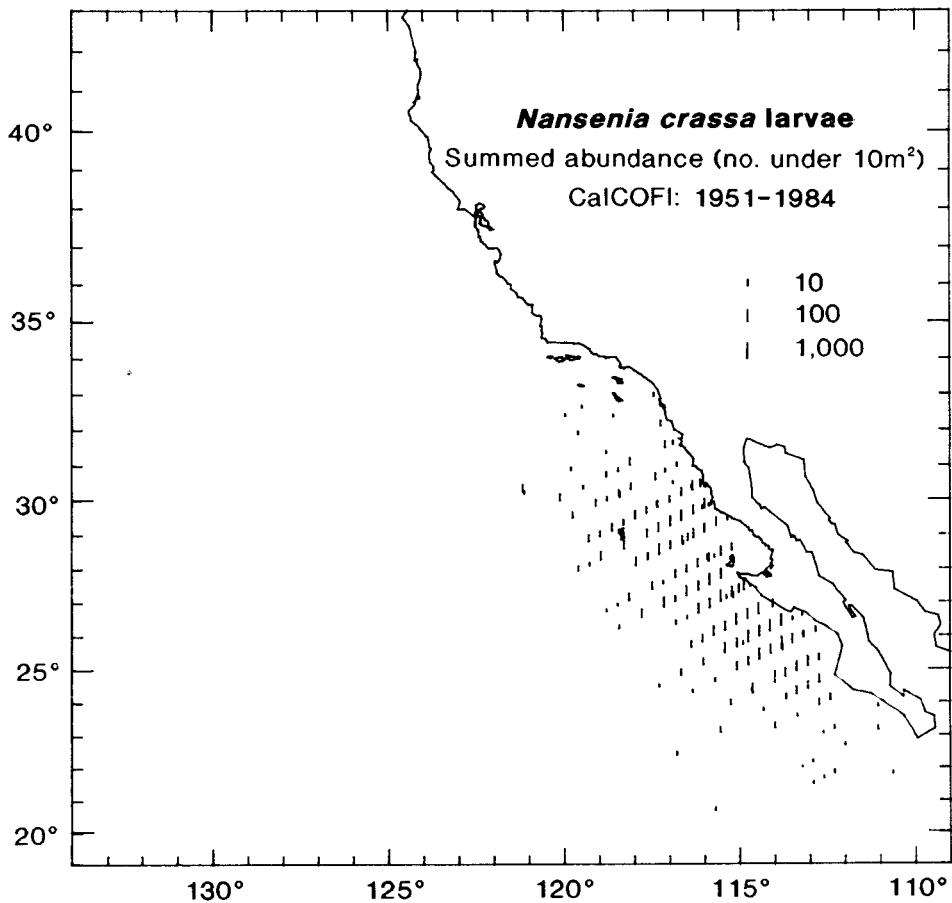
Cutlassfishes

Trichiuridae



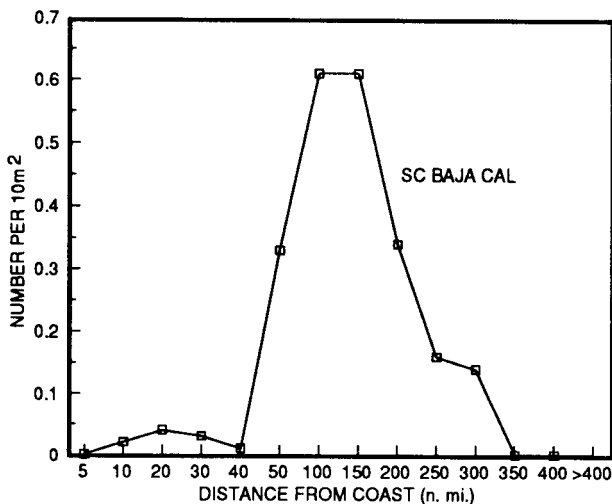
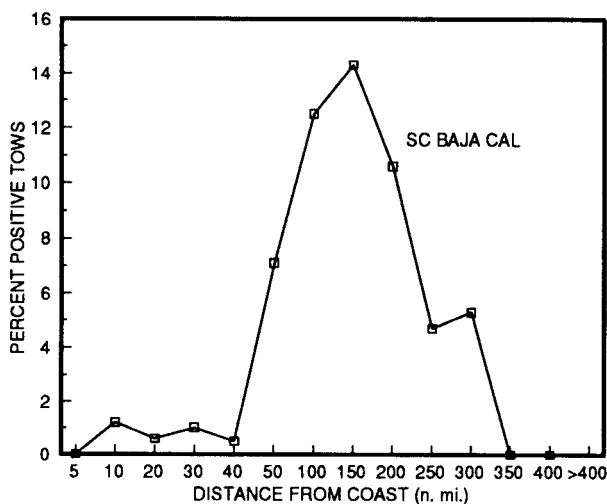
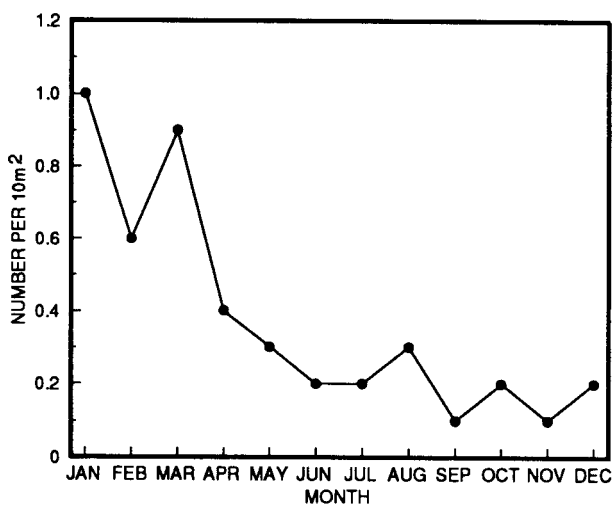
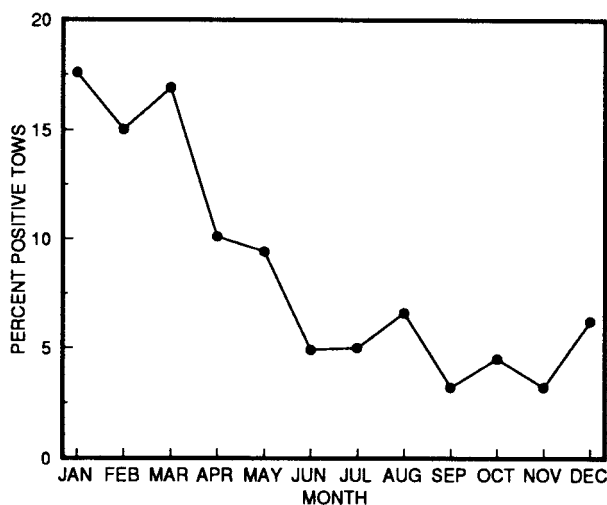
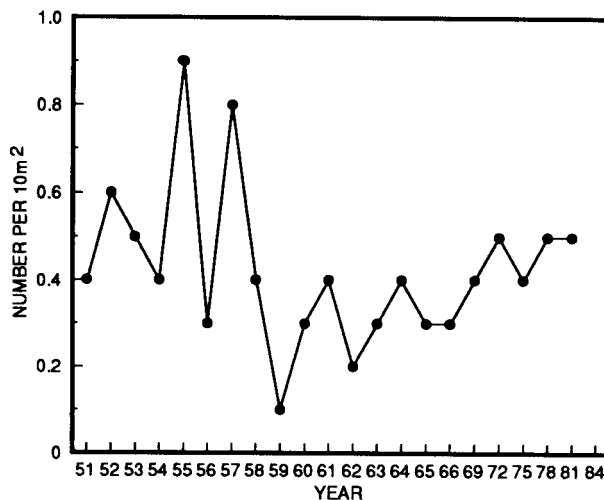
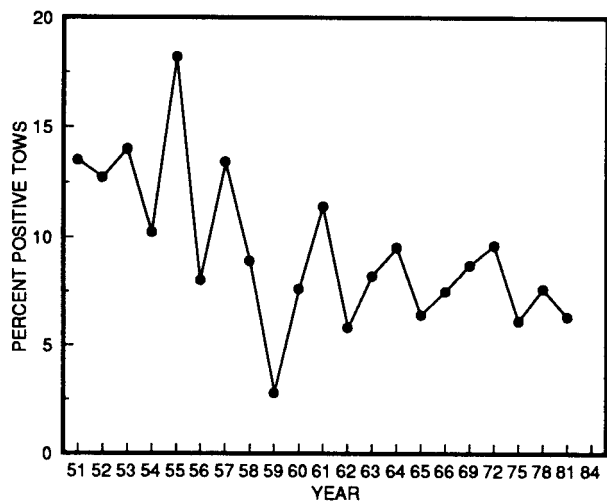
Nansenia crassa

Microstomatidae



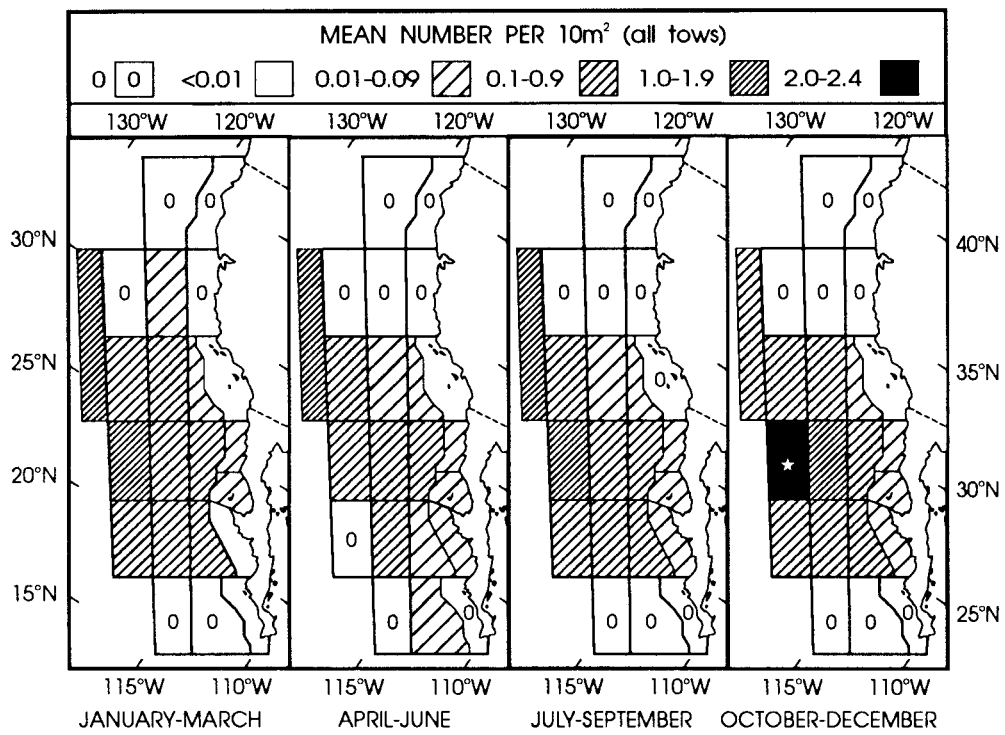
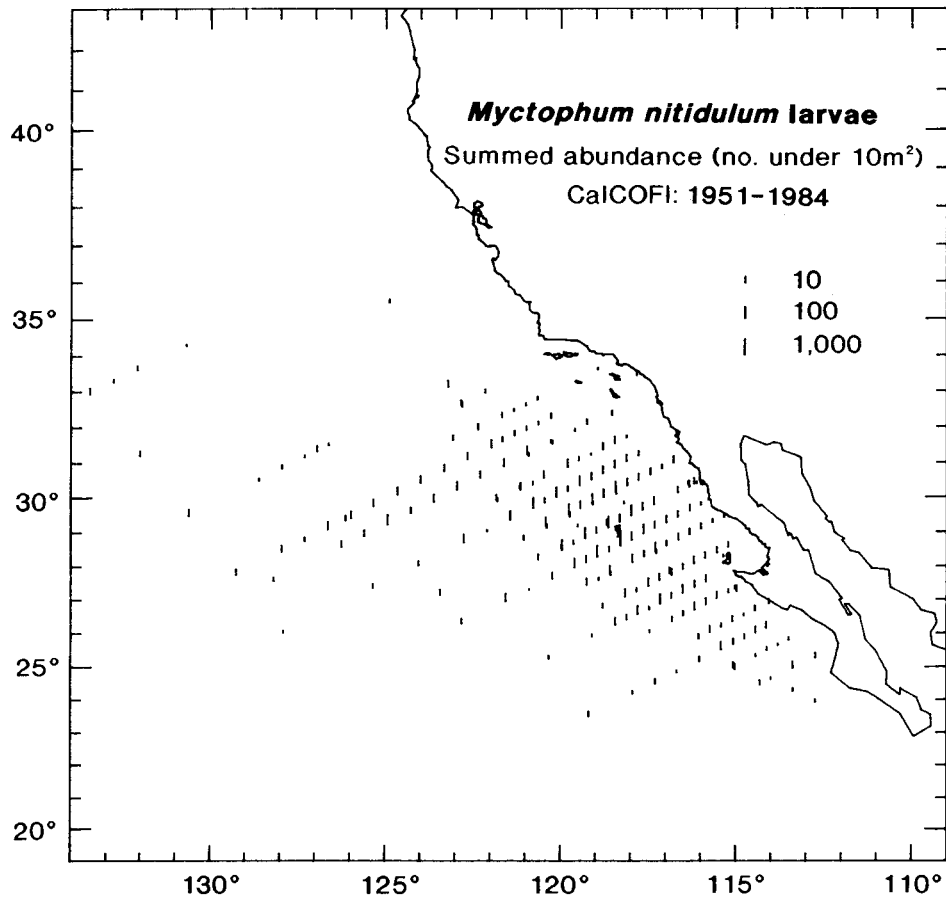
Stout argentine

Nansenia crassa

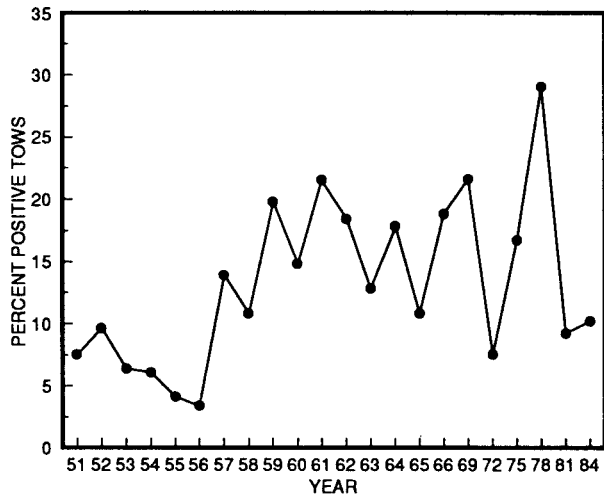


Myctophum nitidulum

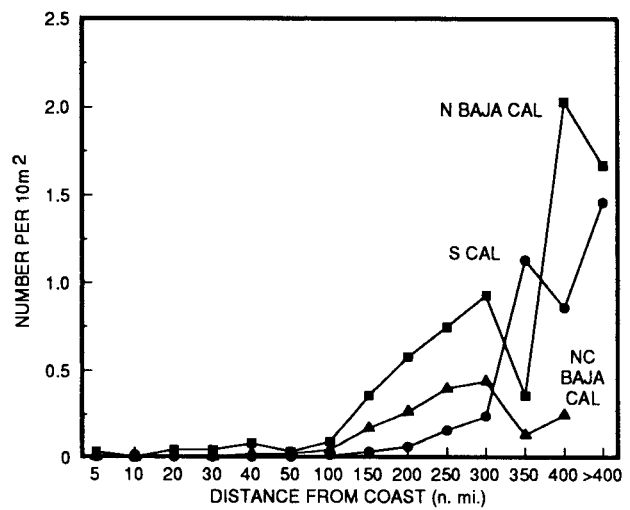
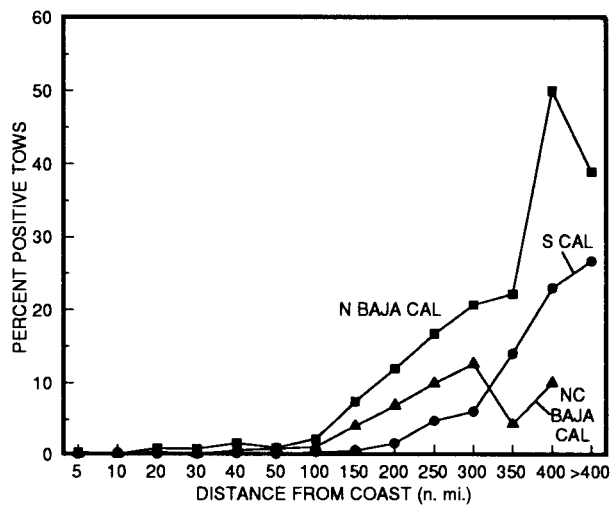
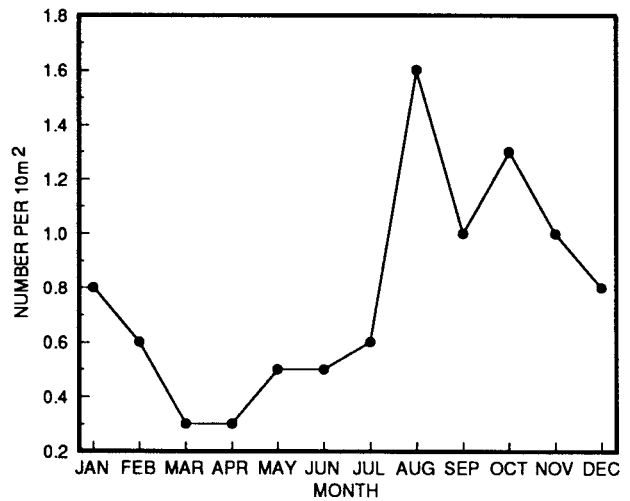
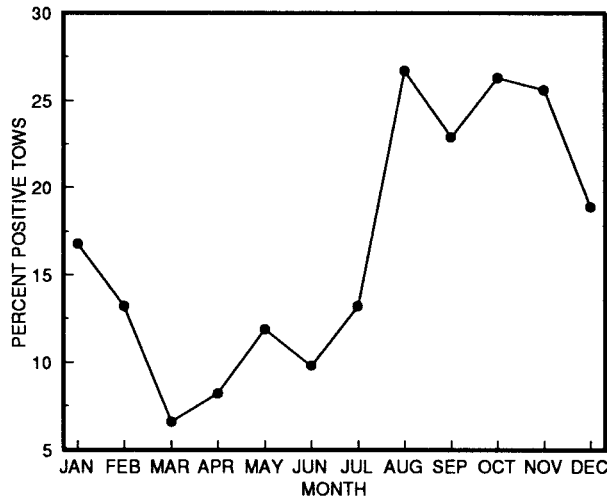
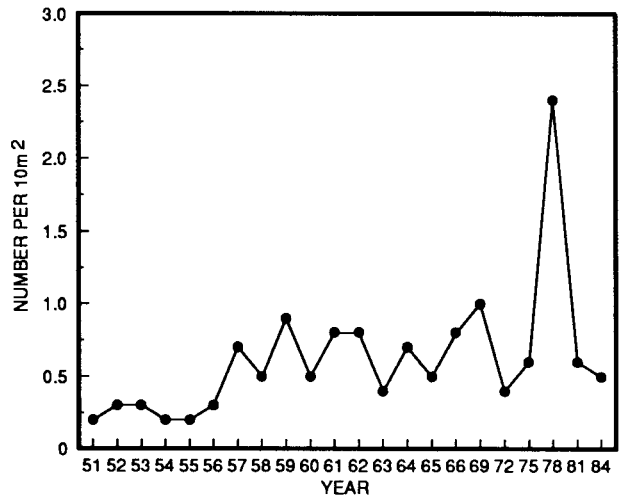
Myctophidae



Pearly lanternfish

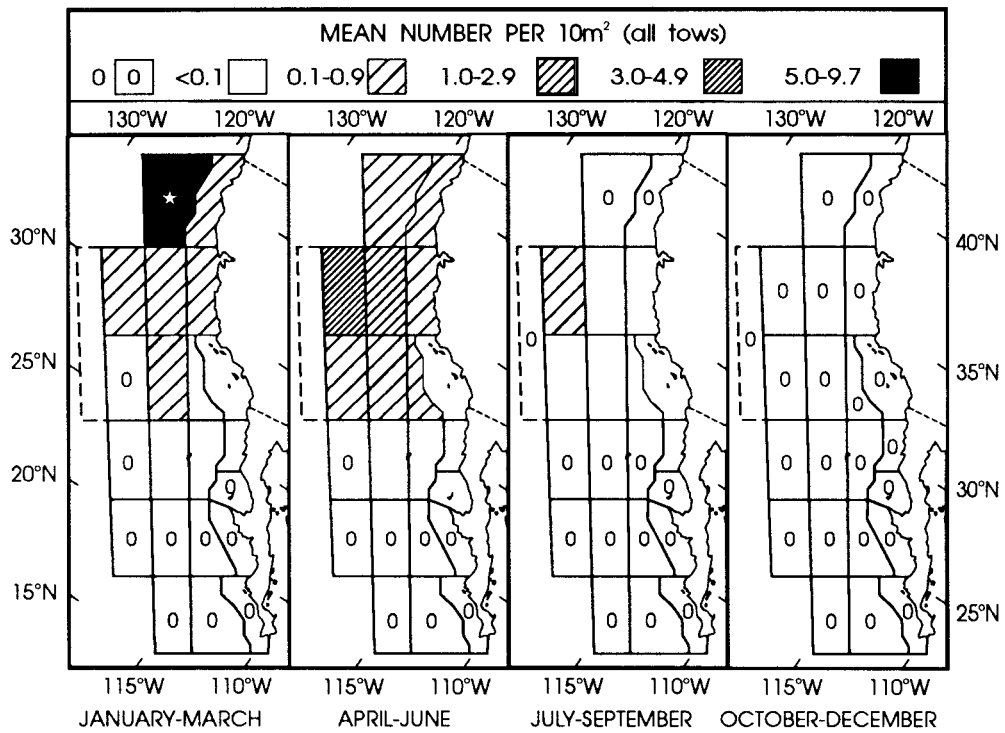
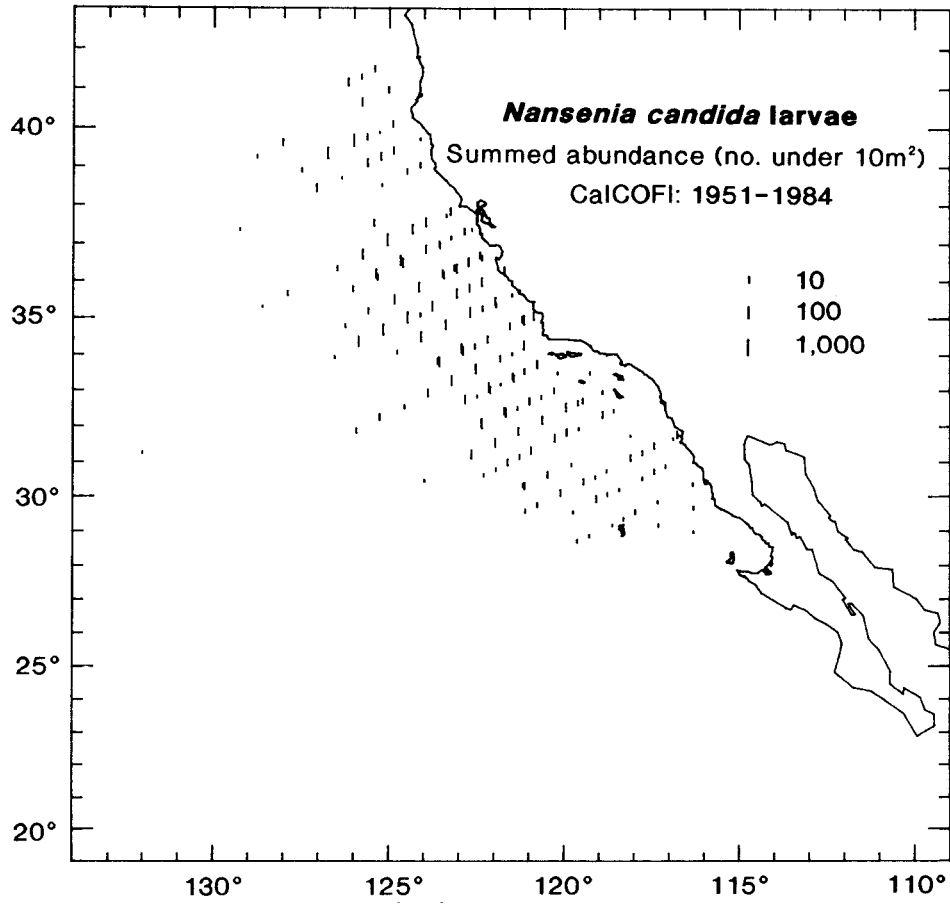


Myctophum nitidulum



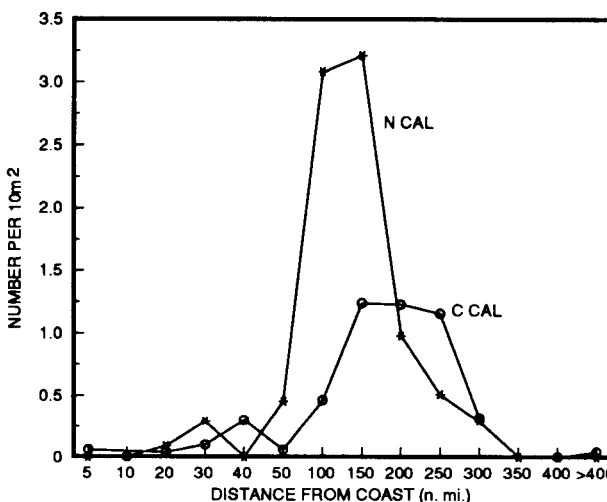
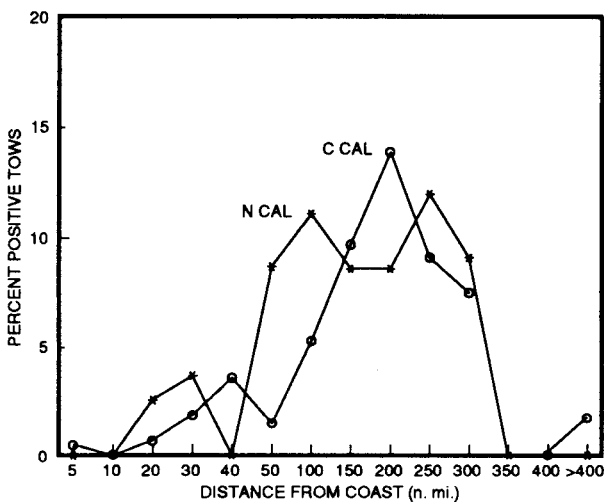
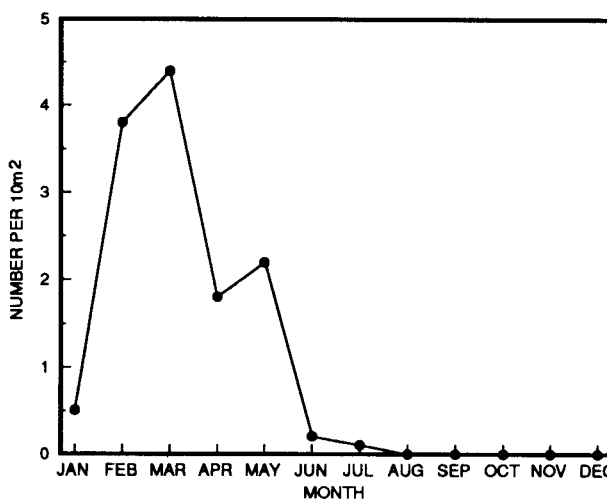
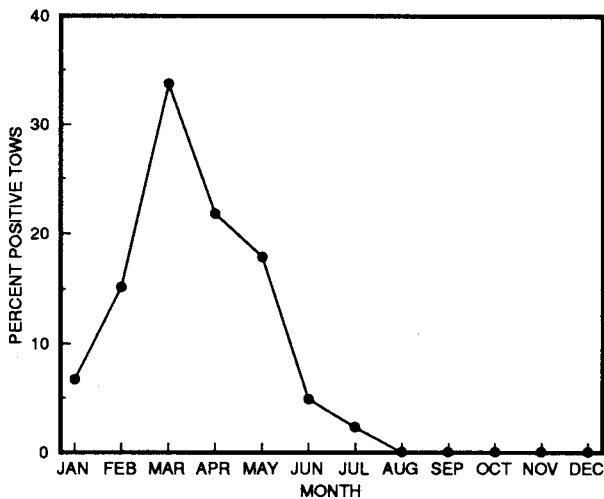
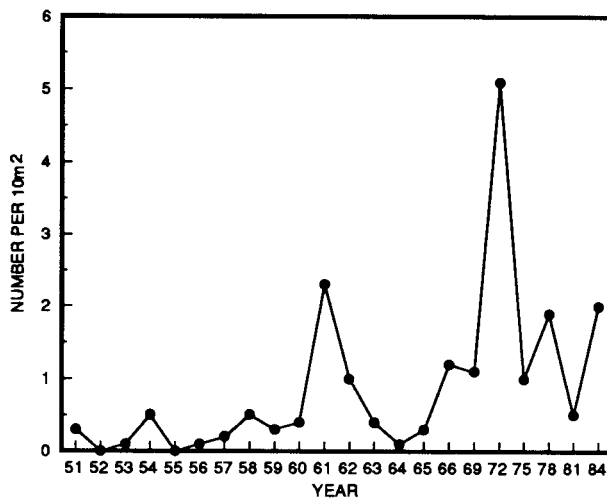
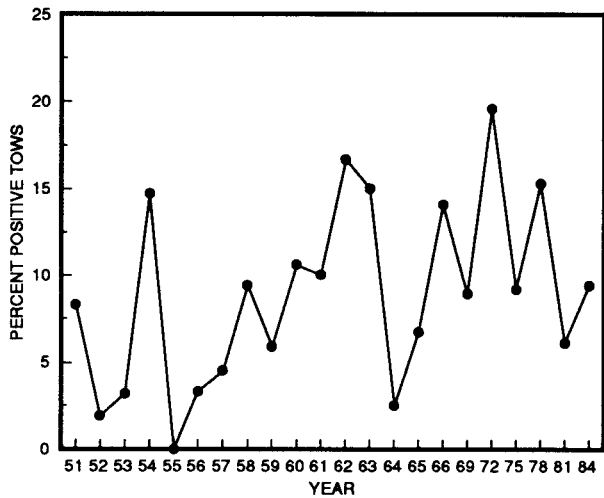
Nansenia candida

Microstomatidae



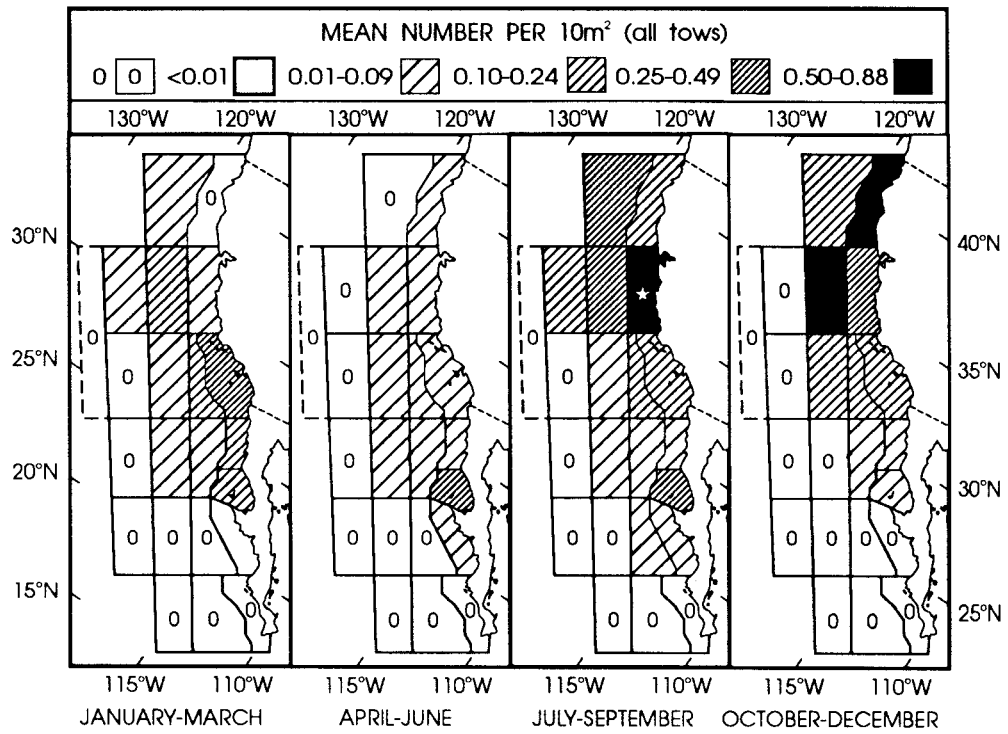
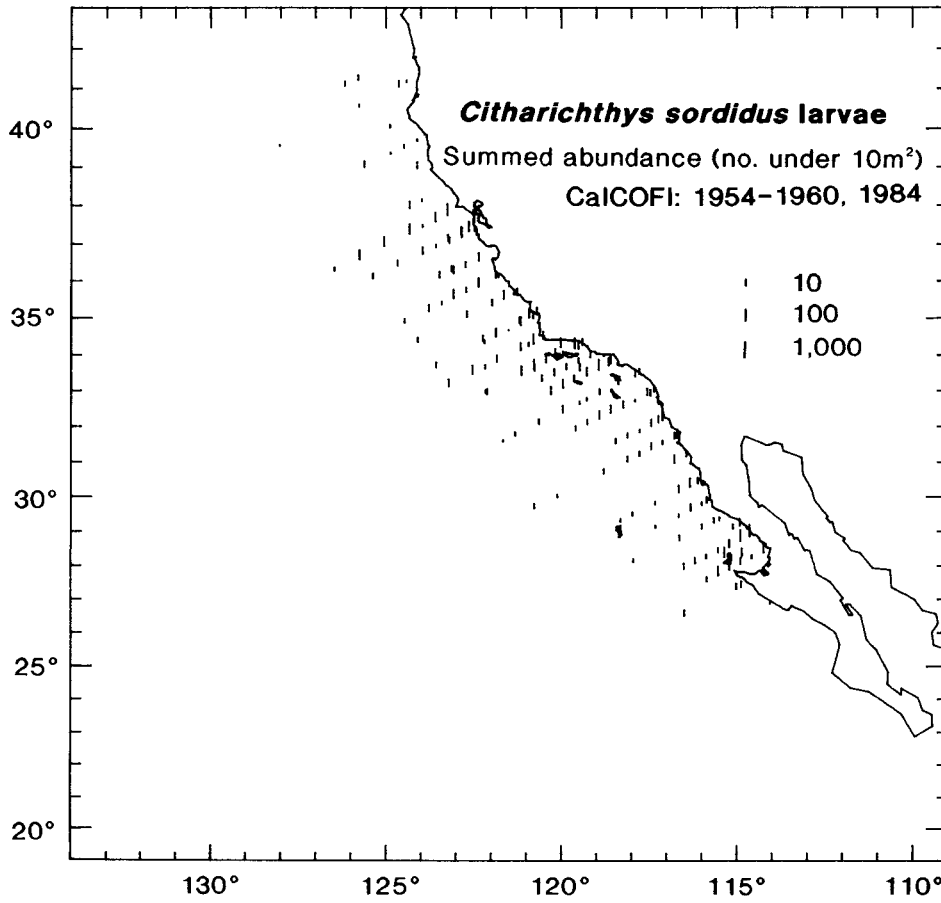
Bluethroat argentine

Nansenia candida



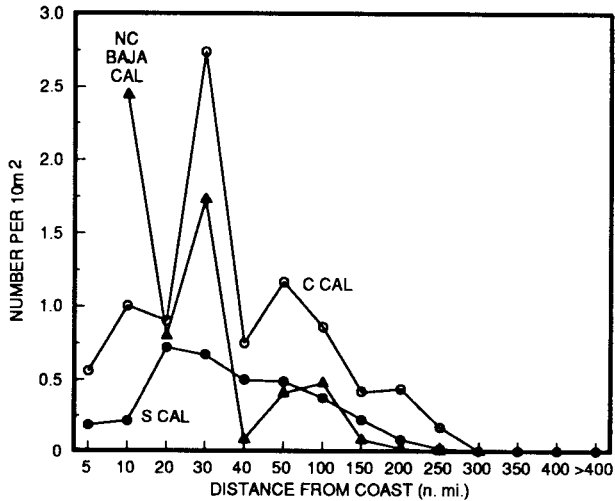
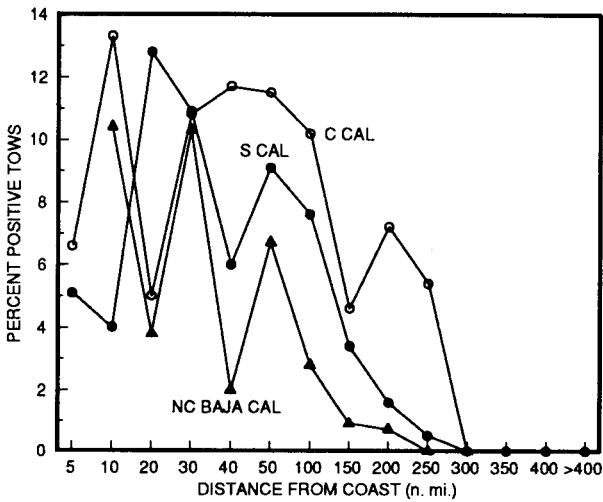
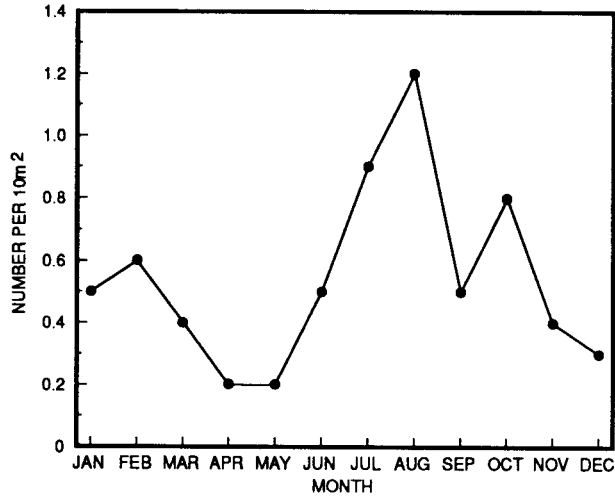
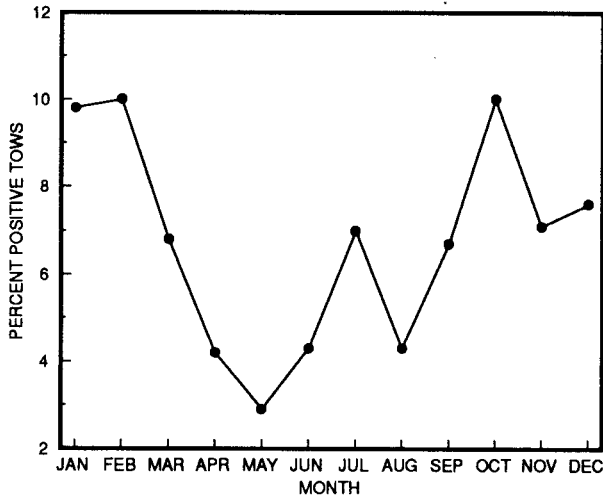
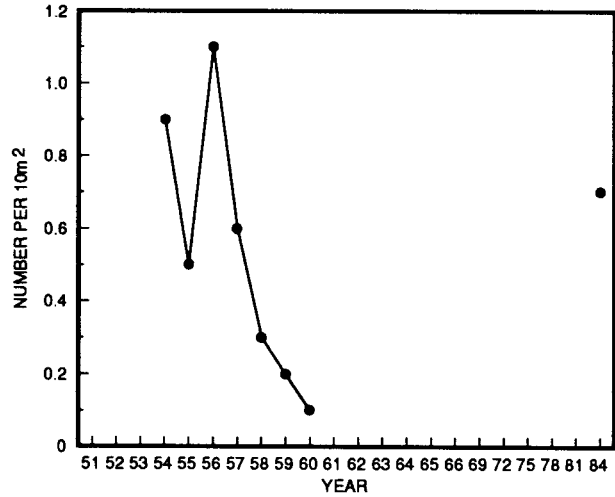
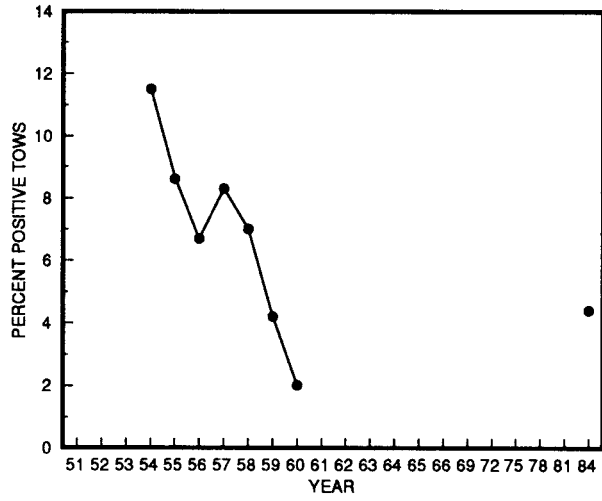
Citharichthys sordidus

Paralichthyidae



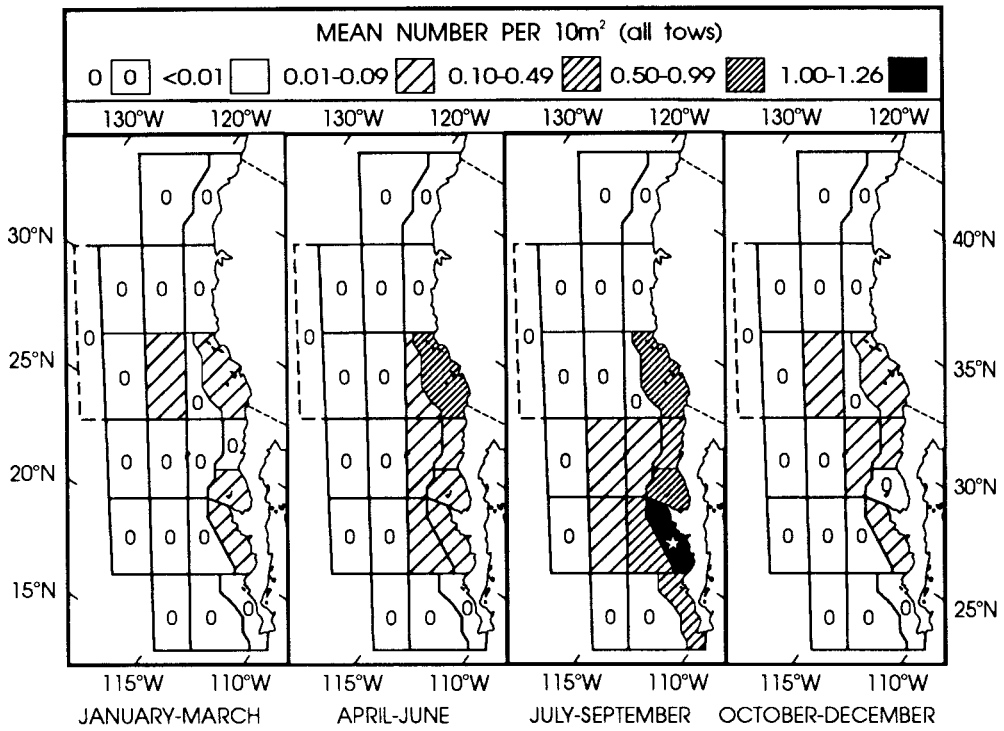
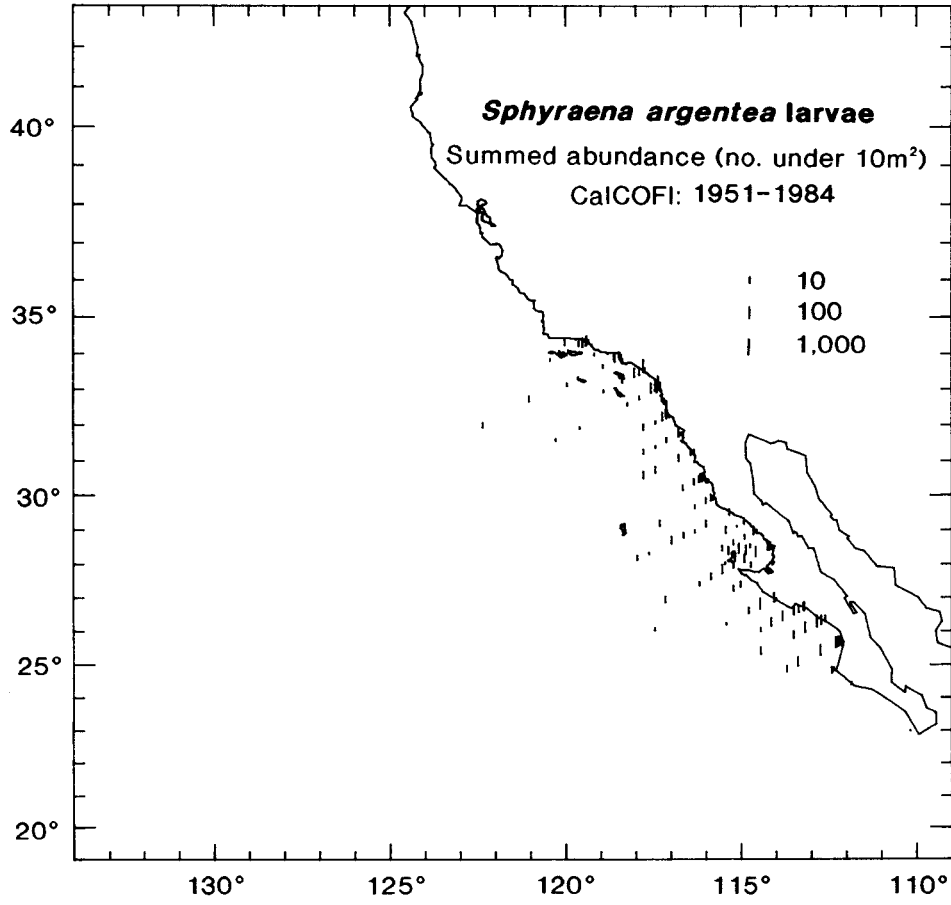
Pacific sanddab

Citharichthys sordidus

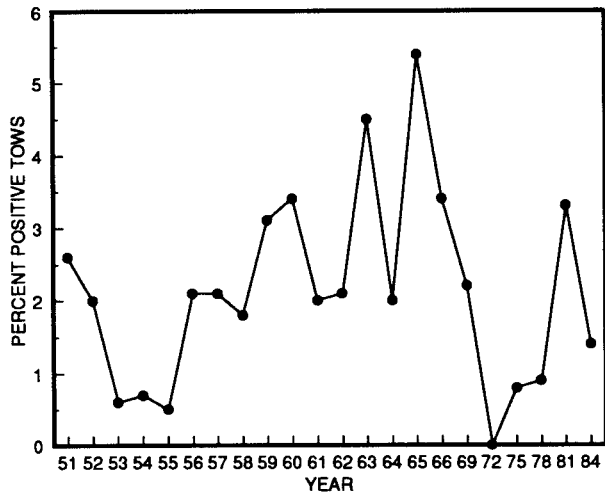


Sphyraena argentea

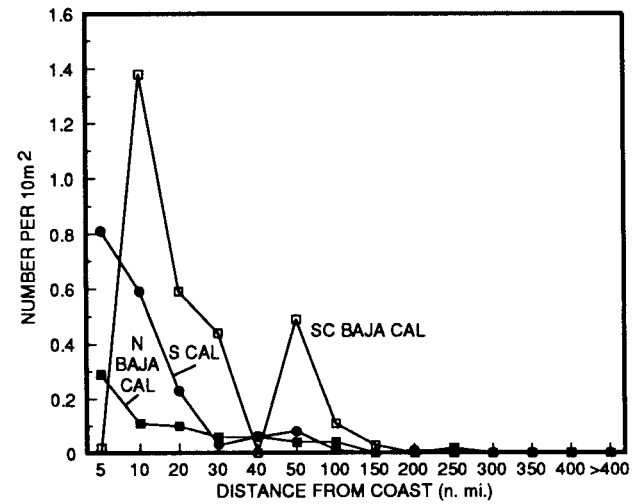
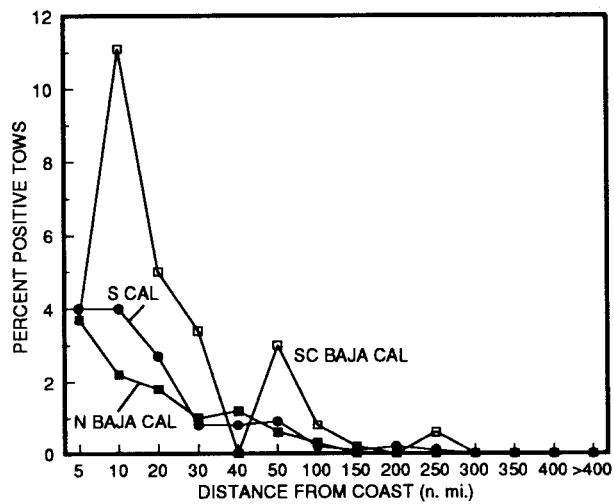
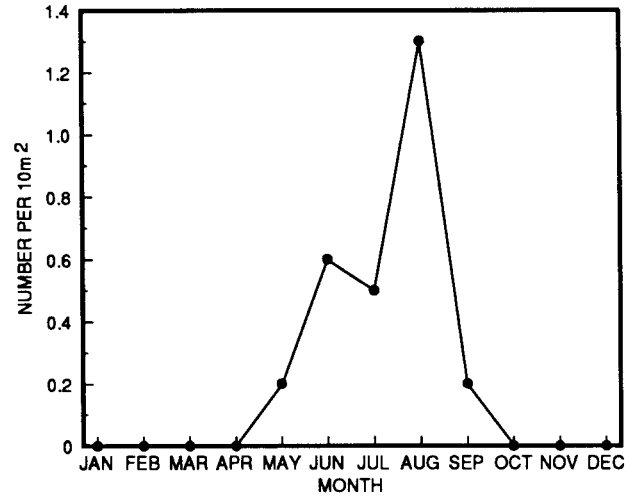
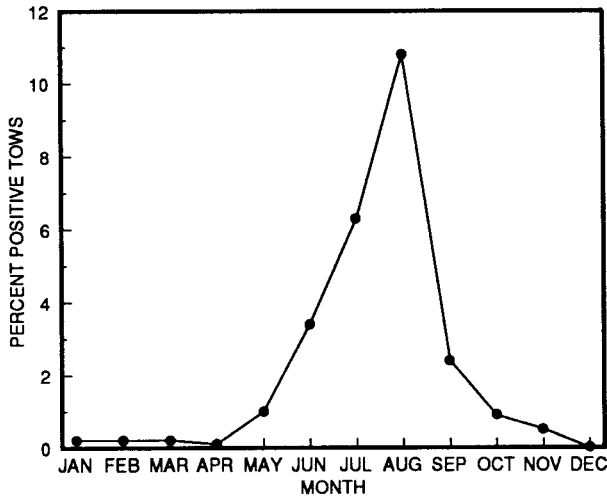
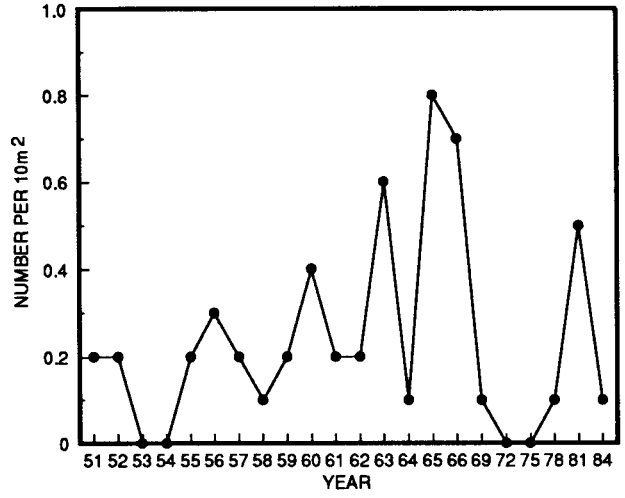
Sphyraenidae



California barracuda

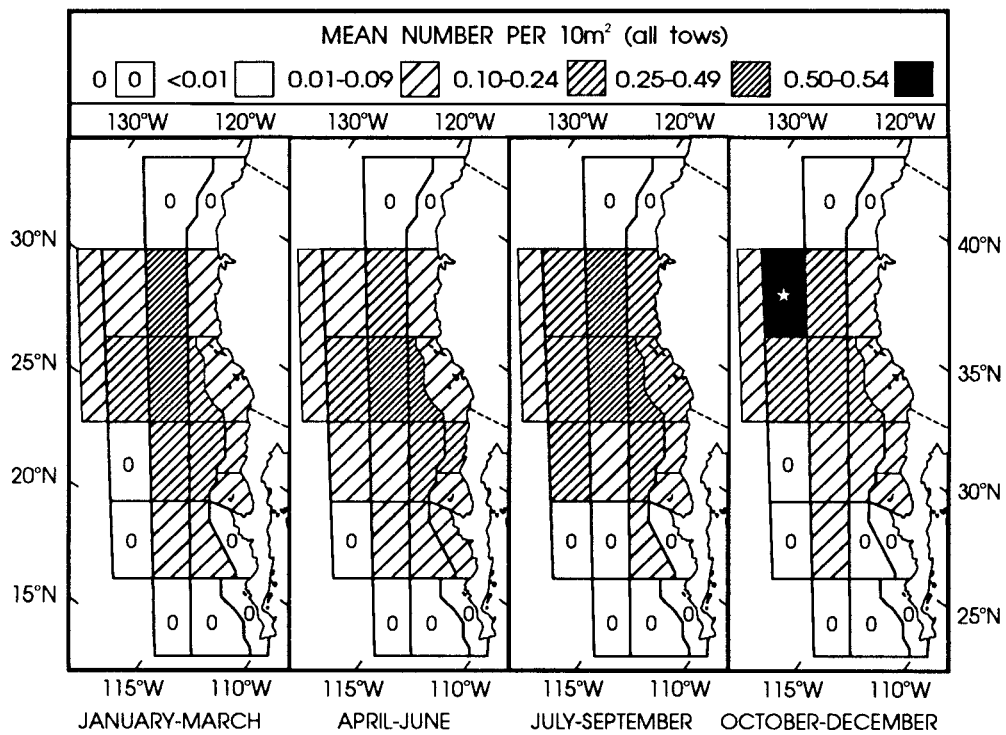
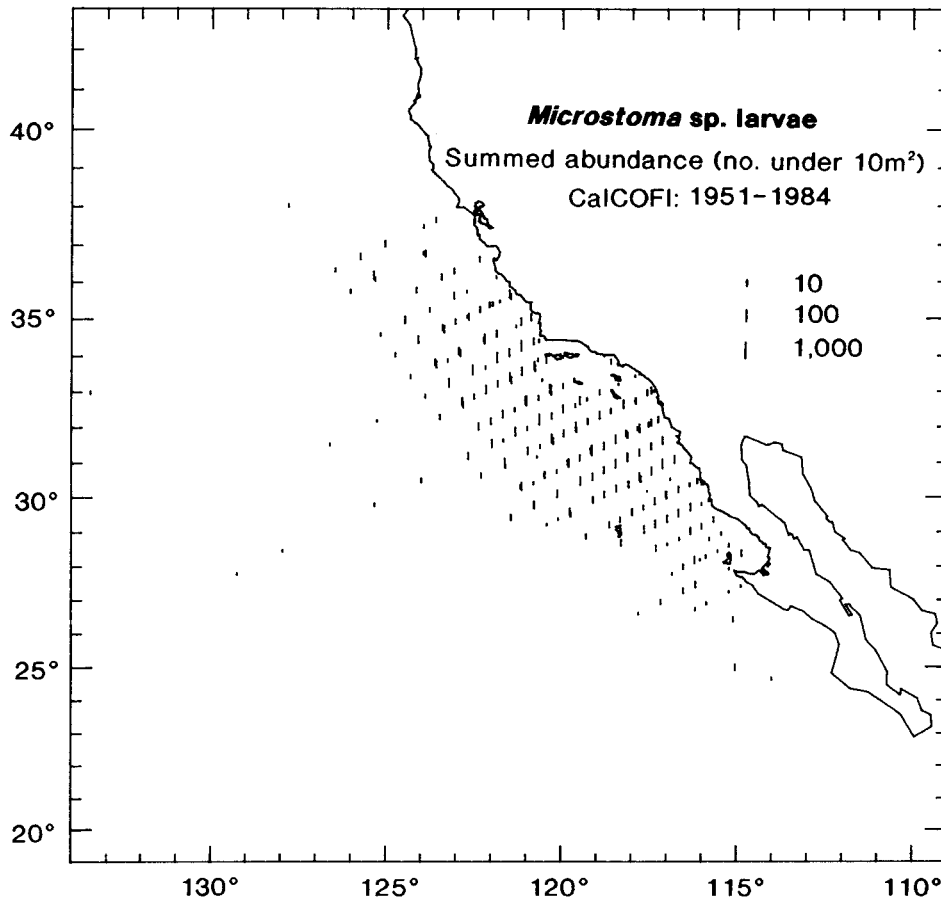


Sphyraena argentea



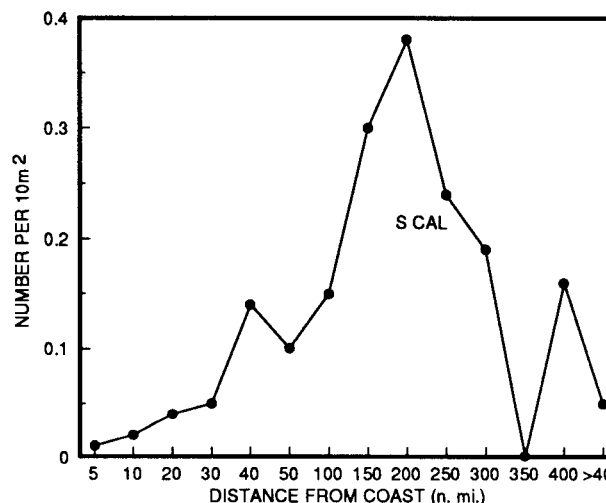
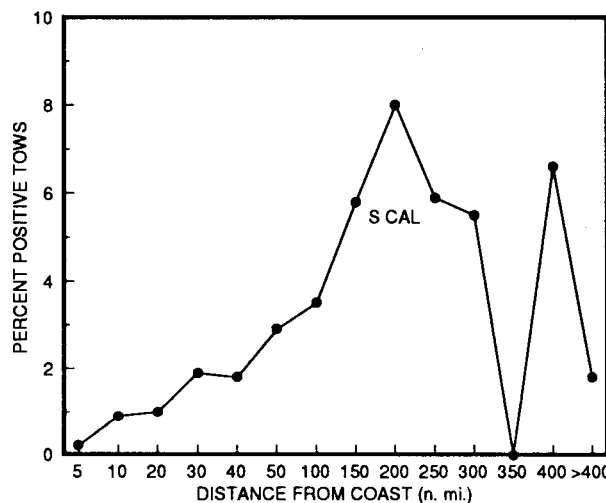
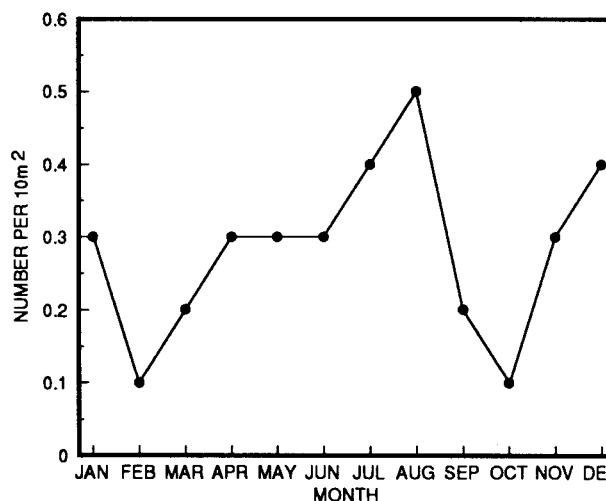
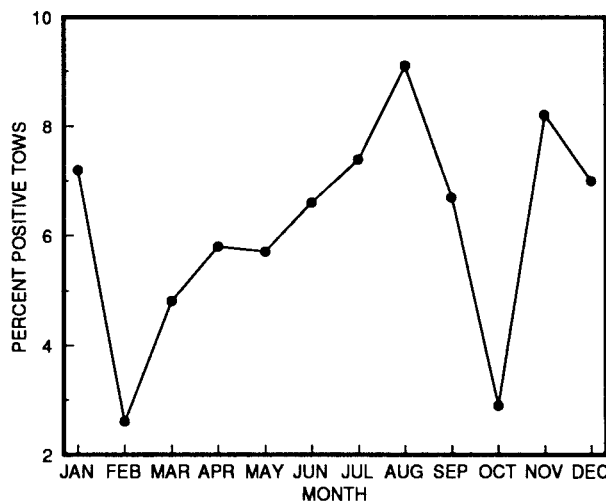
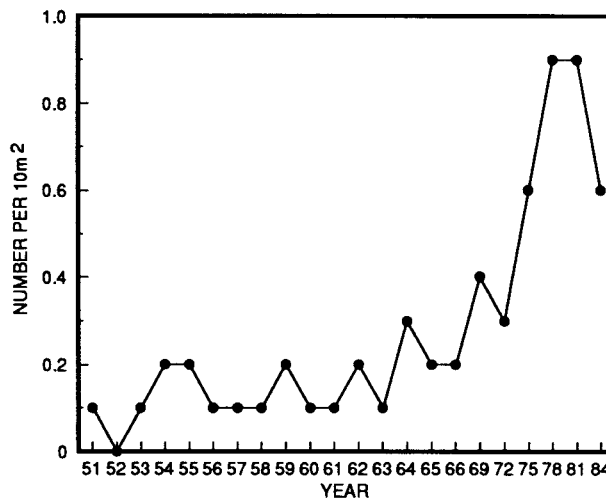
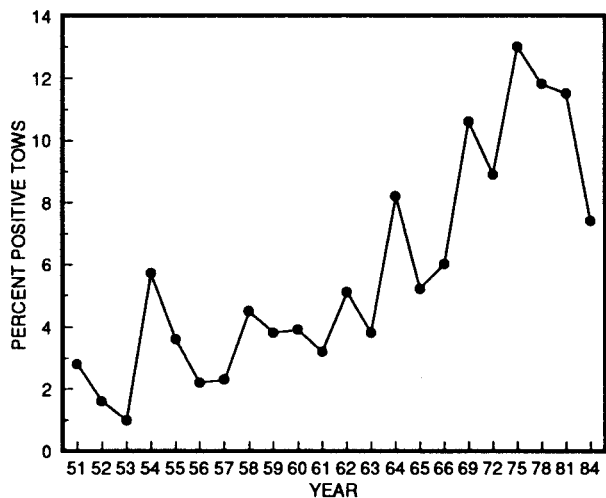
Microstoma sp.

