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ICHTHYOPLANKTON AND STATION DATA FOR MANTA (SURFACE) TOWS TAKEN ON CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS SURVEY CRUISES IN 1991

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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ABSTRACT

This report provides ichthyoplankton data and associated station and tow data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises in 1991. It is the 10th report in a series that presents surface tow data for all biological-oceanographic CalCOFI surveys from 1977 to the present. A total of 244 net tow stations was occupied during four quarterly cruises over the survey area which extended from Avila Beach to San Diego, California and seaward in a southwesterly direction to a maximum of approximately 330 n. mi. The most seaward station, 90.120, was approximately 400 n. mi. west of Punta Baja, Baja California, Mexico. A total of 242 Manta net tows was taken during 1991. The data for stations on which Manta tows were taken are listed in a series of four tables; the background, methodology, and information necessary for interpretation of the data are presented in an accompanying text. All pertinent station and tow data, including volumes of water filtered are listed in the first table. Another table lists, by station and month, standardized counts of each of the 77 larval fish categories identified from Manta tows taken on the survey. This series of reports makes the CalCOFI ichthyoplankton and station data available to all investigators and serves as a guide to the computer data base.

INTRODUCTION

This report, the 11th in a series of surface tow data reports, provides ichthyoplankton and associated station and Manta net tow data from California Cooperative Oceanic Fisheries Investigations (CalCOFI) joint biological-oceanographic survey cruises conducted in 1991. This program was initiated in 1949, under the sponsorship of the Marine Research Committee of the State of California, to study the population fluctuations of the Pacific sardine (*Sardinops sagax*) and the environmental factors that may play a role in these fluctuations. CalCOFI is a partnership among the Southwest Fisheries Science Center (SWFSC) of the National Marine Fisheries Service (NMFS), the Scripps Institution of Oceanography (SIO), and the California Department of Fish and Game (CDFG). NMFS and SIO supply ships and personnel to conduct the sea surveys, NMFS processes the plankton samples and analyzes the ichthyoplankton from them. SIO processes and analyzes hydrographic and biological samples and analyzes invertebrate groups from the plankton samples.

The boundaries, station placement, and sampling frequency for the CalCOFI surveys were based on the results of joint biological-oceanographic cruises conducted by NMFS and SIO during 1939–41. Originally, CalCOFI cruises were designed to collect sardine eggs and larvae in oblique net tows and hydrographic data associated with the tows over the entire areal and seasonal spawning range of the species. From 1951 to 1960 the surveys were annual with cruises conducted monthly. The survey area was occupied quarterly during 1961–1965 and in 1966 the surveys became triennial with monthly cruises. Beginning in 1985 annual surveys were resumed, with quarterly cruises occupying only the Southern California Bight region (see Hewitt 1988; Moser et al. 1993, 1994, 2001a for summaries of historical CalCOFI sampling effort). Neuston¹ sampling with the Manta net (Figure 1) was initiated in 1977-78. Station and ichthyoplankton data for oblique tows taken on the 1991 CalCOFI survey are published in Sandknop et al. (1999). Ahlstrom and Stevens (1976), Gruber et al. (1982) and Doyle (1992a, b) provided initial information

¹Usage of the term “neuston” for surface-living marine organisms is controversial because it was applied originally to organisms associated with the surface film in freshwater habitats (Naumann 1917). Banse (1975) reviewed in detail the evolution of the usage of this term, a related term, “pleuston”, and the various subdivisions of each. Neuston is now used by most workers in referring to the uppermost (upper ~10–20 cm) layer of the sea and to the assemblage of organisms that lives in that zone, either permanently or facultatively (Zaitsev 1970; Hempel and Weikert 1972; Peres 1982; Doyle 1992b). We accept this definition and use it interchangeably with the more general term “surface” (e.g., surface waters, surface zone, surface tow, surface assemblage).

on the distribution and abundance of surface ichthyoplankton in the northeastern Pacific.

Hydrographic and biological data from the 1991 CalCOFI survey were published by the Scripps Institution of Oceanography (Univ. of Calif., SIO 1991, 1992). All available records for Manta tows on the 1991 CalCOFI surveys were verified and edited to produce this data report. The CalCOFI ichthyoplankton data reports make CalCOFI ichthyoplankton and station data available to all investigators and serve as guides to the ichthyoplankton computer data base. They are the basic documents against which changes in the data base can be compared as it is modified to correct errors and update earlier identifications. Citations for previous reports in this series are:

Survey	Report	Survey	Report
1977-78	Moser et al. 2001b	1987	Sandknop et al. 2002a
1980-81	Ambrose et al. 2002a	1988	Watson et al. 2002
1984	Charter et al. 2002a	1989	Ambrose et al. 2002c
1985	Ambrose et al. 2002b	1990	Charter et al. 2002c
1986	Charter et al. 2002b		

SAMPLING AREA AND PATTERN

The 1991 CalCOFI survey consisted of four quarterly cruises on which a total of 245 Manta net tows was taken at the 244 standard CalCOFI net tow stations occupied during the survey (Table 1; Figures 2 and 3). Two vessels were employed on the survey, the NOAA vessel RV *David Starr Jordan* and the SIO vessel *New Horizon*. Dates and numbers of stations sampled with the Manta net in 1991 (Figures 2 and 3) are summarized below:

9101, RV *David Starr Jordan*, 60 stations, 8–23 January;

9103, RV *David Starr Jordan*, 54 stations, 26 February–11 March;

9108, RV *New Horizon*, 65 stations, 24 July–9 August;

9110, RV *New Horizon*, 63 stations, 28 September–14 October.

The survey area extended from Avila Beach to San Diego, California and seaward on six survey lines to approximately 120–330 n. mi. (Figures 1 and 2). The most seaward station, 90.0 120.0, was approximately 400 n. mi. west of Punta Baja, Baja California, Mexico. Stations on CalCOFI line 76.7 and 80.0 extended seaward to station 100.0 on 9101, 9108, and 9110. Line 76.7 was not occupied on 9103. On cruise 9103 line 80.0 was occupied seaward to station 70.0. Stations on lines 83.3 and 86.7 extended to 90.0 on 9101 and to 110.0 on all other cruises. Stations on lines 90.0 and 93.3 extended seaward to station 120.0 on all cruises (Figures 2 and 3).

SAMPLING GEAR AND METHODS

Plankton tows were made with a modified version of the Manta net originally designed by Brown and Cheng (1981). It consists of a rectangular mouth 15.5 cm deep and 86 cm wide attached to a frame that supports square lateral extensions covered with plywood and urethane foam (Figure 1). These extensions stabilize the net when it is towed and keep the top of the net at the sea surface. The net is constructed of

0.505 mm nylon mesh. The towing bridle is asymmetrical with one side longer than the other; when the net is towed this bridle arrangement forces the mouth away from the ship at a slight angle. A General Oceanics flowmeter was suspended across the center of the net mouth to measure the amount of water filtered during each tow. At each Manta tow station the tow line from the bridle was attached to the hydrographic wire and then lowered to slightly below the surface of the water before the net was deployed. The net was towed at a ship speed of 1.0–2.0 knots for 15 minutes. Samples were preserved in 5% buffered formalin and returned to the plankton sorting laboratory at the SWFSC at the end of the cruise.

LABORATORY PROCEDURES

The ichthyoplankton was removed from the invertebrate portion of each sample and bottled separately in 3% buffered formalin. In addition to fish eggs and larvae, some samples contained surface-living juvenile, and occasionally adult, stages of fishes; these were removed and bottled separately in 3% formalin. The volume of water filtered by each net was computed from the flowmeter readings. A “standard haul factor” is used for oblique CalCOFI net tows to calculate the total number of ichthyoplankters of a taxon per unit surface area (Kramer et al 1972; Smith and Richardson 1977; Moser et al. 1993). A requirement for this is the entire depth distribution of the taxon must be encompassed during the tow. The Manta net samples only the upper ~15.5 cm of the water column and most, if not all, ichthyoplankton taxa that inhabit the surface zone have a vertical range > 15.5 cm. Even taxa associated with the immediate surface layer may range deeper than 15.5 cm as a result of diel migratory patterns or vertical mixing (Hempel and Weikert 1972; Doyle 1992b). Calculation of total numbers of eggs or larvae per unit surface area from Manta net samples awaits accurate information on the fine-scale vertical distribution of these organisms in the upper region of the water column. Even if there are few species whose larvae are restricted to the upper 15.5 cm of the water column, the time series of Manta samples provides a useful index of relative abundance for species whose larvae appear in these samples. In this report we express quantities of eggs or larvae in each sample as unadjusted counts or as numbers of eggs or larvae per unit volume of water filtered by the net.

IDENTIFICATION

Constituent taxa in the samples were identified by the senior author. Early ontogenetic stages of fishes are difficult to identify; most identifications were based on descriptions of ontogenetic series of fishes in published identification guides to early stages of fishes in the northeastern Pacific (Matarese et al. 1989; Moser 1996). Larval specimens that could not be identified with these guides were identified by establishing ontogenetic series on the basis of morphology, meristics, and pigmentation, and then linking these series through overlapping features to known metamorphic, juvenile, or adult stages (Miller and Lea 1972; Eschmeyer et al. 1983; Powles and Markle 1984). Except for damaged specimens, most of the larvae and juvenile/adults taken in the surface tows could be identified to species. A total of 77 larval fish categories (including the unidentified category) was identified: 69 to species, 6 to genus, and 1 to family.

The following taxonomic categories in Tables 2–4 require special explanation:

Lampanyctus spp.—most of the larvae in this category are small (< 5 mm), often damaged, specimens belonging to the subgroup of *Lampanyctus*, characterized by small or absent pectoral fins in adults, placed by Zahuranec (2000) in the genus *Nannobranchium*; two *Nannobranchium* species, *N. ritteri* (formerly *L. ritteri*) and *N. regale* (formerly *L. regalis*), occur commonly in the present CalCOFI survey pattern; larvae of these species > ~ 5 mm have been identified in oblique tow samples since 1954; beginning in 1985, larvae of two other species, *N. bistori* and *N. hawaiiensis*, have been identified and included in the CalCOFI data base for oblique tows; in previous oblique tow data reports these were referred to as *Lampanyctus* “niger” and *Lampanyctus* “no pectorals”, respectively (see Moser 1996).

Vinciguerria lucetia–*V. lucetia*, an eastern tropical Pacific species, is common in the present CalCOFI region whereas the central water mass species *V. poweriae* is rarely encountered; a small percentage of *V. poweriae* larvae may have been included in the *V. lucetia* category because of the difficulty in separating early larvae of the two species.

SPECIES SUMMARY

Of the five most abundant larvae, northern anchovy (*Engraulis mordax*) ranked first in abundance with 64.0% of the total fish larvae and first in occurrence with larvae taken in 28.9% of the total samples (Tables 2 and 3). They were more than twice as abundant as the second most abundant species, Pacific sardine (*Sardinops sagax*), which had 10.8% of the total larvae and ranked third occurrence (17.8% of the total samples). Jacksmelt (*Atherinopsis californiensis*) was the third most abundant taxon with 4.9% of the total larvae and ranked 13th in frequency of occurrence (3.7% of the samples). The rockfish genus *Sebastes* ranked fourth in abundance (3.2% of total larvae) and fourth in total occurrences (17.4% of the samples). Pacific saury (*Cololabis saira*) ranked fifth in abundance (3.0% of total larvae) and second in total occurrences (28.5% of the samples). The next five most abundant taxa were cabezon *Scorpaenichthys marmoratus* (2.4% of total larvae), Pacific hake *Merluccius productus* (2.3%), Pacific mackerel *Scomber japonicus* (1.6%), lingcod *Ophiodon elongatus* (1.3%), and seniorita *Oxyjulis californica* (0.7%). These species ranked 5th, 14th, tied for 9th, 49th, and tied for 9th in frequency of occurrence, respectively. The high abundance of lingcod is attributable to a single large collection (99 larvae) at station 83.3 55.0 on Cruise 9103. The 10 most abundant taxa comprised 94.1% of all the larvae collected in Manta net tows on CalCOFI cruises in 1991. The remaining 5.9% was distributed among 67 other taxa (including the unidentified category). Of the ten most abundant taxa, four were coastal pelagic species, four were coastal demersal taxa, and one was epipelagic.

In comparison with the Manta collections, among the 149 taxa collected in the oblique tows during the 1991 survey, northern anchovy also ranked first in abundance with 33.9% of the total larvae and ranked third in occurrence with 33.9% positive tows. Pacific sardine ranked third in abundance in Manta tows and sixth in abundance in oblique tows. Among the top ten most abundant taxa in the oblique tows, only four (northern anchovy, Pacific hake, *Sebastes* spp., and Pacific sardine), were among the ten most abundant in the Manta tows (Sandknop et al. 1999).

EXPLANATION OF TABLES

Table 1. This table lists for each tow the pertinent station and tow data, the volume of water filtered, and the total number of fish eggs and larvae for ichthyoplankton stations occupied during the 1991 CalCOFI survey. Cruises are designated by a six character alphanumeric code; the first two digits indicate the year and the second two the month, followed by the ship code, JD (*David Starr Jordan*) or NH (*New Horizon*). Within each cruise the data are listed in order of increasing line and station number (southerly and seaward directions); the order of station occupancy is shown on the station charts (Figures 2 and 3). Stations are designated by two groups of numbers; the first set indicates the line and decimal fraction and the second set indicates the station and decimal fraction. Time is listed as Pacific Standard Time at the start of each tow in 24-hour designation. The values for total fish eggs and larvae are raw counts (unadjusted for volume of water filtered). The listings for station latitude and longitude in this table may differ from values given for the same station in the SIO data reports, reflecting the slight difference in position of the net tow and hydrocast.

