 776

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Kinds and Abundances of Fish Larvae in the Caribbean Sea and Adjacent Areas

William J. Richards

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U.S. DEPARTMENT OF COMMERCE
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U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
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John V Byrne, Administrator
National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

CONTENTS

Figures

Tables

Kinds and Abundances of Fish Larvae in the Caribbean Sea and Adjacent Areas[1,2]

WILLIAM J. RICHARDS[3]

ABSTRACT

Fish larvae were studied from collections made in the western central Atlantic, principally the Caribbean Sea. Larvae were collected with bongo and neuston nets during two cruises of the FRV *Oregon II* in the summer of 1972 and winter of 1973. Eighty-eight families were represented in the bongo collections, and 58 families were represented in the neuston collections, for a total of 97 families represented overall. In the bongo tows, myctophid larvae were the most abundant and were represented in every collection. Gonostomatid larvae ranked second in abundance and occurred in all but two collections. Other abundant larvae were bothids, scarids, bregmacerotids, paralepidids, gobiids, scombrids, labrids, carangids, and serranids. The top 15 families accounted for 69-74% of the total larvae for both cruises.

On the summer cruise, five stations had >1,000 larvae under 10 m² of sea surface, with two of these near the Virgin Islands, one east of the Antilles, one south of Hispaniola, and one between Cuba and the Bahama Islands. On the winter cruise, two stations had 1,000 larvae under 10 m² of sea surface, and these were off the northern coast of Venezuela in an area of upwelling. This area is especially abundant in reef fishes with mid-depth fishes also common. Large concentrations of clupeids are not seen here, since they are in the Gulf of Mexico for lack of a large shelf area. Oceanic pelagic fishes, such as the scombrids, were only moderately abundant here compared with the eastern Atlantic. Since there is no major nutrient transport to most of the area, great abundances of fish are precluded. For the most part, the area is uniform in distribution and abundance of larvae, the exception being the northern coast of South America, an area of upwelling.

INTRODUCTION

This report deals with composition and relative abundance of fish larvae in the Caribbean Sea and adjacent areas, collected on the Marine Mapping, Assessment and Prediction Operational Test Phase cruises in the summer of 1972 and winter of 1973. (MARMAP OTP I and II, respectively). The multivessel surveys covered the Atlantic coast of the United States, the Atlantic Ocean north of Puerto Rico, and the Caribbean Sea; however, collections made by the FRV *Oregon II* (cruise 7239 in summer 1972, and 7343 in winter 1973) form the basis for this report. Collections from the other vessels are still under study by others and identifications are not complete. Unfortunately, coverage was not identical: During the summer cruise more stations were sampled (64), but the cruise track was not extended across the Caribbean (Fig. 1); during the winter cruise fewer stations were sampled (45) and coverage was reduced, although the cruise track extended across the Caribbean on three transects (Fig. 1).

The general outline of this report roughly parallels the two reports made by Ahlstrom (1971, 1972) on fish larvae from the eastern tropical Pacific (EASTROPAC). The collecting done in the Caribbean was of a much more modest nature than the EASTROPAC surveys, thus some of the interesting comparisons done by Ahlstrom cannot be included here. I also compared my findings with surveys made in the northeastern Gulf of Mexico by Houde et al.[4] and in the western Indian Ocean by Nellen (1973). Aspects of the distribution patterns of fish larvae and the means used to identify them are covered.

A brief preliminary account of this study was presented at the Early Life History of Fish Symposium at Woods Hole in April 1979 (Richards 1981).

MATERIALS AND METHODS

Locations of the stations are given in Figure 1 and station data in Appendix Tables 1 and 2. Bongo and neuston net tows were made during these surveys. The bongo tows consisted of 61 cm bongo samplers[5] fitted with conical nets of Nitex mesh with 0.505 and 0.333 mm apertures. A flowmeter was mounted inside the net mouth of the 0.333 mm mesh net and a time-depth recorder was attached 1 m above the sampler. Nets of the 61 cm bongo sampler were 3.33 m long, with ratios of mouth opening to total netting aperture of 1:8.8 and 1:7.8 for the 0.505 and 0.333 mm mesh, respectively. Double-oblique tows were made with a prescribed payout and retrieval rate of 50 m/min and 20 m/min, respectively. Intended maximum depth was within 5 m of the bottom or 200 m. Ship speed during the tow was held between 1.5 and 2 kn to maintain a 45° wire angle. The winch used on the *Oregon II* was not designed for this type of towing, and, consequently, winch speed on retrieval often exceeded 20 m/min and usually approached 35 m/min. Problems associated with weather and currents affected the depth of tows; thus the desired depth of 200 m was not always met (Table 1). The high net speeds caused a great deal of damage to the larvae and probably contributed significantly to extrusion.

The neuston net tows were surface tows with a 1 × 2 m neuston net, 9.4 m long, made of Nitex mesh with an aperture of

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[2]MARMAP Contribution, Southeast Fisheries Center, National Marine Fisheries Service, NOAA, Miami, Fla.

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[4]Houde, E.D., J. C. Leak, C. E. Dowd, S. A. Berkeley, and W. J. Richards. 1979. Ichthyoplankton abundance and diversity in the eastern Gulf of Mexico. Report to the Bureau of Land Management under Contract No. AA550-CT7-28. NTIS PB-299 839, 546 p.

[5]Bongo samplers have been described in an unpublished manuscript by J. A. Posgay, R. R. Marak, and R. C. Hennemuth. 1968. Development and tests of new zooplankton samplers. Annual meeting of International Commission for the Northwest Atlantic Fisheries. Res. Doc. 85, 7 p., Northeast Fisheries Center, Woods Hole Laboratory, National Marine Fisheries Service, NOAA, Woods Hole, MA 02543.

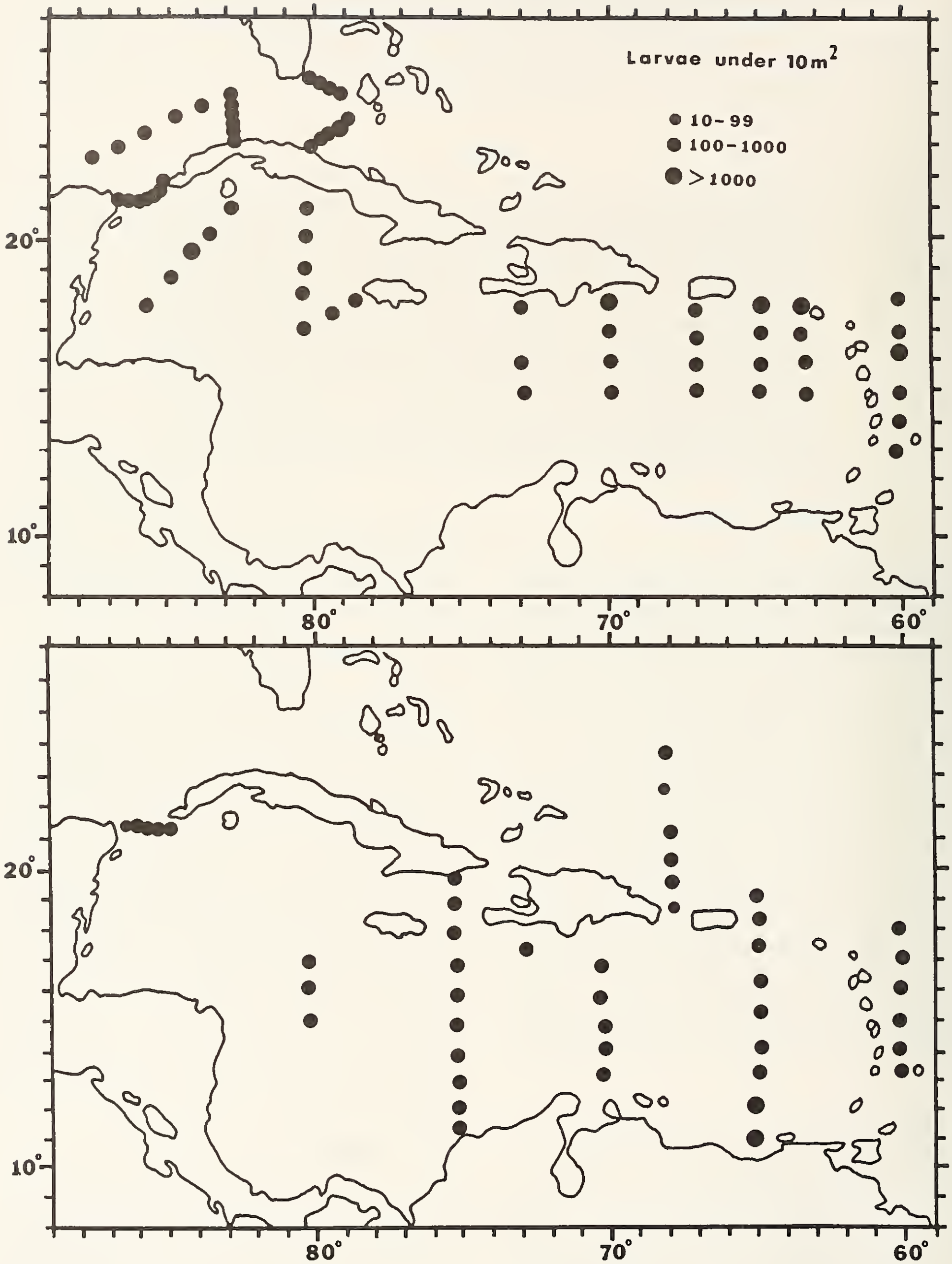


Figure 1.—Locations of bongo net tows and number larvae per station during *Oregon II* cruises 7239 (upper) and 7343 (lower).

0.947 mm. The total netting aperture ratio was 1:11. The neuston net was towed at a speed of 5 kn for 10 min. Length of the bridle was adjusted so that the net usually fished the upper 0.5 m of water. Sea conditions greatly affected the depth fished. Towing speed together with warmth of the water caused significant damage to the specimens, thus complicating identification.

The 0.505 mm bongo samples and neuston samples were sorted manually for fish eggs, larvae, and juveniles. The 0.333 mm bongo samples were used for volumetric determination of zooplankton abundance. Neither the egg data nor volumetric data are presented in this report.

To compare abundances of fish larvae in bongo tows, the volume of water filtered was determined for each tow, and this value was divided into the product of the depth of tow multiplied by 10 to yield a standard haul factor. This haul factor, when multiplied by the number of larvae in a net tow, yields the number of larvae under 10 m^2 of sea surface. All of the neuston tow data are expressed as number of larvae per tow.

Collections were made when the ship arrived on station, regardless of the time of day; consequently, collection times varied (Table 2).

Observations made at each station included an XBT (expendable bathythermograph) cast. I reviewed the XBT traces and abstracted information which is presented in the water temperatures section below.

I identified larvae to the lowest taxon possible, with the exception of the following: All leptocephali were identified by D. G. Smith, University of Texas Medical School, Galveston, Tex.; some myctophid larvae were identified by E. H. Ahlstrom and H. G. Moser, NMFS Southwest Fisheries Center; belonids and some hemiramphids from neuston collections were identified by B. B. Collette, NMFS Northeast Fisheries Center; myctophid juveniles of the genus *Diaphus* were identified by B. G. Nafpaktitis, University of Southern California; diodontids from neuston collections were identified by J. M. Leis, University of Hawaii; and clupeids and *Bregmaceros* were identified by E. D. Houde, University of Miami. I used literature sources and some original studies for the larvae that I identified. Larvae that could not be identified were placed in two categories: 1) Damaged larvae whose identification was questionable, and 2) larvae in good condition but not identified.

RESULTS

Overall standardized abundances were greater at night than day (Table 3). Numbers of larvae caught near sunrise and sunset were intermediate. Mean standardized number per tow was 1.48 greater at night in summer and 1.54 greater at night in winter. Ahlstrom (1971, 1972) found greater differences in both EASTROPAC I and II data, with 2.76 more night-caught larvae in the first cruise and 2.27 more night-caught larvae in the second cruise. His sunrise-sunset collections were intermediate between day and night cruises.

Day-night numbers for 23 selected families showed some interesting differences (Table 3). In comparing families with different mean standardized numbers per haul, the families Myctophidae, Gonostomatidae, Gobiidae, Scaridae, and Bregmacerotidae were more prevalent at night, whereas the remaining families exhibited no differences based on inspection of the data. Small sample sizes may account for this lack of difference, because the families demonstrating clear differences were the most abundant ones. Also, there were some strong differences between cruises. With the myctophids there were 2.13 times more night- than day-caught larvae on the summer cruise compared with 1.43 more night- than day-caught larvae on the winter cruise. This is also reflected in the gonostomatids, 1.57 at night compared with 1.28 during the day; gobiids, 3.53 compared with 1.51; and the scarids, 2.44 compared with 1.20. With the Bregmacerotidae, the opposite was true; the greater day-night difference occurred on the winter cruise which reflects a very large sample size from a single station. Differences in day-night collections probably were due to the larvae's visual reaction to the net, or lack thereof, or to vertical migrations below the sampling depth of the net. I believe the first reason to be the major factor for the differences or lack of differences seen, because the net presumably sampled the entire vertical range of the larvae.

Number of Fish Larvae Obtained

Fish larvae were obtained in every bongo net tow made on each cruise; actual counts of larvae per haul ranged from 24 to 267 on cruise OTP I and from 13 to 435 on OTP II. Relative numbers per haul are given in Table 4 together with average numbers per haul. Mean standardized abundance of larvae per haul is shown in Figure 1. There was no apparent geographic or hydrographic relationship between abundance of larvae and station location. On cruise OTP I, six stations had >1,000 larvae under 10 m^2 of sea surface, with two of these near the Virgin Islands, one east of the Antilles Islands, one south of Hispaniola, one in the Yucatan Basin, and one between Cuba and the Bahama Islands. There were no trends in latitude or proximity to land masses. One cruise OTP II, only two stations had >1,000 larvae under 10m^2 of seas surface, and these were off the coast of Venuzuela in an area of strong upwelling. Also on OTP II, two stations had <100 larvae under 10 m^2, whereas on OTP I, no stations had <100 larvae under 10 m^2. On OTP II, other than the two stations mentioned, there were no apparent features affecting the number of larvae.

Unfortunately, information is lacking on the depth distribution of these larvae, particularly in relation to thermocline depth. I do not know whether thermocline depth or depth of the mixed surface layer is related to abundance.

Comparisons with Ahlstrom's (1971, 1972) catches cannot be made directly since he reported his catches in number per tow. However, in his appendix tables, he gives standardized haul factors which I averaged and multiplied by his average catch per tow. His catches under 10 m^2 of sea surface were for EASTROPAC I: 399.1 (*Argo*), 614.7 (*Jordan*), 675.0 (*Rockaway*), and 828.56 (*Alaminos*); for EASTROPAC II: 754.7 (*Washington*), 1,249.1 (*Undaunted*), and 1,367.74 (*Rockaway*). Comparing these values with the *Oregon II* data (see Table 4) indicates that catches at EASTROPAC I stations were within the same order of magnitude as in the Atlantic, but that two EASTROPAC II regions yielded much higher values. During OTP II, two stations had values >1,000 larvae under 10 m^2 of sea surface, comparable to EASTROPAC II conditions (Fig. 1).

Water Temperatures

Water temperatures at depth were available for each station from XBT casts. For each cast I looked at the temperature of the surface, depth of the mixed surface layer (MSL), temperature of the MSL, depth of the 24°C isotherm, depth of the 20°C isotherm, and temperature at 200 m depth. I chose the 24° and 20°C isotherms because they relate to presence or absence of tuna larvae (Richards 1969). I divided the area into five regions, which were occupied during both cruises, to compare the temperature regimes. These areas include the region east of the Lesser Antilles, the Caribbean Sea (east of long. 66°W, north of lat. 14°N), the central Caribbean Sea (east of long. 76°W, south of lat. 18°N, north of lat. 14°N), the western Caribbean Sea (west of long. 76°W, north of lat. 14°N), and the Yucatan Channel.

Comparison of the five regions is shown in Table 5. Basically, winter temperatures (OTP II) are consistently cooler than summer temperatures (OTP I). The mixed surface layer lies deeper during winter in all regions except in the western Caribbean Sea. To facilitate comparisons further, stations from both cruises which occurred at the same geographic location were compared for the same temperature data (Table 6). These actual values, rather than averages, reveal more strikingly the warmer summer values and the shallower thermocline. The depths of the 24° and 20°C isotherms reveal their variable natures, which are obscured in the averages given in Table 5. The area is characterized by eddies created by the westerly flow of water past the Lesser Antilles (Ingham and Mahnken 1966). Instead of the Caribbean appearing as a rather stable environment, there is evidence that it is quite complex. Ingham (1968) pointed out that the mixed surface layer in the Caribbean does not mean that vertical gradients of conservative properties are zero. He has shown that this is a complicated region with the isothermal layer often quite different from the isohaline layer. Ingham (1968) suggested that the mechanism creating these structures may include advection—besides cooling evaporation, precipitation, wind mixing, and convective mixing—because of the rather high horizontal transport through this region. He further added that other mechanisms include wind mixing under conditions of surface heating, but evaporation and the "two-diffusivity" convection of Stommel and Fedorov (1967), caused by differential vertical transport of heat and salts, were negligible. Despite these unusual oceanographic features, the environment for larval fish is quite thermally stable with temperatures above 18°C at 200 m. Where the nets traveled deeper than 200 m, only 12 of 109 stations had temperatures < 16°C, and only two tows (both during cruise 7239) reached depths with temperatures < 10°C.

Kinds of Fish Larvae Obtained

The same basic kinds of fish larvae were obtained on both cruises with some interesting exceptions (Table 7). As expected, the family Myctophidae was represented at every station and was the most numerous kind of larvae. The Gonostomatidae was the second most abundant family and occurred at all but two stations during OTP I and at all stations during OTP II. The following additional 19 families ranked in the top 15 (for either cruise) in occurrence or abundance: Bothidae, Scaridae, Bregmacerotidae, Paralepididae, Gobiidae (ranked fourth in all categories), Scombridae, Labridae, Scopelarchidae, Gempylidae, Carangidae, Serranidae, Evermannellidae, Epigonidae, Nomeidae, Synodontidae, Engraulidae, Congridae, Callionymidae, and Chauliodontidae. Of these 19 families, 11 were in the top 15 on each cruise in both abundance and occurrence: Myctophidae, Gonostomatidae, Bothidae, Gobiidae, Scaridae, Labridae, Paralepididae, Bregmacerotidae, Gempylidae, Epigonidae, and Scopelarchidae. The Scombridae, Caragnidae, and Serranidae were in the top 15 in three of the four categories, the Nomeidae in two categories, and the Callionymidae, Congridae, Synodontidae, Evermannellidae, Chauliodontidae, and Engraulidae appeared once. A total of 88 families were recognized in these collections, and several additional families were probably present among the unidentifiable specimens. Of the 88 families, 26 occurred on only one cruise: Alepisauridae, Xenocongridae, Dysommidae, Gadidae, Macrouridae, Eutaeniophoridae, Fistularidae, Lophotidae, Diretmidae, Caproidae, Sphyraenidae, Mullidae, Polynemidae, Sciaenidae, Blennidae, Brotulidae, Ophidiidae, Triglidae, Soleidae, Ostracidae, Diodontidae, Gobiesocidae, Ogcocephalidae, Ceratiidae, Linophyrnidae, and Gigantactidae. This probably reflects, in part, seasonality and the fact that some families are very rare. Ahlstrom (1971, 1972) obtained fewer families of fish (about 76) than we did, although both collections shared most families in common. The following were absent from my collections but present in Ahlstrom's: Giganturidae, Scomberesocidae, Trachipteridae, Ammodytidae, Champsodontidae, Tetragonuridae, Uranoscopidae, Neoscopelidae, and Trachichthyidae.

A total of 5,569 actual larvae were collected on OTP I and 3,928 on OTP II. The top 15 families accounted for 69.4% of the total number on OTP I and 73.7% of the total number on OTP II. Conversely, in Ahlstrom's (1971, 1972) EASTROPAC studies, 10 families accounted for over 90% of the larvae. In my work, the Myctophidae accounted for 23.4% of the total on OTP I and 33.3% on OTP II, whereas the Myctophids accounted for 47.2% of the larvae on EASTROPAC I and 52.0% on EASTROPAC II. Gonostomatidae (includes Sternoptychidae) comprised 14.9% of OTP I and 13.7% of OTP II, compared with 29.2% in EASTROPAC I and 25.7% in EASTROPAC II. Of the other top 10 families of EASTROPAC I and II: the Bathylagidae were important, accounting for 5%, but were unimportant in the OTP collections; the Melamphaiidae and Idiacanthidae were also important in EASTROPAC collections but unimportant in OTP collections; the Bregmacerotidae and Paralepididae were important in both regions as were the Nomeidae, Engraulidae, and Scombridae; and the Scaridae, Labridae, and Gobiidae were important in the OTP collections but not in EASTROPAC.

In the OTP collections, 10 families accounted for 1.0% or more of the total on OTP I, and 12 families comprised 1.0% or more on OTP II. Seasonality produced some striking differences between OTP I and II. The Scombridae comprised 2.3% of the total on OTP I but did not make the top 15 on OTP II. The Nomeidae were unimportant on OTP I but made up 1.8% of the total on OTP II. Other families ranked among the top 15 in occurrence on either cruise but were absent from the other cruise: Chauliodontidae (15th on OTP II); Evermannellidae (10th on OTP II); Carangidae (10th on OTP I); and Callionymidae (15th on OTP I).

Two families representative of the vast coral reef habitat of the western central Atlantic—Scaridae and Labridae—were also important components of the oceanic ichthyoplankton. The Scaridae ranked in the top 10 in both occurrence and numbers on OTP I and II. The Labridae ranked in the top 10 in both categories on OTP I and in the top 15 on OTP II. Gobiid larvae ranked fourth in both categories on OTP I and II because their larvae are also highly oceanic, despite being benthic in habit as adults. Similarly, the benthic family Bothidae ranked in the top 10 in both categories on both cruises. Bathypelagic fishes of the families Paralepididae, Bregmacerotidae, Gempylidae, Scopelarchidae, and Evermannellidae are not surprising major components of the oceanic ichthyoplankton.

Comparisons can also be made with two other important studies of tropical fish larvae. Houde et al. (footnote 4) studied the larvae of the eastern Gulf of Mexico on a series of 18 cruises over a 4-yr period. In that study, 91 families of fish larvae were identified. Most of the collecting was done over the broad continental shelf in waters < 50 m deep, although some stations were sampled in deeper water. The 10 most abundant families were (in standardized order of abundance): Clupeidae, Gobiidae, Bothidae, Myctophidae, Serranidae, Carangidae, Synodontidae, Ophidiidae, Bregmacerotidae, and Labridae. These 10 families accounted for 67% of the total number of fish larvae. Differences in family composition are probably due to the relative number of samples from shallow water where clupeids, synodontids, bothids, gobiids, and ophidiids are dominant.