Microstomatidae



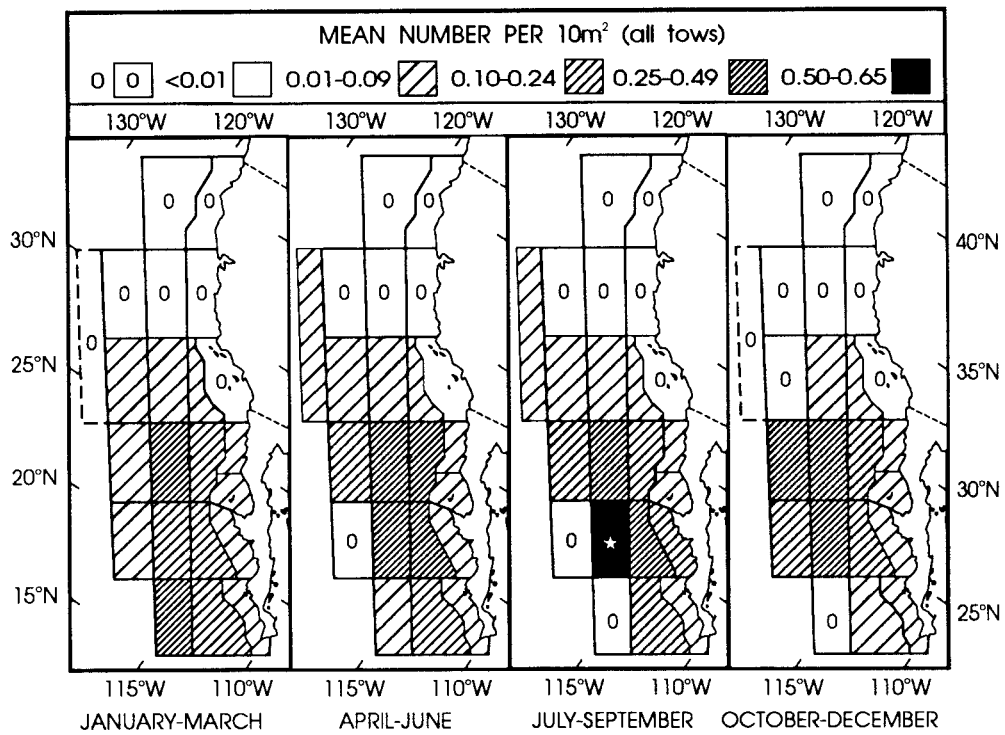
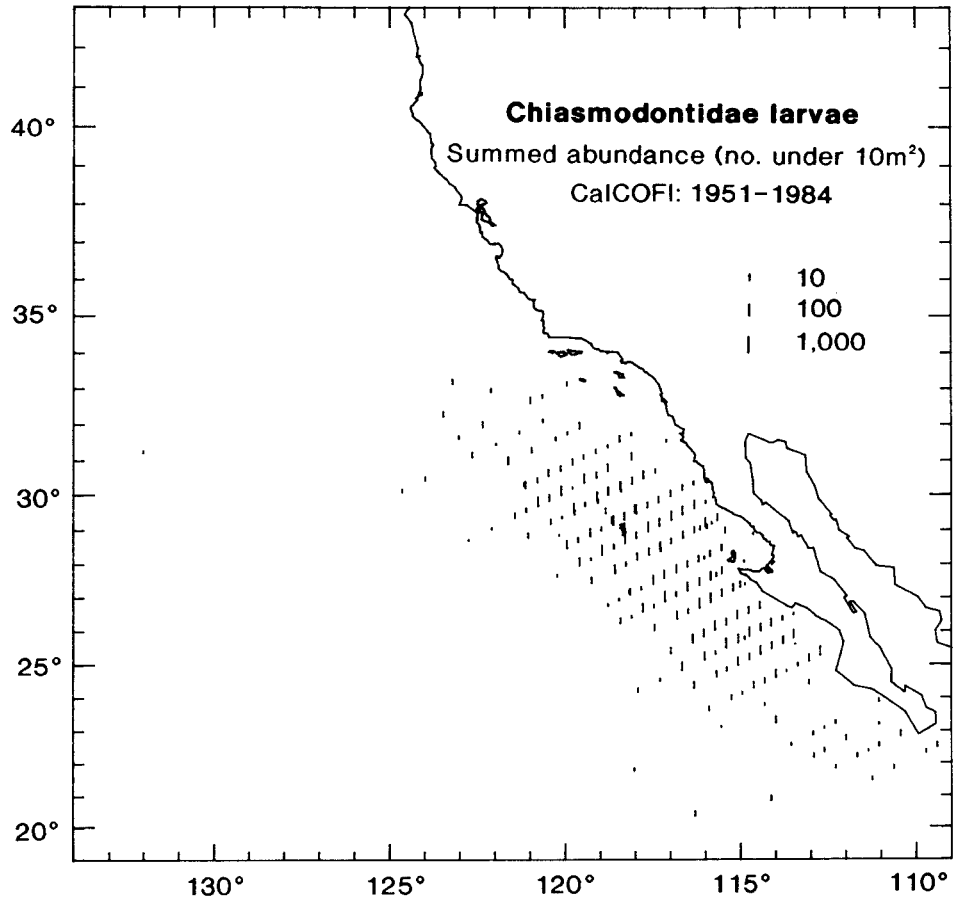
Dusky pencilsmelt

Microstoma sp.

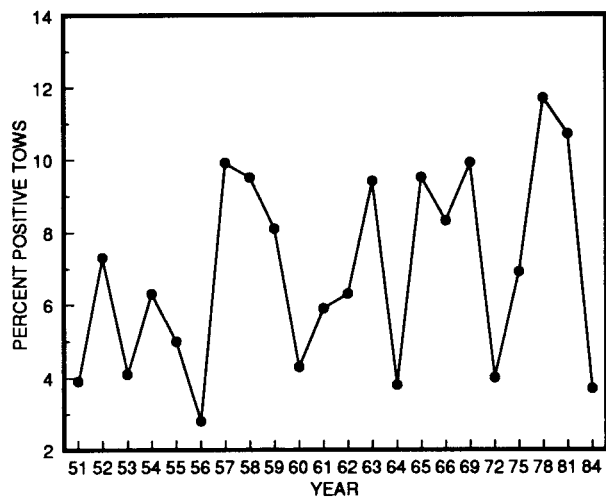


Chiasmodontidae

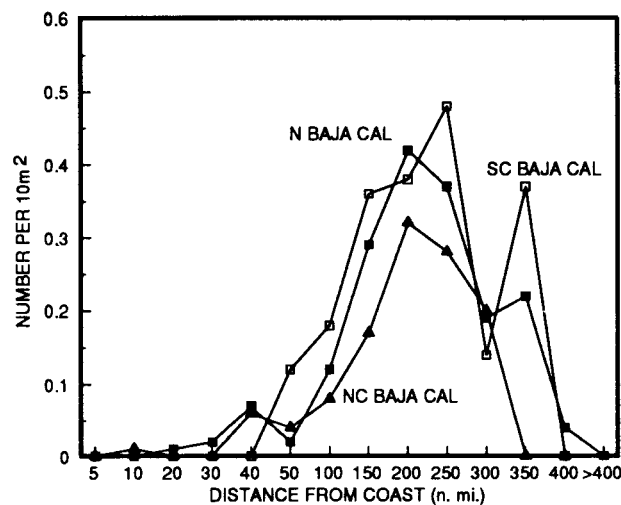
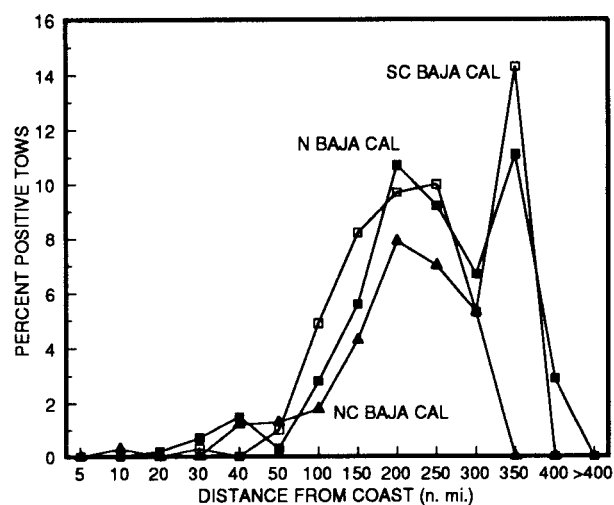
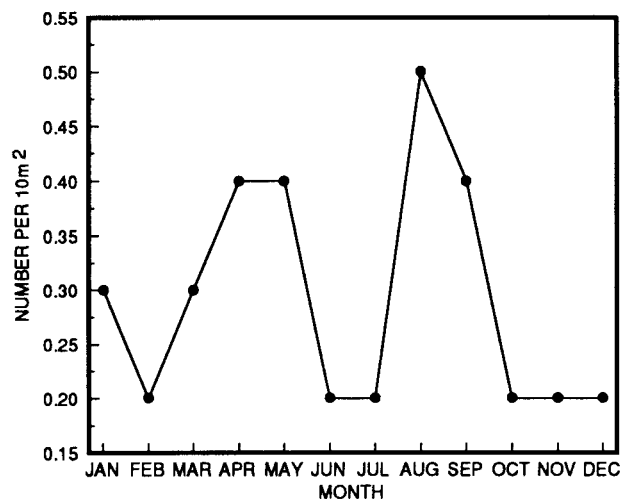
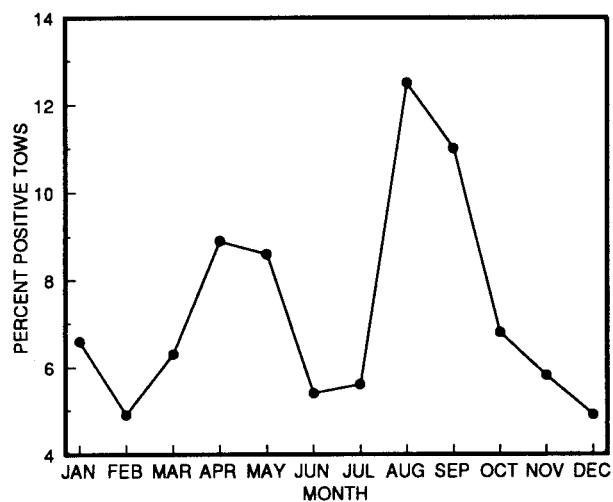
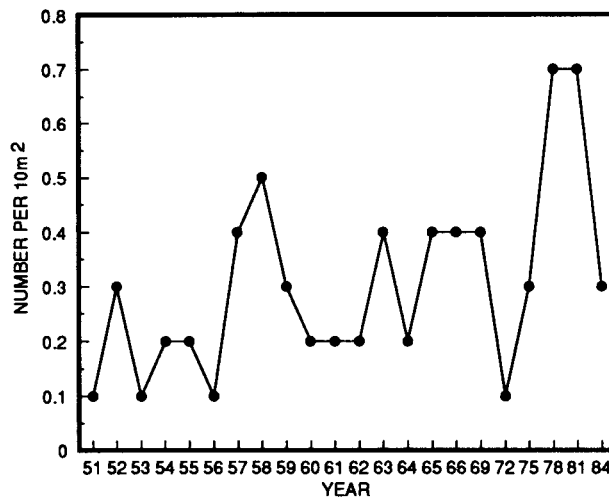
Chiasmodontidae



Swallowers

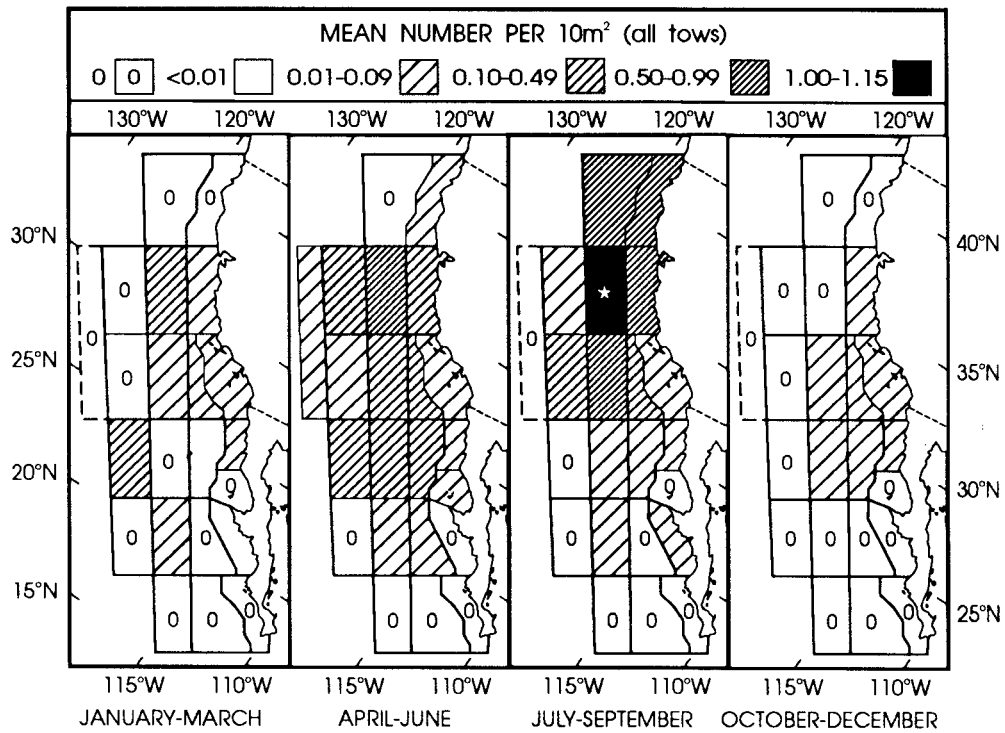
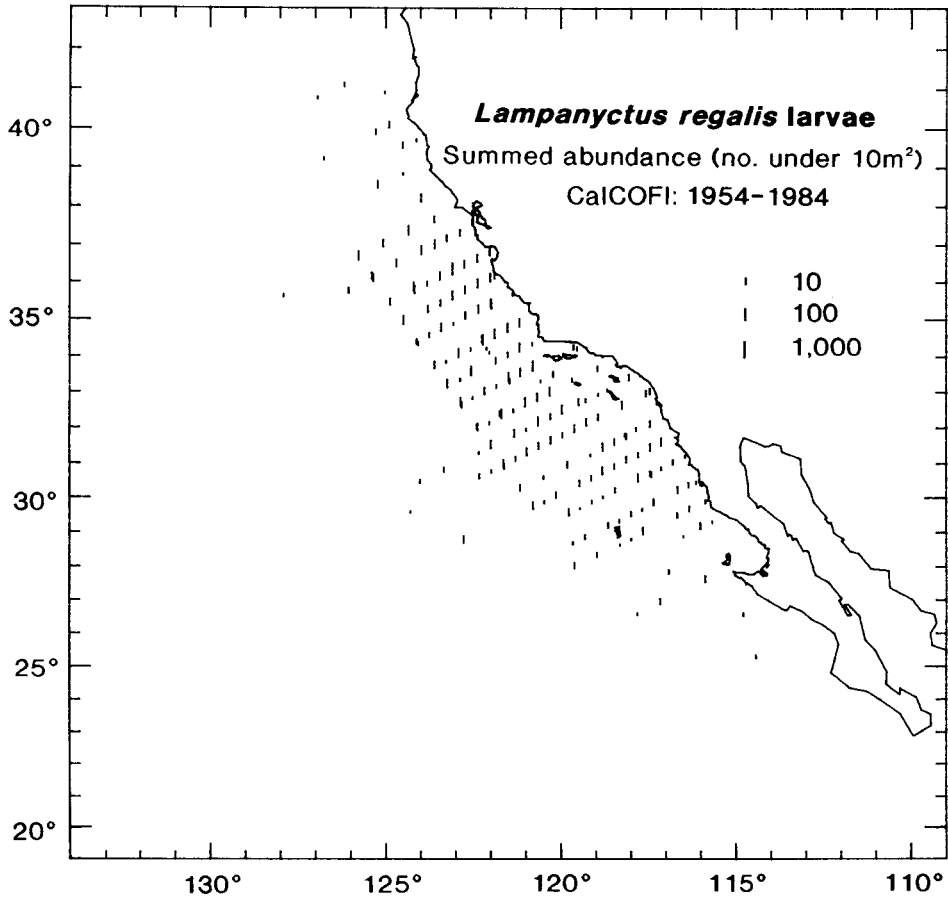


Chiasmodontidae

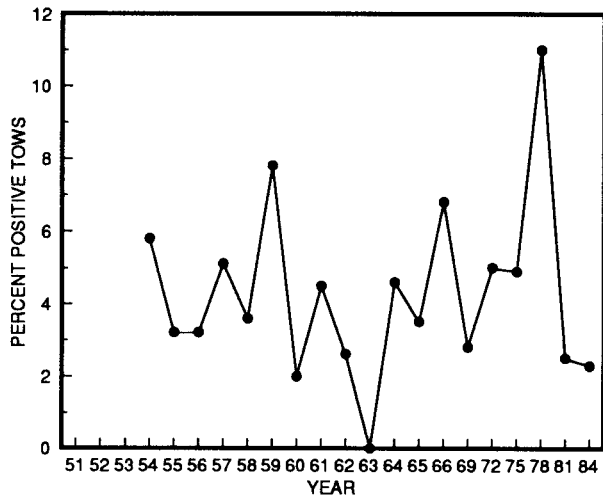


Lampanyctus regalis

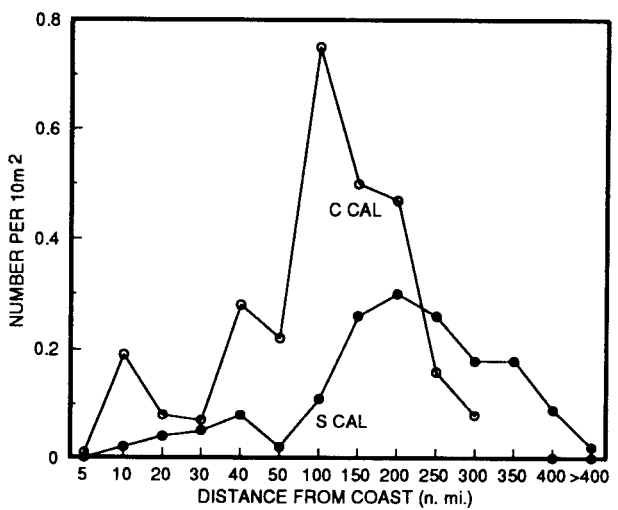
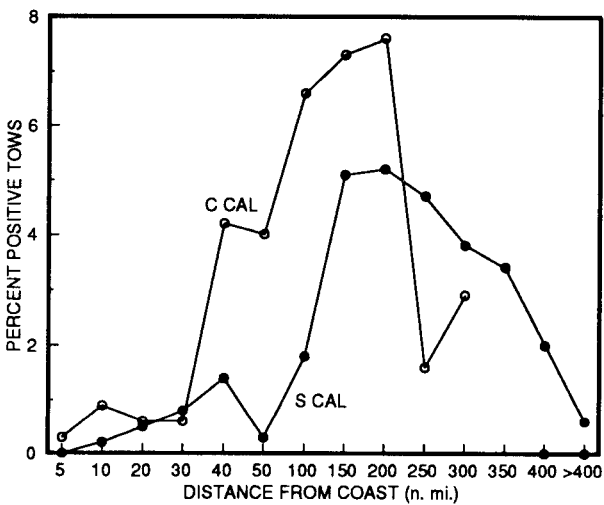
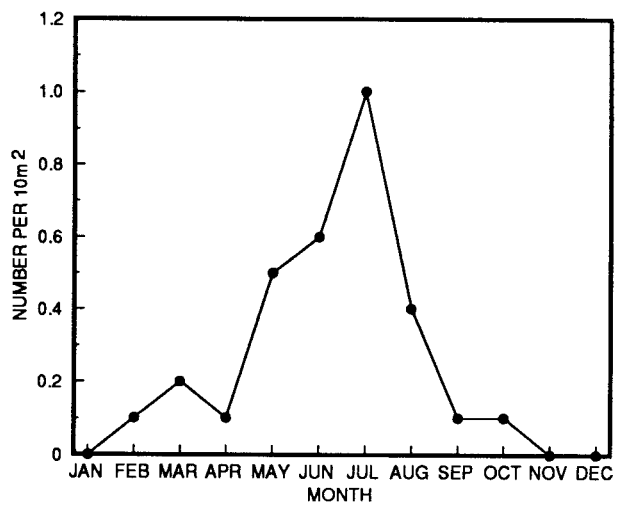
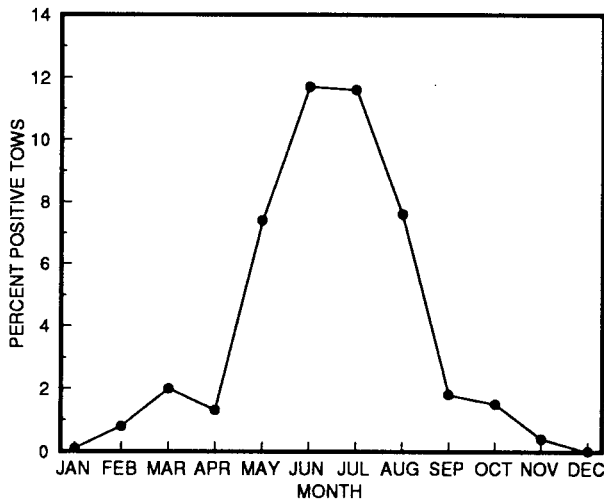
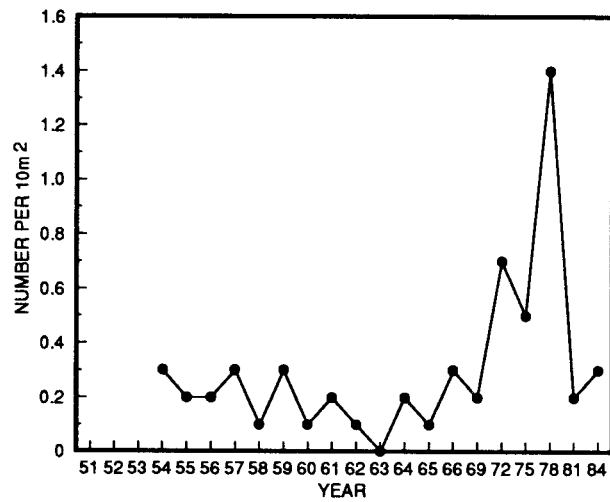
Myctophidae



Pinpoint lampfish

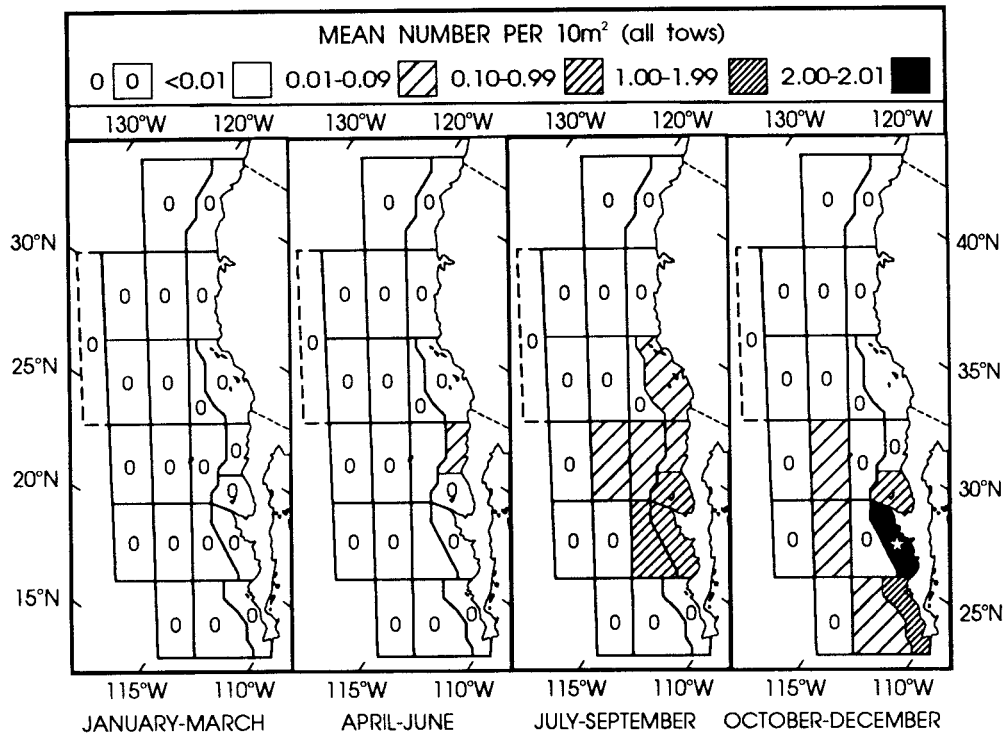
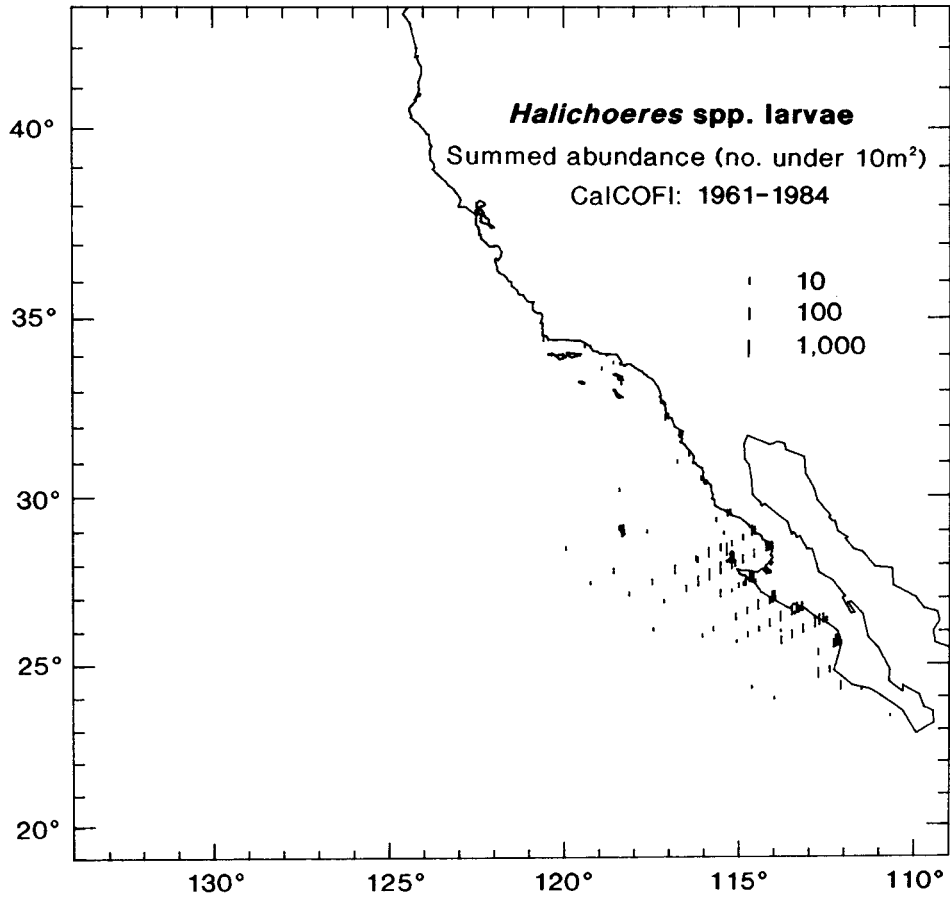


Lampanyctus regalis



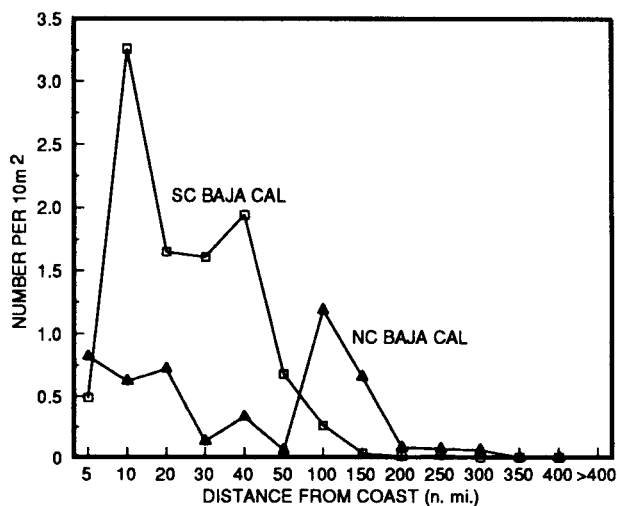
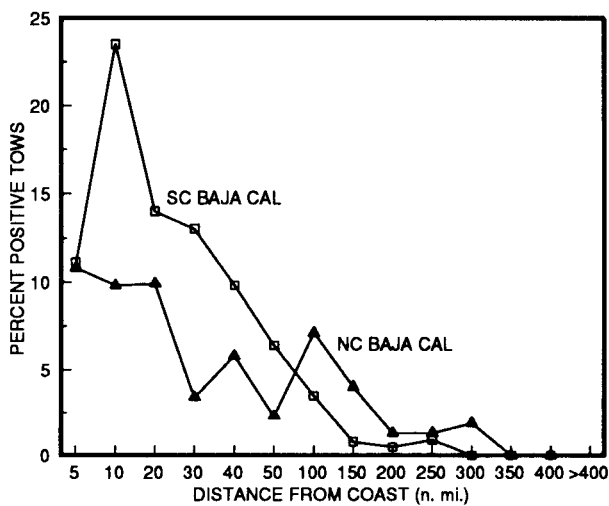
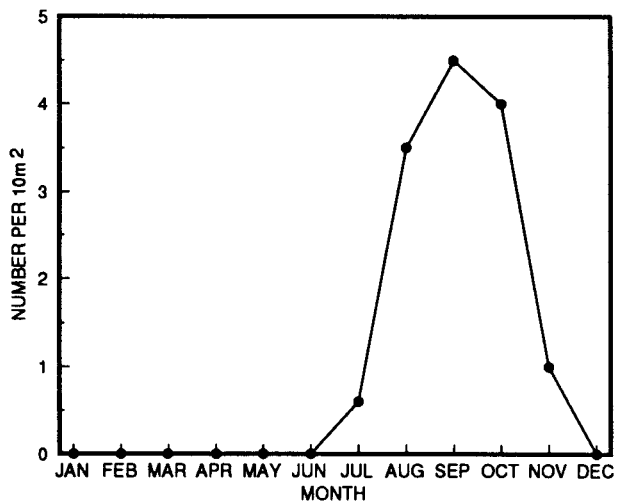
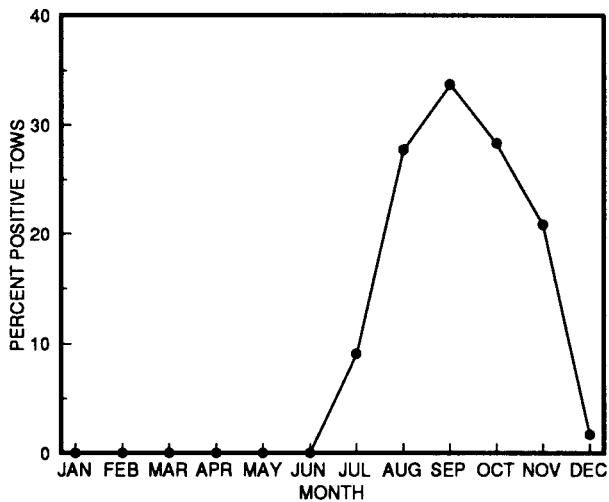
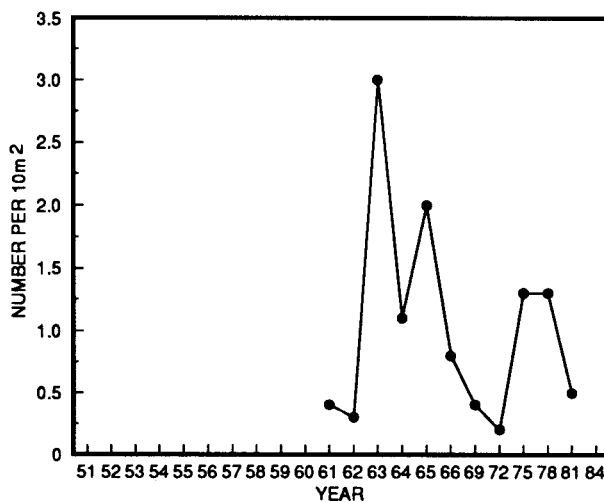
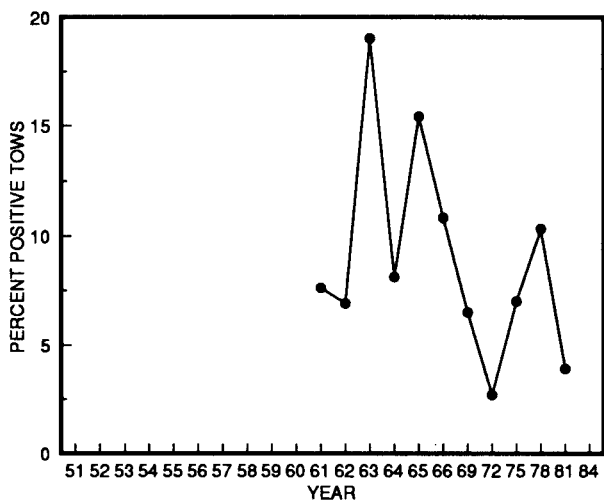
Halichoeres spp.

Labridae



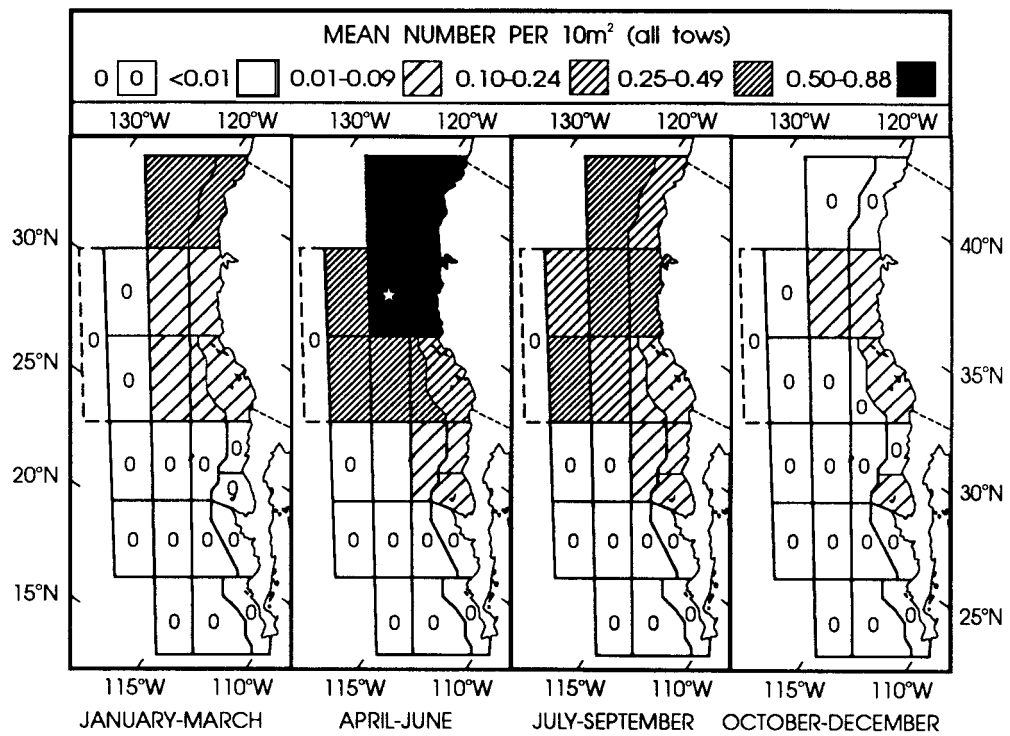
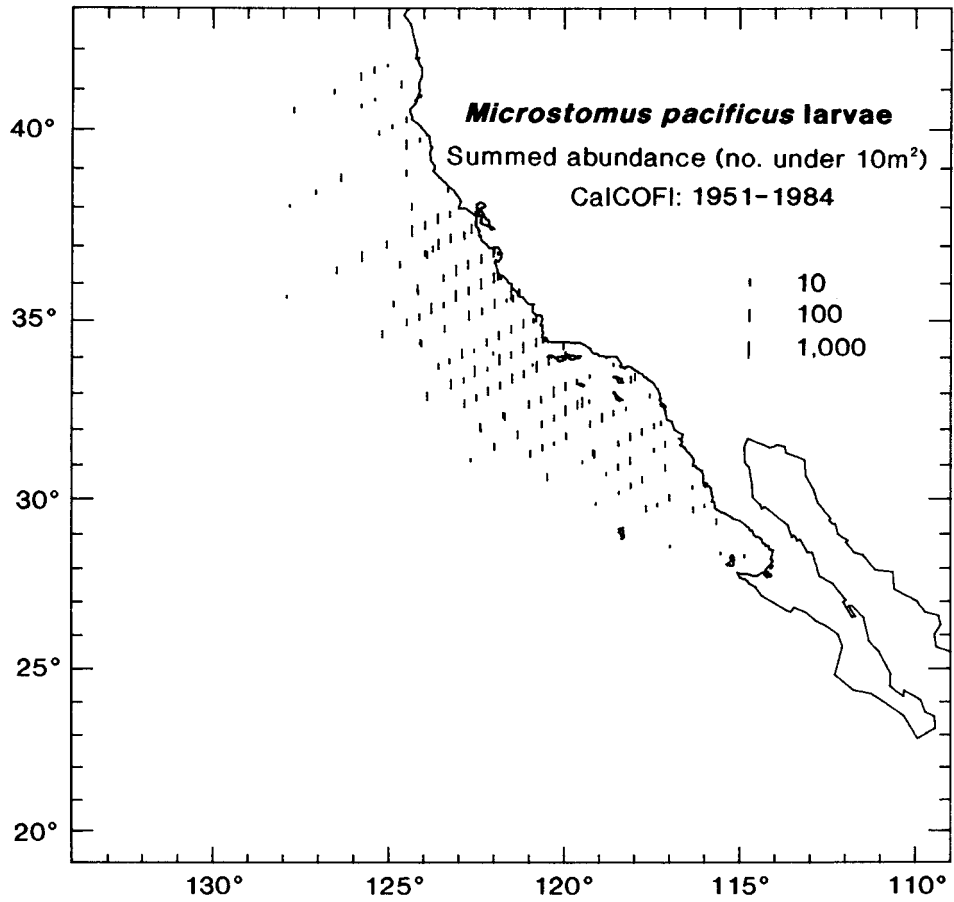
Rock wrasses

Halichoeres spp.



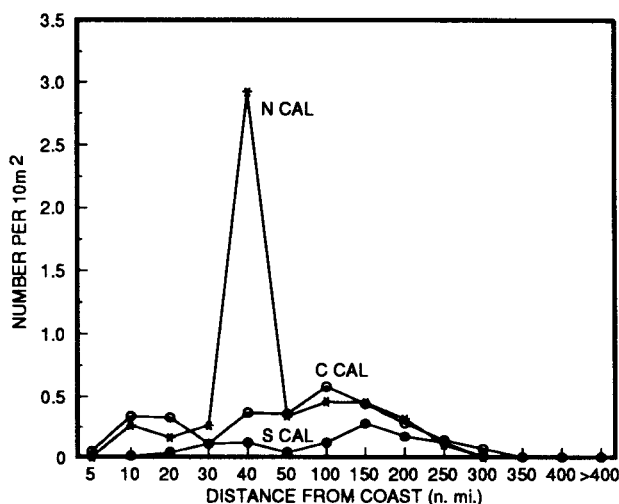
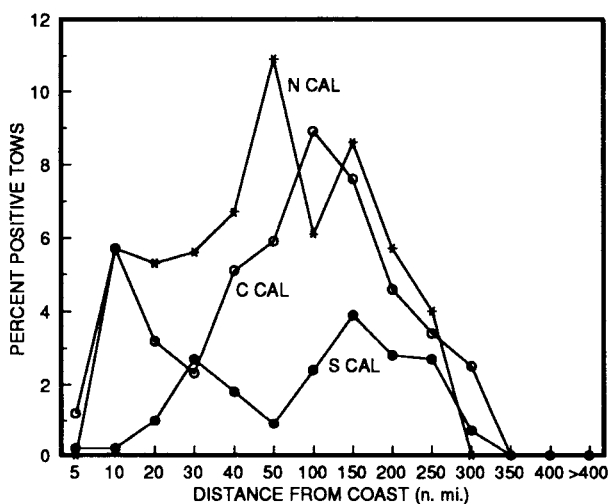
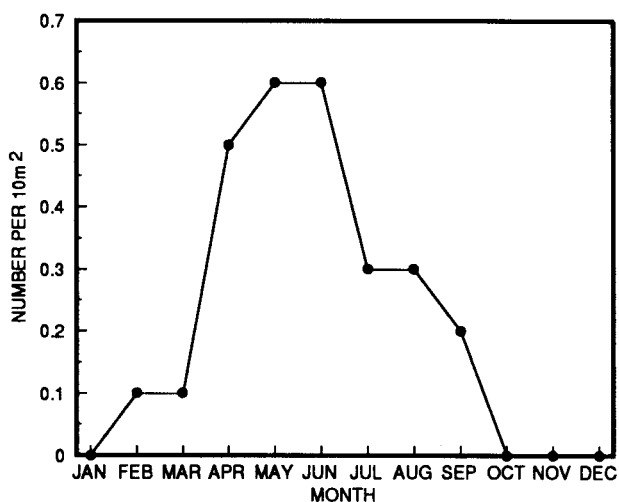
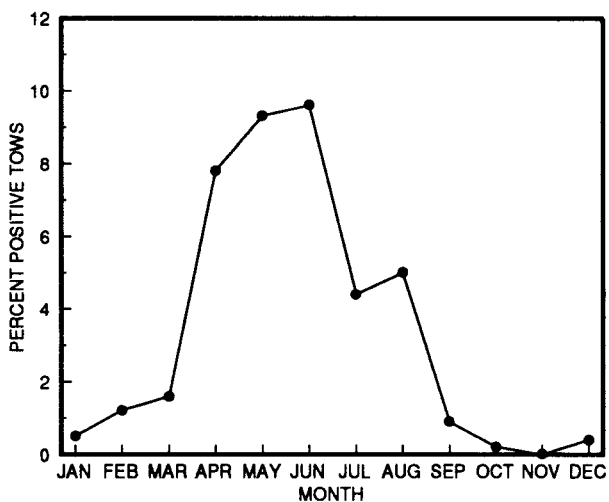
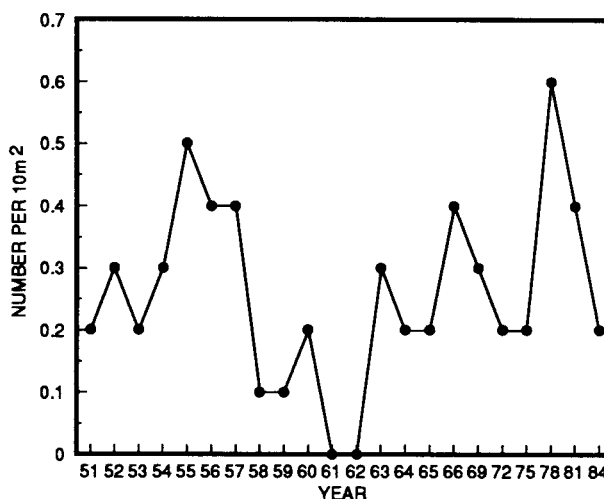
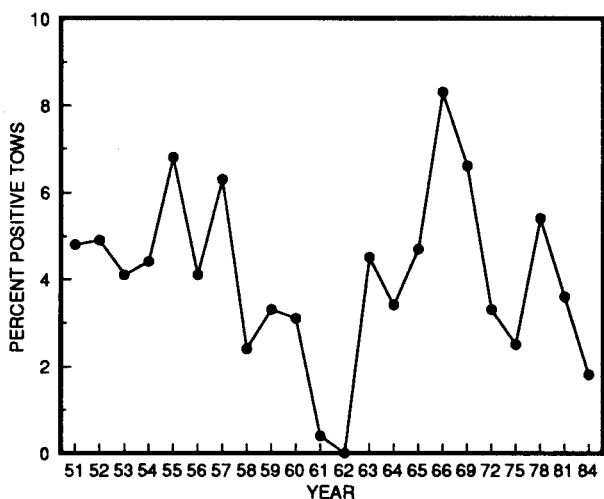
Microstomus pacificus

Pleuronectidae



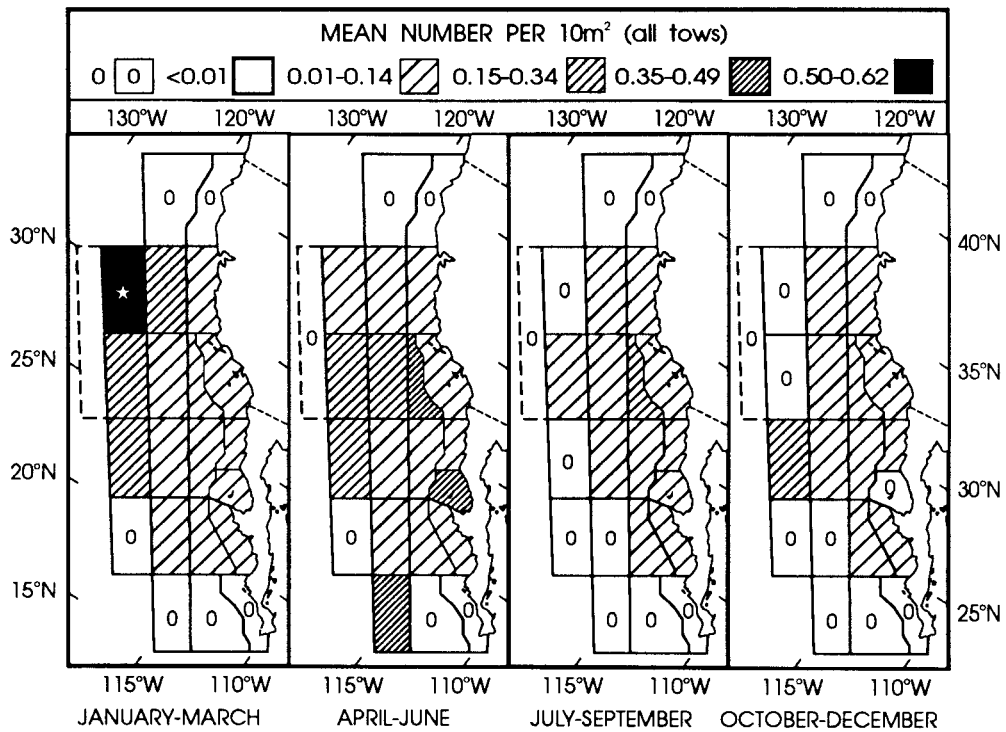
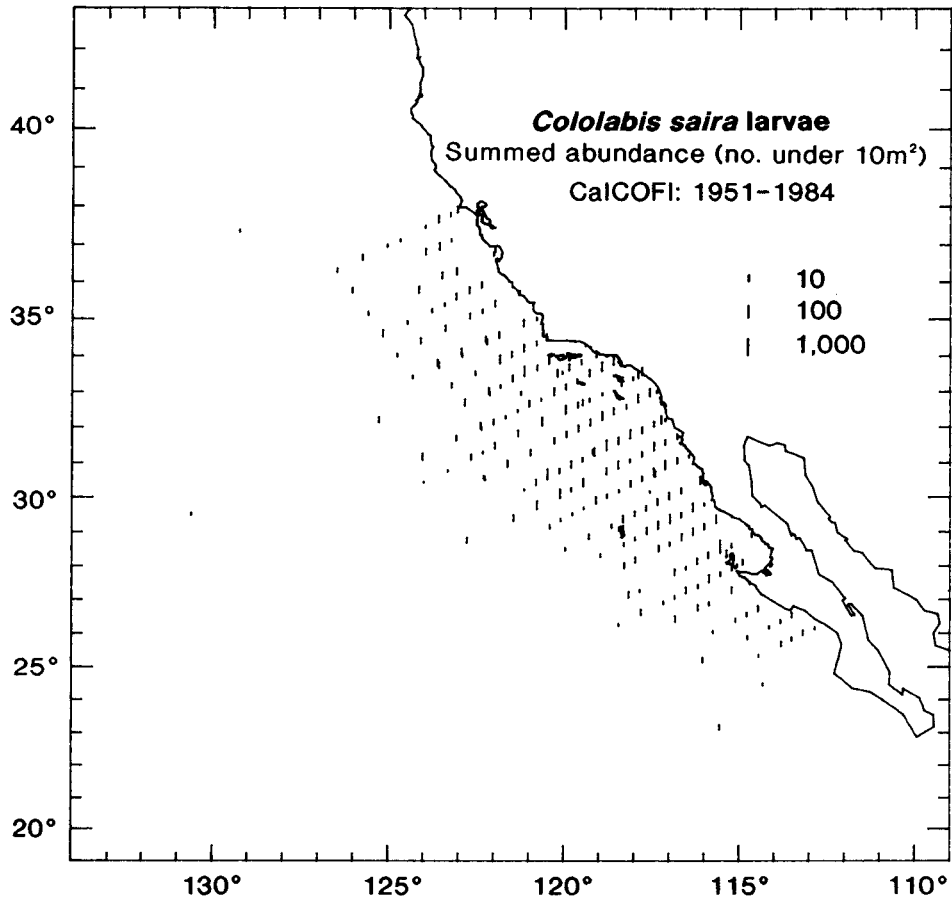
Dover sole