Table 2. Pooled occurrences of all larval fish taxa taken in Manta nets on the RV *David Starr Jordan* and the RV *New Horizon* during the 1991 CalCOFI survey. Taxa are listed in rank order.

Table 3. Pooled counts (unadjusted for volume of water filtered) of all larval fish taxa taken in Manta net tows on the the RV *David Starr Jordan* and the RV *New Horizon* during the 1991 CalCOFI survey. Taxa are listed in rank order.

Table 4. Numbers of fish larvae for each taxon taken in Manta net tows on the RV *David Starr Jordan* and the RV *New Horizon* during the 1991 CalCOFI survey. Numbers of larvae are listed as number per 100 m³ of water filtered. Orders and families are listed in phylogenetic sequence (Eschmeyer 1998); other taxa are listed alphabetically.

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LITERATURE CITED

- Ahlstrom, E. H. and E. G. Stevens. 1976. Report of neuston (surface) collections made on an extended CalCOFI cruise during May 1972. Calif. Coop. Oceanic Fish. Invest. Rep. 18:167–180.
- Ambrose, D. A., R. L. Charter, and H. G. Moser. 2002a. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1980-81. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-319. 100 pp.
- Ambrose, D. A., R. L. Charter, and H. G. Moser. 2002b. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1985. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-321. 36 pp.
- Ambrose, D. A., R. L. Charter, and H. G. Moser. 2002c. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1989. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-325. 45 pp.
- Banse, K. 1975. Pleuston and neuston: on the categories of organisms in the uppermost pelagial. Int. Rev. ges. Hydrobiol. 60(4):439–447.
- Brown, D. M. and L. Cheng. 1981. New net for sampling the ocean surface. Mar. Ecol. Prog. Ser. 5:224–227.
- Charter, S. R., R. L. Charter, and H. G. Moser. 2002a. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1984. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-320. 84 pp.
- Charter, S. R., R. L. Charter, and H. G. Moser. 2002b. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1986. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-322. 40 pp.

- Charter, S. R., R. L. Charter, and H. G. Moser. 2002c. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1990. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-326. 41 pp.
- Doyle, M. J. 1992a. Patterns in distribution and abundance of ichthyoplankton off Washington, Oregon, and northern California (1980–1987). U.S. Dep. Commer., Nat. Mar. Fish. Serv., Alaska Fish. Sci. Ctr. Proc. Rep. 92-14. 344 pp.
- Doyle, M. J. 1992b. Neustonic ichthyoplankton in the northern region of the California Current ecosystem. Calif. Coop. Oceanic Fish. Invest. Rep. 33:141–161.
- Eschmeyer, W. N. (ed.). 1998. Catalog of fishes. Center for Biodiversity Research and Information. Calif. Acad. Sci. Spec. Publ. 1. Vols. I-III. 2905 pp.
- Eschmeyer, W. N., E. S. Herald, and H. Hammann. 1983. A field guide to Pacific coast fishes of North America. Houghton Mifflin Co. Boston. 336 pp.
- Gruber, D., E. H. Ahlstrom, and M. M. Mullin. 1982. Distribution of ichthyoplankton in the Southern California Bight. Calif. Coop. Oceanic Fish. Invest. Rep. 23:172–179.
- Hempel, G. and H. Weikert. 1972. The neuston of the subtropical and boreal northeastern Atlantic Ocean. A review. Mar. Biol. 13:70–88.
- Hewitt, R. P. 1988. Historical review of the oceanographic approach to fishery research. Calif. Coop. Oceanic Fish. Invest. Rep. 29:27-41.
- Kramer, D., M. Kalin, E. G. Stevens, J. R. Thrailkill, and J. R. Zweifel. 1972. Collecting and processing data on fish eggs and larvae in the California Current Region. NOAA Tech. Rep. NMFS Circ. 370. 38 pp.
- Matarese, A. C., A. W. Kendall, Jr., D. M. Blood, and B. M. Vinter. 1989. Laboratory guide to early life history stages of northeast Pacific fishes. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 80. 652 pp.
- Miller, D. J. and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Dep. Fish Game. Fish Bull. 157. 235 pp.
- Moser, H. G. (ed.). 1996. The early stages of fishes in the California Current region. CalCOFI Atlas 33. 1505 pp.
- Moser, H. G., R. L. Charter, P. E. Smith, D. A. Ambrose, S. R. Charter, C. A. Meyer, E. M. Sandknop, and W. Watson. 1993. Distributional atlas of fish larvae and eggs in the California Current region: taxa with 1000 or more total larvae, 1951 through 1984. CalCOFI Atlas 31. 233 pp.
- Moser, H. G., R. L. Charter, P. E. Smith, D. A. Ambrose, S. R. Charter, C. A. Meyer, E. M. Sandknop, and W. Watson. 1994. Distributional atlas of fish larvae in the California Current region: taxa with less than 1000 total larvae, 1951 through 1984. CalCOFI Atlas 32. 181 pp.

- Moser, H. G., R. L. Charter, P. E. Smith, D. A. Ambrose, W. Watson, S. R. Charter, and E. M. Sandknop. 2001a. Distributional atlas of fish larvae and eggs in the Southern California Bight region: 1951–1998. CalCOFI Atlas 34. 166 pp.
- Moser, H. G., R. L. Charter, D. A. Ambrose, and E. M. Sandknop. 2001b. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1977–78. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-313. 58 pp.
- Naumann, E. 1917. Beiträge zur Kenntnis des Teichnannoplanktons. II. Über das Neuston das Süßwassers. Biol. Zentralbl. 37:98–106.
- Peres, J. M. 1982. Specific pelagic assemblages: 1. Assemblages at the air-ocean interface *In* Marine Ecology. O. Kinne (ed.). 5 (1):313–372.
- Powles, H. and D. F. Markle. 1984. Identification of larvae. Pages 31–33 *in* H. G. Moser, W. J. Richards, D. M. Cohen, M. P. Fahay, A. W. Kendall, Jr., and S. L. Richardson (eds.). Ontogeny and Systematics of Fishes. Am. Soc. Ichthyol. Herpetol. Spec. Publ. 1. 760 pp.
- Sandknop, E. M., R. L. Charter, and H. G. Moser. 1999. Ichthyoplankton and station data for California Cooperative Oceanic Fisheries Investigations survey cruises in 1991. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-272. 90 pp.
- Sandknop, E. M., R. L. Charter, and H. G. Moser. 2002a. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1987. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-323. 40 pp.
- Smith, P. E. and S. L. Richardson. 1977. Standard techniques for pelagic fish egg and larva surveys. FAO Fish. Tech. Pap. 175. 100 pp.
- University of California, Scripps Institution of Oceanography. 1991. Data Report. Physical, chemical and biological data. CalCOFI Cruise 9101, 8–23 January 1991 and CalCOFI Cruise 9103, 26 February–11 March 1991. SIO Ref. 91-22. 89 pp.
- University of California, Scripps Institution of Oceanography. 1992. Data Report. Physical, chemical and biological data. CalCOFI Cruise 9108, 24 July–9 August 1991 and CalCOFI Cruise 9110, 28 September–14 October 1991. SIO Ref. 92-16. 97 pp.
- Watson, W., R. L. Charter, and H. G. Moser. 2002. Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations survey cruises in 1988. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-324. 44 pp.
- Zahuranec, B. J. 2000. Zoogeography and systematics of the lanternfishes of the genus *Nannobranchium* (Lampanyctini: Myctophidae). Smiths. Contrib. Zool. 607. 69 pp.
- Zaitsev, Y. P. 1970. Marine neustonology. Naukova Dumka. Kiev. 264 pp. [In Russian]. [English transl.: 1971. Israel Progr. Sci. Transl. No. 5976. 207 pp.]

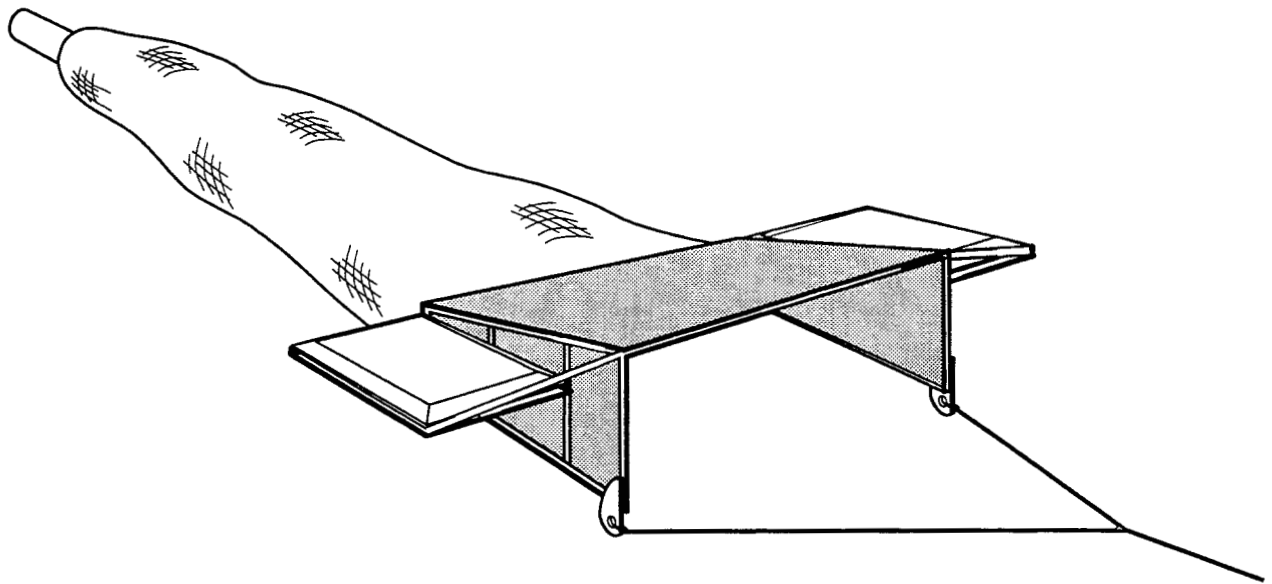


Figure 1. Diagram of the Manta net used on CalCOFI surveys.

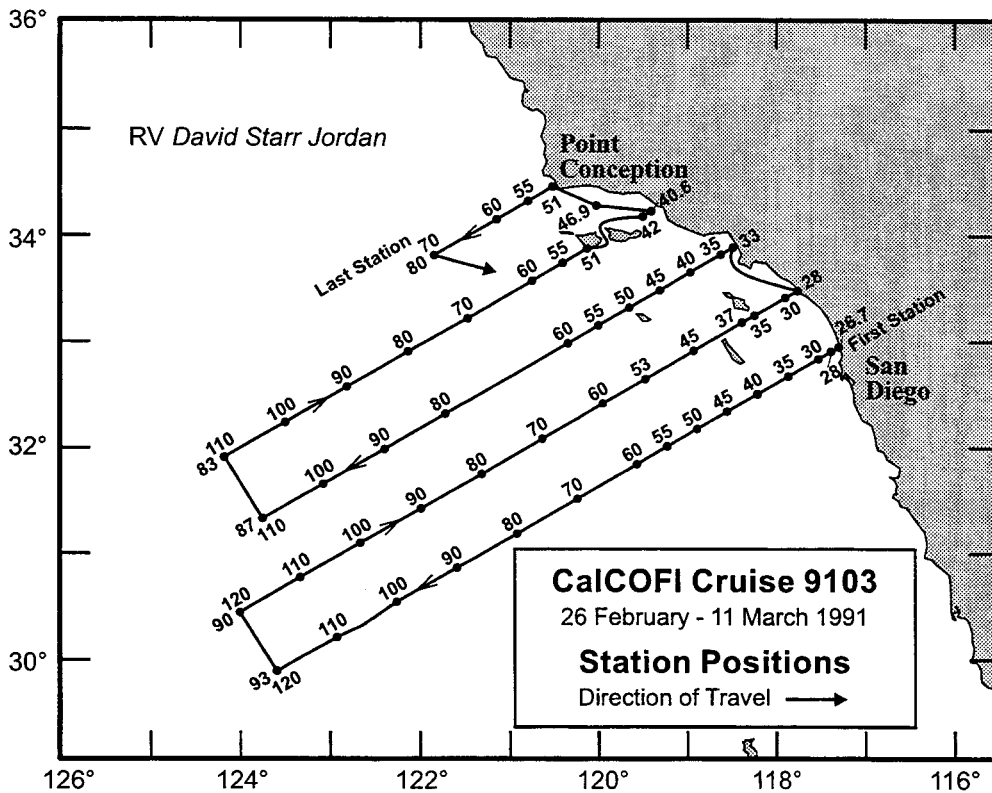
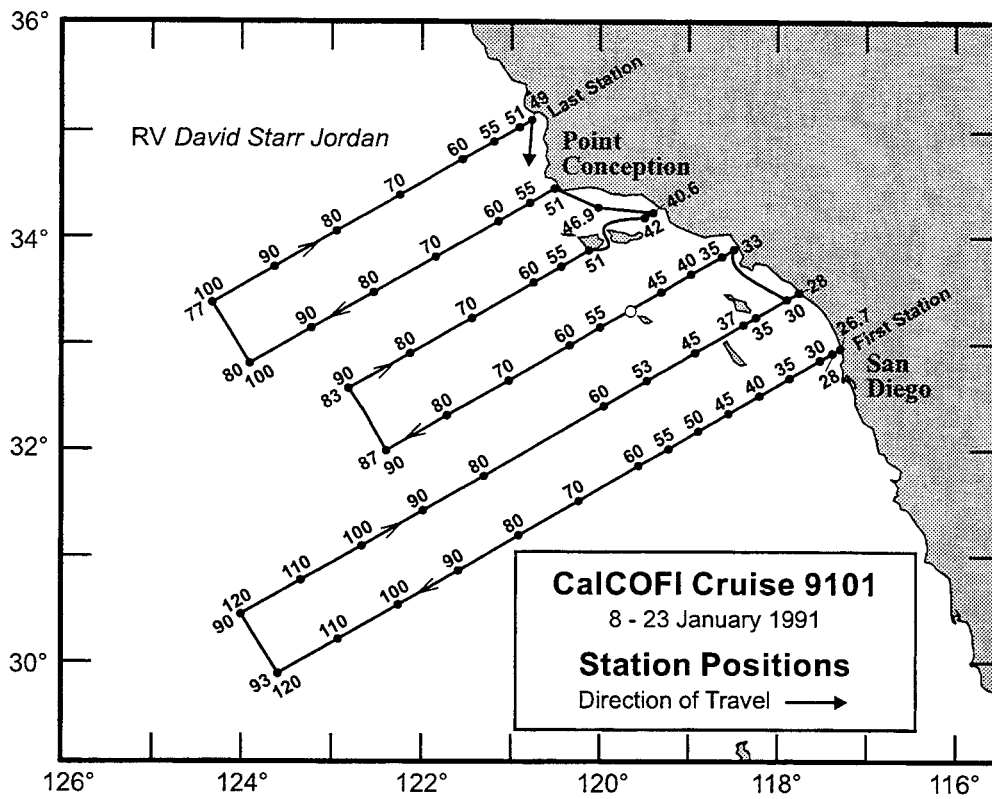


Figure 2. Stations and cruise tracks for CalCOFI cruises 9101 (above) and 9103 (below). Dots indicate stations where Manta and oblique tows were taken; open circles indicate stations where only oblique tows were taken.