The other major work on tropical fish larvae is by Nellen (1973) who carried out an ichthyoplankton survey during 1964 and 1965 in the western Indian Ocean, mainly in the Red Sea, Arabian Sea, and Persian Gulf. He reported on larvae of 100 families, but did not identify eels to the family level. This high number of larval families is characteristic of the rich diversity of the Indo-Pacific region. The 10 most abundant families in order of abundance were: Myctophidae, Clupeidae, Gonostomatidae, Pomadasyidae, Gobiidae, Carangidae, Bregmacerotidae, Nomeidae, Engraulidae, and Serranidae. These 10 families accounted for 81% of the total number of fish larvae.

Both similarities and dissimilarities among the four areas are striking. Similarities are due to the real lack of differences in family occurrences in the tropical, oceanic, and pelagic realms, whereas dissimilarities represent real differences both in family occurrences over continental shelves and in the oceanographic regimes of the four varied areas.

Neuston Collections

I did not have sufficient time to identify all specimens collected in neuston net tows to the same degree as the bongo material. Much of the neuston net material was in such poor condition that, although identification was possible, a great amount of time would have been necessary to accomplish the task, especially for the myctophids and exocoetids. Due to the poor condition of the neuston net material, most of it was identified only to the family level and to the specific level in some cases (see Table 20). Since neuston tows are not quantitative, they cannot be compared quantitatively with other calibrated tows; however, they can be compared qualitatively since each tow was of approximately the same duration and filtered approximately the same volume of water. Also, neuston tows sample only nearsurface waters and not the complete depth range of many fish larvae. Thus, they yield many of those animals that migrate to the surface at night, such as myctophids, and those animals which live in nearsurface waters, such as exocoetids.

As expected, exocoetids ranked first in frequency of occurrence on both cruises. In numbers, myctophids ranked first on the summer cruise and fifth on the winter cruise, whereas mullids ranked first in numbers on the winter cruise. I identified a few myctophids to species, and most were *Myctophum* represented by *M. asperum*, *M. affine*, and *M. nitidulum*. Also common were *Centrobranchus nigroocellatus* and *Gonichthys coccoi*. Coryphaenids ranked high in occurrence and in the top 15 in numbers. *Coryphaena equiselis* were more abundant than *C. hippurus* on the summer cruise, but the opposite was true for the winter cruise. Carangids ranked second in occurrence on both cruises and in the top 10 in numbers for both cruises. Most of the carangids were *Caranx*, represented by *C. crysos*, *C. bartholomaei*, *C. hippos*, *C. latus*, and *C. ruber*. Other carangids taken on the summer cruise were *Elagatis bipinnulata*, *Selar crumenophthalmus*, *Seriola* sp., and *Trachinotus falcatus*. On the winter cruise a few specimens of *Selene vomer* and *Naucrates ductor* were identified. Balistids ranked in the top 15 in occurrence and numbers on both cruises, which is indicative of the nearsurface habits of their young. Likewise, *Dactylopterus volitans* ranked in the top 10 in occurrence and numbers on both cruises. Scombrids ranked high in numbers and occurrence on the summer cruises; but their high numbers on the winter cruise were due only to one large collection of *Auxis* off the Venezuelan coast. Istiophorids and *Xiphias gladius* were prominent due to their presence in the surface water. A large number of eel leptocephali were collected on the summer cruise and about 200 were identified: 185 of these were the congrid, *Ariosoma;* others were muraenids, mostly *Gymnothorax*, and ophichthids, mostly *Ahlia*.

Of the 58 families identified from the neuston collections, only the Scomberesocidae, Belonidae, Hemiramphidae, Berycidae, Mugilidae, Pomadasyidae, Sparidae, Lobotidae, and perhaps the Antennariidae were represented in the bongo collections. Except for the berycids, pomadasyids, and sparids, these other families are noted for their nearsurface habits or association with floating objects. The mullids are another family in which the young juveniles occur at the surface before seeking bottom habitats, and this family ranked in the top 10 in occurrence and numbers and first in numbers during the winter cruise. The Mugilidae also have oceanic pelagic young stages and were highly ranked in both numbers and occurrence.

The neuston net is a good tool for collecting larvae of certain life history stages and also gives a qualitative assessment of those larval groups with specialized nearsurface habits. It is an excellent supplement to bongo tows because it adds another perspective to our knowledge of the kinds and abundances of fish larvae.

FAMILY ACCOUNTS

1. Elopidae
(3 occurrences, 3 larvae)

Larvae of two species of elopids were collected. Two specimens of *Elops saurus* were collected at two stations during cruise 7239, and one specimen of *Megalops atlanticus* was obtained during cruise 7343. Adults of these species are common throughout the area but are confined to inshore areas. However, their larvae are found in oceanic waters as evidenced by these data. Ahlstrom (1971, 1972) did not record any larval members of this family from the eastern tropical Pacific, but Houde et al. (footnote 4) obtained five *M. atlanticus* larvae and one *E. saurus* larva from the eastern Gulf of Mexico. Eldred and Lyons (1966) reported *E. saurus* larvae from the Gulf of Mexico, also. Nellen (1973) recorded one *Elops* sp. larva from tropical waters of the western Indian Ocean.

Identification.—Several larval descriptions have been published; the most recent and comprehensive is by Smith (1979).

2. Clupeidae
(6 occurrences, 24 larvae)

Larvae of three species of clupeids were obtained: *Etrumeus teres* during cruise 7343 at one station along the coast of Venezuela; *Opisthonema* sp. at three locations during cruise 7239 and at one location during cruise 7343; and *Harengula* sp. colocated with *Opisthonema* during cruise 7239 and at one other station on the north coast of Cuba during the same cruise. Larvae of *E. teres* are abundant in the Gulf of Mexico between 30 and 100 m depths (Houde et al. footnote 4). Their single occurrence in my collections may be explained, in part, by the paucity of continental shelf samples. *Etrumeus teres* was found at the station (station 104) richest in numbers of larvae encountered on either cruise. This station is located in the Gulf of Cariaco in a biologically rich area of substantial coastal upwelling, and will be referred to in several other accounts. Two species of *Opisthonema* are known from this area with *O. oglinum* being by far the most common. *Opisthonema captivae* is known only from the coastal waters of Venezuela and Columbia and may be the species obtained on cruise 7343. The three records of *Opisthonema* from cruise 7239 are probably *O. oglinum,* since records of adults are known from the Antilles and Jamaica (Wagner 1974). Interestingly, Wagner (1974) did not find many *Opisthonema* from the northeastern Caribbean area where larvae were taken, but rather from southeastern Caribbean. Several species of *Harengula* are found throughout the Caribbean area and, like the other clupeids, are coastal species. Clupeids are not as abundant in the Caribbean area as they are in the Gulf of Mexico and off the southeast coast of the United States (Klima 1976).

In the eastern tropical Pacific, Ahlstrom (1971,1972) also found three clupeid species, associated either with islands or coastal areas, similar to my results. Houde et al. (footnote 4) obtained a great number of clupeids, the most abundant larvae found in the eastern Gulf of Mexico. Nellen (1973) obtained many clupeids in the western Indian Ocean.

Identification.—Identification was based on Houde and Fore (1973), Houde et al. (1974), and Richards et al. (1974).

3. Engraulidae (8 occurrences, 60 larvae)

Anchovy larvae were abundant only at the two coastal stations north of Venezuela during cruise 7343. Two of the stations having the greater numbers of larvae were situated in this area of upwelling. Anchovies were found at three stations during cruise 7239 and at three additional stations during cruise 7343, with only one or two larvae per station. Ahlstrom (1971, 1972) found high numbers of anchovies at his coastal stations in the eastern tropical Pacific; Houde et al. (footnote 4) found engraulids to be the 12th most common family in the eastern Gulf of Mexico; Nellen (1973) commonly found them in the western Indian Ocean.

Identification.—No attempt was made to identify these larvae to species because generic and specific identifications have been worked out for only a few taxa of this speciose family.

4. Argentinidae (2 occurrences, 2 larvae)

One Argentinidae larva was found on each cruise, and the one collected during cruise 7343 was tentatively identified as *Microstoma* sp. Houde et al. (footnote 4) found few argentinid larvae in the Gulf of Mexico; Nellen (1973) did not report them in the western tropical Indian Ocean; Ahlstrom (1971, 1972) recorded them in the eastern tropical Pacific.

5. Bathylagidae (8 occurrences, 14 larvae)

Bathylagids were found in scattered locations in the Caribbean Sea and east of the Antilles and were slightly more common than the related argentinids. Houde et al. (footnote 4) found only 11 larvae in the eastern Gulf of Mexico; Nellen (1973) found very few in the tropical western Indian Ocean; Ahlstrom (1971, 1972) found abundances of two species in the eastern tropical Pacific.

6. Gonostomatidae (107 occurrences, 1,368 larvae)

Gonostomatids were the second most abundant group of larvae taken. A comparison of the occurrences and numbers of larvae are given in Table 8. I followed Ahlstrom (1974) in combining the sternoptychids with the gonostomatids in the Family Gonostomatidae. The gonostomatines were the most common, especially the genera *Cyclothone, Gonostoma,* and *Vinciguerria.* Gonostomatids were very abundant in the eastern tropical Pacific (Ahlstrom 1971, 1972), eastern Gulf of Mexico (Houde et al. footnote 4), and western tropical Indian Ocean (Nellen 1973).

Cyclothone **spp. (98 occurrences, 490 larvae).**—*Cyclothone* larvae were present at every station during cruise 7343 and at 83% of the stations of cruise 7239 (Fig. 2). Of the 53 stations on cruise 7239, all but seven had fewer than 10 larvae; of the 45 stations of cruise 7343, all but two had fewer than 10 larvae. These larvae are ubiquitous but not especially abundant. Houde et al. (footnote 4) found these larvae to be the second most abundant gonostomatid species in the eastern Gulf of Mexico, and Ahlstrom (1971, 1972) also found these to be second in abundance in the eastern tropical Pacific.

Identification.—Grey (1964).

Pollichthys mauli **(56 occurrences, 169 larvae).**—The distribution of this species is shown in Figure 3. As with *G. elongatum, P. mauli* was more abundant during the summer and is found throughout the area. Houde et al. (footnote 4) found a few larvae (some identified as *Polymetme* type I) at his offshore stations. This species is found only in the Atlantic.

Identification.—This species has been identified by Ozawa (1976). I originally suspected that these larvae were *Polymetme* which has similar meristics. *Polymetme* larvae are still unknown since Ahlstrom (1974:664) was referring to these *Pollichthys* specimens.

Gonostoma elongatum **(63 occurrences, 209 larvae).**—This species was five times more abundant in the summer months than in the winter and was found throughout the area. It is the most abundant gonostomatid species, considering that *Cyclothone* is composed of more than one species. Houde et al. (footnote 4) found this species to be common at his offshore stations in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) found a few larvae, most at his southernmost stations off Peru.

Identification.—Ahlstrom (1974).

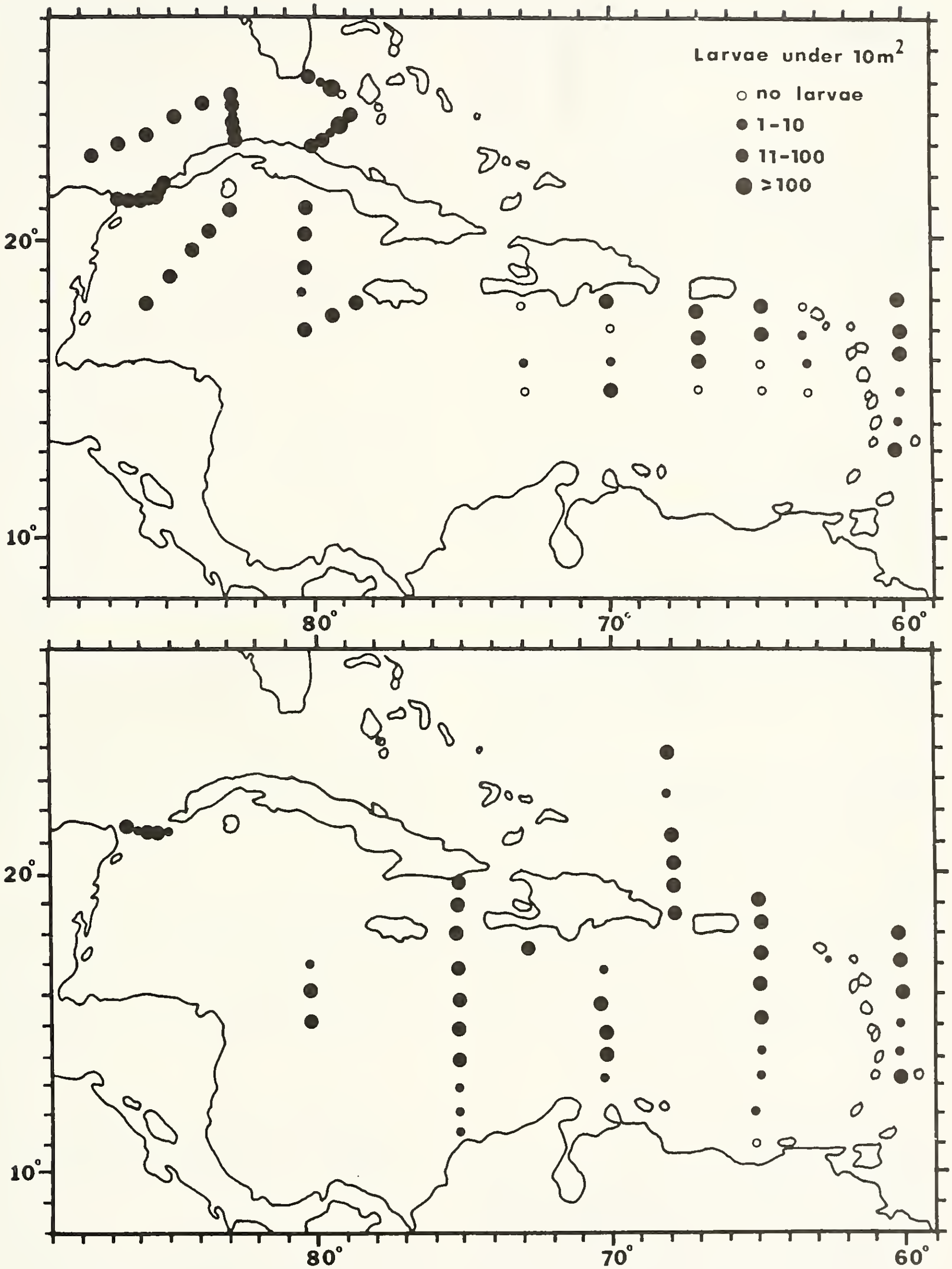


Figure 2.—Distribution and number per station of the gonostomatid larvae *Cyclothone* spp. during *Oregon II* cruises 7239 (upper) and 7343 (lower).

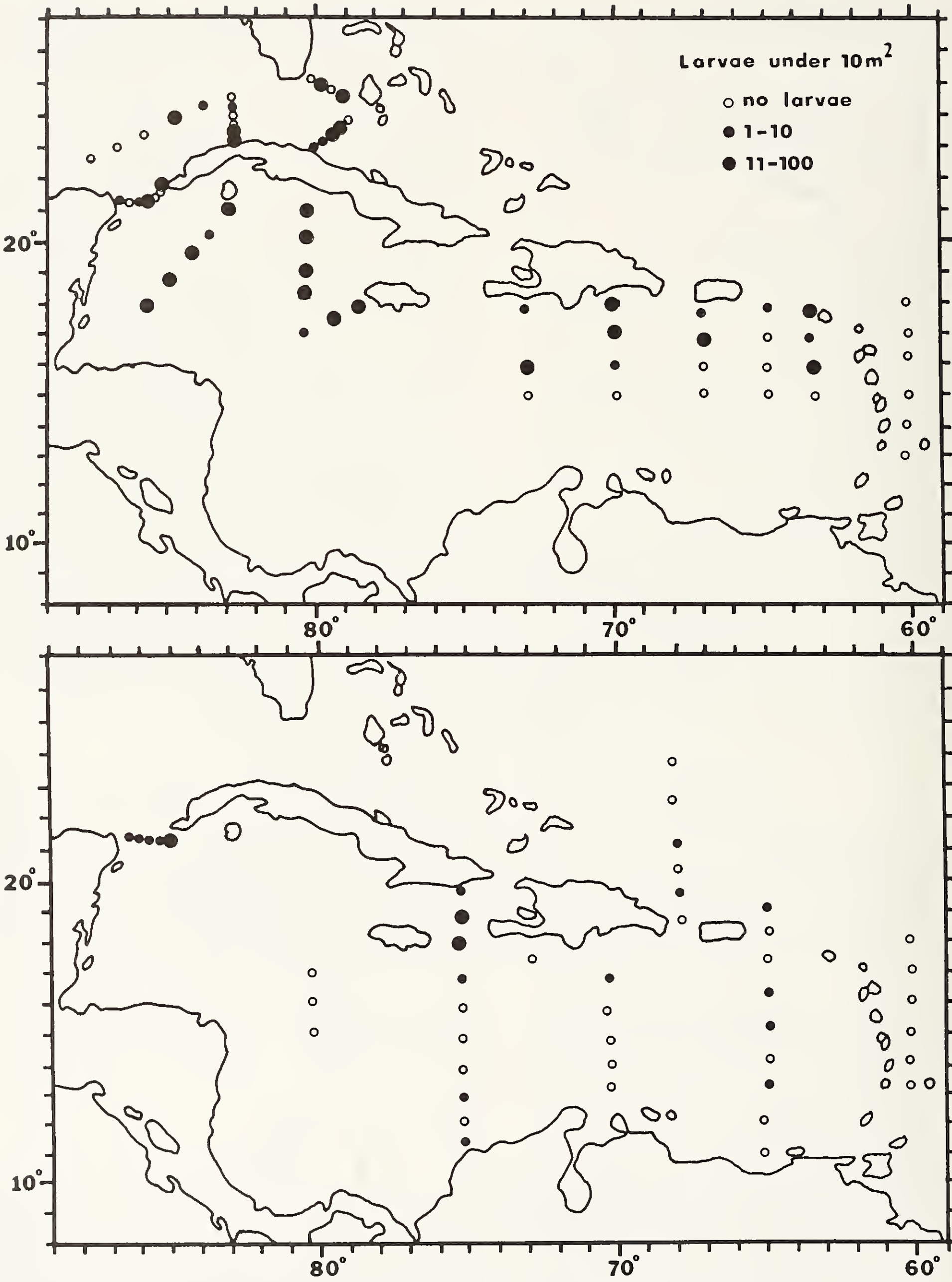


Figure 3.—Distribution and number per station of the gonostomatid larvae *Pollichthys mauli* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Gonostoma atlanticum **(25 occurrences, 48 larvae).**—This species was not abundant but was found throughout the area on both cruises.

Identification.—Ahlstrom (1974).

Vinciguerria nimbaria **(47 occurrences, 100 larvae).**—*Vinciguerria nimbaria* occurred throughout the area and did not exhibit any seasonality. Houde et al. (footnote 4) also found this species to be the most common *Vinciguerria* in the eastern Gulf of Mexico.

Identification.—Ahlstrom and Counts (1958).

Vinciguerria attenuata **(4 occurrences, 6 larvae).**—This species was rare; Houde et al. (footnote 4) also found this species to be the least abundant *Vinciguerria* in the Gulf of Mexico.

Identification.—Ahlstrom and Counts (1958).

Vinciguerria poweriae **(2 occurrences, 2 larvae).**—This species occurred at only two locations during the summer cruise. Houde et al. (footnote 4) found this species to be almost as abundant as *V. nimbaria* in the Gulf of Mexico.

Identification.—Ahlstrom and Counts (1958).

Bonapartia pedaliota **(4 occurrences, 4 larvae).**—This species is rare; Houde et al. (footnote 4) collected only one specimen in the Gulf of Mexico.

Identification.—Jesperson and Tåning (1919) and Grey (1964).

Maurolicus muelleri **(3 occurrences, 3 larvae).**—This species is rare. Houde et al. (footnote 4) found this to be the most abundant gonostomatid in the Gulf of Mexico and the 20th most observed species in their collections. This species ranked third in abundance in Ahlstrom's (1971, 1972) eastern tropical Pacific data, although Nellen (1973) reported only three specimens from the western Indian Ocean.

Identification.—Okiyama (1971).

Type "Alpha" **(2 occurrences, 2 larvae).**—This unusual larva was found at two stations near the Antilles. It is the first record of this maurolicine type from the Atlantic, having been found first in the Pacific by Ahlstrom (1974). Ahlstrom presumed that this might be the larval form of *Neophos* because of similar vertebral counts. *Neophos* is not known from the Atlantic, thus the identification of this larval form remains an interesting question.

Identification.—Ahlstrom (1974).

Margrethia obtusirostra **(17 occurrences, 21 larvae).**—This species occurred sporadically throughout the area. Houde et al. (footnote 4) reported only one specimen from the Gulf of Mexico.

Identification.—Grey (1964) and Ahlstrom (1974).

Other Gonostomatines.—Four other species of gonostomatine larvae occurred rarely and only seasonally. *Woodsia nonsuchae* occurred only in the summer as did *Diplophos taenia*. *Yarella blackfordi* and *Valenciennellus tripunctulatus* occurred only in the winter. These species were either very rare or not collected by Houde et al. (footnote 4) in the Gulf of Mexico. Ahlstrom (1971, 1972) found significant numbers of *Yarella argenteola* in the eastern tropical Pacific. Both Ahlstrom (1971, 1972) and Nellen (1973) reported the presence of *Ichthyococcus* in their respective waters.

Identification.—Grey (1964) and Ahlstrom (1974).

Argyropelecus **spp. (7 occurrences, 11 larvae).**—Larvae of this genus were sparse, occurring only between Florida and Cuba in the summer and scattered in the winter. Houde et al. (footnote 4) caught 70 specimens in the Gulf of Mexico; Ahlstrom (1972) reported that this genus accounted for 15% of sternoptychid larvae in the eastern tropical Pacific.

Identification.—I followed Jespersen and Tåning (1926) and Sanzo (1931) and made no attempt to identify to species. Baird (1971) gave an account of the adults.