Microstomus pacificus

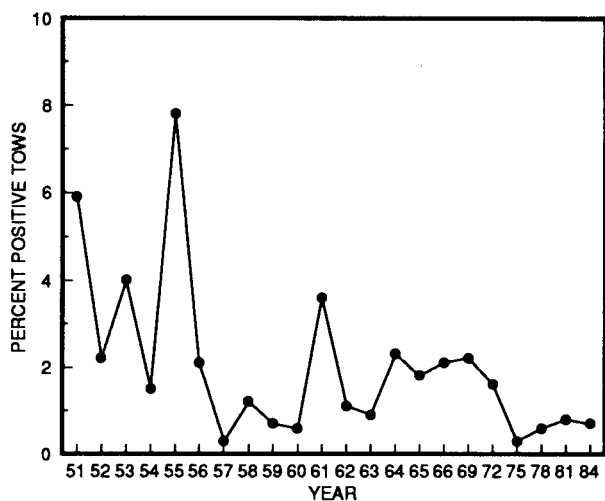


Cololabis saira larvae

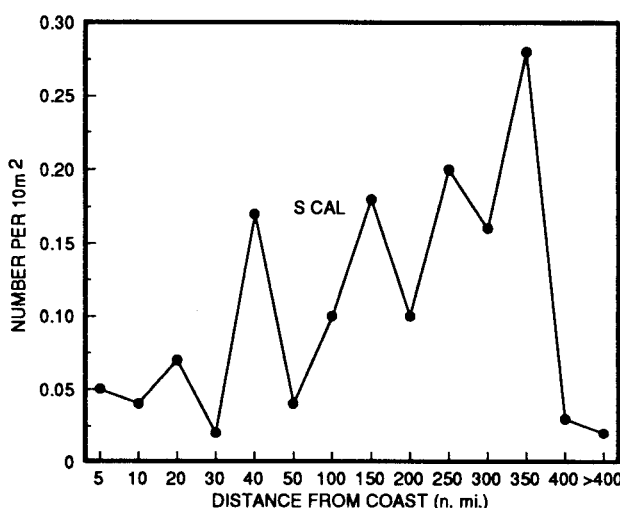
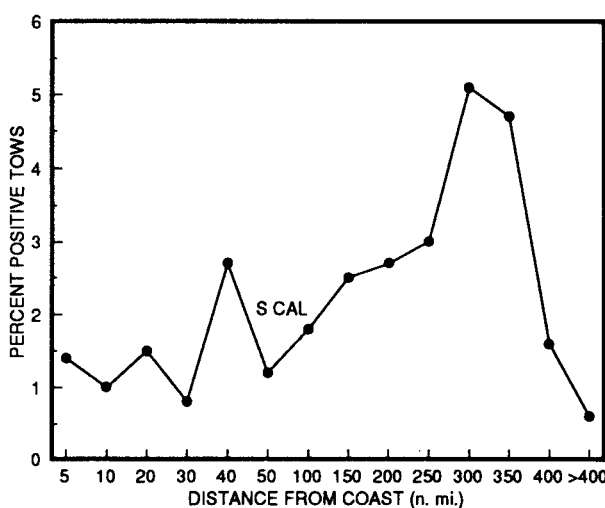
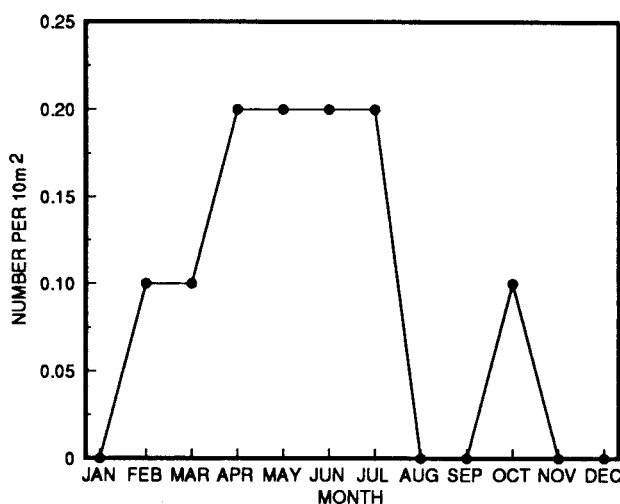
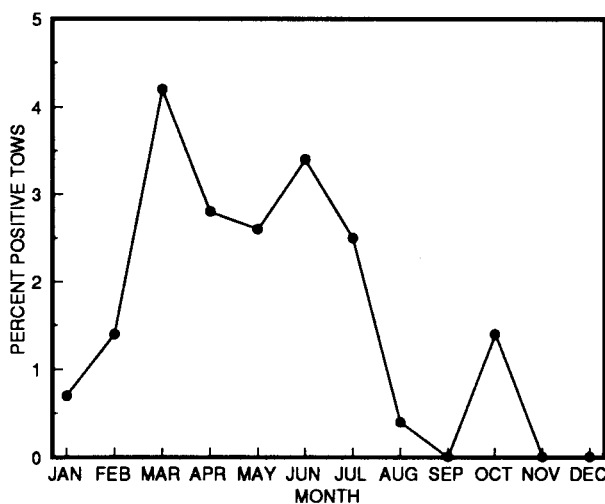
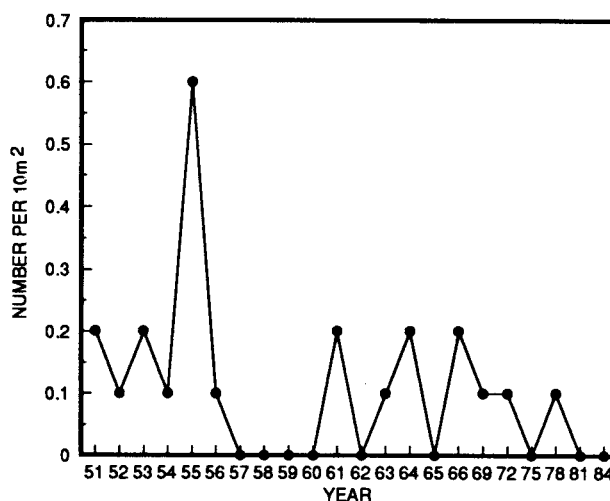
Scomberesocidae



Pacific saury

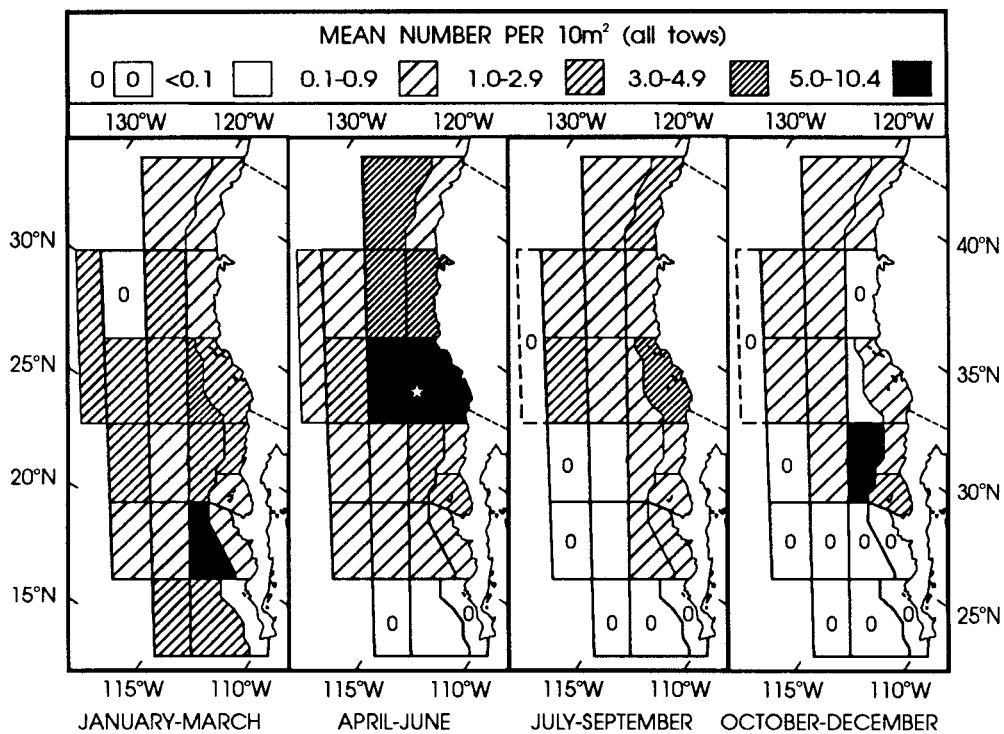
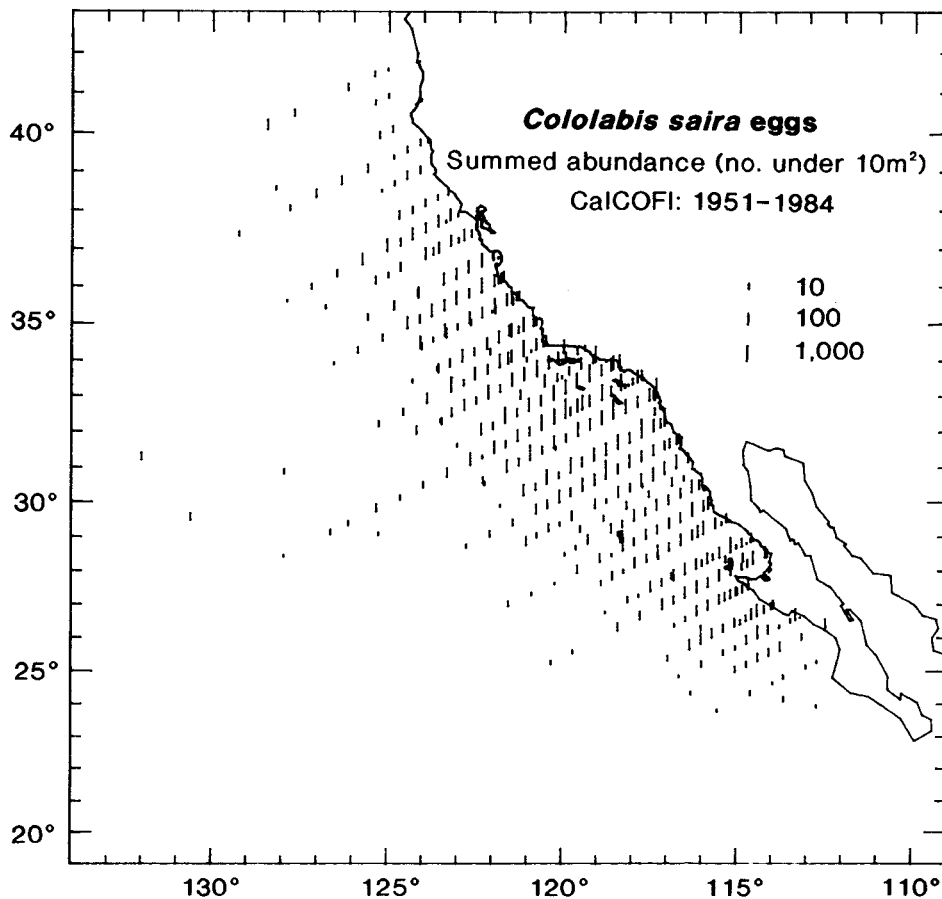


Cololabis saira larvae



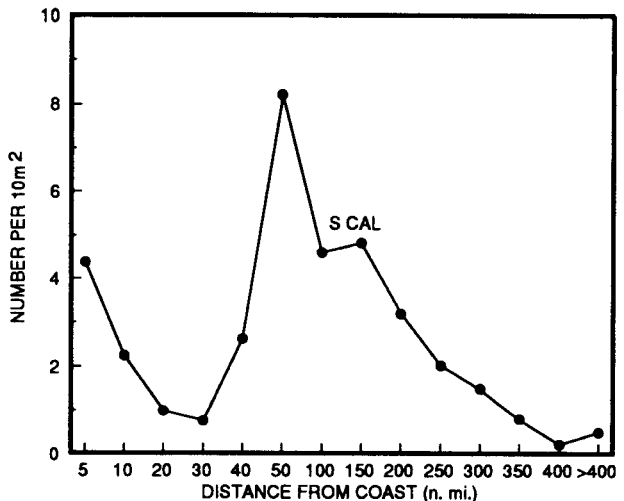
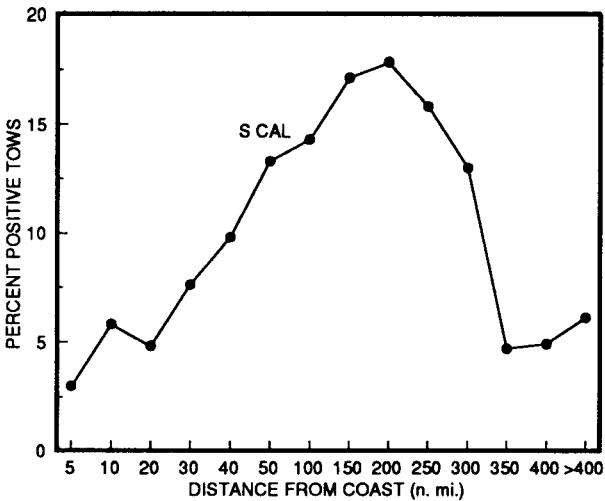
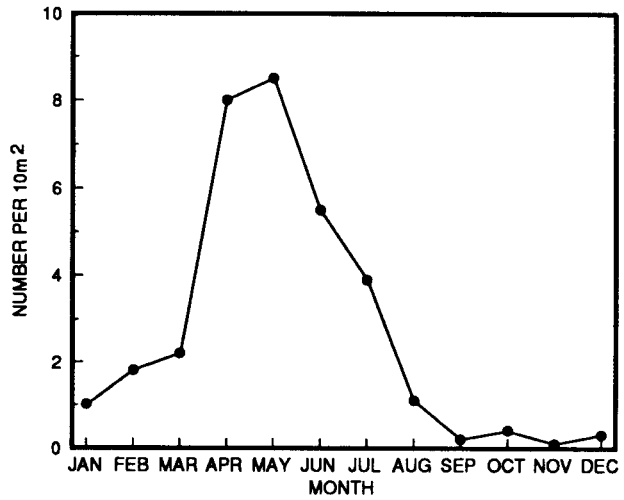
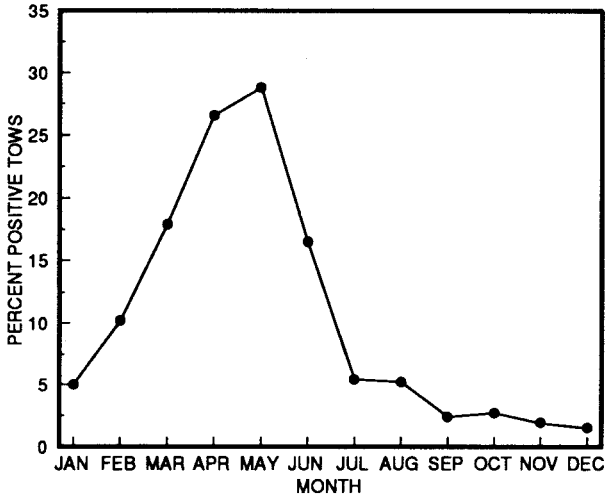
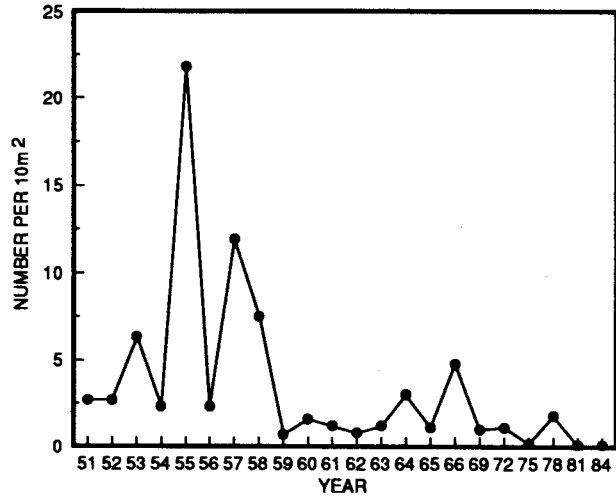
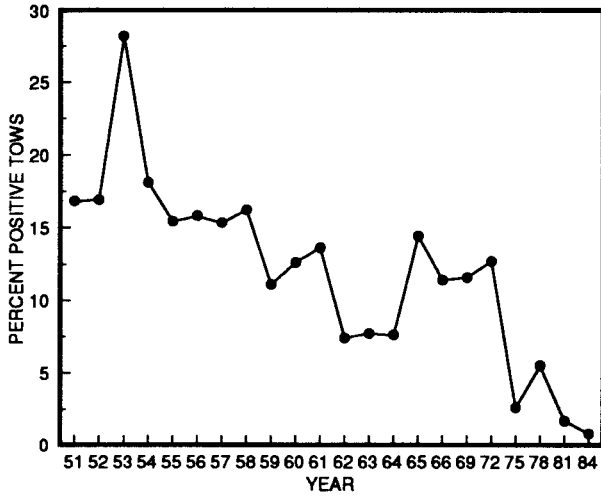
Cololabis saira eggs

Scomberesocidae



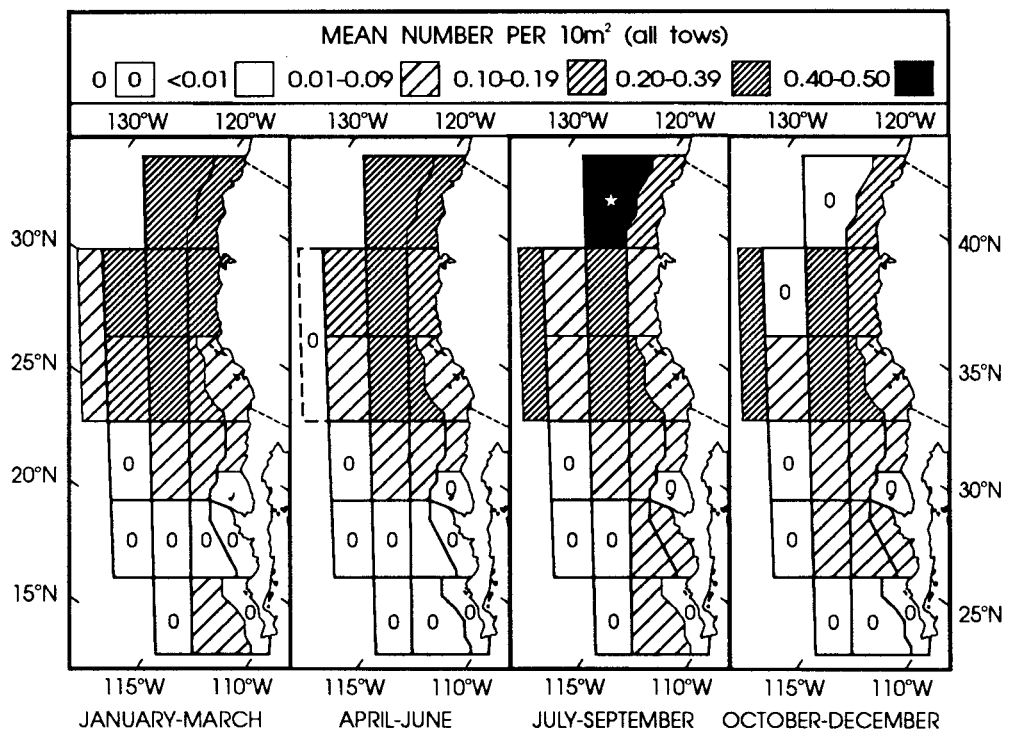
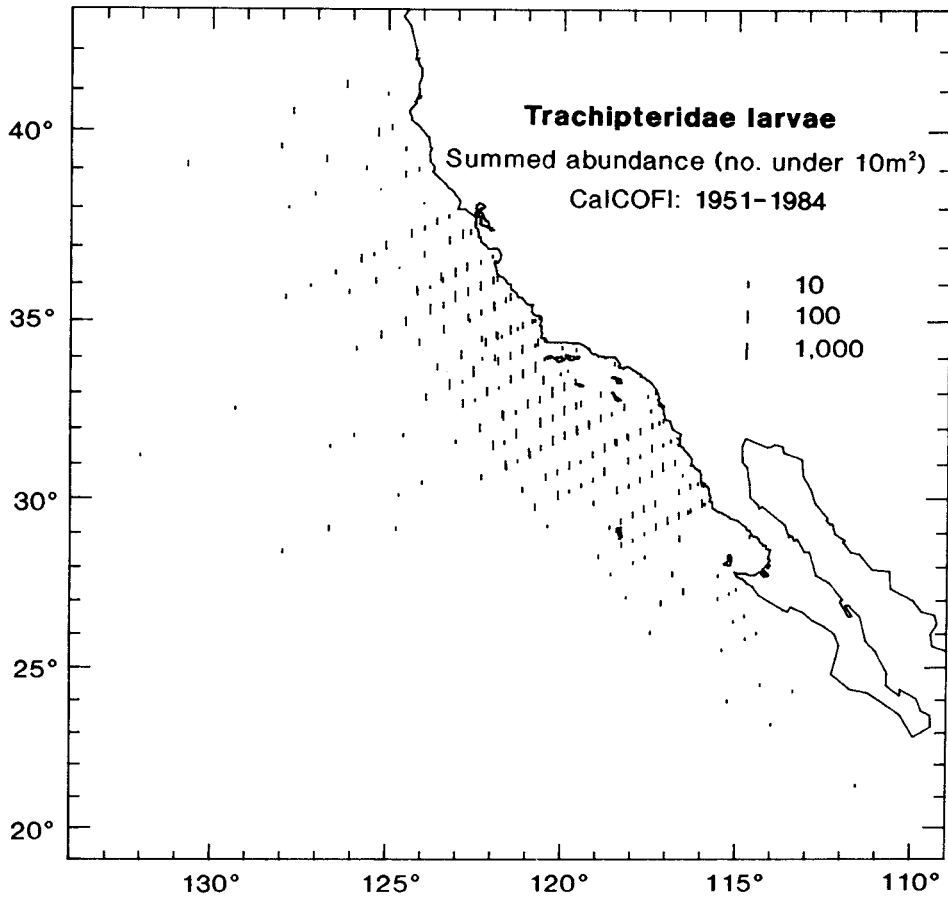
Pacific saury eggs

Cololabis saira eggs



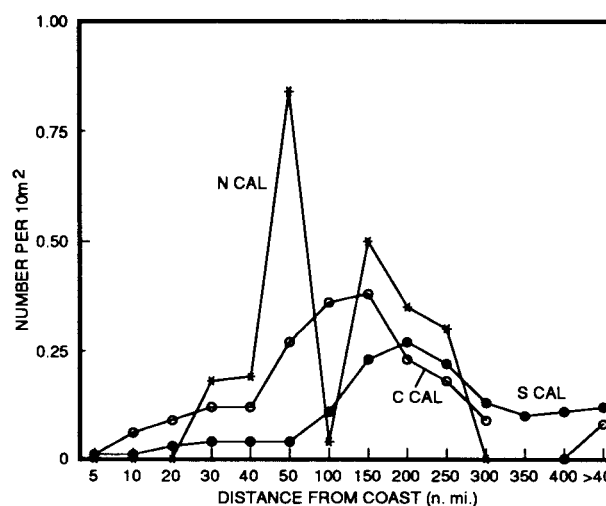
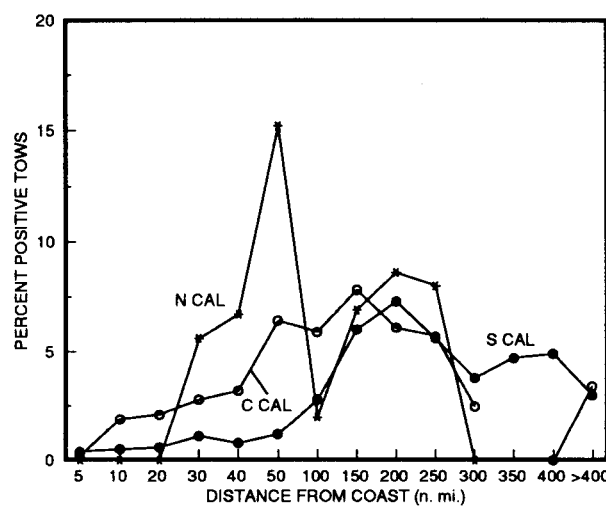
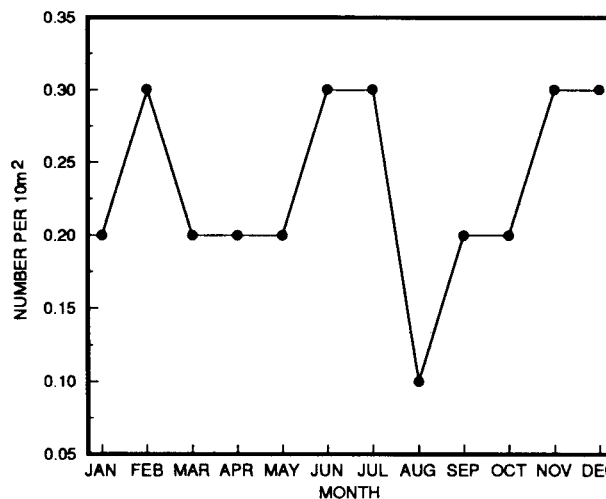
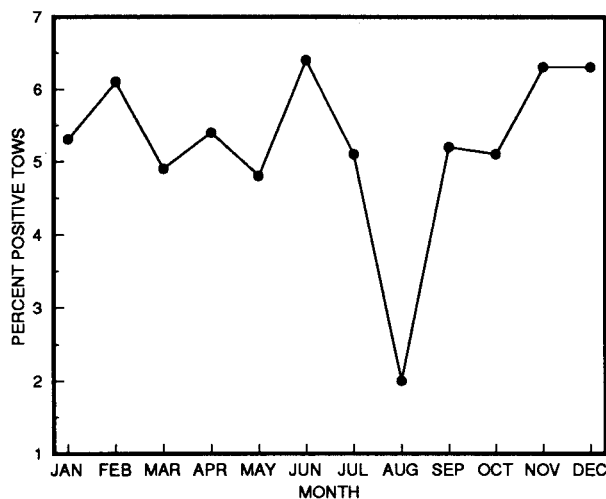
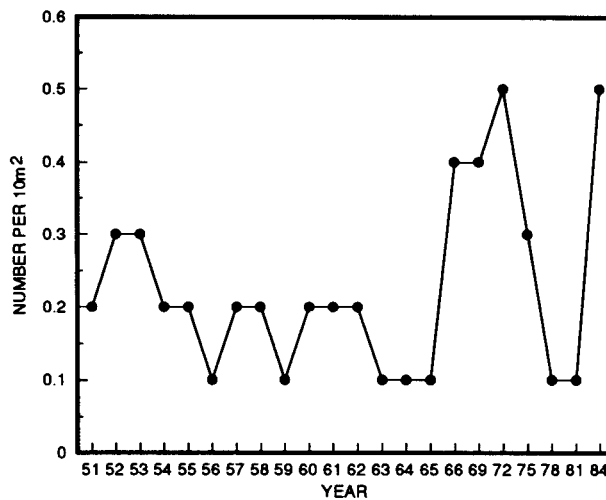
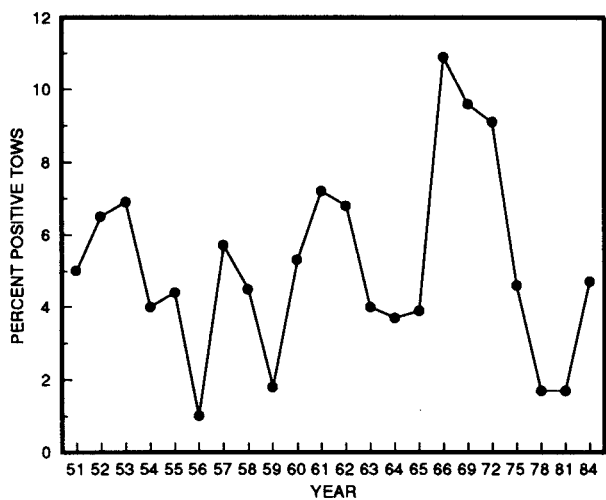
Trachipteridae

Trachipteridae



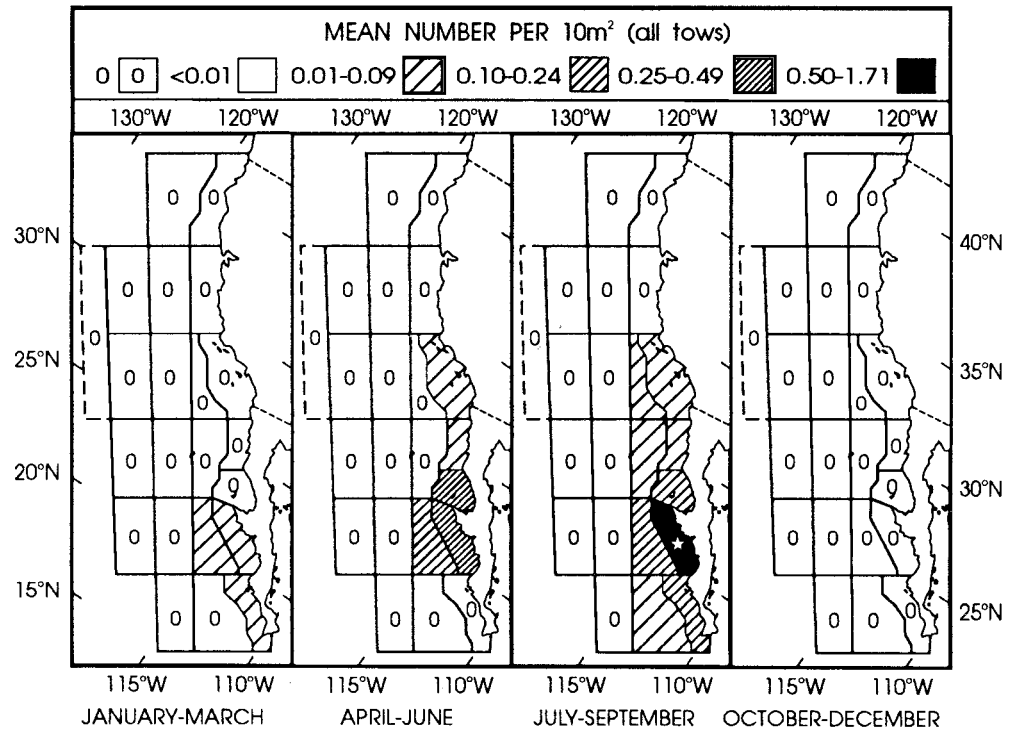
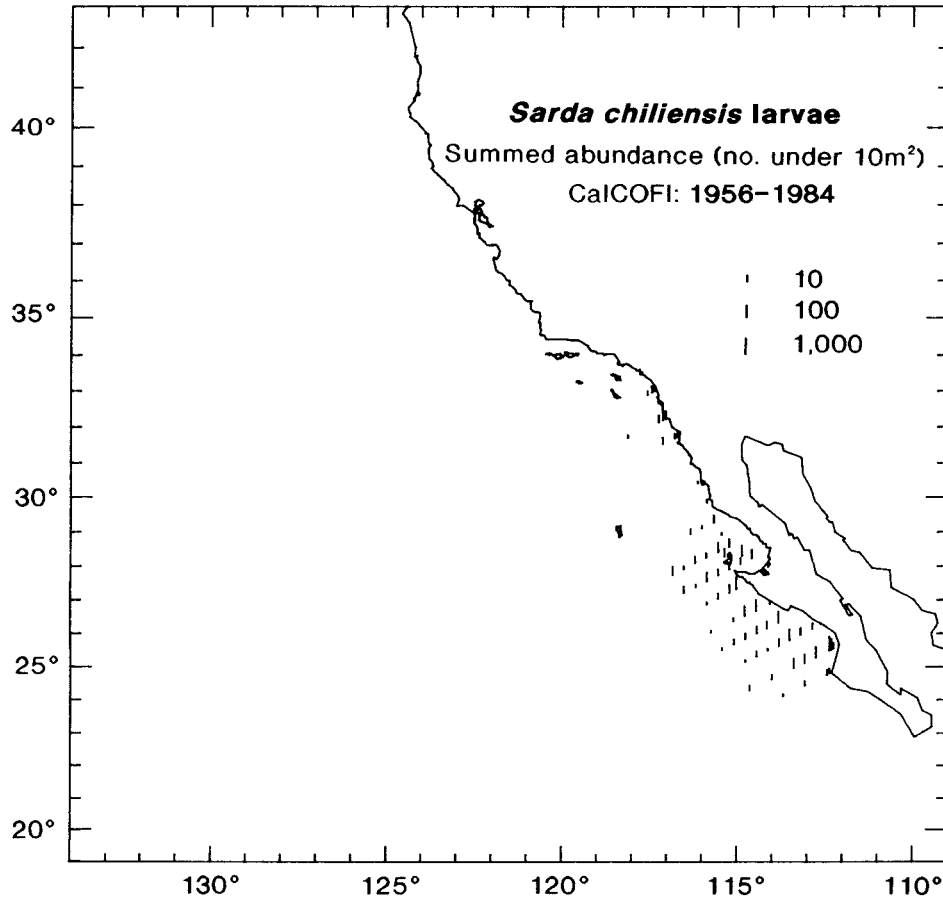
Ribbonfishes

Trachipteridae



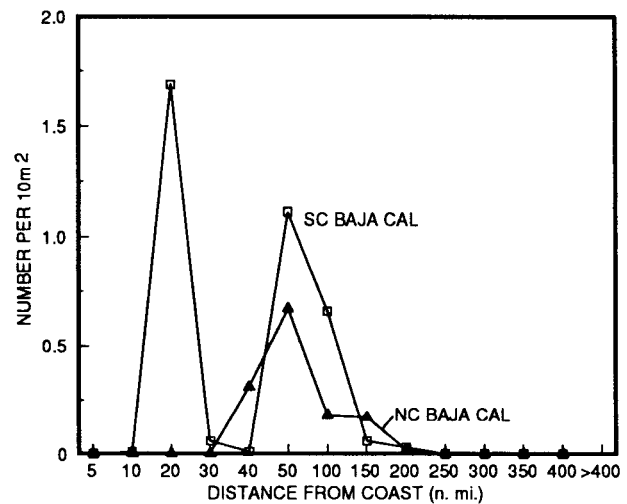
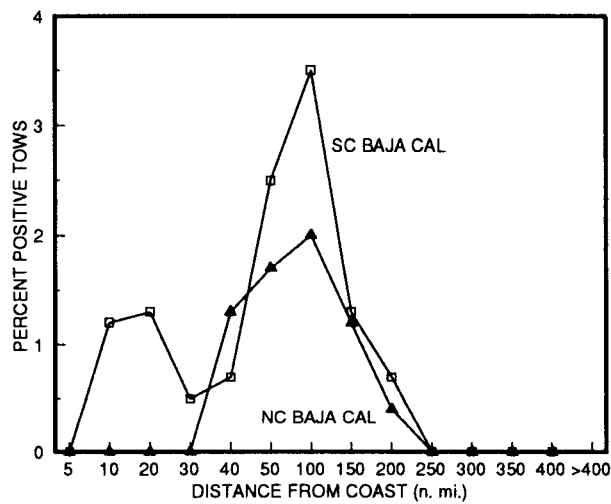
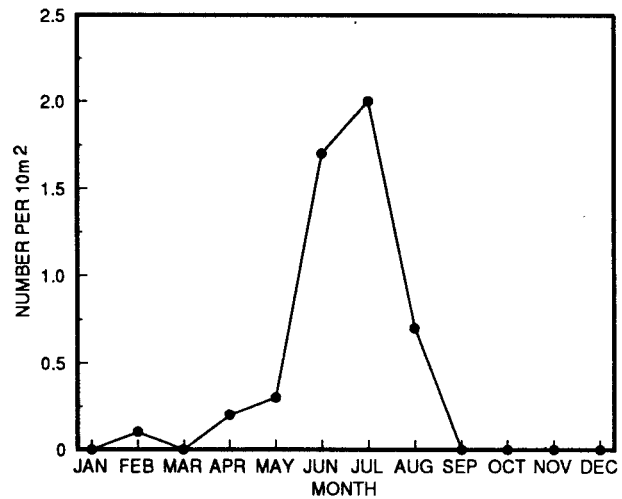
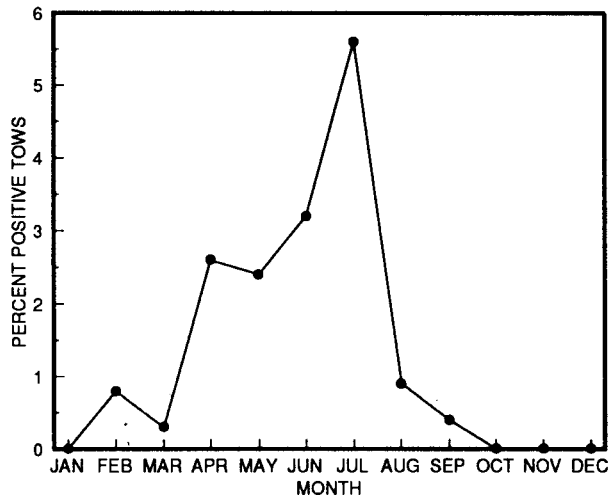
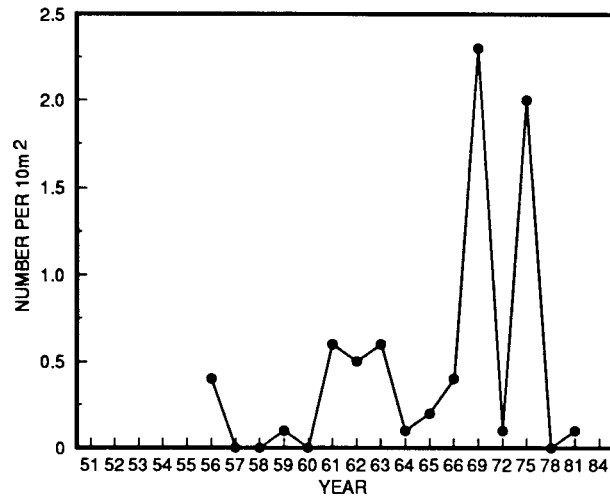
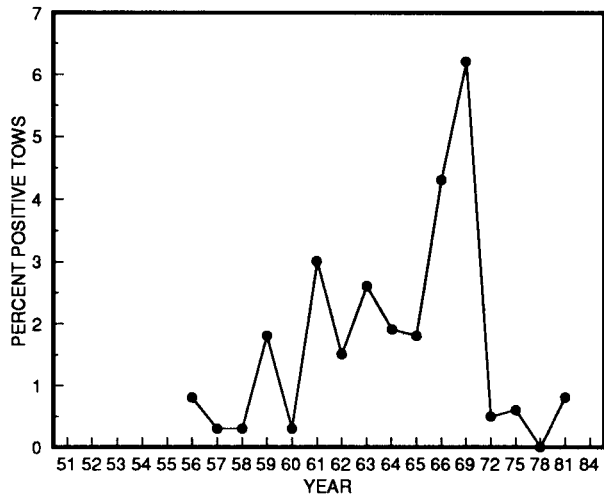
Sarda chiliensis

Scombridae



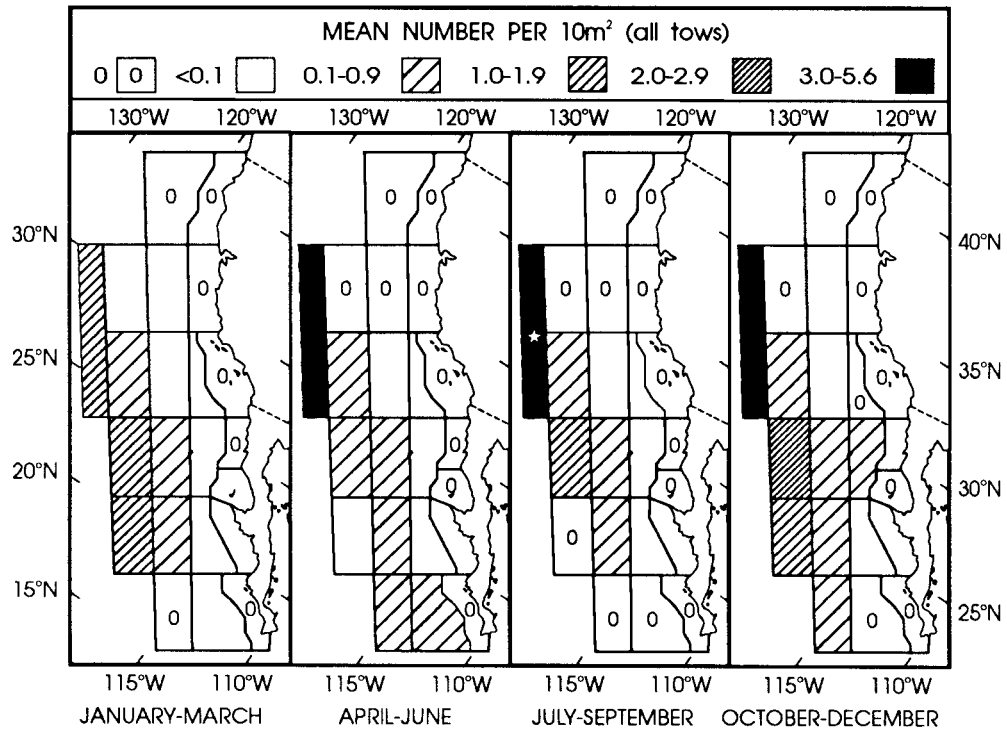
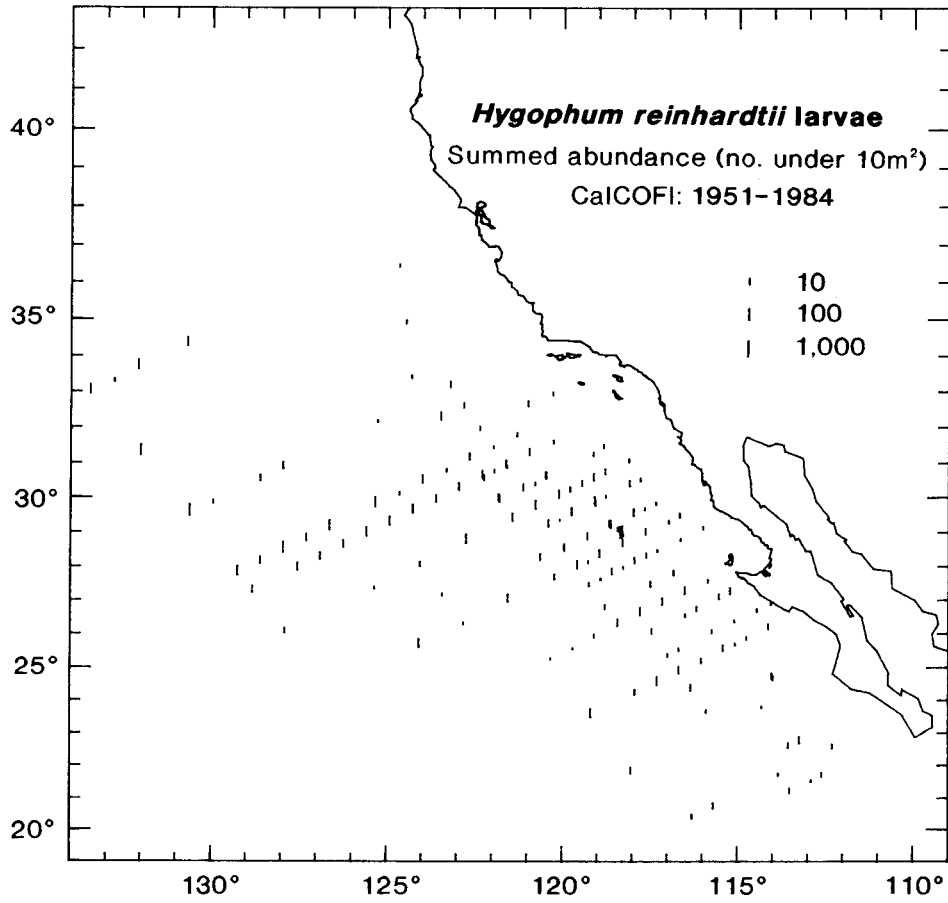
Pacific bonito

Sarda chiliensis

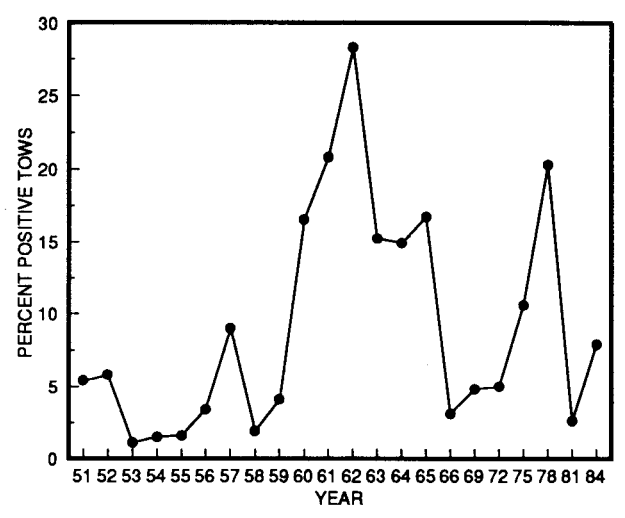


Hygophum reinhardtii

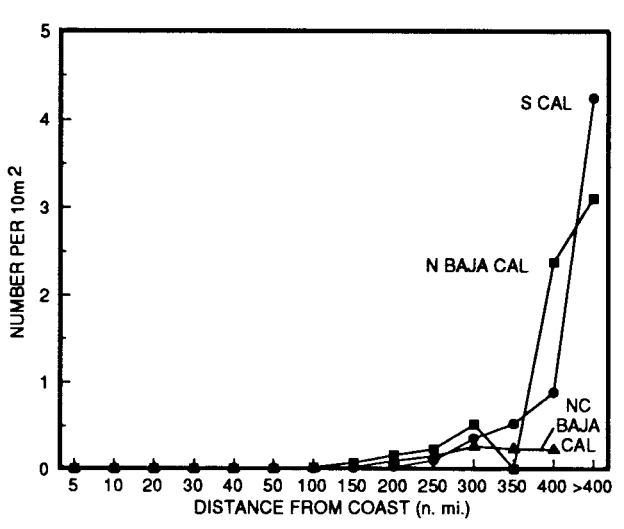
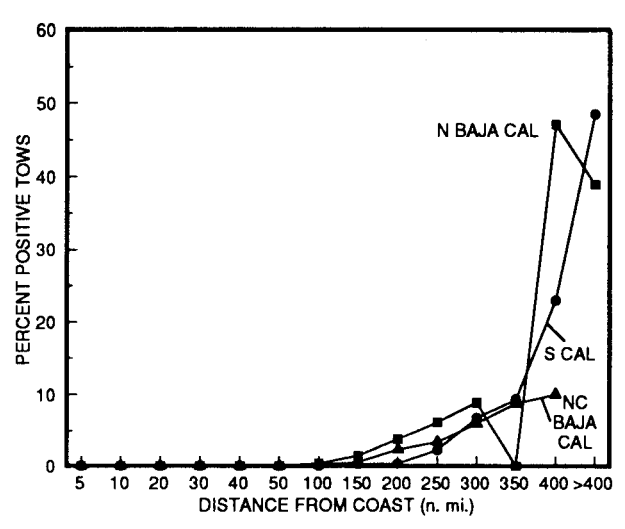
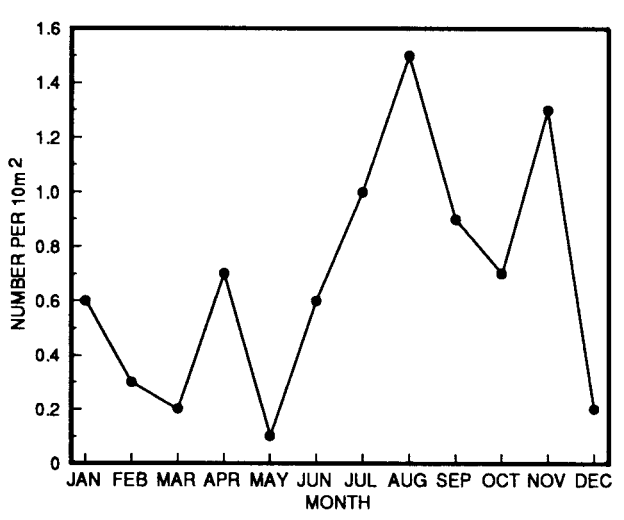
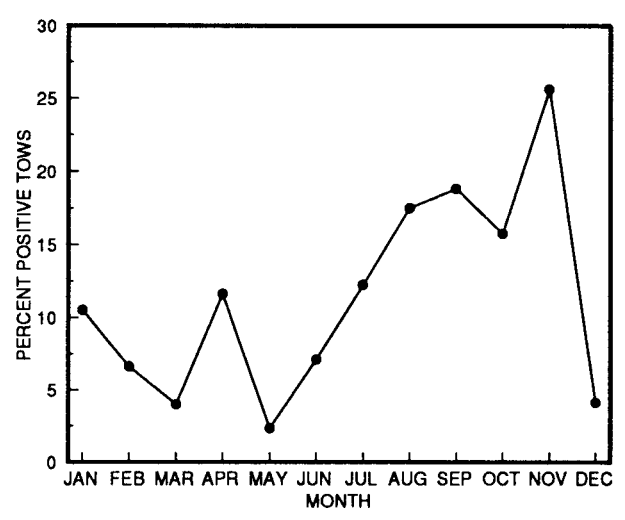
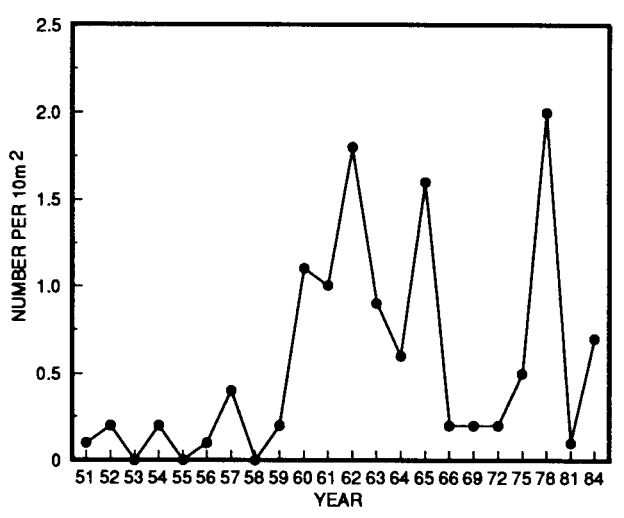
Myctophidae



Slender lanternfish

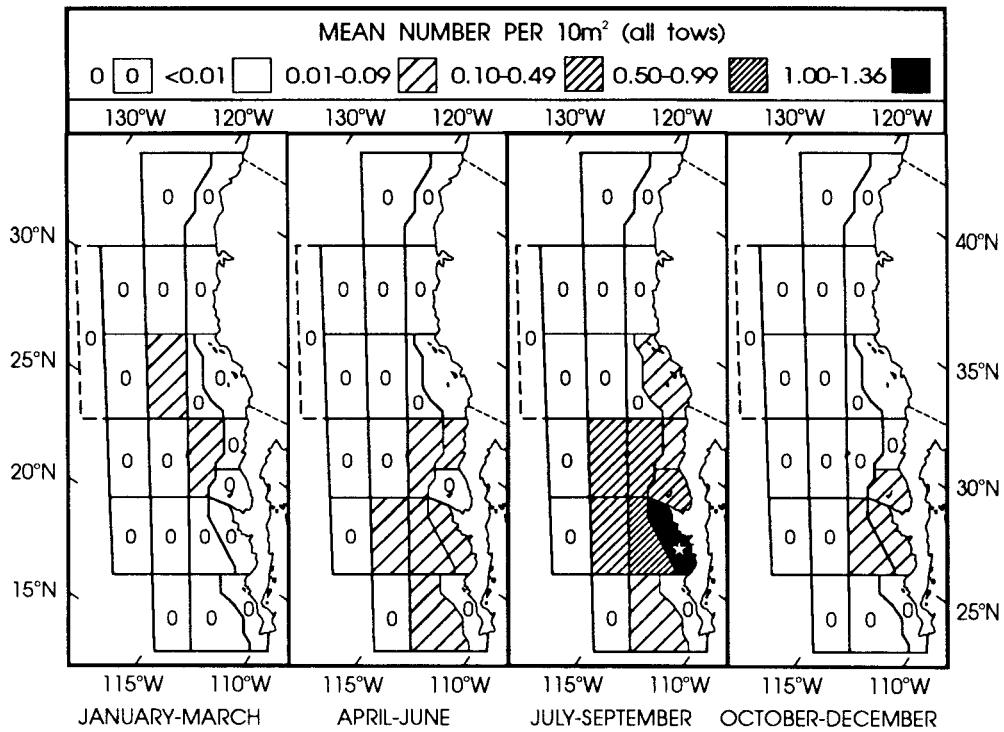
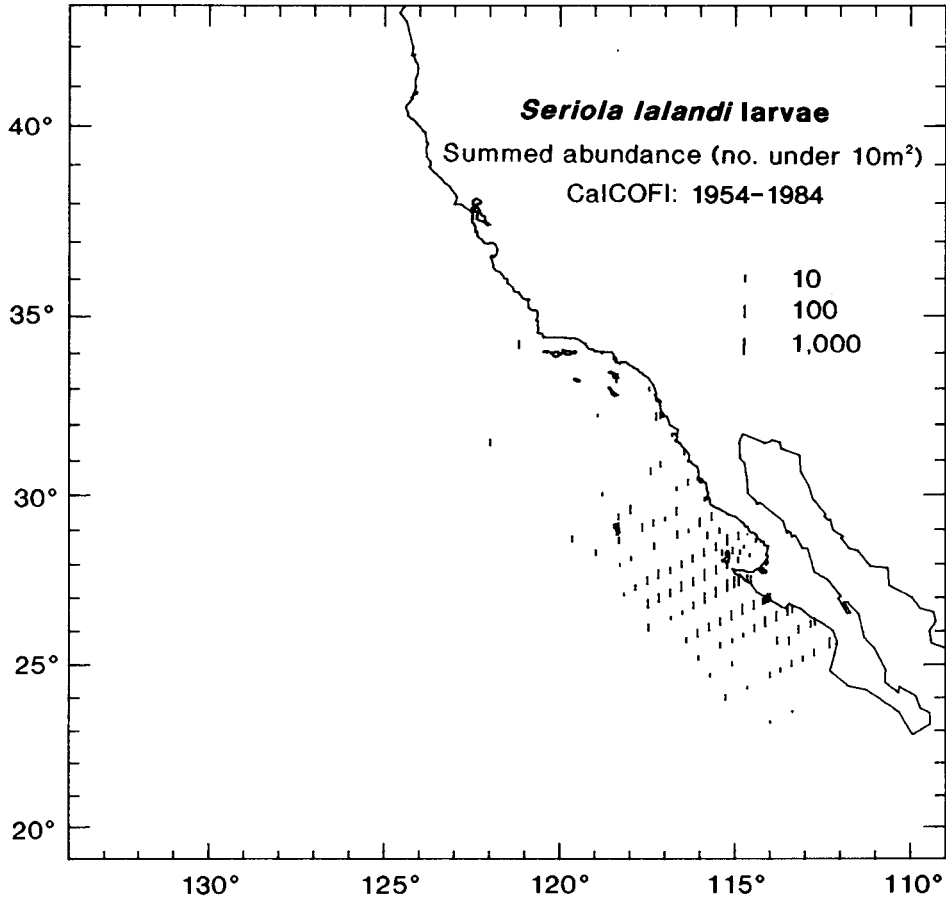


Hygophum reinhardtii



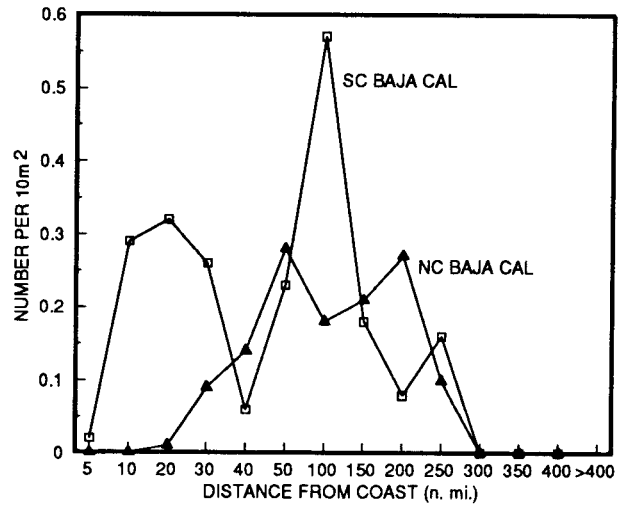
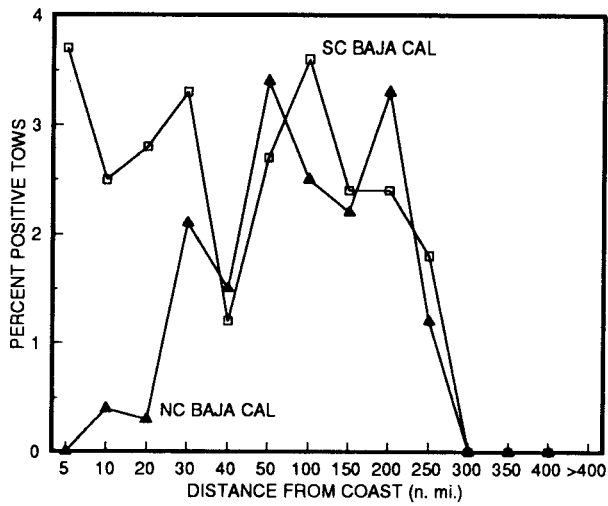
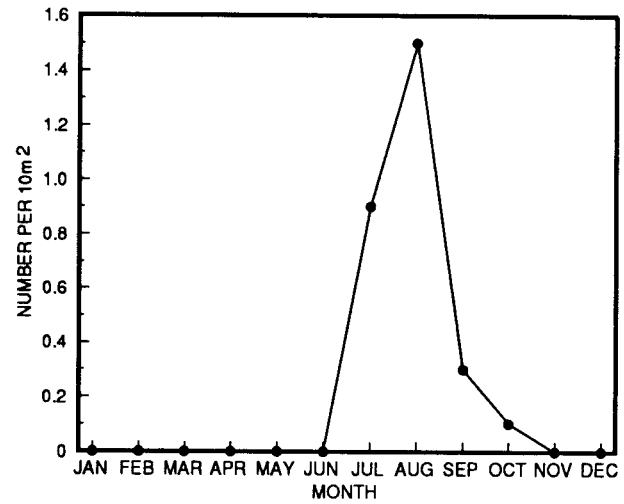
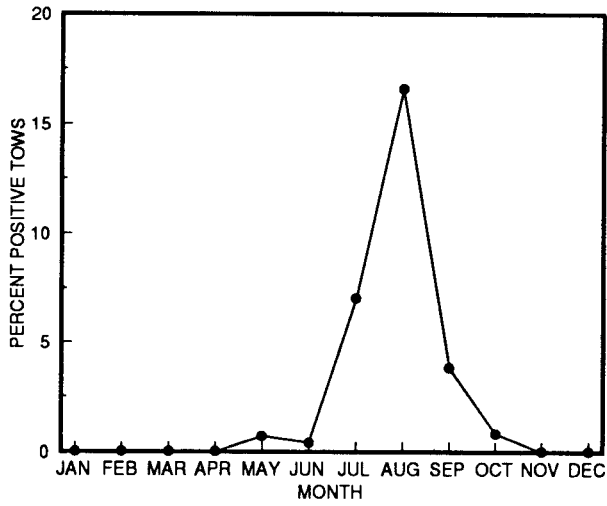
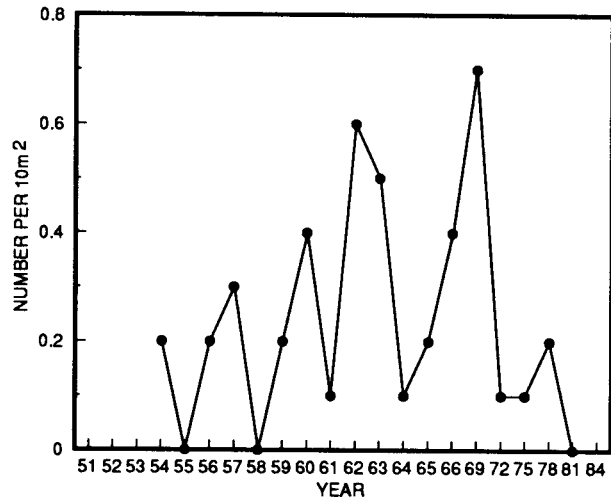
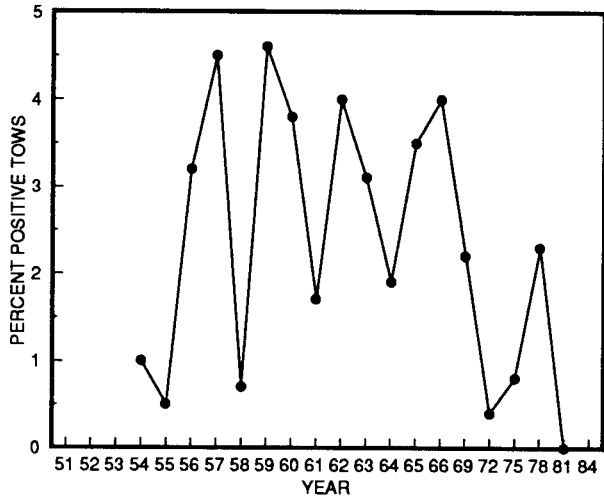
Seriola lalandi

