NOAA Technical Memorandum NMFS

MAY 2002

ICHTHYOPLANKTON AND STATION DATA FOR MANTA (SURFACE) TOWS TAKEN ON CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS SURVEY CRUISES IN 1993

David A. Ambrose
Richard L. Charter
H. Geoffrey Moser

NOAA-TM-NMFS-SWFSC-329

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

The National Oceanic and Atmospheric Administration (NOAA), organized in 1970, has evolved into an agency which establishes national policies and manages and conserves our oceanic, coastal, and atmospheric resources. An organizational element within NOAA, the Office of Fisheries is responsible for fisheries policy and the direction of the National Marine Fisheries Service (NMFS).

In addition to its formal publications, the NMFS uses the NOAA Technical Memorandum series to issue informal scientific and technical publications when complete formal review and editorial processing are not appropriate or feasible. Documents within this series, however, reflect sound professional work and may be referenced in the formal scientific and technical literature.

NOAA Technical Memorandum NMFS
This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information. The TMs have not received complete formal review, editorial control, or detailed editing.

MAY 2002

ICHTHYOPLANKTON AND STATION DATA FOR MANTA (SURFACE) TOWS TAKEN ON CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS SURVEY CRUISES IN 1993

David A. Ambrose, Richard L. Charter, and H. Geoffrey Moser

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, California, USA 92037

NOAA-TM-NMFS-SWFSC-329

U.S. DEPARTMENT OF COMMERCE
Donald L. Evans, Secretary
National Oceanic and Atmospheric Administration
Scott B. Gudes, Acting Under Secretary for Oceans and Atmosphere
National Marine Fisheries Service
William T. Hogarth, Assistant Administrator for Fisheries

CONTENTS

LIST OF FIGURES

Page

LIST OF TABLES

Page

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 1993. It is the 12th report in a series that presents surface tow data for all biological-oceanographic CalCOFI surveys from 1977 to the present. A total of 263 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 262 Manta net tows was taken during 1993. 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 67 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 12th 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 1993. 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). Neuston[1] sampling with the Manta net (Figure 1) was initiated in 1977-78. Station and ichthyoplankton data for oblique tows taken on the 1993 CalCOFI survey are published in Ambrose et al. (1999). Ahlstrom and Stevens (1976), Gruber et al. (1982) and Doyle (1992a, b) provided initial information

[1]Usage 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 1993 CalCOFI survey were published by the Scripps Institution of Oceanography (Univ. of Calif., SIO 1993, 1994). All available records for Manta tows on the 1993 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	1988	Watson et al. 2002a
1980-81	Ambrose et al. 2002a	1989	Ambrose et al. 2002c
1984	Charter et al. 2002a	1990	Charter et al. 2002c
1985	Ambrose et al. 2002b	1991	Sandknop et al. 2002b
1986	Charter et al. 2002b	1992	Watson et al. 2002b
1987	Sandknop et al. 2002a		

SAMPLING AREA AND PATTERN

The 1993 CalCOFI survey consisted of four quarterly cruises on which a total of 262 Manta net tows was taken at the 263 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 RV *New Horizon*. Dates and numbers of stations sampled with the Manta net in 1993 (Figures 2 and 3) are summarized below:

9301, RV *David Starr Jordan*, 65 stations, January 12–16;

9304, RV *David Starr Jordan*, 66 stations, March 30–April 14;

9308, RV *New Horizon*, 65 stations, August 11–26;

9310, RV *New Horizon*, 66 stations, October 8–25.

The survey area extended from Avila Beach to San Diego, California and seaward on six survey lines to approximately 120–330 n. mi. (Figures 2 and 3). The most seaward station, 90.0 120.0, was approximately 400 n. mi. west of Punta Baja, Baja California, Mexico. Stations on CalCOFI lines 76.7 and 80.0 extended seaward to station 100.0, stations on lines 83.3 and 86.7 extended seaward to station 110.0, and 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 67 larval fish categories was identified (including the unidentified category): 56 to species, 9 to genus, and 1 to family.

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

Nannobrachium–Zahuranec (2000) moved the subgroup of *Lampanyctus* characterized by small or absent pectoral fins in adults to the genus *Nannobrachium*; two *Nannobrachium* 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. bristori* 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 65.3% of the total fish larvae and second in occurrence with larvae collected in 28.2% of the total samples. (Tables 2 and 3). They were almost eight times as abundant as the second most abundant species, Pacific saury (*Cololabis saira*) which had 8.2% of the total larvae and ranked first in occurrence (34.0% of the total samples). Pacific sardine (*Sardinops sagax*) was the third most abundant taxon with 4.4% of the total larvae and ranked tied for fifth in frequency of occurrence (9.9% of the samples). The rockfish genus *Sebastes* ranked fourth in abundance (3.1% of total larvae) and fourth in total occurrences (12.2% of the samples). Mussel blenny (*Hypsoblennius jenkinsi*) ranked fifth in abundance (2.9% of total larvae) and tied for fifth in total occurrences (9.9% of the samples). The next five most abundant taxa were Pacific mackerel *Scomber japonicus* (2.1% of total larvae), Panama lightfish *Vinciguerria lucetia* (1.9%), jacksmelt *Atherinopsis californiensis* (1.8%), California barracuda *Sphyraena argentea* (1.5%), and jack mackerel *Trachurus symmetricus* (1.4%). These species ranked tied for 7th, 3rd, tied for 9th, tied for 13th, and 8th in frequency of occurrence, respectively. The 10 most abundant taxa comprised 92.6% of all the larvae collected in Manta net tows on CalCOFI cruises in 1993. The remaining 7.4% was distributed among 57 other taxa. Of the ten most abundant taxa, six were coastal pelagic species, two were coastal demersal taxa, one was an epipelagic species, and one was a mesopelagic species.

In contrast to the surface collections, among the 150 taxa collected in the oblique tows during the 1993 survey, northern anchovy also ranked first in abundance (27.8% of the total), followed by Panama lightfish (19.1%), and Pacific hake (7.0%). The rockfish genus *Sebastes* also ranked fourth in the oblique collections (6.3% of the total). In 1993, none of the five mesopelagic blacksmelt species taken in oblique tows occurred in the Manta collections (Ambrose 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 1993 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 RV *New Horizon* during the 1993 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 RV *New Horizon* during the 1993 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 RV *New Horizon* during the 1993 CalCOFI survey. Numbers of larvae are listed as number per 100 m^3 of water filtered. Orders and families are listed in phylogenetic sequence (Eschmeyer 1998); other taxa are listed alphabetically.

ACKNOWLEDGMENTS

The following NMFS personnel were responsible for making the collections at sea: Dimitry Abramenkoff (all cruises), Ronald Dotson (9301, 9304), David Griffith (9301, 9304, 9310), Amy Hays (9308, 9310), and Susan Manion (9301, 9304). The samples were sorted by Lucy Dunn, Jeanne Haddox, and Frances Pocinich.. Susan Manion entered the data and Susan Jacobson provided programming assistance. The cooperation and assistance provided by the crews of the CalCOFI research vessels were instrumental in making the collections and observations at sea.

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. 1999. Ichthyoplankton and station data for California Cooperative Oceanic Fisheries Investigations survey cruises in 1993. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFSC-274. 88 pp.

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. 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.

Sandknop, E. M., 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 1991. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-327. 41 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. 1993. Data Report. Physical, chemical, and biological data. CalCOFI Cruise 9301, 12–27 January 1993 and CalCOFI Cruise 9304, 30 March–15 April 1993. SIO Ref. 93-26. 96 pp.

University of California, Scripps Institution of Oceanography. 1994. Data Report. Physical, chemical, and biological data. CalCOFI Cruise 9308, 11–27 August, 1993 and CalCOFI Cruise 9310, 8–26 October 1993. SIO Ref. 94-14. 100 pp.

Watson, W, 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 1988. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-324. 44 pp.

Watson, W, 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 1992. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-328. 40 pp.

Zahuranec, B. J. 2000. Zoogeography and systematics of the lanternfishes of the genus *Nannobrachium* (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.]

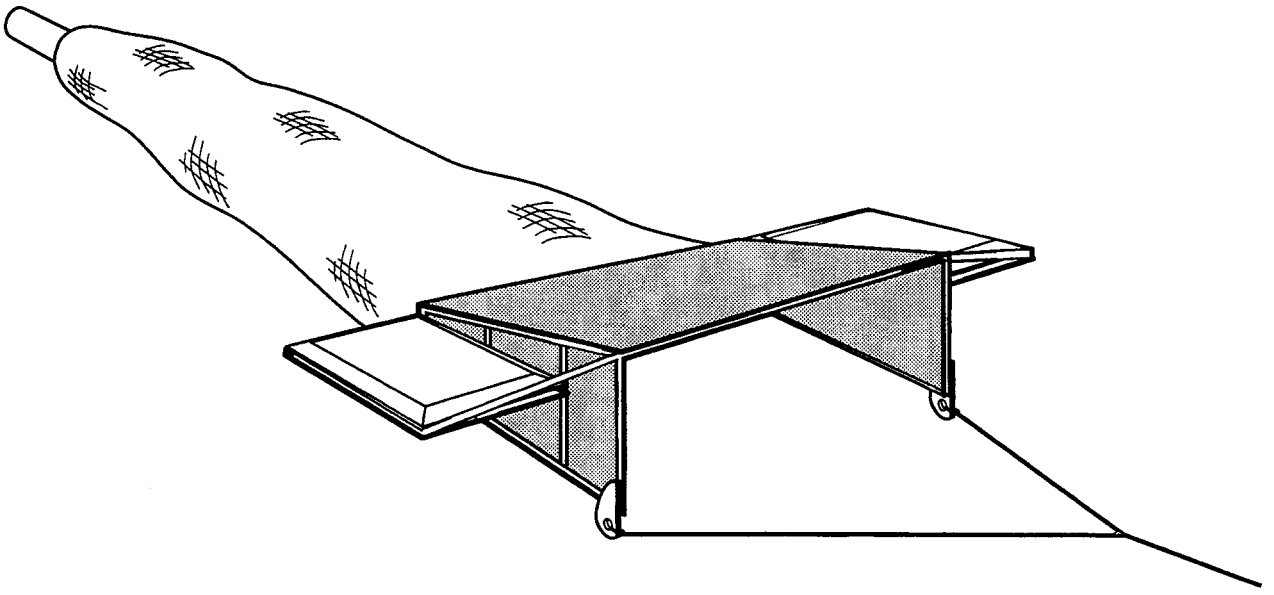

Figure 1. Diagram of the Manta net used on CalCOFI surveys.