Polyipnus **spp. (3 occurrences, 6 larvae).**—Larvae of this genus were rare in these collections. Houde et al. (footnote 4) reported the capture of three specimens in the eastern Gulf of Mexico.

Identification.—Larvae have not been described in the literature. I made no attempt to identify these to species. Baird (1971) gave a good account of the adults.

Sternoptyx **spp. (26 occurrences, 31 larvae).**—These were the most abundant sternoptychine larvae, being most abundant during the summer. They are widespread throughout the area. Houde et al. (footnote 4) reported capturing 75 specimens in the eastern Gulf of Mexico; Ahlstrom (1972) reported that this genus accounted for 85% of the sternoptychine species from the eastern tropical Pacific.

Identification.—Larvae have not been described in the literature. I made no attempt to identify to species. Baird (1971) gave an account of adults.

7. Stomiatidae
(3 occurrences, 3 larvae)

Larvae of this family were rare in these collections. In the eastern Gulf of Mexico, eastern tropical Pacific, and western Indian Ocean few larvae of this family were taken (Houde et al. footnote 4; Ahlstrom 1971, 1972; Nellen 1973).

Identification.—I followed Sanzo (1931) and made no attempt to identify the specimens to a lower taxonomic level.

8. Chauliodontidae
(14 occurrences, 20 larvae)

All larvae of this family are in the genus *Chauliodus*. Four times more larvae were taken on the winter cruise; but with so few taken, I do not wish to speculate whether this is a true seasonal difference or possibly due to specific differences. Houde et al. (footnote 4) could not find any seasonality in specimens collected in the eastern Gulf of Mexico. Chauliodontid larvae were taken most abundantly in a quadrant south of the Equator and closer to the continents in the eastern tropical Pacific (Ahlstrom 1971, 1972).

Identification.—I followed Sanzo (1931) and made no attempt to identify the specimens to species.

9. Astronesthidae
(7 occurrences, 7 larvae)

These larvae, though rare, were found on both cruises. Houde et al.(footnote 4) collected only one specimen in the eastern Gulf of Mexico; few were taken by Nellen (1973) in the western Indian Ocean; but Ahlstrom (1971, 1972) collected many in the eastern tropical Pacific.

Identification.—I followed Sanzo (1931) and made no attempt to identify the specimens to a lower taxonomic level.

10. Melanostomiatidae
(11 occurrences, 16 larvae)

As with the chauliodontids, larvae of this family, though rare, were taken more frequently during the winter cruise. Houde et al.(footnote 4) collected more representatives of this family than of the preceding three families in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) also collected more of this family in the eastern tropical Pacific, as did Nellen (1973) in the western Indian Ocean.

Identification.—I followed Sanzo (1931) and made no attempt to identify the specimens to a lower taxonomic level.

11. Idiacanthidae
(3 occurrences, 3 larvae)

This is a monotypic family in the Atlantic represented by *Idiacanthus fasciola.* In contrast to the eastern tropical Pacific, where Ahlstrom (1972) found them to be abundant, only a few were found in my collections. Nellen (1973) collected only one specimen in the western Indian Ocean, and none were taken by Houde et al. (footnote 4) in the eastern Gulf of Mexico.

Identification.—Gibbs (1964).

12. Synodontidae
(15 occurrences, 33 larvae)

Larvae of this family were three times more abundant in the summer and were widely scattered throughout the area. Adults have nearshore benthic habits, but the larvae are pelagic. Ahlstrom (1971, 1972) found them only nearshore in the eastern tropical Pacific; Houde et al. (footnote 4) found them to be the seventh most abundant larvae in the eastern Gulf of Mexico; Nellen (1973) found them to be abundant in the southern Red Sea and Aden area and less abundant elsewhere in the western Indian Ocean.

Identification.—Even though some work has been done with this group, my larvae were small and did not clearly fit the described forms (Gibbs 1959; Anderson et al. 1966a,b); thus, I did not identify any specimens below the family level.

13. Scopelarchidae
(36 occurrences, 65 larvae)

Larvae of this family ranked 15th or higher in occurrence and number on both cruises. Five species of this midwater family of fishes are known from this region and three were represented in the collections. Nellen (1973) obtained few representatives of this family in the western Indian Ocean; Houde et al. (footnote 4) captured only 28 specimens in the eastern Gulf of Mexico; Ahlstrom (1971, 1972) obtained many in the eastern tropical Pacific, but, as in the Caribbean, very few per station.

Identification.—Johnson (1974).

***Benthabella infans* (31 occurrences, 56 larvae).**—This species was widespread throughout the area, and both Johnson (1974) and Merrett et al.(1973) have shown it to be widely distributed. The latter authors have shown that larvae <15 mm in length occur in the upper 200 m. All of my larvae except one were <15 mm in length; the one exception was 17.5 mm in length from a tow in which the net reached a depth of 255 m. This species was among the most abundant non-myctophid myctophiform species (Table 9).

***Scopelarchiodes danae* (7 occurrences, 8 larvae).**—This wide-ranging species was limited to the eastern Caribbean during the summer cruise.

***Scopelarchus analis* (1 occurrence, 1 larva).**—This single specimen may be a damaged *Benthabella infans.*

14. Evermannellidae
(29 occurrences, 45 larvae)

Larvae of this family were more abundant during the winter than summer. A summary of occurrence and numbers of this species is shown in Table 9. This family was not ranked in the upper 15 families. As with other midwater fishes, the species are widely distributed over the area. Ahlstrom (1971, 1972) collected most evermannellids at stations farthest from shore; Houde et al. (footnote 4) took six specimens from deep water in the eastern Gulf of Mexico; Nellen (1973) took only seven specimens from deep stations, also in the western Indian Ocean.

Identification.—Rofen (1966a) and Johnson and Glodek (1975).

15. Paralepididae
(82 occurrences, 180 larvae)

Paralepidid larvae ranked eighth in number on both cruises and sixth and third in occurrence on cruises 7239 and 7343, respectively (Table 7). The lowest level of taxa identified is summarized in Table 9. In the eastern tropical Pacific (Ahlstrom 1971, 1972), paralepids ranked sixth in abundance and contributed over 2% of the total; Houde et al. (footnote 4) found them at offshore stations in the eastern Gulf of Mexico; Nellen (1973) included chlorophthalmids in this group, making it difficult to determine relative abundances in the western Indian Ocean.

Identification.—A number of small and damaged specimens could not be identified. Except for the distinctive *Sudis hyalina*, I did not identify the other specimens below genus because of the difficulty involved. Many specimens were identifiable to the species level, but a large proportion were not; thus the generic level was used. I followed Rofen (1966b) in the identification, with the exception of *Pontosudis* which Rofen did not describe. However, the adults have characteristic long dorsal fins, which were a distinctive character on the larvae I tentatively attribute to this genus.

***Lestidium* spp. (44 occurrences, 79 larvae).**—This was the most abundant genus of barracudinas (Table 9), and larvae were widely distributed throughout the area. In the winter cruise, larvae were absent from the Straits of Florida and north of the Caribbean (Fig. 4).

***Lestidiops* spp. (18 occurrences, 25 larvae).**—These larvae were found in limited numbers throughout the area.

***Sudis hyalina* (25 occurrences, 35 larvae).**—This species was more abundant and widely distributed on the winter, than on the summer, cruise.

***Stemonosudis* spp. (8 occurrences, 8 larvae).**—Representatives of this genus were rare in these collections.

***Pontosudis* spp. (6 occurrences, 6 larvae).**—This tentatively identified taxon was rarely taken and only outside of the Caribbean.

***Lestrolepis* spp. (12 occurrences, 15 larvae).**—These rare larvae were taken more often in the summer than in the winter.

16. Alepisauridae (2 occurrences, 2 larvae)

The two larvae were taken in the middle of the Caribbean south of Hispaniola during the winter cruise.

Identification.—Two species of *Alepisaurus* occurred in this area, but their specific identification has not been determined. I followed the description of Rofen (1966c) for *Alepisaurus* sp.

17. Myctophidae (109 occurrences, 2,674 larvae)

Larvae of this family were the most abundant of any family and occurred at every station. It was the most speciose family as represented by the kinds of larvae found, and many taxa were identified as summarized in Table 10. A number of specimens were not identified, not because they were unknown, but because they were too damaged to identify to the generic level with any reliability. These larvae are listed as Myctophidae spp. The remaining larvae are discussed by genus or species. In the western Indian Ocean and in the eastern tropical Pacific, this family also dominated (Ahlstrom 1971, 1972; Nellen 1973). In the eastern Gulf of Mexico, they were the fourth most frequently observed family, even though most stations were in water <50 m deep, because of their dominance at the deeper stations (Houde et al. footnote 4). Most of the same genera of larvae are found in the areas I have compared with the Caribbean, but they differ strikingly in many instances as I discuss at the end of the family account.

***Diaphus* spp. (101 occurrences, 1,233 larvae and transformed juveniles).**—Larvae of this genus occurred at nearly every station and were most abundant at the generic level (Fig. 5). Nine species were identified but these were transformed individuals. *Diaphus* has 23 species occurring in the North Atlantic Ocean of which 20 have been reported from this survey area (Nafpaktitis et al. 1977). Their absence from four stations on each cruise is not indicative of their distribution, but rather of their low abundance at those locations. These larvae are oceanic and generally quite abundant, with 13 stations having >100 larvae under 10 m^2 of sea surface. The two stations on cruise 7343 off the coast of Venezuela had >300 larvae under 10 m^2, and the other two stations on that cruise had between 100 and 200 larvae under 10 m^2. The nine stations on cruise 7239 with >100 larvae under 10 m^2 ranged from 101 to 192 larvae. In the eastern tropical Pacific, Ahlstrom (1972) found *Diaphus* to rank third in abundance, exceeded only by *Diogenichthys* and *Lampanyctus*. In this study, *Diogenichthys* was not abundant and *Lampanyctus* ranked fifth. In the eastern Gulf of Mexico *Diaphus* was most common (Houde et al. footnote 4), and in the western Indian Ocean *Diaphus* ranked second, exceeded only by *Benthosema* (Nellen 1973).

Identification.—The nine species identified by B. G. Nafpaktitis et al. (1977) were transformed specimens. Larvae were identified following the criteria of Moser and Ahlstrom (1972, 1974). Only limited attempts were made to identify larvae to species. Several metamorphosing specimens were identified as *D. dumerilii*, which appears to have been one of the most common species. However, the complexity of this group precluded me from attempting to work out identification at the species level at this time. Pigmentation, body shape, and photophore development characters will be useful in identifying these species.

***Notolychnus valdivae* (26 occurrences, 44 larvae).**—This species ranked seventh in abundance among the myctophid genera and was scattered throughout the area on both cruises. This species showed some seasonal variation, with twice as many present during the summer cruise as the winter cruise. Adults of this species are widely distributed and abundant in tropical and subtropical waters (Nafpaktitis et al. 1977). Ahlstrom (1972) found it in rather narrow geographical limits on the eastern tropical Pacific; Houde et al. (footnote 4) found it throughout the eastern Gulf of Mexico at stations deeper than 100 m; Nellen (1973) found 178 larvae in the western Indian Ocean.

Identification.—I followed Moser and Ahlstrom (1974) in identifying these larvae. Larvae of this species acquire photophores at small size (10 mm), and the distinctive arrangement of photophores makes these specimens easy to identify. Before the acquisition of photophores, the distinct shape of the eye and body and characteristic pigment at the base of the tail aid in identification.

***Lampadena* spp. (27 occurrences, 46 larvae).**—Larvae of this genus were more abundant during the summer than the winter and ranked sixth in abundance. This genus was not well represented in the eastern tropical Pacific (Ahlstrom 1971, 1972); Nafpaktitis et al. (1977) indicated that only one species (*L. luminosa*) is abundant in this area and one species *(L. anomala)* is rare; Houde et al. (1979) caught 42 larvae attributed to *L. luminosa* in the eastern Gulf of Mexico; Nellen (1973) reported on 86 larvae from the western Indian Ocean.

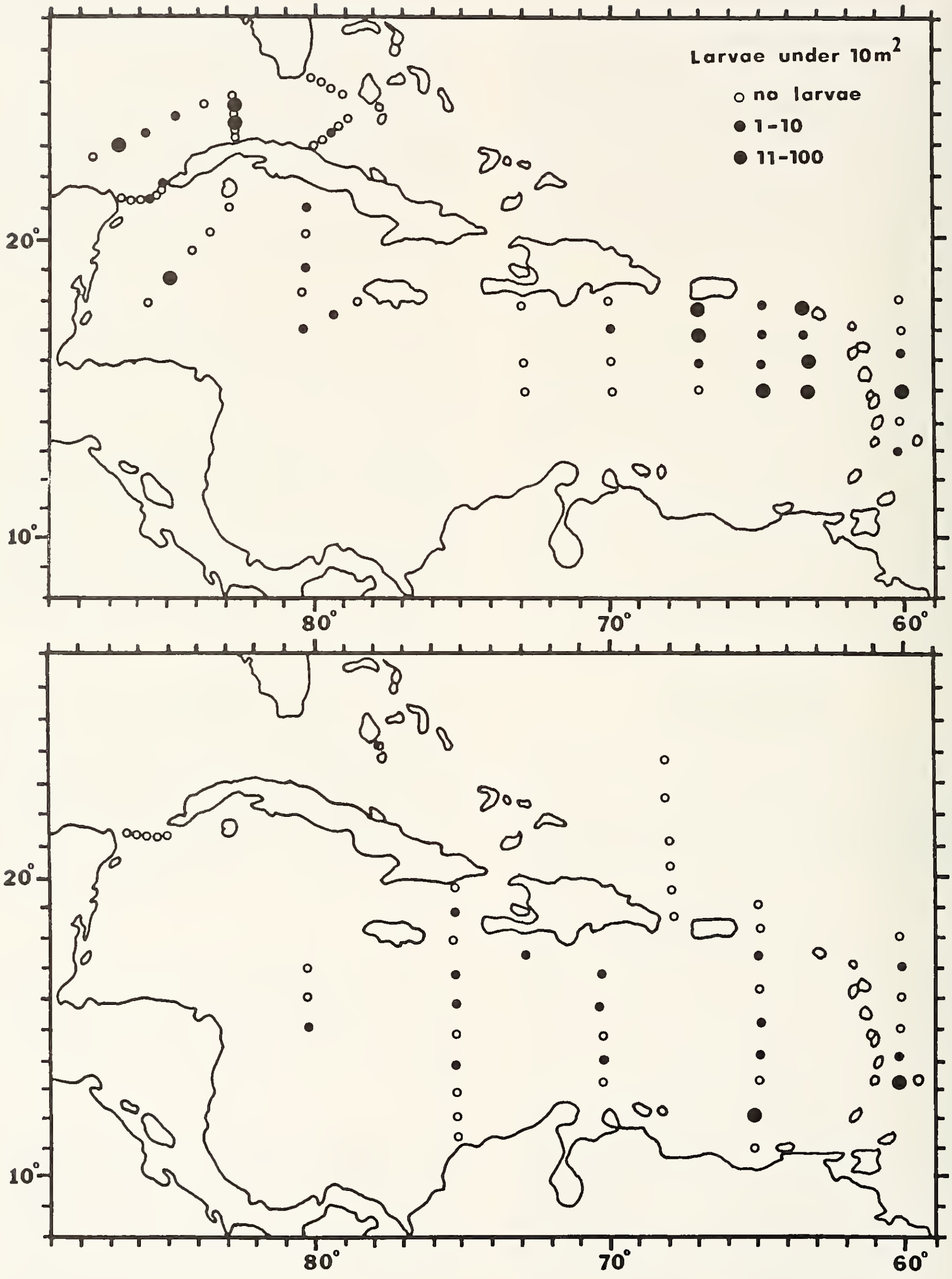


Figure 4.—Distribution and number per station of the paralepidid larvae *Lestidium* spp. during *Oregon II* cruises 7239 (upper) and 7343 (lower).

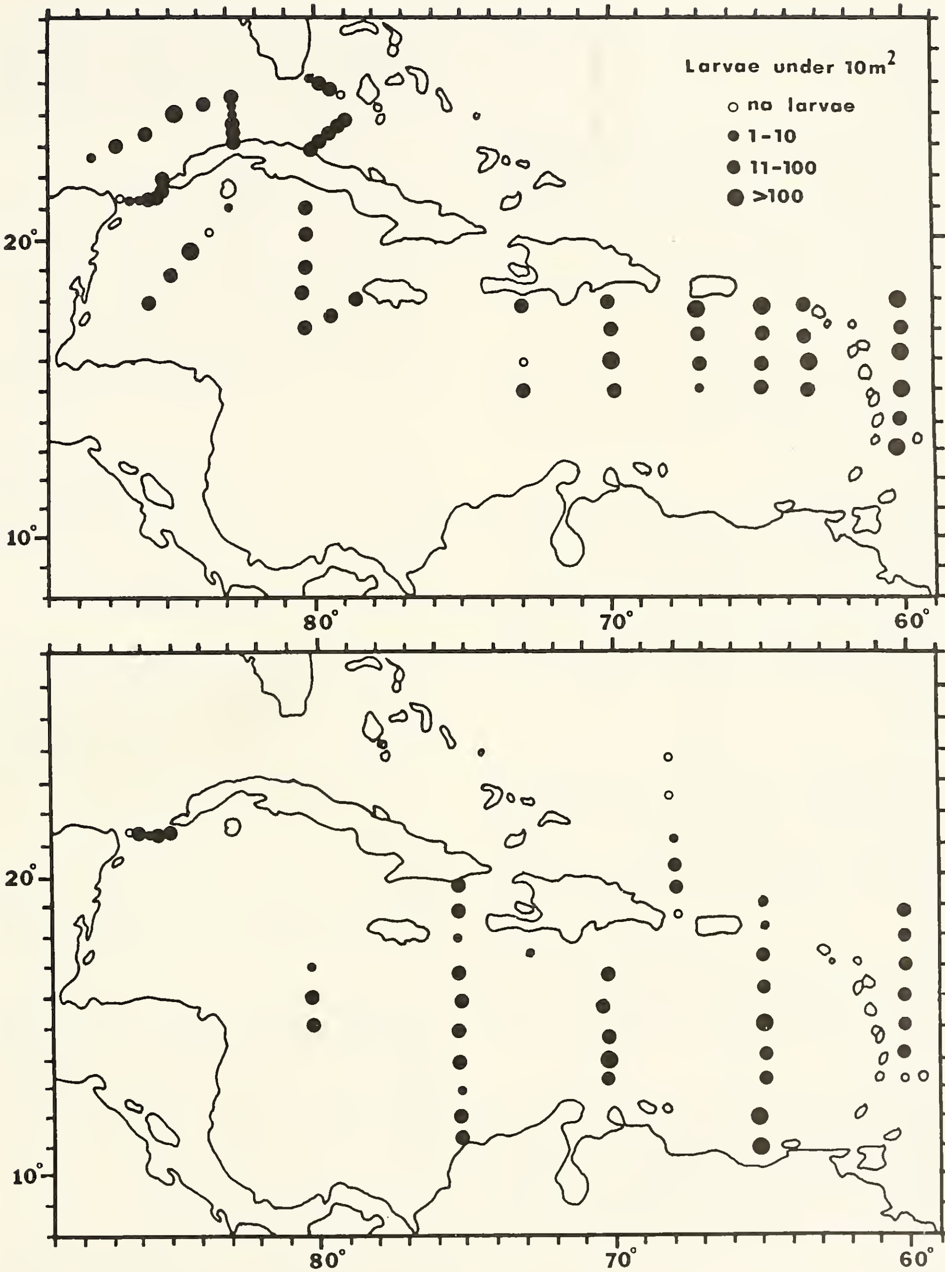


Figure 5.—Distribution and number per station of the myctophid larvae *Diaphus* spp. during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Identification.—I followed Moser and Ahlstrom (1972, 1974) in their concept of the genus. I made no attempt to identify the specimens to species.

Lampanyctus **complex (45 occurrences, 82 larvae).**—Larvae of *Lampanyctus* were ranked fifth in abundance among the genera, and three types were identified to species. Ahlstrom (1971, 1972) found larvae of this genus to be the second most abundant myctophid; Houde et al. (footnote 4) did not find it very abundant in the eastern Gulf of Mexico; Nellen (1973) found it to be the third most abundant in the western Indian Ocean.

Identification.—I followed Moser and Ahlstrom (1974). Because of the presence of seven species in the Gulf or Caribbean, I was not able to identify all of the material to species.

Lampanyctus **spp. (12 occurrences, 18 larvae, and 2 juveniles).**—Only these few larvae were not specifically identified. A single juvenile specimen was *L. alatus,* and this was the most abundant species of *Lampanyctus* in the eastern Gulf of Mexico (Houde et al. footnote 4).

Lampanyctus cuprarius **(7 occurrences, 8 larvae).**—This species occurred rarely. Nafpaktitis et al. (1977) indicated that the center of abundance of this species is the subtropics, although it is found in significant numbers in the Caribbean area. Houde et al. (footnote 4) collected 16 specimens in the eastern Gulf of Mexico.

Identification.—I followed an unpublished account of Ahlstrom[6] for this species, which has a long snout with a distinct streak of pigment, pigment on the tip of both jaws, behind the eye, around the nares, and between the forebrain and midbrain, but it lacks trunk pigment.

Lampanyctus nobilis **(35 occurrences, 55 larvae).**—This was the most abundant species of *Lampanyctus* having a wide distribution throughout the area in both seasons. It is also the third ranked myctophid species of those identified to species. The adults are also widely distributed in the area (Nafpaktitis et al. 1977). Houde et al. (footnote 4) did not report this species, but my later examination of the unidentified specimens revealed it to be the second most abundant species after *L. alatus* in his eastern Gulf collection.

Identification.—This species is often mistaken for tuna larvae by inexperienced identifiers because of its similar head and body profile. However, the head is laterally compressed with complex pigmentation on the gular membrane, tip of lower jaw, forebrain, hindbrain, and gut.

Myctophum **complex (75 occurrences, 190 larvae).**—Larvae of this genus were widely distributed and ranked third in abundance. All but five larvae were identified to species. Larvae of all species known as adults were taken from the area (Nafpaktitis et al. 1977). Ahlstrom (1971, 1972) obtained two species (*M. nitidulum* and *M. asperum*) in the tropical Pacific common to those in this area.

[6]E. H. Ahlstrom, late of the Southwest Fisheries Center, La Jolla Laboratory, National Marine Fisheries Service, NOAA, La Jolla, CA 92037. Unpublished illustrations and identified specimens in his collection.