Carangidae



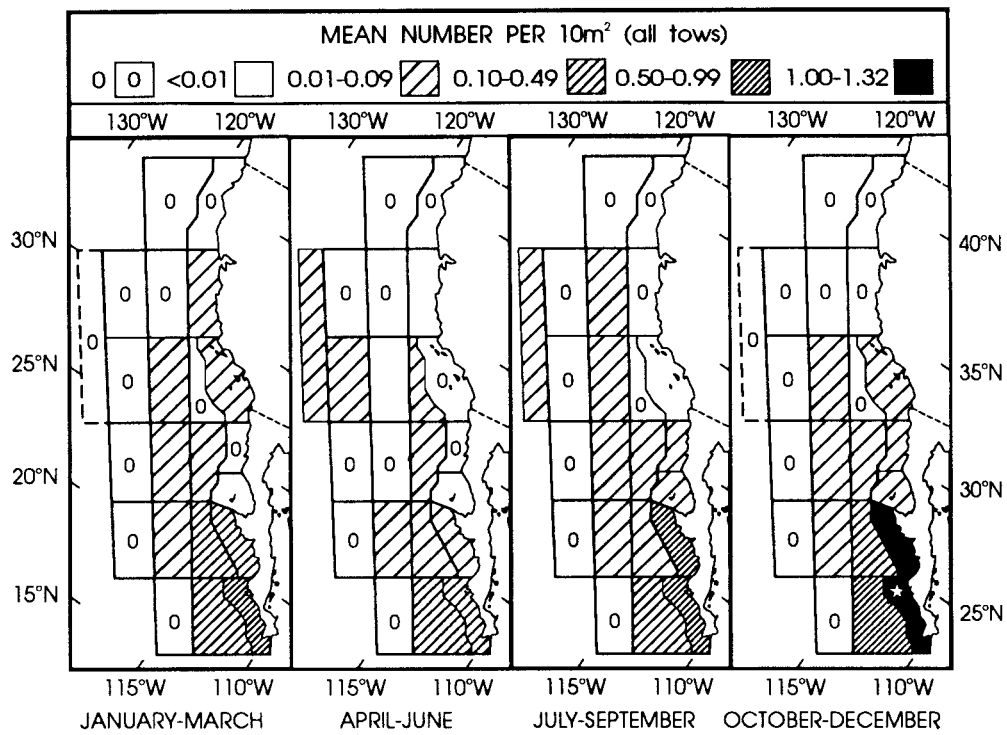
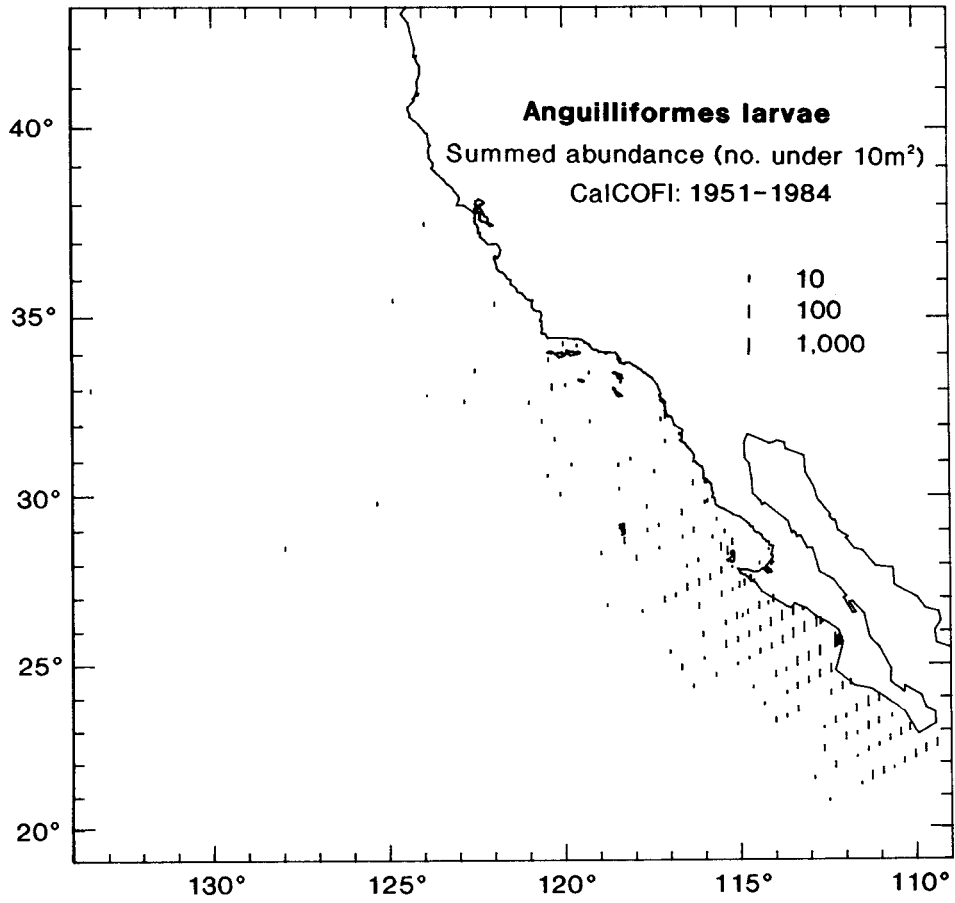
Yellowtail

Seriola lalandi



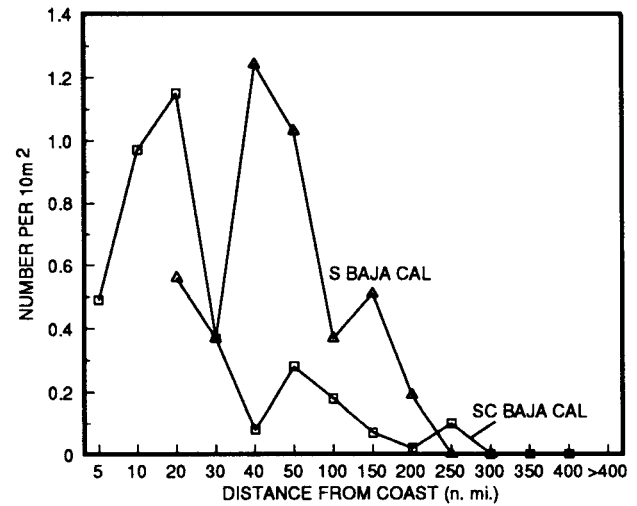
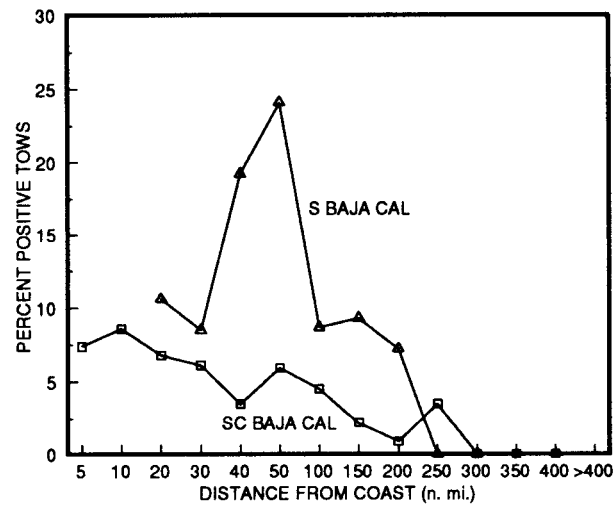
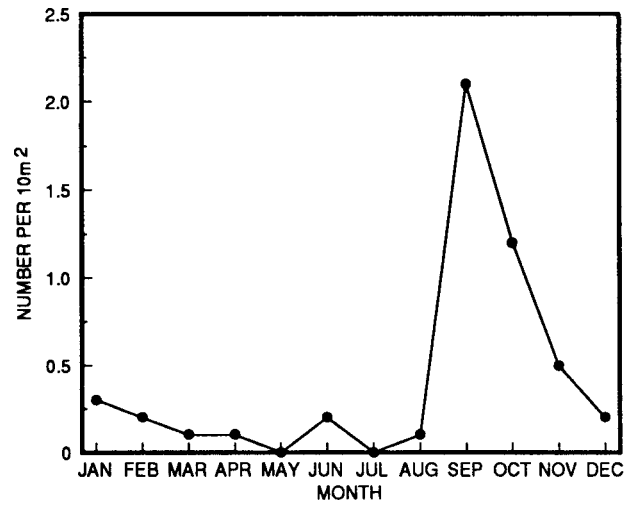
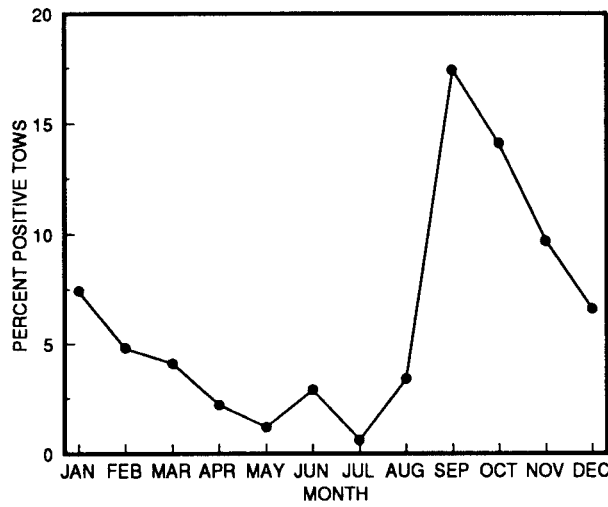
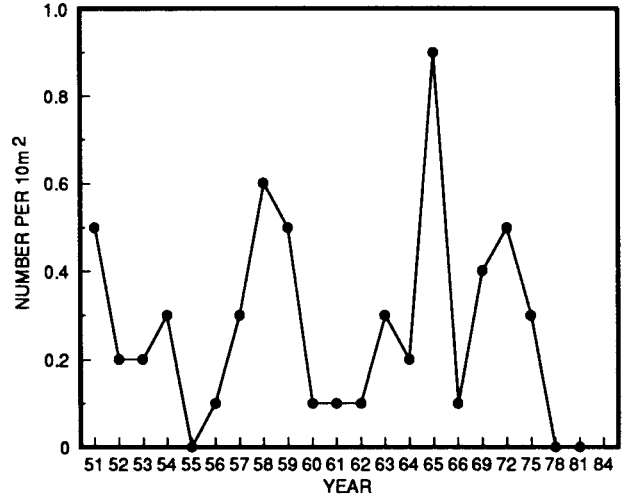
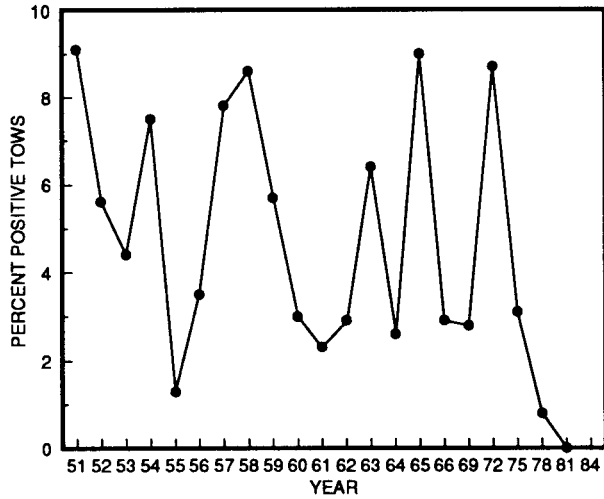
Anguilliformes

Anguilliformes



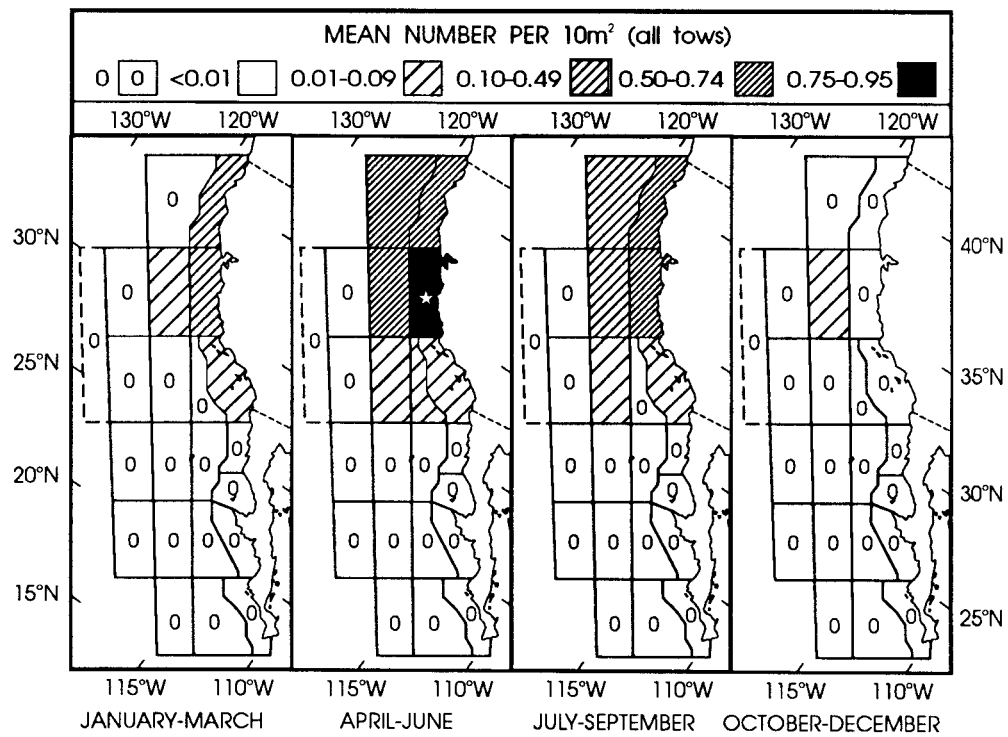
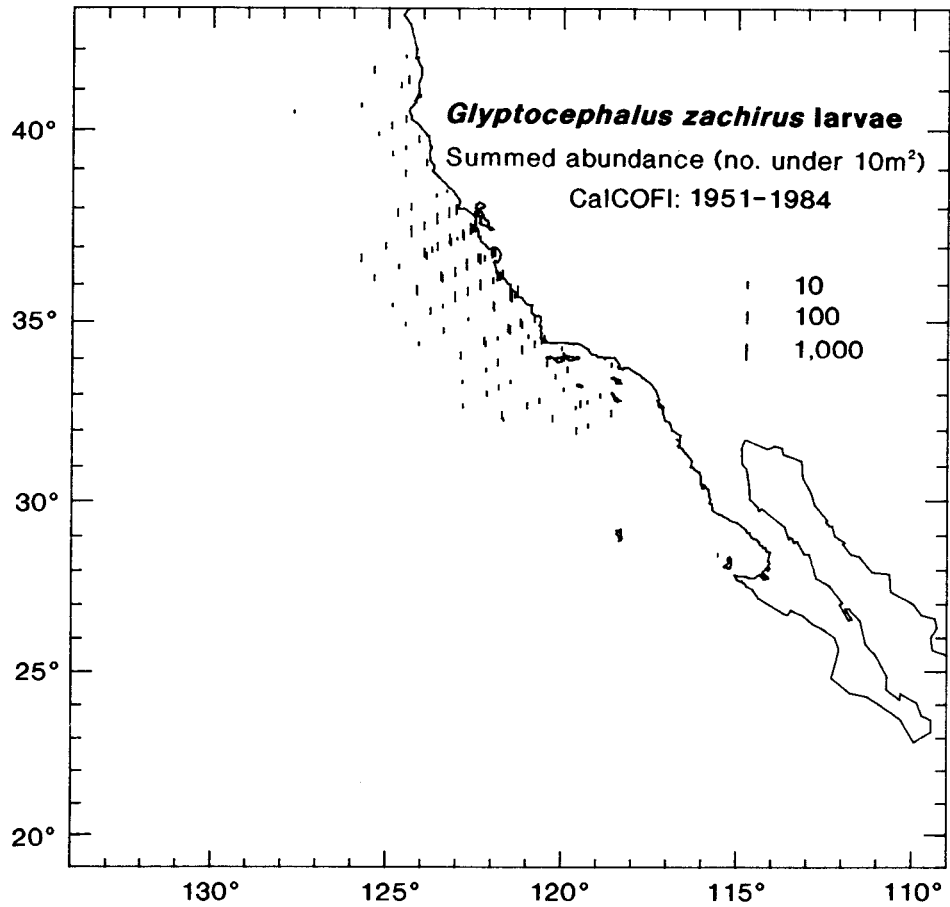
Eels

Anguilliformes



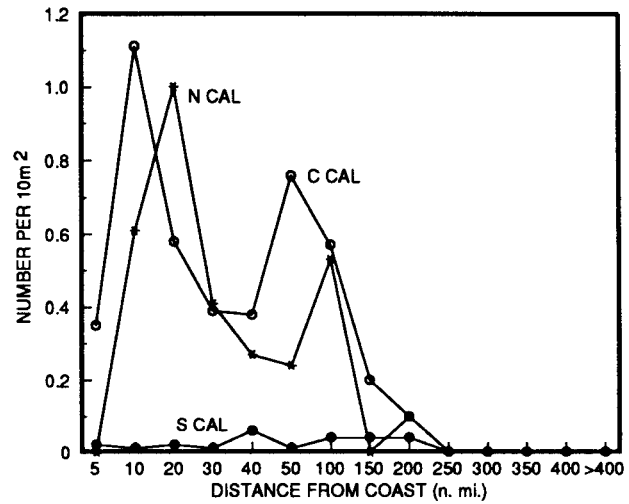
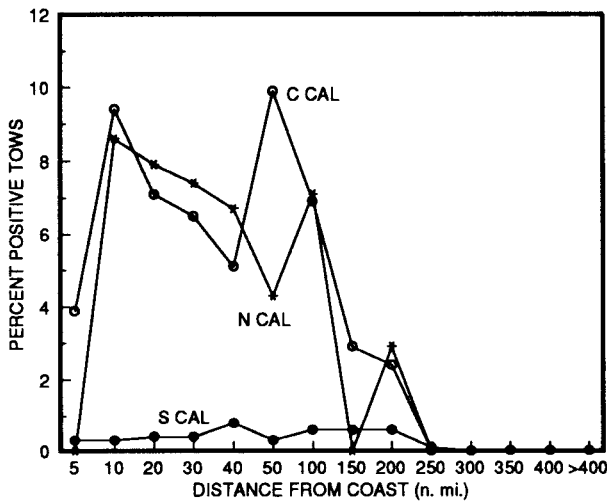
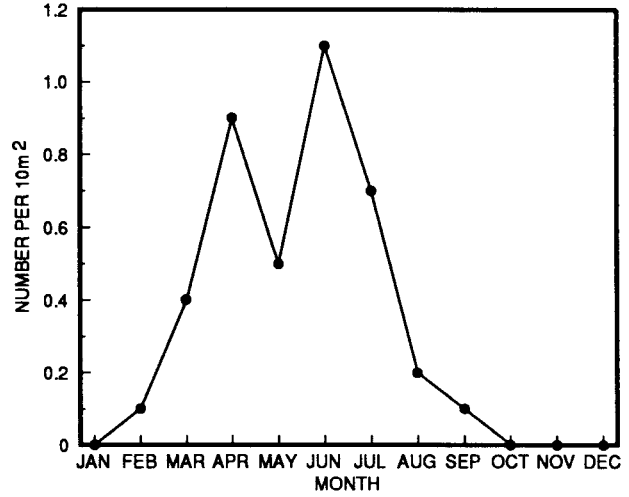
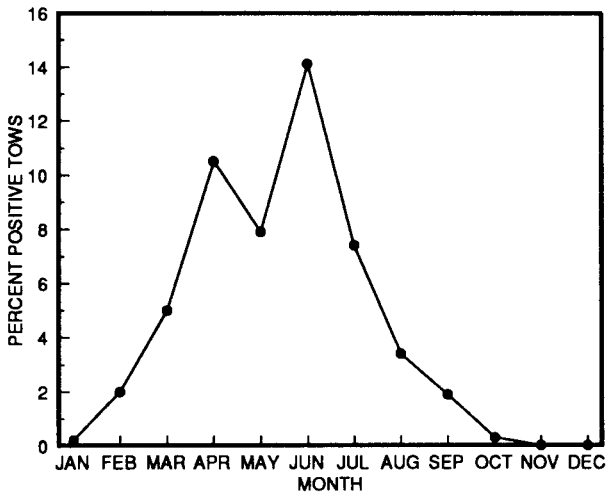
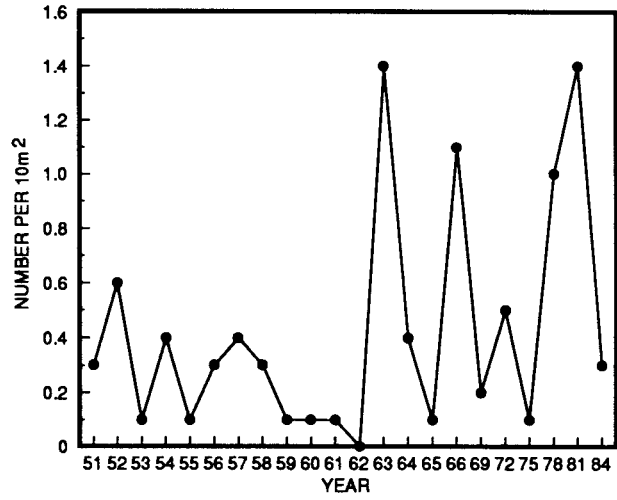
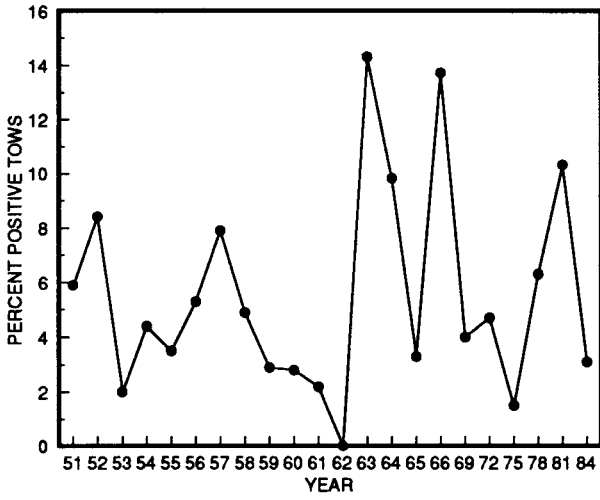
Glyptocephalus zachirus

Pleuronectidae



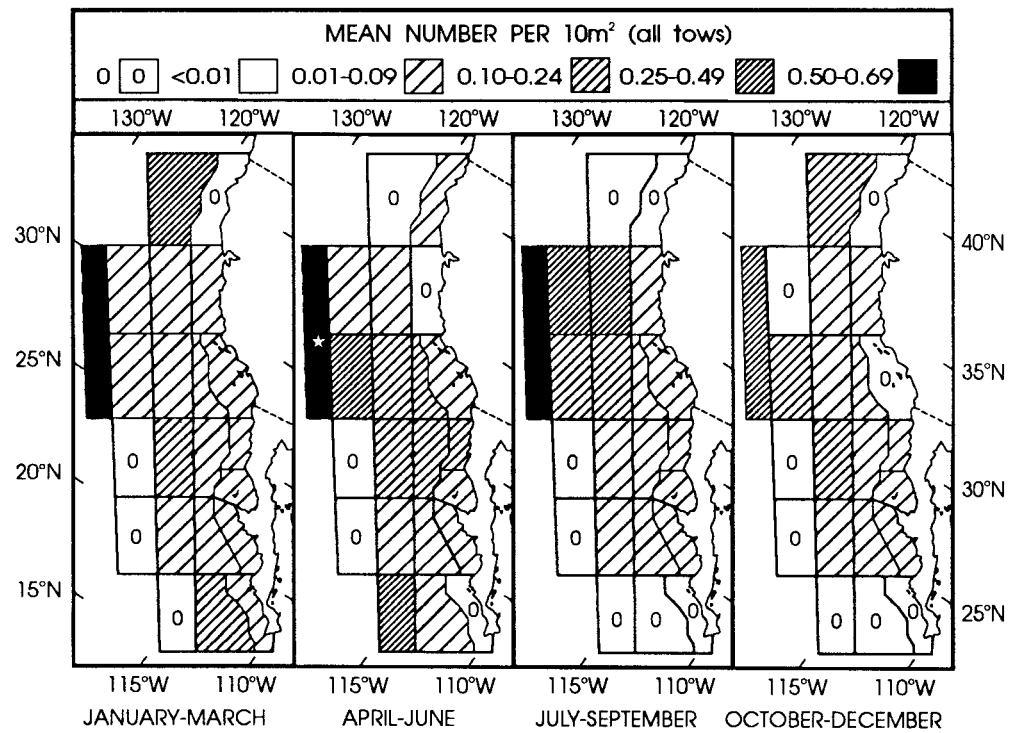
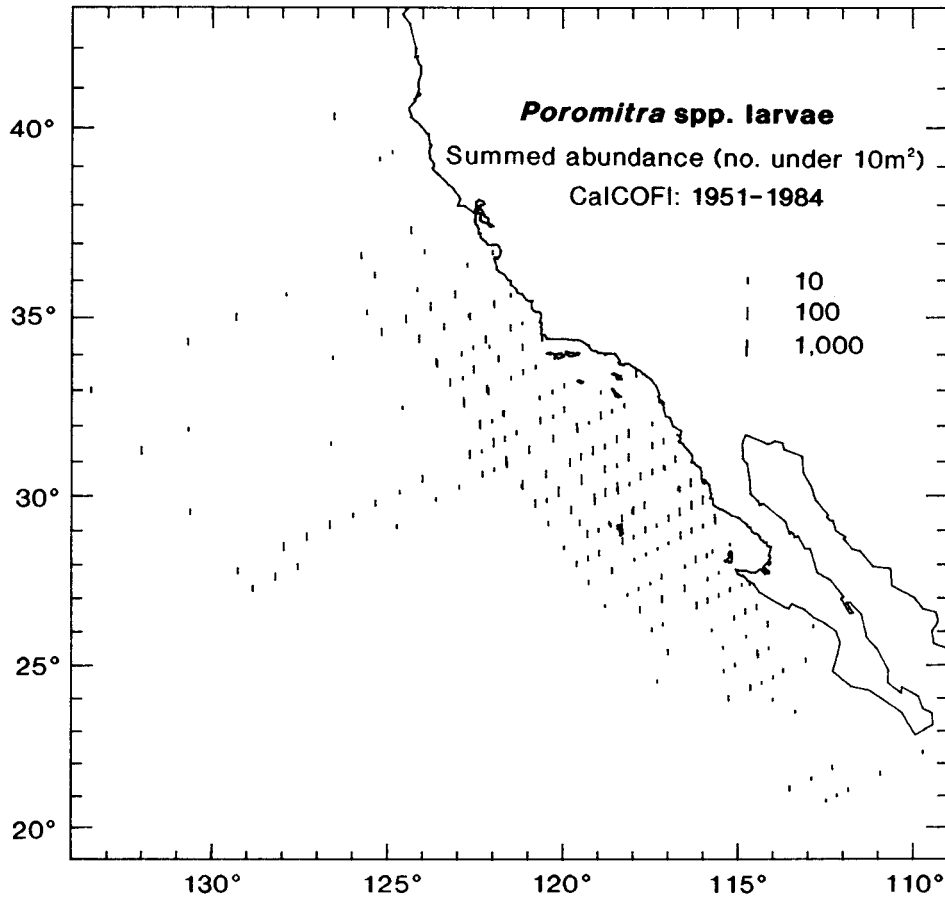
Rex sole

Glyptocephalus zachirus



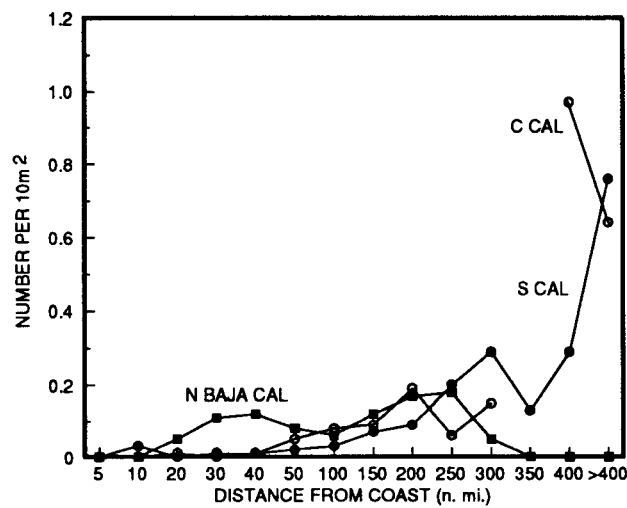
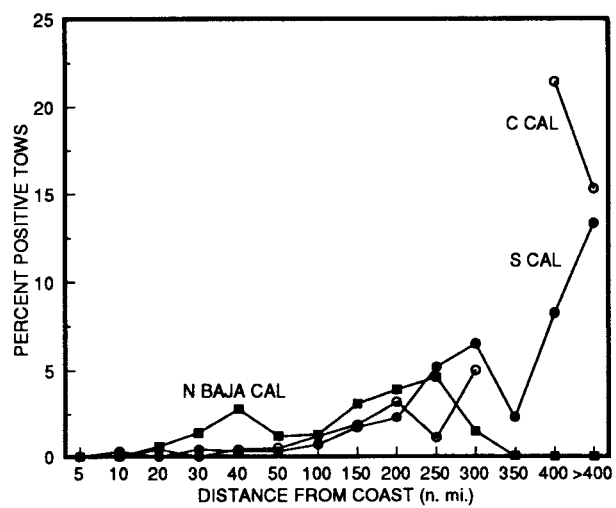
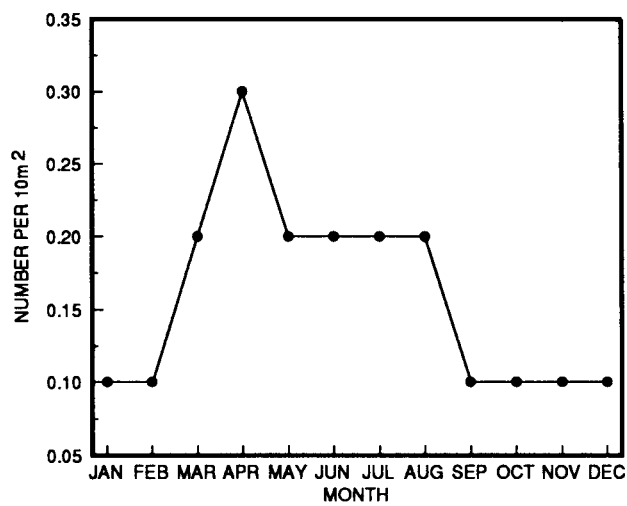
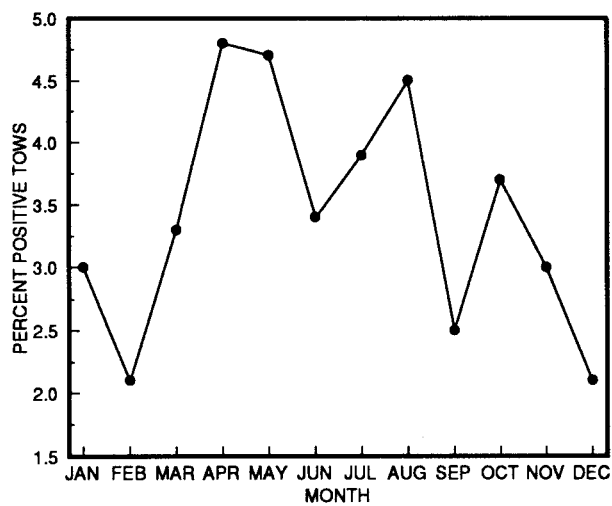
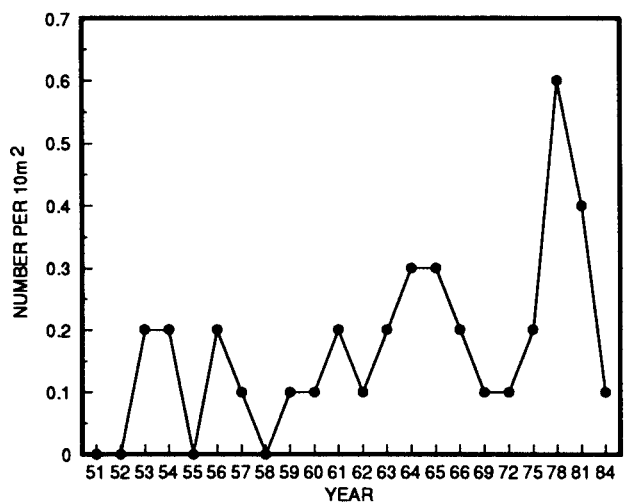
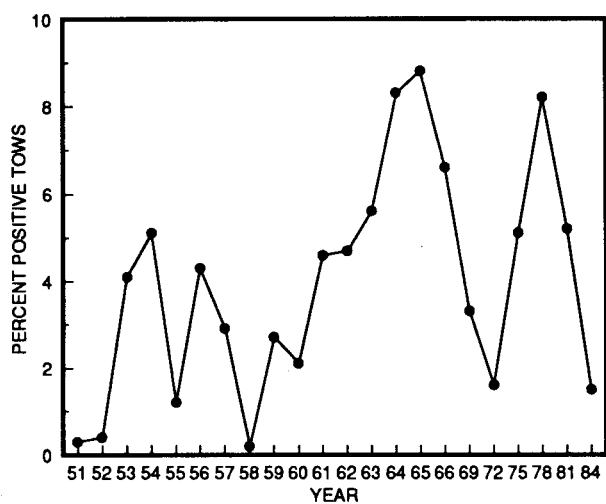
Poromitra spp.

Melamphaidae



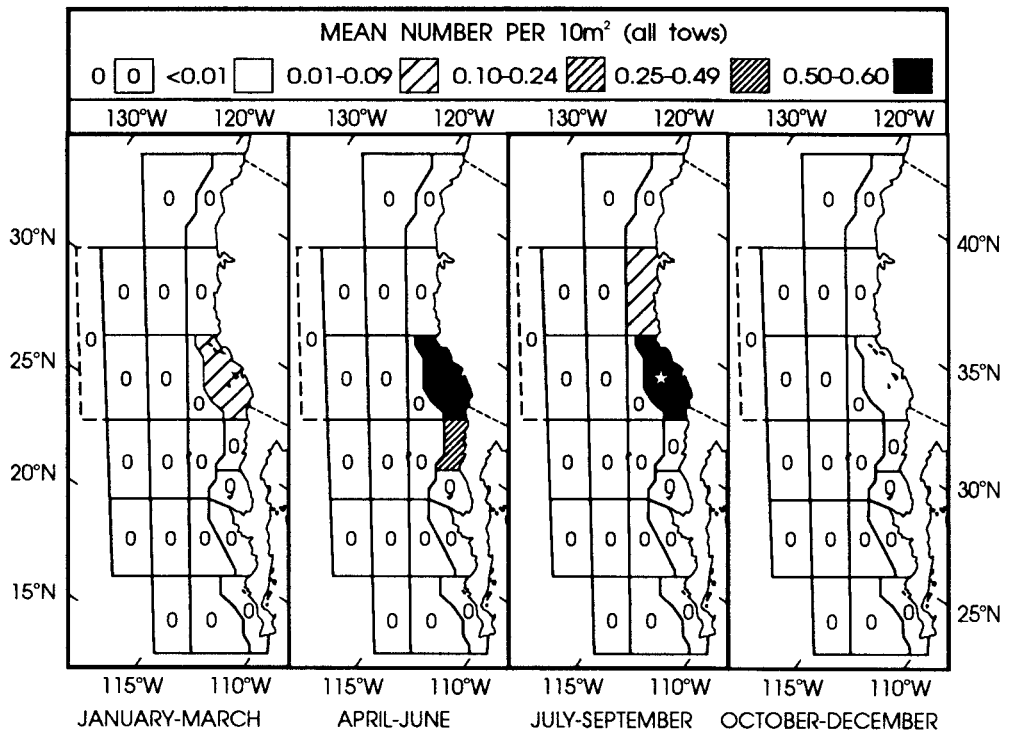
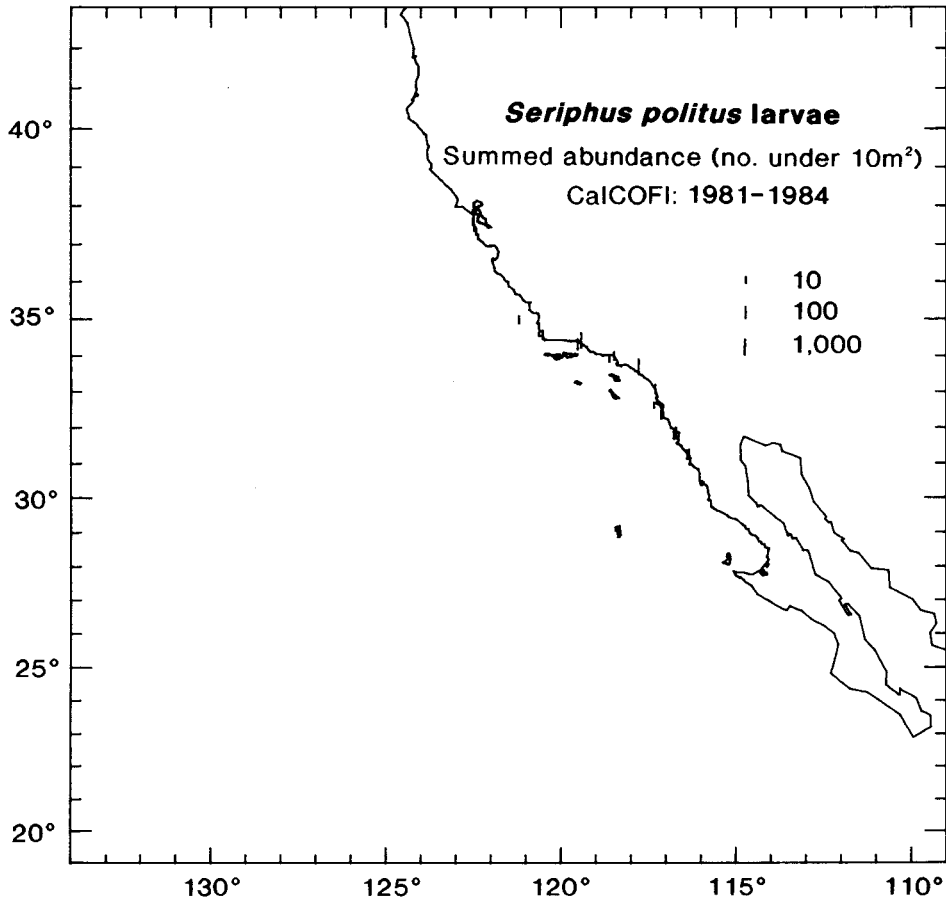
Crested bigscales

Poromitra spp.



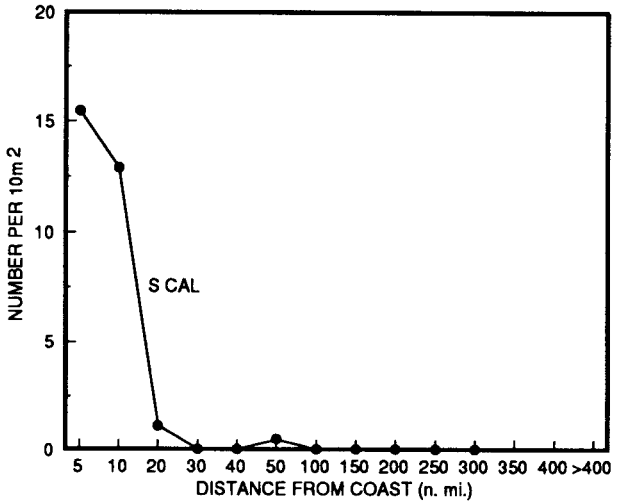
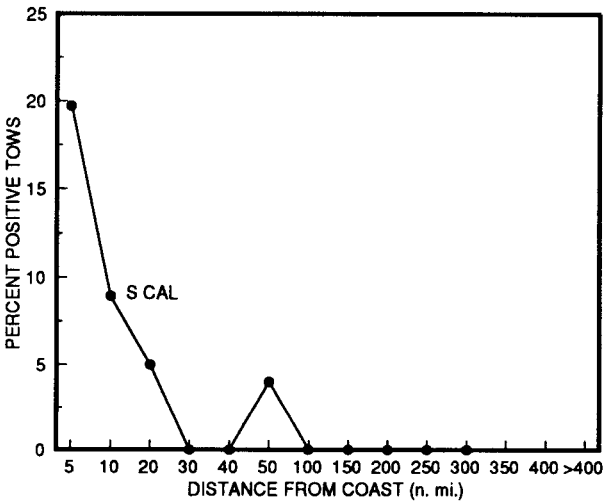
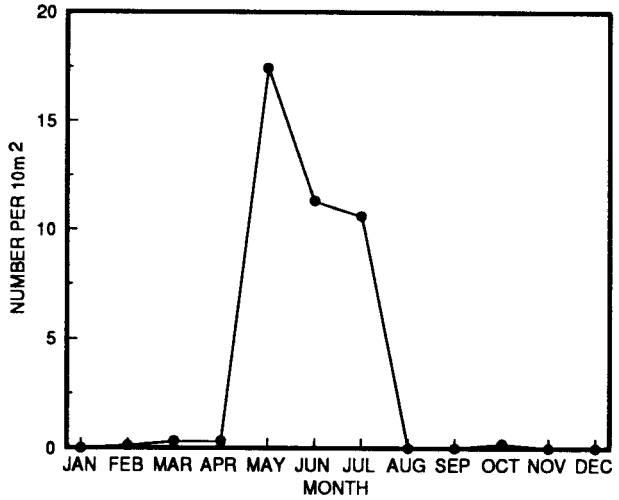
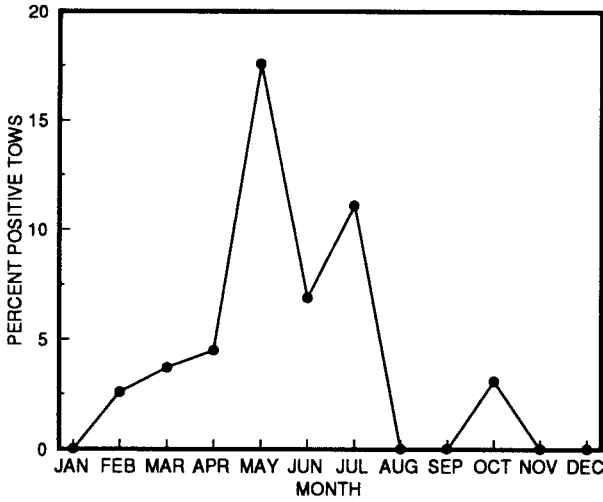
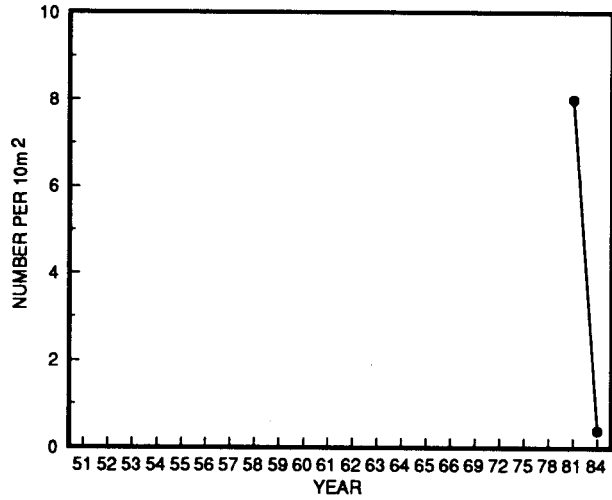
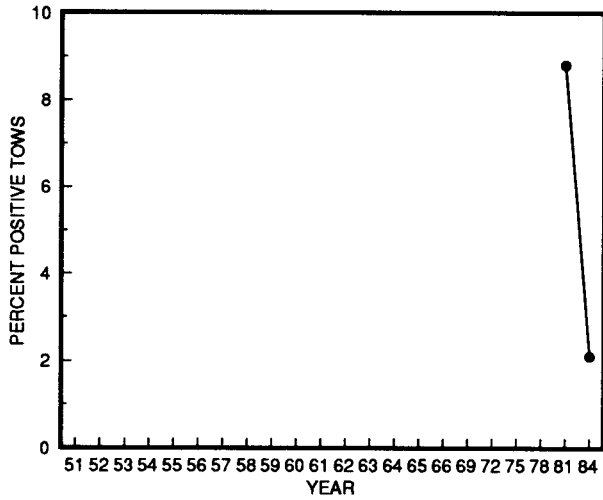
Seriphus politus

Sciaenidae



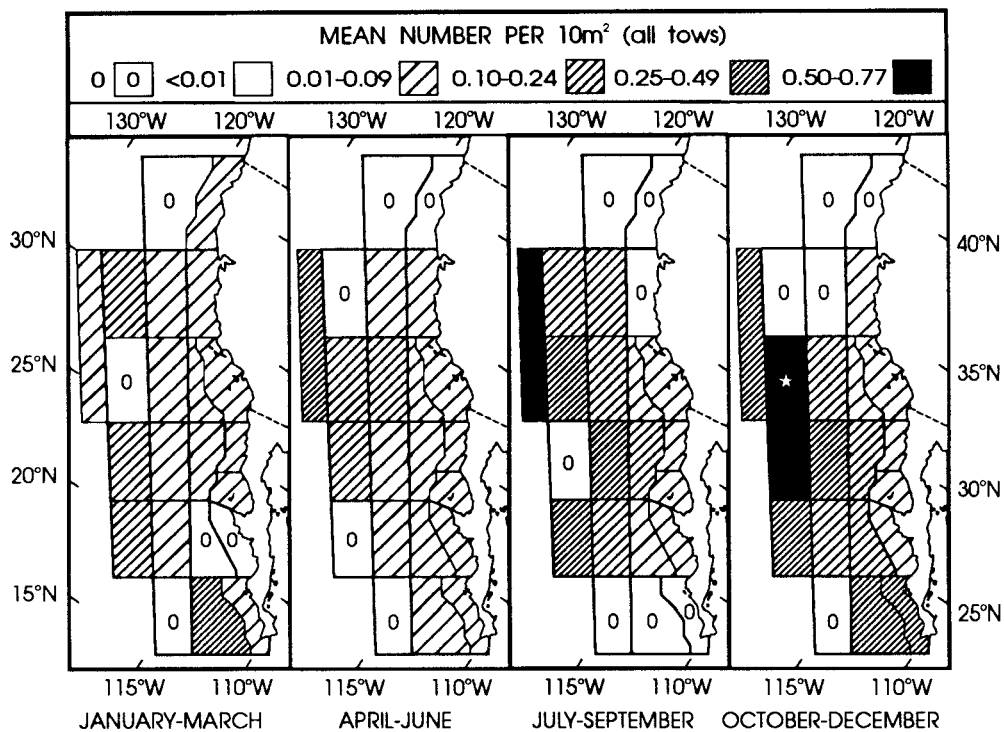
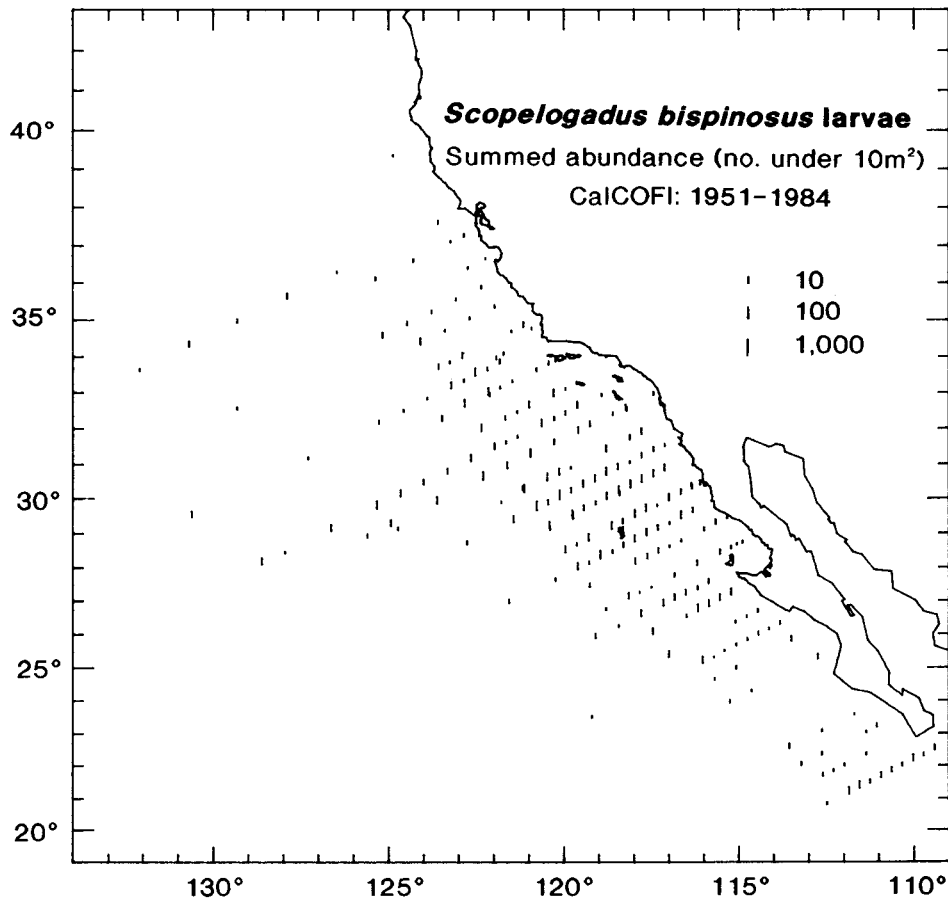
Queenfish

Seriphus politus



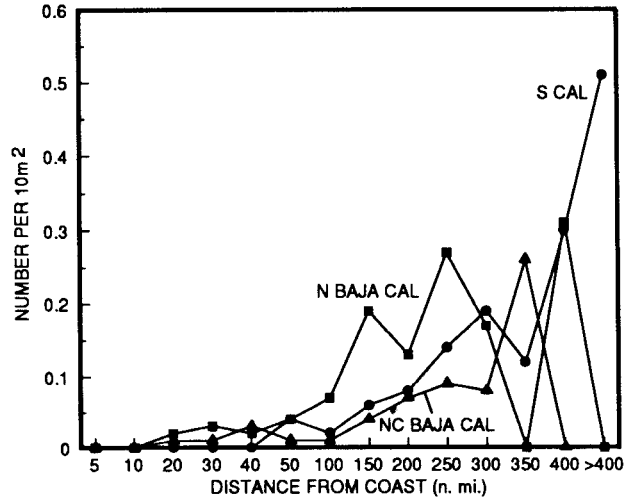
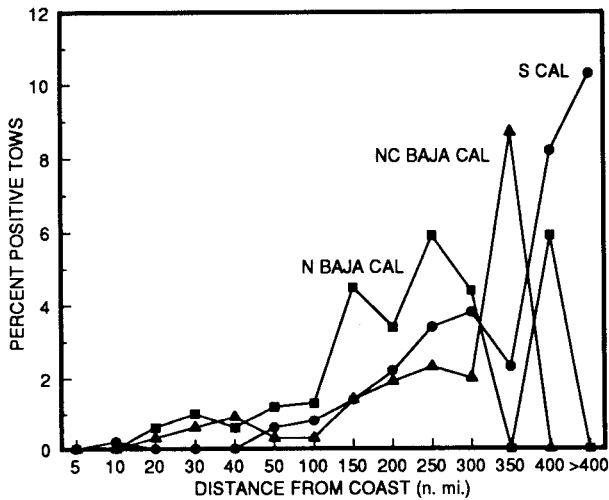
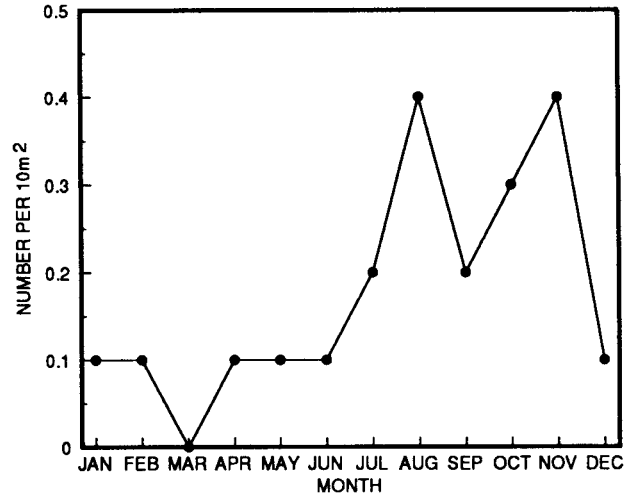
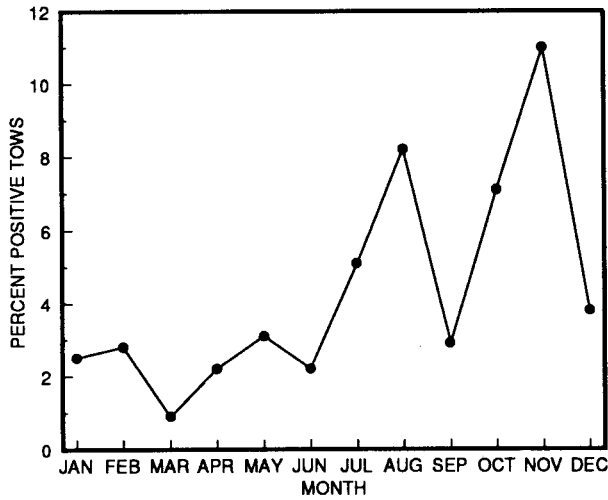
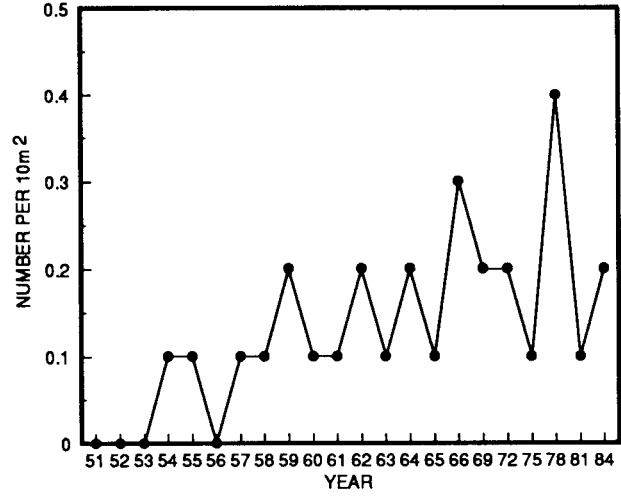
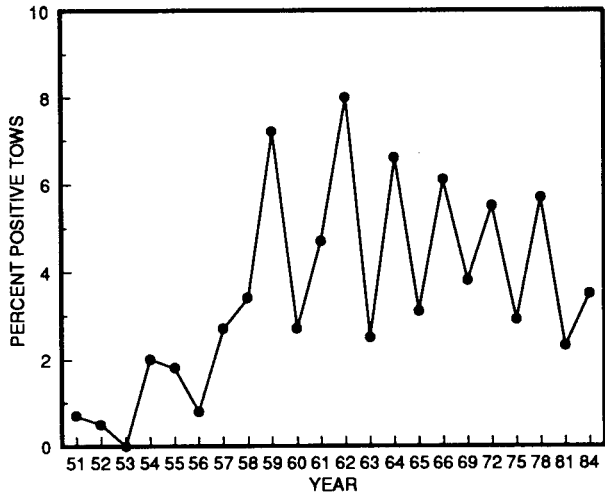
Scopelogadus bispinosus