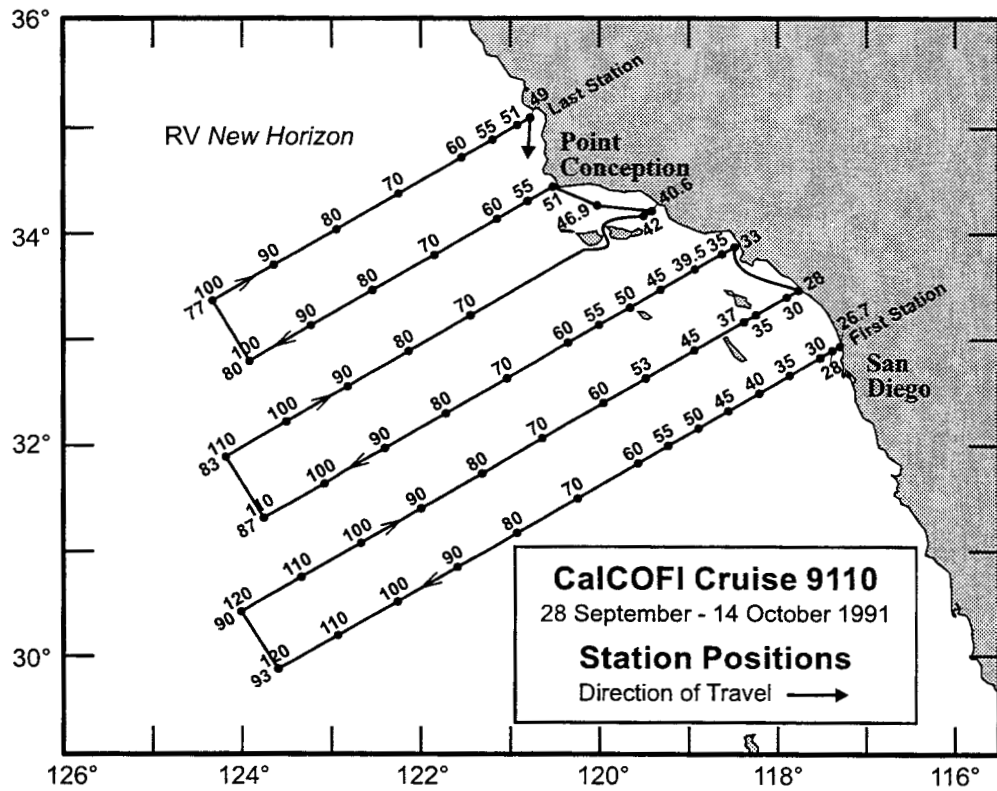
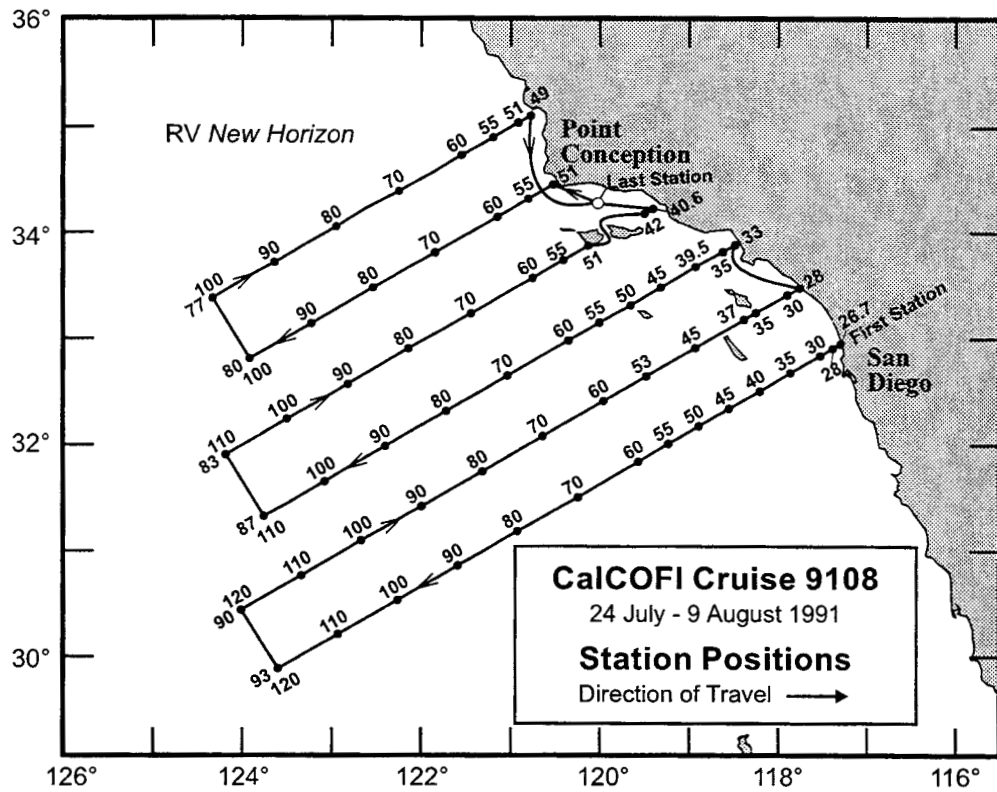


Figure 3. Stations and cruise tracks for CalCOFI cruises 9108 (above) and 9110 (below). Symbols as in Figure 2.

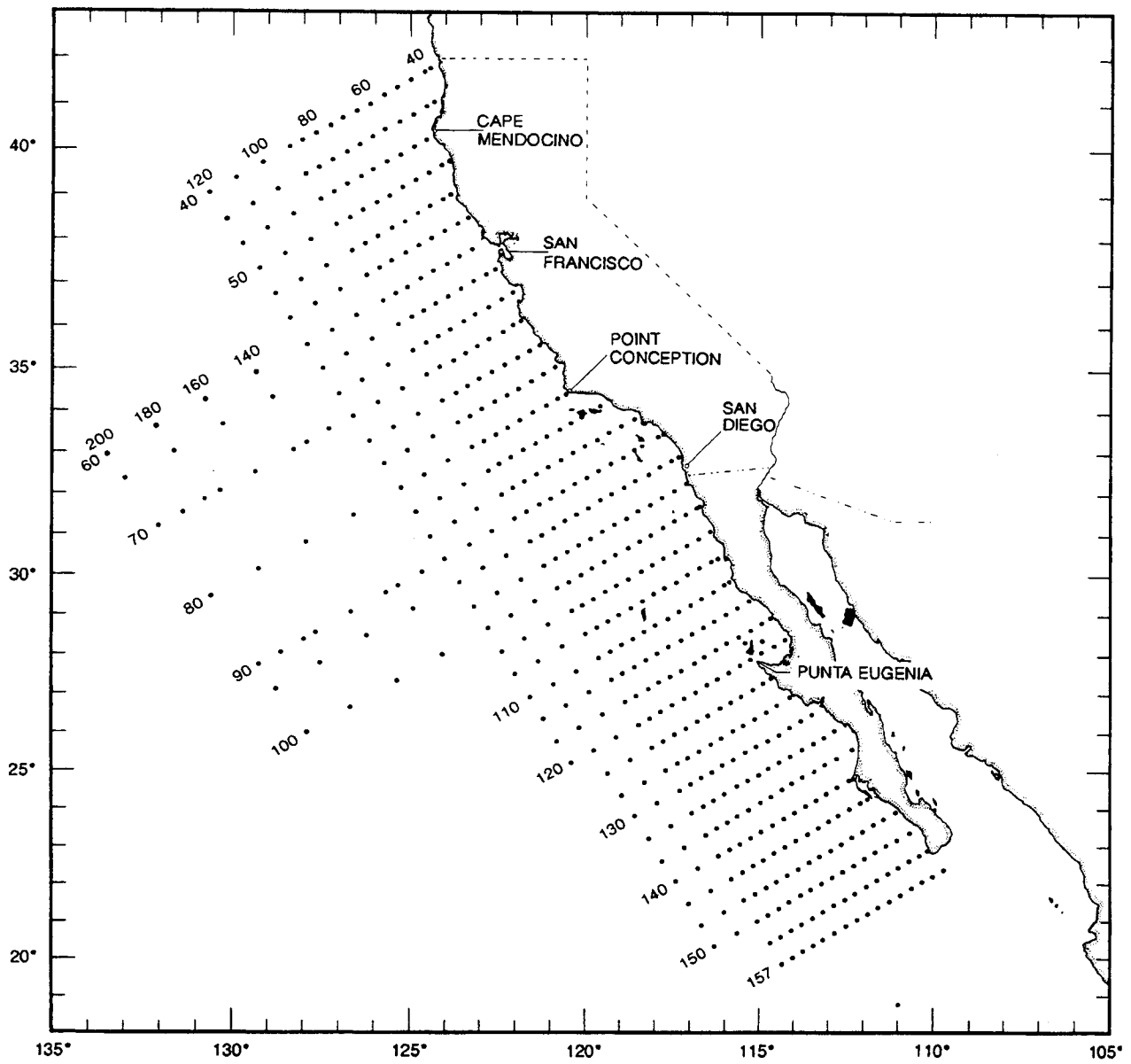


Figure 4. The basic station plan for CalCOFI cruises from 1950 - 1984.

TABLE 1. Station and plankton tow data for Manta tows taken on the 1991 CalCOFI survey. Numbers of fish eggs and larvae are raw counts, unadjusted for volume (cubic meters) of water filtered.

CalCOFI Cruise 9101													
Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume		
		deg.	min.	deg.	min.		yr.	mo.	day		Water Strained	Total Larvae	Total Eggs
76.7	49.0	35	05.4	120	46.5	JD	91	01	22	1320	92	54	508
76.7	51.0	35	01.3	120	55.1	JD	91	01	22	1023	97	2	835
76.7	55.0	34	53.3	121	11.9	JD	91	01	22	0722	80	1	7
76.7	60.0	34	43.4	121	32.9	JD	91	01	22	0313	90	5	34
76.7	70.0	34	23.3	122	14.8	JD	91	01	21	2045	81	172	47
76.7	80.0	34	03.3	122	56.5	JD	91	01	21	1305	103	2	73
76.7	90.0	33	43.3	123	38.0	JD	91	01	21	0659	80	0	1
76.7	100.0	33	23.2	124	19.4	JD	91	01	21	0032	80	1	2
80.0	51.0	34	27.0	120	31.4	JD	91	01	19	1034	90	12	401
80.0	55.0	34	19.0	120	48.1	JD	91	01	19	1408	70	0	10
80.0	60.0	34	09.0	121	09.0	JD	91	01	19	1835	77	1	14
80.0	70.0	33	49.0	121	50.6	JD	91	01	20	0048	79	0	9
80.0	80.0	33	29.0	122	32.0	JD	91	01	20	0649	70	0	12
80.0	90.0	33	09.0	123	13.2	JD	91	01	20	1248	79	0	5
80.0	100.0	32	49.0	123	54.4	JD	91	01	20	1818	71	2	7
81.8	46.9	34	16.5	120	01.5	JD	91	01	19	0629	92	37	50
83.3	40.6	34	13.5	119	24.7	JD	91	01	19	0126	99	45	4400
83.3	42.0	34	10.7	119	30.5	JD	91	01	18	2305	60	48	812
83.3	51.0	33	52.7	120	07.9	JD	91	01	18	1703	87	18	597
83.3	55.0	33	43.7	120	26.7	JD	91	01	18	1312	94	1	5
83.3	60.0	33	34.7	120	45.4	JD	91	01	18	0903	91	5	38
83.3	70.0	33	14.6	121	26.6	JD	91	01	18	0253	96	0	7
83.3	80.0	32	54.7	122	07.6	JD	91	01	17	2043	91	0	13
83.3	90.0	32	34.8	122	48.7	JD	91	01	17	1420	92	0	3
86.7	33.0	33	53.4	118	29.5	JD	91	01	15	0145	95	319	213
86.7	35.0	33	49.3	118	37.9	JD	91	01	15	0422	93	289	2045
86.7	40.0	33	39.4	118	58.6	JD	91	01	15	0826	79	1	166
86.7	45.0	33	29.4	119	19.0	JD	91	01	15	1251	76	26	269
86.7	55.0	33	09.4	120	00.4	JD	91	01	16	0806	87	8	197
86.7	60.0	32	59.4	120	20.9	JD	91	01	16	1224	78	0	36
86.7	70.0	32	39.4	121	02.0	JD	91	01	16	1928	72	1	1
86.7	80.0	32	19.6	121	42.9	JD	91	01	17	0132	85	1	2
86.7	90.0	31	59.4	122	23.6	JD	91	01	17	0738	74	0	0
90.0	28.0	33	29.1	117	46.1	JD	91	01	14	1710	92	13	117
90.0	30.0	33	25.1	117	54.2	JD	91	01	14	1935	84	7	1093
90.0	35.0	33	15.1	118	15.0	JD	91	01	14	1045	94	5	3717
90.0	37.0	33	11.0	118	23.3	JD	91	01	14	0745	92	19	74
90.0	45.0	32	55.1	118	56.0	JD	91	01	14	0226	82	0	3
90.0	53.0	32	39.3	119	28.8	JD	91	01	13	2040	78	12	141
90.0	60.0	32	25.1	119	57.6	JD	91	01	13	1450	72	0	13
90.0	80.0	31	45.1	121	18.8	JD	91	01	13	0228	83	1	1
90.0	90.0	31	25.0	121	59.1	JD	91	01	12	1832	77	2	2
90.0	100.0	31	05.0	122	39.7	JD	91	01	12	1150	80	0	1
90.0	110.0	30	45.1	123	19.9	JD	91	01	12	0531	81	9	0
90.0	120.0	30	25.2	123	59.9	JD	91	01	12	0001	92	7	3
93.3	26.7	32	57.4	117	18.3	JD	91	01	08	1520	109	0	1
93.3	28.0	32	54.8	117	23.6	JD	91	01	08	1829	82	0	3