Myctophum affine **(9 occurrences, 13 larvae).**—This species occurred rarely, but more abundantly during the summer. Adults of this species are tropical and show unusual scarcities in some areas, but are abundant in the Caribbean and Gulf (Nafpaktitis et al. 1977). No specimens of this species were taken by Houde et al. (footnote 4) in the Gulf of Mexico.

Identification.—Five species occur in this area and of those all but *M. affine* have been described. I assume this undescribed larval type to be *M. affine.* It is nearly identical to *M. nitidulum* in body and eye shape but differs in pigmentation. It has a row of melanophores along the posterior ramus of the lower jaw, a few melanophores behind the eye, one pigment spot on each side of the midbrain, and one behind the midbrain. Pigmentation on the trunk consists of melanophores at the pectoral symphysis, above the pectoral fin base, a few ventrally posterior to the pectoral symphysis, and on the anal papilla. Distinct pigment blotches occur beneath the posterior end of the dorsal fin, below the adipose fin, and above the anal fin.

Myctophum asperum **(5 occurrences, 5 larvae).**—This species occurred rarely in the area. Adults are tropical and found commonly in this area (Nafpaktitis et al. 1977). Houde et al. (footnote 4) captured one specimen in the eastern Gulf of Mexico; Ahlstrom (1972) found this species offshore in an equatorial tongue in the eastern tropical Pacific.

Identification.—Moser and Ahlstrom (1974).

Myctophum nitidulum **(19 occurrences, 35 larvae).**—This species was commonly taken throughout the area and was found to be widespread and abundant by Nafpaktitis et al. (1977). It was the most abundant *Myctophum* species in the eastern Gulf of Mexico (Houde et al. footnote 4) and was one of the commonest *Myctophum* found in the eastern tropical Pacific (Ahlstrom 1971, 1972) and western Indian Ocean (Nellen 1973).

Identification.—Moser and Ahlstrom (1970, 1974).

Myctophum obtusirostre **(33 occurrences, 51 larvae).**—This species was more abundant during the winter than the summer and is common throughout the area. Adults exhibit a tropical distribution (Nafpakitis et al. 1977). In the eastern Gulf of Mexico only two specimens were captured (Houde et al. footnote 4).

Myctophum selenops **(47 occurrences, 81 larvae).**—This was the second most abundant myctophid taxon identified to species. It occurred in both seasons but was more abundant during the summer (Table 10, Fig. 6). Nafpaktitis et al. (1977) considered this species to be uncommon with a tropical-subtropical distribution pattern. In contrast, it was the most abundant *Myctophum* in my material. Houde et al. (footnote 4) found this to be the second most abundant *Myctophum* in the eastern Gulf of Mexico.

Identification.—Moser and Ahlstrom (1974).

Bolinichthys **spp. (19 occurrences, 24 larvae).**—Three species of *Bolinichthys* have been recorded as adults in this area and two others occur in adjacent areas. Larvae were uncommon but widespread in this area (Table 10). One positively identified specimen of *B. supralateralis* was collected in the Gulf of Mexico. Adults of this species were common to the area (Nafpaktitis et al. 1977). Larvae of this genus were not taken in the eastern tropical

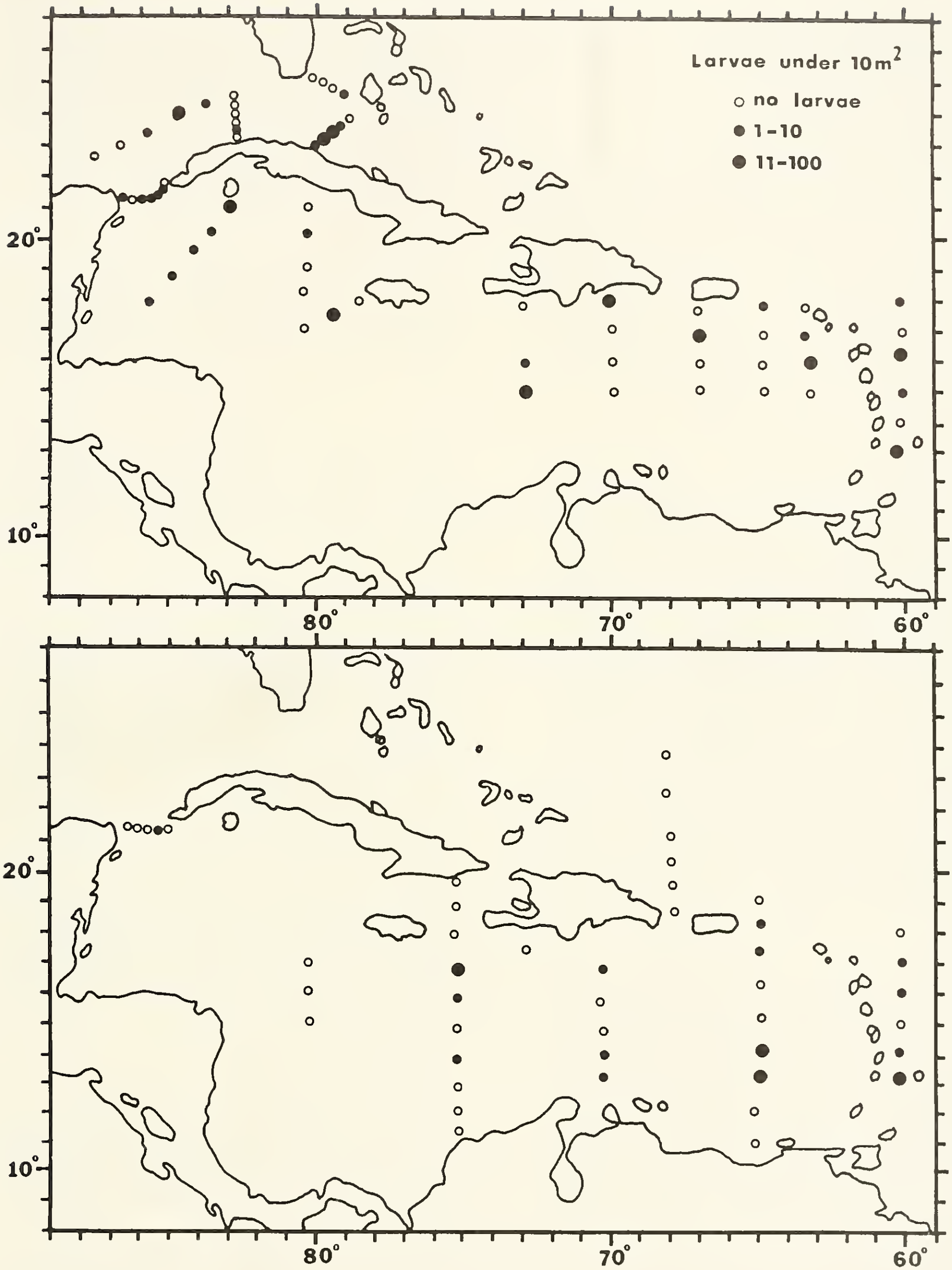


Figure 6.—Distribution and number per station of the myctophid larvae *Myctophum selenops* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Pacific by Ahlstrom (1971, 1972) nor in the western Indian Ocean by Nellen (1973). Houde et al. (footnote 4) captured five specimens in the eastern Gulf of Mexico.

Identification.—Moser and Ahlstrom (1972, 1974).

Ceratoscopelus-Lepidophanes **complex.**—Larvae of these species were second in abundance to *Diaphus* and were distributed abundantly throughout the area (Table 10). As noted in Table 10, some of the *Ceratoscopelus* were identified to the species level, but *Lepidophanes* were not identified to species. Reasons for considering these as a single complex are given in the identification remarks below. In the eastern tropical Pacific, Ahlstrom (1971, 1972) found these larvae to be common. Nellen (1973) collected representatives of both genera in the western Indian Ocean. Nafpaktitis et al. (1977) found *Ceratoscopelus warmingi* and *L. guentheri* to be abundant in this area and *L. gaussi* to occur infrequently in the area. Houde et al. (footnote 4) found *C. warmingi* to be common and also collected 169 specimens of *Lepidophanes* in the eastern Gulf of Mexico.

Identification.—This group presented two serious problems, prompting me now to consider them as a single complex. First, a significant number of larvae were identified as *C. maderensis* following the description by Tåning (1918) and Moser and Ahlstrom (1972). Additionally, both Moser and Ahlstrom personally examined many of my specimens and agreed that they were typical *C. maderensis.* Nafpaktitis et al. (1977), despite extensive collecting, have not recorded the presence of this easily identified species in the Gulf of Mexico or Caribbean. Until this problem is resolved, I do not wish to place too much emphasis on this identification. Second, small larvae of *Ceratoscopelus* and *Lepidophanes* are very similar in appearance, and I was not confident of many of my identifications. Even though Moser and Ahlstrom (1972,1974) have identified both species of *Lepidophanes* and stated that *C. warmingi* is an unpigmented form similar to *C. townsendi* of the eastern Pacific, I believe additional work is needed, especially on the smaller sizes. Houde et al. (footnote 4) found no *C. maderensis*-type larvae in the eastern Gulf of Mexico, which greatly facilitated the identification of the *Ceratoscopelus-Lepidophanes* types. The presence of *C. maderensis* larvae, if correctly identified, would indicate that the range of this species is greatly extended into tropical waters.

Hygophum **complex (68 occurrences, 178 larvae).**—Larvae of this genus ranked fourth in abundance, and *H. taaningi* was the most abundant myctophid larvae identified to species. Only a few specimens could not be identified to species (Table 10). Of the five species known from this area, all but one were taken (Nafpaktitis et al. 1977). Houde et al. (footnote 4) found *Hygophum* to be common but did not identify many to species in the eastern Gulf of Mexico. They only identified *H. reinhardti* and *H. benoiti* (the only species not found by me in the Caribbean). This genus is well represented in the eastern tropical Pacific, but the two regions have only *H. reinhardti* in common (Ahlstrom 1971, 1972). *Hygophum* is also a common type found in the western Indian Ocean (Nellen 1973).

Hygophum hygomi **(3 occurrences, 4 larvae).**—This species was taken in the Yucatan Channel and north of Hispaniola. Adults are uncommon in this area, as this species is considered to have a temperate-semisubtropical distribution by Nafpaktitis et al. (1977).

Identification.—Tåning (1918) and Moser and Ahlstrom (1974).

Hygophum reinhardti **(14 occurrences, 15 larvae).**—This species was widely distributed, but not abundant throughout the area. Houde et al. (footnote 4) collected 66 specimens in the eastern Gulf of Mexico. Adults are commonly found in the area (Nafpaktitis et al. 1977). Ahlstrom (1971, 1972) took *H. reinhardti* only at the southernmost stations on EASTROPAC I and none on EASTROPAC II because the coverage was not as extensive.

Identification.—Moser and Ahlstrom (1970).

Hygophum macrochir **(14 occurrences, 28 larvae).**—This species was widely distributed throughout the area (Table 10), and was found more abundant in winter than in summer. It was absent from the western Caribbean, although there are adult records from there (Nafpaktitis et al. 1977).

Identification.—Moser and Ahlstrom (1974) and Shiganova (1975).

Hygophum taaningi **(53 occurrences, 126 larvae).**—This species was the most abundant myctophid taxon identified to the species level and occurred abundantly throughout the area (Table 10, Fig. 7). Adults of this tropical species are abundant in this area (Nafpaktitis et al. 1977).

Identification.—Moser and Ahlstrom (1974).

Centrobranchus nigroocellatus **(6 occurrences, 7 larvae).**—This species was taken at only one location (north of Cuba) in the summer and was rare in the winter collection (Table 10). Houde et al. (footnote 4) collected this species during all seasons in the eastern Gulf of Mexico. *Centrobranchus nigroocellatus* adults are known from the area (Nafpaktitis et al. 1977), and few *Centrobranchus* were found in the eastern tropical Pacific (Ahlstrom 1971, 1972). Nellen (1973) collected 69 specimens in the western Indian Ocean.

Identification.—My specimens were identical to the Pacific *C. choerocephalus*, as described by Moser and Ahlstrom (1970, 1974).

Notoscopelus resplendens **(4 occurrences, 4 larvae).**—This species was rare in this area (Table 10). Houde et al. (footnote 4) collected a few specimens of this species in the eastern Gulf of Mexico. Larvae of this species were taken in the eastern tropical Pacific (Ahlstrom 1971, 1972), and Nafpaktitis et al. (1977) found it abundant in this area. Nellen (1973) did not report any *Notoscopelus* in the western Indian Ocean.

Identification.—Moser and Ahlstrom (1972, 1974).

Notoscopelus caudispinosus **(3 occurrences, 8 larvae).**—This species was rare during the winter cruise and was not taken during the summer cruise (Table 10). Houde et al. (footnote 4) found this species only during winter cruises in the eastern Gulf of Mexico. It was found throughout this area, though not abundantly, by Nafpaktitis et al. (1977).

Identification.—Notoscopelus caudispinosus larvae are very similar to larvae of *N. resplendens* but differ in number of dorsal fin rays (25-27) as compared with *N. resplendens* (21-24). Its pigmentation is similar to *N. resplendens*, but it lacks the distinct melanophores on the dorsal surface of the trunk.

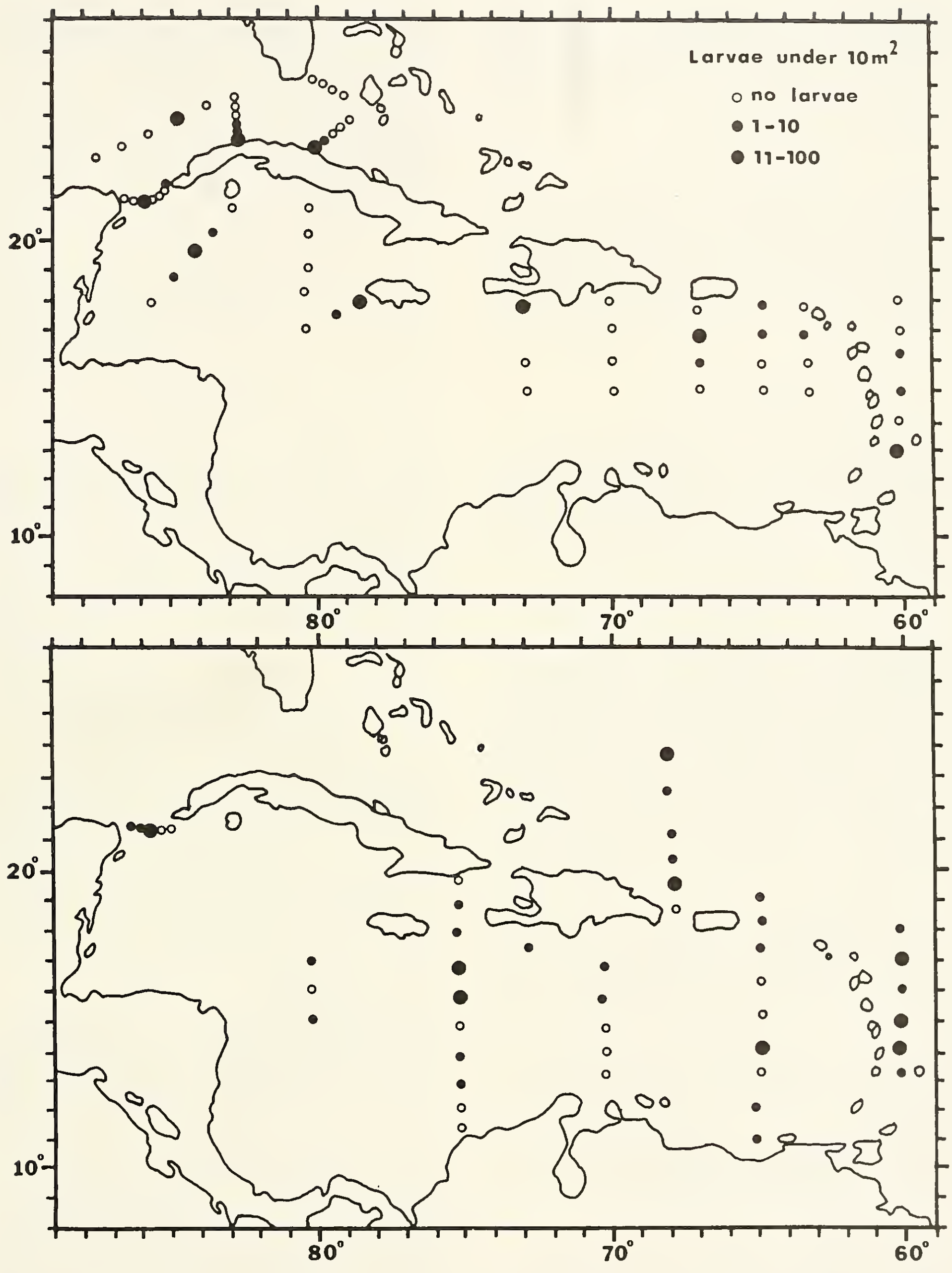


Figure 7.—Distribution and number per station of the myctophid larvae *Hygophum taaningi* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Lobianchia gemellarii **(2 occurrences, 5 larvae).**—This species was rare and occurred only in the winter (Table 10). Larvae of this genus were rare in the eastern tropical Pacific (Ahlstrom 1971, 1972), but adults are common in the Gulf and Caribbean (Nafpaktitis et al. 1977). Houde et al. (footnote 4) collected a few specimens in the eastern Gulf of Mexico; the species is absent from the western Indian Ocean (Nellen 1973).

Identification.—Tåning (1918) and Moser and Ahlstrom (1974).

Benthosema suborbitale **(4 occurrences, 4 larvae).**—Larvae of the *Benthosema* were taken only during the summer cruise (Table 10). Larvae of this species were rare in the eastern tropical Pacific (Ahlstrom 1972). Adults are common in the Gulf and Caribbean (Nafpaktitis et al. 1977). It was quite abundant in the eastern Gulf of Mexico (Houde et al. footnote 4), and this genus was the most abundant myctophid in the western Indian Ocean (Nellen 1973).

Identification—Moser and Ahlstrom (1974).

Diogenichthys atlanticus **(6 occurrences, 8 larvae).**—This species was rare during both cruises (Table 10), but Houde et al. (footnote 4) found it to be common in the eastern Gulf of Mexico. Larvae of this species were also taken in the eastern tropical Pacific (Ahlstrom 1971). The commonest species in the eastern tropical Pacific is *D. laternatus* and was also present in the western Indian Ocean (Nellen 1973); adults of *D. atlanticus* are widespread in the Atlantic (Nafpaktitis et al., 1977).

Identification.—Tåning (1918) and Moser and Ahlstrom (1970).

Symbolophorus **spp. (4 occurrences, 4 larvae).**—Larvae were rarely encountered on both cruises (Table 10). *Symbolophorus* larvae were common in the eastern tropical Pacific (Ahlstrom 1971, 1972). *Symbolophorus rufinus* adults are common in the Gulf and Caribbean (Nafpaktitis et al. 1977), and Houde et al. (footnote 4) captured nine specimens in the eastern Gulf of Mexico. This genus is commonly represented in the eastern tropical Pacific (Ahlstrom 1971, 1972) and western Indian Ocean (Nellen 1973).

Identification.—Two larval types were collected, which I tentatively place in *Symbolophorus*. One species had a pigment pattern similar to *M. spinosum*, illustrated by Moser and Ahlstrom (1974), but with a deeper body. The other type was slender like the *S. californiense* illustrated by Moser and Ahlstrom (1970, 1974). Neither type resembled *S. veranyi* described by Tåning (1918). As mentioned above, *S. rufinus* is the only *Symbolophorus* known from the area. Further collecting is needed to resolve this question.

Loweina rara **(1 occurrence, 1 larva).**—One specimen of this species was taken. This species is known from the eastern tropical Pacific (Moser and Ahlstrom 1970; Ahlstrom 1971, 1972), and the genus is also found in the western Indian Ocean (Nellen 1973). Adults were not reported from the Gulf and Caribbean by Nafpaktitis et al. (1977), but the presence of this unique larvae confirms its presence here.

Identification.—Moser and Ahlstrom (1970).

Myctophid **distributions.**—The distribution maps provided by Nafpaktitis et al. (1977) allow for an opportunity to compare adult distribution with larval distribution as I have done above. There were only four adult taxa reported by them which were not represented in my larvae—*Gonichthys coccoi* and three species of *Taaningichthys*. Houde et al. (footnote 4) collected four specimens of *G. coccoi* but no *Taaningichthys* in the eastern Gulf of Mexico. Larval occurrences provided a range extension for *L. rara*, but several questions were raised because of identification problems with *Ceratoscopelus* and *Symbolophorus*. Further research and additional collecting are needed to work out the identification problems of larvae of which specific identifications were not possible.

Backus et al. (1977) divided the Atlantic into several regions which are subdivided into provinces. The area of this study is their Atlantic tropical region which includes two provinces—the Caribbean Sea and the Lesser Antilles. In addition, some of our stations occur in the North Atlantic subtropical region and two of its provinces—the Straits of Florida and south Sargasso Sea. Stations north of the Yucatan Channel are on the boundary between the Straits of Florida province and the Gulf of Mexico region which includes a sole province of the same name. All of my study area stations are adjacent to the Backus et al. (1977) tropical region; thus I combined all my stations and assume them to be roughly equivalent to the Backus et al. (1977) tropical region. This allows a comparison of the relative abundance of my specimens with that of theirs, given in Table 11. I combined some of their taxa to match mine. Values < 0.1 were given an arbitrary value of 0.05 when I added species.

There are some interesting similarities and dissimilarities between the Backus et al. (1977) data set and mine. The speciose genus *Diaphus* ranked first and the *Ceratoscopelus-Lepidophanes* complex ranked second in both data sets. Other taxa ranking in the top 10 in both studies were *Notolychnus valdivae*, *Lampanyctus nobilis*, other *Lampanyctus* spp., and *Hygophum macrochir.* Striking dissimilarities include the high abundance in my material of *Hygophum taaningi* and *Myctophum selenops* and the low abundance of *Benthosema suborbitale*, *Diogenichthys atlanticus*, and *Bolinichthys* spp. The taxa lacking from my specimens—*Lobianchis dofleini*, *Gonichthys coccoi*, and *Taaningichthus*—were not abundant in the Woods Hole Oceanographic Institution collections of Backus et al. Three taxa had identical or nearly identical relative abundance percentages in both data sets—*Lampadena* spp., *Lampanyctus nobilis*, and *Myctophum affine*. These comparative data indicate a close relationship between larvae and adults in relative abundance of myctophid fishes. The dissimilarities are probably due to sampling inefficiencies used in the collection of specimens for both data sets. Additional larval collections and advancement in identification will provide superior comparisons in the future.