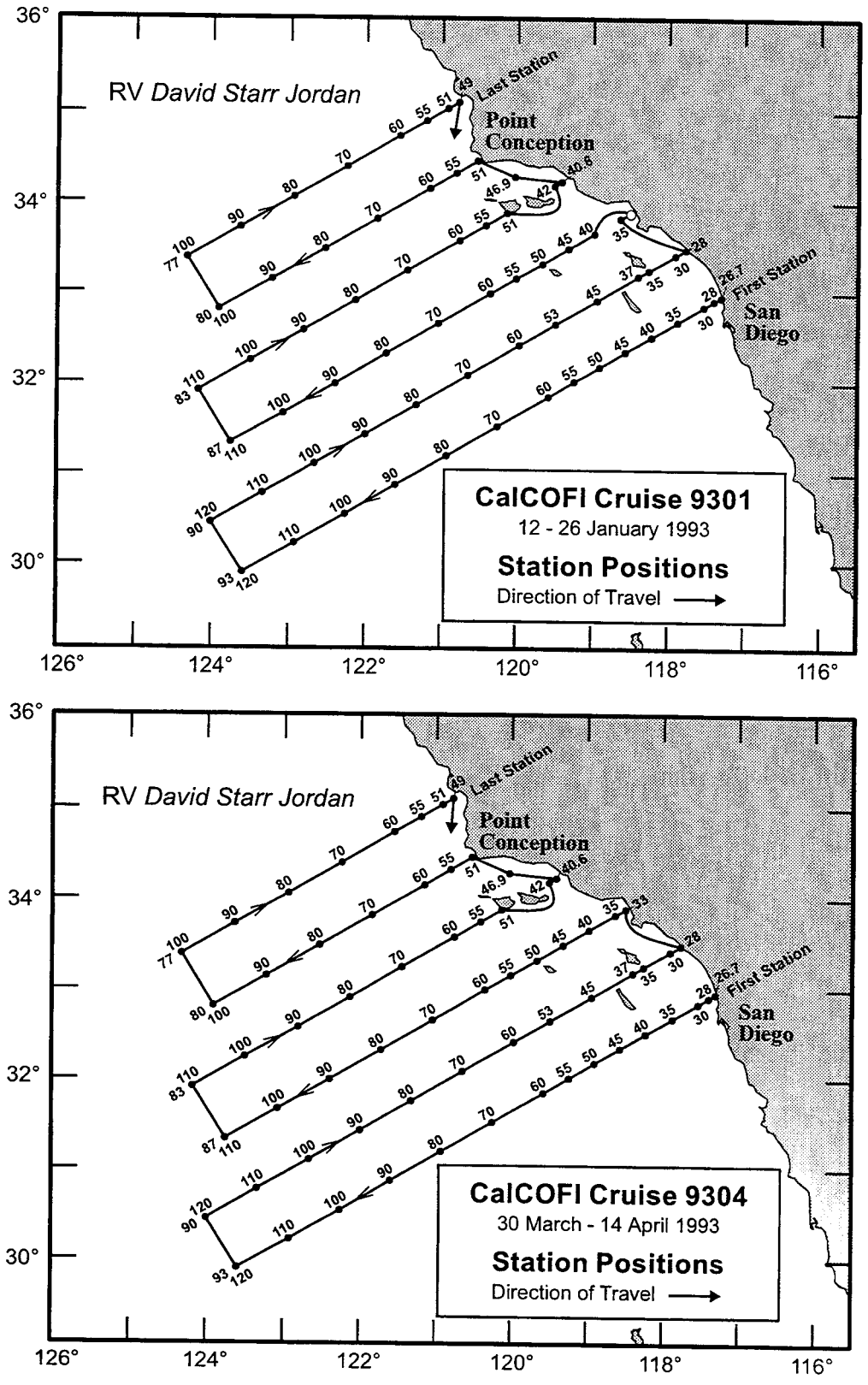

Figure 2. Stations and cruise tracks for CalCOFI cruises 9301 (above) and 9304 (below). Dots indicate stations where Manta and oblique tows were taken; open circles indicate stations where only oblique tows were taken.

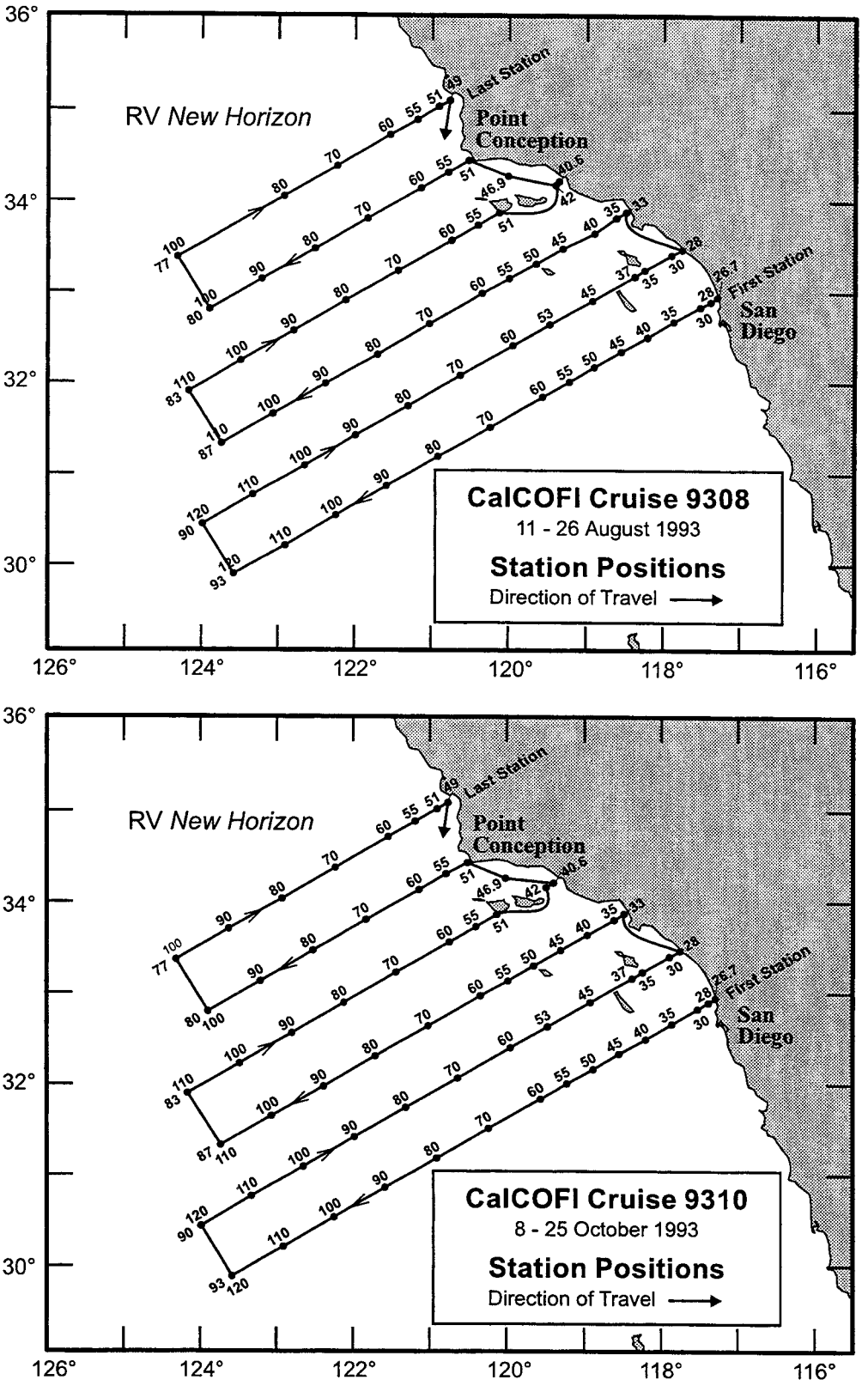

Figure 3. Stations and cruise tracks for CalCOFI cruises 9308 (above) and 9310 (below). Symbols as in Figure 2.

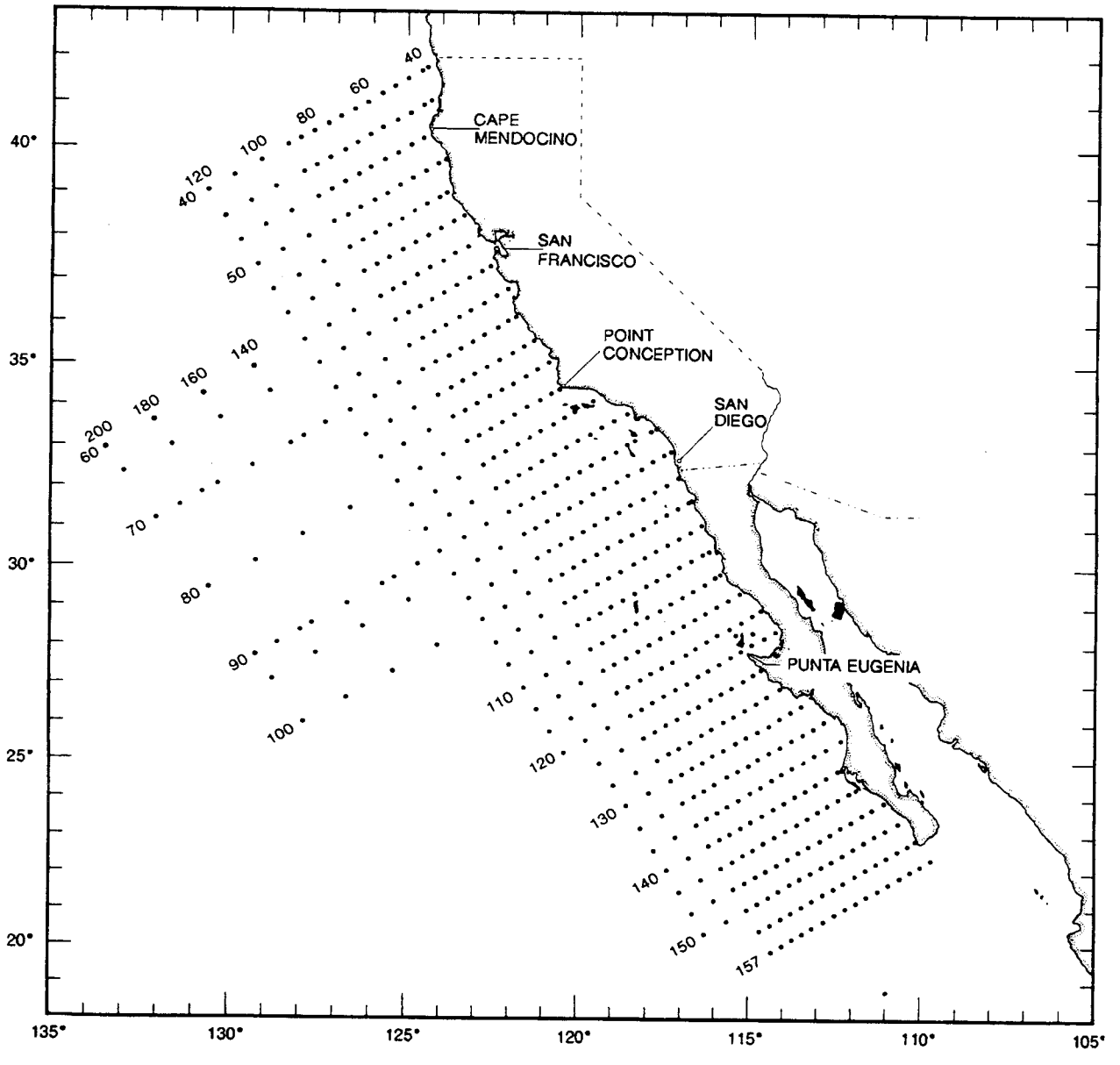

Figure 4. The basic station plan for CalCOFI cruises from 1950 - 1984.