TABLE 1. (cont.)

CalCOFI Cruise 9101 (cont.)

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
93.3	30.0	32	50.9	117	32.0	JD	91	01	08	2136	96	3	2
93.3	35.0	32	40.8	117	52.3	JD	91	01	09	0208	84	10	27
93.3	40.0	32	30.8	118	12.7	JD	91	01	09	0618	87	2	11
93.3	45.0	32	20.8	118	33.2	JD	91	01	09	1035	78	1	3
93.3	50.0	32	10.9	118	53.6	JD	91	01	09	1609	79	3	6
93.3	55.0	32	00.7	119	13.9	JD	91	01	09	2105	82	11	9
93.3	60.0	31	50.9	119	34.2	JD	91	01	10	0119	70	3	6
93.3	70.0	31	30.7	120	14.8	JD	91	01	10	0821	82	0	0
93.3	80.0	31	10.9	120	55.2	JD	91	01	10	1735	72	0	5
93.3	90.0	30	50.5	121	35.4	JD	91	01	10	2340	79	3	3
93.3	100.0	30	30.8	122	15.4	JD	91	01	11	0542	81	11	3
93.3	110.0	30	10.9	122	55.3	JD	91	01	11	1149	91	1	48
93.3	120.0	29	50.8	123	35.2	JD	91	01	11	1803	84	8	0

CalCOFI Cruise 9103

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
80.0	51.0	34	27.1	120	31.4	JD	91	03	09	2012	96	844	80
80.0	55.0	34	19.0	120	48.1	JD	91	03	09	2308	82	122	8
80.0	60.0	34	09.0	121	09.0	JD	91	03	10	0303	50	10	5
80.0	70.0	33	49.0	121	50.5	JD	91	03	10	0907	75	1	6
81.8	46.9	34	16.5	120	01.5	JD	91	03	09	1535	94	712	218
83.3	40.6	34	13.5	119	24.7	JD	91	03	09	1017	102	4	629
83.3	42.0	34	10.6	119	30.5	JD	91	03	09	0827	89	56	40
83.3	51.0	33	52.7	120	08.0	JD	91	03	09	0223	92	1209	366
83.3	55.0	33	44.7	120	24.6	JD	91	03	08	2259	88	355	65
83.3	60.0	33	34.7	120	45.2	JD	91	03	08	1900	100	3	8
83.3	70.0	33	13.4	121	28.3	JD	91	03	08	1300	85	0	9
83.3	80.0	32	54.7	122	07.9	JD	91	03	08	0642	84	2	0
83.3	90.0	32	34.7	122	48.7	JD	91	03	08	0037	68	4	43
83.3	100.0	32	14.5	123	29.6	JD	91	03	07	1840	81	0	26
83.3	110.0	31	54.8	124	10.2	JD	91	03	07	1242	68	1	9
86.7	33.0	33	53.4	118	29.4	JD	91	03	04	2320	98	383	3912
86.7	35.0	33	49.4	118	37.7	JD	91	03	05	0133	84	33	32
86.7	40.0	33	39.4	118	58.5	JD	91	03	05	0548	85	7	49
86.7	45.0	33	29.4	119	19.1	JD	91	03	05	0958	74	10	228
86.7	50.0	33	19.5	119	39.8	JD	91	03	05	1411	79	296	1135
86.7	55.0	33	09.4	120	00.4	JD	91	03	05	1828	76	203	2
86.7	60.0	32	59.4	120	21.0	JD	91	03	05	2227	89	3	4
86.7	80.0	32	19.4	121	43.0	JD	91	03	06	1022	90	0	1
86.7	90.0	31	59.3	122	23.6	JD	91	03	06	1703	82	2	1
86.7	100.0	31	39.3	123	04.2	JD	91	03	06	2302	79	0	40
86.7	110.0	31	19.4	123	44.7	JD	91	03	07	0552	81	2	6
90.0	28.0	33	29.1	117	46.1	JD	91	03	04	1708	105	387	1900
90.0	30.0	33	25.1	117	54.3	JD	91	03	04	1440	85	14	2149
90.0	35.0	33	15.1	118	15.0	JD	91	03	04	1041	85	187	4051
90.0	37.0	33	11.1	118	23.3	JD	91	03	04	0707	98	3	232
90.0	45.0	32	55.2	118	56.0	JD	91	03	04	0156	85	7	289

TABLE 1. (cont.)

CalCOFI Cruise 9103 (cont.)

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
90.0	53.0	32	39.1	119	28.8	JD	91	03	03	2100	104	172	34
90.0	60.0	32	25.2	119	57.5	JD	91	03	03	1617	94	3	15
90.0	70.0	32	05.1	120	38.3	JD	91	03	03	0942	69	0	2
90.0	80.0	31	45.1	121	18.9	JD	91	03	03	0323	68	2	114
90.0	90.0	31	25.0	121	59.4	JD	91	03	02	2207	68	1	1
90.0	100.0	31	05.1	122	39.7	JD	91	03	02	1638	87	1	5
90.0	110.0	30	45.1	123	19.7	JD	91	03	02	0831	85	1	4
90.0	120.0	30	25.1	123	59.9	JD	91	03	02	0254	74	13	5
93.3	26.7	32	57.4	117	18.4	JD	91	02	26	1241	98	9	73
93.3	28.0	32	54.9	117	23.7	JD	91	02	26	1434	98	1	1
93.3	30.0	32	50.7	117	31.9	JD	91	02	26	1730	96	16	15
93.3	35.0	32	40.7	117	52.5	JD	91	02	26	2132	90	3	5052
93.3	40.0	32	30.8	118	12.9	JD	91	02	27	0123	71	6	17
93.3	45.0	32	20.9	118	33.3	JD	91	02	27	0551	88	1	108
93.3	50.0	32	10.9	118	53.7	JD	91	02	27	1024	92	2	60
93.3	55.0	32	00.8	119	14.1	JD	91	02	27	1538	74	6	215
93.3	60.0	31	50.8	119	34.2	JD	91	02	27	2001	79	5	24
93.3	70.0	31	30.8	120	14.7	JD	91	02	28	0241	76	3	4
93.3	80.0	31	10.4	120	55.3	JD	91	02	28	1000	79	3	3
93.3	90.0	30	50.7	121	35.3	JD	91	02	28	1931	84	1	1
93.3	100.0	30	30.9	122	15.6	JD	91	03	01	0707	82	0	2
93.3	110.0	30	10.4	122	55.4	JD	91	03	01	1428	62	0	3
93.3	120.0	29	50.8	123	35.2	JD	91	03	01	2050	69	0	0

CalCOFI Cruise 9108

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
76.7	49.0	35	05.3	120	46.5	JD	91	08	08	0020	69	9	229
76.7	51.0	35	01.4	120	55.1	JD	91	08	07	2220	72	29	0
76.7	55.0	34	53.3	121	11.9	JD	91	08	07	1909	71	26	0
76.7	60.0	34	43.3	121	32.9	JD	91	08	07	1517	74	2	3
76.7	70.0	34	23.3	122	14.8	JD	91	08	07	0803	72	0	30
76.7	80.0	34	03.3	122	56.5	JD	91	08	07	0100	78	7	45
76.7	90.0	33	43.3	123	38.0	JD	91	08	06	1836	78	2	17
76.7	100.0	33	23.3	124	19.4	JD	91	08	06	1206	83	8	53
80.0	51.0	34	27.0	120	31.4	JD	91	08	04	2138	77	32	503
80.0	55.0	34	19.1	120	48.2	JD	91	08	05	0055	76	30	3
80.0	60.0	34	09.0	121	09.0	JD	91	08	05	0443	68	8	0
80.0	70.0	33	49.0	121	50.5	JD	91	08	05	1200	69	2	87
80.0	80.0	33	29.0	122	32.0	JD	91	08	05	1807	79	1	6
80.0	90.0	33	09.0	123	13.5	JD	91	08	06	0030	75	15	61
80.0	100.0	32	49.0	123	54.4	JD	91	08	06	0558	88	3	13
83.3	40.6	34	13.6	119	24.8	JD	91	08	04	1218	87	67	1838
83.3	42.0	34	10.7	119	30.5	JD	91	08	04	0728	92	189	614
83.3	51.0	33	52.7	120	08.1	JD	91	08	04	0055	56	0	168
83.3	55.0	33	44.7	120	24.6	JD	91	08	03	2129	80	2	0
83.3	60.0	33	34.7	120	45.3	JD	91	08	03	1712	21	0	20
83.3	70.0	33	14.6	121	26.6	JD	91	08	03	1120	74	4	73

TABLE 1. (cont.)

CalCOFI Cruise 9108 (cont.)

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
83.3	80.0	32	54.9	122	07.9	JD	91	08	03	0428	82	5	0
83.3	90.0	32	34.7	122	48.8	JD	91	08	02	2201	76	1	1
83.3	100.0	32	14.7	123	29.6	JD	91	08	02	1419	70	5	4
83.3	110.0	31	54.7	124	10.2	JD	91	08	02	0630	70	8	4
86.7	33.0	33	53.4	118	29.4	JD	91	07	30	1655	83	3	2451
86.7	35.0	33	49.4	118	37.7	JD	91	07	30	1910	86	2	451
86.7	39.5	33	41.0	118	56.0	JD	91	07	31	0010	78	5	1800
86.7	45.0	33	29.4	119	19.2	JD	91	07	31	0357	87	5	11
86.7	50.0	33	19.4	119	39.7	JD	91	07	31	0724	85	2	563
86.7	55.0	33	09.4	120	00.4	JD	91	07	31	1228	72	0	17
86.7	60.0	32	59.4	120	21.0	JD	91	07	31	1630	78	0	4
86.7	70.0	32	39.4	121	02.0	JD	91	07	31	2320	83	8	40
86.7	80.0	32	19.4	121	42.9	JD	91	08	01	0448	82	0	70
86.7	90.0	31	59.4	122	23.6	JD	91	08	01	1014	70	1	14
86.7	100.0	31	39.3	123	04.4	JD	91	08	01	1725	77	3	7
86.7	110.0	31	19.3	123	44.7	JD	91	08	02	0005	76	8	489
90.0	28.0	33	29.1	117	46.0	JD	91	07	30	0731	88	2	551
90.0	30.0	33	25.2	117	54.2	JD	91	07	30	0530	93	9	8
90.0	35.0	33	15.1	118	15.3	JD	91	07	30	0133	94	0	548
90.0	37.0	33	11.1	118	23.2	JD	91	07	29	2240	74	7	23
90.0	45.0	32	55.1	118	56.1	JD	91	07	29	1748	76	0	4
90.0	53.0	32	39.0	119	28.9	JD	91	07	29	1202	80	0	0
90.0	60.0	32	25.1	119	57.6	JD	91	07	29	0546	74	0	27
90.0	70.0	32	05.1	120	38.4	JD	91	07	28	2351	76	0	34
90.0	80.0	31	45.1	121	18.9	JD	91	07	28	1707	78	5	6
90.0	90.0	31	25.1	121	59.4	JD	91	07	28	1125	82	4	208
90.0	100.0	31	05.2	122	39.6	JD	91	07	28	0505	79	0	25
90.0	110.0	30	45.1	123	19.9	JD	91	07	27	2321	81	5	232
90.0	120.0	30	25.0	123	59.9	JD	91	07	27	1756	88	3	194
93.3	26.7	32	57.4	117	18.3	JD	91	07	24	1028	95	4	39
93.3	28.0	32	54.8	117	23.7	JD	91	07	24	1533	88	2	25
93.3	30.0	32	50.8	117	31.9	JD	91	07	24	1825	85	5	47
93.3	35.0	32	41.0	117	52.4	JD	91	07	24	2159	86	43	1251
93.3	40.0	32	30.8	118	12.8	JD	91	07	25	0200	65	79	27
93.3	45.0	32	20.8	118	33.4	JD	91	07	25	0630	66	0	16
93.3	50.0	32	10.9	118	53.6	JD	91	07	25	1017	74	0	20
93.3	55.0	32	01.0	119	13.9	JD	91	07	25	1550	74	0	256
93.3	60.0	31	50.8	119	34.3	JD	91	07	25	2023	77	2	46
93.3	70.0	31	30.1	120	14.8	JD	91	07	26	0238	71	5	208
93.3	80.0	31	10.8	120	55.2	JD	91	07	26	0818	78	0	216
93.3	90.0	30	50.9	121	35.3	JD	91	07	26	1622	85	0	56
93.3	100.0	30	30.8	122	15.5	JD	91	07	26	2236	79	1	138
93.3	110.0	30	10.9	122	55.3	JD	91	07	27	0422	92	6	62
93.3	120.0	29	50.9	123	35.2	JD	91	07	27	1007	83	0	590

TABLE 1. (cont.)