I also compare (in Table 12) the relative percentages of larvae in my study with those in the eastern Gulf of Mexico (Houde et al. footnote 4), the eastern tropical Pacific—EASTROPAC I and II—(Ahlstrom 1971, 1972), and the western Indian Ocean (Nellen 1973). The contrasts between these areas are quite striking. *Diaphus* is ranked first in the Caribbean and eastern Gulf of Mexico by a wide margin, as are *Diogenichthys* in the eastern tropical Pacific and *Benthosema* in the western Indian Ocean. Great disparities are not prevalent, however, when comparing other taxa among the different areas. As one would expect, differences are not very great between the Caribbean and eastern Gulf of Mexico, except that *Ceratoscopelus-Lepidophanes* was more abundant in the Caribbean and *Benthosema* was more common in the Gulf of Mexico. *Diaphus* ranked second in the western Indian Ocean and third in the eastern tropical Pacific, whereas *Lampanyctus* ranked third in the western Indian Ocean and second in the eastern tropical Pacific. *Hygophum* and *Myctophum* ranked higher in both Atlantic areas than in the Indian and Pacific areas.

18. Chlorophthalmidae (7 occurrences, 20 larvae)

Three species of chlorophthalmids occur in this area and larvae were found only in or near the Yucatan Channel predominantly in the summer. Houde et al. (footnote 4) collected 11 larvae in the eastern Gulf of Mexico; Ahlstrom (1971) reported only a few larvae of this family from the eastern tropical Pacific.

Identification.—I followed Tåning (1918) for features at the family level. Subfamilial larval identifications have not been done. All my specimens closely resembled Tåning's (1918) description of *C. agassizi.* I did not examine the number of vertebrae which in part separates the species.

19. Notosudidae (15 occurrences, 23 larvae)

Two species of this family were collected in this area: *Scopelosaurus smithii* and *S. mauli.* Bertelsen et al. (1976) found specimens of *S. smithii* and *S. mauli* commonly in the Caribbean Sea. In addition, they found two other species, *Ahliesaurus berryi* and *S. argenteus*, which did not occur in my samples. Houde et al. (footnote 4) collected only two larvae, one of which was *S. mauli*, in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) found some notosudids in the eastern tropical Pacific in a narrow equatorial band.

Identification.—Bertelsen et al. (1976).

Anguilliformes (Eel Leptocephali) (55 occurrences, 110 leptocephali)

Eel leptocephali representing eight different families were collected on both cruises (Table 13). Separate brief accounts are given for each family. Nellen (1973) collected 193 leptocephali in the western Indian Ocean but did not discuss them.

Identification.—David G. Smith examined and identified all of the leptocephali using his methodology (Smith 1979).

20. Xenocongridae (2 occurrences, 2 leptocephali)

Two species, *Kaupichthys* sp. and *Robinsia catherinae*, were taken during the winter cruise (Table 13). Ahlstrom (1971, 1972) also found a few larvae of this family in the eastern tropical Pacific, although Houde et al. (footnote 4) collected no members of this family in the eastern Gulf of Mexico.

21. Muraenidae (19 occurrences, 21 leptocephali)

Two identified taxa and a few unidentified larvae represented this family (Table 13). *Gymnothorax* spp. were more abundant during the winter cruise and were widely distributed in the eastern Caribbean. This distribution possibly reflects the abundant habitat for moray eels in the Lesser Antilles. *Anarchias yoshiae* leptocephali were taken only in the northwestern Caribbean and Straits of Florida in the summer. In the eastern Gulf of Mexico, *Gymnothorax* leptocephali were abundant, especially in the spring, summer, and fall cruises (Houde et al. footnote 4). Four *A. yoshiae* were also collected in the eastern gulf by Houde et al. (footnote 4), and Ahlstrom (1971, 1972) found a few leptocephali of this family in the eastern tropical Pacific.

22. Moringuidae (4 occurrences, 12 leptocephali)

Two species were present in these samples—*Moringua edwardsi* was present in both cruises, whereas *Neoconger mucronatus* was found only in the winter cruise. This family was not listed in the eastern Gulf of Mexico (Houde et al. footnote 4). Ahlstrom (1971, 1972) found very few moringuids and only near the coast of the eastern tropical Pacific. The Atlantic moringuid leptocephali are found widespread in the western Atlantic (Smith and Castle 1972).

23. Nettastomatidae (4 occurrences, 5 leptocephali)

These few leptocephali were found in widely spaced locations on each cruise. Ninety larvae, all identified as *Hoplunnis*, were taken in the eastern Gulf of Mexico (Houde et al. footnote 4); Ahlstrom (1971, 1972) found only a few specimens of this family in the eastern tropical Pacific.

24. Congridae (25 occurrences, 36 leptocephali)

This was the most speciose and abundant family of leptocephali (Table 13). More larvae were present during the summer than winter. These leptocephali are scattered throughout the area, although there was an absence from many of the Caribbean Sea stations during cruise 7239. I do not believe this represents an absence of these animals, but rather a scarcity; few are taken in small nets (see Ahlstrom 1971: 33). Congrid eels were the second most abundant leptocephali in the eastern Gulf of Mexico, with *Hildebrandia* spp. the most abundant followed by *Paraconger caudilimbatus* (Houde et al. footnote 4). Congrid eels were also the most abundant eels in the eastern tropical Pacific (Ahlstrom, 1971, 1972).

25. Ophichthidae (17 occurrences, 27 leptocephali)

Snake eel leptocephali were more widely distributed during summer (Table 13). These were the most abundant leptocephali found in the eastern Gulf of Mexico, most of which were identified as *Ophichthus* spp. (Houde et al. footnote 4). Ahlstrom 1971, 1972) found these larvae along a broad coastal band in the eastern tropical Pacific.

26. Synaphobranchidae (1 occurrence, 1 leptocephalus)

One leptocephalus of the subfamily Dysomminae was taken east of the Lesser Antilles during the summer cruise. Two larvae were collected on summer cruises in the eastern Gulf of Mexico. The family was not represented in the eastern tropical Pacific (Ahlstrom 1971, 1972).

27. Serrivomeridae
(3 occurrences, 3 leptocephali)

Leptocephali of this family were rare (Table 13). They were present well offshore in the eastern tropical Pacific (Ahlstrom 1971, 1972), and were not collected in the eastern Gulf of Mexico (Houde et al. footnote 4).

28. Exocoetidae
(9 occurrences, 12 larvae)

Despite the abundance of this family in tropical waters, it was poorly represented in these collections because these larvae are confined to nearsurface waters. Representatives of this family were taken in the eastern Gulf of Mexico (Houde et al. footnote 4), eastern tropical Pacific (Ahlstrom 1971), and western Indian Ocean (Nellen 1973).

29. Gadidae
(2 occurrences, 3 larvae)

These larvae were from stations where nets were lowered to greater than normal depths (293 and 325 m), and they are tentatively identified as belonging to this family. Houde et al. (footnote 4) found a few larvae of *Urophycis* in the eastern Gulf of Mexico; Nellen (1973) recorded a few gadids from the western Indian Ocean; and Ahlstrom (1971, 1972) reported very few from the eastern tropical Pacific.

30. Bregmacerotidae
(64 occurrences, 390 larvae)

Four species of bregmacerotids comprised these abundant larvae from this area (Table 14). Both *Bregmaceros macclellandii* and *B. atlanticus* were widely distributed and abundant during both cruises (Fig. 8, 9). *Bregmaceros* spp. were damaged specimens of these two species which could not be specifically identified, although they reflect the same distribution pattern. *Bregmaceros* type A were not widely distributed; *Bregmaceros* type B were found on both cruises, but were especially concentrated off the coast of Venezuela adjacent to the Gulf of Cariaco. Nellen (1973) found members of this family to be common in the western Indian Ocean, but identifications were not made to the species level. Belyanina (1980) described the distribution of three species (*B. atlanticus, B. macclellandii*, and *B. nectananus* = type B) in the western Caribbean and southwestern Gulf of Mexico.

Bregmaceros macclellandii is widely distributed in the tropical Atlantic (D'Ancona and Cavinato 1965). Houde et al. (footnote 4) and Houde (1981) found *B. macclellandii* larvae in the eastern Gulf of Mexico, but they were relatively uncommon and were taken there only at offshore stations (> 50 m). *Bregmaceros macclellandii* was abundant on my cruises because the stations were in deep water. Ahlstrom (1971) tentatively identified this species in limited numbers in the eastern tropical Pacific.

Bregmaceros atlanticus is also widely distributed in the Atlantic (D'Ancona and Cavinato 1965). Houde et al. (footnote 4) and Houde (1981) found it in greater abundance in the eastern Gulf of Mexico than *B. macclellandii*, but it too is principally a deepwater species being absent from station samples taken < 50 m deep. As in the Caribbean, neither *B. atlanticus* nor *B. macclellandii* exhibited any seasonality in the eastern Gulf of Mexico (Houde et al. footnote 4; Houde 1981).

Bregmaceros Type A was the second most abundant *Bregmaceros* in the eastern Gulf of Mexico (Houde et al. footnote 4; Houde 1981). Few larvae were taken at stations < 50 m deep. Interestingly, I found only one small area of occurrence of this species. Houde et al. (footnote 4) and Houde (1981) found variation in annual abundance of these larvae in the eastern Gulf, which may explain in part type A's unusual distribution pattern in the Caribbean Sea.

Bregamaceros Type B was the most abundant *Bregamaceros* found in the eastern Gulf of Mexico (Houde et al. footnote 4; Houde 1981). It was also wideranging, found in shallow water < 50 m deep. In the Caribbean collections, it was extremely abundant in the two stations off the Gulf of Cariaco. The inshore station was in water < 200 m (110 m depth of tow). This species was most abundant in the fall in the eastern Gulf, but it did occur throughout the year (Houde et al. footnote 4; Houde 1981). Unfortunately, my cruises did not sample the Gulf of Cariaco in the summer months, which precluded determining the prevalence of seasonality. Baird et al. (1973) have discussed the distribution of adults in the Cariaco Trench area.

Identification.—Bregmaceros macclellandi and *B. atlanticus* follow D'Ancona and Cavinato (1965). *Bregmaceros* Type A is an undescribed species illustrated in Houde et al. (footnote 4) and Houde (1981). *Bregmaceros* Type B is also undescribed, and notes on its larval identification are given by Houde et al. (footnote 4) and Houde (1981). Houde confirmed the identification of all my material. He noted that the *B. nectabanus* discussed by Baird et al. (1973) is a misidentification of the *Bregmaceros* Type B species.

31. Macrouridae
(1 occurrence, 1 larva)

One specimen of this family was taken north of the Gulf of Cariaco off Venezuela. Houde et al. (footnote 4) collected four specimens in the eastern Gulf of Mexico. Neither Ahlstrom (1971, 1972) nor Nellen (1973) reported this taxon.

Identification.—Sanzo (1933).

32. Eutaeniophoridae
(1 occurrence, 1 larva)

One specimen of the unusual *Eutaeniophorus festivus* was taken in the eastern Caribbean. Bertelsen and Marshall (1956) found them to be abundant in the Sargasso Sea. Nellen (1973) collected two specimens in the western Indian Ocean as did Ahlstrom (1972) in the eastern tropical Pacific Ocean.

Identification.—Bertelsen and Marshall (1956)

33. Aulostomidae
(3 occurrences, 3 larvae)

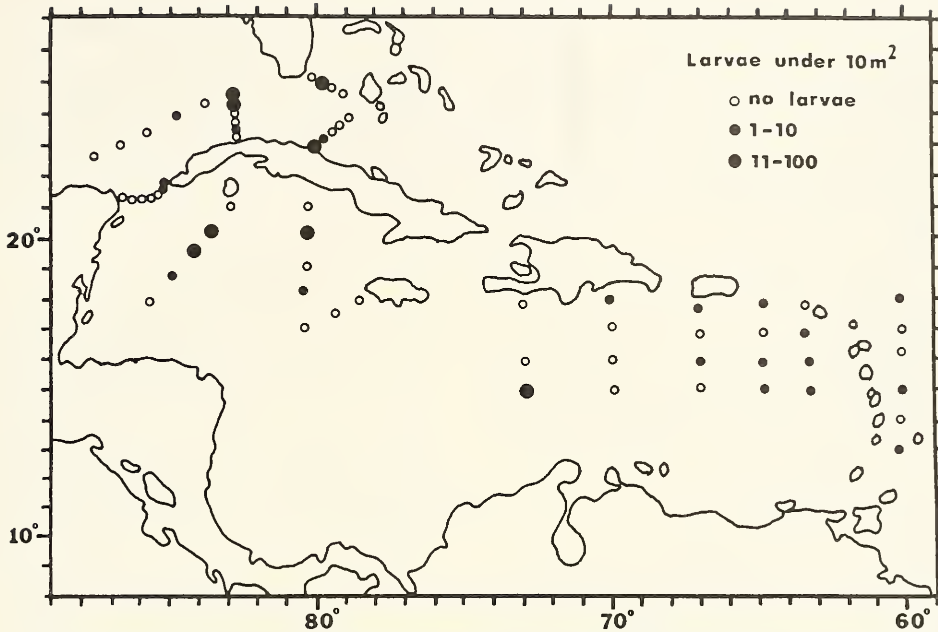
Larvae of *Aulostomus maculatus* were rare. None were collected in the eastern Gulf of Mexico (Houde et al. footnote 4).

Identification.—Larvae resemble adults and present no identification problems.

34. Fistulariidae
(1 occurrence, 1 larva)

Only one specimen of *Fistularia tabacaria* was taken on the winter cruise. Nellen (1973) reported one specimen from the western Indian Ocean; Ahlstrom (1972) reported one specimen from the eastern tropical Pacific; and Houde et al. (footnote 4) collected one specimen in the eastern Gulf of Mexico.

Identification.—Fritzsche (1976).



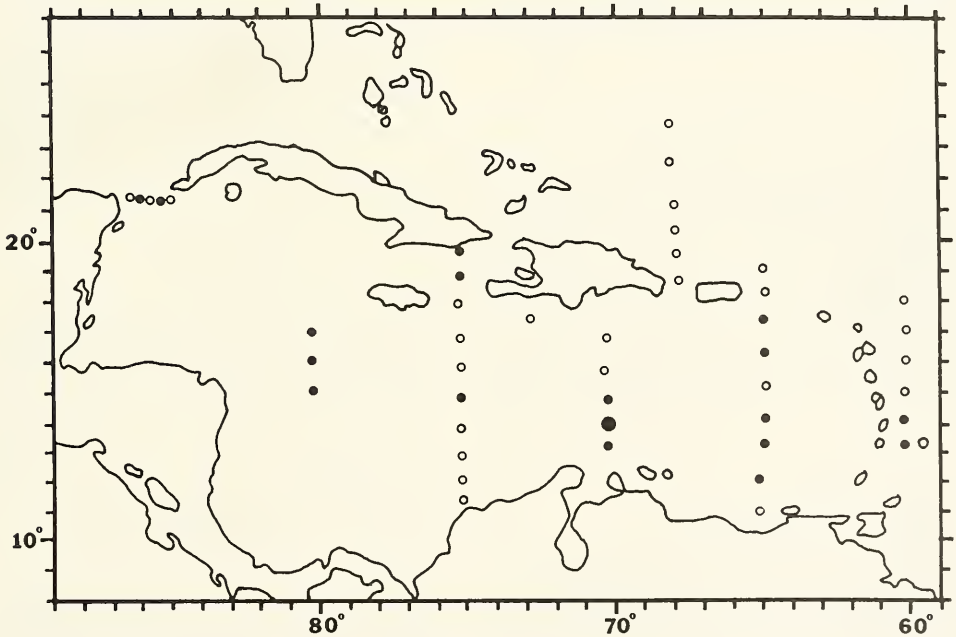


Figure 8.—Distribution and number per station of the bregmacerotid larvae *Bregmaceros mucclellandii* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

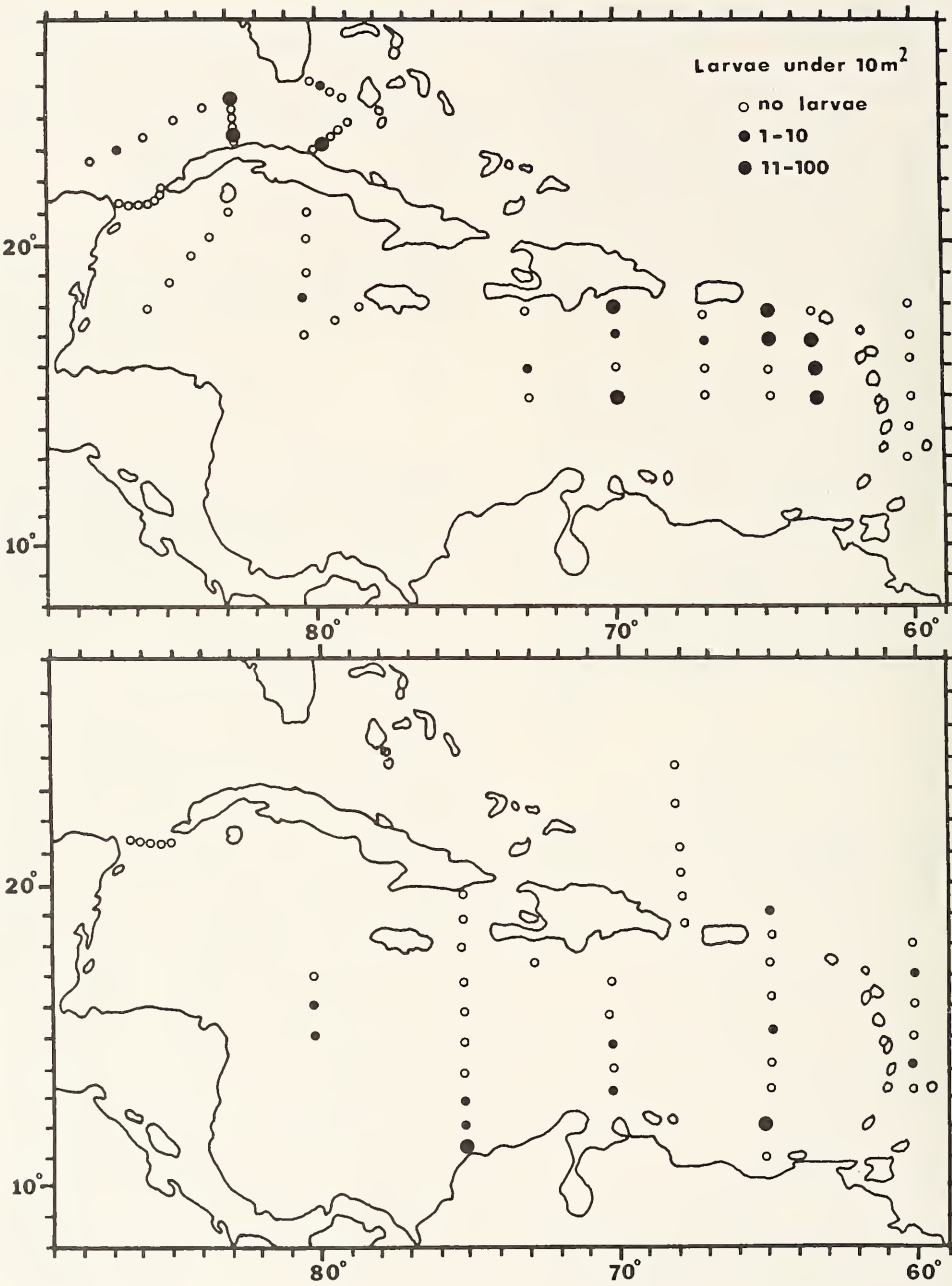


Figure 9.—Distribution and number per station of the bregmacerotid larvae *Bregmaceros atlanticus* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

35. Syngnathidae
(33 occurrences, 3 larvae)

Only three specimens comprising two species were collected, *Syngnathus dunckeri* and *Micrognathus* sp. Houde et al. (footnote 4) collected 247 larvae representing seven taxa in the eastern Gulf of Mexico; Nellen (1973) collected 10 specimens in the western Indian Ocean.

Identification.—Herald (1942).

36. Stylephoride
(4 occurrences, 4 larvae)

Very few larvae of this family were collected (Table 7). They were all taken on the winter cruise, with two from adjacent stations in the Yucatan Channel, one south of Hispaniola, and one west of Guadeloupe in the eastern Caribbean Sea.

Identification.—These larvae are tentatively placed in this family, one of the three trachipteroid families and the only one with an anal fin. Presence of an anal fin in the two largest larvae was the basis for this identification. Dr. John E. Olney (Virginia Institute of Marine Sciences, Gloucester Point, Va.) recently identified three specimens as *Stylephorus chordatus* (Family Stylephoridae), but the fourth specimen was too mutilated to be identified.

37. Melamphaidae
(7 occurrences, 8 larvae)

Very few larvae of this family were collected (Table 7). In contrast, representatives of this family were quite abundant in the eastern tropical Pacific (Ahlstrom 1971, 1972). Houde et al. (footnote 4) collected only 38 *Melamphaes* larvae in the eastern Gulf of Mexico, and Nellen (1973) collected 66 larvae in the western Indian Ocean. Thus, the eastern tropical Pacific seems to support a much larger melamphaiid fauna than the other areas.

Identification.—Ebeling (1962) and Ebeling and Weed (1963.)

38. Diretmidae
(1 occurrence, 1 larva)

Only one specimen of this family was taken on the winter cruise at the station between Jamaica and Haiti. Nellen (1973) collected two larvae in the western Indian Ocean, but Ahlstrom (1971, 1972) and Houde et al. (footnote 4) did not report them from their respective areas in the eastern tropical Pacific and eastern Gulf of Mexico.

Identification.—I used the meristic data from Woods and Sonoda (1973).

39. Holocentridae
(3 occurrences, 9 larvae)

These fishes are abundant reef fishes and their larvae have been reported from the area (McKenney 1959), but few were taken in my collections. Houde et al. (footnote 4) collected a few during all seasons in the eastern Gulf of Mexico and Nellen (1973) reported very few from the western Indian Ocean.

Identification.—McKenney (1959) and Woods and Sonoda (1973).

40. Caproidae
(1 occurrence, 1 larva)

One specimen was taken on the winter cruise at the station off Lake Maracaibo, Venezuela. Houde et al. (footnote 4) collected a few larvae in the Gulf of Mexico as did Nellen (1973) in the western Indian Ocean.

Identification.—These larvae have strong preopercular spines and a strong, medial supraoccipital crest and spine (Uchida 1936).