TABLE 1. Station and plankton tow data for Manta tows taken on the 1993 CalCOFI survey. Numbers of fish eggs and larvae are raw counts, unadjusted for volume (cubic meters) of water filtered.

CalCOFI Cruise 9301

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
76.7	49.0	35	05.3	120	46.6	JD	93	01	26	0628	93	41	37
76.7	51.0	35	01.3	120	55.2	JD	93	01	26	0345	90	55	0
76.7	55.0	34	53.3	121	11.9	JD	93	01	25	2356	82	53	98
76.7	60.0	34	43.3	121	33.0	JD	93	01	25	1950	87	8	324
76.7	70.0	34	23.4	122	14.8	JD	93	01	25	1204	81	2	83
76.7	80.0	34	03.3	122	56.5	JD	93	01	25	0500	75	63	13
76.7	90.0	33	43.3	123	38.0	JD	93	01	24	2317	76	1	2
76.7	100.0	33	23.3	124	19.3	JD	93	01	24	1709	73	0	0
80.0	51.0	34	27.0	120	31.3	JD	93	01	23	0253	79	22	273
80.0	55.0	34	19.0	120	48.2	JD	93	01	23	0615	59	36	1
80.0	60.0	34	09.0	121	09.1	JD	93	01	23	1015	71	0	27
80.0	70.0	33	49.0	121	50.6	JD	93	01	23	1646	73	0	10
80.0	80.0	33	29.0	122	32.1	JD	93	01	23	2256	72	2	0
80.0	90.0	33	09.0	123	13.3	JD	93	01	24	0430	66	2	0
80.0	100.0	32	49.0	123	54.5	JD	93	01	24	1002	71	0	0
81.8	46.9	34	16.5	120	01.5	JD	93	01	22	2302	76	2	1
83.3	40.6	34	13.5	119	24.7	JD	93	01	22	1832	85	0	912
83.3	42.0	34	10.7	119	30.5	JD	93	01	22	1640	63	58	162
83.3	51.0	33	52.7	120	08.0	JD	93	01	22	0937	78	11	175
83.3	55.0	33	44.7	120	24.6	JD	93	01	22	0630	65	6	10
83.3	60.0	33	34.7	120	45.4	JD	93	01	22	0247	79	1	13
83.3	70.0	33	14.7	121	26.6	JD	93	01	21	2118	72	9	2
83.3	80.0	32	54.7	122	07.8	JD	93	01	21	1602	67	3	7
83.3	90.0	32	34.8	122	48.6	JD	93	01	21	0902	75	7	4
83.3	100.0	32	14.7	123	29.5	JD	93	01	21	0340	84	1	2
83.3	110.0	31	54.7	124	10.1	JD	93	01	20	2143	79	2	3
86.7	35.0	33	49.4	118	37.7	JD	93	01	18	1210	67	0	0
86.7	40.0	33	39.3	118	58.5	JD	93	01	18	1823	62	9	99
86.7	45.0	33	29.4	119	19.1	JD	93	01	18	2151	65	25	490
86.7	50.0	33	19.4	119	39.8	JD	93	01	19	0115	69	9	120
86.7	55.0	33	09.4	120	00.5	JD	93	01	19	0511	60	12	7
86.7	60.0	32	59.4	120	21.0	JD	93	01	19	0855	65	0	2
86.7	70.0	32	39.4	121	02.0	JD	93	01	19	1635	61	1	1
86.7	80.0	32	19.4	121	43.0	JD	93	01	19	2223	71	1	1
86.7	90.0	31	59.3	122	23.6	JD	93	01	20	0347	70	16	1
86.7	100.0	31	39.4	123	04.2	JD	93	01	20	0922	74	0	9
86.7	110.0	31	19.5	123	44.6	JD	93	01	20	1600	90	1	1
90.0	28.0	33	29.1	117	46.1	JD	93	01	18	0518	67	0	0
90.0	30.0	33	25.1	117	54.3	JD	93	01	18	0255	82	9	100
90.0	35.0	33	15.0	118	15.0	JD	93	01	17	2309	68	3	28
90.0	37.0	33	11.1	118	23.2	JD	93	01	17	2051	71	1	0
90.0	45.0	32	55.0	118	56.1	JD	93	01	17	1621	66	0	0
90.0	53.0	32	39.1	119	28.9	JD	93	01	17	1128	58	0	0
90.0	60.0	32	25.1	119	57.6	JD	93	01	17	0613	62	1	0
90.0	70.0	32	05.1	120	38.3	JD	93	01	17	0040	64	1	18
90.0	80.0	31	45.1	121	18.9	JD	93	01	16	1900	66	1	0
90.0	90.0	31	25.1	121	59.5	JD	93	01	16	1307	76	0	6

TABLE 1. (cont.) CalCOFI Cruise 9301 (cont.)

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
90.0	100.0	31	05.2	122	39.7	JD	93	01	16	0623	69	3	12
90.0	110.0	30	45.1	123	19.9	JD	93	01	16	0040	75	1	6
90.0	120.0	30	25.1	123	59.9	JD	93	01	15	1903	57	0	2
93.3	26.7	32	57.4	117	17.7	JD	93	01	12	1302	64	39	130
93.3	28.0	32	54.8	117	23.5	JD	93	01	12	1735	52	1	0
93.3	30.0	32	50.9	117	31.6	JD	93	01	12	2047	58	1	0
93.3	35.0	32	40.8	117	52.4	JD	93	01	13	0111	77	1	1
93.3	40.0	32	30.8	118	12.8	JD	93	01	13	0520	67	2	3
93.3	45.0	32	20.8	118	33.2	JD	93	01	13	0902	66	1	3
93.3	50.0	32	10.7	118	53.5	JD	93	01	13	1440	76	1	2
93.3	55.0	32	00.8	119	14.0	JD	93	01	13	1851	71	0	2
93.3	60.0	31	50.8	119	34.2	JD	93	01	13	2258	66	0	4
93.3	70.0	31	30.8	120	14.8	JD	93	01	14	0522	65	3	2
93.3	80.0	31	10.8	120	55.1	JD	93	01	14	1212	72	0	42
93.3	90.0	30	50.8	121	35.4	JD	93	01	14	1833	70	3	15
93.3	100.0	30	30.8	122	15.4	JD	93	01	15	0027	64	1	145
93.3	110.0	30	10.8	122	55.4	JD	93	01	15	0633	60	0	71
93.3	120.0	29	50.8	123	35.2	JD	93	01	15	1313	63	0	5

CalCOFI Cruise 9304

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
76.7	49.0	35	05.4	120	46.6	JD	93	04	14	1703	89	14	5
76.7	51.0	35	01.3	120	55.1	JD	93	04	14	1417	73	0	0
76.7	55.0	34	53.3	121	11.9	JD	93	04	14	0934	80	0	3
76.7	60.0	34	43.3	121	32.9	JD	93	04	14	0536	82	2	8
76.7	70.0	34	23.3	122	14.8	JD	93	04	13	2304	76	5	74
76.7	80.0	34	03.2	122	56.6	JD	93	04	13	1620	77	1	257
76.7	90.0	33	43.3	123	38.0	JD	93	04	13	0640	61	1	33
76.7	100.0	33	23.3	124	19.4	JD	93	04	13	0027	63	4	5
80.0	51.0	34	27.0	120	31.3	JD	93	04	11	0427	70	11	4
80.0	55.0	34	19.0	120	48.2	JD	93	04	11	0742	70	0	6
80.0	60.0	34	09.0	121	08.9	JD	93	04	11	1420	76	3	2
80.0	70.0	33	49.0	121	50.6	JD	93	04	11	2037	50	0	57
80.0	80.0	33	29.0	122	32.1	JD	93	04	12	0240	77	1	5
80.0	90.0	33	09.0	123	13.3	JD	93	04	12	0936	65	0	3
80.0	100.0	32	49.0	123	54.3	JD	93	04	12	1711	72	2	0
81.8	46.9	34	16.5	120	01.5	JD	93	04	11	0004	73	5	1
83.3	40.6	34	13.5	119	24.7	JD	93	04	10	1840	76	10	52
83.3	42.0	34	10.7	119	30.5	JD	93	04	10	1633	76	20	27
83.3	51.0	33	52.7	120	08.1	JD	93	04	10	0753	72	28	5
83.3	55.0	33	44.7	120	24.5	JD	93	04	10	0436	80	16	11
83.3	60.0	33	34.7	120	45.3	JD	93	04	10	0006	71	15	47
83.3	70.0	33	14.7	121	26.7	JD	93	04	09	1723	75	0	12
83.3	80.0	32	54.7	122	07.7	JD	93	04	09	0954	75	1	3
83.3	90.0	32	34.7	122	48.8	JD	93	04	09	0357	77	3	46
83.3	100.0	32	14.7	123	29.5	JD	93	04	08	2222	75	4	25
83.3	110.0	31	54.7	124	10.2	JD	93	04	08	1650	77	0	31

TABLE 1. (cont.) CalCOFI Cruise 9304 (cont.)