CalCOFI Cruise 9110

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
76.7	49.0	35	05.3	120	46.6	NH	91	10	12	0419	94	267	389
76.7	51.0	35	01.3	120	55.2	NH	91	10	12	0148	94	12	114
76.7	55.0	34	53.3	121	11.9	NH	91	10	11	2155	86	20	4
76.7	60.0	34	43.4	121	32.8	NH	91	10	11	1800	81	19	1
76.7	70.0	34	23.3	122	14.8	NH	91	10	11	1210	85	0	5
76.7	80.0	34	03.3	122	56.2	NH	91	10	11	0554	104	2	10
76.7	90.0	33	43.3	123	37.9	NH	91	10	11	0009	97	3	23
76.7	100.0	33	23.3	124	19.4	NH	91	10	10	1827	100	8	12
80.0	51.0	34	27.0	120	31.4	NH	91	10	09	0245	86	161	790
80.0	55.0	34	19.0	120	48.4	NH	91	10	09	0607	78	32	8
80.0	60.0	34	09.1	121	09.0	NH	91	10	09	1115	98	0	6
80.0	70.0	33	49.0	121	50.7	NH	91	10	09	1730	94	0	3
80.0	80.0	33	29.0	122	32.0	NH	91	10	09	2330	93	2	0
80.0	90.0	33	09.1	123	13.5	NH	91	10	10	0541	98	1	2
80.0	100.0	32	49.0	123	54.4	NH	91	10	10	1220	104	1	9
81.8	46.9	34	16.5	120	01.5	NH	91	10	08	2228	107	74	11
83.3	40.6	34	13.5	119	24.9	NH	91	10	08	1716	101	8	412
83.3	42.0	34	10.7	119	30.6	NH	91	10	08	1528	101	0	99
83.3	70.0	33	14.7	121	26.6	NH	91	10	08	0234	85	1	0
83.3	80.0	32	54.7	122	07.8	NH	91	10	07	2020	85	5	0
83.3	90.0	32	34.7	122	48.7	NH	91	10	07	1405	87	0	0
83.3	100.0	32	14.8	123	29.6	NH	91	10	07	0643	80	3	3
83.3	110.0	31	54.7	124	10.2	NH	91	10	07	0040	91	0	4
86.7	33.0	33	53.4	118	29.4	NH	91	10	04	1330	107	1	181
86.7	35.0	33	49.4	118	37.7	NH	91	10	04	1540	105	8	83
86.7	39.5	33	40.9	118	56.1	NH	91	10	04	2012	96	8	44
86.7	45.0	33	29.4	119	19.1	NH	91	10	05	0005	105	2	0
86.7	50.0	33	19.4	119	39.7	NH	91	10	05	0322	95	1	7
86.7	55.0	33	09.5	120	00.2	NH	91	10	05	0710	94	1	0
86.7	60.0	32	59.4	120	21.0	NH	91	10	05	1320	109	1	23
86.7	70.0	32	39.1	121	02.1	NH	91	10	05	1937	93	6	8
86.7	80.0	32	19.4	121	42.9	NH	91	10	06	0144	93	2	8
86.7	90.0	31	59.4	122	23.7	NH	91	10	06	0709	93	1	18
86.7	100.0	31	39.4	123	04.2	NH	91	10	06	1335	96	0	5
86.7	110.0	31	19.5	123	44.8	NH	91	10	06	1912	92	5	1
90.0	28.0	33	29.0	117	46.3	NH	91	10	04	0644	103	4	53
90.0	30.0	33	25.1	117	54.3	NH	91	10	04	0433	97	124	16
90.0	35.0	33	15.0	118	15.0	NH	91	10	04	0042	98	9	539
90.0	37.0	33	11.2	118	23.1	NH	91	10	03	2210	99	5	25
90.0	45.0	32	55.1	118	56.2	NH	91	10	03	1700	100	4	76
90.0	53.0	32	39.2	119	28.9	NH	91	10	03	1116	92	0	0
90.0	60.0	32	25.2	119	57.5	NH	91	10	03	0545	80	7	1
90.0	70.0	32	05.1	120	38.3	NH	91	10	02	2318	93	8	4
90.0	80.0	31	45.1	121	18.9	NH	91	10	02	1624	75	0	1
90.0	90.0	31	25.0	121	59.4	NH	91	10	02	0855	92	0	17
90.0	100.0	31	05.1	122	39.7	NH	91	10	02	0314	91	20	14
90.0	110.0	30	45.1	123	20.0	NH	91	10	01	2115	88	2	16
90.0	120.0	30	25.0	123	59.9	NH	91	10	01	1437	87	0	36
93.3	26.7	32	57.4	117	18.3	NH	91	09	28	1212	96	1	92

TABLE 1. (cont.)

CalCOFI Cruise 9110 (cont.)

Line	Station	Latitude (N)		Longitude (W)		Ship Code	Tow Date			Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
		deg.	min.	deg.	min.		yr.	mo.	day				
93.3	28.0	32	54.9	117	23.6	NH	91	09	28	1515	101	1	4
93.3	30.0	32	50.9	117	31.8	NH	91	09	28	1807	91	0	569
93.3	35.0	32	40.8	117	52.4	NH	91	09	28	2239	92	3	113
93.3	40.0	32	30.8	118	12.8	NH	91	09	29	0303	92	1	2
93.3	45.0	32	20.9	118	33.5	NH	91	09	29	0653	101	0	5
93.3	50.0	32	10.9	118	53.8	NH	91	09	29	1204	101	2	41
93.3	55.0	32	00.8	119	14.0	NH	91	09	29	1603	99	0	16
93.3	60.0	31	50.9	119	34.4	NH	91	09	29	2007	101	1	3
93.3	70.0	31	30.8	120	14.8	NH	91	09	30	0201	91	1	15
93.3	80.0	31	10.7	120	55.3	NH	91	09	30	0745	96	0	31
93.3	90.0	30	50.8	121	35.4	NH	91	09	30	1443	92	3	59
93.3	100.0	30	30.8	122	15.4	NH	91	09	30	2023	93	1	13
93.3	110.0	30	10.8	122	55.4	NH	91	10	01	0205	90	2	8
93.3	120.0	29	50.8	123	35.1	NH	91	10	01	0753	98	1	14

TABLE 2. Pooled occurrences of fish larvae taken in Manta tows on the 1991 CalCOFI survey.

Rank	Taxon	Occurrences
1	<i>Engraulis mordax</i>	70
2	<i>Cololabis saira</i>	69
3	<i>Sardinops sagax</i>	43
4	<i>Sebastes</i> spp.	42
5	<i>Scorpaenichthys marmoratus</i>	17
6	<i>Sebastes diploproa</i>	13
6	<i>Chromis punctipinnis</i>	13
8	<i>Trachurus symmetricus</i>	12
9	<i>Hypsoblennius jenkinsi</i>	11
9	<i>Scomber japonicus</i>	11
9	<i>Oxyjulis californica</i>	11
9	<i>Vinciguerria lucetia</i>	11
13	<i>Atherinopsis californiensis</i>	9
14	<i>Merluccius productus</i>	8
14	<i>Medialuna californiensis</i>	8
16	<i>Triphoturus mexicanus</i>	7
17	<i>Hexagrammos decagrammus</i>	6
17	<i>Pleuronichthys coenosus</i>	6
17	<i>Citharichthys stigmaeus</i>	6
17	<i>Sphyraena argentea</i>	6
17	<i>Genyonemus lineatus</i>	6
22	<i>Ceratoscopelus townsendi</i>	5
23	<i>Sebastes jordani</i>	4
23	<i>Aristostomias scintillans</i>	4
23	<i>Cyclothone signata</i>	4
23	<i>Nannobranchium ritteri</i>	4
23	Unidentified fish larvae	4
23	<i>Coryphopterus nicholsii</i>	4
23	<i>Citharichthys sordidus</i>	4
23	<i>Tetragonurus cuvieri</i>	4
31	<i>Stenobranchius leucopsarus</i>	3
31	<i>Icosteus aenigmaticus</i>	3
31	<i>Neoclinus blanchardi</i>	3
34	<i>Cheilopogon heterurus</i>	2
34	<i>Symbolophorus californiensis</i>	2
34	<i>Paralabrax</i> spp.	2
34	<i>Ophidion scrippsae</i>	2
34	<i>Diaphus</i> spp.	2
34	<i>Symphurus atricaudus</i>	2
34	<i>Tactostoma macropus</i>	2
34	<i>Synodus luciocephalus</i>	2
34	<i>Halichoeres semicinctus</i>	2
34	<i>Paralichthys californicus</i>	2
34	<i>Girella nigricans</i>	2
34	Clupeidae	2
34	<i>Hypsoblennius gilberti</i>	2
34	<i>Bathophilus flemingi</i>	2
34	<i>Semicossyphus pulcher</i>	2
49	<i>Macroramphosus gracilis</i>	1

TABLE 2. (cont.)

Rank	Taxon	Occurrences
49	<i>Pleuronichthys verticalis</i>	1
49	<i>Bathylagus wesethi</i>	1
49	<i>Leuroglossus stilbius</i>	1
49	<i>Lampanyctus</i> spp.	1
49	<i>Cyclothone</i> spp.	1
49	<i>Stomias atriventer</i>	1
49	<i>Cyclothone pseudopallida</i>	1
49	<i>Stemonosudis macrura</i>	1
49	<i>Hirundichthys marginatus</i>	1
49	<i>Icichthys lockingtoni</i>	1
49	<i>Lepidogobius lepidus</i>	1
49	<i>Hypsoblennius gentilis</i>	1
49	<i>Hippoglossina stomata</i>	1
49	<i>Hermosilla azurea</i>	1
49	<i>Ruscarius creaseri</i>	1
49	<i>Hemilepidotus spinosus</i>	1
49	<i>Cheilopogon pinnatibarbus</i>	1
49	<i>Sebastes paucispinis</i>	1
49	<i>Diogenichthys atlanticus</i>	1
49	<i>Sebastes aurora</i>	1
49	<i>Pleuronichthys decurrens</i>	1
49	<i>Leuresthes tenuis</i>	1
49	<i>Atherinops affinis</i>	1
49	<i>Gigantactis</i> spp.	1
49	<i>Antennarius avalonis</i>	1
49	<i>Chilara taylori</i>	1
49	<i>Hygophum reinhardtii</i>	1
49	<i>Ophiodon elongatus</i>	1
	Total	490

TABLE 3. Pooled raw counts of fish larvae taken in Manta tows on the 1991 CalCOFI survey.

Rank	Taxon	Count
1	<i>Engraulis mordax</i>	5002
2	<i>Sardinops sagax</i>	842
3	<i>Atherinopsis californiensis</i>	384
4	<i>Sebastes</i> spp.	251
5	<i>Cololabis saira</i>	237
6	<i>Scorpaenichthys marmoratus</i>	185
7	<i>Merluccius productus</i>	178
8	<i>Scomber japonicus</i>	124
9	<i>Ophiodon elongatus</i>	99
10	<i>Oxyjulis californica</i>	58
11	<i>Hypsoblennius jenkinsi</i>	42
12	<i>Sebastes diploproa</i>	33
13	<i>Vinciguerria lucetia</i>	31
14	<i>Trachurus symmetricus</i>	29
15	<i>Medialuna californiensis</i>	24
15	<i>Chromis punctipinnis</i>	24
15	Unidentified fish larvae	24
18	<i>Sebastes jordani</i>	18
19	<i>Pleuronichthys coenosus</i>	16
20	<i>Triphoturus mexicanus</i>	15
20	<i>Genyonemus lineatus</i>	15
22	<i>Cheilopogon pinnatibarbatus</i>	14
22	<i>Hexagrammos decagrammus</i>	14
24	<i>Ceratoscopelus townsendi</i>	12
25	<i>Sphyræna argentea</i>	11
26	<i>Cyclothone signata</i>	10
27	<i>Ophidion scrippsae</i>	8
27	<i>Citharichthys sordidus</i>	8
27	<i>Citharichthys stigmaeus</i>	8
30	<i>Coryphopterus nicholsii</i>	6
31	<i>Tetragonurus cuvieri</i>	5
31	Clupeidae	5
31	<i>Hypsoblennius gilberti</i>	5
31	<i>Neoclinus blanchardi</i>	5
35	<i>Nannobranchium ritteri</i>	4
35	<i>Paralabrax</i> spp.	4
35	<i>Stenobranchius leucopsarus</i>	4
35	<i>Aristostomias scintillans</i>	4
35	<i>Paralichthys californicus</i>	4
40	<i>Tactostoma macropus</i>	3
40	<i>Synodus lucioceps</i>	3
40	<i>Stomias atriventer</i>	3
40	<i>Cheilopogon heterurus</i>	3
40	<i>Semicossyphus pulcher</i>	3
40	<i>Icosteus aenigmaticus</i>	3
46	<i>Bathophilus flemingi</i>	2
46	<i>Diaphus</i> spp.	2
46	<i>Cyclothone pseudopallida</i>	2
46	<i>Girella nigricans</i>	2

TABLE 3. (cont.)