Melamphaidae



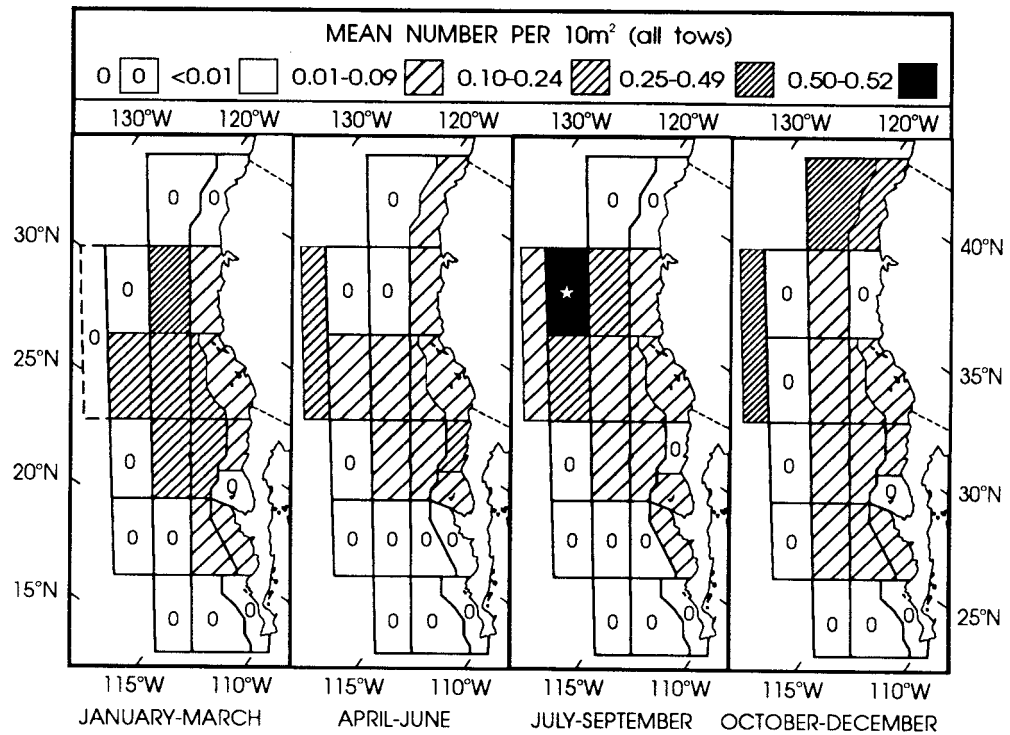
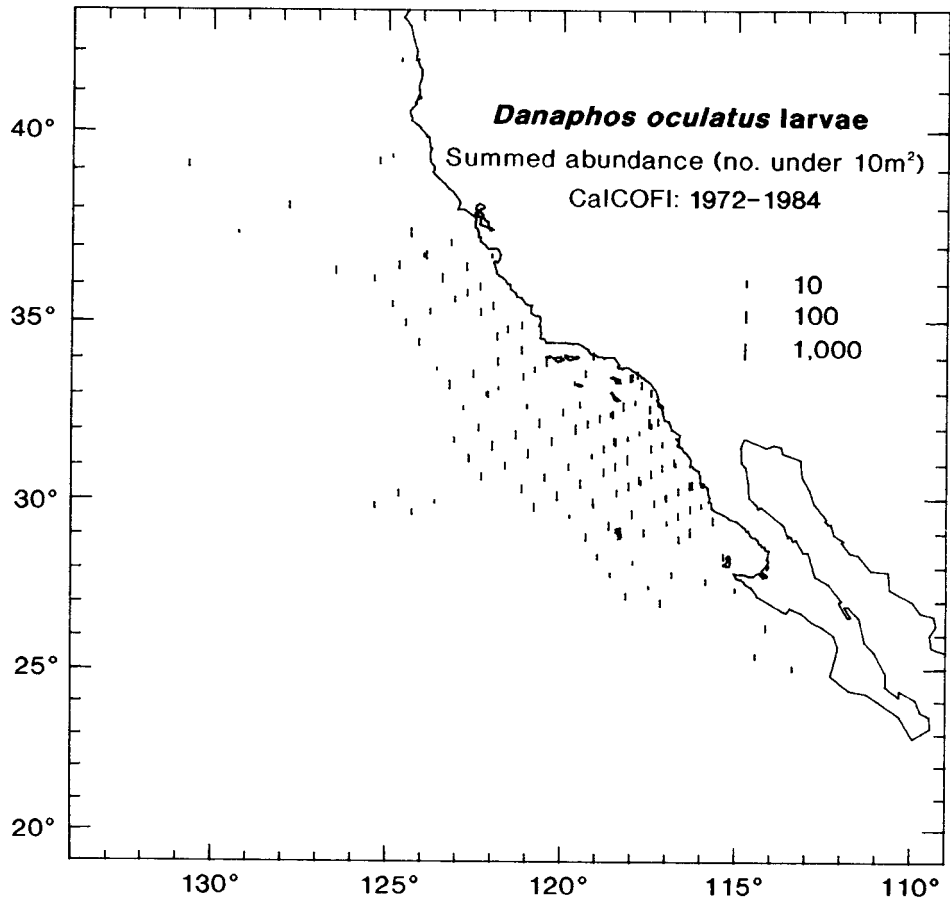
Twospine bigscale

Scopelogadus bispinosus

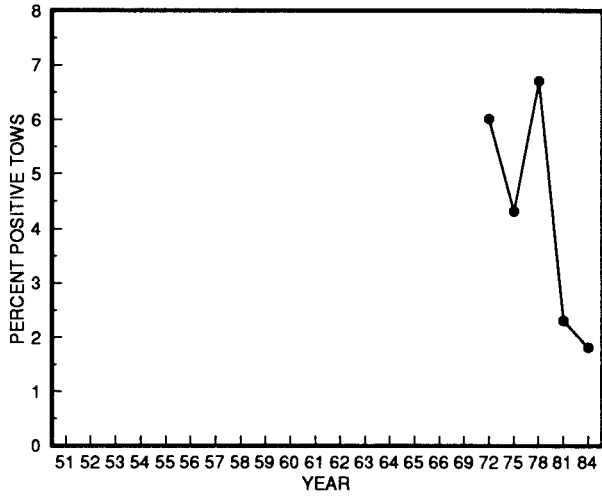


Danaphos oculatus

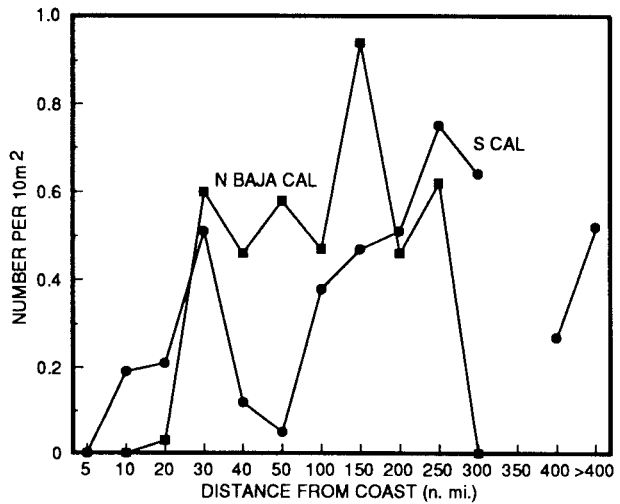
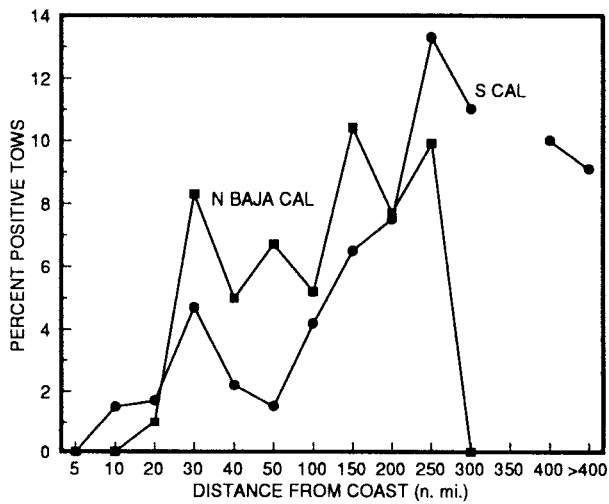
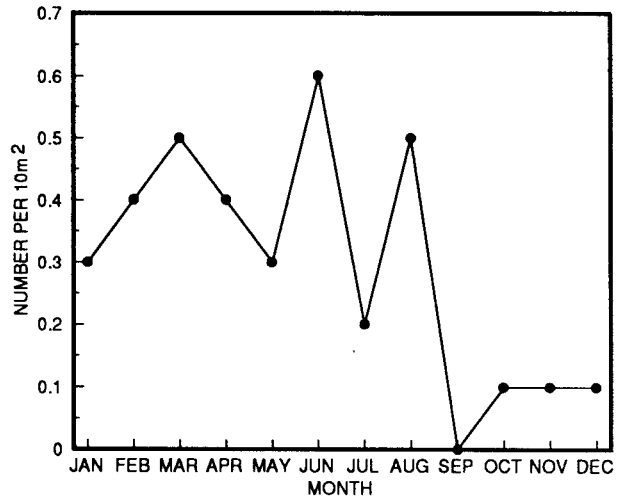
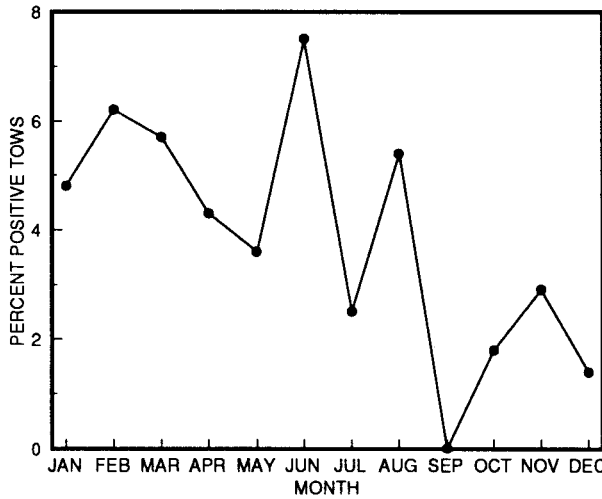
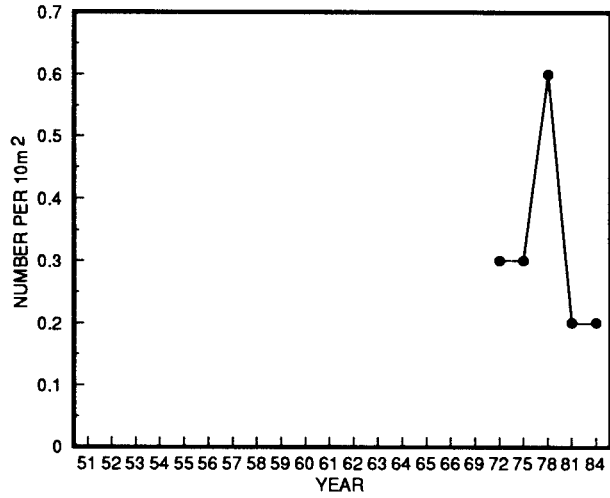
Sternoptychidae



Bottlelights

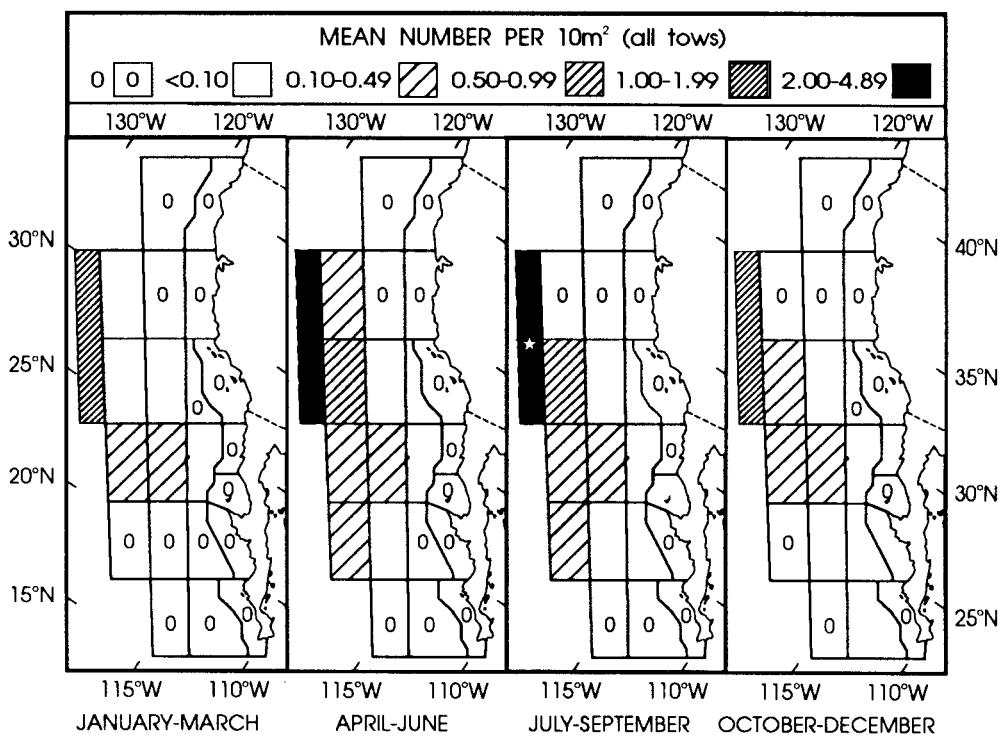
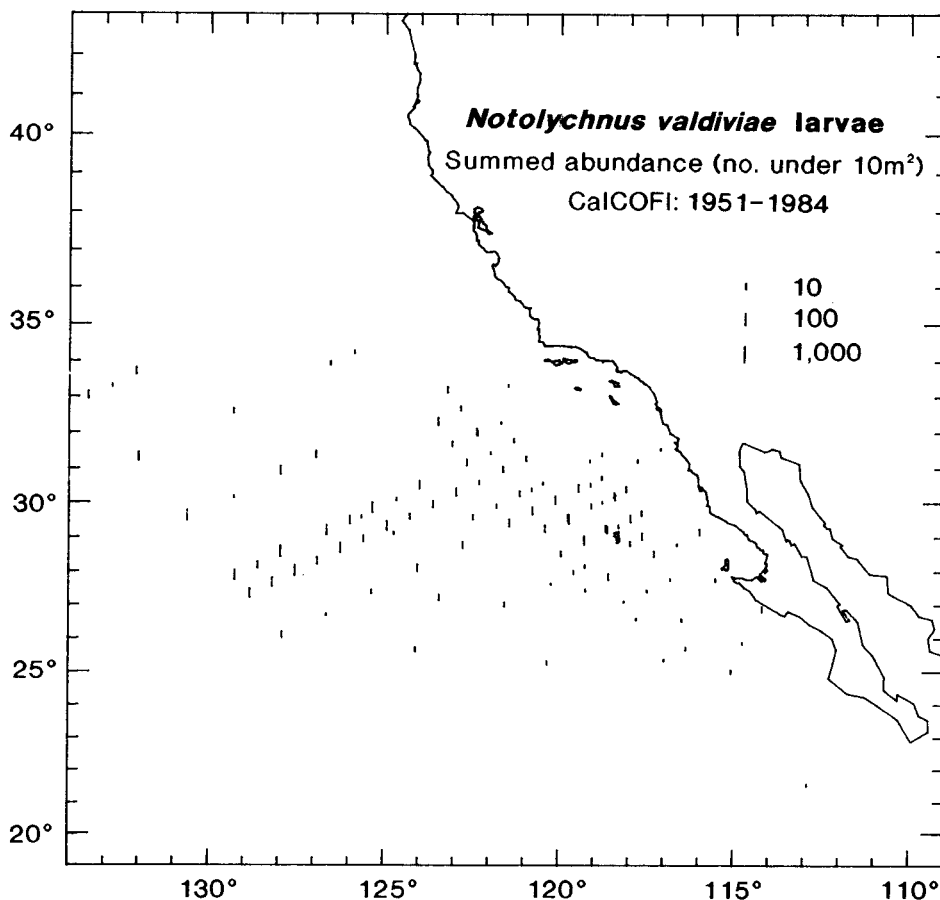


Danaphos oculatus



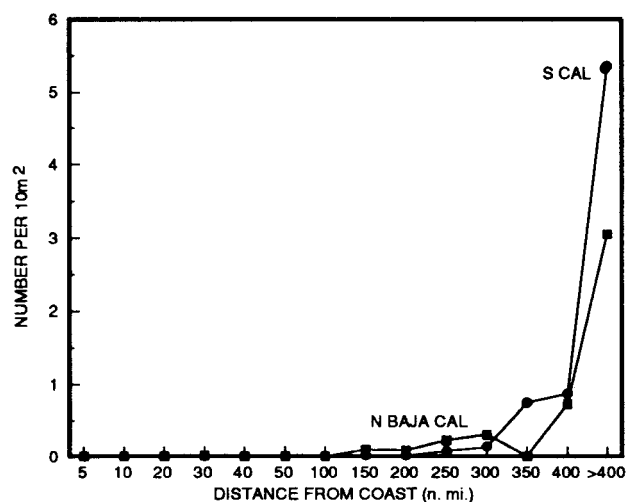
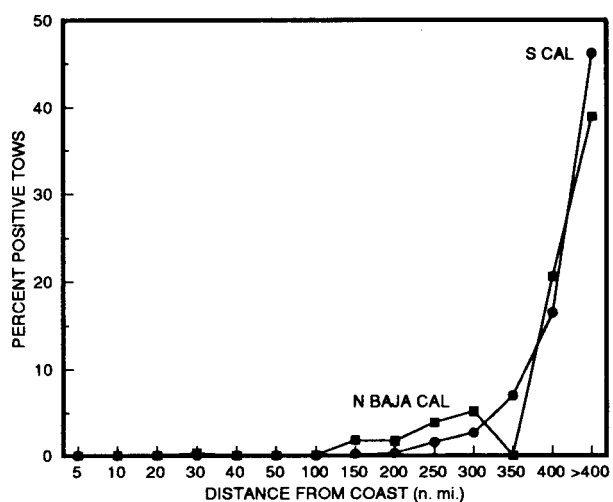
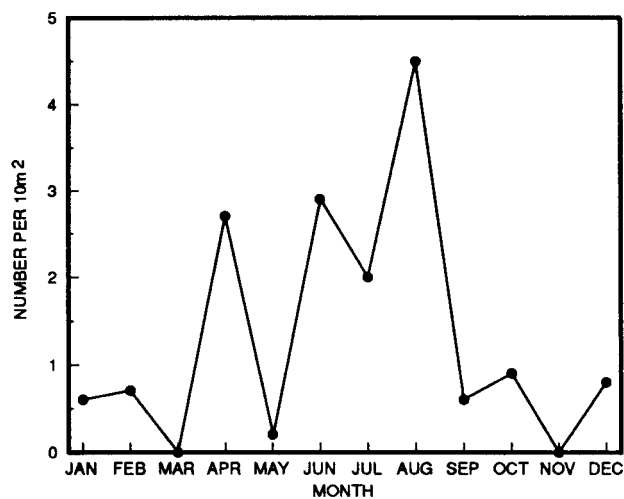
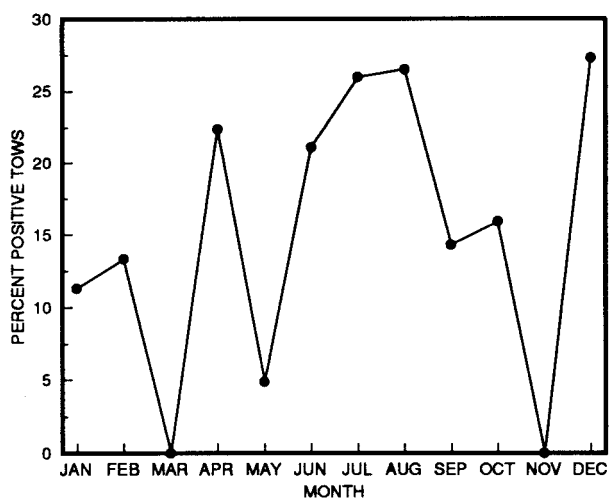
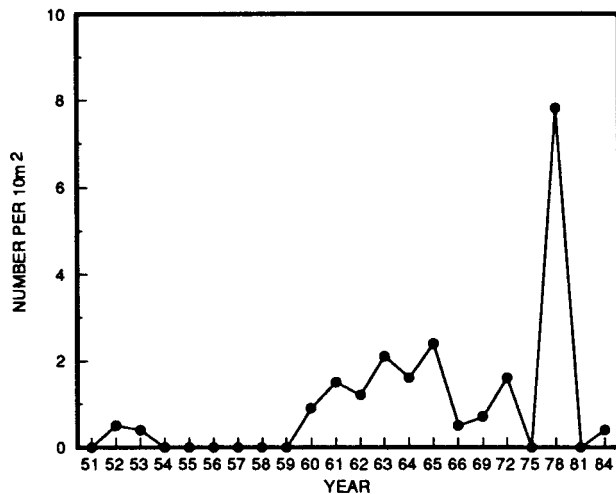
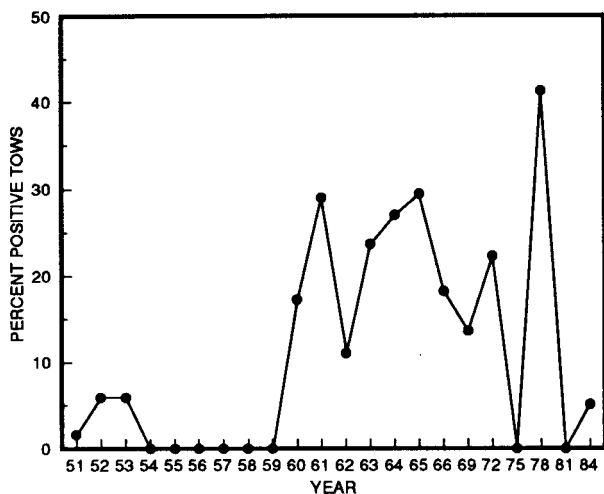
Notolychnus valdiviae

Myctophidae



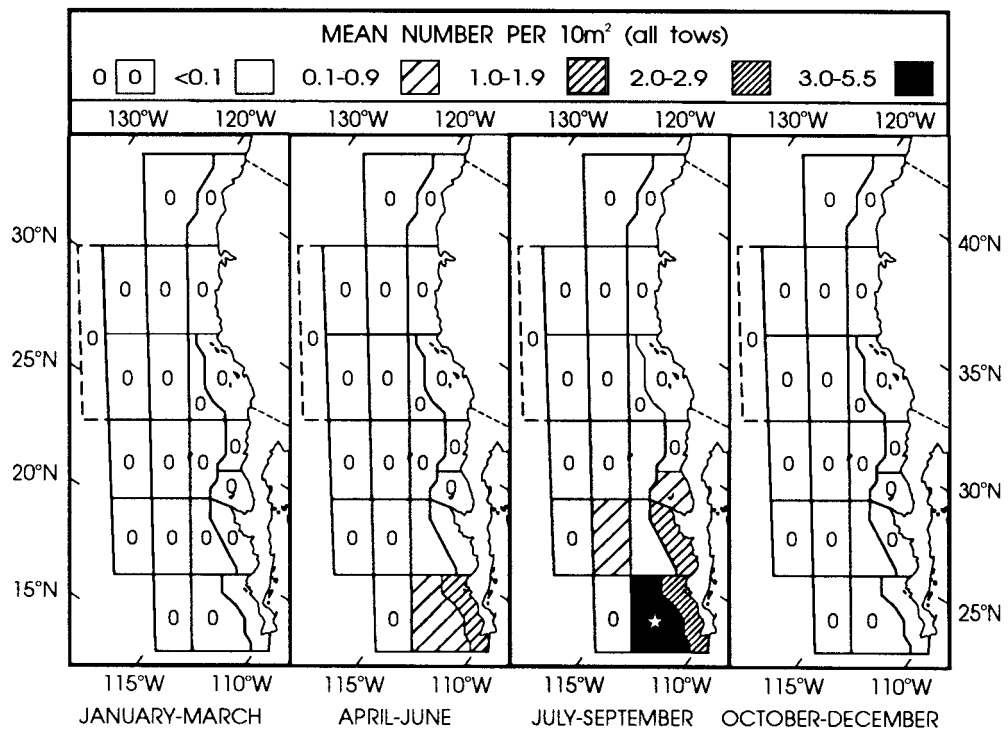
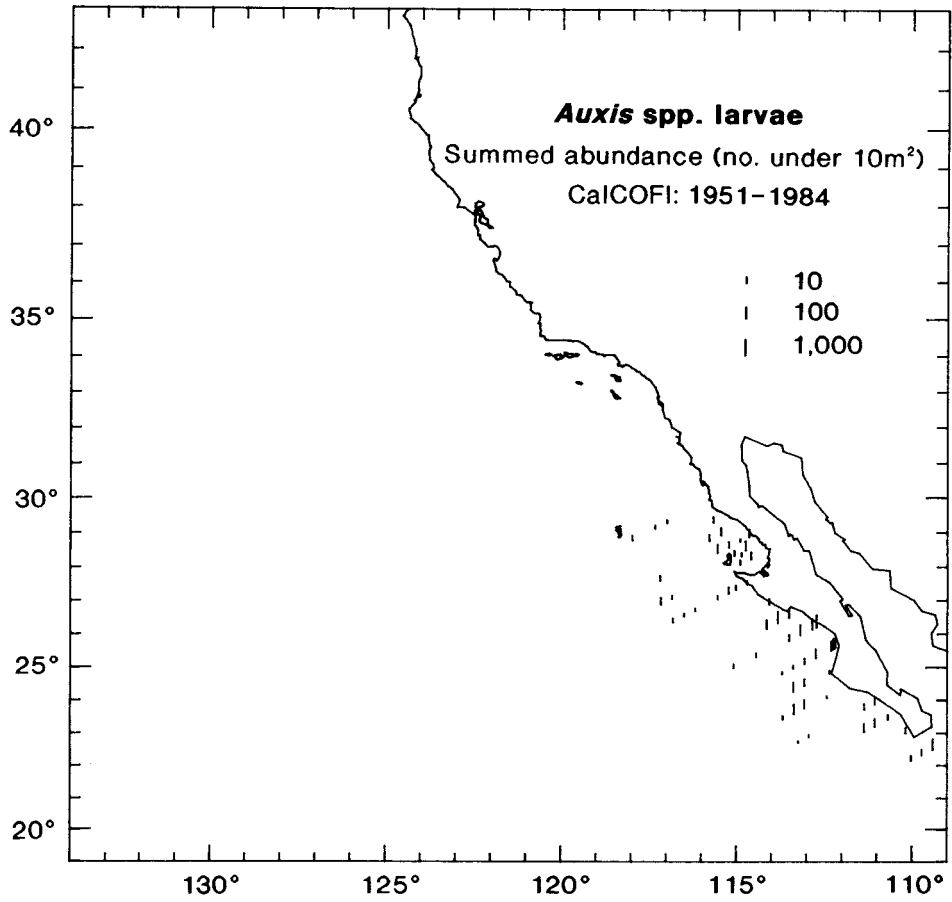
Topside lampfish

Notolychnus valdiviae



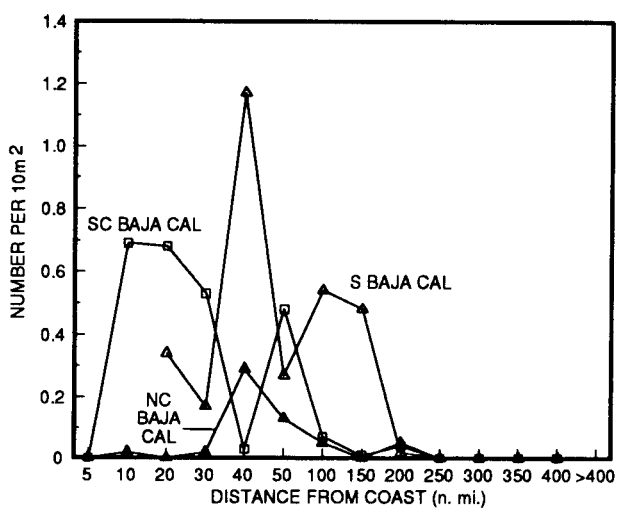
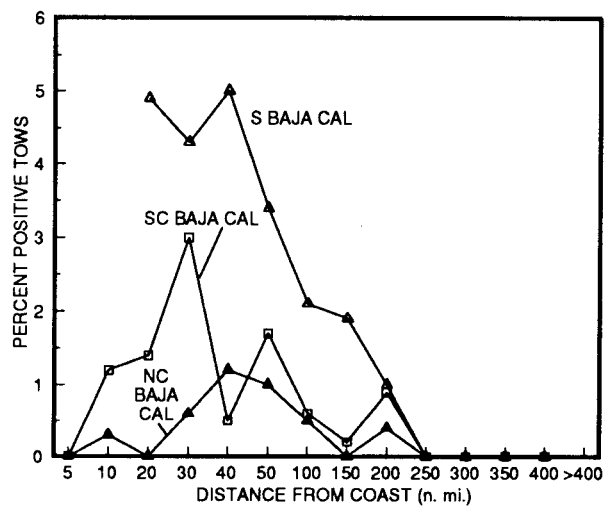
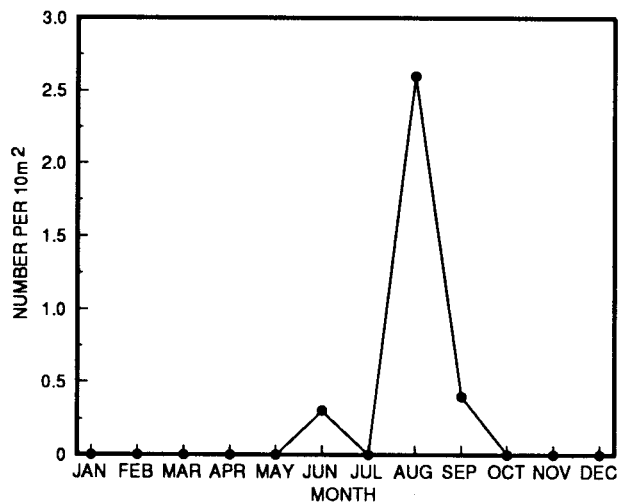
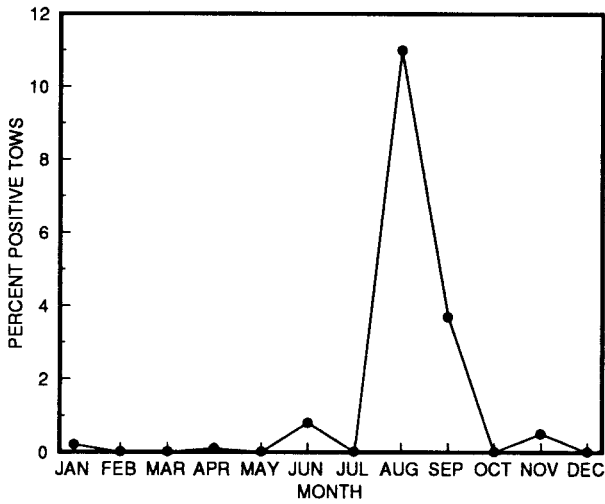
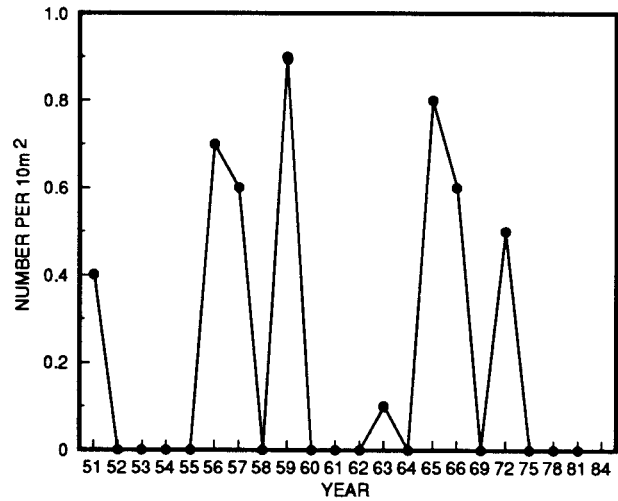
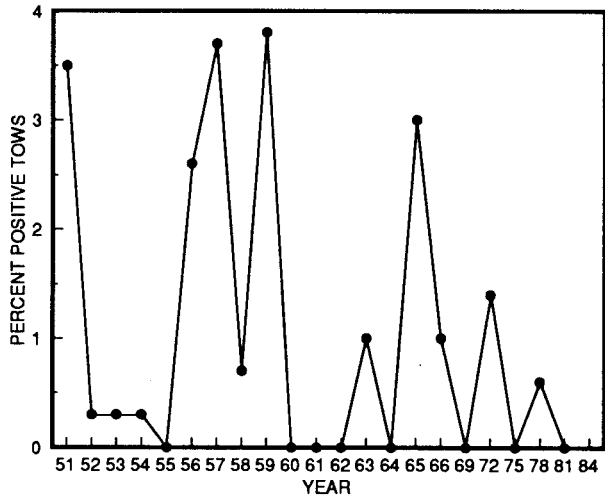
Auxis spp.

Scombridae



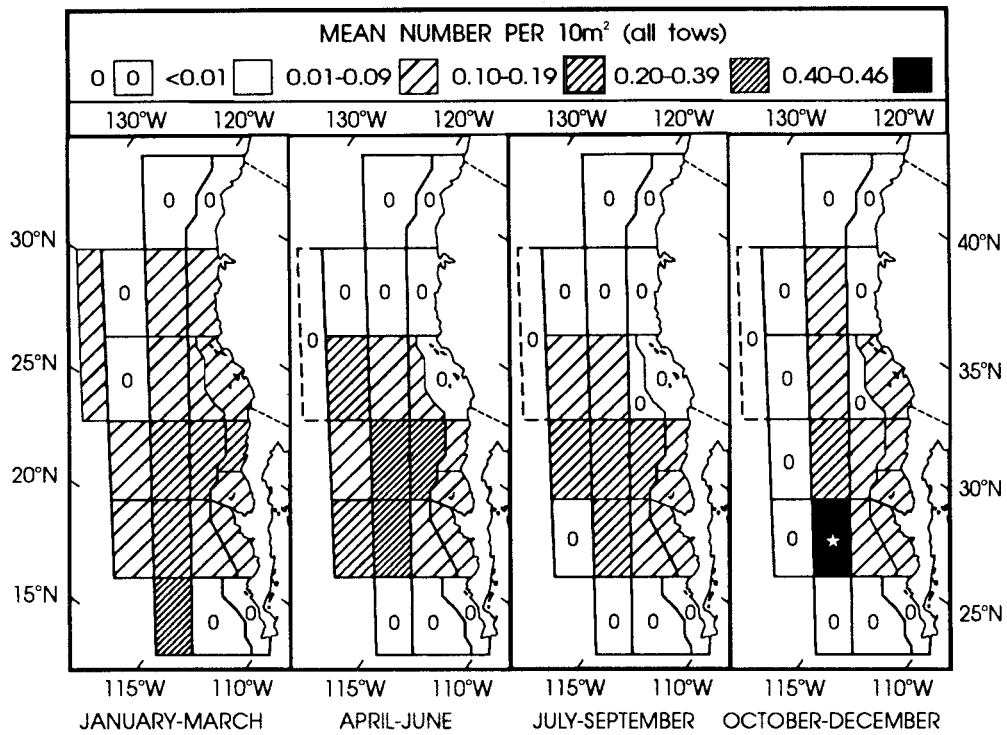
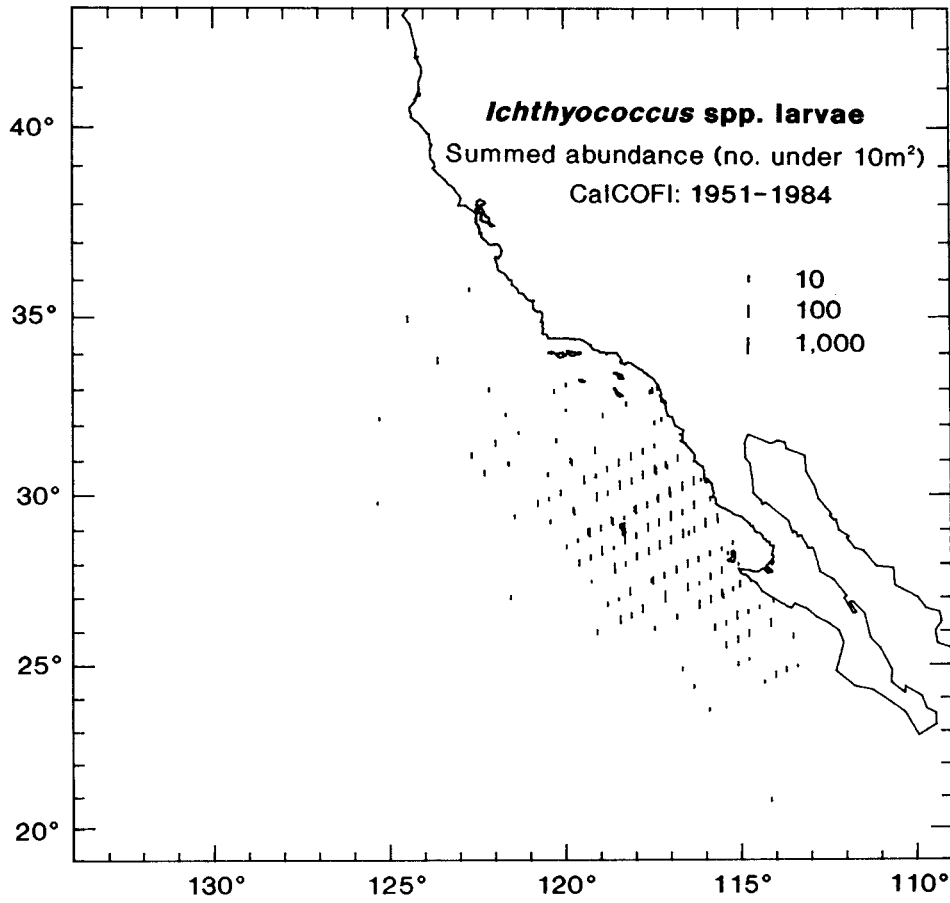
Frigate mackerels

Auxis spp.



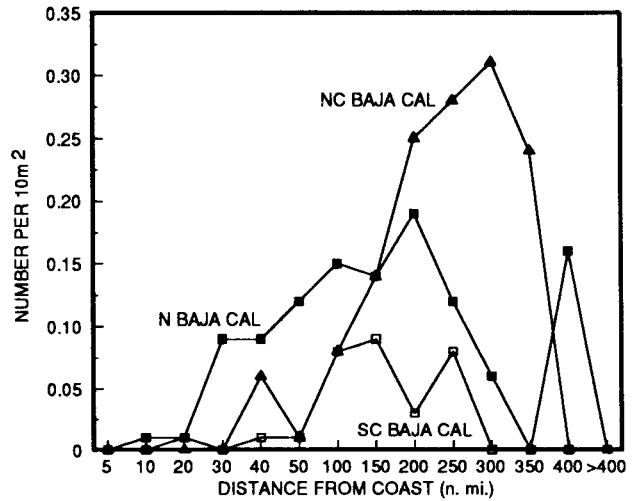
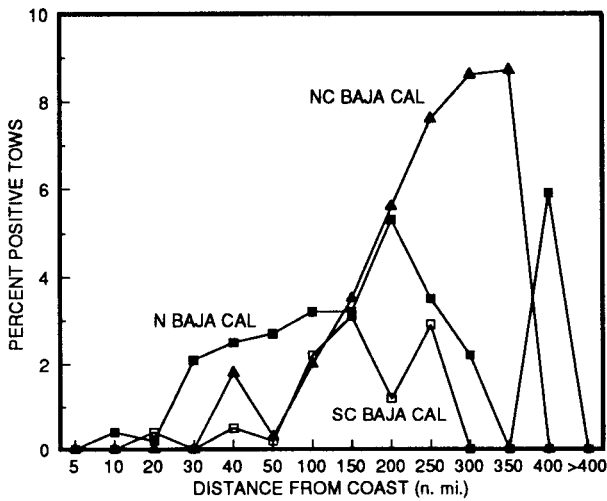
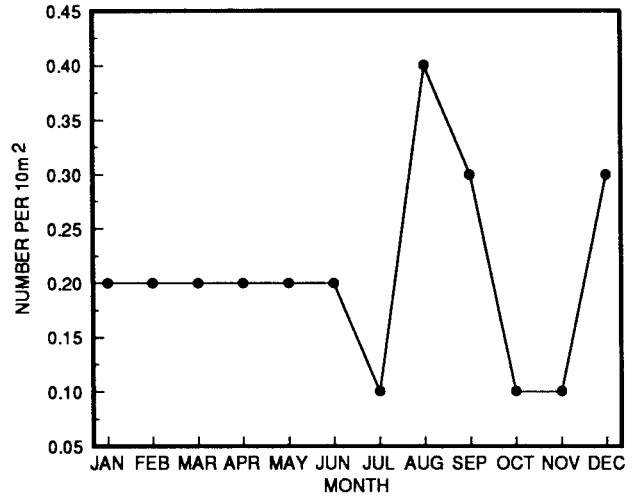
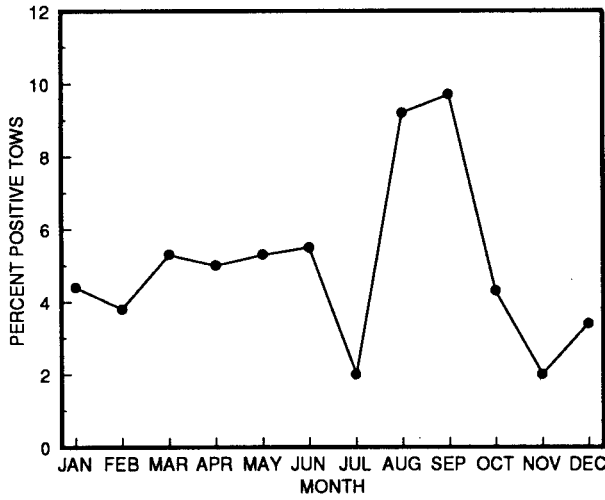
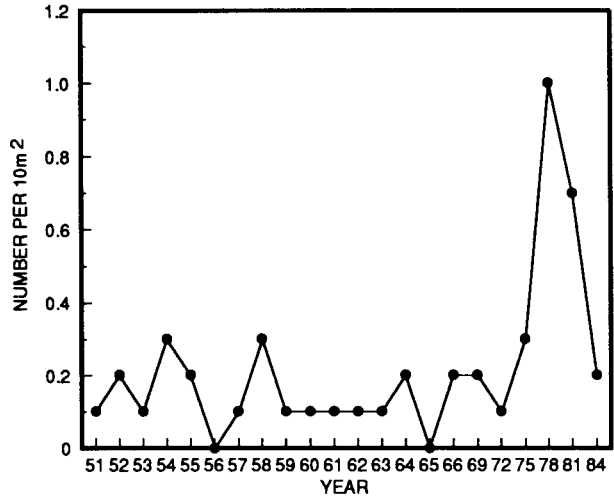
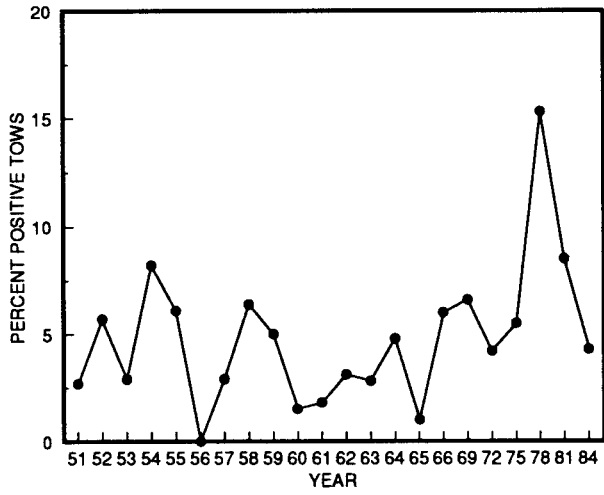
Ichthyococcus spp.

Phosichthyidae



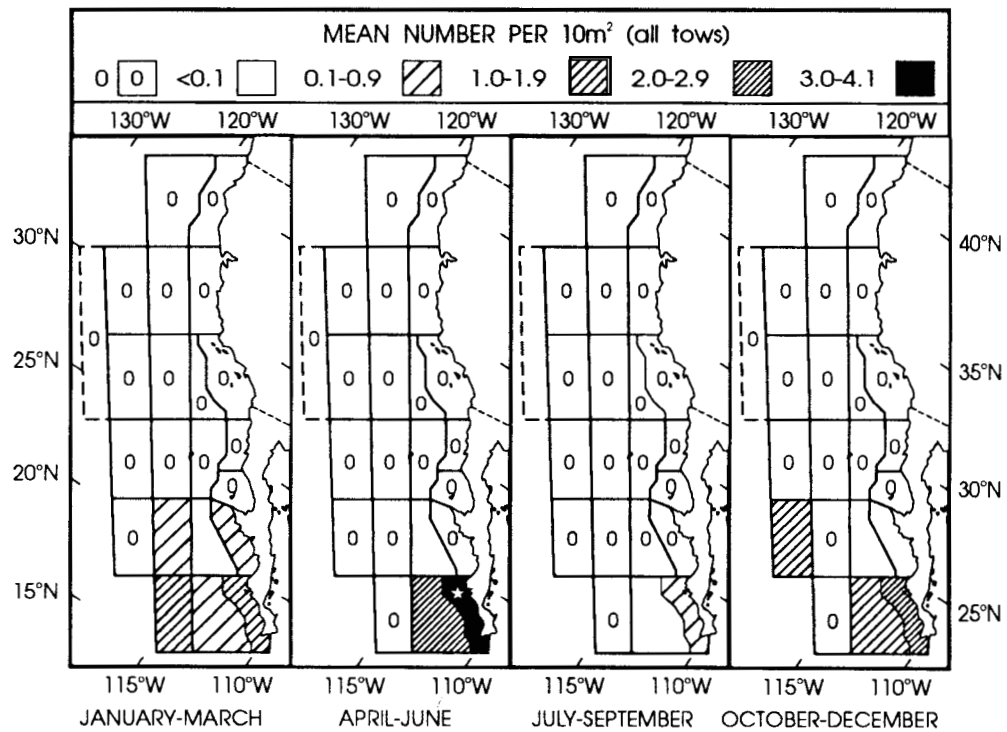
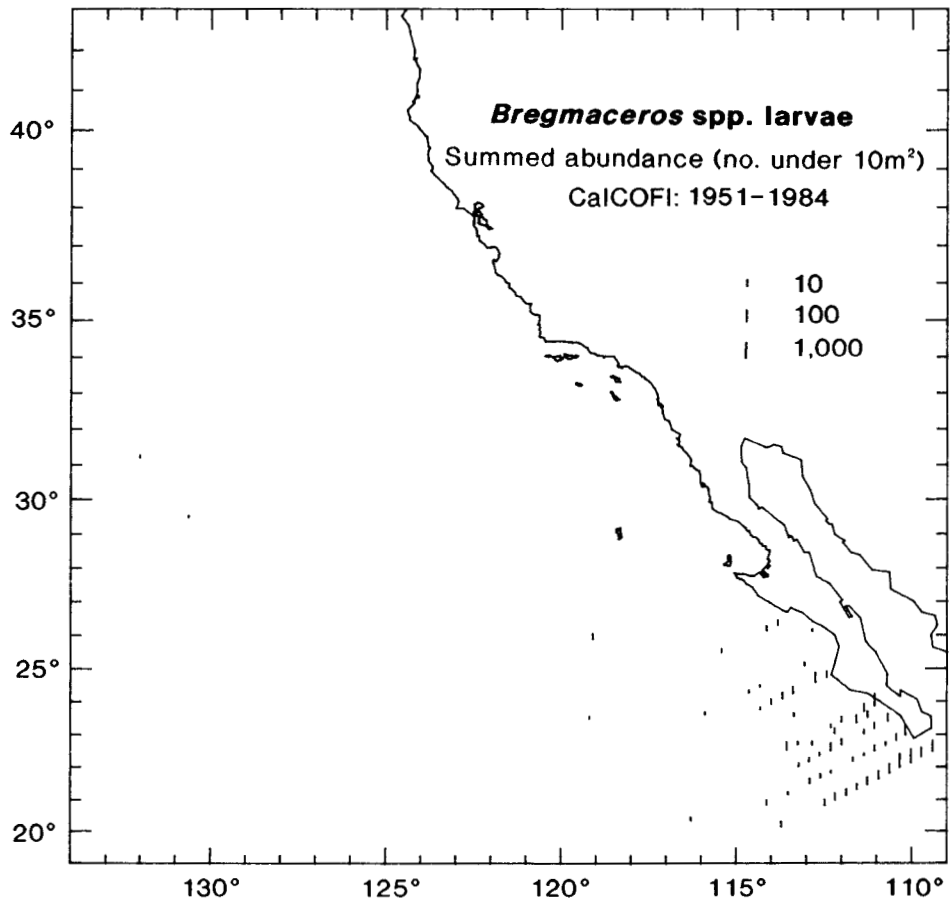
Bulldog lightfishes

***Ichthyococcus* spp.**



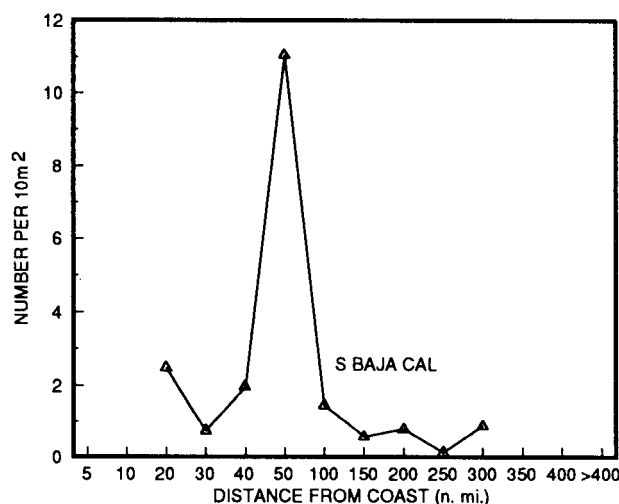
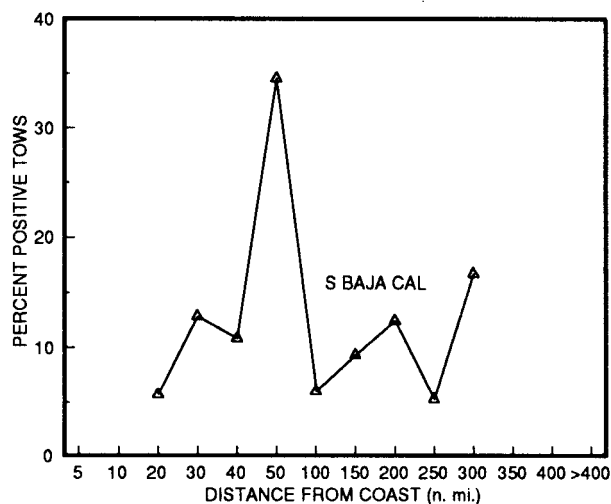
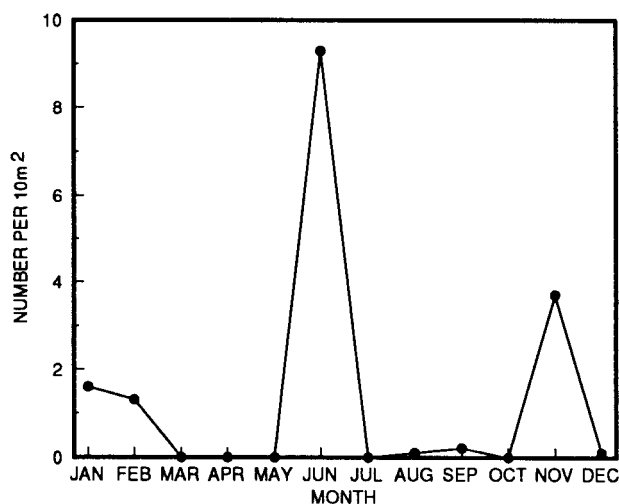
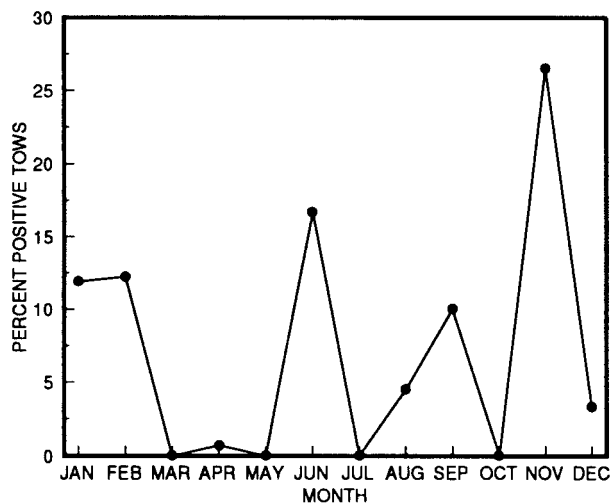
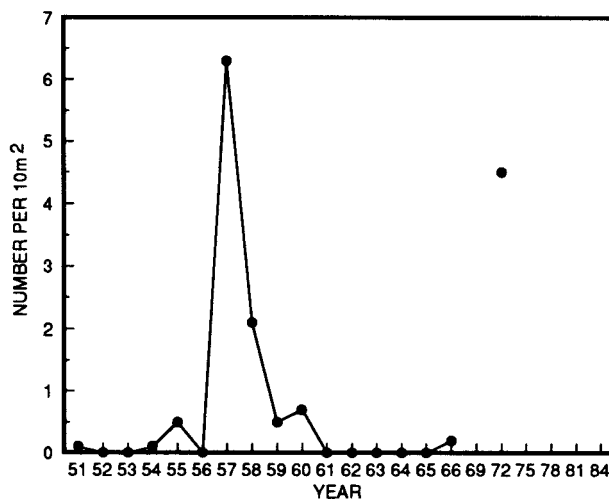
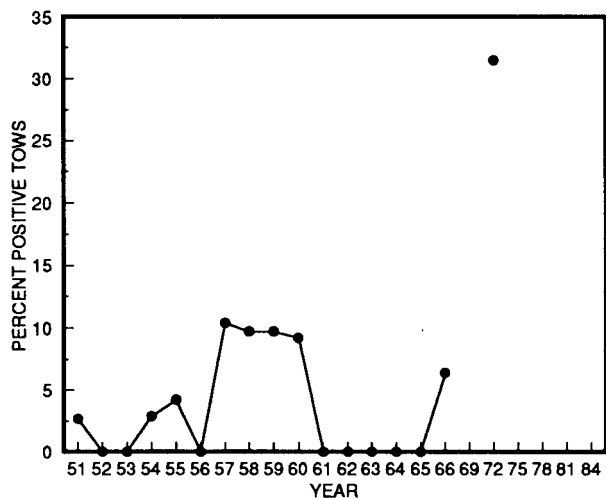
Bregmaceros spp.