41. Sphyraenidae
(10 occurrences, 17 larvae)

Larvae of *Sphyraena barracuda* were taken only during the summer cruise and were found in several localities, especially in the western Caribbean and Straits of Florida (Table 7). Houde et al. (footnote 4) took a few specimens in the Gulf of Mexico during the summer; Ahlstrom (1971, 1972) did not record this family in the eastern tropical Pacific; Nellen (1973) collected a few sphyraenid larvae in the western Indian Ocean.

Identification.—DeSylva (1963) and Houde (1972).

42. Polynemidae
(1 occurrence, 1 juvenile)

The lone specimen was a 23.1 mm juvenile which resembles the adult. Nellen (1973) collected only three specimens in the western Indian Ocean. Ahlstrom (1971, 1972) collected several specimens in the eastern tropical Pacific Ocean.

43. Serranidae
(30 occurrences, 87 larvae)

Larvae of serranids ranked in the top 15 families during both cruises (Table 7). A number of the larvae were small and were not identified to subfamilial taxa. The occurrences of taxa of serranids are given in Table 18. More larvae identified to lower taxa were taken during the summer cruise, especially those of *Epinephelus* and *Liopropoma*. The larvae of these largely reef-inhabiting fishes were widely distributed throughout the area. Serranid larvae were not major components in the ichthyoplankton of the eastern tropical Pacific (Ahlstrom 1971, 1972). Houde et al. (footnote 4) found serranid larvae to be a major component in the eastern Gulf of Mexico with some kinds of serranids present at all stations sampled, both inshore and offshore. Nellen (1973) found significant numbers in the western Indian Ocean, as this family ranked 10th in numbers collected

Identification.—Kendall (1979).

44. Priacanthidae
(14 occurrences, 22 larvae)

These larvae were widely distributed throughout the area but not abundantly. They were not found in the eastern tropical Pacific (Ahlstrom 1971, 1972). Houde et al. (footnote 4) found these larvae in the eastern Gulf of Mexico, and Nellen (1973) found them in the western Indian Ocean.

Identification.—These larvae resemble the adults in general shape and meristic features.

45. Apogonidae
(5 occurrences, 7 larvae)

Although the Apogonidae are an abundant reef species, few larvae of this family were taken in the Caribbean. In contrast, apogonids were common in the eastern tropical Pacific (Ahlstrom 1971, 1972), and in the eastern Gulf of Mexico it ranked the 15th most frequently observed family (Houde et al. footnote 4). Nellen (1973) ranked these 14th in number in the western Indian Ocean.

Identification.—Body shape resembles adults, and meristic characters are diagnostic.

46. Branchiostegidae
(9 occurrences, 11 larvae)

Representatives of this family were uncommon but widely scattered over the area in both cruises. Houde et al. (footnote 4) collected a few in the eastern Gulf of Mexico.

Identification.—Okiyama (1964).

47. Echeneidae
(3 occurrences, 3 larvae)

These larvae were rare in our collections, and only three were collected in the eastern Gulf of Mexico by Houde et al. (footnote 4). They were not reported in the eastern tropical Pacific by Ahlstrom (1971, 1972), but Nellen (1973) found 20 specimens in the western Indian Ocean. Adults are not uncommon in tropical seas and are frequently noted in association with mammals and other large pelagics.

Identification.—Larvae are heavily pigmented and superficially resemble *Coryphaena* and *Rachycentron*.

48. Carangidae
(27 occurrences, 119 larvae)

Carangid larvae were the 10th most abundant larvae found on cruise 7239 and the ninth most abundant on cruise 7343. *Caranx* was the most abundant taxon but occurred only during summer cruise 7239. *Trachurus* were common on both cruises, and *Decapturus* also occurred on both cruises (Table 18). The larvae are widely scattered over the area but do show seasonal trends. Houde et al. (footnote 4) and Leak (1981) ranked these as sixth most abundant in the eastern Gulf of Mexico, which indicates their preference to shelf waters. Ahlstrom (1971, 1972) collected a number of different species in the eastern tropical Pacific. Nellen (1973) ranked them as sixth most abundant in numbers in the western Indian Ocean.

Identification.—Aprieto (1974) and Aboussouan (1975).

49. Bramidae
(9 occurrences, 9 larvae)

Bramid larvae occurred uncommonly on both cruises (Table 7). No attempt was made to identify them below the family level. Ahlstrom (1971, 1972), Houde et al. (footnote 4), and Nellen (1973) collected few bramids in the eastern tropical Pacific, eastern Gulf of Mexico, and western Indian Ocean, respectively.

Identification.—Mead (1972).

50. Coryphaenidae
(10 occurrences, 11 larvae)

Few larvae of this common tropical genus were caught, but most were taken on the summer cruise (Table 7). Ahlstrom (1971, 1972) found these larvae to be widely distributed throughout the eastern tropical Pacific. Houde et al. (footnote 4) found very few in the eastern Gulf of Mexico, and Nellen (1973) found them in the western Indian Ocean with the exception of the Gulf of Oman and Persian Gulf. These larvae, like those of the family Istiophoridae, are concentrated near the surface, which accounts in part for their low abundance. Of the larvae taken on summer cruise 7239, one was *C. equiselis* and eight were *C. hippurus*. The two larvae taken during cruise 7343 were *C. hippurus*.

Identification.—Gibbs and Collette (1959).

51. Lutjanidae
(9 occurrences, 12 larvae)

Larvae of this important reef family were not common in our collections (Table 18) and were about equally distributed on both cruises. Ahlstrom (1971, 1972) did not report them in his eastern tropical Pacific collections, but Houde et al. (footnote 4) ranked lutjanids as the 19th most abundant larvae in the eastern Gulf of Mexico, and Nellen (1973) reported very few in the western Indian Ocean.

Identification.—*Rhomboplites* were identified according to Laroche (1977); *Lutjanus* according to Richards and Saksena (1980) and Collins et al. (1980); and *Symphosanodon* according to Sumida.[7]

52. Acanthuridae
(18 occurrences, 29 larvae)

Larvae of this abundant reef family were widely distributed throughout the area but were not abundant (Table 7). Ahlstrom (1971, 1972) did not record them from the eastern tropical Pacific, and Houde et al. (footnote 4) found very few in the eastern Gulf of Mexico and western Indian Ocean. No seasonality was apparent in the distribution of these larvae.

Identification.—All acanthurids in the area are in the genus *Acanthurus*, but no attempt was made to identify the material to species.

53. Sciaenidae
(1 occurrence, 2 larvae)

These two larvae were found only at the Gulf of Cariaco station on the Venezuelan coast during winter cruise 7343. Sciaenids are abundant along the northern coast of South America, but no other larvae were found because of the coastal and estuarine habits of these species. Ahlstrom (1971, 1972) collected sciaenids in this nearshore transect in the eastern tropical Pacific; Houde et al. (footnote 4) obtained many in the eastern Gulf of Mexico; Nellen (1973) also collected these larvae in the coastal areas in the western Indian Ocean.

Identification.—No attempt was made to identify these specimens to a lower taxon.

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[7]B. Sumida, Southwest Fisheries Center, La Jolla Laboratory, National Marine Fisheries Service, NOAA, La Jolla, CA 92037, pers. commun. May 1975.

54. Epigonidae
(35 occurrences, 58 larvae)

Larvae of this family were abundant and widely distributed during both cruises (Table 7). Ahlstrom (1971, 1972), Nellen (1973) and Houde et al. (footnote 4) did not list this family.

Identification.—G.D. Johnson, South Carolina Division of Wildlife and Marine Resources, Charleston, S.C.

55. Chaetodontidae
(10 occurrences, 13 larvae)

Larvae of this family were widely distributed during both cruises. The larvae collected on cruise 7343 are all possibly *Centropyge argi* based on meristics, and one of two specimens from the easternmost station on cruise 7239 is a *Chaetodon*, also based on meristics. The remaining specimens could not be identified with certainty below the family level. Houde et al. (footnote 4) found only a few larvae of this family in the eastern Gulf of Mexico; Ahlstrom (1971, 1972) and Nellen (1973) did not report its occurrence in either the eastern tropical Pacific Ocean or western Indian Ocean, respectively.

Identification.—Larvae of chaetodontids closely resemble adults in body outline and have the greatly expanded head bones of the *Tholichthys* stage. Meristic characters are useful in separating some types at the generic level.

56. Pomacentridae
(9 occurrences, 12 larvae)

Larvae of this family were widely distributed during the summer cruise but were found at only two locations during the winter cruise (Table 7). Houde et al. (footnote 4) found these larvae to be quite abundant but also found fewer larvae on winter cruises. Ahlstrom (1971, 1972) did not record this family from the eastern tropical Pacific, although Nellen (1973) collected a few larvae in the western Indian Ocean. Eggs of this family are demersal but its larvae are pelagic. The adults are an important component of reefs, and it is surprising that so few larvae were taken.

Identification.—Larvae were not identified below the family level.

57. Labridae
(53 occurrences, 233 larvae)

Larvae of this family ranked in the top 10 in occurrence and number on the summer cruise and in the top 15 in both categories on the winter cruise. The larvae are widespread throughout the area (Fig. 10). Houde et al. (footnote 4) ranked them the 10th most abundant larva in the eastern Gulf of Mexico, and Ahlstrom (1971, 1972) found them to be common in the eastern tropical Pacific. Nellen (1973) ranked them the 15th most abundant in numbers in the western Indian Ocean. These fish are major components of reef communities, and their larvae are major components of the pelagic ichthyoplankton. I had some success in identifying these larvae below the familial level and these results are given in Table 15. Although six types were not identified to a known taxon, this at least gives some indication of the number of species and their relative abundances. The distribution of the most abundant species, tentatively identifed as *Xyrichthys* sp. (type A), is shown in Figure 11. This species was very abundant during the summer cruise, especially in the Yucatan Basin, Yucatan Channel, and north of Cuba. During the winter cruise, it was still widely distributed, though less abundant. All 19 labrid species known from the tropical western Atlantic are widely distributed throughout this area.

Identification.—Several distinct types of larvae of this family were discerned using external characters. Examples of the larval types were cleared and stained to determine vertebral and fin ray counts. These counts were compared with meristic data of adults garnered from the literature. These meristic values are presented in Table 16. Using the various combinations of precaudal and caudal vertebrae with dorsal and anal fin counts, it was possible to make specific identification of *Halichoeres maculipinna* and *Thalassoma bifasciatum* and assign two types to the genus *Xyrichthys*. Overlap of meristic characters prevented identification of the other types. The external characters used were 1) shape of the eye, since round normal eyes were found as well as narrow eyes with ventral choroid tissue similar to many myctophiform larval eyes, and 2) unique pigment distribution. Interestingly, one type with narrow eyes, 13 unusual pigment structures resembling photophores (concentrated melanophores in a small circular organlike structure) above the anal fin, a melanophore beneath the pectoral base, and a pigmented rectum had meristic characters that would refer it to either the labrid *Doratonotus megalepis* or the family Scaridae (see Table 16). Because this type of larva is so abundant, I tentatively consider it to be a scarid rather than *D. megalepis*. The other labrid larvae with narrow eyes divide into two types. One type has a pigmented rectum, a streak of black pigment on the dorsal edge of the caudal peduncle, and eyes less narrow than the others although definitely not round. This is my type J. The other narrow-eye type lacks pigment entirely, except for the eye. This type further subdivides into a slender-body type (*Xyrichthys* type A) and a deep-body type (*Xyrichthys* type B).

The remaining types have normal eyes and are characterized as follows: *T. bifasciatum* have melanophores only between the first five dorsal spines and a few erythrophores on the snout and over the gut. *Halichoeres maculipinna* have melanophores on the last three dorsal and anal rays and erythrophores on the breast and along the dorsal and ventral midline. Type C have melanophores only at the anterior end of the dorsal fin and posterior end of the anal fin. This type has 20 dorsal fin elements, 16 anal fin elements, and 9 plus 16 vertebrae. The remaining types have melanophores on the body. *Bodianus* sp. have dots of melanophores along the base of the dorsal fin and a few above the anal fin. Erythrophores are distinct on the chin and pectoral fin base. Type K have melanophores at the base of the last anal ray and at the base of the first dorsal soft ray. Type L have melanophores grouped as dots below the dorsal fin base and above the anal fin base and a concentration of melanophores at the base of the last dorsal and anal fin ray. Neither types J, K, or L were cleared and stained because there were so few specimens.

58. Scaridae
(75 occurrences, 554 larvae)

Larvae of this family were widespread and abundant (Fig. 12), ranking among the top 10 families in occurrences and numbers. Nellen (1973) found few scarids in the western Indian Ocean; Ahlstrom (1971, 1972) did not list them for the eastern tropical Pacific; and Houde et al. (footnote 4) found them to be common in the eastern Gulf of Mexico.

Identification.—Please refer to the identification remarks for the Labridae preceding this family account.

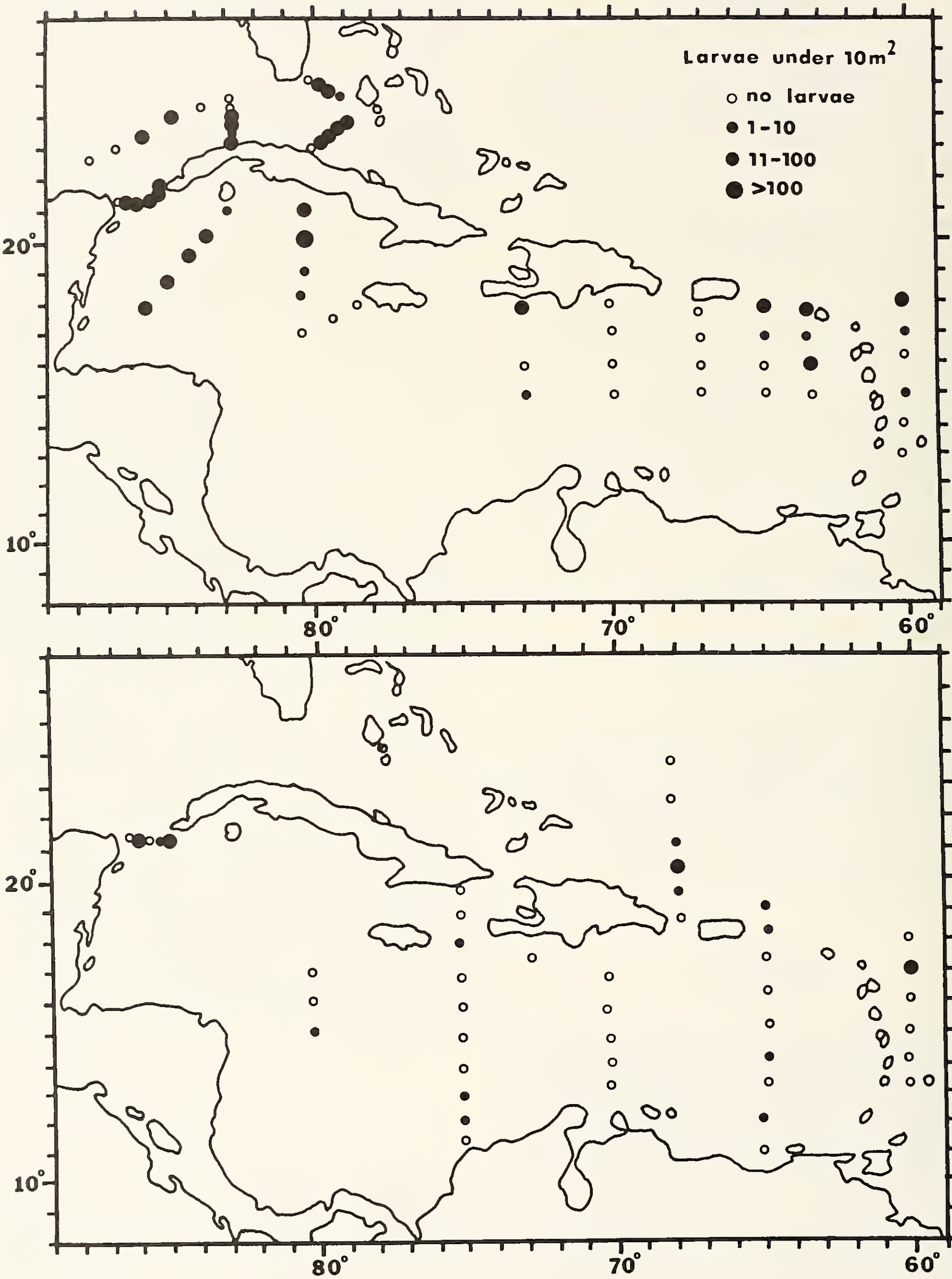

Figure 10.—Distribution and number per station of labrid larvae during *Oregon II* cruises 7239 (upper) and 7343 (lower).

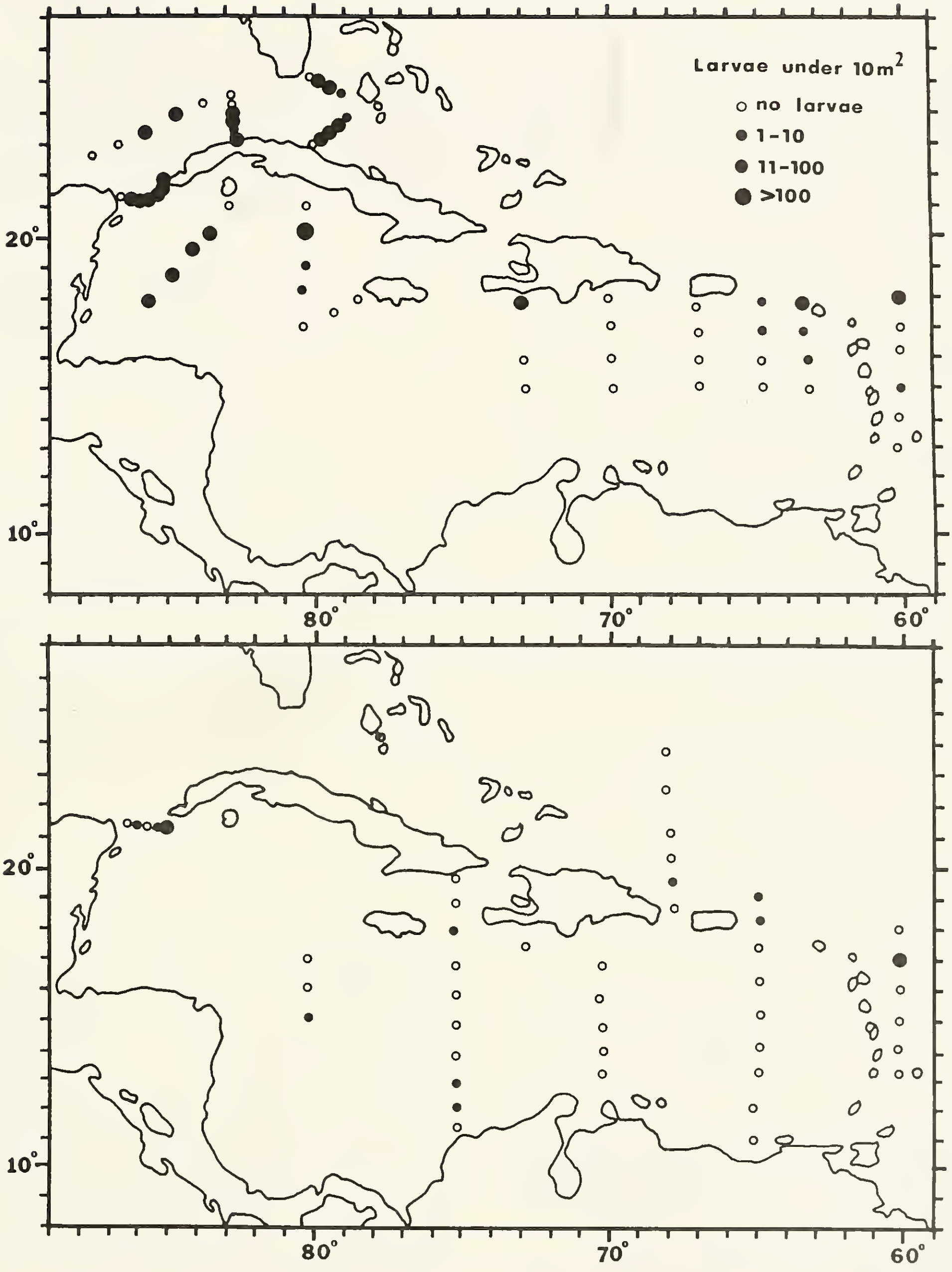

Figure 11.—Distribution and number per station of the labrid larvae *Xyrichthys* sp. (type A) during *Oregon II* cruises 7239 (upper) and 7343 (lower).

59. Mullidae
(2 occurrences, 5 larvae)

Few goatfish larvae were collected, all occurring at two localities during the winter cruise. Houde et al. (footnote 4) collected them commonly in all seasons in the eastern Gulf of Mexico, but Nellen (1973) collected very few in the western Indian Ocean.

Identification.—Caldwell (1962).

60. Chiasmodontidae
(10 occurrences, 13 larvae)

These rare larvae were taken more often in the summer cruise than the winter cruise (Table 7). Larvae of this family were encountered in the eastern tropical Pacific (Ahlstrom 1971, 1972) and western Indian Ocean (Nellen 1973).

Identification.—Larvae of this family are very distinctive for their long spines (modified scales?) on the trunk and very distinct black pigment bands.

61. Blenniidae
(1 occurrence, 1 larva)

Despite being very abundant on reefs, only one specimen was taken during the winter cruise. In the eastern Gulf of Mexico, Houde et al. (footnote 4) ranked it the 18th most common family taken principally in the winter-spring period. They were uncommon in the eastern tropical Pacific (Ahlstrom 1972) and in the western Indian Ocean (Nellen 1973).

Identification.—I followed Mito (1954).

62. Ophidiidae
(5 occurrences, 7 larvae)

Few larvae of this family were collected, but they are very abundant in the eastern Gulf of Mexico where they were the eighth most frequently observed family in the study by Houde et al. (footnote 4). However, they were not common in the eastern tropical Pacific (Ahlstrom 1971, 1972) nor in the western Indian Ocean (Nellen 1973).

Identification.—They are very elongate larvae which resemble the adults. Consult Smith and Richardson (1979) for references.

63. Carapidae
(3 occurrences, 5 larvae)

Two taxa were collected in the area: *Echiodon* sp. was collected on both cruises, and an unidentified taxon was collected on the winter cruise. Adults are associated with holothurians. Few specimens of this family were taken in the eastern tropical Pacific (Ahlstrom 1971, 1972) and western Indian Ocean (Nellen 1973). Houde et al. (footnote 4) collected common larvae of *Echiodon* sp. and few *Carapus bermudiensis*.