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
86.7	33.0	33	53.4	118	29.4	JD	93	04	05	2255	77	18	264
86.7	35.0	33	49.4	118	37.8	JD	93	04	06	0117	71	13	5
86.7	40.0	33	39.4	118	58.6	JD	93	04	06	0512	79	83	1689
86.7	45.0	33	29.4	119	19.1	JD	93	04	06	0909	67	8	36
86.7	50.0	33	19.4	119	39.8	JD	93	04	06	1825	81	262	222
86.7	55.0	33	09.4	120	00.4	JD	93	04	06	2238	73	4	54
86.7	60.0	33	00.0	120	20.8	JD	93	04	07	0305	72	2	15
86.7	70.0	32	39.4	121	02.0	JD	93	04	07	0918	80	7	186
86.7	80.0	32	19.4	121	42.9	JD	93	04	07	1624	76	0	11
86.7	90.0	31	59.4	122	23.7	JD	93	04	07	2155	79	0	2
86.7	100.0	31	39.5	123	04.2	JD	93	04	08	0325	75	1	7
86.7	110.0	31	19.4	123	44.7	JD	93	04	08	0854	76	0	36
90.0	28.0	33	29.1	117	46.1	JD	93	04	05	1620	93	9	815
90.0	30.0	33	25.1	117	54.3	JD	93	04	05	1325	83	11	163
90.0	35.0	33	15.1	118	15.0	JD	93	04	05	0829	78	10	22
90.0	37.0	33	11.1	118	23.2	JD	93	04	05	0532	78	5	50
90.0	45.0	32	55.1	118	56.0	JD	93	04	04	2355	78	53	88
90.0	53.0	32	39.1	119	29.0	JD	93	04	04	1750	84	14	1
90.0	60.0	32	25.1	119	57.6	JD	93	04	04	1215	71	1	15
90.0	70.0	32	05.1	120	38.3	JD	93	04	04	0540	79	9	14
90.0	80.0	31	45.1	121	18.9	JD	93	04	03	2303	68	19	19
90.0	90.0	31	25.1	121	59.4	JD	93	04	03	1645	83	10	153
90.0	100.0	31	05.1	122	39.8	JD	93	04	03	0807	65	1	52
90.0	110.0	30	45.1	123	19.9	JD	93	04	03	0203	75	0	8
90.0	120.0	30	25.0	123	59.8	JD	93	04	02	1947	81	0	8
93.3	26.7	32	57.4	117	18.3	JD	93	03	30	1302	83	21	147
93.3	28.0	32	54.8	117	23.8	JD	93	03	30	1839	89	96	0
93.3	30.0	32	50.8	117	31.9	JD	93	03	30	2113	86	565	269
93.3	35.0	32	40.8	117	52.5	JD	93	03	31	0100	92	10	208
93.3	40.0	32	30.8	118	12.9	JD	93	03	31	0446	90	58	354
93.3	45.0	32	20.8	118	33.3	JD	93	03	31	1000	93	7	305
93.3	50.0	32	10.9	118	53.6	JD	93	03	31	1445	74	3	431
93.3	55.0	32	00.7	119	14.1	JD	93	03	31	1854	85	12	54
93.3	60.0	31	50.8	119	34.3	JD	93	03	31	2258	68	13	2
93.3	70.0	31	30.8	120	14.8	JD	93	04	01	0510	82	1	56
93.3	80.0	31	10.8	120	55.2	JD	93	04	01	1158	87	1	66
93.3	90.0	30	50.8	121	35.4	JD	93	04	01	1840	87	1	17
93.3	100.0	30	30.8	122	15.5	JD	93	04	02	0050	73	2	1
93.3	110.0	30	10.8	122	55.4	JD	93	04	02	0641	77	0	0
93.3	120.0	29	50.8	123	35.3	JD	93	04	02	1303	68	0	3

CalCOFI Cruise 9308

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
76.7	49.0	35	05.3	120	47.0	NH	93	08	26	0313	93	64	4478
76.7	51.0	35	01.4	120	55.3	NH	93	08	26	0014	95	12	2607
76.7	55.0	34	53.1	121	11.9	NH	93	08	25	2035	84	12	3
76.7	60.0	34	43.4	121	32.9	NH	93	08	25	1654	96	1	3

TABLE 1. (cont.) CalCOFI Cruise 9308 (cont.)

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
76.7	70.0	34	22.9	122	14.7	NH	93	08	25	0917	85	1	0
76.7	80.0	34	03.4	122	56.4	NH	93	08	25	0320	86	21	0
76.7	100.0	33	23.4	124	19.3	NH	93	08	24	1138	86	4	6
80.0	51.0	34	26.9	120	32.0	NH	93	08	22	1951	87	628	439
80.0	55.0	34	19.0	120	48.1	NH	93	08	22	2302	98	40	178
80.0	60.0	34	09.0	121	09.1	NH	93	08	23	0254	81	25	0
80.0	70.0	33	48.9	121	50.5	NH	93	08	23	0826	56	2	5
80.0	80.0	33	29.0	122	32.1	NH	93	08	23	1619	74	0	0
80.0	90.0	33	08.9	123	13.3	NH	93	08	23	2202	85	21	22
80.0	100.0	32	49.1	123	54.4	NH	93	08	24	0409	77	34	6
81.8	46.9	34	16.5	120	01.4	NH	93	08	22	1537	93	311	42
83.3	40.6	34	13.4	119	24.8	NH	93	08	22	0750	95	72	423
83.3	42.0	34	10.8	119	24.8	NH	93	08	22	0921	93	55	578
83.3	51.0	33	52.7	120	08.2	NH	93	08	22	0048	91	29	2061
83.3	55.0	33	44.6	120	24.6	NH	93	08	21	2120	81	248	1
83.3	60.0	33	34.7	120	45.3	NH	93	08	21	1717	78	21	1
83.3	70.0	33	14.5	121	26.5	NH	93	08	21	0930	77	0	0
83.3	80.0	32	54.9	122	07.7	NH	93	08	21	0439	75	11	982
83.3	90.0	32	34.5	122	48.7	NH	93	08	20	2230	72	37	16
83.3	100.0	32	14.8	123	29.6	NH	93	08	20	1633	75	0	4
83.3	110.0	31	54.3	124	10.2	NH	93	08	20	0809	73	1	15
86.7	33.0	33	53.3	118	29.5	NH	93	08	17	1830	74	502	1234
86.7	35.0	33	49.4	118	37.5	NH	93	08	17	2107	93	107	2
86.7	40.0	33	39.4	118	54.4	NH	93	08	18	0055	103	11	0
86.7	45.0	33	29.5	119	19.1	NH	93	08	18	0507	82	0	0
86.7	50.0	33	19.4	119	39.8	NH	93	08	18	0922	83	1	8
86.7	55.0	33	09.5	120	00.4	NH	93	08	18	1444	87	0	0
86.7	60.0	32	59.6	120	21.2	NH	93	08	18	2013	91	2	1
86.7	70.0	32	39.4	121	02.3	NH	93	08	19	0215	82	24	0
86.7	80.0	32	18.9	121	42.7	NH	93	08	19	0817	81	8	1
86.7	90.0	31	59.4	122	23.6	NH	93	08	19	1613	76	3	4
86.7	100.0	31	39.2	123	04.2	NH	93	08	19	2125	80	4	134
86.7	110.0	31	19.6	123	44.7	NH	93	08	20	0259	86	11	212
90.0	28.0	33	28.9	117	46.1	NH	93	08	17	1206	94	22	541
90.0	30.0	33	25.1	117	54.3	NH	93	08	17	0923	111	0	11
90.0	35.0	33	15.1	118	15.2	NH	93	08	17	0455	77	19	25
90.0	37.0	33	10.9	118	22.9	NH	93	08	17	0154	96	8	8
90.0	45.0	32	54.9	118	55.9	NH	93	08	16	2040	86	9	0
90.0	53.0	32	39.2	119	28.9	NH	93	08	16	1522	80	0	0
90.0	60.0	32	24.9	119	57.5	NH	93	08	16	0835	78	0	0
90.0	70.0	32	05.1	120	38.4	NH	93	08	16	0341	84	32	75
90.0	80.0	31	44.8	121	18.8	NH	93	08	15	2154	86	11	203
90.0	90.0	31	25.1	121	59.5	NH	93	08	15	1630	70	0	82
90.0	100.0	31	04.6	122	39.7	NH	93	08	15	0844	87	3	13
90.0	110.0	30	45.0	123	19.9	NH	93	08	15	0403	78	7	104
90.0	120.0	30	25.0	123	59.8	NH	93	08	14	2215	85	0	846
93.3	26.7	32	57.3	117	18.2	NH	93	08	11	1225	97	7	71
93.3	28.0	32	54.4	117	23.6	NH	93	08	11	1812	93	10	9
93.3	30.0	32	50.8	117	31.8	NH	93	08	11	2127	99	18	3

TABLE 1. (cont.) CalCOFI Cruise 9308 (cont.)

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
93.3	35.0	32	41.2	117	52.6	NH	93	08	12	0310	89	6	3
93.3	40.0	32	30.7	118	12.9	NH	93	08	12	0732	31	2	3
93.3	45.0	32	21.0	118	33.3	NH	93	08	12	1255	84	0	0
93.3	50.0	32	10.9	118	54.4	NH	93	08	12	1755	86	3	2
93.3	55.0	32	00.9	119	13.7	NH	93	08	12	2210	93	3	77
93.3	60.0	31	51.0	119	34.4	NH	93	08	13	0230	79	3	12
93.3	70.0	31	30.6	120	14.8	NH	93	08	13	0716	79	4	6
93.3	80.0	31	10.9	120	55.2	NH	93	08	13	1618	77	7	70
93.3	90.0	30	50.9	121	35.2	NH	93	08	13	2157	90	20	71
93.3	100.0	30	31.1	122	15.4	NH	93	08	14	0356	79	5	184
93.3	110.0	30	10.6	122	55.1	NH	93	08	14	0841	96	3	232
93.3	120.0	29	51.0	123	35.1	NH	93	08	14	1646	89	8	29