Bregmacerotidae



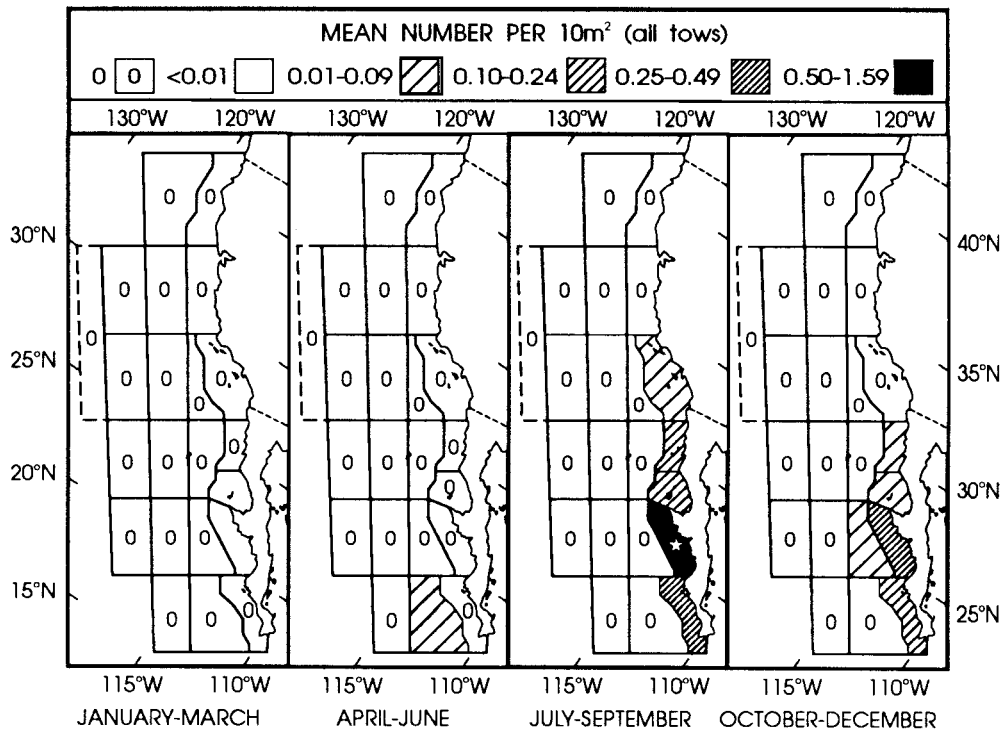
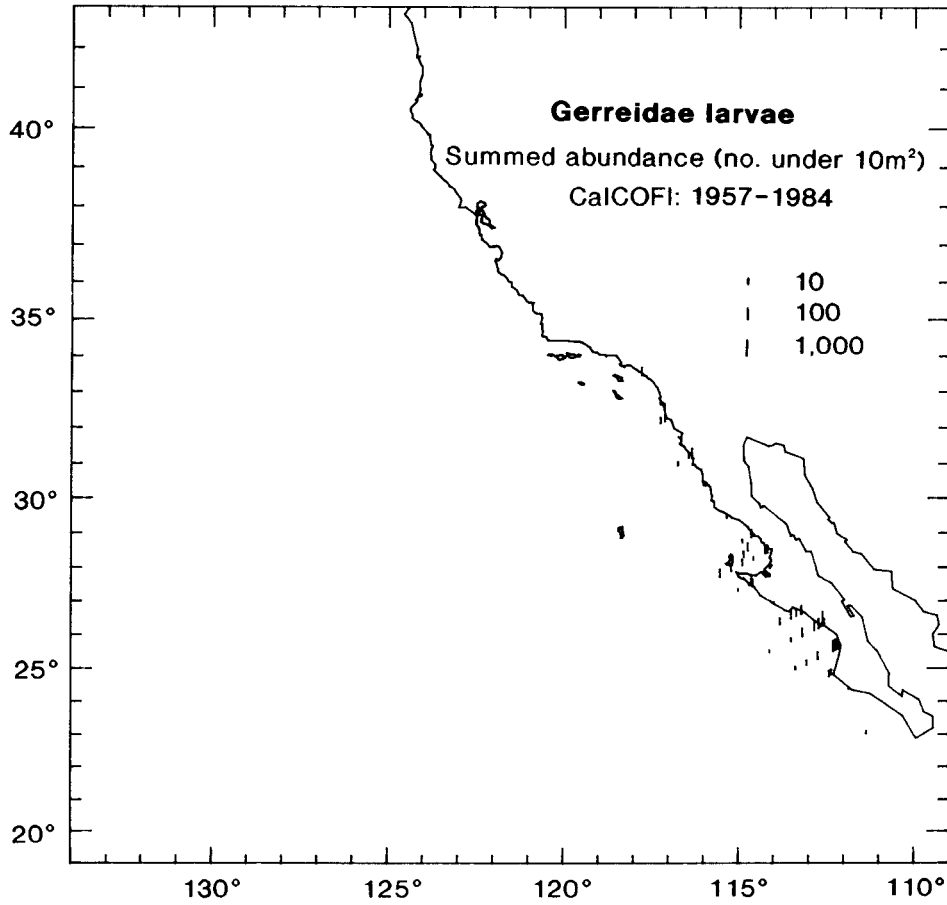
Codlets

Bregmaceros spp.

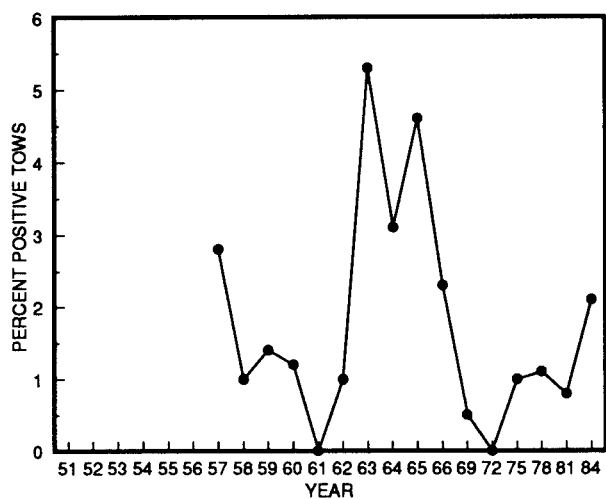


Gerreidae

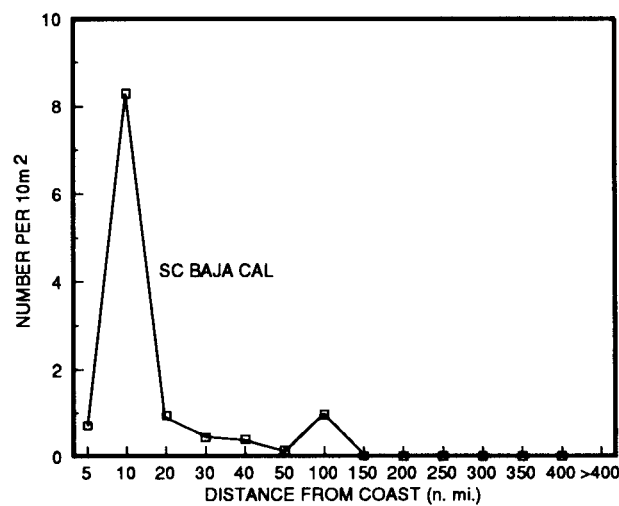
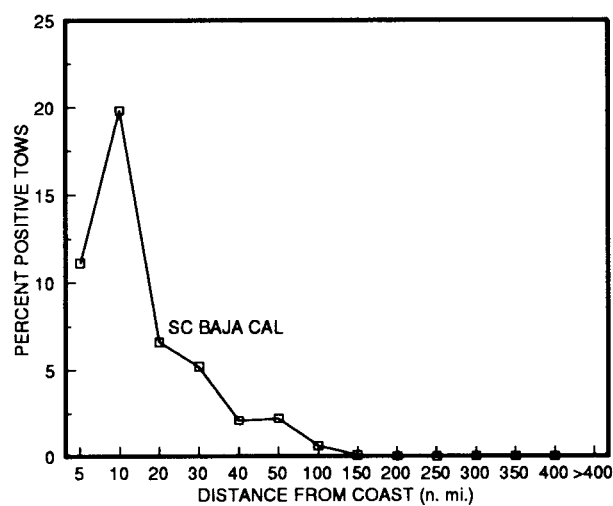
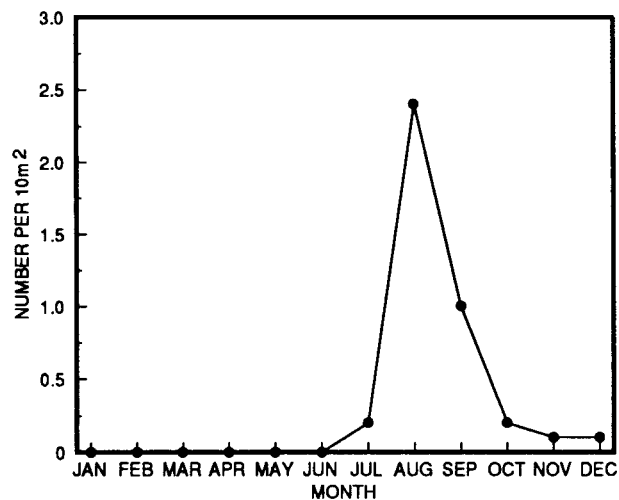
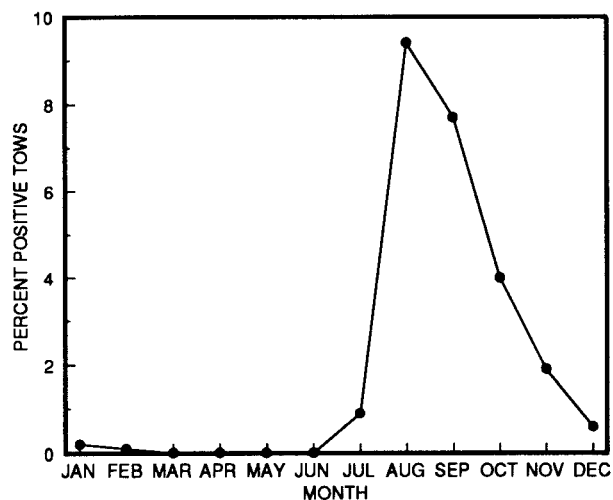
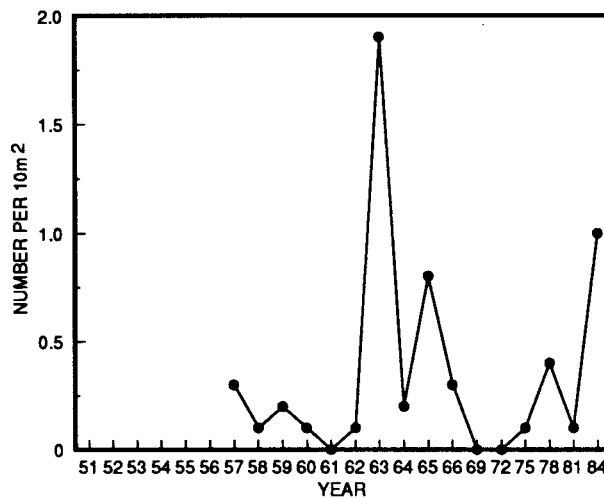
Gerreidae



Mojarras

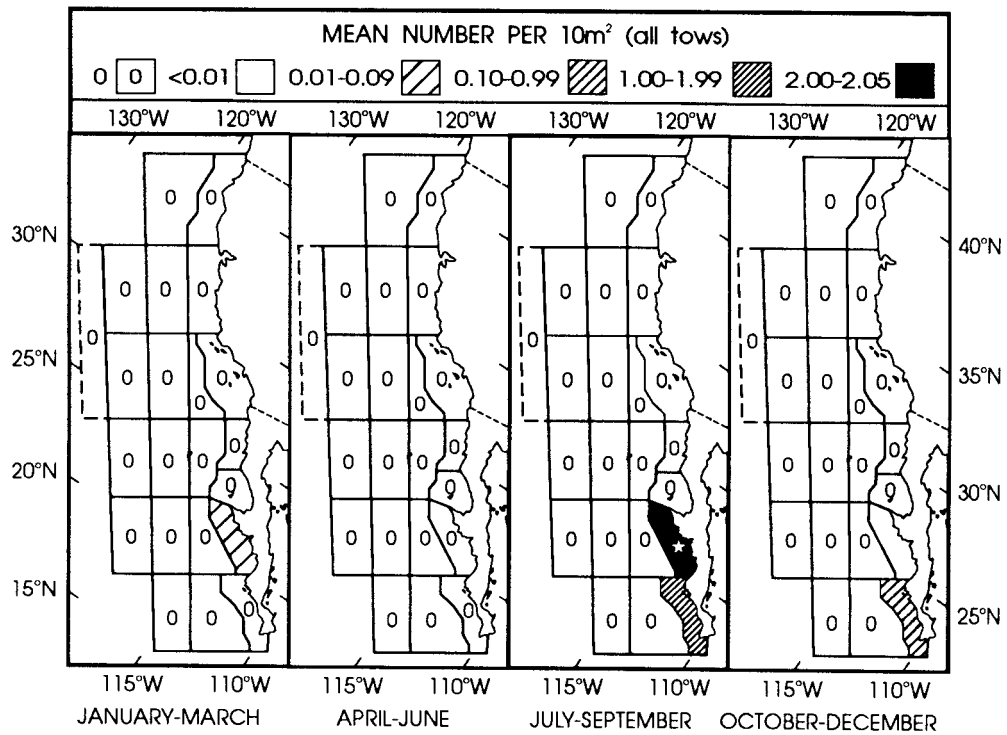
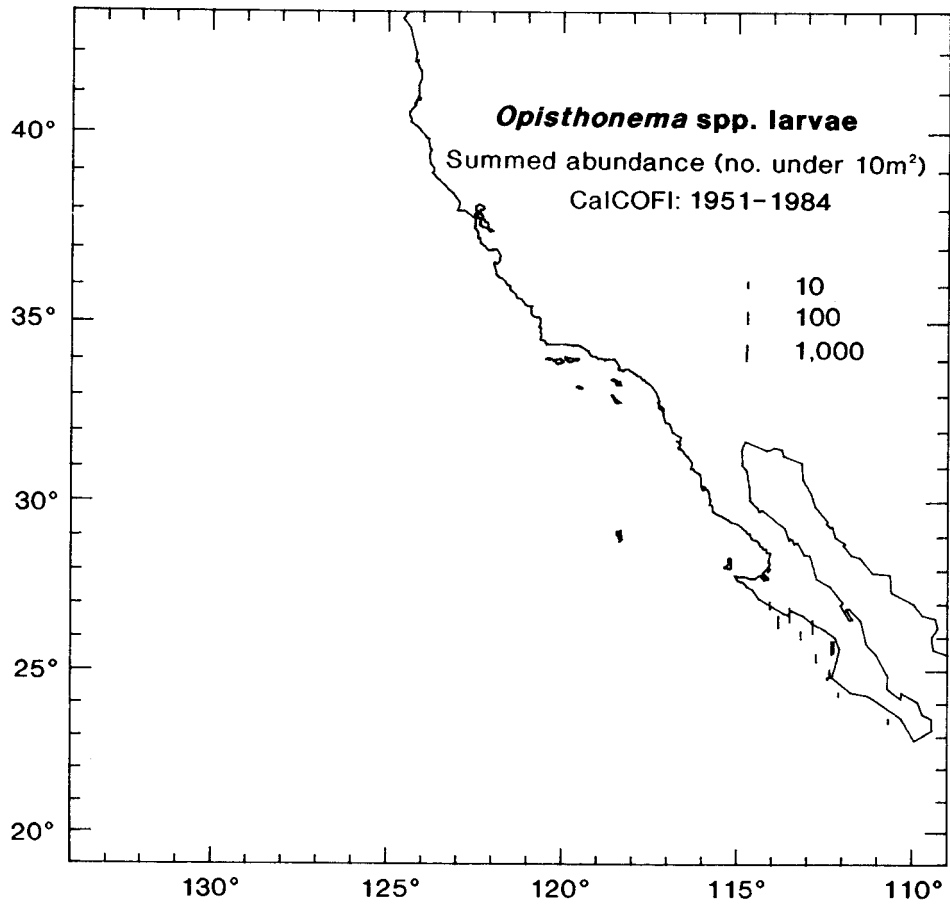


Gerreidae



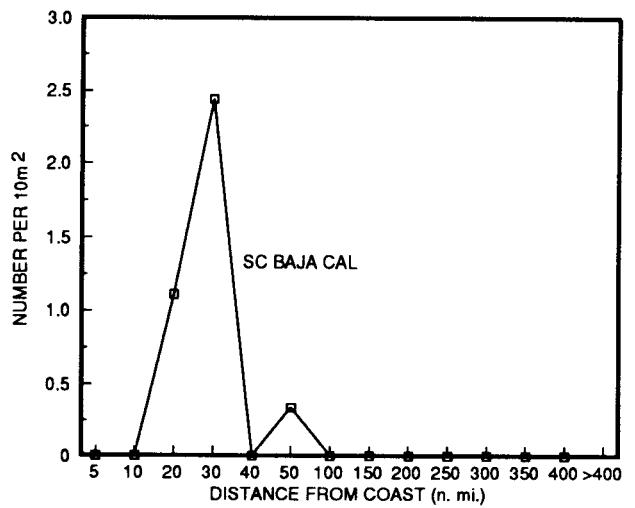
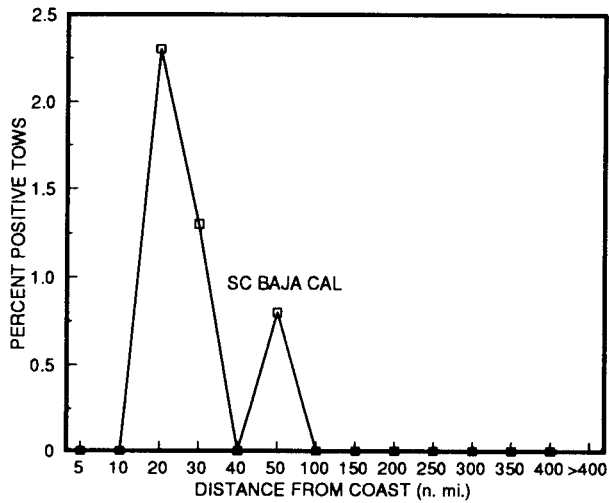
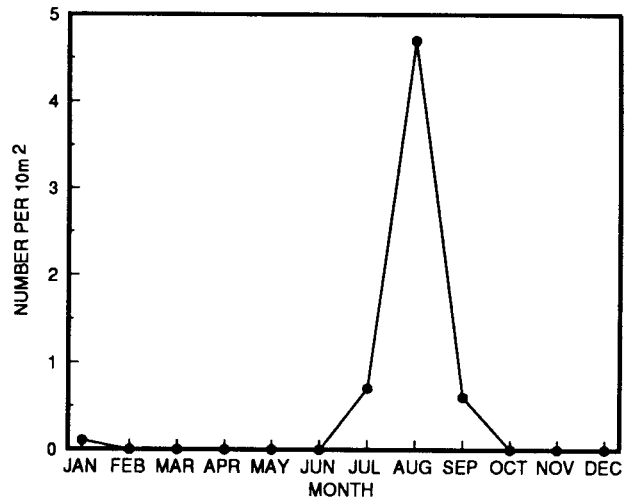
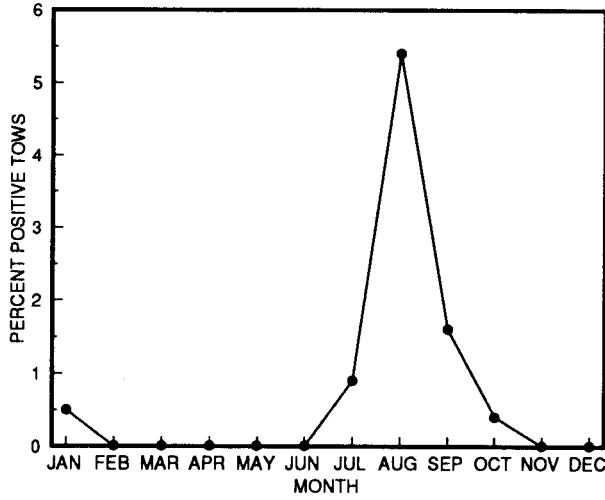
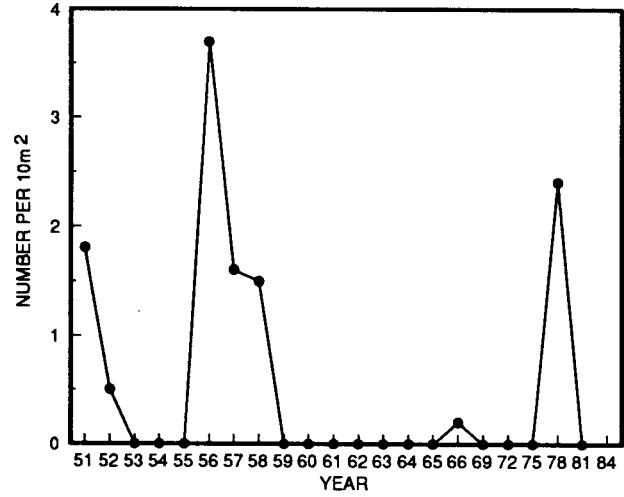
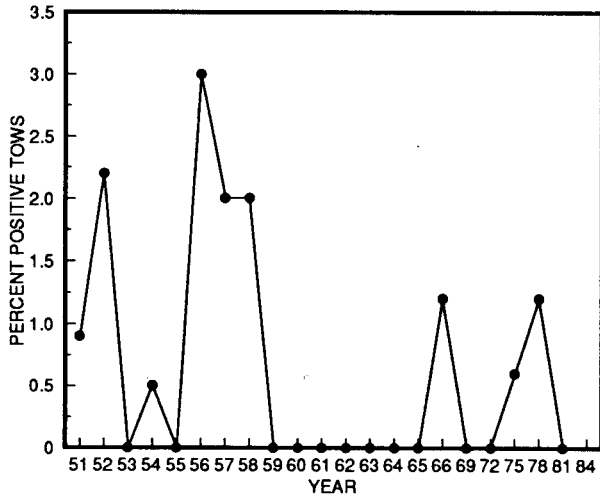
Opisthonema spp.

Clupeidae



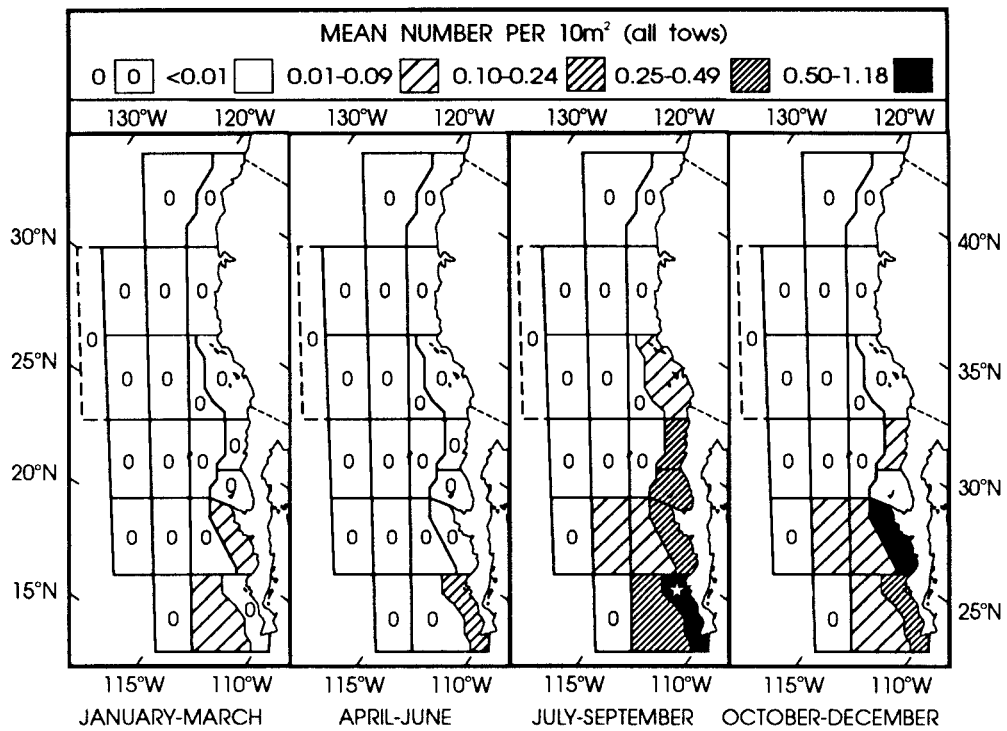
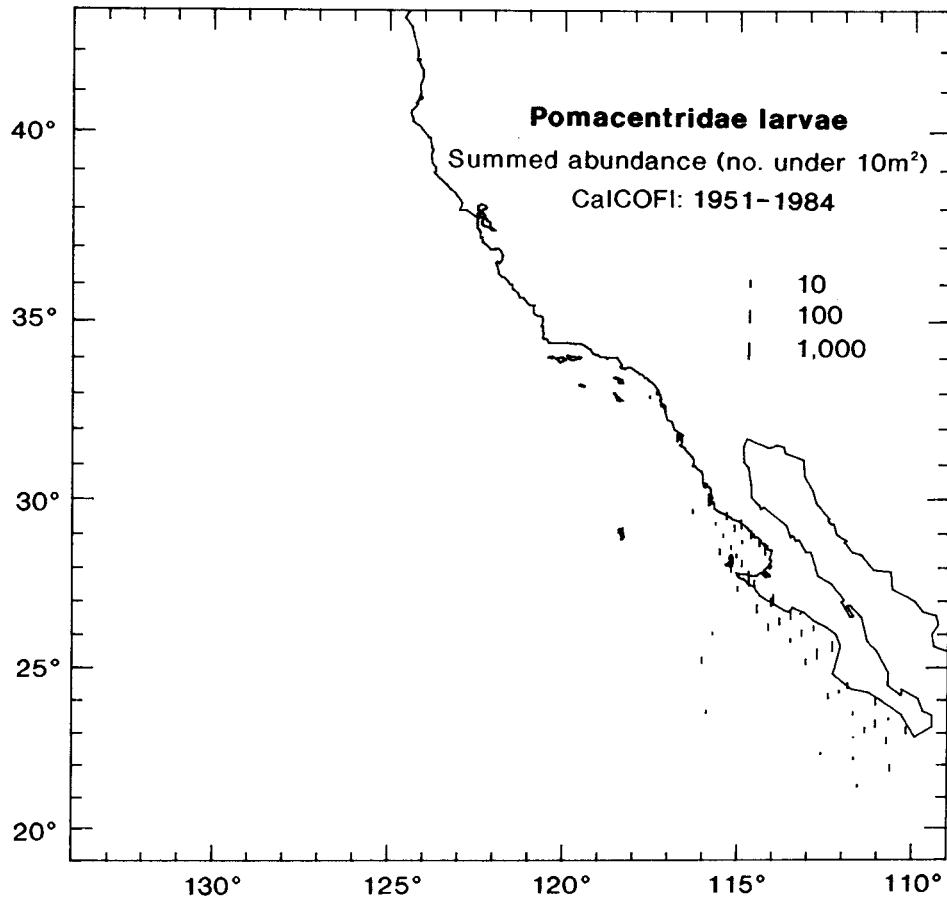
Thread herrings

Opisthonema spp.

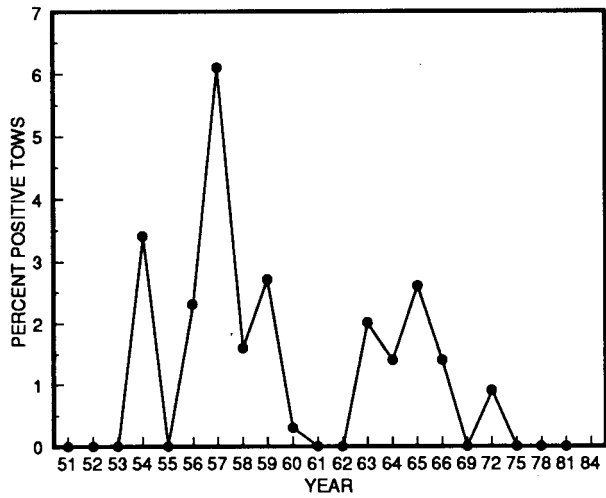


Pomacentridae

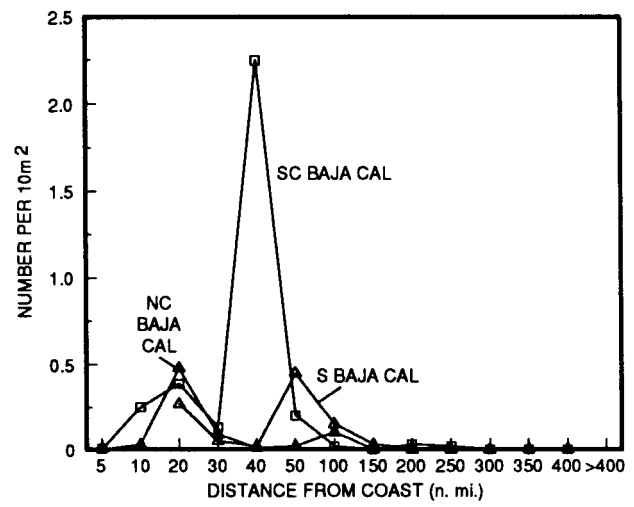
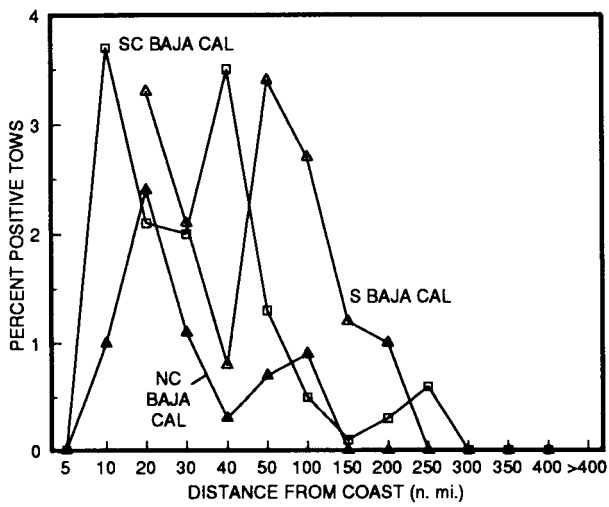
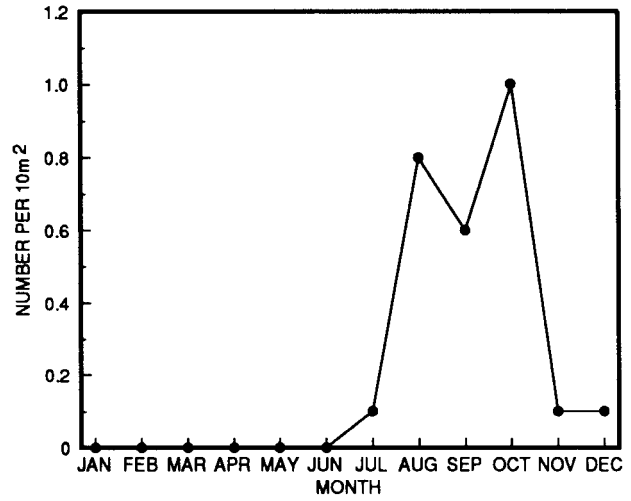
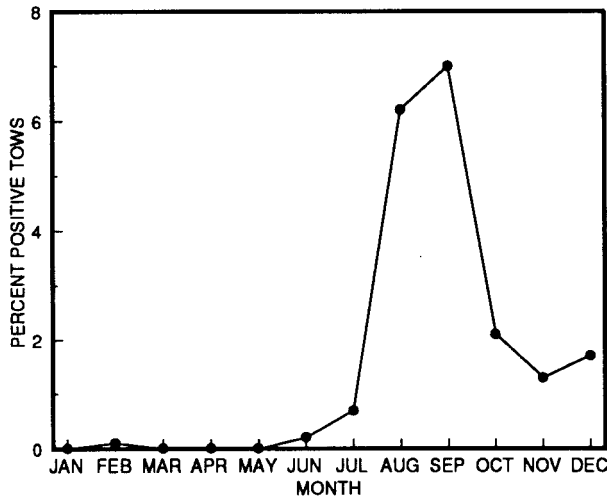
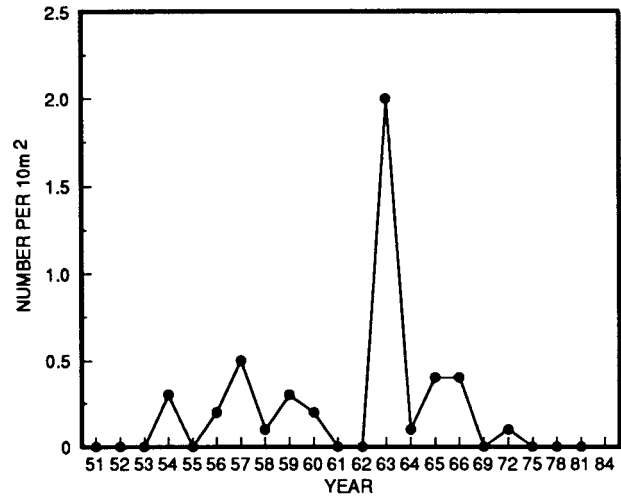
Pomacentridae



Damselfishes

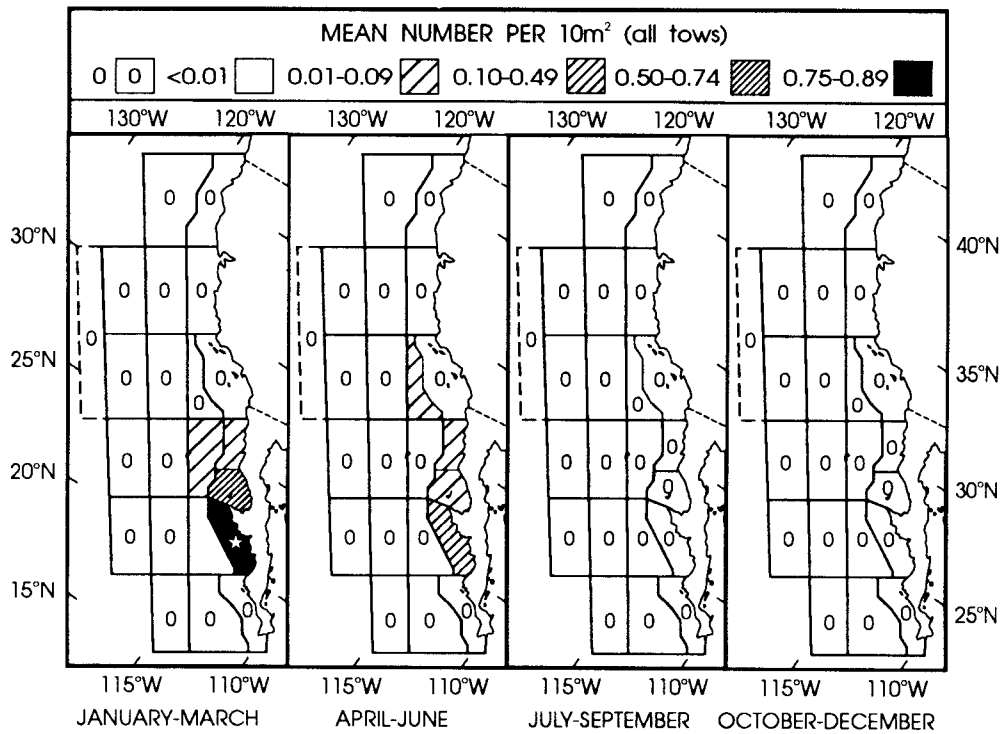
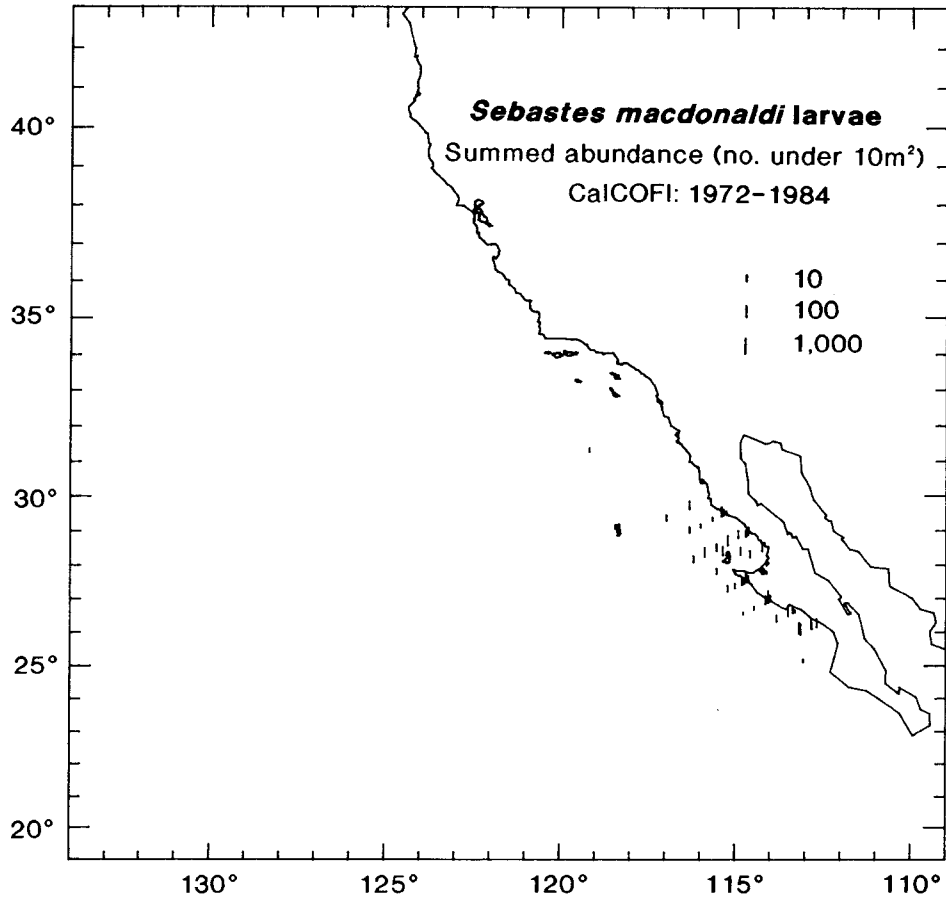


Pomacentridae



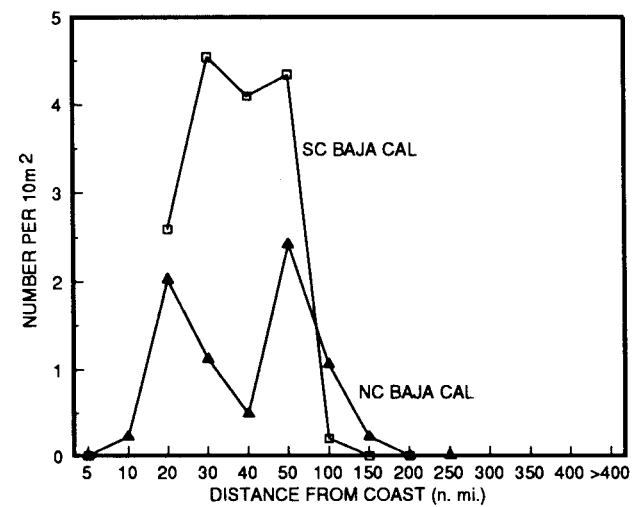
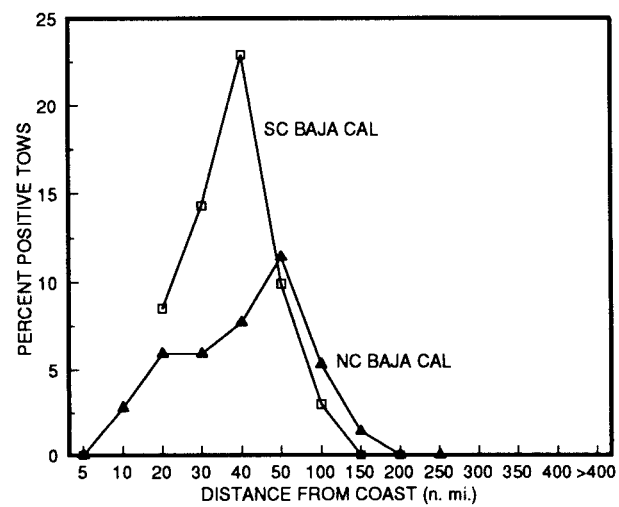
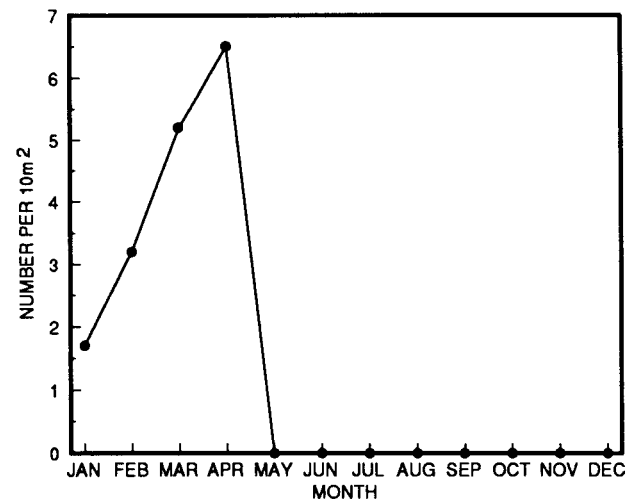
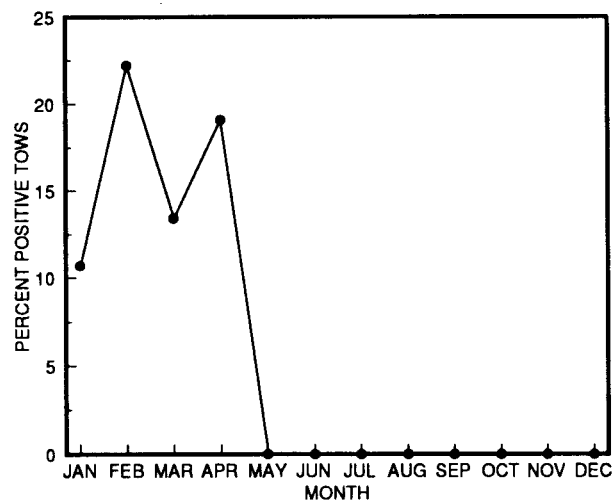
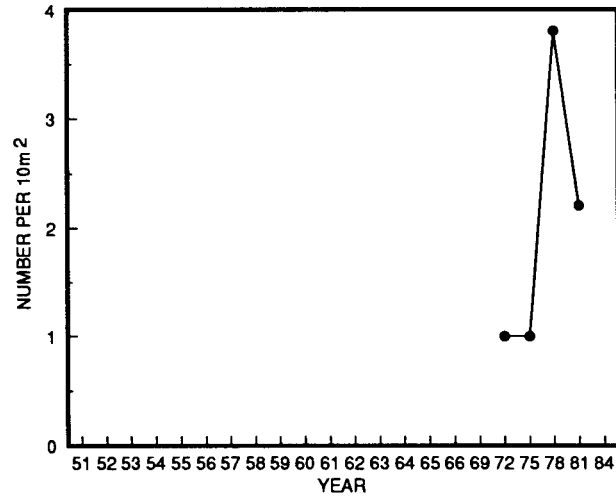
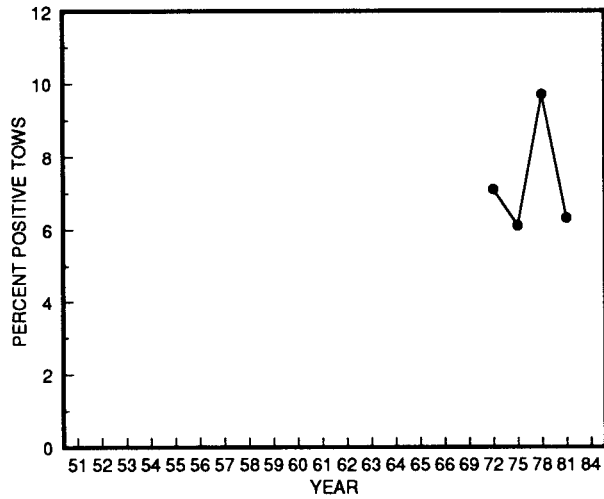
Sebastes macdonaldi

Scorpaenidae



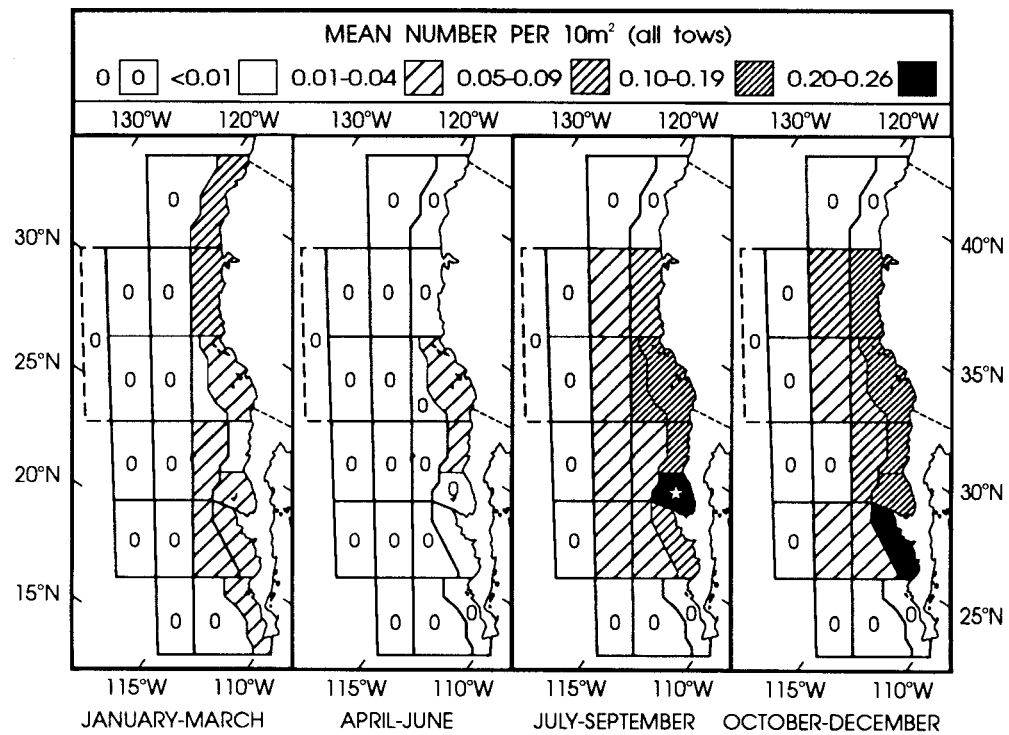
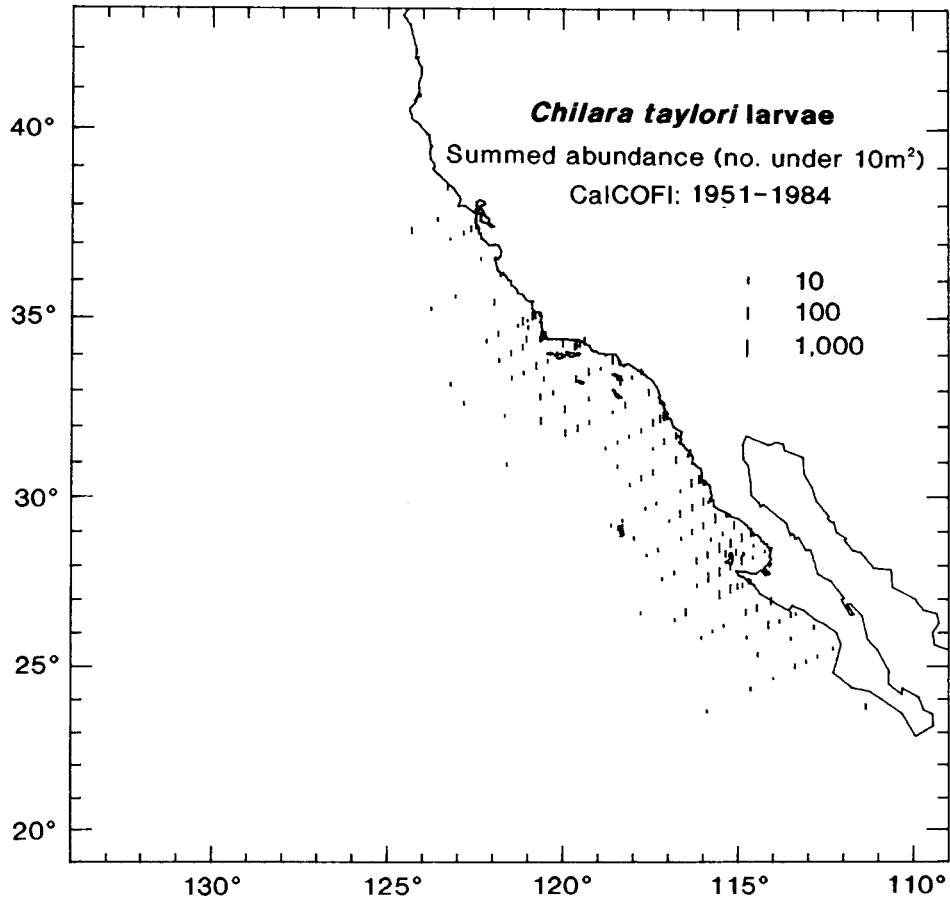
Mexican rockfish

Sebastes macdonaldi

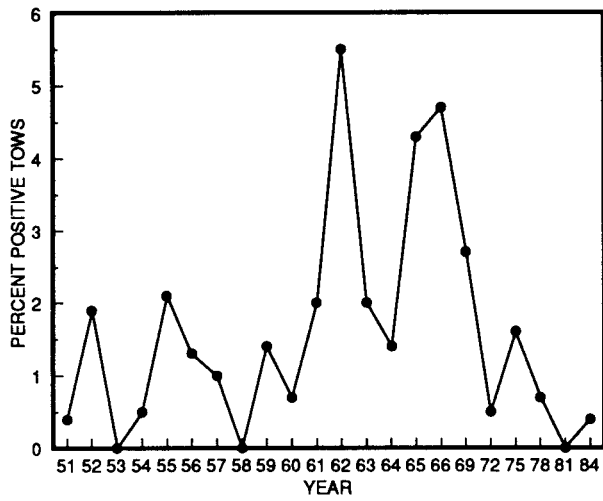


Chilara taylori

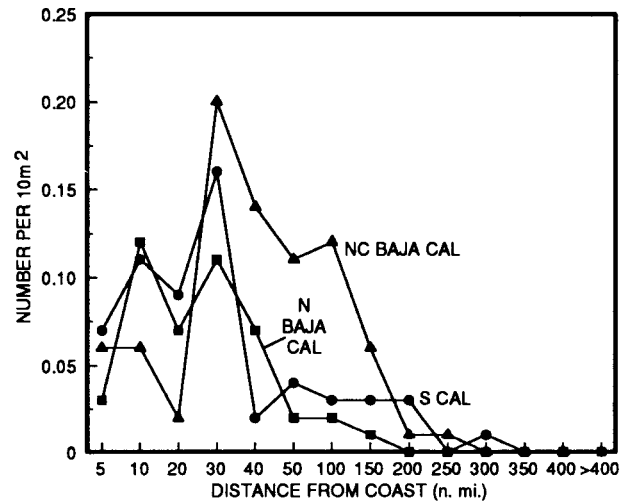
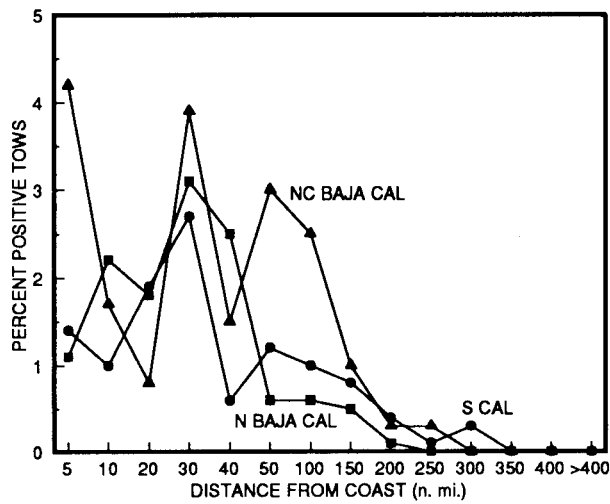
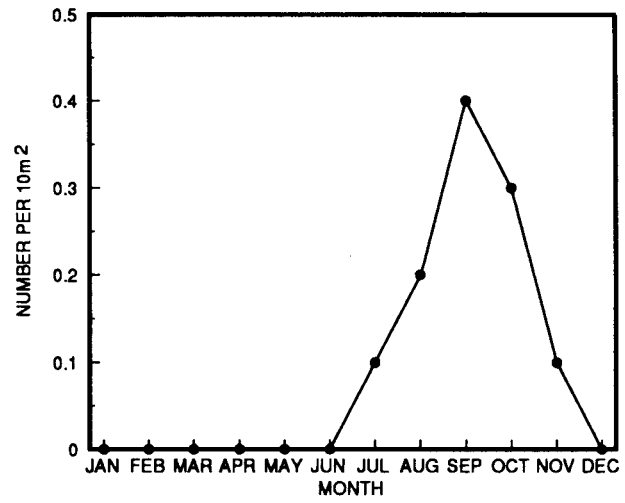
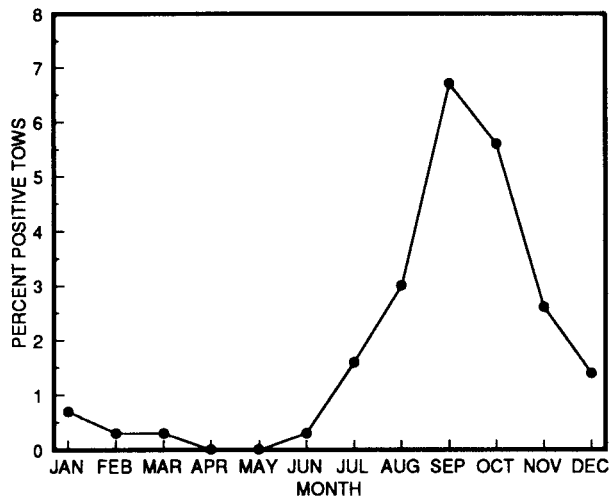
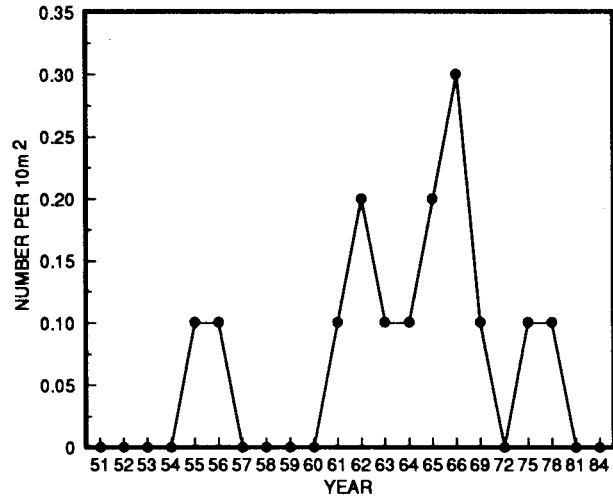
Ophidiidae



Spotted cusk-eel

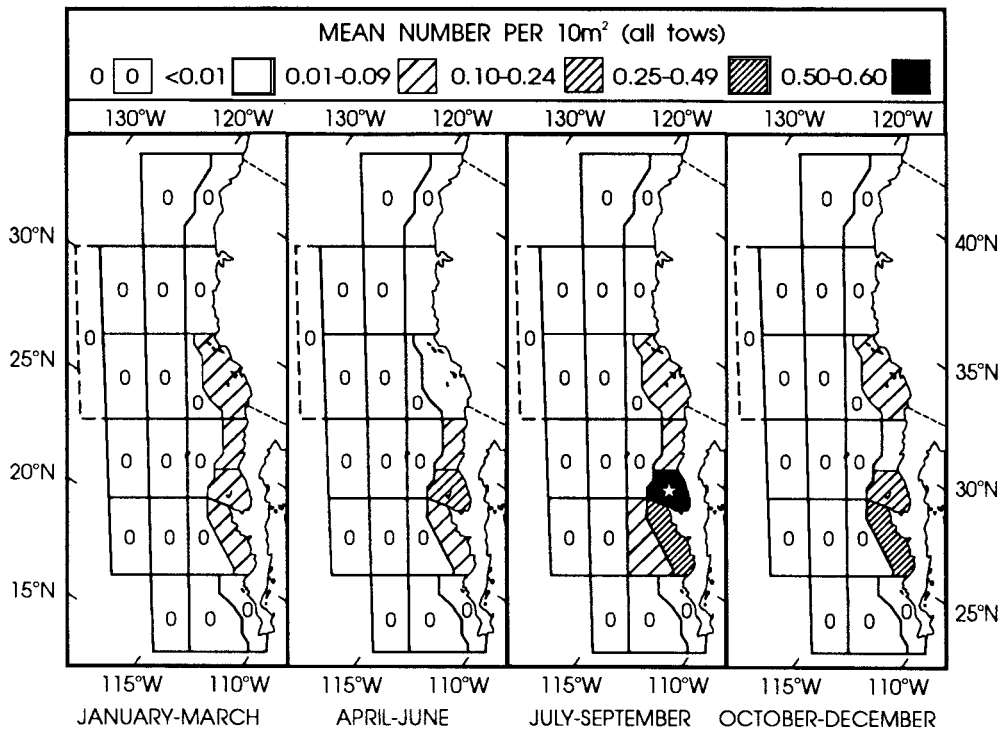
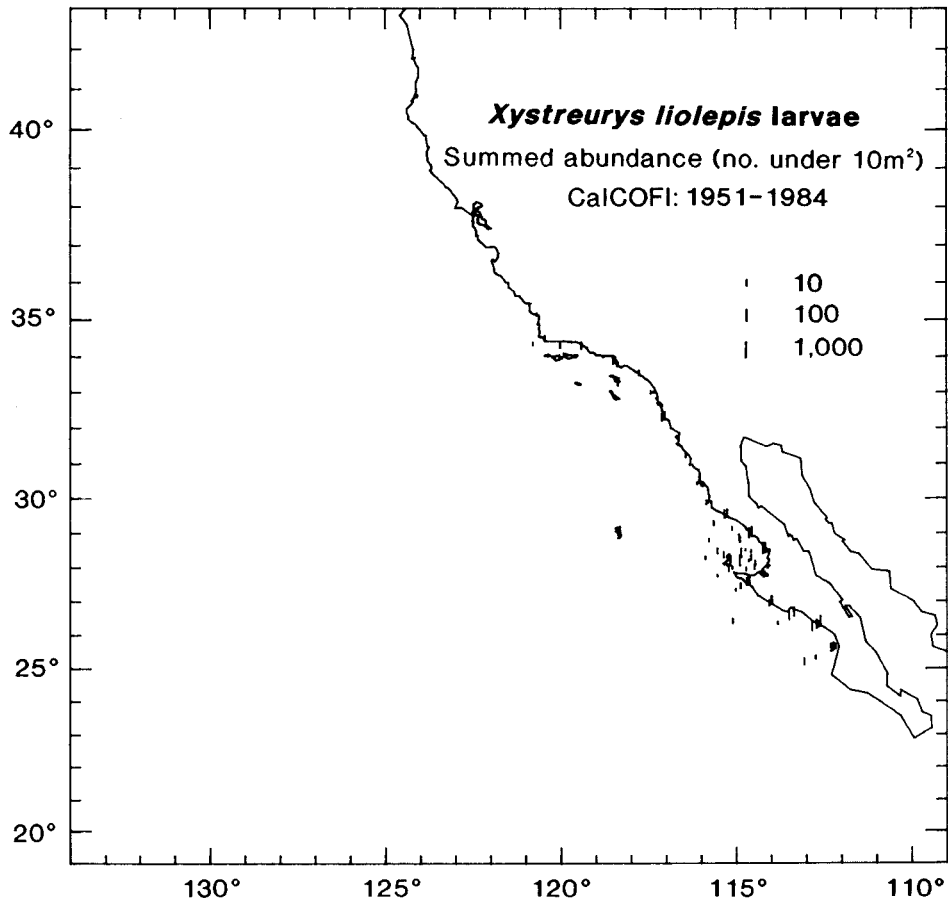