Identification.—Olney and Markel (1979) identified this material and commented upon the unidentified carapids which could not be assigned to *Echiodon*, *Carapus*, or *Snyderidia*, the three taxa known in the western Atlantic.

64. Callionymidae
(21 occurrences, 29 larvae)

These larvae were much more abundant during the summer cruise (Table 7) and were widely distributed throughout the area. Houde et al. (footnote 4) found these larvae in all seasons, but most commonly in the summer in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected few, but most during EASTROPAC I in the eastern tropical Pacific. This family ranked 12th in numbers collected in the western Indian Ocean (Nellen 1973).

Identification.—Larvae strongly resemble adults in the size range collected ($>$2.6 mm SL). In fact, my larvae were all $<$ 6.0 mm SL. Two genera occur which can be separated with fin ray counts, according to Davis (1966). Counts could not be made on many of the specimens (clearing and staining was not carried out), but those counted appeared to be *Callionymus bairdi*.

65. Scombridae
(57 occurrences, 152 larvae)

Larvae of this family ranked seventh in percentage of occurrence and abundance in the summer cruise and 14th in percentage of occurrence during the winter cruise (but not in the top 15 in abundance). Scombrids were common in the eastern Gulf of Mexico (Houde et al. footnote 4); markedly less abundant during EASTROPAC II, as compared with similar coverage on EASTROPAC I in the eastern tropical Pacific (Ahlstrom 1971, 1972); and uncommon in the western Indian Ocean (Nellen 1973). In another study of the western Indian Ocean (oceanic waters north of Madagascar), scombrid larvae were quite abundant (Conand and Richards 1982). Larvae of this family were identified to lower taxa, and these taxa are discussed below. A comparison of the occurrences and numbers of larvae for each taxa are given in Table 17.

Unidentified Scombrids.—Twelve larvae could not be identified below the family level (Table 17).

***Auxis* spp.**—Larvae of this taxa were widely distributed but few in number (Table 17). Houde et al. (footnote 4) collected *Auxis* larvae in all seasons, but 77.5% were captured in the summer in the eastern Gulf of Mexico. These larvae were also among the 20 most abundant identified species on six cruises, with mean abundances ranging from 0.6 to 5.8 under 10 m^2 of sea surface. Richards and Potthoff (1980) found *Auxis* to be widely distributed in the Gulf of Mexico in May. Nellen (1973) reported *Auxis* to be most abundant in collections made along the east African coast in the Gulf of Aden and south of the Horn of Africa in the western Indian Ocean. Richards and Simmons (1971) pointed out that *Auxis* larvae were the most abundant scombrid species in the Gulf of Guinea of the eastern tropical Atlantic. Klawe (1963) reported *Auxis* larvae to be abundant in the eastern tropical Pacific, and Ahlstrom (1971, 1972) also found them to be the most abundant larvae in the same areas during the EASTROPAC cruises. This taxon is the most widely distributed and abundant scombrid in tropical oceans.

Identification.—Matsumoto (1959).

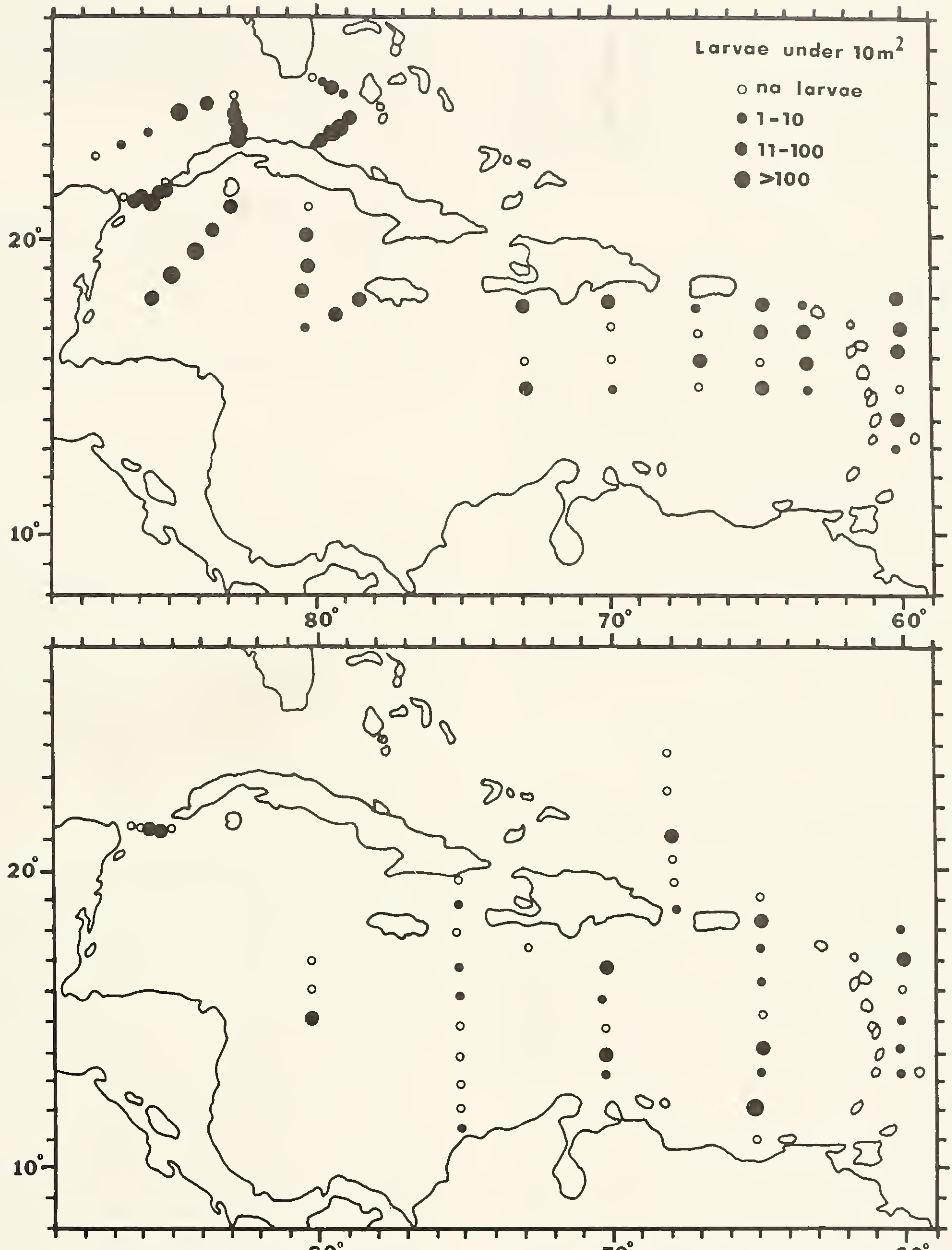

Figure 12.—Distribution and number per station of scarid larvae during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Euthynnus alletteratus.—Very few *E. alletteratus* larvae were collected (Table 17). Richards and Simmons (1971) reported them to be abundant in the Gulf of Guinea, and Houde et al. (footnote 4) found them to be the most common scombrid in the eastern Gulf of Mexico. They were among the 20 most abundant identified species on six cruises, with mean abundances ranging from 0.7 to 6.5 under 10 m^2 of sea surface. Richards and Potthoff (1980b) reported them to be widely distributed in May in the Gulf of Mexico. This species is confined to the Atlantic.

Identification.—Matsumoto (1959).

Katsuwonus pelamis.—These larvae were much more widely distributed and abundant during summer cruise 7239 than the winter cruise (Table 17). Few larvae of this species were taken in the eastern Gulf of Mexico by Houde et al. (footnote 4), but Richards and Potthoff (1980) found large numbers in May 1978 in the Gulf of Mexico with concentrations in the eastern Gulf. Ahlstrom (1971) collected a few larvae in the eastern tropical Pacific only on EASTROPAC I. Nellen (1973) collected this species in scattered offshore locations in the western Indian Ocean. Conand and Richards (1982) found these larvae to be the most abundant of all scombrids in the tropical western Indian Ocean north of Madagascar. This is a widely distributed and abundant species in the tropical oceans of the world.

Identification.—Matsumoto (1958).

Thunnus spp.—These larvae were the most abundant scombrids taken on the summer cruise (Table 17). I presume that most of these are probably *T. atlanticus*, but their size was too small for confirmation. Richards and Potthoff (1980) had this same problem in the Gulf of Mexico.

Identification.—Richards and Potthoff (1974).

Thunnus atlanticus.—Larvae of this western Atlantic tuna were widely distributed in the area (Table 17). Houde et al. (footnote 4) and Richards and Potthoff (1980) found them to be abundant in the Gulf of Mexico.

Identification.—Richards and Potthoff (1974).

Thunnus alalunga.—The occurrence (Table 17) of this single specimen (9.1 mm SL) confirms that this species spawns in the winter months. Nishikawa et al. (1978) collected albacore larvae off the northern coast of South America in the January-March period, but they made no collections in the April-September period. Wise and Davis (1973) showed the distribution of adults to be year-round in the Sargasso Sea area immediately adjacent to the larval collection site.

Identification.—Richards and Potthoff (1974).

Scomber japonicus.—One specimen was taken north of the Yucatan Channel in the summer cruise (Table 17). Houde et al. (footnote 4) found very few larvae in the eastern Gulf of Mexico; Ahlstrom (1971, 1972) collected few in the eastern tropical Pacific; Nellen (1973) did not list the genus.

Identification.—Kramer (1960).

Acanthocybium solandri.—Two specimens were taken on the summer cruise (Table 17). These larvae are widespread but few in number. Houde et al. (footnote 4) reported two from the eastern Gulf of Mexico; Ahlstrom (1971, 1972) collected four larvae in the eastern tropical Pacific; and Nellen (1973) collected one larvae in the western Indian Ocean.

Identification.—Matsumoto (1967).

Sarda sarda.—Two larvae were collected in the rich waters off the coast of Venezuela (Table 17). Neither Houde et al. (footnote 4) nor Ahlstrom (1971, 1972) reported this taxon from their areas; Nellen (1973) collected three specimens in the western Indian Ocean.

Identification.—I followed Pinkas (1961), although his description is of the closely related *S. chiliensis* which shares the same generic characters. A thorough description is needed of the complete size range of larval *S. sarda*.

66. Gempylidae (37 occurrences, 59 larvae)

Five species of this family were taken throughout the area during both seasons but more larvae were taken during the winter season (Table 17). *Prometichthys prometheus* were taken only on the winter cruise (Table 17). *Gempylus serpens* was taken on both cruises and was the most abundant gempylid (Table 17). *Scombrolabrax heterolepis* was widely distributed and was the second most abundant (Table 17). *Nesiarchus nasutus* were most frequently taken on the summer cruise (Table 17). A single *Thyrsites atun* larva was taken on the winter cruise (Table 17). Houde et al. (footnote 4) identified only four larvae, although 79 were taken in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) found larvae of *G. serpens* and *Nealotus tripes* to be widely distributed in the eastern tropical Pacific. Nellen (1973) collected nearly 200 larvae in the western Indian Ocean but did not identify them. Potthoff et al. (1980) described the worldwide distribution of *S. heterolepis* larvae and included my specimens in their account.

Identification.—Research on larval identification is needed on this group. Potthoff et al. (1980) gave a thorough description of *S. heterolepis*, and Voss (1954) described *Gempylis serpens* (= *Gempylus* B). The remaining species were identified using pigmentation and meristic characters. *Nesiarchus nasutus* larvae have heavily pigmented gular membranes and a distinctly pigmented streak on the nose. *Thyrsites atun* larvae have heavily pigmented first dorsal fins. *Prometichthys prometheus* larvae have the gular area and the first dorsal fin pigmented. These pigmentation characters, used in conjunction with the first dorsal fin ray counts, aid in identification. However, accurate meristics are not available for all species, thus my identifications are tentative.

67. Trichiuridae (14 occurrences, 18 larvae)

These larvae were mostly *Diplospinus multistriatus*, which were taken in equal numbers on both cruises (Table 17). One specimen each of *Benthodesmus tenuis* and *B. elongatus* (Table 17) were also taken. Houde et al. (footnote 4) collected 10 larvae of *D. multistriatus*, and Ahlstrom (1971, 1972) found them to be distributed in two widely separated groups and few in number in the eastern tropical Pacific. Nellen (1973) reported the occurrence of *Trichiurus* in the western Indian Ocean, which was also taken by Ahlstrom on the EASTROPAC cruises.

Identification.—*Diplospinus multistriatus* larvae were described by Voss (1954) and closely resemble those of *Gempylus serpens*. Consequently she identified them as *Gempylus* Type A, as pointed out by Ahlstrom (1971). The *Benthodesmus* larvae were tentatively identified based on meristics.

68. Istiophoridae
(3 occurrences, 4 larvae)

During the summer cruise, two larvae of *Istiophorus platypterus* were taken south of Key West, Fla; and one *Makaira nigricans* was taken off the north coast of Cuba. During the winter cruise, one specimen of *Tetrapturus pfluegeri* was taken southeast of Jamaica. Houde et al. (footnote 4) took only two istiophorids in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) took none in the eastern tropical Pacific, and Nellen (1973) listed none in the western Indian Ocean. The main reason for so few reports is that these larvae are concentrated in the surface layers, as evidenced by the considerable numbers caught in neuston nets. However, their absence still reflects a very low abundance per standard area sampled.

Identification.—Richards (1974).

69. Nomeidae
(22 occurrences, 94 larvae)

Nomeid larvae numbers are given in Table 18. Most of the larvae were *Cubiceps pauciradiatus* which were widely distributed in the eastern Caribbean Sea. Houde et al. (footnote 4) found *C. pauciradiatus* to be the most abundant nomeid in the eastern Gulf of Mexico. Nomeids were the eighth most abundant family in the western Indian Ocean, but no *Cubiceps* were listed (Nellen 1973). Larvae of *Cubiceps* were abundant in the eastern tropical Pacific (Ahlstrom 1971, 1972). The widespread eastern Pacific distribution of this species is shown by Ahlstrom et al. (1976).

Identification.—Ahlstrom et al. (1976).

70. Gobiidae
(81 occurrences, 498 larvae)

Larvae of this family ranked fourth in abundance and occurrence on both cruises (Table 7) and were widely distributed throughout the area (Fig. 13). Houde et al. (footnote 4) found gobies to be the second most frequently observed family in number of larvae in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected large numbers of gobies in the eastern tropical Pacific, and Nellen (1973) ranked them the fifth most abundant family in the western Indian Ocean. It is interesting to note that these basically inshore fishes form such an important complement of the oceanic ichthyoplankton.

Identification.—I attempted to determine the number of species present on the winter cruise. After carefully examining 129 specimens, I found that the specimens represented 17 different types; but I was unable to assign them to any taxa because the Gobiidae is such a speciose family. Because of their importance in the ichthyofauna, a detailed systematic study to identify the species would be an important research project.

71. Scorpaenidae
(18 occurrences, 29 larvae)

Larvae of this family were widespread throughout the area and slightly more abundant during the summer cruise (Table 7). In the eastern Gulf of Mexico, Houde et al. (footnote 4) ranked them the 17th most abundant family; Ahlstrom (1971, 1972) collected some in the eastern tropical Pacific; and Nellen (1973) collected some in the western Indian Ocean.

Identification.—No attempt was made to identify the larvae below the family level. A few could be provisionally assigned to genus, but the larvae were too small and the series not extensive enough to confirm any identification. The guide by Moser et al. (1977) on eastern Pacific species is very useful.

72. Triglidae
(2 occurrences, 2 larvae)

This family was represented only on the winter cruise. Houde et al. (footnote 4) encountered this family on every cruise in the eastern Gulf of Mexico; Ahlstrom (1971) collected only four larvae on EASTROPAC I; and Nellen (1973) collected only a few in the western Indian Ocean.

Identification.—These larvae resemble scorpaenid larvae except for very concave lateral profiles between the snout and eyes.

73. Dactylopteridae
(4 occurrences, 4 larvae)

Few larvae were taken because, like istiophorids, the larvae of the only Atlantic species, *Dactylopterus volitans*, live at the surface. Houde et al. (footnote 4) collected one larva in the eastern Gulf of Mexico; neither Ahlstrom (1971, 1972) nor Nellen (1973) reported this family in their collections.

Identification.—Larvae resemble billfish without snouts. They are very darkly pigmented and have strong nuchal and preopercular spines.

74. Bothidae
(81 occurrences, 258 larvae)

Larvae of this family ranked third in occurrence and sixth in abundance during the summer cruise, and fifth and sixth, respectively, on the winter cruise (Table 7). Most of the larvae were identified to lower taxa and these results are given in Table 19. This was the third most frequently observed family in the eastern Gulf of Mexico (Houde et al. footnote 4); but, though common, they were not especially abundant in the eastern tropical Pacific (Ahlstrom 1971, 1972) or in the western Indian Ocean (Nellen 1973).

***Citharichthys* spp.**—Eight larvae from six stations were taken in the Caribbean Sea (Table 19). Houde et al. (footnote 4) collected four species in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected few larvae of the *Citharichthys-Etropus* complex in the eastern tropical Pacific.

Identification.—Richardson and Joseph (1973).

***Syacium* spp.**—This was the second most abundant and widespread bothid (Table 19). Houde et al. (footnote 4) ranked this the most abundant bothid taxa in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected some *Syacium* larvae in the eastern tropical Pacific.

Identification.—Futch and Hoff (1971).

Engyrophrys senta.—A few larvae of this species were taken in scattered locations (Table 19). A few *E. senta* larvae were taken in the eastern Gulf of Mexico (Houde et al. footnote 4), and the

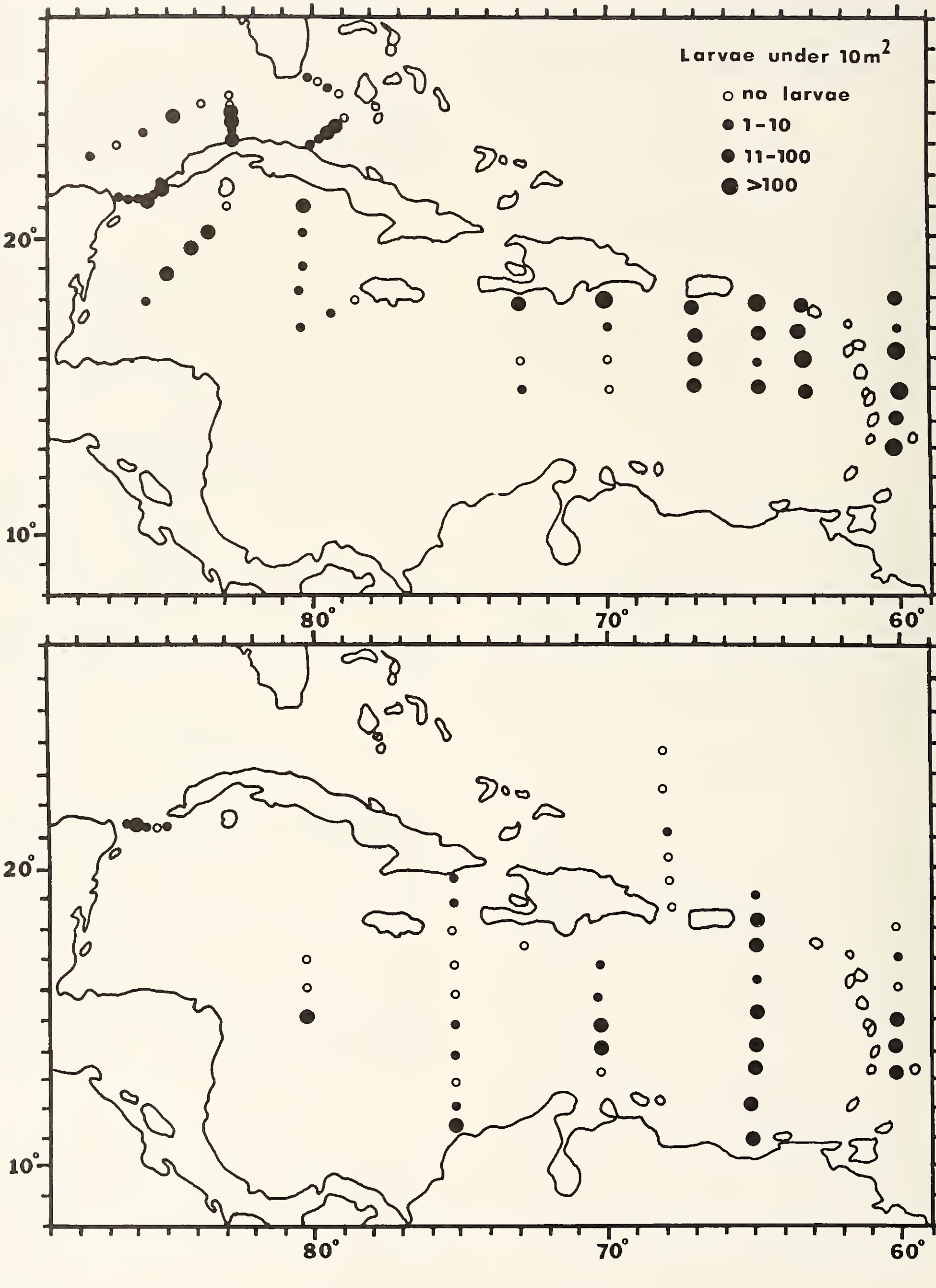

Figure 13.—Distribution and number per station of gobiid larvae during *Oregon II* cruises 7239 (upper) and 7343 (lower).

genus was represented by a few specimens in the eastern tropical Pacific (Ahlstrom 1971, 1972).

Identification.—I followed Hensley (1977) and Evseenko (1977), both of whom described these larvae in 1977, unknown to each other.

Trichopsetta ventralis.—One specimen was taken during the winter cruise (Table 19). Houde et al. (footnote 4) collected two larvae in the eastern Gulf of Mexico.

Identification.—I followed Futch (1977).

Bothus.—Three species of *Bothus* were collected and all but two specimens are *B. ocellatus* (Table 19, Fig. 14). *Bothus robinsi* occurs abundantly in the Gulf of Mexico and Florida Straits and its larvae are indistinguishable from, and closely related to, *B. ocellatus* (Houde et al. footnote 4). *Bothus ocellatus*, which in part may be *B. robinsi*, were the most abundant bothid in the collections studied. *Bothus* species were taken in small numbers in the eastern tropical Pacific (Ahlstrom 1971, 1972) and western Indian Ocean (Nellen 1973).

Identification.—I followed Kyle (1913). Larval differences between *B. robinsi* and *B. ocellatus* need to be studied. *Bothus lunatus* and *B. maculiferus* were identified using meristics (Gutherz 1967).