Rank	Taxon	Count
46	<i>Symphurus atricaudus</i>	2
46	<i>Symbolophorus californiensis</i>	2
46	<i>Halichoeres semicinctus</i>	2
53	<i>Hippoglossina stomata</i>	1
53	<i>Antennarius avalonis</i>	1
53	<i>Hermosilla azurea</i>	1
53	<i>Pleuronichthys verticalis</i>	1
53	<i>Bathylagus wesethi</i>	1
53	<i>Leuroglossus stilbius</i>	1
53	<i>Cyclothone</i> spp.	1
53	<i>Pleuronichthys decurrens</i>	1
53	<i>Sebastes paucispinis</i>	1
53	<i>Sebastes aurora</i>	1
53	<i>Gigantactis</i> spp.	1
53	<i>Hypsoblennius gentilis</i>	1
53	<i>Ruscarius creaseri</i>	1
53	<i>Lampanyctus</i> spp.	1
53	<i>Atherinops affinis</i>	1
53	<i>Chilara taylori</i>	1
53	<i>Leuresthes tenuis</i>	1
53	<i>Icichthys lockingtoni</i>	1
53	<i>Macroramphosus gracilis</i>	1
53	<i>Hirundichthys marginatus</i>	1
53	<i>Lepidogobius lepidus</i>	1
53	<i>Stemonosudis macrura</i>	1
53	<i>Diogenichthys atlanticus</i>	1
53	<i>Hygophum reinhardtii</i>	1
53	<i>Hemilepidotus spinosus</i>	1
	Total	7819

TABLE 4. Numbers of fish larvae taken in Manta net tows on the 1991 CalCOFI survey, listed by taxon, station, and month. Numbers of larvae are expressed as larvae per 100 cubic meters of water filtered. Unoccupied stations are indicated by a dash.

		Clupeidae											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
93.3	60.0	0.0	-	-	-	-	0.8	-	0.0	-	-	-	
93.3	70.0	0.0	-	-	-	-	2.8	-	0.0	-	-	-	
		<i>Sardinops sagax</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
76.7	49.0	-	-	-	-	-	-	0.0	-	0.9	-	-	
76.7	55.0	-	-	-	-	-	-	4.2	-	0.0	-	-	
80.0	51.0	-	18.2	-	-	-	-	6.1	-	0.0	-	-	
80.0	55.0	-	6.5	-	-	-	-	2.3	-	0.0	-	-	
80.0	60.0	-	0.0	-	-	-	-	3.4	-	0.0	-	-	
81.8	46.9	-	27.1	-	-	-	-	-	-	0.0	-	-	
83.3	40.6	-	0.0	-	-	-	-	23.4	-	1.0	-	-	
83.3	42.0	-	5.4	-	-	-	-	59.5	-	0.0	-	-	
83.3	51.0	-	7.3	-	-	-	-	0.0	-	-	-	-	
83.3	55.0	-	10.5	-	-	-	-	0.0	-	-	-	-	
83.3	90.0	-	1.4	-	-	-	-	0.0	-	0.0	-	-	
86.7	33.0	-	35.4	-	-	-	0.0	-	-	0.0	-	-	
86.7	35.0	-	3.4	-	-	-	0.0	-	-	1.0	-	-	
86.7	39.5	-	-	-	-	-	0.0	-	-	1.0	-	-	
86.7	40.0	-	3.4	-	-	-	-	-	-	-	-	-	
86.7	45.0	-	3.7	-	-	-	2.6	-	-	0.0	-	-	
86.7	50.0	-	189.8	-	-	-	0.0	-	-	0.0	-	-	
86.7	55.0	-	18.2	-	-	-	0.0	-	-	0.0	-	-	
86.7	110.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-	
90.0	28.0	-	161.7	-	-	-	0.0	-	-	1.0	-	-	
90.0	30.0	-	0.0	-	-	-	7.4	-	-	91.6	-	-	
90.0	35.0	-	0.0	-	-	-	0.0	-	-	1.0	-	-	
90.0	37.0	-	1.0	-	-	-	0.7	-	-	1.0	-	-	
90.0	45.0	-	0.8	-	-	-	0.0	-	-	0.0	-	-	
90.0	53.0	-	2.1	-	-	-	0.0	-	-	0.0	-	-	
90.0	80.0	-	1.4	-	-	-	0.0	-	-	0.0	-	-	

TABLE 4. (cont.)

		<i>Sardinops sagax</i> (cont.)											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
93.3	35.0	0.0	-	-	-	-	0.0	-	1.8	-	-	-	
93.3	40.0	0.7	-	-	-	-	5.2	-	0.0	-	-	-	
		<i>Engraulis mordax</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
76.7	49.0	-	-	-	-	-	-	1.4	-	239.8	-	-	
76.7	51.0	-	-	-	-	-	-	15.0	-	8.4	-	-	
76.7	55.0	-	-	-	-	-	-	0.7	-	14.6	-	-	
76.7	70.0	-	-	-	-	-	-	0.0	-	0.0	-	-	
76.7	100.0	-	-	-	-	-	-	0.0	-	1.0	-	-	
80.0	51.0	-	767.4	-	-	-	-	15.3	-	134.5	-	-	
80.0	55.0	-	76.9	-	-	-	-	6.8	-	8.6	-	-	
80.0	60.0	-	2.0	-	-	-	-	0.0	-	0.0	-	-	
80.0	80.0	-	-	-	-	-	-	0.0	-	0.9	-	-	
81.8	46.9	-	575.0	-	-	-	-	-	-	42.7	-	-	
83.3	40.6	-	1.0	-	-	-	-	9.5	-	6.0	-	-	
83.3	42.0	-	26.8	-	-	-	-	12.8	-	0.0	-	-	
83.3	51.0	-	1031.8	-	-	-	-	0.0	-	-	-	-	
83.3	55.0	-	136.7	-	-	-	-	0.8	-	-	-	-	
86.7	33.0	-	250.9	-	-	-	0.0	-	-	1.1	-	-	
86.7	35.0	-	19.4	-	-	-	0.0	-	-	5.2	-	-	
86.7	39.5	-	-	-	-	-	2.4	-	-	1.0	-	-	
86.7	40.0	-	1.7	-	-	-	-	-	-	-	-	-	
86.7	45.0	-	3.7	-	-	-	0.9	-	-	0.0	-	-	
86.7	50.0	-	14.3	-	-	-	0.0	-	-	0.0	-	-	
86.7	55.0	-	103.4	-	-	-	0.0	-	-	0.0	-	-	
86.7	70.0	-	-	-	-	-	0.8	-	-	0.0	-	-	
90.0	28.0	-	10.5	-	-	-	0.0	-	-	1.0	-	-	
90.0	30.0	-	6.8	-	-	-	0.0	-	-	22.4	-	-	
90.0	35.0	-	146.4	-	-	-	0.0	-	-	0.0	-	-	
90.0	37.0	-	1.0	-	-	-	0.7	-	-	3.0	-	-	
90.0	45.0	-	0.8	-	-	-	0.0	-	-	0.0	-	-	
90.0	53.0	-	174.2	-	-	-	0.0	-	-	0.0	-	-	
93.3	26.7	7.8	-	-	-	-	0.0	-	0.0	-	-	-	
93.3	30.0	14.4	-	-	-	-	0.0	-	0.0	-	-	-	
93.3	35.0	8.4	-	-	-	-	0.0	-	0.0	-	-	-	

TABLE 4. (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Engraulis mordax</i> (cont.)												
93.3 40.0	0.0	0.0	-	-	-	-	1.3	-	0.0	-	-	-
93.3 50.0	1.6	0.0	-	-	-	-	0.0	-	0.0	-	-	-
93.3 55.0	4.9	0.0	-	-	-	-	0.0	-	0.0	-	-	-
93.3 60.0	0.0	2.4	-	-	-	-	0.0	-	0.0	-	-	-
93.3 70.0	0.0	2.3	-	-	-	-	0.0	-	0.0	-	-	-
<i>Bathylagus wesethi</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 110.0	-	-	0.7	-	-	-	-	0.0	-	0.0	-	-
<i>Leuroglossus stilbius</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 60.0	0.9	-	0.0	-	-	-	-	0.0	-	-	-	-
<i>Cyclothone</i> spp.												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 60.0	0.0	-	0.0	-	-	-	0.0	-	-	0.8	-	-
<i>Cyclothone pseudopallida</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 90.0	0.0	-	-	-	-	-	-	0.0	-	1.9	-	-
<i>Cyclothone signata</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 110.0	4.9	-	0.0	-	-	-	0.0	-	-	0.0	-	-
90.0 120.0	0.0	-	1.5	-	-	-	0.0	-	-	0.0	-	-
93.3 80.0	0.0	0.8	-	-	-	-	0.0	-	0.0	-	-	-
93.3 100.0	0.8	-	0.0	-	-	-	0.0	-	0.0	-	-	-
<i>Vinciguerria lucetia</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 80.0	0.0	-	0.0	-	-	-	-	1.6	-	0.0	-	-
83.3 90.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
86.7 110.0	-	-	0.0	-	-	-	-	0.0	-	4.6	-	-
90.0 70.0	-	-	0.0	-	-	-	0.0	-	-	1.9	-	-
90.0 100.0	0.0	-	0.0	-	-	-	0.0	-	-	12.8	-	-
90.0 110.0	1.6	-	0.0	-	-	-	0.0	-	-	0.9	-	-
90.0 120.0	0.0	-	0.7	-	-	-	0.9	-	-	0.0	-	-

TABLE 4. (cont.)

<i>Vinciguerria lucetia</i> (cont.)												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 100.0	0.8	-	0.0	-	-	-	0.0	-	0.0	-	-	-
93.3 120.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-	-
<i>Stomias atriventer</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 55.0	0.0	2.2	-	-	-	-	0.0	-	0.0	-	-	-
<i>Bathophilus flemingi</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 100.0	0.0	-	0.0	-	-	-	0.0	-	-	0.9	-	-
93.3 120.0	0.8	-	0.0	-	-	-	0.0	-	-	0.0	-	-
<i>Tactostoma macropus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 100.0	-	-	0.0	-	-	-	-	0.7	-	0.0	-	-
83.3 110.0	-	-	0.0	-	-	-	-	1.4	-	0.0	-	-
<i>Aristostomias scintillans</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 90.0	0.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-
90.0 90.0	0.0	-	0.7	-	-	-	0.0	-	-	0.0	-	-
93.3 80.0	0.0	0.8	-	-	-	-	0.0	-	0.0	-	-	-
93.3 90.0	0.0	0.8	-	-	-	-	0.0	-	0.0	-	-	-
<i>Synodus lucioceps</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	-	-	-	-	0.0	-	1.9	-	-
76.7 55.0	0.0	-	-	-	-	-	-	0.0	-	0.9	-	-
<i>Stemonosudis macrura</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 120.0	0.0	-	0.7	-	-	-	0.0	-	-	0.0	-	-
<i>Ceratoscopelus townsendii</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 80.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
86.7 110.0	-	-	0.8	-	-	-	-	0.0	-	0.0	-	-
90.0 120.0	0.0	-	1.5	-	-	-	0.0	-	-	0.0	-	-

TABLE 4. (cont.)

		<i>Ceratoscopelus townsendii</i> (cont.)											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
93.3 100.0	1.6	-	0.0	-	-	-	0.0	-	0.0	-	-	-	
93.3 120.0	5.0	-	0.0	-	-	-	0.0	-	-	0.0	-	-	
		<i>Diaphus</i> spp.											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
86.7 110.0	-	-	0.0	-	-	-	-	0.8	-	0.0	-	-	
90.0 120.0	0.0	-	0.0	-	-	-	0.9	-	-	0.0	-	-	
		<i>Lampanyctus</i> spp.											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
90.0 100.0	0.0	-	0.9	-	-	-	0.0	-	-	0.0	-	-	
		<i>Nannobranchium ritteri</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
80.0 60.0	0.0	-	0.5	-	-	-	-	0.0	-	0.0	-	-	
86.7 70.0	0.7	-	-	-	-	-	0.0	-	-	0.0	-	-	
86.7 90.0	0.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-	
90.0 80.0	0.0	-	0.0	-	-	-	0.8	-	-	0.0	-	-	
		<i>Stenobranchius leucopsarus</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
76.7 70.0	0.8	-	-	-	-	-	-	0.0	-	0.0	-	-	
80.0 60.0	0.0	-	1.0	-	-	-	-	0.0	-	0.0	-	-	
80.0 100.0	0.0	-	-	-	-	-	-	0.0	-	1.0	-	-	
		<i>Triphoturus mexicanus</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-	
83.3 42.0	0.0	-	0.0	-	-	-	-	2.7	-	0.0	-	-	
83.3 55.0	0.0	-	0.0	-	-	-	-	0.8	-	-	-	-	
86.7 100.0	-	-	0.0	-	-	-	-	2.3	-	0.0	-	-	
90.0 28.0	0.0	-	0.0	-	-	-	0.9	-	-	0.0	-	-	
93.3 28.0	0.0	0.0	-	-	-	-	1.8	-	0.0	0.0	-	-	
93.3 30.0	0.0	0.0	-	-	-	-	3.4	-	0.0	-	-	-	

TABLE 4. (cont.)