CalCOFI Cruise 9310

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
76.7	49.0	35	05.3	120	46.6	NH	93	10	25	0907	96	103	1524
76.7	51.0	35	01.3	120	55.0	NH	93	10	25	0637	92	4	520
76.7	55.0	34	53.3	121	12.0	NH	93	10	25	0313	78	4	2
76.7	60.0	34	43.1	121	32.9	NH	93	10	24	2318	78	2	0
76.7	70.0	34	23.3	122	14.8	NH	93	10	24	1748	73	3	1
76.7	80.0	34	03.1	122	56.4	NH	93	10	24	1130	81	0	0
76.7	90.0	33	43.2	123	38.1	NH	93	10	24	0512	69	13	1
76.7	100.0	33	23.1	124	19.3	NH	93	10	23	2325	96	21	2
80.0	51.0	34	26.9	120	31.2	NH	93	10	22	1100	88	9	843
80.0	55.0	34	19.3	120	48.0	NH	93	10	22	1404	91	38	121
80.0	60.0	34	09.0	121	09.1	NH	93	10	22	1841	80	358	0
80.0	70.0	33	49.1	121	50.4	NH	93	10	22	2356	86	3	3
80.0	80.0	33	29.1	122	32.0	NH	93	10	23	0530	79	11	2
80.0	90.0	33	09.0	123	13.1	NH	93	10	23	1130	91	3	4
80.0	100.0	32	49.0	123	54.2	NH	93	10	23	1733	74	2	1
81.8	46.9	34	16.7	120	01.6	NH	93	10	22	0637	92	1	4426
83.3	40.6	34	13.5	119	24.7	NH	93	10	22	0113	96	77	83
83.3	42.0	34	10.6	119	30.4	NH	93	10	21	2249	92	43	28
83.3	51.0	33	52.8	120	08.2	NH	93	10	21	1539	81	1	0
83.3	55.0	33	44.7	120	24.7	NH	93	10	21	1202	92	3	0
83.3	60.0	33	34.7	120	45.2	NH	93	10	21	0737	83	0	4
83.3	70.0	33	14.8	121	26.6	NH	93	10	21	0223	90	3	5
83.3	80.0	32	54.5	122	07.8	NH	93	10	20	2100	85	10	2
83.3	90.0	32	34.7	122	48.6	NH	93	10	20	1547	82	5	3
83.3	100.0	32	14.6	123	29.4	NH	93	10	20	0801	98	8	3
83.3	110.0	31	54.6	124	10.2	NH	93	10	20	0232	85	11	2
86.7	33.0	33	53.4	118	29.6	NH	93	10	17	1757	77	396	11
86.7	35.0	33	49.3	118	37.5	NH	93	10	17	2014	66	103	18
86.7	40.0	33	39.5	118	58.3	NH	93	10	17	2321	86	15	93
86.7	45.0	33	29.4	119	19.1	NH	93	10	18	0321	85	1	0
86.7	50.0	33	19.4	119	39.8	NH	93	10	18	0642	67	0	2
86.7	55.0	33	09.3	119	59.8	NH	93	10	18	1044	82	0	0

TABLE 1. (cont.) CalCOFI Cruise 9310 (cont.)

Line	Station	Latitude (N) deg.	min.	Longitude (W) deg.	min.	Ship Code	Tow Date yr.	mo.	day	Time (PST)	Volume Water Strained	Total Larvae	Total Eggs
86.7	60.0	32	59.4	120	20.9	NH	93	10	18	1520	83	1	0
86.7	70.0	32	39.4	121	01.8	NH	93	10	18	2059	87	8	7
86.7	80.0	32	19.4	121	43.0	NH	93	10	19	0248	78	6	50
86.7	90.0	31	59.2	122	23.6	NH	93	10	19	0802	86	8	47
86.7	100.0	31	39.4	123	04.2	NH	93	10	19	1602	87	13	2
86.7	110.0	31	19.6	123	44.4	NH	93	10	19	2114	97	10	0
90.0	28.0	33	29.1	117	46.0	NH	93	10	17	1005	87	8	81
90.0	30.0	33	25.1	117	54.5	NH	93	10	17	0630	75	0	0
90.0	35.0	33	15.1	118	15.2	NH	93	10	17	0212	86	1	0
90.0	37.0	33	11.0	118	23.3	NH	93	10	16	2242	78	7	0
90.0	45.0	32	55.1	118	55.9	NH	93	10	16	1739	77	2	0
90.0	53.0	32	39.1	119	29.1	NH	93	10	16	0939	102	3	4
90.0	60.0	32	25.0	119	57.8	NH	93	10	15	0931	102	4	10
90.0	70.0	32	05.0	120	38.5	NH	93	10	14	2306	103	2	3
90.0	80.0	31	44.9	121	19.0	NH	93	10	14	0840	93	6	13
90.0	90.0	31	25.1	121	59.4	NH	93	10	13	2344	90	8	0
90.0	100.0	31	05.1	122	39.7	NH	93	10	13	1040	103	5	24
90.0	110.0	30	45.1	123	19.9	NH	93	10	13	0509	101	7	8
90.0	120.0	30	25.0	123	59.8	NH	93	10	12	1610	84	5	9
93.3	26.7	32	57.6	117	18.3	NH	93	10	08	1225	96	41	87
93.3	28.0	32	54.8	117	23.5	NH	93	10	08	1601	90	0	0
93.3	30.0	32	50.8	117	31.9	NH	93	10	08	1843	85	19	1
93.3	35.0	32	40.8	117	52.4	NH	93	10	08	2222	100	4	825
93.3	40.0	32	30.7	118	12.8	NH	93	10	09	0237	105	1	5
93.3	45.0	32	21.0	118	33.3	NH	93	10	09	0704	92	0	1
93.3	50.0	32	10.9	118	53.5	NH	93	10	09	1118	84	0	13
93.3	55.0	32	01.1	119	13.9	NH	93	10	09	2000	105	0	20
93.3	60.0	31	50.9	119	34.3	NH	93	10	10	0222	103	0	42
93.3	70.0	31	30.9	120	14.7	NH	93	10	10	1152	86	2	12
93.3	80.0	31	10.7	120	55.1	NH	93	10	10	2117	94	0	2
93.3	90.0	30	50.9	121	35.2	NH	93	10	11	0238	93	9	21
93.3	100.0	30	30.8	122	15.6	NH	93	10	11	1110	96	1	110
93.3	110.0	30	10.7	122	55.2	NH	93	10	12	0057	91	2	2
93.3	120.0	29	50.9	123	35.2	NH	93	10	12	0941	89	2	1

TABLE 2. Pooled occurrences of fish larvae taken in Manta tows on the 1993 CalCOFI survey.

Rank	Taxon	Occurrences
1	*Cololabis saira*	89
2	*Engraulis mordax*	74
3	*Vinciguerria lucetia*	35
4	*Sebastes* spp.	32
5	*Sardinops sagax*	26
5	*Hypsoblennius jenkinsi*	26
7	*Scomber japonicus*	18
8	*Trachurus symmetricus*	15
9	*Ceratoscopelus townsendi*	14
9	*Atherinopsis californiensis*	14
11	*Chromis punctipinnis*	13
12	*Scorpaenichthys marmoratus*	10
13	*Sphyraena argentea*	8
13	*Cheilopogon* spp.	8
13	*Girella nigricans*	8
16	*Stenobrachius leucopsarus*	7
16	*Sebastes diploproa*	7
16	*Oxyjulis californica*	7
19	*Merluccius productus*	6
19	*Paralabrax* spp.	6
21	*Citharichthys stigmaeus*	5
21	*Fodiator acutus*	5
21	*Lampanyctus* spp.	5
21	*Triphoturus mexicanus*	5
21	*Lampadena urophaos*	5
26	*Paralichthys californicus*	4
26	*Stomias atriventer*	4
26	*Hypsoblennius gilberti*	4
29	*Xenistius californiensis*	3
29	*Diaphus* spp.	3
29	*Medialuna californiensis*	3
29	*Pleuronichthys coenosus*	3
29	*Macroramphosus gracilis*	3
29	*Ophiodon elongatus*	3
29	*Tetragonurus cuvieri*	3
29	*Sebastes jordani*	3
37	*Cyclothone signata*	2
37	*Aristostomias scintillans*	2
37	*Atherinops affinis*	2
37	*Hexagrammos decagrammus*	2
37	*Sebastes aurora*	2
37	*Neoclinus blanchardi*	2
37	*Hemilepidotus spinosus*	2
37	*Anisotremus davidsoni*	2
45	*Icichthys lockingtoni*	1
45	*Nannobrachium ritteri*	1
45	*Hypsoblennius* spp.	1
45	*Parvilux ingens*	1
45	*Typhlogobius californiensis*	1

TABLE 2. (cont.)

Rank	Taxon	Occurrences
45	*Symbolophorus californiensis*	1
45	*Psenes pellucidus*	1
45	*Peprilus simillimus*	1
45	*Citharichthys sordidus*	1
45	*Lyopsetta exilis*	1
45	*Hypsoblennius gentilis*	1
45	*Sebastes goodei*	1
45	*Genyonemus lineatus*	1
45	*Tarletonbeania crenularis*	1
45	*Trachipterus altivelis*	1
45	*Ophidion scrippsae*	1
45	*Caulophryne* spp.	1
45	*Oneirodes* spp.	1
45	*Gigantactis* spp.	1
45	Cottidae	1
45	Unidentified fish larvae	1
45	*Cheilopogon heterurus*	1
45	*Semicossyphus pulcher*	1
	Total	523

TABLE 3. Pooled raw counts of fish larvae taken in Manta tows on the 1993 CalCOFI survey.

Rank	Taxon	Count
1	*Engraulis mordax*	3904
2	*Cololabis saira*	489
3	*Sardinops sagax*	262
4	*Sebastes* spp.	186
5	*Hypsoblennius jenkinsi*	175
6	*Scomber japonicus*	124
7	*Vinciguerria lucetia*	115
8	*Atherinopsis californiensis*	106
9	*Sphyraena argentea*	90
10	*Trachurus symmetricus*	84
11	*Oxyjulis californica*	44
12	*Chromis punctipinnis*	43
13	*Girella nigricans*	42
14	*Scorpaenichthys marmoratus*	31
15	*Merluccius productus*	26
16	*Ceratoscopelus townsendi*	20
16	*Ophiodon elongatus*	20
18	*Hexagrammos decagrammus*	19
19	*Sebastes jordani*	18
20	*Stenobrachius leucopsarus*	13
21	*Paralabrax* spp.	12
21	*Lampadena urophaos*	12
23	*Triphoturus mexicanus*	10
23	*Cheilopogon* spp.	10
23	*Sebastes diploproa*	10
26	*Hypsoblennius gilberti*	9
27	*Hemilepidotus spinosus*	8
28	*Paralichthys californicus*	6
28	*Xenistius californiensis*	6
30	*Lampanyctus* spp.	5
30	*Citharichthys stigmaeus*	5
30	*Fodiator acutus*	5
30	*Neoclinus blanchardi*	5
34	*Hypsoblennius gentilis*	4
34	*Pleuronichthys coenosus*	4
34	*Macroramphosus gracilis*	4
34	*Stomias atriventer*	4
38	*Medialuna californiensis*	3
38	*Diaphus* spp.	3
38	*Tetragonurus cuvieri*	3
38	*Symbolophorus californiensis*	3
38	*Cyclothone signata*	3
43	*Aristostomias scintillans*	2
43	*Atherinops affinis*	2
43	*Sebastes aurora*	2
43	*Citharichthys sordidus*	2
43	*Hypsoblennius* spp.	2
43	*Anisotremus davidsoni*	2
43	Cottidae	2

TABLE 3. (cont.)