Chilara taylori

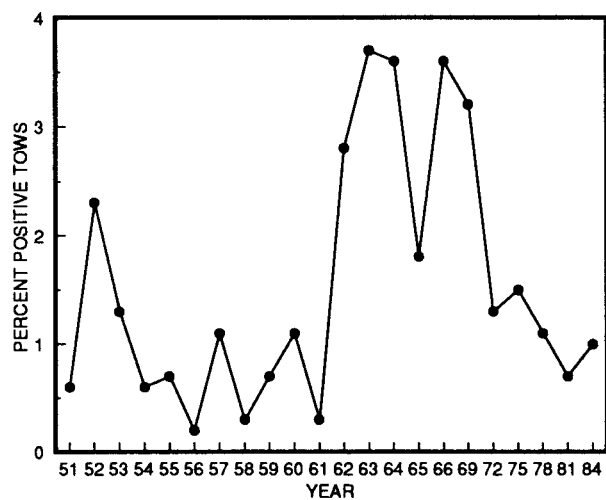


Xystreurus liolepis

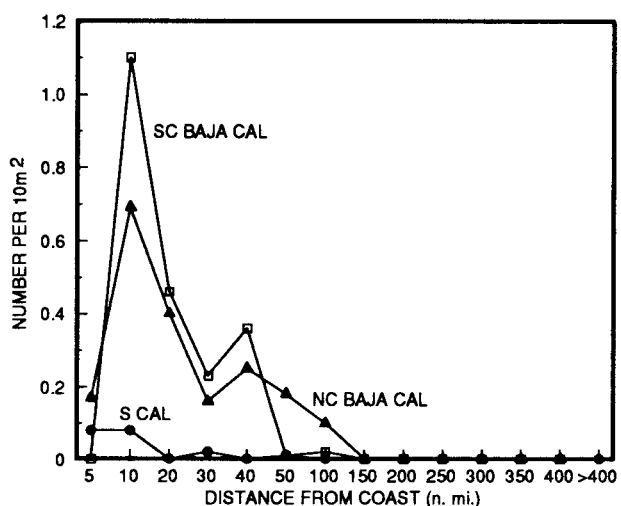
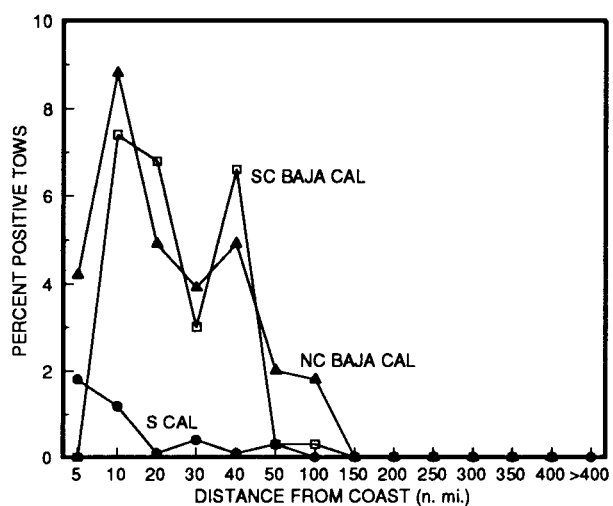
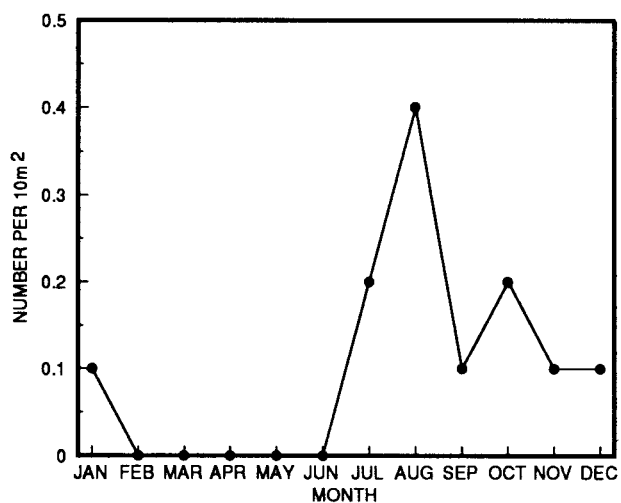
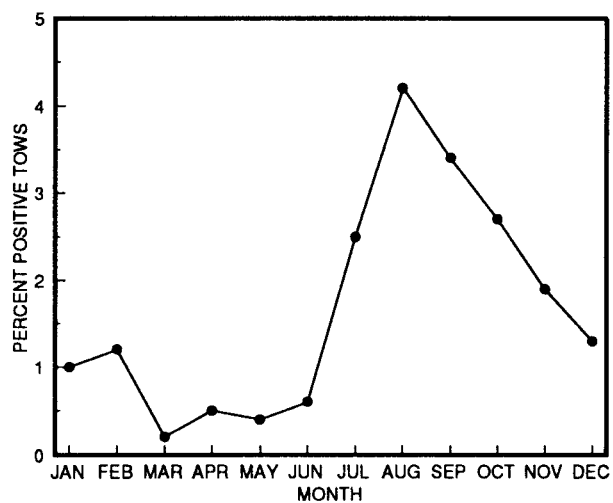
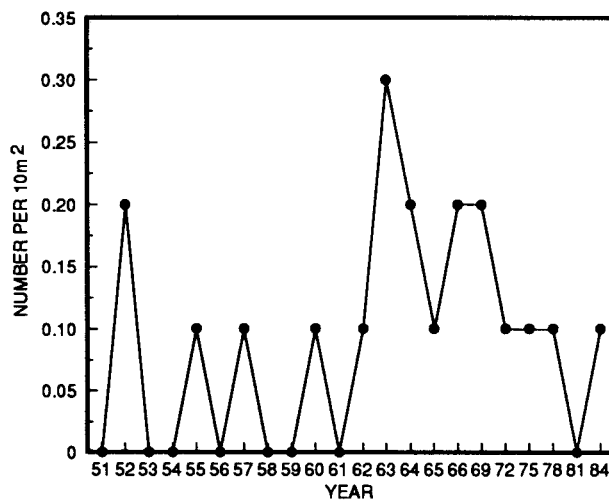
Paralichthyidae



Fantail sole

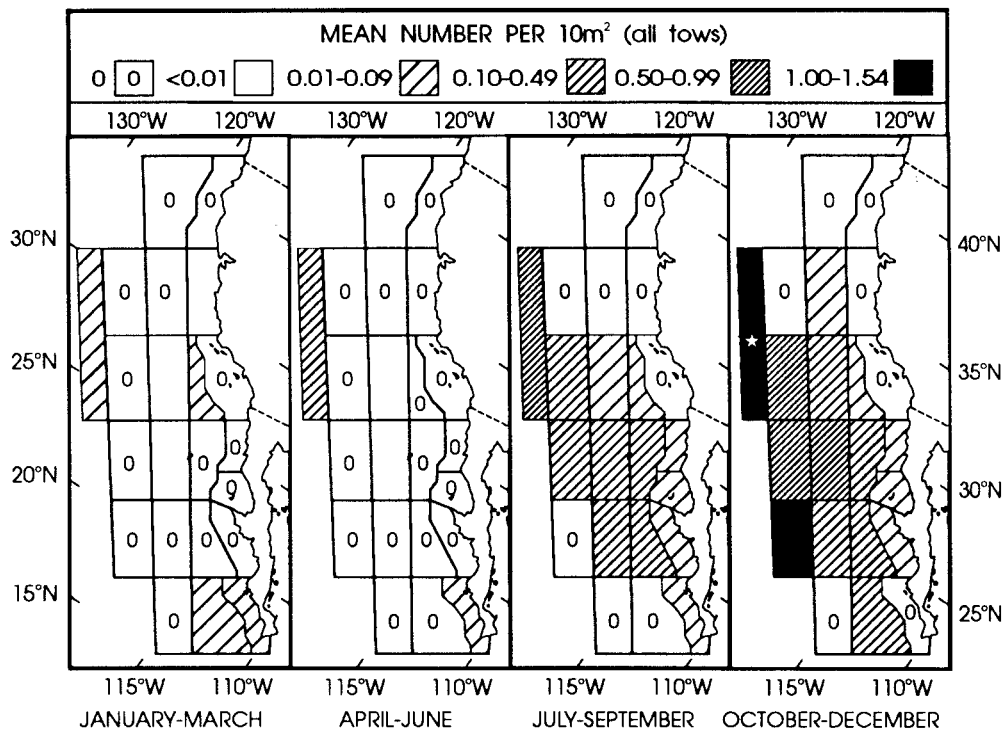
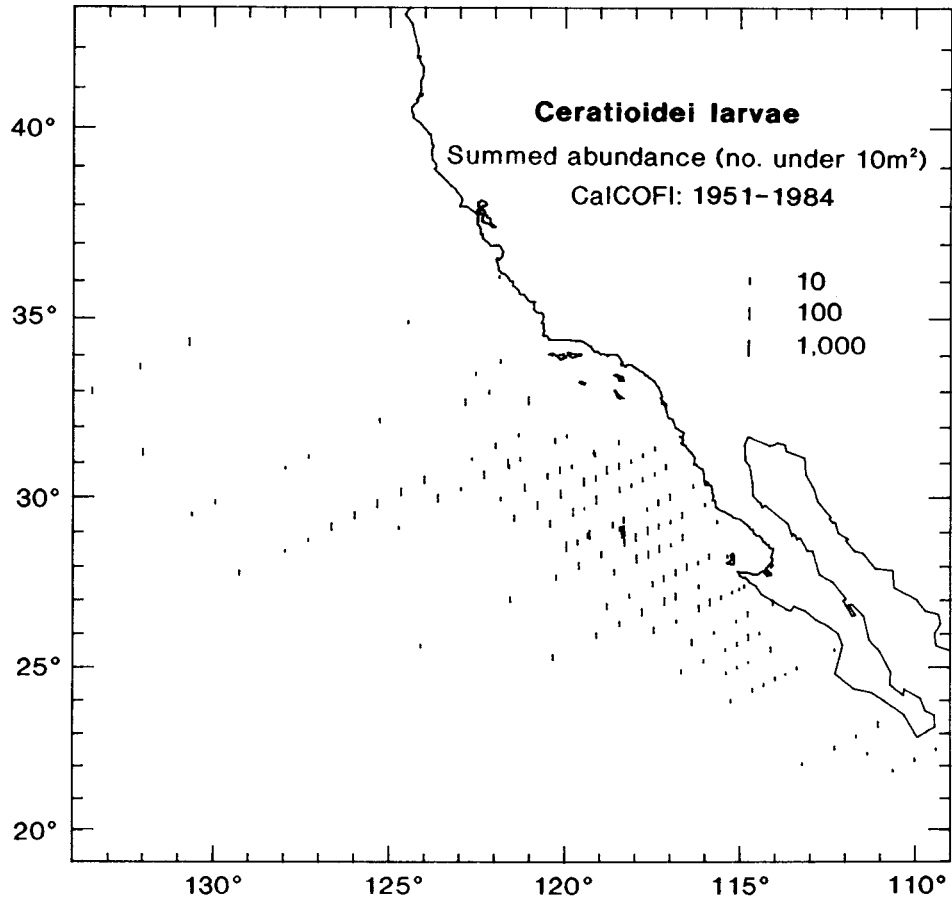


Xystreurus liolepis



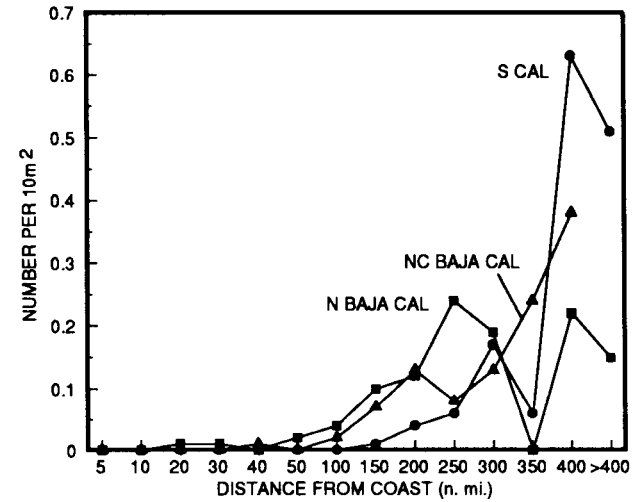
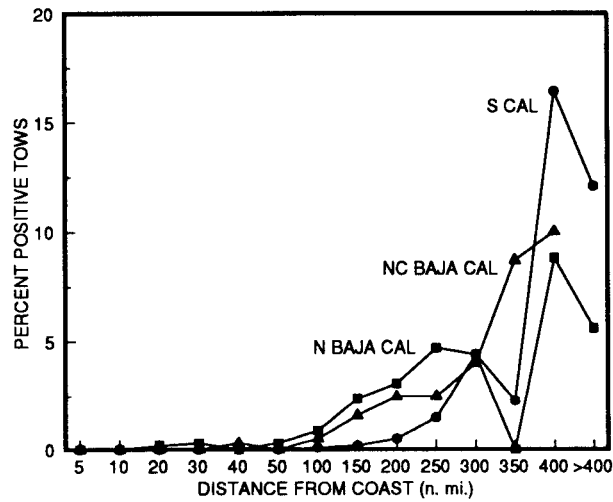
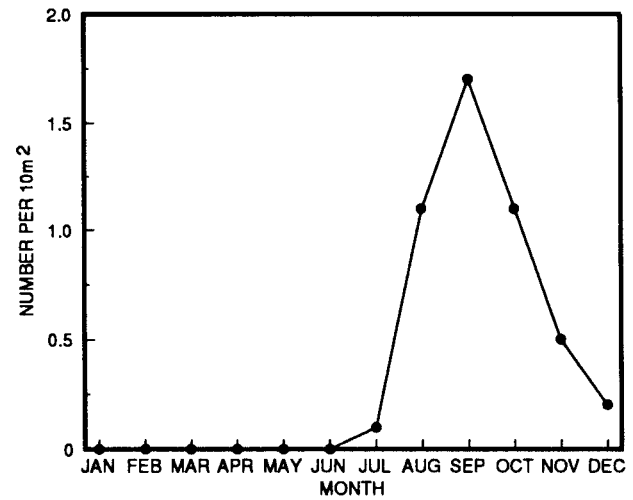
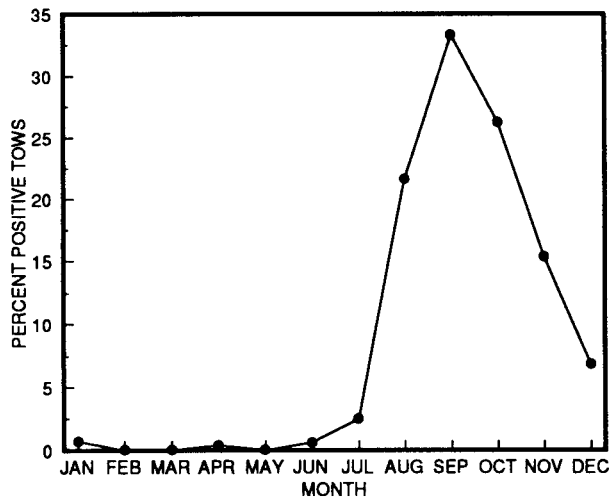
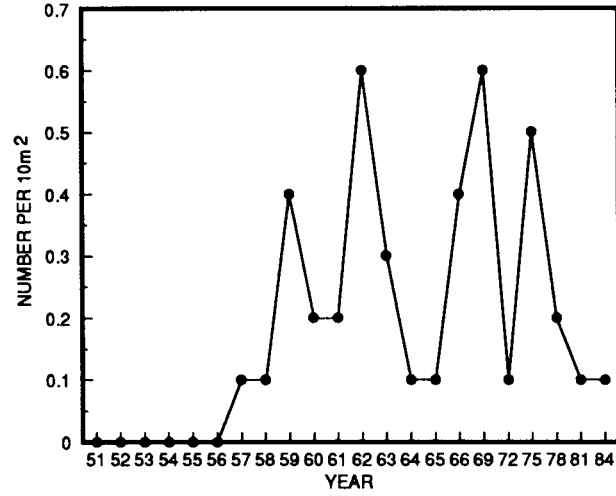
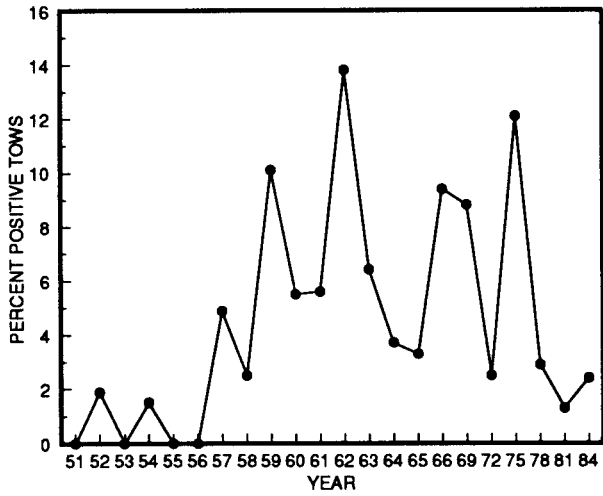
Ceratioidei

Ceratioidei



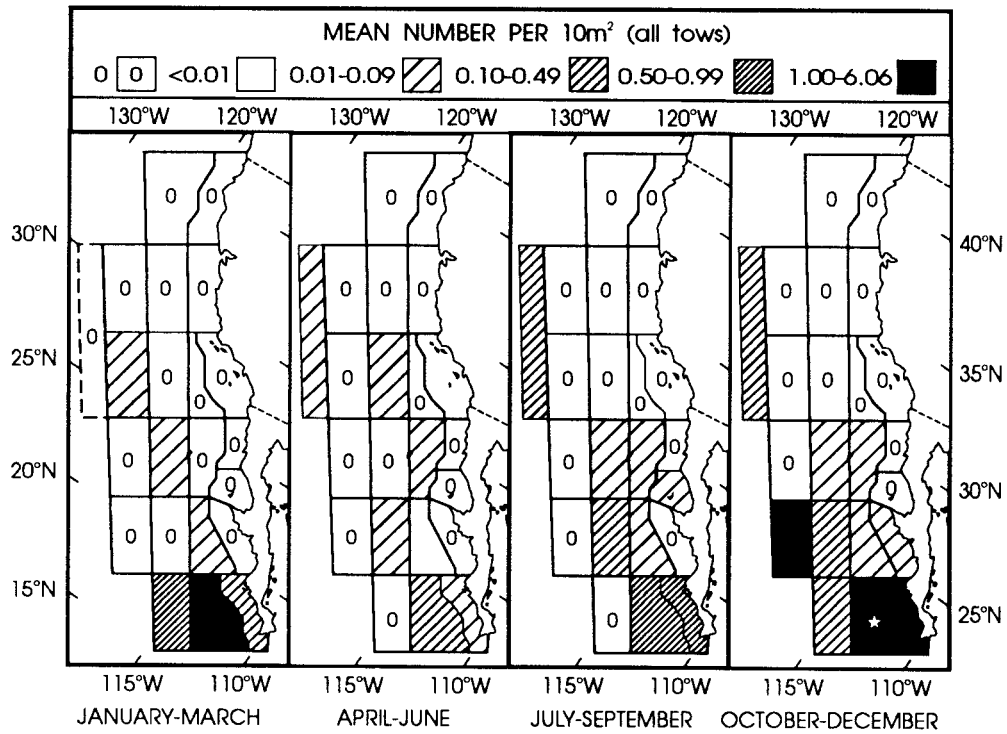
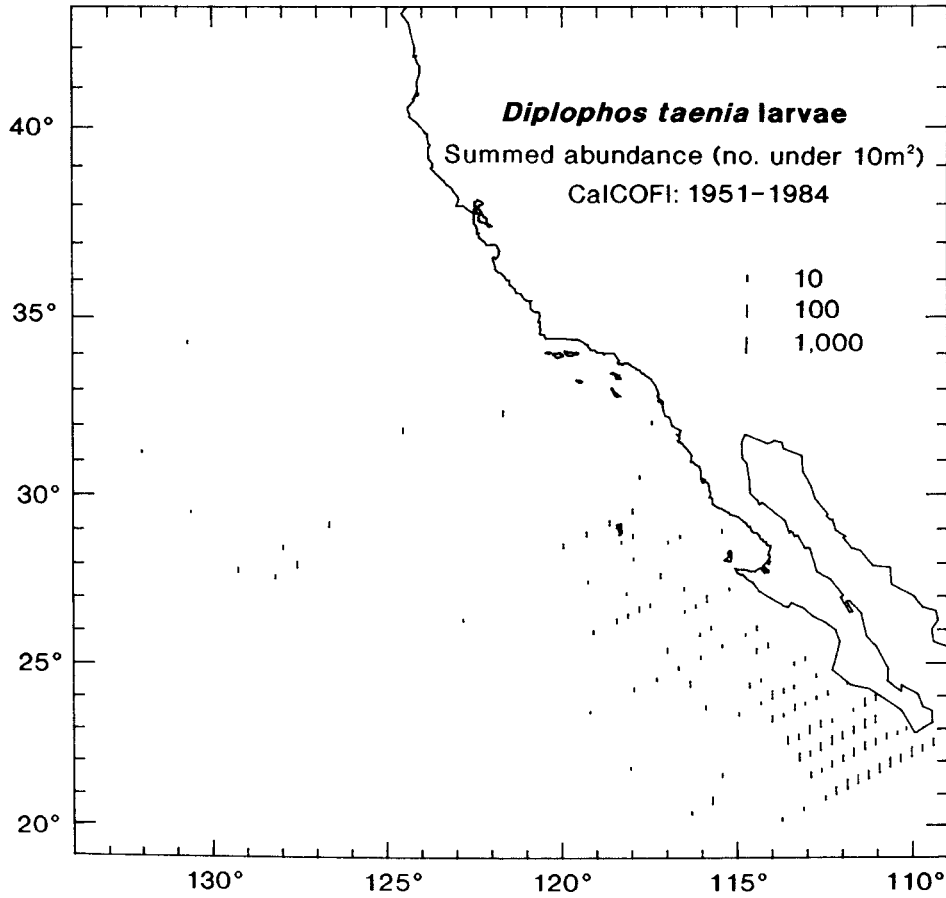
Deep-sea anglerfishes

Ceratioidei



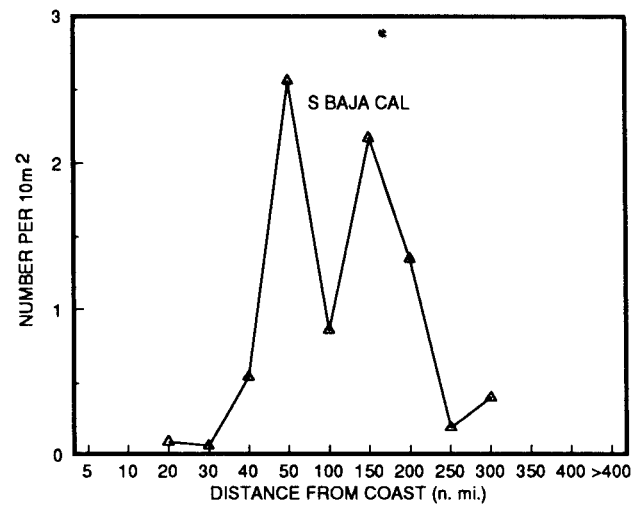
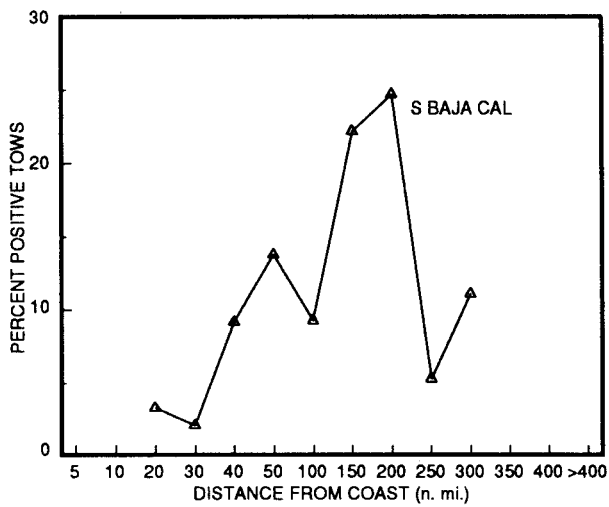
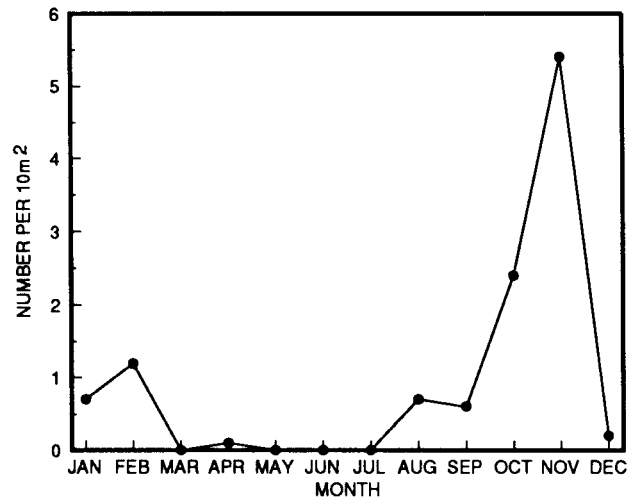
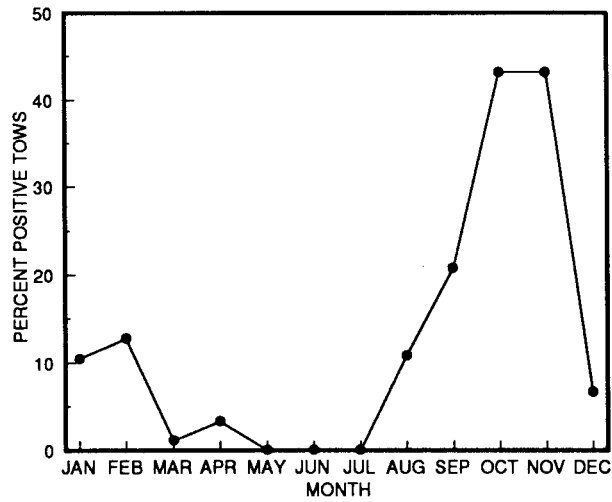
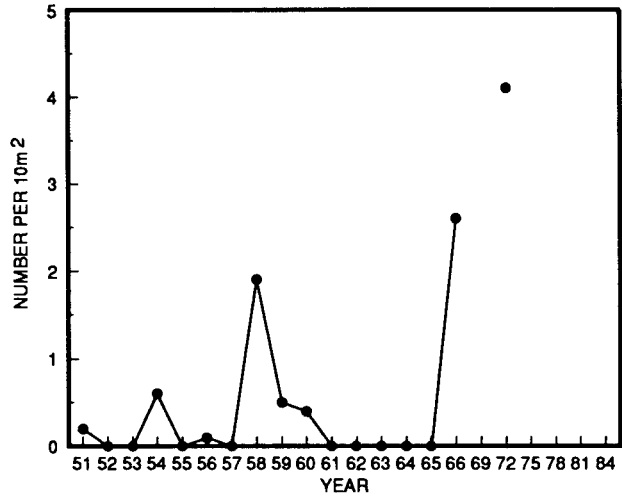
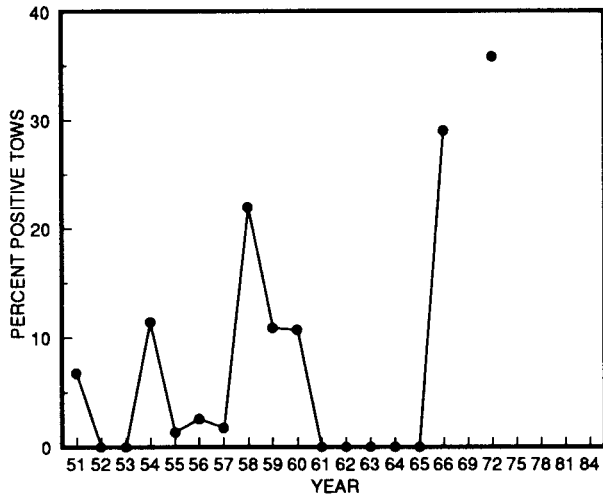
Diplophos taenia

Gonostomatidae



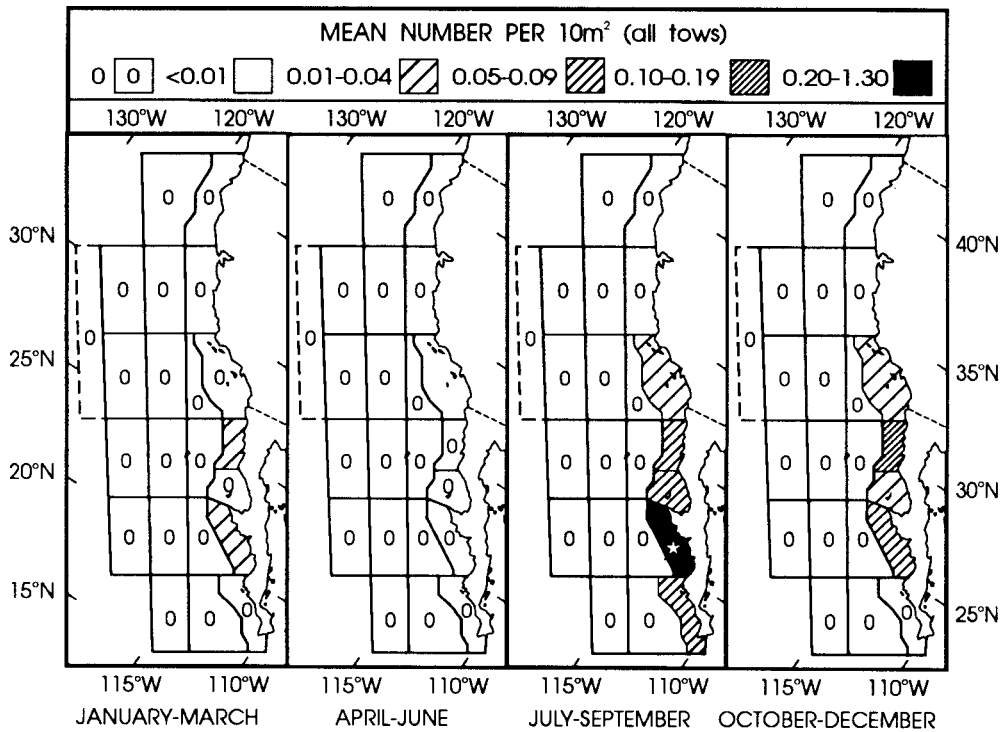
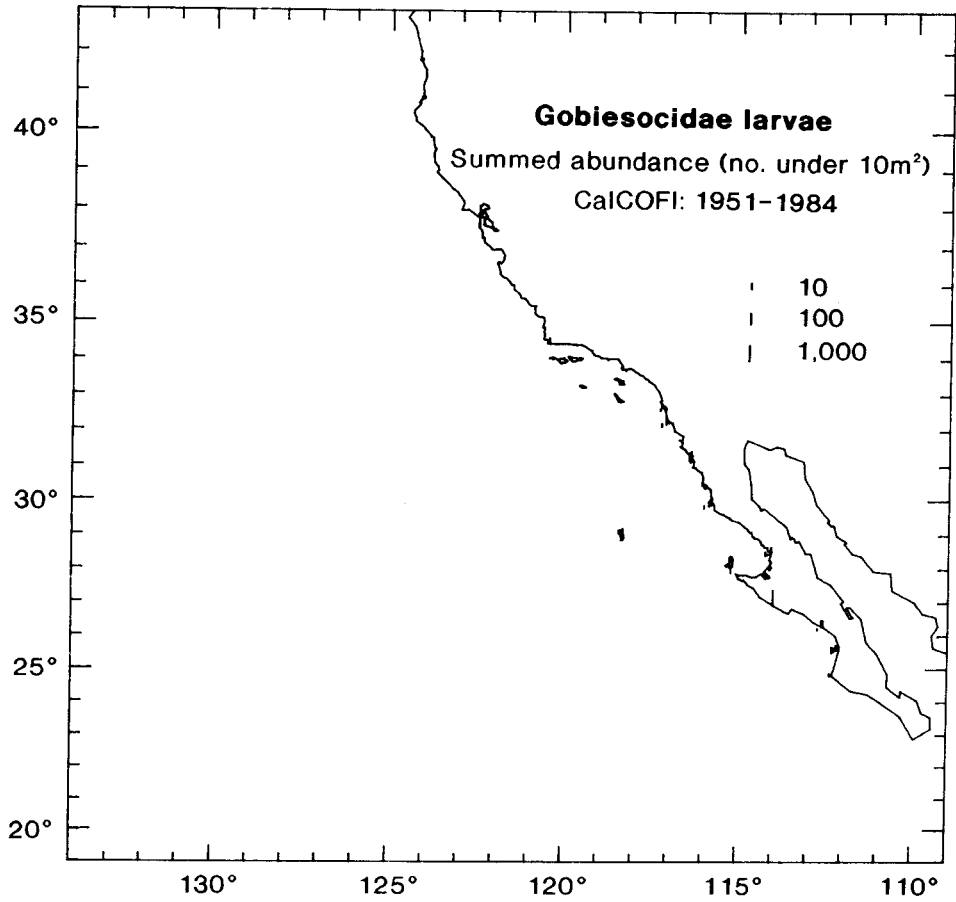
Ribbon bristlemouth

Diplophos taenia



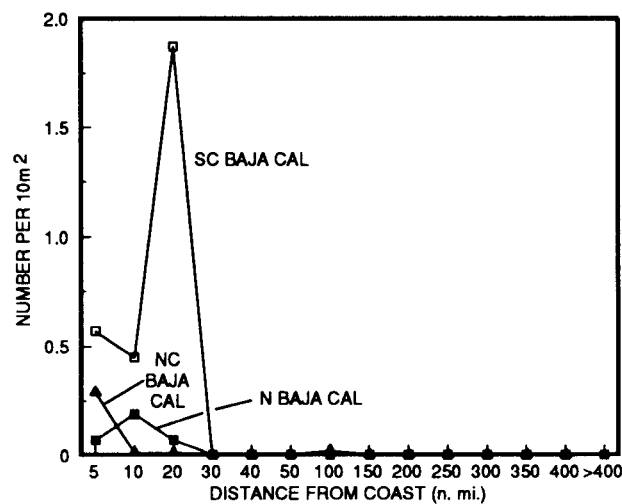
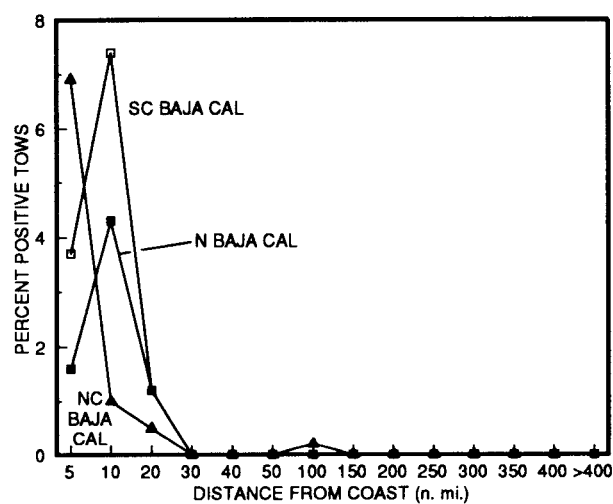
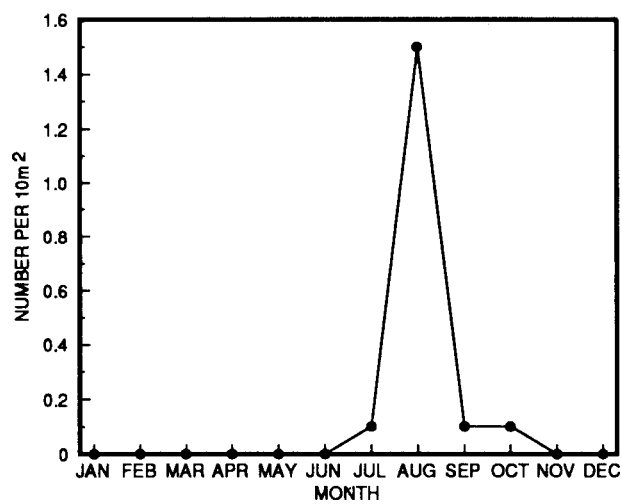
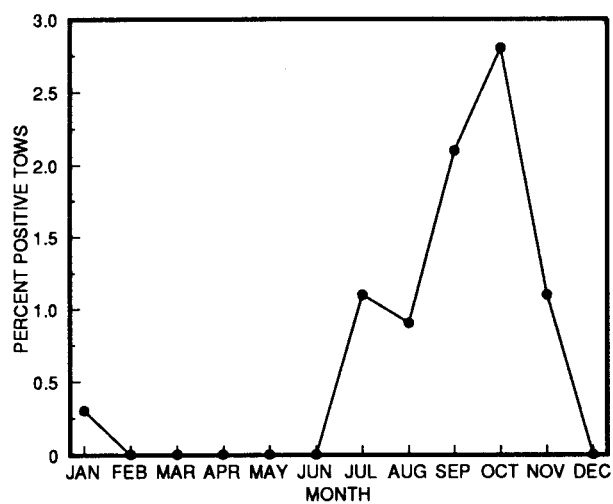
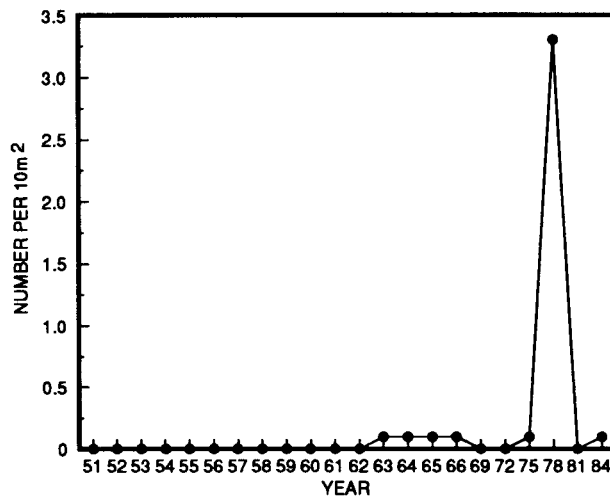
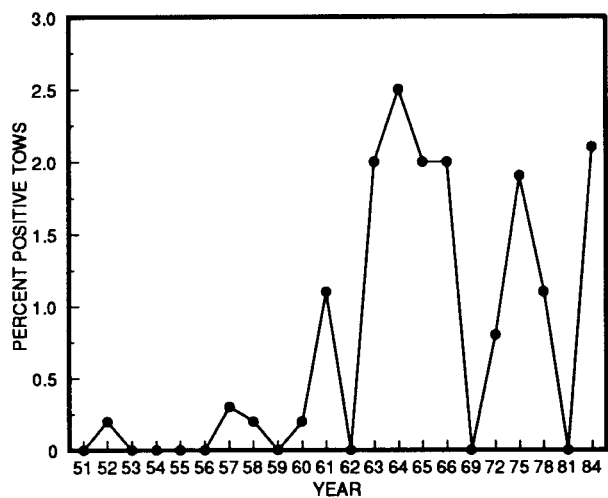
Gobiesocidae

Gobiesocidae



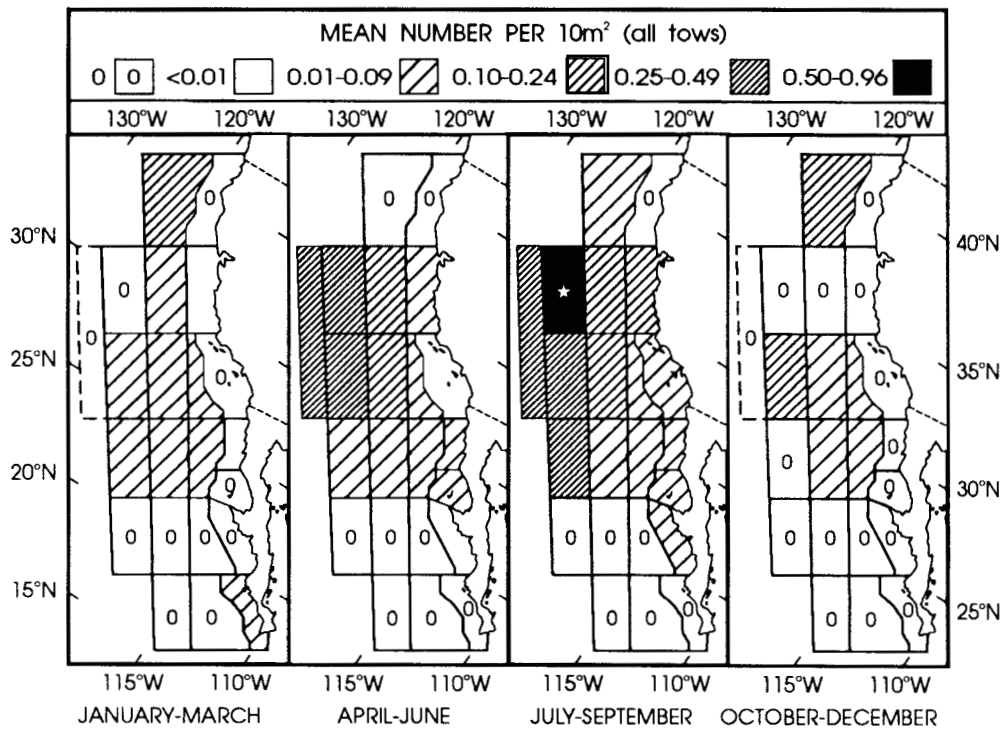
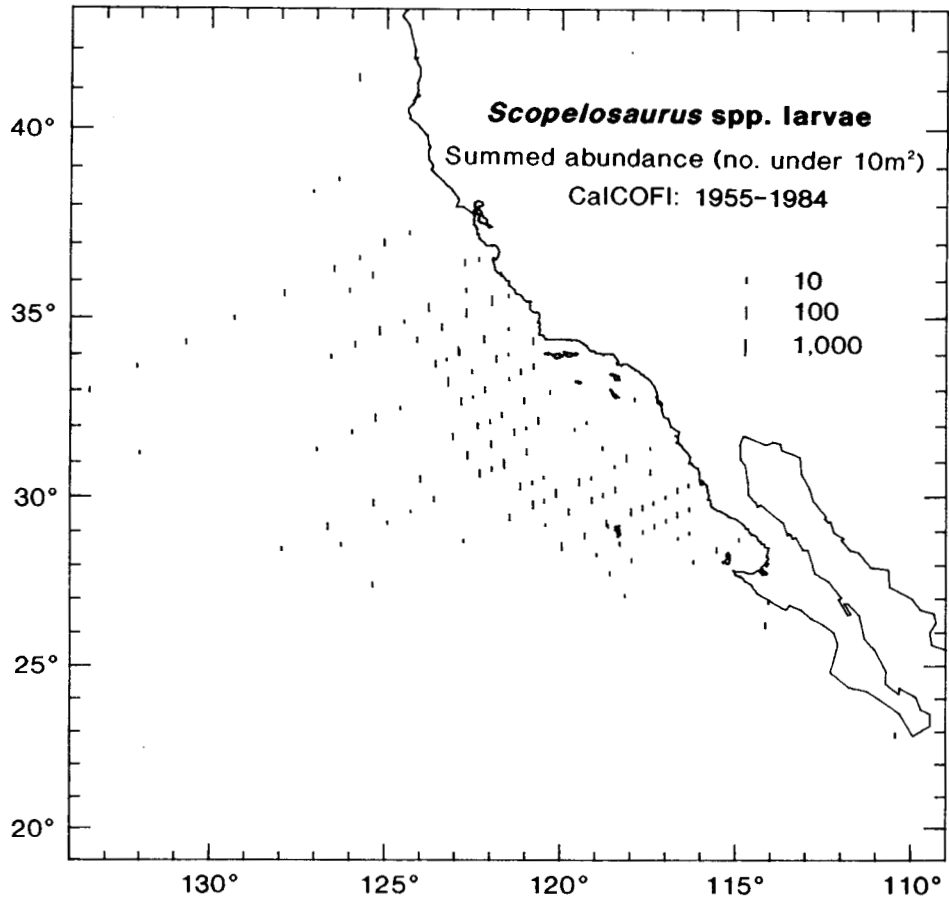
Clingfishes

Gobiesocidae

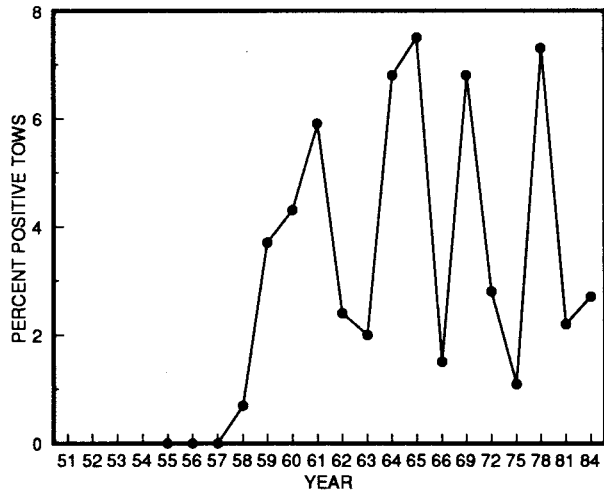


Scopelosaurus spp.

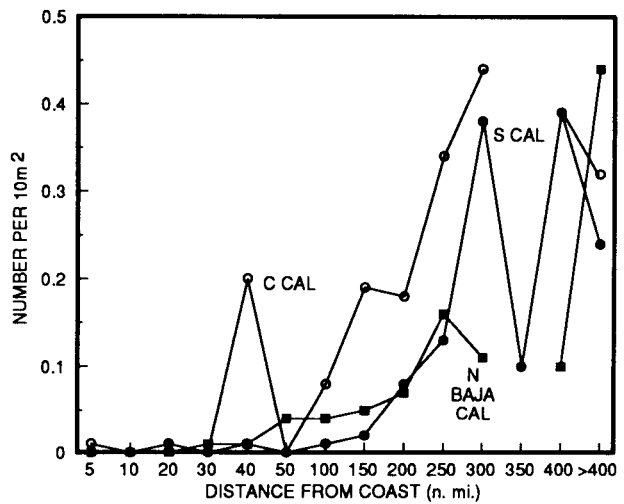
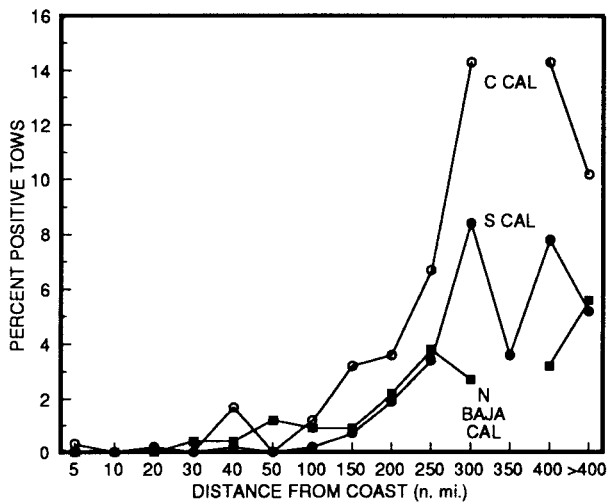
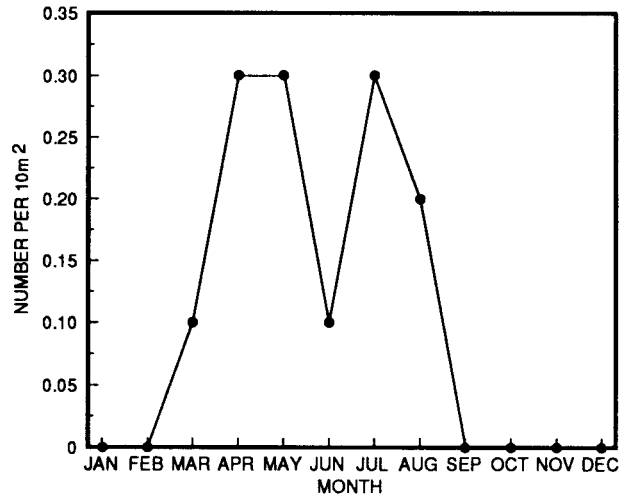
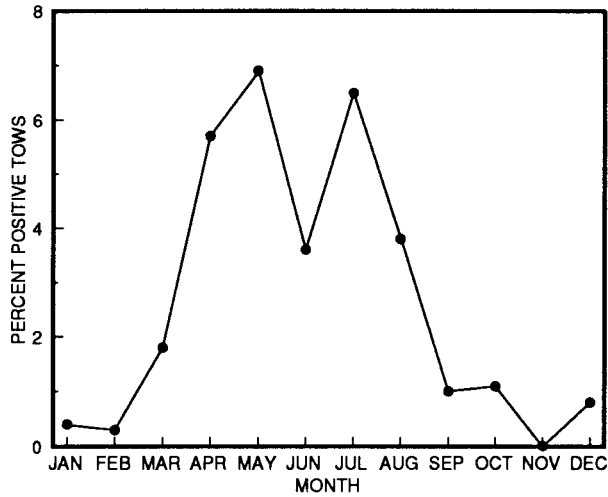
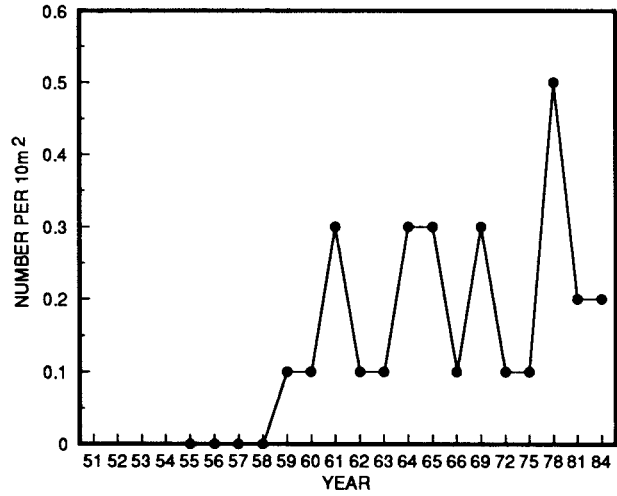
Notosudidae



Paperbones

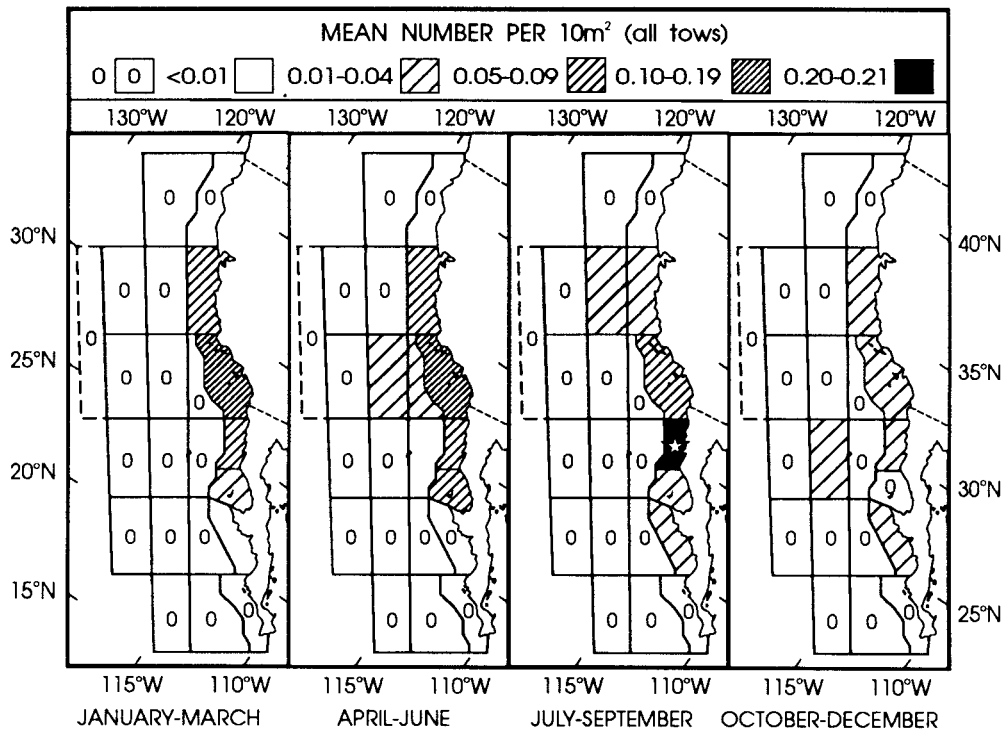
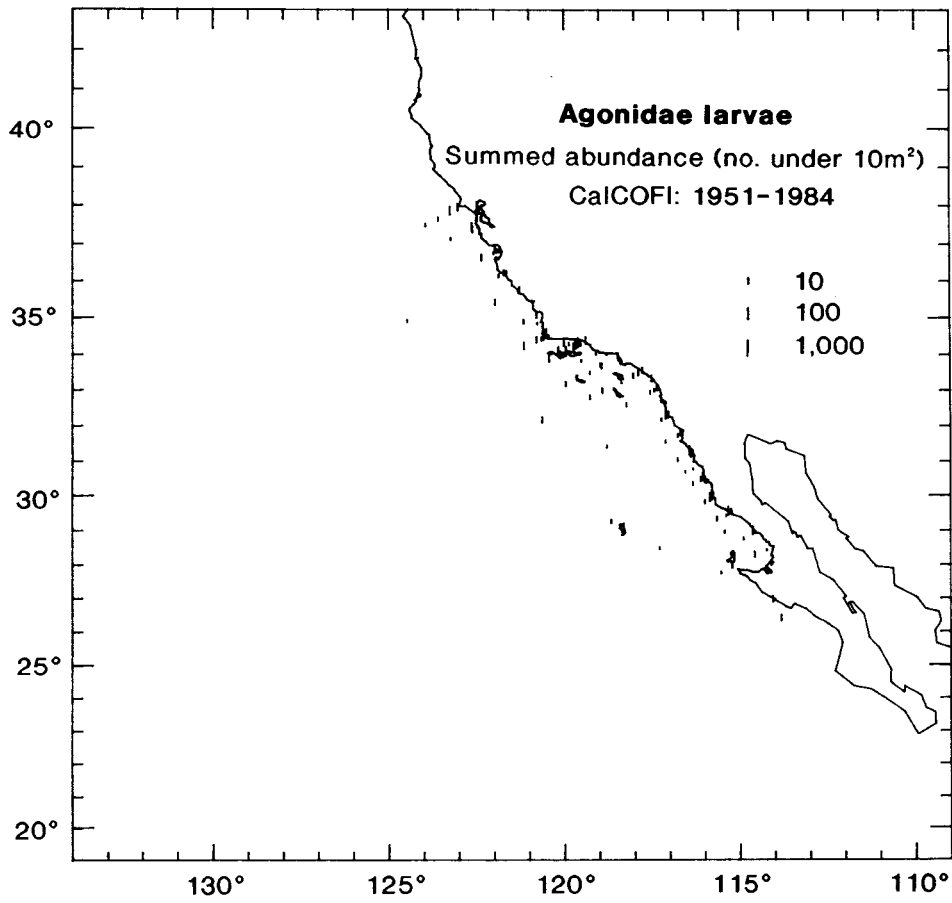


Scopelosaurus spp.