<i>Diogenichthys atlanticus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 90.0	0.8	-	0.0	-	-	-	0.0	-	-	0.0	-	-
<i>Hygophum reinhardtii</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 110.0	-	-	0.8	-	-	-	-	0.0	-	0.0	-	-
<i>Symbolophorus californiensis</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 90.0	0.8	-	0.0	-	-	-	0.0	-	-	0.0	-	-
90.0 110.0	0.8	-	0.0	-	-	-	0.0	-	-	0.0	-	-
<i>Mertuucius productus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-
76.7 70.0	135.9	-	-	-	-	-	-	0.0	-	0.0	-	-
80.0 51.0	0.0	-	1.0	-	-	-	-	0.0	-	0.0	-	-
80.0 55.0	0.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-
80.0 60.0	0.0	-	0.5	-	-	-	-	0.0	-	0.0	-	-
83.3 60.0	1.8	-	0.0	-	-	-	-	0.0	-	-	-	-
86.7 40.0	0.0	-	0.8	-	-	-	-	-	-	-	-	-
86.7 55.0	2.6	-	0.0	-	-	-	0.0	-	-	0.0	-	-
<i>Chilara taylori</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 55.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
<i>Ophidion scrippsae</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 42.0	0.0	-	3.6	-	-	-	-	0.0	-	0.0	-	-
83.3 51.0	0.0	-	3.7	-	-	-	-	0.0	-	-	-	-
<i>Antennarius avalonis</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 110.0	-	-	0.0	-	-	-	-	0.8	-	0.0	-	-
<i>Gigantactis spp.</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 110.0	0.0	-	0.0	-	-	-	0.0	-	-	0.9	-	-

TABLE 4. (cont.)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Atherinops affinis</i>													
Station	80.0	51.0	-	1.0	-	-	-	-	0.0	-	0.0	-	-
<i>Atherinopsis californiensis</i>													
Station	76.7	49.0	-	-	-	-	-	-	0.0	-	0.0	-	-
	81.8	46.9	-	2.8	-	-	-	-	-	-	0.0	-	-
	83.3	40.6	-	3.1	-	-	-	-	0.0	-	0.0	-	-
	83.3	51.0	-	56.0	-	-	-	-	0.0	-	-	-	-
	86.7	33.0	-	84.6	-	-	-	0.0	-	-	0.0	-	-
	90.0	28.0	-	217.4	-	-	-	0.9	-	-	0.0	-	-
	90.0	53.0	-	2.1	-	-	-	0.0	-	-	0.0	-	-
<i>Leuresthes tenuis</i>													
Station	93.3	26.7	1.0	-	-	-	-	0.0	-	0.0	-	-	-
<i>Cololabis saira</i>													
Station	76.7	51.0	-	-	-	-	-	-	1.4	-	0.0	-	-
	76.7	55.0	-	-	-	-	-	-	0.0	-	1.7	-	-
	76.7	60.0	-	-	-	-	-	-	1.5	-	0.0	-	-
	76.7	80.0	-	-	-	-	-	-	5.4	-	2.1	-	-
	76.7	100.0	-	-	-	-	-	-	6.7	-	6.0	-	-
	80.0	70.0	-	0.0	-	-	-	-	1.4	-	0.0	-	-
	80.0	80.0	-	-	-	-	-	-	0.8	-	0.9	-	-
	80.0	90.0	-	-	-	-	-	-	11.3	-	1.0	-	-
	80.0	100.0	-	-	-	-	-	-	2.6	-	0.0	-	-
	83.3	60.0	-	2.0	-	-	-	-	0.0	-	-	-	-
	83.3	70.0	-	0.0	-	-	-	-	3.0	-	0.8	-	-
	83.3	80.0	-	0.0	-	-	-	-	1.6	-	4.2	-	-
	83.3	90.0	-	1.4	-	-	-	-	0.0	-	0.0	-	-
	83.3	100.0	-	0.0	-	-	-	-	2.8	-	2.4	-	-
	86.7	35.0	-	0.8	-	-	-	0.0	-	-	0.0	-	-
	86.7	55.0	-	0.0	-	-	-	0.0	-	-	0.9	-	-
	86.7	60.0	-	0.0	-	-	-	0.0	-	-	1.1	-	-
	86.7	70.0	-	-	-	-	-	5.8	-	-	5.6	-	-

TABLE 4. (cont.)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Cololabis saira</i> (cont.)													
Station													
86.7	80.0	0.9	-	0.0	-	-	-	-	0.0	-	0.9	-	-
86.7	90.0	0.0	-	0.0	-	-	-	-	0.7	-	0.9	-	-
86.7	110.0	-	-	0.0	-	-	-	-	3.8	-	0.0	-	-
90.0	35.0	0.0	-	2.5	-	-	0.0	0.0	-	-	0.0	-	-
90.0	37.0	0.0	-	1.0	-	-	0.0	0.0	-	-	0.0	-	-
90.0	45.0	0.0	-	2.5	-	-	0.0	0.0	-	-	0.0	-	-
90.0	53.0	0.8	-	1.0	-	-	0.0	0.0	-	-	0.0	-	-
90.0	60.0	0.0	-	1.9	-	-	0.0	0.0	-	-	3.2	-	-
90.0	70.0	-	-	0.0	-	-	0.0	0.0	-	-	5.6	-	-
90.0	80.0	0.8	-	0.0	-	-	3.1	0.0	-	-	0.0	-	-
90.0	90.0	0.0	-	0.0	-	-	3.3	0.0	-	-	0.0	-	-
90.0	100.0	0.0	-	0.0	-	-	0.0	0.0	-	-	4.6	-	-
90.0	110.0	0.0	-	0.9	-	-	4.1	0.0	-	-	0.9	-	-
90.0	120.0	6.4	-	5.2	-	-	0.0	0.0	-	-	0.0	-	-
93.3	28.0	0.0	1.0	-	-	-	0.0	0.0	-	1.0	-	-	-
93.3	30.0	2.9	1.0	-	-	-	0.0	0.0	-	0.0	-	-	-
93.3	35.0	0.0	0.0	-	-	-	1.7	0.0	-	0.9	-	-	-
93.3	40.0	0.9	2.8	-	-	-	27.2	0.0	-	0.0	-	-	-
93.3	50.0	0.0	0.9	-	-	-	0.0	0.0	-	0.0	-	-	-
93.3	60.0	0.0	0.0	-	-	-	0.8	0.0	-	0.0	-	-	-
93.3	90.0	2.4	0.0	-	-	-	0.0	0.0	-	0.0	-	-	-
93.3	100.0	5.6	-	0.0	-	-	0.0	0.0	-	0.9	-	-	-
93.3	110.0	0.9	-	0.0	-	-	5.5	0.0	-	-	0.9	-	-
93.3	120.0	0.8	-	0.0	-	-	0.0	0.0	-	-	0.0	-	-
<i>Cheilopogon heterurus</i>													
Station													
86.7	39.5	-	-	-	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0	37.0	0.0	-	0.0	-	-	-	1.6	-	-	0.0	-	-
								0.7	-	-	0.0	-	-
<i>Cheilopogon pinnatibarbatulus</i>													
Station													
93.3	40.0	0.0	0.0	-	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
								9.1	-	0.0	-	-	-
<i>Hirundichthys marginatus</i>													
Station													
93.3	90.0	0.0	0.0	-	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
								0.0	-	0.9	-	-	-

TABLE 4. (cont.)

		<i>Macroramphosus gracilis</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
93.3	45.0	0.0	-	-	-	-	0.0	-	0.0	-	-	-	
		<i>Sebastes</i> spp.											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
76.7	49.0	-	-	-	-	-	-	0.7	-	0.0	-	-	
76.7	51.0	-	-	-	-	-	-	0.0	-	0.0	-	-	
76.7	80.0	-	-	-	-	-	-	0.0	-	0.0	-	-	
80.0	51.0	-	7.7	-	-	-	-	0.0	-	0.0	-	-	
80.0	55.0	-	2.5	-	-	-	-	0.8	-	2.3	-	-	
80.0	60.0	-	0.5	-	-	-	-	0.7	-	0.0	-	-	
80.0	70.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-	
80.0	100.0	-	-	-	-	-	-	0.0	-	0.0	-	-	
81.8	46.9	-	58.9	-	-	-	-	-	-	0.0	-	-	
83.3	40.6	-	0.0	-	-	-	-	0.9	-	0.0	-	-	
83.3	51.0	-	0.0	-	-	-	-	0.0	-	-	-	-	
83.3	55.0	-	0.9	-	-	-	-	0.0	-	-	-	-	
83.3	60.0	-	0.0	-	-	-	-	0.0	-	-	-	-	
83.3	80.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-	
86.7	33.0	-	0.0	-	-	-	0.0	-	-	0.0	-	-	
86.7	40.0	-	0.0	-	-	-	-	-	-	-	-	-	
86.7	50.0	-	29.4	-	-	-	0.8	-	-	0.0	-	-	
86.7	55.0	-	31.9	-	-	-	0.0	-	-	0.0	-	-	
86.7	60.0	-	2.7	-	-	-	0.0	-	-	0.0	-	-	
90.0	28.0	-	5.3	-	-	-	0.0	-	-	1.0	-	-	
90.0	35.0	-	0.8	-	-	-	0.0	-	-	0.0	-	-	
90.0	37.0	-	0.0	-	-	-	0.0	-	-	0.0	-	-	
90.0	53.0	-	0.0	-	-	-	0.0	-	-	0.0	-	-	
93.3	40.0	0.7	-	-	-	-	1.3	-	0.0	-	-	-	
93.3	45.0	0.9	-	-	-	-	0.0	-	0.0	-	-	-	
93.3	50.0	0.9	-	-	-	-	0.0	-	0.0	-	-	-	
93.3	55.0	1.5	-	-	-	-	0.0	-	0.0	-	-	-	
93.3	60.0	0.8	-	-	-	-	0.0	-	0.0	-	-	-	
		<i>Sebastes aurora</i>											
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
93.3	70.0	0.0	-	-	-	-	0.7	-	0.0	-	-	-	

TABLE 4. (cont.)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Sebastes diploproa</i>													
Station													
76.7	49.0	2.8	-	-	-	-	-	-	0.0	-	0.9	-	-
76.7	51.0	0.0	-	-	-	-	-	-	0.7	-	0.9	-	-
76.7	60.0	0.0	-	-	-	-	-	-	0.0	-	0.8	-	-
80.0	51.0	0.0	0.0	-	-	-	-	-	0.0	-	0.9	-	-
80.0	55.0	0.0	0.8	-	-	-	-	-	1.5	-	10.9	-	-
81.8	46.9	3.7	0.0	-	-	-	-	-	-	-	0.0	-	-
86.7	50.0	-	0.0	-	-	-	-	0.8	-	-	0.0	-	-
90.0	28.0	1.8	0.0	-	-	-	-	0.0	-	-	0.0	-	-
93.3	30.0	0.0	0.0	-	-	-	-	0.9	-	0.0	-	-	-
<i>Sebastes jordani</i>													
Station													
76.7	49.0	0.9	-	-	-	-	-	-	0.0	-	0.0	-	-
80.0	51.0	0.9	-	0.0	-	-	-	-	0.0	-	0.0	-	-
90.0	30.0	0.0	-	5.1	-	-	-	0.0	-	-	0.0	-	-
90.0	35.0	0.0	-	8.5	-	-	-	0.0	-	-	0.0	-	-
<i>Sebastes paucispinis</i>													
Station													
83.3	60.0	0.9	-	0.0	-	-	-	-	0.0	-	-	-	-
<i>Hexagrammos decagrammus</i>													
Station													
76.7	49.0	8.3	-	-	-	-	-	-	0.0	-	0.0	-	-
76.7	60.0	0.9	-	-	-	-	-	-	0.0	-	0.0	-	-
80.0	60.0	0.0	-	0.5	-	-	-	-	0.0	-	0.0	-	-
81.8	46.9	0.9	-	0.0	-	-	-	-	-	-	0.0	-	-
83.3	51.0	0.0	-	0.9	-	-	-	-	0.0	-	-	-	-
86.7	33.0	0.0	-	1.0	-	-	-	0.0	-	-	0.0	-	-
<i>Ophiodon elongatus</i>													
Station													
83.3	55.0	0.0	-	86.7	-	-	-	-	0.0	-	-	-	-
<i>Hemilepidotus spinosus</i>													
Station													
76.7	60.0	0.9	-	-	-	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

<i>Trachurus symmetricus</i> (cont.)												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 100.0	0.0	-	0.0	-	-	-	0.8	-	0.0	-	-	-
<i>Genyonemus lineatus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	1.8	-	0.0	-	-	-	-	0.0	-	0.0	-	-
80.0 55.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
81.8 46.9	0.0	-	0.9	-	-	-	-	-	-	0.0	-	-
86.7 33.0	3.8	-	0.0	-	-	0.0	-	-	-	0.0	-	-
86.7 35.0	2.8	-	0.0	-	-	0.0	-	-	-	0.0	-	-
90.0 28.0	0.0	-	4.2	-	-	0.0	-	-	-	0.0	-	-
<i>Girella nigricans</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-
86.7 45.0	0.0	-	0.0	-	-	-	0.9	-	-	0.0	-	-
<i>Hermosilla azurea</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 35.0	0.0	-	0.0	-	-	-	0.9	-	-	0.0	-	-
<i>Mediatuna californiensis</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 90.0	0.0	-	-	-	-	-	-	0.8	-	0.0	-	-
81.8 46.9	0.0	-	0.0	-	-	-	-	-	-	1.1	-	-
83.3 40.6	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
83.3 42.0	0.0	-	0.0	-	-	-	-	6.4	-	0.0	-	-
90.0 60.0	0.0	-	0.0	-	-	-	0.0	-	-	0.8	-	-
93.3 40.0	0.0	0.0	-	-	-	-	6.5	-	0.0	-	-	-
93.3 50.0	0.0	0.0	-	-	-	-	0.0	-	2.0	-	-	-
93.3 70.0	0.0	0.0	-	-	-	-	0.0	-	0.9	-	-	-
<i>Chromis punctipinnis</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-
80.0 51.0	0.0	-	0.0	-	-	-	-	0.0	-	1.7	-	-
80.0 55.0	0.0	-	0.0	-	-	-	-	0.0	-	0.8	-	-
80.0 60.0	0.0	-	0.0	-	-	-	-	0.7	-	0.0	-	-

TABLE 4. (cont.)