Rank	Taxon	Count
50	*Gigantactis* spp.	1
50	*Caulophryne* spp.	1
50	*Lyopsetta exilis*	1
50	*Ophidion scrippsae*	1
50	*Typhlogobius californiensis*	1
50	*Sebastes goodei*	1
50	*Genyonemus lineatus*	1
50	*Semicossyphus pulcher*	1
50	*Trachipterus altivelis*	1
50	*Oneirodes* spp.	1
50	Unidentified fish larvae	1
50	*Nannobrachium ritteri*	1
50	*Icichthys lockingtoni*	1
50	*Parvilux ingens*	1
50	*Peprilus simillimus*	1
50	*Psenes pellucidus*	1
50	*Tarletonbeania crenularis*	1
50	*Cheilopogon heterurus*	1
	Total	5977

TABLE 4. Numbers of fish larvae taken in Manta net tows on the 1993 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.

Sardinops sagax

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7	70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
80.0	51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
81.8	46.9	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-
83.3	40.6	0.0	-	-	0.0	-	-	-	5.7	-	1.0	-	-
83.3	42.0	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
83.3	55.0	0.0	-	-	0.0	-	-	-	7.3	-	0.0	-	-
86.7	33.0	-	-	-	0.0	-	-	-	67.2	-	1.5	-	-
86.7	35.0	0.0	-	-	0.0	-	-	-	18.5	-	0.0	-	-
86.7	40.0	0.0	-	-	0.0	-	-	-	1.0	-	0.0	-	-
86.7	70.0	0.0	-	-	0.0	-	-	-	4.1	-	0.0	-	-
90.0	28.0	0.0	-	-	2.8	-	-	-	0.9	-	0.0	-	-
90.0	35.0	0.0	-	-	0.0	-	-	-	11.6	-	0.0	-	-
90.0	37.0	0.0	-	-	3.9	-	-	-	1.0	-	0.0	-	-
90.0	45.0	0.0	-	-	27.4	-	-	-	0.0	-	0.0	-	-
93.3	26.7	0.0	-	0.0	-	-	-	-	3.9	-	0.0	-	-
93.3	28.0	0.0	-	0.0	-	-	-	-	3.7	-	0.0	-	-
93.3	30.0	0.0	-	0.0	-	-	-	-	3.0	-	0.0	-	-
93.3	35.0	0.0	-	2.8	-	-	-	-	0.0	-	0.0	-	-
93.3	40.0	0.0	-	38.5	-	-	-	-	0.0	-	0.0	-	-
93.3	45.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-
93.3	60.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-
93.3	70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-

Engraulis mordax

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7	49.0	0.0	-	-	0.0	-	-	-	47.5	-	97.0	-	-
76.7	51.0	15.3	-	-	0.0	-	-	-	6.6	-	0.9	-	-
76.7	55.0	35.9	-	-	0.0	-	-	-	7.6	-	0.0	-	-
76.7	60.0	1.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7	70.0	0.0	-	-	1.5	-	-	-	0.9	-	0.0	-	-
80.0	51.0	15.8	-	-	5.6	-	-	-	512.1	-	5.3	-	-

TABLE 4. (cont.)

Engraulis mordax (cont.)

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0	55.0	16.6	-	-	0.0	-	-	-	35.2	-	33.6	-	-
80.0	60.0	0.0	-	-	0.0	-	-	-	20.2	-	283.0	-	-
80.0	70.0	0.0	-	-	0.0	-	-	-	0.0	-	2.6	-	-
81.8	46.9	0.0	-	-	3.7	-	-	-	261.6	-	0.9	-	-
83.3	40.6	0.0	-	-	6.9	-	-	-	36.9	-	28.9	-	-
83.3	42.0	24.1	-	-	14.4	-	-	-	2.8	-	0.0	-	-
83.3	51.0	0.8	-	-	0.7	-	-	-	25.4	-	0.0	-	-
83.3	55.0	0.0	-	-	0.8	-	-	-	191.3	-	0.0	-	-
83.3	60.0	0.0	-	-	0.0	-	-	-	2.3	-	0.0	-	-
86.7	33.0	-	-	-	0.0	-	-	-	206.9	-	293.0	-	-
86.7	35.0	0.0	-	-	7.8	-	-	-	38.0	-	53.8	-	-
86.7	40.0	2.5	-	-	61.9	-	-	-	3.1	-	12.8	-	-
86.7	45.0	5.2	-	-	4.7	-	-	-	0.0	-	0.0	-	-
86.7	50.0	0.0	-	-	151.7	-	-	-	0.0	-	0.0	-	-
86.7	60.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
86.7	70.0	0.0	-	-	0.0	-	-	-	1.6	-	0.0	-	-
86.7	80.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
90.0	28.0	0.0	-	-	5.6	-	-	-	0.0	-	4.4	-	-
90.0	30.0	0.8	-	-	8.3	-	-	-	0.0	-	0.0	-	-
90.0	35.0	2.0	-	-	3.1	-	-	-	0.0	-	0.0	-	-
90.0	37.0	0.7	-	-	0.0	-	-	-	1.0	-	0.8	-	-
90.0	45.0	0.0	-	-	11.7	-	-	-	0.0	-	0.0	-	-
90.0	80.0	0.0	-	-	1.4	-	-	-	0.0	-	0.0	-	-
90.0	110.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
93.3	26.7	0.0	-	5.0	-	-	-	-	2.9	-	37.6	-	-
93.3	28.0	0.0	-	64.8	-	-	-	-	2.8	-	0.0	-	-
93.3	30.0	0.0	-	484.4	-	-	-	-	4.0	-	10.2	-	-
93.3	35.0	0.0	-	4.6	-	-	-	-	0.0	-	0.0	-	-
93.3	40.0	0.7	-	7.2	-	-	-	-	0.0	-	0.0	-	-
93.3	55.0	0.0	-	0.0	-	-	-	-	2.8	-	0.0	-	-

Cyclothone signata

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3	60.0	0.0	-	-	1.4	-	-	-	0.0	-	0.0	-	-
86.7	90.0	0.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

Vinciguerria lucetia

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 100.0	0.0	-	-	0.6	-	-	-	1.7	-	0.0	-	-
80.0 90.0	0.0	-	-	0.0	-	-	-	5.1	-	0.0	-	-
80.0 100.0	0.0	-	-	0.0	-	-	-	8.4	-	0.0	-	-
83.3 51.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
83.3 60.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
83.3 70.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
83.3 90.0	0.0	-	-	0.0	-	-	-	8.7	-	3.3	-	-
83.3 110.0	0.8	-	-	0.0	-	-	-	0.7	-	1.7	-	-
86.7 60.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
86.7 80.0	0.0	-	-	0.0	-	-	-	1.6	-	0.8	-	-
86.7 90.0	9.1	-	-	0.0	-	-	-	2.3	-	1.7	-	-
86.7 100.0	0.0	-	-	0.0	-	-	-	0.8	-	6.1	-	-
86.7 110.0	0.0	-	-	0.0	-	-	-	2.6	-	1.9	-	-
90.0 35.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
90.0 60.0	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-
90.0 70.0	0.0	-	-	0.0	-	-	-	9.3	-	0.0	-	-
90.0 80.0	0.0	-	-	0.0	-	-	-	6.0	-	0.0	-	-
90.0 110.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
90.0 120.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
93.3 50.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
93.3 70.0	0.0	-	-	0.0	-	-	-	2.4	-	0.0	-	-
93.3 80.0	0.0	-	-	0.0	-	-	-	3.8	-	0.0	-	-
93.3 90.0	0.0	-	-	0.0	-	-	-	1.8	-	0.9	-	-
93.3 100.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
93.3 120.0	0.0	-	-	0.0	-	-	-	1.8	-	0.0	-	-

Stomias atriventer

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 60.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
90.0 53.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
93.3 60.0	0.0	-	0.7	-	-	-	-	0.0	-	0.0	-	-
93.3 80.0	0.0	-	-	0.9	-	-	-	0.0	-	0.0	-	-

Aristostomias scintillans

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 100.0	0.0	-	-	0.0	-	-	-	0.0	-	0.7	-	-

TABLE 4. (cont.)

Aristostomias scintillans (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 100.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-

Ceratoscopelus townsendi

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 100.0	0.0	-	-	1.9	-	-	-	0.0	-	0.0	-	-
80.0 80.0	0.0	-	-	0.8	-	-	-	0.0	-	0.8	-	-
80.0 90.0	0.0	-	-	0.0	-	-	-	1.7	-	0.0	-	-
80.0 100.0	0.0	-	-	0.7	-	-	-	0.8	-	0.0	-	-
86.7 80.0	0.0	-	-	0.0	-	-	-	0.0	-	2.3	-	-
86.7 100.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
90.0 70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
90.0 80.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
93.3 90.0	0.0	-	-	0.9	-	-	-	0.9	-	0.0	-	-
93.3 110.0	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-
93.3 120.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Diaphus spp.

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 90.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
83.3 110.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-

Lampadena urophaos

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 100.0	0.0	-	-	0.0	-	-	-	0.0	-	4.3	-	-
90.0 45.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
90.0 120.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
93.3 80.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
93.3 120.0	0.0	-	-	0.0	-	-	-	3.6	-	0.0	-	-

Lampanyctus spp.

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
83.3 55.0	0.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 60.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
93.3 60.0	0.0	-	0.7	-	-	-	-	0.8	-	0.0	-	-

TABLE 4. (cont.)

Nannobrachium ritteri

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 90.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-

Parvilux ingens

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 100.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-

Stenobrachius leucopsarus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	0.9	-	-	-	0.0	-	0.0	-	-
76.7 70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
80.0 60.0	0.0	-	-	1.5	-	-	-	0.0	-	0.0	-	-
83.3 55.0	0.0	-	-	4.0	-	-	-	0.0	-	0.0	-	-
83.3 90.0	0.0	-	-	0.0	-	-	-	1.4	-	0.0	-	-
86.7 100.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
93.3 50.0	0.0	-	0.7	-	-	-	-	0.0	-	0.0	-	-

Triphoturus mexicanus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
83.3 60.0	0.0	-	-	0.0	-	-	-	3.9	-	0.0	-	-
86.7 33.0	-	-	-	0.0	-	-	-	1.5	-	0.0	-	-
86.7 40.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
93.3 70.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-

Symbolophorus californiensis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 55.0	0.0	-	-	2.2	-	-	-	0.0	-	0.0	-	-

Tarletonbeania crenularis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 60.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-

Trachipterus altivelis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 60.0	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-

TABLE 4. (cont.)