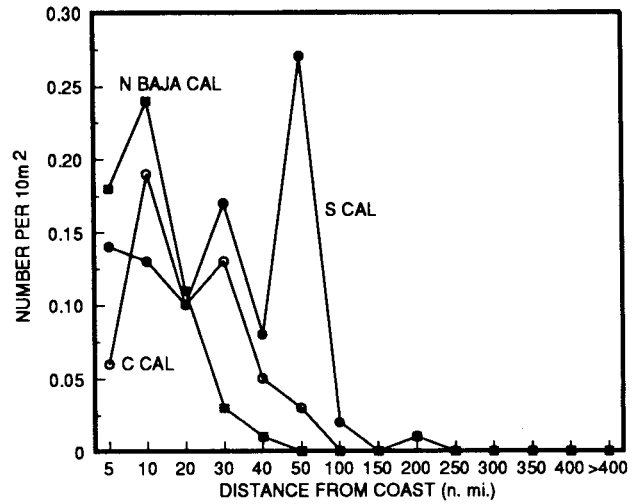
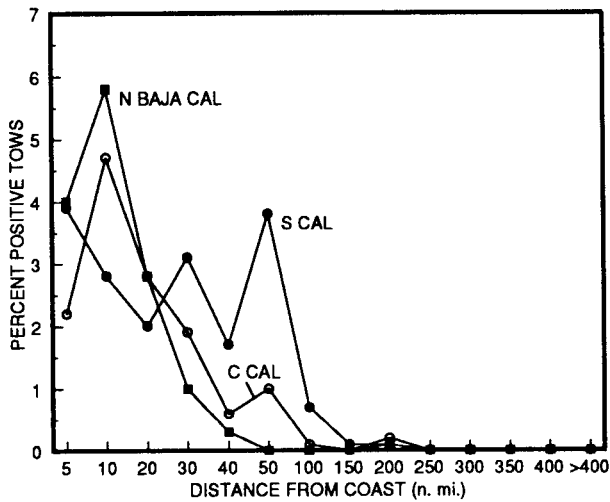
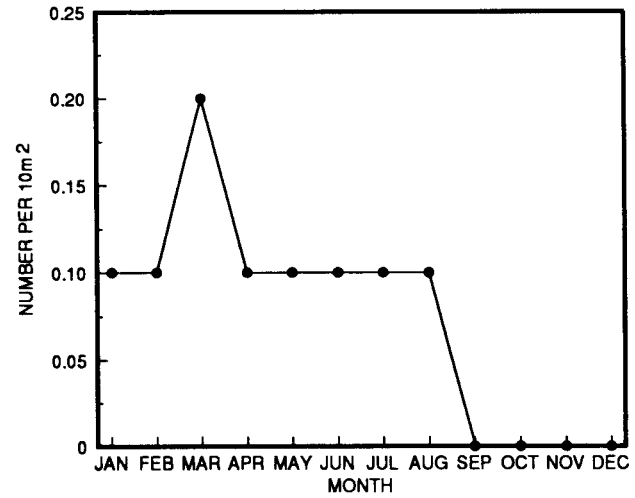
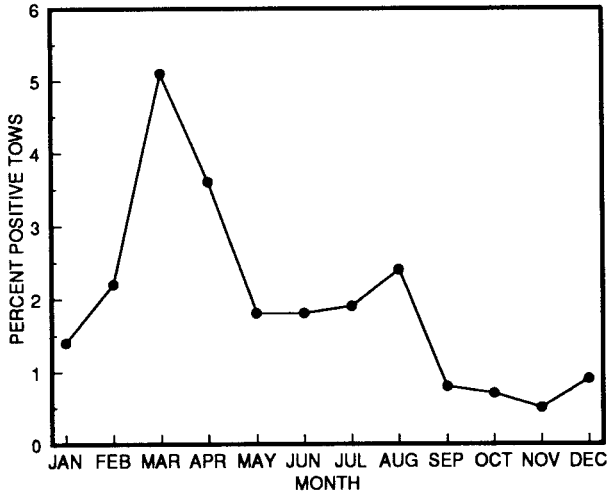
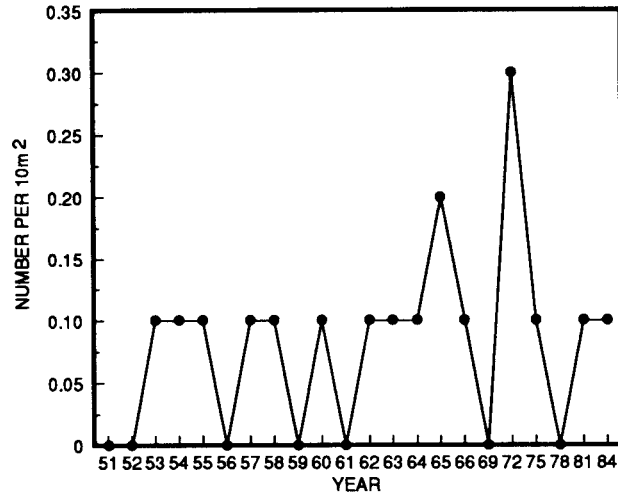
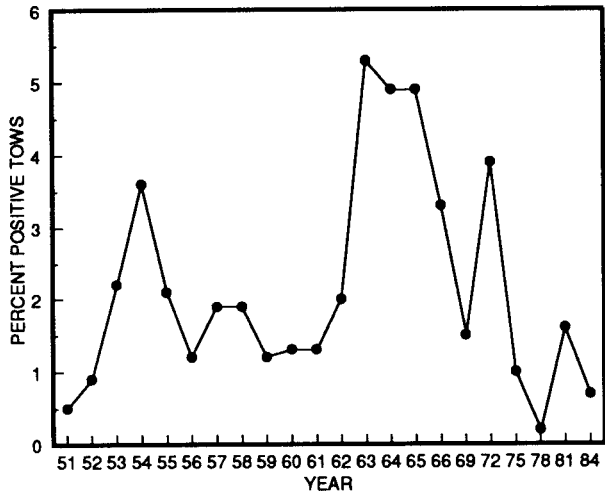
Agonidae

Agonidae



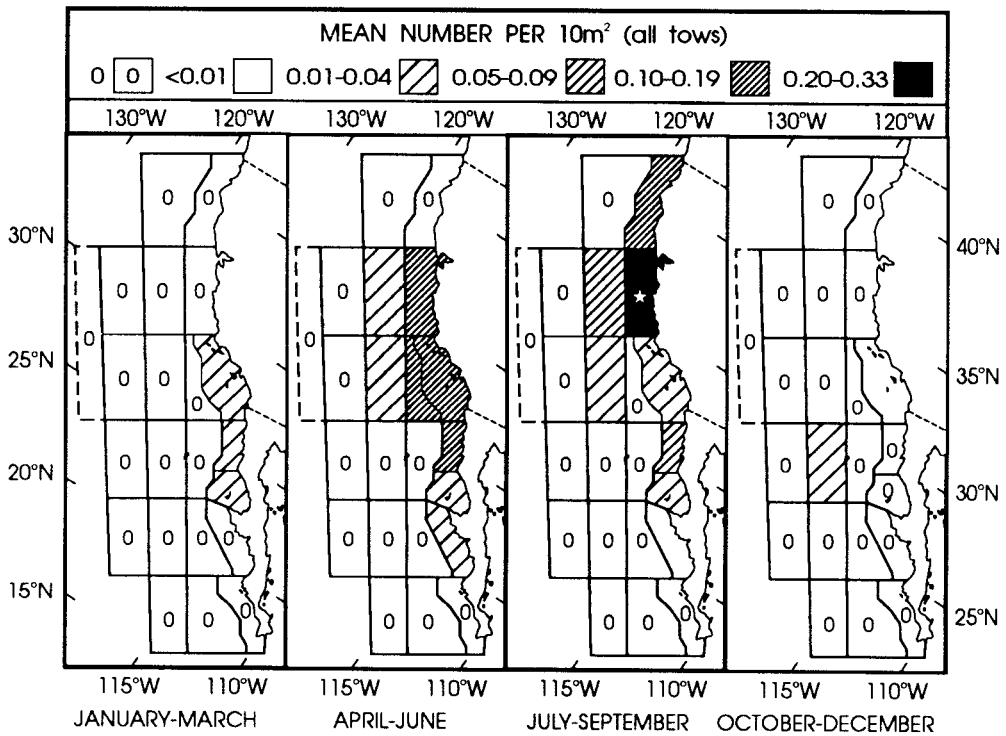
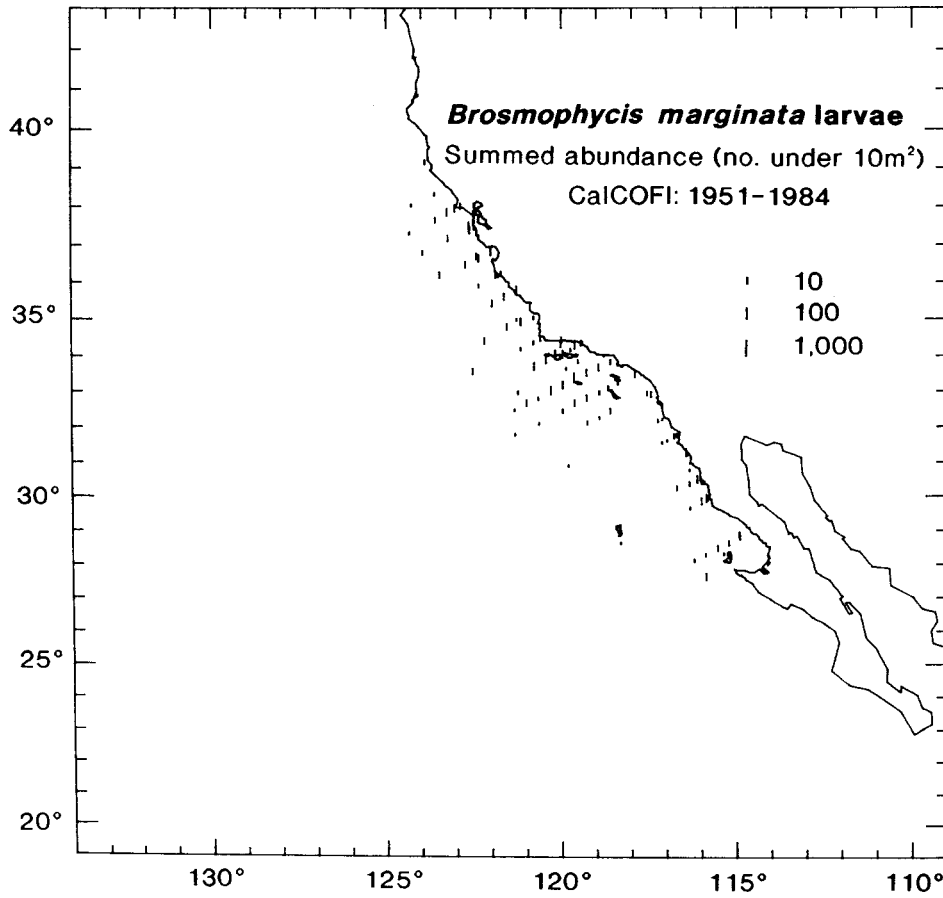
Poachers

Agonidae



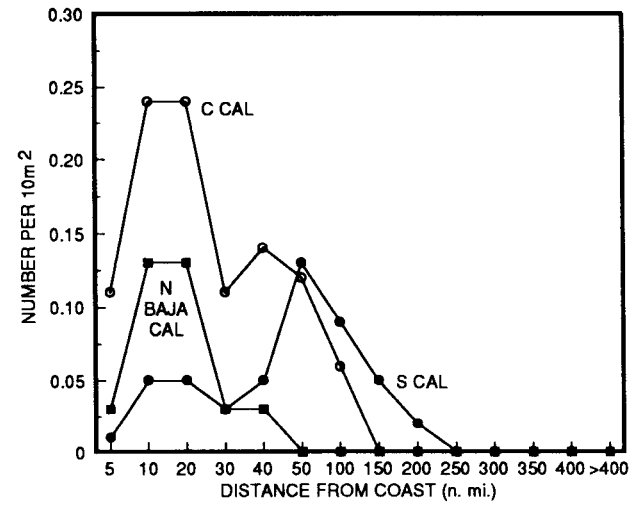
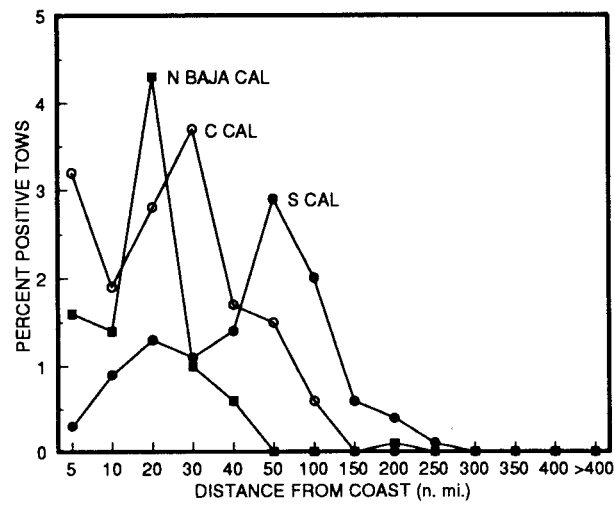
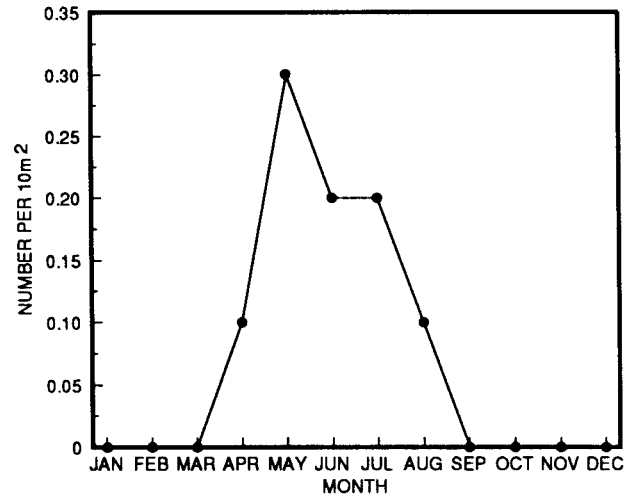
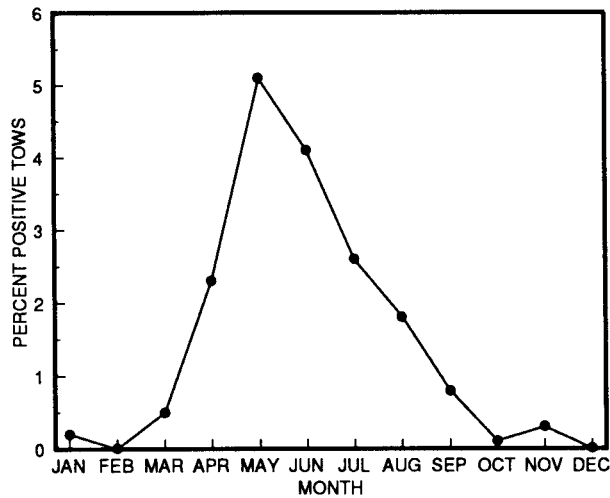
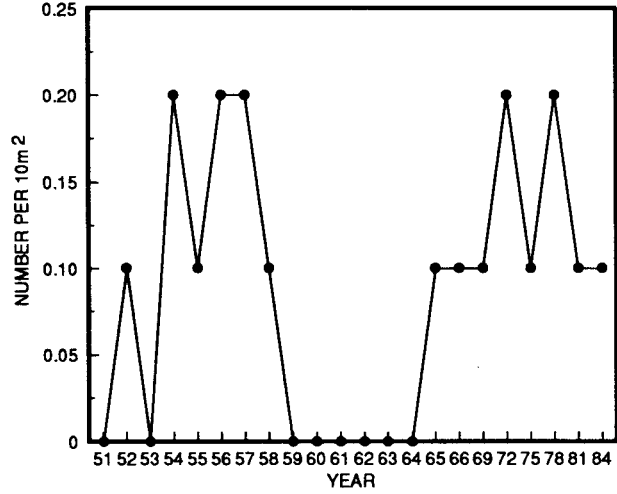
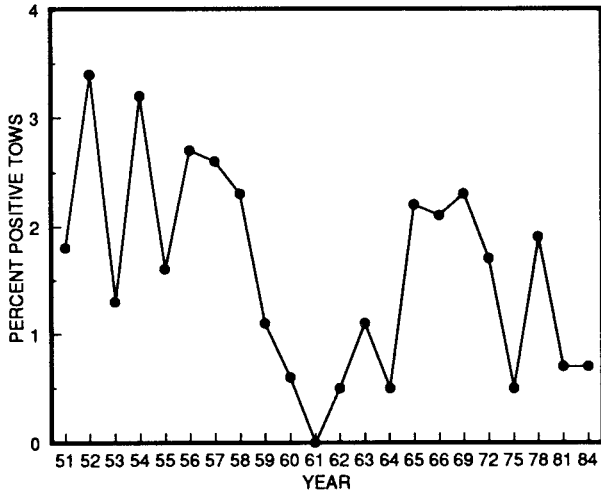
Brosmophycis marginata

Bythitidae



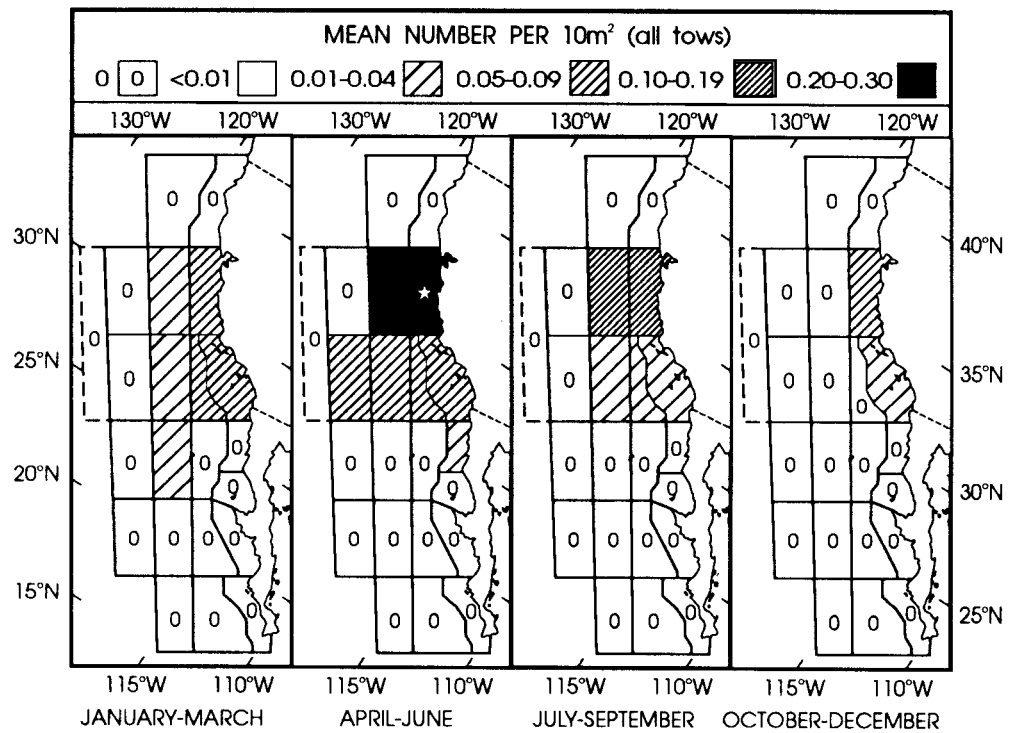
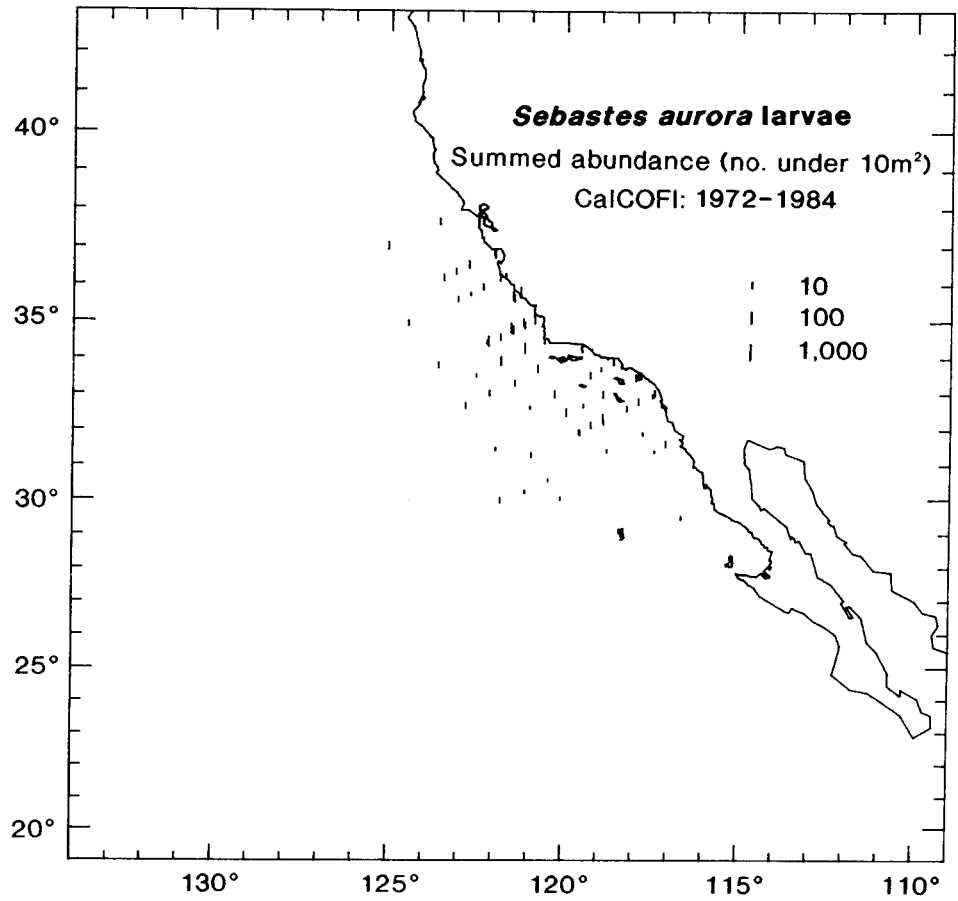
Red brotula

Brosmophycis marginata



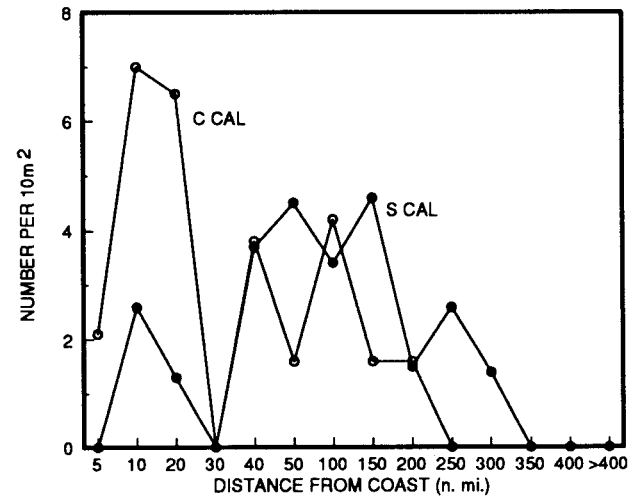
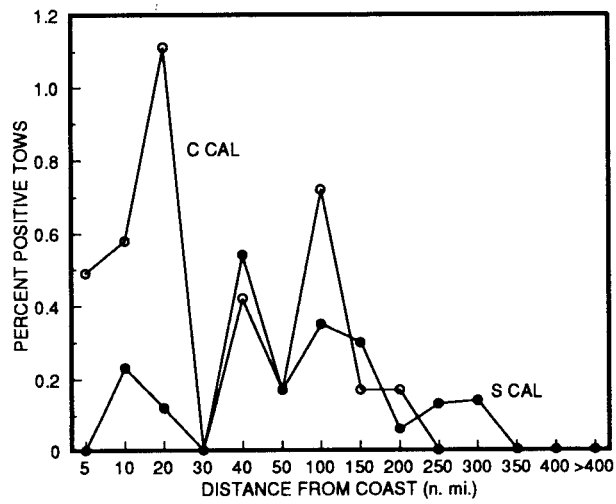
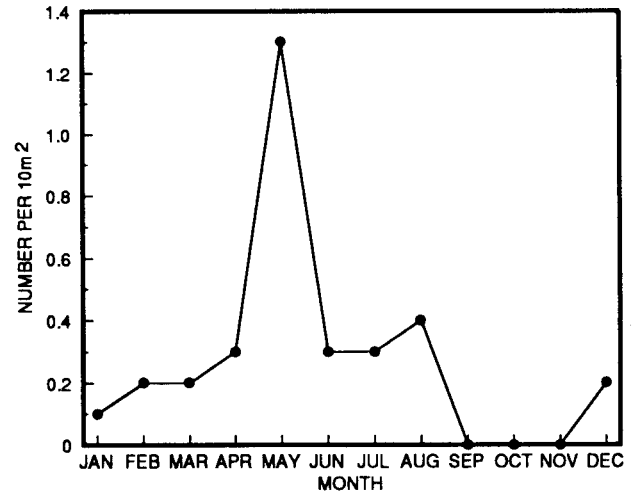
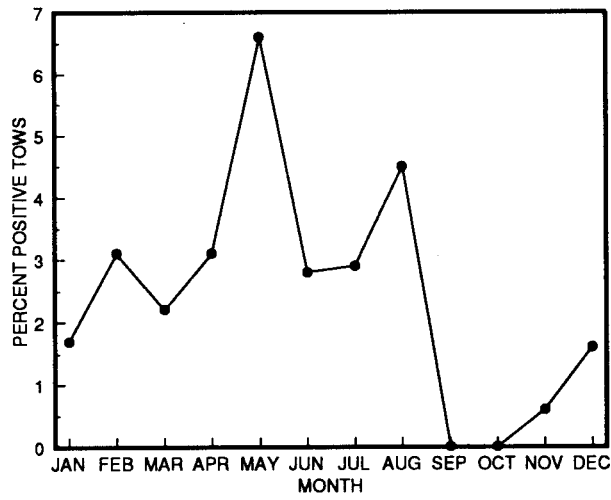
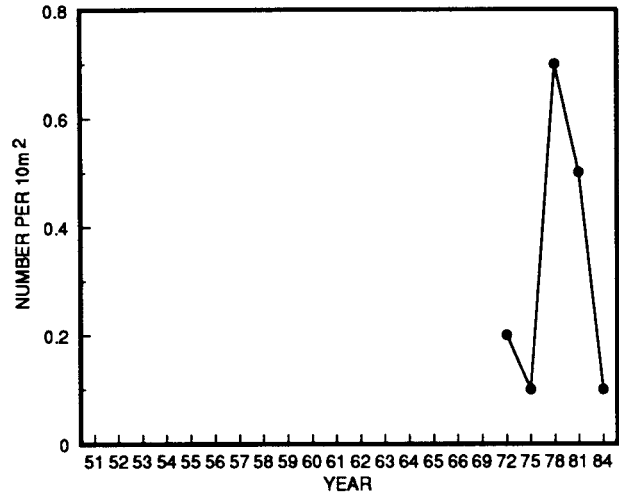
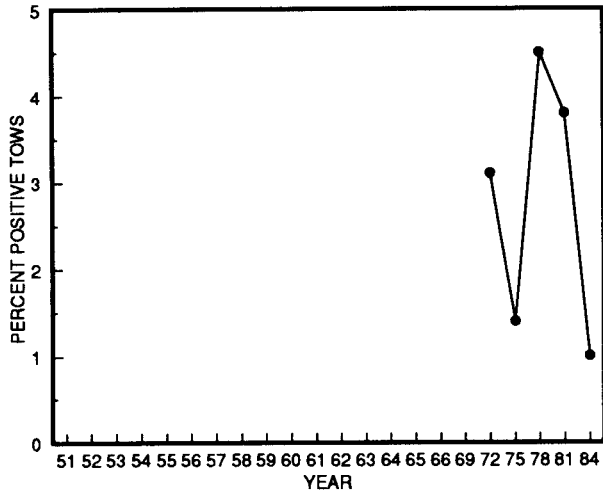
Sebastes aurora

Scorpaenidae



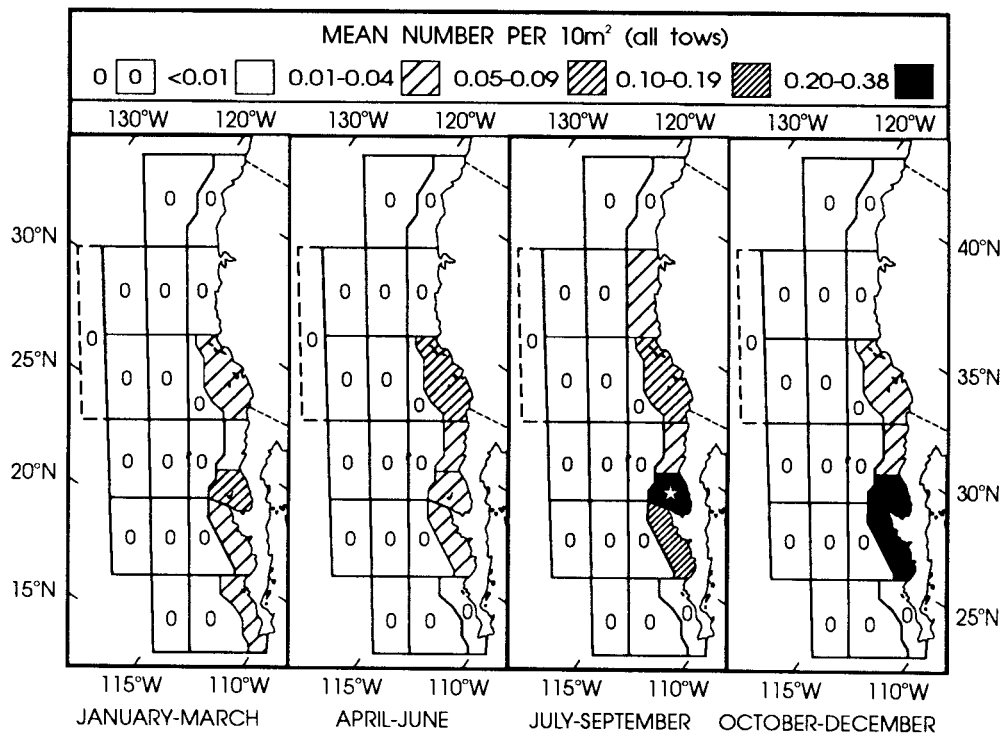
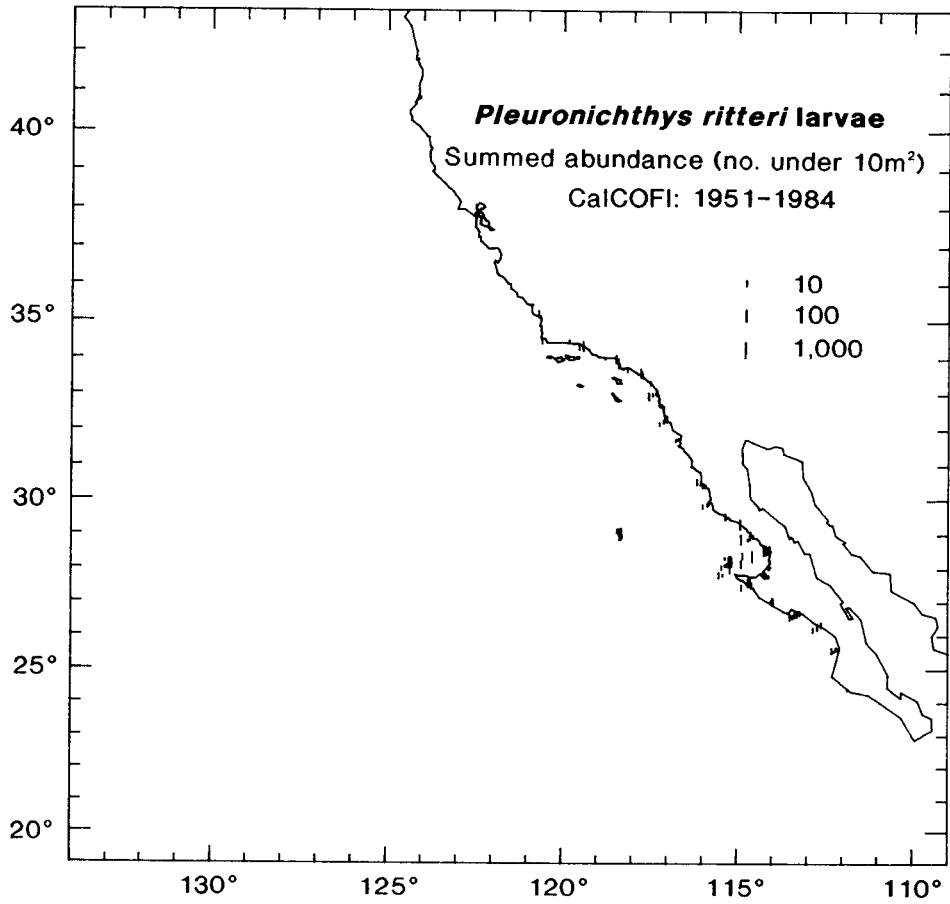
Aurora rockfish

Sebastes aurora

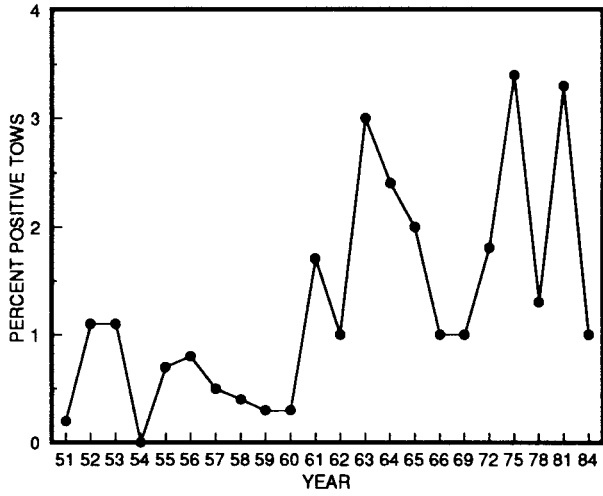


Pleuronichthys ritteri

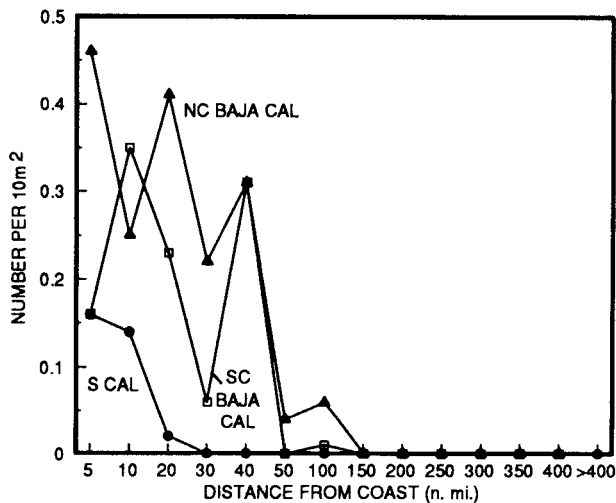
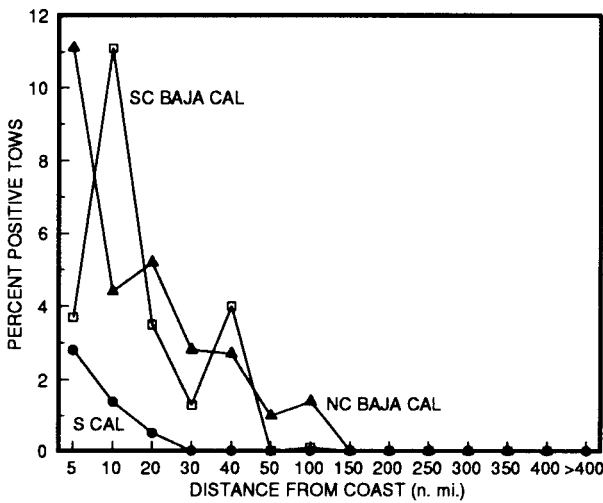
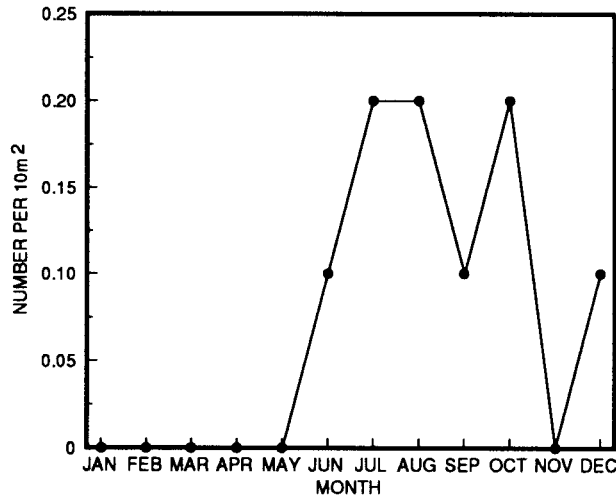
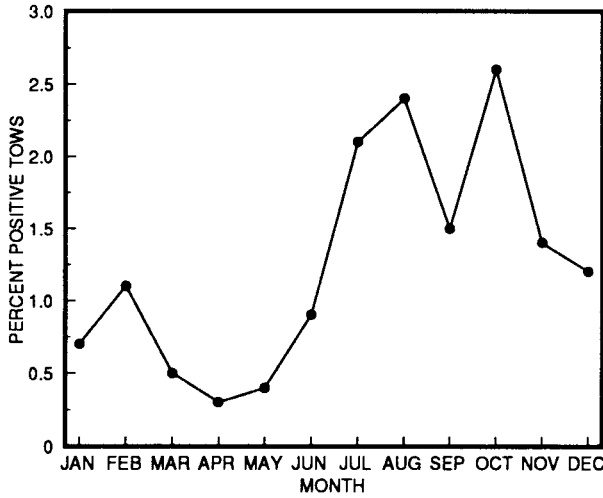
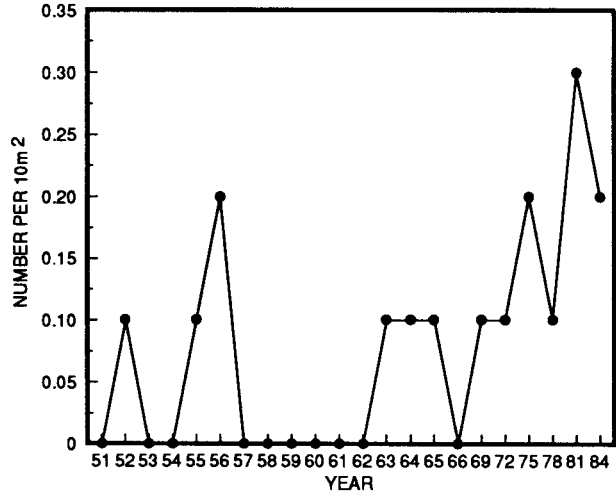
Pleuronectidae



Spotted turbot

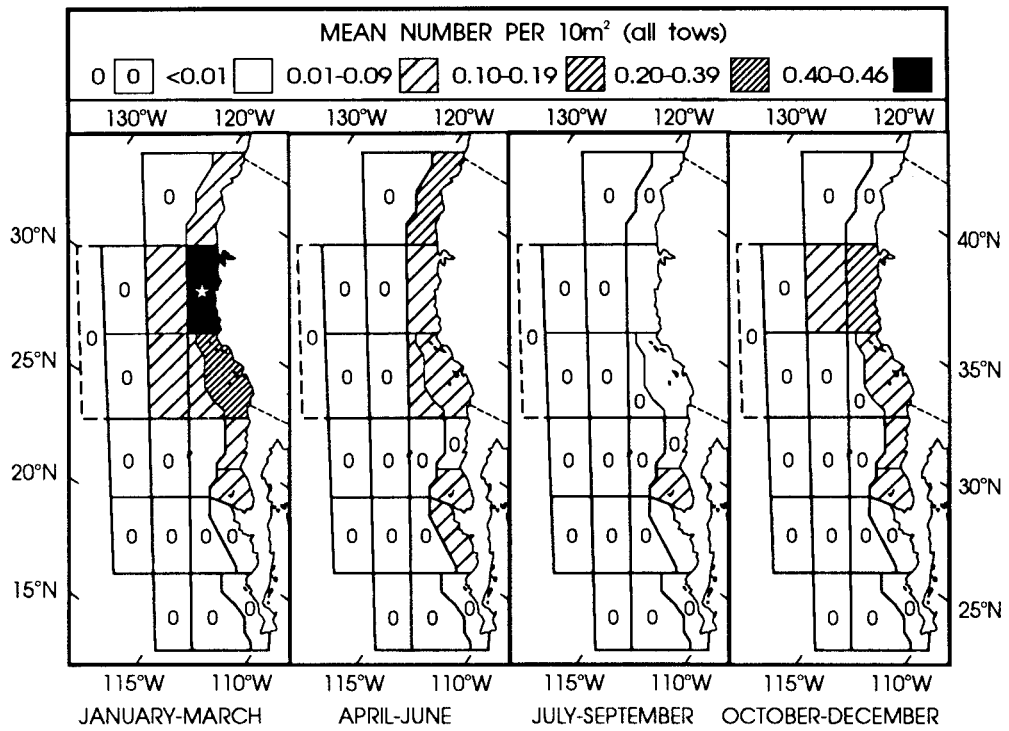
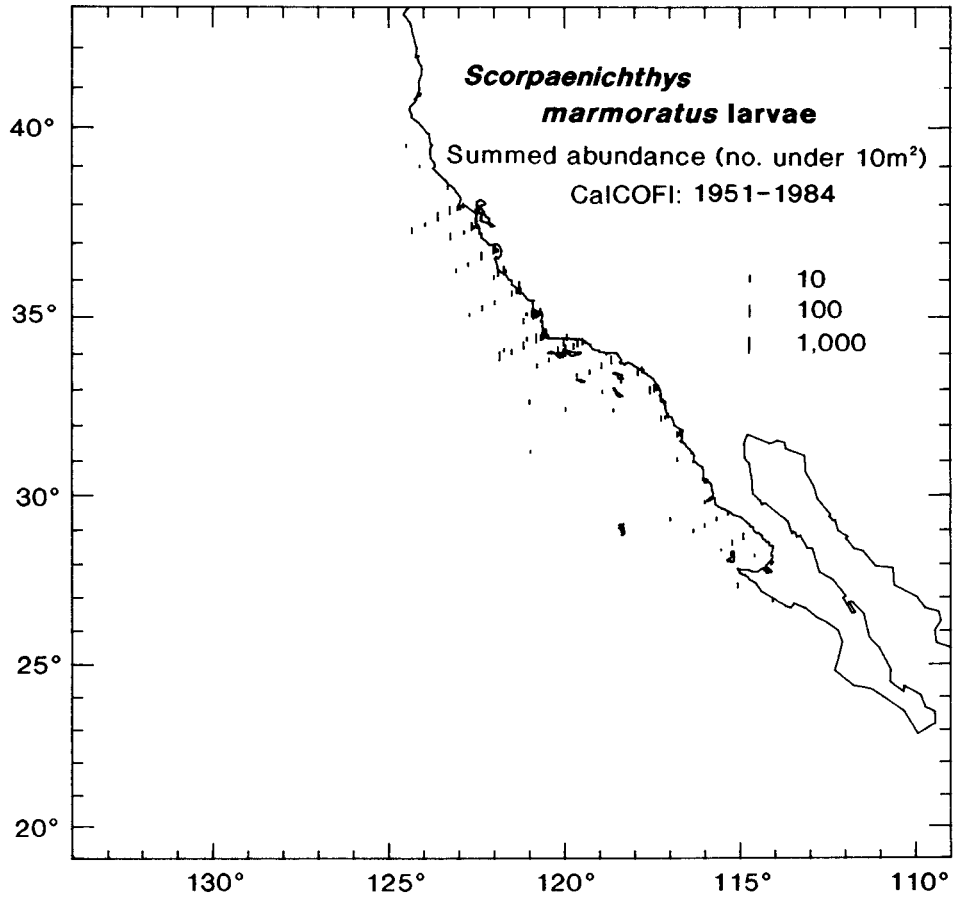


Pleuronichthys ritteri

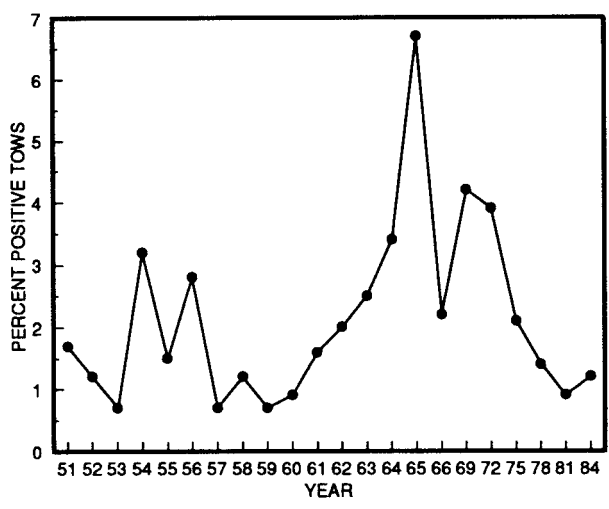


Scorpaenichthys marmoratus

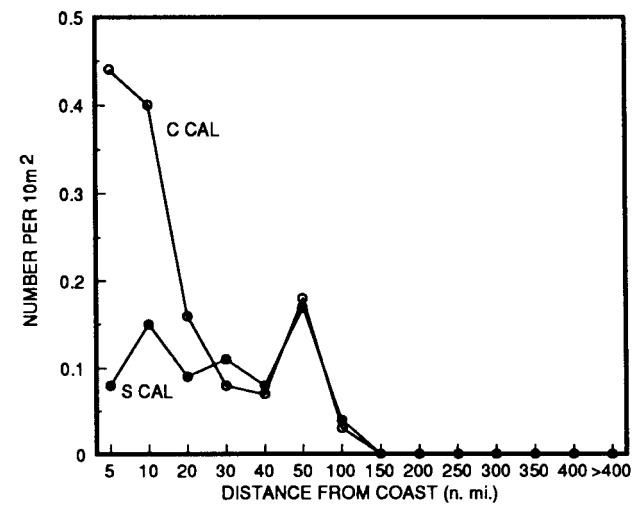
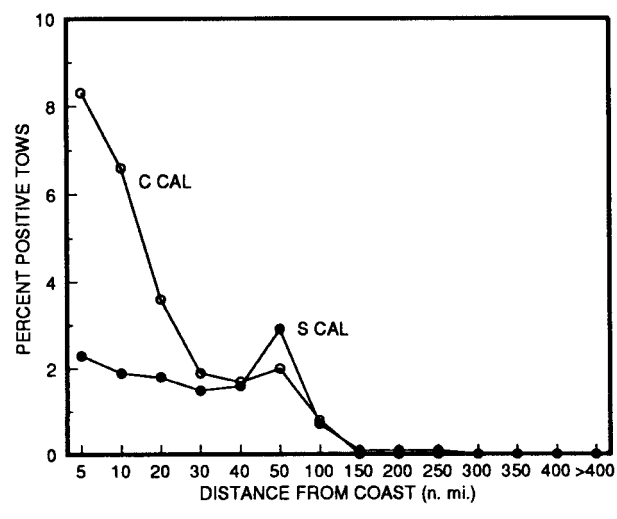
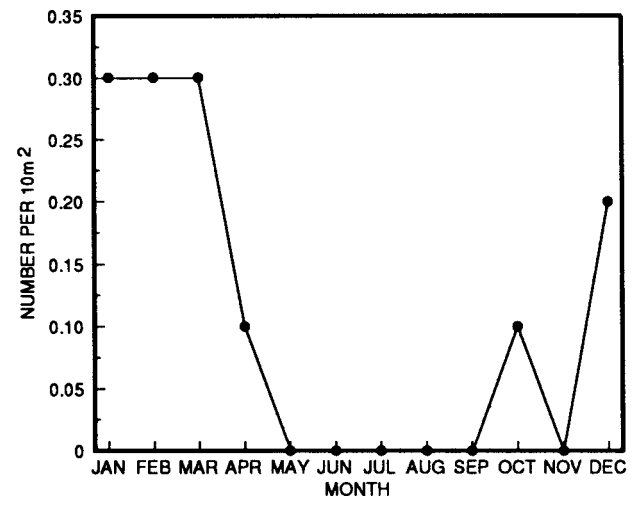
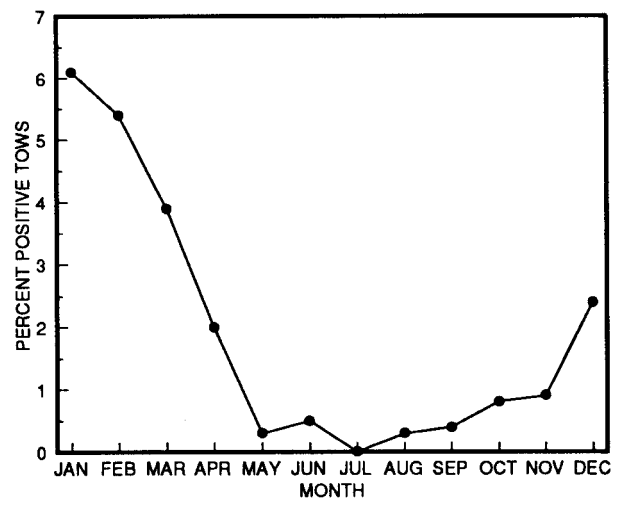
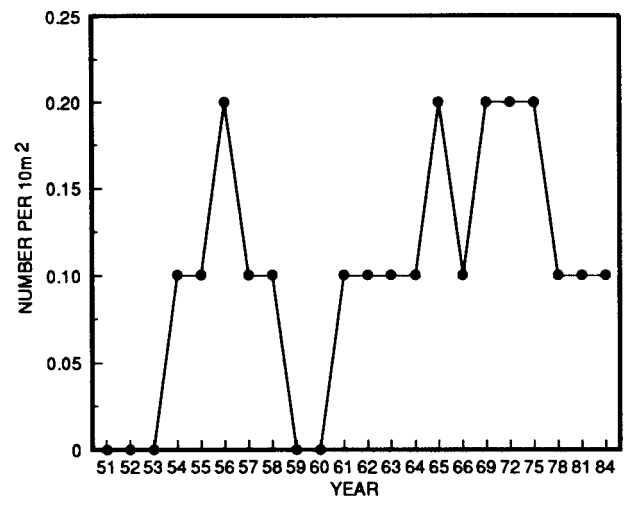
Cottidae



Cabezon



Scorpaenichthys marmoratus



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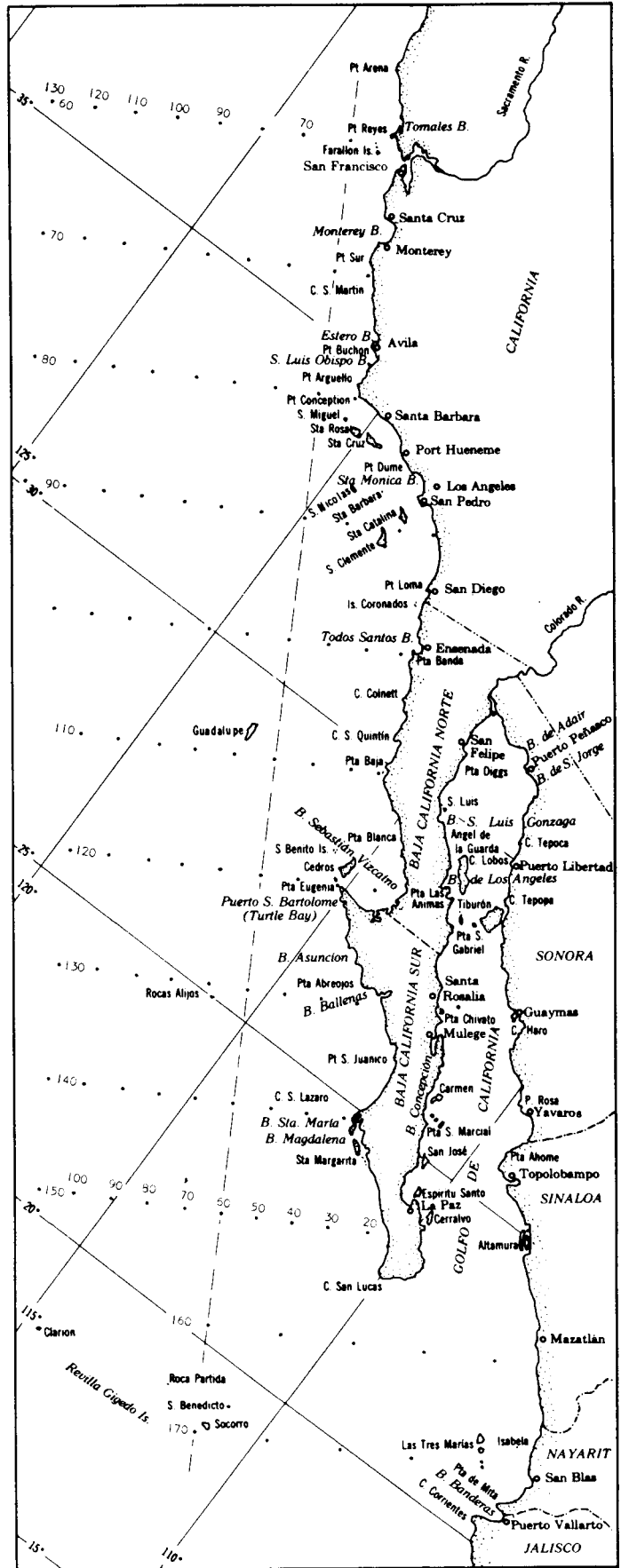
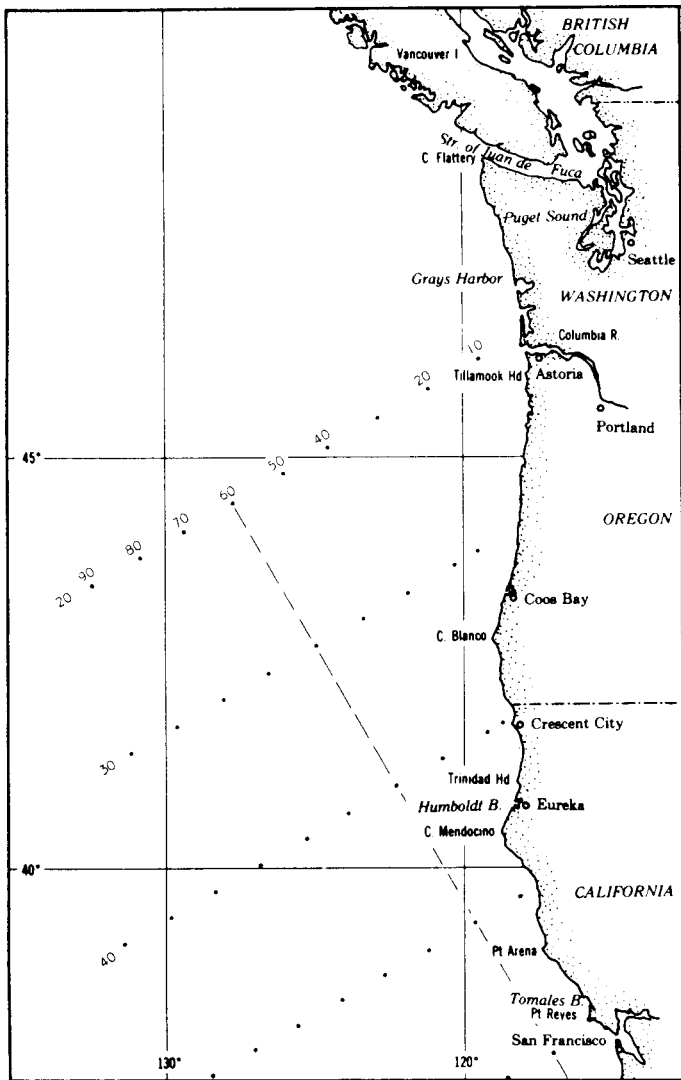
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<i>Tarletonbeania crenularis</i>	38
<i>Tetragonurus cuvieri</i>	104
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Total fish larvae	2
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These maps are designed to show essential details of the area most intensively studied by the California Cooperative Oceanic Fisheries Investigations. This is approximately the same area as is shown in color on the front cover. Geographical place names are those most commonly used in the various publications emerging from the research. The cardinal station lines extending southwestward from the coast are shown. They are 120 miles apart. Additional lines are utilized as needed and can be as closely spaced as 12 miles apart and still have individual numbers. The stations along the lines are numbered with respect to the station 60 line, the numbers increasing to the west and decreasing to the east. Most of them are 40 miles apart, and are numbered in groups of 10. This permits adding stations as close as 4 miles apart as needed. An example of the usual identification is 120.65. This station is on line 120, 20 nautical miles southwest of station 60.

The projection of the front cover is Lambert's Azimuthal Equal Area Projection. The detail maps are a Mercator projection.

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