		Jan.	Feb.	Mar.	Apr.	<i>Chromis punctipinnis</i> (cont.)				Oct.	Nov.	Dec.
Station						May	June	July	Aug.	Sep.		
81.8	46.9	0.0	-	0.0	-	-	-	-	-	-	2.1	-
83.3	40.6	0.0	-	0.0	-	-	-	-	1.7	-	0.0	-
83.3	42.0	0.0	-	0.0	-	-	-	-	1.8	-	0.0	-
86.7	35.0	0.0	-	0.0	-	-	-	0.9	-	-	0.0	-
86.7	39.5	-	-	-	-	-	-	0.0	-	-	1.0	-
90.0	30.0	0.0	-	0.0	-	-	-	0.0	-	-	1.9	-
90.0	35.0	0.0	-	0.0	-	-	-	0.0	-	-	6.9	-
93.3	26.7	0.0	0.0	-	-	-	-	0.0	-	1.0	-	-
93.3	40.0	0.0	0.0	-	-	-	-	0.6	-	0.0	-	-
		Jan.	Feb.	Mar.	Apr.	<i>Halichoeres semicinctus</i>				Oct.	Nov.	Dec.
Station						May	June	July	Aug.	Sep.		
83.3	42.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-
90.0	28.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-
		Jan.	Feb.	Mar.	Apr.	<i>Oxyjulis californica</i>				Oct.	Nov.	Dec.
Station						May	June	July	Aug.	Sep.		
76.7	51.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-
76.7	60.0	0.0	-	-	-	-	-	-	0.0	-	8.1	-
80.0	51.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-
80.0	55.0	0.0	-	0.0	-	-	-	-	0.0	-	2.3	-
81.8	46.9	0.0	-	0.0	-	-	-	-	-	-	2.1	-
83.3	40.6	0.0	-	0.0	-	-	-	-	9.5	-	1.0	-
83.3	42.0	0.0	-	0.0	-	-	-	-	22.0	-	0.0	-
86.7	35.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-
90.0	45.0	0.0	-	0.0	-	-	-	0.0	-	-	3.0	-
90.0	60.0	0.0	-	0.0	-	-	-	0.0	-	-	0.8	-
		Jan.	Feb.	Mar.	Apr.	<i>Semicossyphus pulcher</i>				Oct.	Nov.	Dec.
Station						May	June	July	Aug.	Sep.		
80.0	51.0	0.0	-	0.0	-	-	-	-	0.8	-	1.7	-
		Jan.	Feb.	Mar.	Apr.	<i>Neoclinus blanchardi</i>				Oct.	Nov.	Dec.
Station						May	June	July	Aug.	Sep.		
76.7	49.0	0.0	-	-	-	-	-	-	0.0	-	0.9	-
81.8	46.9	0.0	-	0.0	-	-	-	-	-	-	2.1	-

TABLE 4. (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Neoclinus blanchardi</i> (cont.)												
86.7 33.0	0.0	-	2.0	-	-	-	0.0	-	-	0.0	-	-
<i>Hypsoblennius gentilis</i>												
86.7 35.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-	-
<i>Hypsoblennius gilberti</i>												
76.7 49.0	0.0	-	-	-	-	-	-	0.0	-	0.9	-	-
81.8 46.9	0.0	-	0.0	-	-	-	-	-	-	4.3	-	-
<i>Hypsoblennius jenkinsi</i>												
76.7 51.0	0.0	-	-	-	-	-	-	1.4	-	0.0	-	-
80.0 55.0	0.0	-	0.0	-	-	-	-	3.8	-	0.0	-	-
80.0 60.0	0.0	-	0.0	-	-	-	-	0.7	-	0.0	-	-
81.8 46.9	0.0	-	0.0	-	-	-	-	-	-	19.2	-	-
83.3 40.6	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
86.7 39.5	-	-	-	-	-	-	0.0	-	-	1.0	-	-
86.7 45.0	0.0	-	0.0	-	-	-	0.0	-	-	2.1	-	-
90.0 30.0	0.0	-	0.0	-	-	-	0.0	-	-	2.9	-	-
90.0 35.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-	-
90.0 37.0	0.0	-	0.0	-	-	-	2.9	-	-	0.0	-	-
93.3 26.7	0.0	0.0	-	-	-	-	3.8	-	0.0	-	-	-
<i>Icosteus aenigmaticus</i>												
83.3 60.0	0.0	-	1.0	-	-	-	-	0.0	-	-	-	-
83.3 80.0	0.0	-	0.8	-	-	-	-	0.0	-	0.0	-	-
93.3 55.0	0.0	0.7	-	-	-	-	0.0	-	0.0	-	-	-
<i>Coryphopterus nicholsii</i>												
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-
86.7 33.0	0.0	-	1.0	-	-	-	0.0	-	-	0.0	-	-
86.7 35.0	1.9	-	0.0	-	-	-	0.0	-	-	0.0	-	-
86.7 50.0	-	-	1.6	-	-	-	0.0	-	-	0.0	-	-

TABLE 4. (cont.)

<i>Lepidogobius lepidus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 33.0	0.0	-	1.0	-	-	-	0.0	-	-	0.0	-	-
<i>Sphyaena argentea</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-
80.0 55.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
83.3 40.6	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
83.3 42.0	0.0	-	0.0	-	-	-	-	5.5	-	0.0	-	-
90.0 30.0	0.0	-	0.0	-	-	-	0.9	-	-	1.0	-	-
<i>Scomber japonicus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 60.0	0.0	-	-	-	-	-	-	0.0	-	0.8	-	-
76.7 90.0	0.0	-	-	-	-	-	-	0.8	-	0.0	-	-
80.0 55.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
81.8 46.9	0.0	-	0.0	-	-	-	-	-	-	2.1	-	-
83.3 40.6	0.0	-	0.0	-	-	-	-	10.4	-	0.0	-	-
83.3 42.0	0.0	-	0.0	-	-	-	-	60.4	-	0.0	-	-
86.7 33.0	0.0	-	0.0	-	-	-	0.8	-	-	0.0	-	-
86.7 39.5	-	-	-	-	-	-	0.0	-	-	2.9	-	-
90.0 28.0	0.0	-	7.4	-	-	-	0.0	-	-	0.0	-	-
90.0 30.0	0.0	-	0.0	-	-	-	0.0	-	-	1.0	-	-
93.3 35.0	0.0	0.0	-	-	-	-	24.8	-	0.0	-	-	-
<i>Icichthys lockingtoni</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 60.0	0.0	-	0.9	-	-	-	0.0	-	-	0.0	-	-
<i>Tetragonurus cuvieri</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 90.0	0.0	-	-	-	-	-	-	0.0	-	1.0	-	-
76.7 100.0	0.0	-	-	-	-	-	-	0.0	-	1.0	-	-
86.7 80.0	0.0	-	0.0	-	-	-	-	0.0	-	0.9	-	-
93.3 90.0	0.0	0.0	-	-	-	-	0.0	-	1.8	-	-	-

TABLE 4. (cont.)

<i>Citharichthys sordidus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 60.0	0.0	-	-	-	-	-	-	0.0	-	3.2	-	-
76.7 70.0	1.6	-	-	-	-	-	-	0.0	-	0.0	-	-
80.0 51.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
83.3 51.0	0.9	-	0.0	-	-	-	-	0.0	-	-	-	-
<i>Citharichthys stigmaeus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	-	-	-	-	0.0	-	1.9	-	-
76.7 60.0	0.0	-	-	-	-	-	-	0.0	-	0.8	-	-
76.7 100.0	0.8	-	-	-	-	-	-	0.0	-	0.0	-	-
80.0 51.0	0.0	-	1.0	-	-	-	-	0.0	-	0.0	-	-
86.7 33.0	1.9	-	0.0	-	-	-	0.0	-	-	0.0	-	-
86.7 50.0	-	-	0.0	-	-	-	0.0	-	-	0.9	-	-
<i>Hippoglossina stomata</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
<i>Paralichthys californicus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
81.8 46.9	0.0	-	0.9	-	-	-	-	-	-	0.0	-	-
86.7 33.0	2.8	-	0.0	-	-	-	0.0	-	-	0.0	-	-
<i>Pleuronichthys coenosus</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	4.7	-	-
76.7 60.0	0.0	-	-	-	-	-	-	0.0	-	0.8	-	-
80.0 55.0	0.0	-	3.3	-	-	-	-	2.3	-	0.0	-	-
81.8 46.9	0.0	-	0.0	-	-	-	-	-	-	2.1	-	-
<i>Pleuronichthys decurrens</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 60.0	0.8	-	0.0	-	-	-	-	0.0	-	0.0	-	-
<i>Pleuronichthys verticalis</i>												
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	-	-	-	-	0.7	-	0.0	-	-

TABLE 4. (cont.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
<i>Symphurus atricaudus</i>												
Station												
76.7	60.0	-	-	-	-	-	-	0.0	-	0.8	-	-
83.3	42.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
Unidentified fish larvae												
Station												
76.7	55.0	-	-	-	-	-	-	13.4	-	0.0	-	-
86.7	45.0	-	0.0	-	-	-	0.0	-	-	0.0	-	-
90.0	120.0	-	0.0	-	-	-	0.9	-	-	0.0	-	-
93.3	50.0	0.0	-	-	-	-	0.0	-	-	-	-	-

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<i>Atherinops affinis</i>	28	<i>Macroramphosus gracilis</i>	30
<i>Atherinopsis californiensis</i>	28	<i>Medialuna californiensis</i>	33
<i>Bathophilus flemingi</i>	25	<i>Merluccius productus</i>	27
<i>Bathylagus wesethi</i>	24	<i>Nannobranchium ritteri</i>	26
<i>Ceratoscopelus townsendi</i>	25	<i>Neoclinus blanchardi</i>	34
<i>Cheilopogon heterurus</i>	29	<i>Ophiodon elongatus</i>	31
<i>Cheilopogon pinnatibarbus</i>	29	<i>Ophidion scrippsae</i>	27
<i>Chilara taylori</i>	27	<i>Oxyjulis californica</i>	34
<i>Chromis punctipinnis</i>	33	<i>Paralabrax</i> spp.	32
<i>Citharichthys sordidus</i>	37	<i>Paralichthys californicus</i>	37
<i>Citharichthys stigmaeus</i>	37	<i>Pleuronichthys coenosus</i>	37
Clupeidae	22	<i>Pleuronichthys decurrens</i>	37
<i>Cololabis saira</i>	28	<i>Pleuronichthys verticalis</i>	37
<i>Coryphopterus nicholsii</i>	35	<i>Ruscarius creaseri</i>	32
<i>Cyclothone pseudopallida</i>	24	<i>Sardinops sagax</i>	22
<i>Cyclothone signata</i>	24	<i>Scomber japonicus</i>	36
<i>Cyclothone</i> spp.	24	<i>Scorpaenichthys marmoratus</i>	32
<i>Diaphus</i> spp.	26	<i>Sebastes aurora</i>	30
<i>Diogenichthys atlanticus</i>	27	<i>Sebastes diploproa</i>	31
<i>Engraulis mordax</i>	23	<i>Sebastes jordani</i>	31
<i>Genyonemus lineatus</i>	33	<i>Sebastes paucispinis</i>	31
<i>Gigantactis</i> spp.	27	<i>Sebastes</i> spp.	30
<i>Girella nigricans</i>	33	<i>Semicossyphus pulcher</i>	34
<i>Halichoeres semicinctus</i>	34	<i>Sphyræna argentea</i>	36
<i>Hemilepidotus spinosus</i>	31	<i>Stemonusudis macrurus</i>	25
<i>Hermosilla azurea</i>	33	<i>Stenobranchius leucopsarus</i>	26
<i>Hexagrammos decagrammus</i>	31	<i>Stomias atriventer</i>	25
<i>Hippoglossina stomata</i>	37	<i>Symbolophorus californiensis</i>	27
<i>Hirundichthys marginatus</i>	29	<i>Symphurus atricauda</i>	38
<i>Hygophum reinhardtii</i>	27	<i>Synodus lucioceps</i>	25
<i>Hypsoblennius gentilis</i>	35	<i>Tactostoma macropus</i>	25
<i>Hypsoblennius gilberti</i>	35	<i>Tetragonurus cuvieri</i>	36
<i>Hypsoblennius jenkinsi</i>	35	<i>Trachurus symmetricus</i>	32
<i>Icichthys lockingtoni</i>	36	<i>Triphoturus mexicanus</i>	26
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