Merluccius productus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.9	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 51.0	0.0	-	-	0.0	-	-	-	0.0	-	1.8	-	-
76.7 55.0	5.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
80.0 51.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
86.7 50.0	3.5	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 55.0	6.0	-	-	0.0	-	-	-	0.0	-	0.0	-	-

Ophidion scrippsae

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 55.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-

***Caulophryne* spp.**

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 120.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-

***Oneirodes* spp.**

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 90.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

***Gigantactis* spp.**

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 70.0	0.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-

Atherinops affinis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 33.0	-	-	-	0.0	-	-	-	0.7	-	0.0	-	-
93.3 26.7	0.0	-	0.0	-	-	-	-	0.0	-	1.0	-	-

Atherinopsis californiensis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	9.3	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 40.6	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
83.3 42.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
83.3 51.0	0.0	-	-	2.1	-	-	-	0.0	-	0.0	-	-
86.7 33.0	-	-	-	13.8	-	-	-	1.5	-	0.0	-	-
86.7 35.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
86.7 40.0	0.0	-	-	1.6	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

Atherinopsis californiensis (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 50.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
93.3 26.7	24.8	-	12.4	-	-	-	-	0.0	-	0.0	-	-
93.3 28.0	0.0	-	8.0	-	-	-	-	0.0	-	0.0	-	-
93.3 30.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-

Cololabis saira

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.9	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 55.0	0.8	-	-	0.0	-	-	-	0.0	-	2.3	-	-
76.7 60.0	3.5	-	-	0.0	-	-	-	1.0	-	1.6	-	-
76.7 70.0	1.6	-	-	0.0	-	-	-	0.0	-	2.2	-	-
76.7 80.0	47.2	-	-	0.0	-	-	-	17.1	-	0.0	-	-
76.7 90.0	0.8	-	-	0.6	-	-	-	-	-	9.0	-	-
76.7 100.0	0.0	-	-	0.0	-	-	-	1.7	-	20.2	-	-
80.0 60.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
80.0 70.0	0.0	-	-	0.0	-	-	-	1.1	-	0.0	-	-
80.0 80.0	1.4	-	-	0.0	-	-	-	0.0	-	7.9	-	-
80.0 90.0	1.3	-	-	0.0	-	-	-	9.4	-	2.7	-	-
80.0 100.0	0.0	-	-	0.0	-	-	-	16.1	-	0.0	-	-
83.3 55.0	0.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 60.0	0.8	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 70.0	6.5	-	-	0.0	-	-	-	0.0	-	1.8	-	-
83.3 80.0	2.0	-	-	0.7	-	-	-	8.3	-	8.5	-	-
83.3 90.0	5.3	-	-	2.3	-	-	-	16.7	-	0.8	-	-
83.3 100.0	0.8	-	-	3.0	-	-	-	0.0	-	7.8	-	-
83.3 110.0	0.8	-	-	0.0	-	-	-	0.0	-	6.8	-	-
86.7 40.0	1.9	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 45.0	5.2	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 50.0	1.4	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 55.0	0.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 70.0	0.0	-	-	0.0	-	-	-	12.3	-	7.0	-	-
86.7 80.0	0.7	-	-	0.0	-	-	-	4.9	-	0.0	-	-
86.7 90.0	1.4	-	-	0.0	-	-	-	0.0	-	5.1	-	-
86.7 100.0	0.0	-	-	0.0	-	-	-	1.6	-	0.0	-	-

TABLE 4. (cont.)

Cololabis saira (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 110.0	0.9	-	-	0.0	-	-	-	6.9	-	6.8	-	-
90.0 30.0	6.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
90.0 53.0	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-
90.0 60.0	0.0	-	-	0.0	-	-	-	0.0	-	2.0	-	-
90.0 70.0	0.6	-	-	0.0	-	-	-	17.7	-	1.0	-	-
90.0 80.0	0.7	-	-	0.0	-	-	-	2.6	-	5.6	-	-
90.0 90.0	0.0	-	-	0.0	-	-	-	0.0	-	7.2	-	-
90.0 100.0	2.1	-	-	0.0	-	-	-	2.6	-	5.2	-	-
90.0 110.0	0.8	-	-	0.0	-	-	-	3.9	-	7.1	-	-
90.0 120.0	0.0	-	-	0.0	-	-	-	0.0	-	1.7	-	-
93.3 30.0	0.6	-	0.0	-	-	-	-	0.0	-	0.0	-	-
93.3 35.0	0.8	-	0.0	-	-	-	-	0.0	-	0.0	-	-
93.3 40.0	0.7	-	1.8	-	-	-	-	0.3	-	0.0	-	-
93.3 45.0	0.7	-	5.6	-	-	-	-	0.0	-	0.0	-	-
93.3 70.0	2.0	-	-	0.0	-	-	-	0.0	-	1.7	-	-
93.3 90.0	2.1	-	-	0.0	-	-	-	14.4	-	7.4	-	-
93.3 100.0	0.6	-	-	0.0	-	-	-	3.9	-	1.0	-	-
93.3 110.0	0.0	-	-	0.0	-	-	-	1.0	-	1.8	-	-
93.3 120.0	0.0	-	-	0.0	-	-	-	0.0	-	1.8	-	-

***Cheilopogon* spp.**

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 100.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
83.3 40.6	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
86.7 33.0	-	-	-	0.0	-	-	-	0.7	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	0.0	-	1.3	-	-
93.3 26.7	0.0	-	0.0	-	-	-	-	0.0	-	1.0	-	-
93.3 35.0	0.0	-	0.0	-	-	-	-	1.8	-	0.0	-	-
93.3 40.0	0.0	-	0.0	-	-	-	-	0.3	-	0.0	-	-
93.3 90.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Cheilopogon heterurus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 30.0	0.0	-	0.0	-	-	-	-	0.0	-	0.8	-	-

TABLE 4. (cont.)

Fodiator acutus

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	-	-
90.0 45.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
93.3 30.0	0.0	-	0.0	-	-	-	-	1.0	-	0.0	-	-
93.3 50.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
93.3 60.0	0.0	-	0.0	-	-	-	-	0.8	-	0.0	-	-

Macroramphosus gracilis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 55.0	0.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
90.0 53.0	0.0	-	-	0.0	-	-	-	0.0	-	2.0	-	-
93.3 50.0	0.8	-	0.0	-	-	-	-	0.0	-	0.0	-	-

Sebastes spp.

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	4.6	-	-	11.6	-	-	-	0.0	-	0.0	-	-
76.7 51.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
76.7 55.0	0.8	-	-	0.0	-	-	-	0.0	-	0.0	-	-
80.0 51.0	0.8	-	-	0.7	-	-	-	0.9	-	0.9	-	-
80.0 55.0	1.2	-	-	0.0	-	-	-	0.0	-	0.9	-	-
83.3 40.6	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
83.3 42.0	5.1	-	-	0.8	-	-	-	0.0	-	0.0	-	-
83.3 51.0	6.2	-	-	10.7	-	-	-	0.0	-	0.0	-	-
83.3 55.0	2.0	-	-	8.0	-	-	-	0.0	-	0.0	-	-
86.7 40.0	0.6	-	-	1.6	-	-	-	0.0	-	0.0	-	-
86.7 45.0	5.2	-	-	0.7	-	-	-	0.0	-	0.0	-	-
86.7 50.0	1.4	-	-	60.0	-	-	-	0.0	-	0.0	-	-
86.7 55.0	0.6	-	-	0.7	-	-	-	0.0	-	0.0	-	-
90.0 30.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
90.0 35.0	0.0	-	-	4.7	-	-	-	0.0	-	0.0	-	-
90.0 60.0	0.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
93.3 28.0	0.0	-	2.7	-	-	-	-	0.0	-	0.0	-	-
93.3 35.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-
93.3 50.0	0.0	-	0.7	-	-	-	-	0.0	-	0.0	-	-
93.3 55.0	0.0	-	8.5	-	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

Sebastes aurora

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 60.0	0.9	-	-	0.8	-	-	-	0.0	-	0.0	-	-

Sebastes diploproa

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
80.0 51.0	0.0	-	-	0.0	-	-	-	0.0	-	1.8	-	-
80.0 55.0	0.6	-	-	0.0	-	-	-	2.0	-	0.0	-	-
83.3 55.0	0.0	-	-	0.0	-	-	-	0.8	-	1.8	-	-
93.3 28.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-

Sebastes goodei

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 60.0	0.9	-	-	0.0	-	-	-	0.0	-	0.0	-	-

Sebastes jordani

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 55.0	3.0	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 42.0	7.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 51.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-

Hexagrammos decagrammus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	3.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 51.0	13.5	-	-	0.0	-	-	-	0.0	-	0.0	-	-

Ophiodon elongatus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	13.0	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 51.0	0.8	-	-	3.6	-	-	-	0.0	-	0.0	-	-

Cottidae

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 51.0	0.0	-	-	1.4	-	-	-	0.0	-	0.0	-	-

Hemilepidotus spinosus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	3.7	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 51.0	3.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

Scorpaenichthys marmoratus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	1.9	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 51.0	17.1	-	-	0.0	-	-	-	0.0	-	0.0	-	-
76.7 55.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
80.0 51.0	0.8	-	-	0.0	-	-	-	0.0	-	0.0	-	-
81.8 46.9	1.5	-	-	0.0	-	-	-	0.0	-	0.0	-	-
83.3 51.0	0.8	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 40.0	0.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
86.7 45.0	0.6	-	-	0.0	-	-	-	0.0	-	0.0	-	-
93.3 28.0	0.0	-	1.8	-	-	-	-	0.0	-	0.0	-	-
93.3 35.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-

***Paralabrax* spp.**

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	-	0.0	-	-	-	6.1	-	0.0	-	-
83.3 55.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
83.3 60.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	0.0	-	0.7	-	-
90.0 35.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
93.3 30.0	0.0	-	0.0	-	-	-	-	1.0	-	0.0	-	-

Trachurus symmetricus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 80.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
80.0 60.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
83.3 60.0	0.0	-	-	7.8	-	-	-	0.0	-	0.0	-	-
86.7 60.0	0.0	-	-	1.4	-	-	-	0.0	-	0.0	-	-
86.7 70.0	0.0	-	-	5.6	-	-	-	0.0	-	0.0	-	-
90.0 53.0	0.0	-	-	10.9	-	-	-	0.0	-	0.0	-	-
90.0 60.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-
90.0 70.0	0.0	-	-	5.5	-	-	-	0.0	-	0.0	-	-
90.0 80.0	0.0	-	-	11.5	-	-	-	0.0	-	0.0	-	-
90.0 90.0	0.0	-	-	7.5	-	-	-	0.0	-	0.0	-	-
90.0 100.0	0.0	-	-	0.6	-	-	-	0.0	-	0.0	-	-
93.3 50.0	0.0	-	0.7	-	-	-	-	0.0	-	0.0	-	-
93.3 55.0	0.0	-	1.7	-	-	-	-	0.0	-	0.0	-	-
93.3 60.0	0.0	-	6.8	-	-	-	-	0.0	-	0.0	-	-

TABLE 4. (cont.)

Trachurus symmetricus (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 100.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-

Anisotremus davidsoni

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 33.0	-	-	-	0.0	-	-	-	0.7	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Xenistius californiensis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	-	0.0	-	-	-	2.6	-	0.0	-	-
86.7 33.0	-	-	-	0.0	-	-	-	1.5	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Genyonemus lineatus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 40.6	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-

Girella nigricans

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 42.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
83.3 55.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
86.7 33.0	-	-	-	0.0	-	-	-	19.2	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	8.5	-	0.0	-	-
90.0 37.0	0.0	-	-	0.0	-	-	-	1.0	-	0.0	-	-
93.3 30.0	0.0	-	0.0	-	-	-	-	1.0	-	0.0	-	-
93.3 35.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-

Medialuna californiensis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 55.0	0.0	-	-	0.0	-	-	-	1.0	-	0.0	-	-
86.7 45.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
86.7 70.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-

Chromis punctipinnis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 33.0	-	-	-	0.0	-	-	-	0.0	-	1.5	-	-

TABLE 4. (cont.)

Chromis punctipinnis (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 35.0	0.0	-	-	0.0	-	-	-	15.7	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-
90.0 37.0	0.0	-	-	0.0	-	-	-	3.8	-	2.3	-	-
90.0 45.0	0.0	-	-	0.0	-	-	-	2.6	-	0.8	-	-
90.0 70.0	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-
93.3 30.0	0.0	-	0.0	-	-	-	-	1.0	-	3.4	-	-
93.3 35.0	0.0	-	0.0	-	-	-	-	0.9	-	3.0	-	-
93.3 50.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-

Oxyjulis californica

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
80.0 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
81.8 46.9	0.0	-	-	0.0	-	-	-	23.3	-	0.0	-	-
83.3 51.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-
83.3 60.0	0.0	-	-	0.0	-	-	-	4.7	-	0.0	-	-
86.7 33.0	-	-	-	0.0	-	-	-	5.2	-	0.0	-	-
90.0 45.0	0.0	-	-	2.3	-	-	-	0.0	-	0.0	-	-

Semicossyphus pulcher

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Neoclinus blanchardi

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
83.3 40.6	0.0	-	-	0.0	-	-	-	0.0	-	1.9	-	-

Hypsoblennius spp.

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 40.6	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-

Hypsoblennius gentilis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 35.0	0.0	-	-	0.0	-	-	-	0.0	-	2.6	-	-

TABLE 4. (cont.)

Hypsoblennius gilberti

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7	49.0	0.0	-	-	0.0	-	-	-	4.7	-	0.0	-	-
80.0	51.0	0.0	-	-	0.0	-	-	-	1.7	-	0.0	-	-
83.3	42.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
93.3	28.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-

Hypsoblennius jenkinsi

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7	49.0	0.0	-	-	0.0	-	-	-	1.9	-	1.9	-	-
76.7	55.0	0.0	-	-	0.0	-	-	-	1.7	-	0.0	-	-
80.0	51.0	0.0	-	-	0.0	-	-	-	8.7	-	0.0	-	-
80.0	55.0	0.0	-	-	0.0	-	-	-	1.0	-	0.0	-	-
80.0	60.0	0.0	-	-	0.0	-	-	-	0.0	-	4.0	-	-
83.3	40.6	0.0	-	-	0.0	-	-	-	0.0	-	35.6	-	-
83.3	42.0	0.0	-	-	0.0	-	-	-	3.7	-	6.4	-	-
83.3	60.0	0.0	-	-	0.0	-	-	-	1.6	-	0.0	-	-
86.7	33.0	-	-	-	0.0	-	-	-	22.2	-	6.9	-	-
86.7	35.0	0.0	-	-	0.0	-	-	-	19.4	-	7.2	-	-
86.7	40.0	0.0	-	-	0.0	-	-	-	6.2	-	0.0	-	-
86.7	70.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
90.0	28.0	0.0	-	-	0.0	-	-	-	0.0	-	0.9	-	-
90.0	37.0	0.0	-	-	0.0	-	-	-	1.0	-	2.3	-	-
90.0	45.0	0.0	-	-	0.0	-	-	-	4.3	-	0.0	-	-
93.3	28.0	0.5	-	5.3	-	-	-	-	0.0	-	0.0	-	-
93.3	30.0	0.0	-	0.0	-	-	-	-	3.0	-	1.7	-	-
93.3	35.0	0.0	-	0.0	-	-	-	-	1.8	-	0.0	-	-
93.3	40.0	0.0	-	0.0	-	-	-	-	0.0	-	1.0	-	-

Typhlogobius californiensis

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0	51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Sphyraena argentea

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0	51.0	0.0	-	-	0.0	-	-	-	7.0	-	0.0	-	-
83.3	40.6	0.0	-	-	0.0	-	-	-	15.1	-	0.0	-	-
83.3	42.0	0.0	-	-	0.0	-	-	-	34.5	-	0.0	-	-

TABLE 4. (cont.)

Sphyraena argentea (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 33.0	-	-	-	0.0	-	-	-	12.6	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	7.5	-	0.0	-	-
90.0 35.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
93.3 28.0	0.0	-	0.0	-	-	-	-	1.9	-	0.0	-	-

Scomber japonicus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 51.0	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
80.0 51.0	0.0	-	-	0.0	-	-	-	2.6	-	0.0	-	-
81.8 46.9	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
83.3 40.6	0.0	-	-	0.0	-	-	-	4.7	-	5.8	-	-
83.3 42.0	0.0	-	-	0.0	-	-	-	5.6	-	32.0	-	-
83.3 55.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
83.3 60.0	0.0	-	-	0.0	-	-	-	1.6	-	0.0	-	-
86.7 33.0	-	-	-	0.0	-	-	-	31.0	-	0.0	-	-
86.7 35.0	0.0	-	-	0.0	-	-	-	2.8	-	0.0	-	-
86.7 40.0	0.0	-	-	0.0	-	-	-	1.0	-	0.0	-	-
90.0 28.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
90.0 35.0	0.0	-	-	0.0	-	-	-	1.5	-	0.0	-	-
93.3 28.0	0.0	-	0.0	-	-	-	-	0.9	-	0.0	-	-
93.3 30.0	0.0	-	0.0	-	-	-	-	4.0	-	0.0	-	-
93.3 40.0	0.0	-	4.5	-	-	-	-	0.0	-	0.0	-	-
93.3 60.0	0.0	-	0.7	-	-	-	-	0.0	-	0.0	-	-

Icichthys lockingtoni

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
90.0 70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-

Psenes pellucidus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
86.7 110.0	0.0	-	-	0.0	-	-	-	0.0	-	1.0	-	-

Tetragonurus cuvieri

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 100.0	0.0	-	-	0.0	-	-	-	0.0	-	0.7	-	-
86.7 80.0	0.0	-	-	0.0	-	-	-	0.0	-	0.8	-	-

TABLE 4. (cont.)

Tetragonurus cuvieri (cont.)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 80.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-

Peprilus simillimus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
83.3 60.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-

Citharichthys sordidus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 49.0	0.0	-	-	0.0	-	-	-	1.9	-	0.0	-	-

Citharichthys stigmaeus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 70.0	0.0	-	-	0.8	-	-	-	0.0	-	0.0	-	-
76.7 80.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
80.0 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
86.7 50.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
86.7 60.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

Paralichthys californicus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-
86.7 35.0	0.0	-	-	0.7	-	-	-	0.0	-	2.0	-	-
93.3 28.0	0.0	-	0.9	-	-	-	-	0.0	-	0.0	-	-

Lyopsetta exilis

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80.0 51.0	0.0	-	-	0.7	-	-	-	0.0	-	0.0	-	-

Pleuronichthys coenosus

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
76.7 55.0	0.0	-	-	0.0	-	-	-	0.8	-	0.0	-	-
93.3 30.0	0.0	-	1.7	-	-	-	-	0.0	-	0.0	-	-
93.3 35.0	0.0	-	0.0	-	-	-	-	0.0	-	1.0	-	-

Unidentified fish larvae

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
93.3 120.0	0.0	-	-	0.0	-	-	-	0.9	-	0.0	-	-

PHYLOGENETIC INDEX TO TABLE 4

ALPHABETICAL INDEX TO TABLE 4

RECENT TECHNICAL MEMORANDUMS

Copies of this and other NOAA Technical Memorandums are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22167. Paper copies vary in price. Microfiche copies cost $9.00. Recent issues of NOAA Technical Memorandums from the NMFS Southwest Fisheries Science Center are listed below:

NOAA-TM-NMFS-SWFSC-319 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1980-81.
D.A. AMBROSE, R.L. CHARTER, H.G. MOSER
(May 2002)

320 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1984.
S.R. CHARTER, R.L. CHARTER, H.G. MOSER
(May 2002)

321 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1985.
D.A. AMBROSE, R.L. CHARTER, H.G. MOSER
(May 2002)

322 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1986.
S.R. CHARTER, R.L. CHARTER, H.G. MOSER
(May 2002)

323 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1987.
E.M. SANDKNOP, R.L. CHARTER, H.G. MOSER
(May 2002)

324 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1988.
W. WATSON, R.L. CHARTER, H.G. MOSER
(May 2002)

325 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1989.
D.A. AMBROSE, R.L. CHARTER, H.G. MOSER
(May 2002)

326 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1990.
S.R. CHARTER, R.L. CHARTER, H.G. MOSER
(May 2002)

327 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1991.
E.M. SANDKNOP, R.L. CHARTER, H.G. MOSER
(May 2002)

328 Ichthyoplankton and station data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1992.
W. WATSON, R.L. CHARTER, H.G. MOSER
(May 2002)