75. Soleidae
(1 occurrence, 3 larvae)

Three unidentified specimens of this family were taken at a single station in the northeastern Caribbean Sea during the summer cruise. Houde et al. (footnote 4) collected few soleid larvae in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) did not record this family in the eastern tropical Pacific. Nellen (1973) collected most of his soleids in the northern Persian Gulf and few elsewhere in the western Indian Ocean.

Identification.—I followed Houde et al. (1970) for general features of this family.

76. Cynoglossidae
(6 occurrences, 8 larvae)

A few specimens of this family were collected on each cruise at widely scattered locations (Table 7). Houde et al. (footnote 4) collected a number of *Symphurus* in the spring and summer in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected *Symphurus* larvae along a broad coastal band in the eastern tropical Pacific. Nellen (1973) collected some cynoglossids throughout the western Indian Ocean, but most in the northern Persian Gulf.

Identification.—Kyle (1913).

77. Gobiesocidae
(7 occurrences, 11 larvae)

These larvae were collected on the summer cruise from scattered locations throughout the area. Houde et al. (footnote 4) collected a few larvae during fall, winter, and spring cruises in the eastern Gulf of Mexico. Neither Ahlstrom (1971, 1972) nor Nellen (1973) listed these larvae from their respective areas.

Identification.—Larvae in the size range of my specimens resemble adults.

78. Balistidae
(8 occurrences, 11 larvae)

All but one balistid larva were taken on the summer cruise (Table 7), and the specimens were from widely scattered stations. Houde et al. (footnote 4) ranked larvae of this family the 13th most common in the eastern Gulf of Mexico. Larvae of this family were not reported from the eastern tropical Pacific by Ahlstrom (1971, 1972). Nellen (1973) collected some balistids, most from the Red Sea, in the western Indian Ocean.

Identification.—Aboussouan (1966) and Berry and Vogele (1961).

79. Ostracidae
(1 occurrence, 1 larva)

One 11 mm specimen was collected in the southwestern Caribbean Sea on the winter cruise. Houde et al. (footnote 4) collected three larvae in the eastern Gulf of Mexico, but neither Ahlstrom (1972) nor Nellen (1973) listed the family from the eastern tropical Pacific or western Indian Ocean.

Identification.—Larvae of the size captured resemble adults.

80. Tetraodontidae
(14 occurrences, 25 larvae)

Larvae of this family were found throughout the area. Based on meristics, two specimens were identified as *Canthigaster rostratus* and one specimen as *Sphoeroides* sp. Houde et al. (footnote 4) found puffer larvae to be common in the eastern Gulf of Mexico, but Ahlstrom (1972) found only one specimen in the eastern tropical Pacific Ocean. Nellen (1973) found few in the western Indian Ocean.

Identification.—Identification of small specimens is very difficult. This includes placing them in the proper tetraodontiform family or separating them from lophiiform larvae. I followed the characters given by Leis (1978) plus meristics of the adults found in the region.

81. Diodontidae
(10 occurrences, 17 larvae)

These larvae were collected only on the summer cruise from widely scattered locations. Houde et al. (footnote 4) collected only two larvae in the eastern Gulf of Mexico, and Nellen (1973) collected a few in the western Indian Ocean. Ahlstrom (1971, 1972) did not record them from the eastern tropical Pacific.

Identification.—Please refer to the section under the Tetraodontidae.

82. Lophiiformes
(24 occurrences, 33 larvae)

Larvae of this order were found throughout the area and almost equally divided between the two cruises (Table 7). One larva each was identified from the families Lophiidae, Ogcocephalidae, Ceratiidae, Linophrynidae, and two from the Gigantactidae. The remaining larvae were not identified to lower taxa because of their small size. Houde et al. (footnote 4) did not identify any larvae from this order in the eastern Gulf of Mexico. Ahlstrom (1971, 1972) collected several hundred larvae, but only enumerated and discussed his EASTROPAC II larvae. He found representatives of 10 families and discussed their distribution.

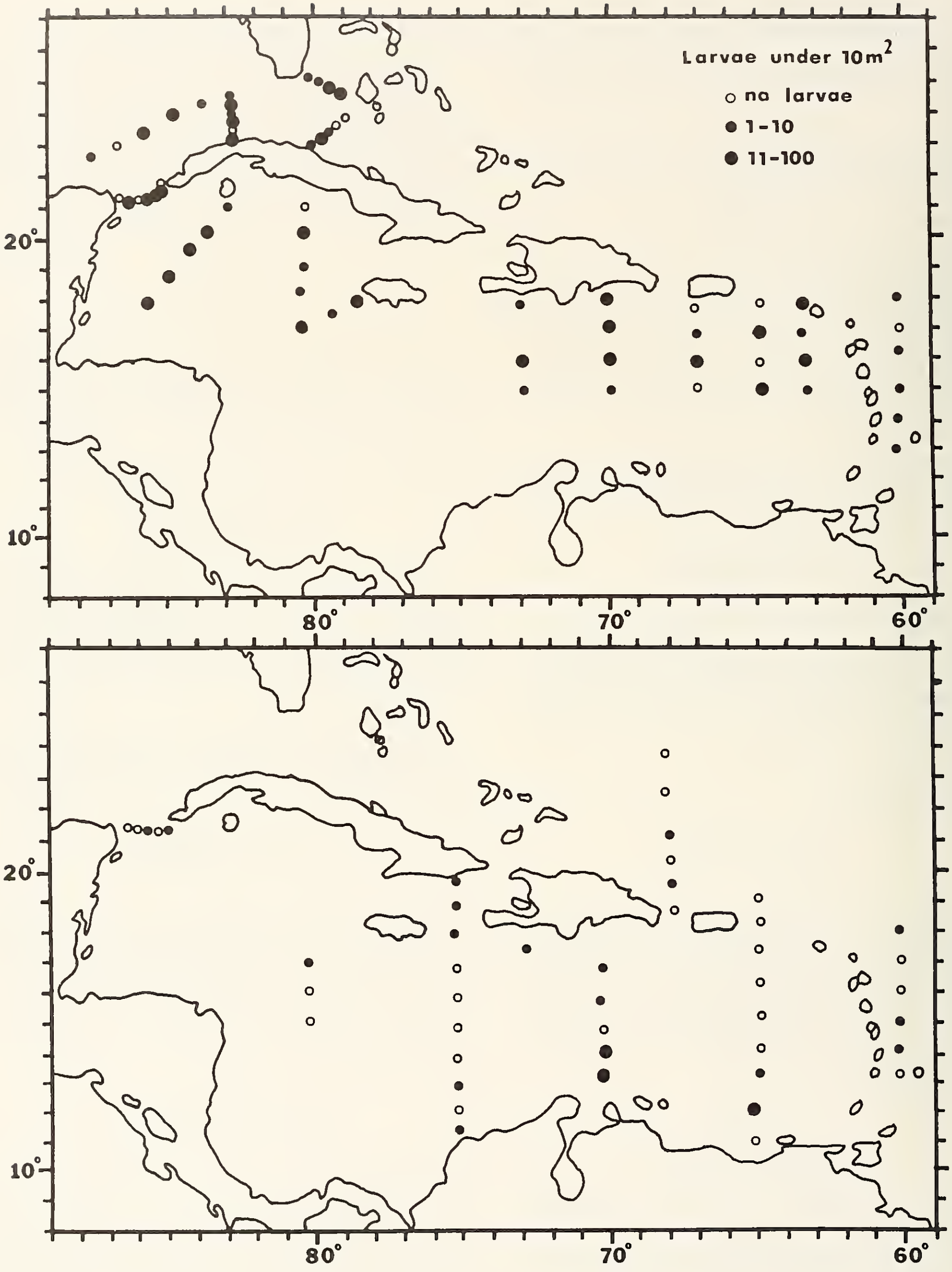

Figure 14.—Distribution and number per station of the bothid larvae *Bothus ocellatus* during *Oregon II* cruises 7239 (upper) and 7343 (lower).

Nellen (1973) also found representatives of 10 families in the western Indian Ocean, eight of which were common to Ahlstrom's families.

Identification.—Bertelsen (1951).

DISCUSSION

The results presented in this paper represent the first major study of the ichthyoplankton of the Caribbean Sea. Very few studies have been carried out previously, and none have comprehensively examined all the fish larvae. Further work is needed, especially to measure the magnitude of reef fish larvae and to solve the complex recruitment patterns of reef fish (Richards 1982).

Reef fish are the major commercial fish of the region and their larvae were especially abundant. Also abundant were the larvae of mid-depth fishes (myctophids, gonostomatids, and paralepidids). Though these fishes are not commercially important, they would appear to be an important source of prey for predators because of their abundance. The area lacks the large concentrations of clupeid resources, as seen in the Gulf of Mexico, due to lack of a large shelf area. Shelf species were found only along the northern coast of South America. This lack of a large shelf area greatly limits the potential of this area as a major source of commercial fish. Oceanic pelagic fishes, like the scombrids, were present in moderate abundance. These fish are highly migratory. They do not occur in major numbers as they do in the eastern Atlantic (Richards 1969).

Oceanographic conditions are very stable in the Caribbean. Furthermore, the area has no major rivers emptying directly into the sea, nor a major cold current to transport nutrients. This stability precludes great abundances occurring there. The largest concentrations of larvae were seen off the northern coast of South America in an area of upwelling. The rest of the area is uniformly warm throughout the year, resulting in rather uniform distribution and abundance of larvae. To carry out a more detailed quantitative comparison is not possible within the scope of this paper. Many of the species collected were not abundant enough to allow for more meaningful comparisons. The station pattern was not dense enough to measure the statistical validity of stations with zero catches of any one species. Further studies using denser grids of station patterns will allow for more conclusive abundances and provide for estimates of spawning stock size.

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Table 1.—Number of bongo hauls taken per depth interval on the two vessel patterns occupied in the Caribbean Sea on MARMAP OTP[1] I (July-August 1972) and II (February-March 1973) (*Oregon II* cruises 7239 and 7343).

Mean depth of haul (m)	No. hauls/depth interval		
	Cruise 7239	Cruise 7343	Both cruises
0-50	1	0	1
50.1-60	0	0	0
60.1-70	0	0	0
70.1-80	0	0	0
80.1-90	0	0	0
90.1-100	0	0	0
100.1-110	0	1	1
110.1-120	0	0	0
120.1-130	0	0	0
130.1-140	0	0	0
140.1-150	1	0	1
150.1-160	0	0	0
160.1-170	2	1	3
170.1-180	2	1	3
180.1-190	9	1	10
190.1-200	7	8	15
200.1-210	3	6	9
210.1-220	2	10	12
220.1-230	18	10	28
230.1-240	5	4	9
240.1-250	4	3	7
250.1-260	6	0	6
260.1-300	3	0	3
300.1-325	1	0	1
Total	64	45	109

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 2.—Number of bongo hauls made per hour of day on the two vessel patterns occupied in the Caribbean Sea on MARMAP OTP[1] I and II (*Oregon II* cruises 7239 and 7343).

Hour of day	No. hauls/hour of day		
	Cruise 7239	Cruise 7343	Both cruises
0001-0100	4	1	5
0101-0200	0	4	4
0201-0300	2	1	3
0301-0400	3	2	5
0401-0500	6	0	6
0501-0600	0	1	1
0601-0700	2	2	4
0701-0800	0	2	2
0801-0900	2	3	5
0901-1000	0	6	6
1001-1100	8	1	9
1101-1200	3	1	4
1201-1300	2	0	2
1301-1400	3	2	5
1401-1500	3	3	6
1501-1600	1	2	3
1601-1700	5	2	7
1701-1800	3	2	5
1801-1900	3	1	4
1901-2000	3	2	5
2001-2100	2	3	5
2101-2200	4	0	4
2201-2300	4	3	7
2301-2400	1	1	2
Total night	28	18	46
Total day	28	24	52
Total sunrise-sunset	8	3	11
Total	64	45	109

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 3.—Comparison of occurrences (stations with positive hauls) and catches of fish larvae in day hauls, night hauls, and hauls taken within 1 h of sunrise or sunset, for selected families collected during MARMAP OTP I (*Oregon II* cruise 7239) and MARMAP OTP II (*Oregon II* cruise 7343).

	Day hauls				Night hauls				Hauls within 1 h of sunrise or sunset				
		Larvae caught				Larvae caught				Larvae caught			
Family or group	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	Total no. positive stations
Myctophidae													
OTPI	28	334	2,082.6	74.4	28	815	4,430.0	158.2	8	155	1,047.0	130.8	64
OTPII	24	622	2,123.1	88.5	18	674	2,280.0	126.7	3	74	254.3	84.8	45
Gonostomatidae													
OTPI	26	262	1,692.3	65.1	28	498	2,865.7	102.3	8	70	495.0	61.9	62
OTPII	24	257	858.6	35.8	18	252	828.0	46.0	3	29	96.7	32.2	45
Bothidae													
OTPI	23	83	543.8	23.6	23	82	443.1	19.3	7	14	96.5	13.8	53
OTPII	15	41	141.7	9.4	11	33	111.0	10.1	2	5	15.2	3.0	28
Gobiidae													
OTPI	20	55	335.8	16.8	26	295	1,542.3	59.3	6	16	105.8	17.6	52
OTPII	14	48	166.0	11.9	13	68	234.5	18.0	2	16	56.0	28.0	29
Scaridae													
OTPI	21	96	580.5	27.6	25	303	1,682.3	67.3	5	43	294.5	58.9	51
OTPII	10	43	150.2	15.0	12	66	216.0	18.0	2	3	10.0	5.0	24
Paralepididae													
OTPI	19	39	257.1	13.5	21	56	291.7	13.9	6	13	94.0	15.7	46
OTPII	17	29	99.3	5.8	16	36	124.0	7.8	3	12	38.0	12.7	36
Scombridae													
OTPI	17	55	390.4	23.0	21	61	292.9	13.9	6	11	74.2	12.4	44
OTPII	4	4	14.2	3.5	8	20	74.2	9.3	1	1	3.1	3.1	13
Labridae													
OTPI	16	109	693.2	43.3	17	73	385.0	22.6	5	17	116.7	23.3	38
OTPII	6	12	38.0	6.3	8	21	78.9	9.9	1	1	3.1	3.1	15
Bregmacerotidae													
OTPI	16	39	249.7	15.6	17	61	292.4	17.2	4	8	51.1	12.8	37
OTPII	14	48	166.7	11.9	10	230	937.2	93.7	3	4	13.2	4.4	27
Carangidae													
OTPI	7	26	155.4	22.2	11	30	152.5	13.9	2	3	27.0	13.5	20
OTPII	5	22	77.6	15.5	2	38	157.4	78.7					7
Serranidae													
OTPI	8	16	89.8	11.2	10	25	121.5	12.1	2	2	13.5	6.7	20
OTPII	7	36	122.2	17.5	3	8	25.1	8.4					10
Epigonidae													
OTPI	7	9	60.6	8.7	8	13	65.6	8.2	2	3	19.7	9.8	17
OTPII	11	16	52.6	4.8	7	17	58.1	3.4					18
Gempylidae													
OTPI	6	8	51.3	8.5	5	12	63.6	12.7	4	5	35.4	8.8	15
OTPII	12	17	57.7	4.4	8	14	42.2	5.3	1	3	11.9	11.9	21
Scopelarchidae													
OTPI	7	15	85.4	12.2	4	5	27.3	6.8	4	4	27.1	6.8	15
OTPII	10	23	80.2	8.0	8	14	45.7	5.7	3	4	13.2	4.4	21

Table 3.—*Continued.*

Family or group	Day hauls				Night hauls				Hauls within 1 h of sunrise or sunset				
		Larvae caught				Larvae caught				Larvae caught			
	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	No. positive stations	Actual no.	Stand. no.	Mean stand. no./haul	Total no. positive stations
Synodontidae													
OTPI	5	13	86.2	17.2	7	12	61.1	8.7					12
OTPII					3	8	31.4	10.5					3
Notosudidae													
OTPI	6	7	44.8	7.5	5	8	37.6	7.5	1	1	6.1	6.1	12
OTPII	2	6	19.6	9.8	1	1	3.2	4.5					3
Callionymidae													
OTPI	4	6	33.0	8.2	10	14	80.0	8.0		3	20.3	20.3	15
OTPII	3	3	9.0	3.0	2	2	6.8	3.4	1	1	3.0	3.0	6
Acanthuridae													
OTPI	6	10	60.0	10.0	5	6	30.4	6.1					11
OTPII	4	8	26.9	6.7	3	5	16.7	5.6					7
Nomeidae													
OTPI	2	7	41.3	20.6	3	13	72.6	24.2	1	1	6.2	6.2	6
OTPII	8	27	99.9	12.0	6	37	124.2	20.7	2	9	31.9	15.9	16
Chiasmodontidae													
OTPI	2	2	10.5	5.2	4	4	26.0	6.5	2	3	19.1	9.5	8
OTPII					1	2	7.2	7.2	1	2	6.0	6.0	2
Coryphaenidae													
OTPI	6	7	45.7	7.6	2	2	10.4	5.2					8
OTPII	1	1	2.8	2.8	1	1	3.2	3.2					2
Engraulidae													
OTPI	1	1	5.2	5.2	2	3	15.2	7.6					3
OTPII	1	24	86.2	86.2	4	32	128.9	32.2					5
Priacanthidae													
OTPI	4	4	27.2	6.8	4	6	35.4	8.8					8
OTPII	3	6	18.1	6.0	3	6	19.8	6.6					6
Other identified													
OTPI	26	123	731.0	27.9	28	165	937.3	33.5	7	28	189.7	27.1	61
OTPII	23	148	485.1	21.1	18	146	474.4	26.4	3	9	34.5	11.5	44
Unidentified													
OTPI	20	82	570.5	28.5	21	129	673.6	32.1	4	25	173.4	43.3	45
OTPII	15	57	191.8	12.8	14	42	143.9	10.3	1	8	31.8	31.8	30
Disintegrated													
OTPI	27	423	2,638.2	97.7	27	468	2,486.4	92.1	8	154	980.7	122.6	62
OTPII	19	220	755.9	39.8	16	191	612.1	38.2	3	65	232.3	77.4	38
Total fish larvae													
OTPI	28	1,831	11,561.5	412.9	28	3,159	17,121.9	611.5	8	579	3,893.0	486.6	64
OTPII	24	1,718	5,843.4	243.5	18	1,964	6,784.1	376.8	3	246	854.2	284.7	45

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 4.—Frequency distribution and mean numbers of fish larvae obtained by the two vessel patterns occupied in the Caribbean Sea on MARMAP OTP[1] I and II (*Oregon II* cruises 7239 and 7343).

	Oregon II 7239		*Oregon II* 7343		Total both cruises	
No. fish larvae/haul	Actual counts	Stand. no.	Actual counts	Stand. no.	Actual counts	Stand. no.
0	0	0	0	0	0	0
1-10	0	0	0	0	0	0
11-100	46	0	34	3	80	3
101-1,000	18	58	10	40	28	98
1,001 +	0	6	0	2	0	8
Mean no. larvae/haul	87.0	509.0	87.3	299.6	87.1	422.8
Mean no. day hauls	65.4	412.9	71.5	243.5	68.2	335.2
Mean no. night hauls	112.8	611.5	108.9	376.8	111.3	520.5
Mean no. sunset-sunrise hauls	72.4	486.6	82.0	284.7	74.7	432.1

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 5.—Comparison of mean thermal conditions observed at various depths in the Caribbean Sea during the MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Area, cruise, and no. of stations	Mean temp. MSL[2] (°C)	Mean depth MSL (m)	Mean depth 24° isotherm (m)	Mean depth 20° isotherm (m)	Mean temp. at 200 m (°C)
East of Lesser Antilles					
7239 - 10	27.3	46	121	192	19.2
7343 - 11	26.3	94	122	184	18.8
Eastern Caribbean Sea (east of long. 66°W, N of lat. 14°N)					
7239 - 16	27.6	43	113	178	18.5
7343 - 8	26.7	91	126	183	18.7
Central Caribbean Sea (east of long. 76°W, S of lat. 18°N, N of lat. 14°N)					
7239 - 8	27.9	69	144	213	20.7
7343 - 19	26.6	98	143	202	19.9
Western Caribbean Sea (W of long. 76°W, N of lat. 14°N)					
7239 - 12	28.3	71	159	208	21.7
7343 - 5	26.9	52	112	172	18.7
Yucatan Channel					
7239 - 7	28.4	49	132	196	20.6
7343 - 5	26.1	126	139	207	20.5

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.
[2]Mixed surface layer.

Table 6.—Comparison of temperature data taken at selected locations and depths during the MARMAP OTP[1] I and II (*Oregon II* cruises 7239 and 7343).

Station no.		Position		Date					Surface temp. (°C)		Depth MSL[2] (m)		Depth 24° isotherm (m)		Depth 20° isotherm (m)		Temp. at 200 m (°C)	
		Lat.	Long.	mo	d	mo	d											
7239	7343	N	W	7239		7343		Area	7239	7343	7239	7343	7239	7343	7239	7343	7239	7343
1	76	13-00	060-00	07	13	02	13	East of	27.2	26.8	56	94	94	110	145	175	16.5	17.8
2	78	14-00	060-00	07	13	02	14	Lesser	27.3	26.4	50	86	117	100	201	150	20.0	16.8
6	82	16-00	060-00	07	14	02	14	Antilles	27.3	26.4	39	96	106	120	169	195	18.5	19.6
10	86	18-00	060-00	07	14	02	15		27.5	25.9	47	92	140	125	215	205	21.0	20.2
18	96	15-00	065-00	07	17	02	17	Eastern	27.6	27.1	42	88	135	130	190	178	19.8	18.8
24	90	18-00	065-00	07	17	02	17	Caribbean	28.0	25.9	30	80	110	120	190	200	19.7	20.0
36	139	17-00	070-00	07	20	03	02	Central	28.0	26.8	65	112	185	140	240	225	23.3	21.0
32	135	15-00	070-00	07	20	03	01	Caribbean	27.5	26.7	49	112	120	130	178	180	18.5	19.0
39	141	18-00	073-00	07	21	03	02	Sea	28.1	26.4	85	89	141	148	218	210	21.0	21.3
50	165	17-00	080-00	07	29	03	08	Western Caribbean	27.5	27.0	67	75	135	120	192	185	19.5	19.3
69	167	21-30	085-15	08	02	03	10	Yucatan	28.7	25.9	50	140	162	142	240	214	22.0	20.6
70	169	21-30	085-30	08	02	03	10	Channel	28.4	26.0	58	119	159	142	225	214	21.4	20.7
72	170	21-30	086-00	08	02	03	10		28.0	26.3	40	122	132	140	182	210	19.3	20.4

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.
[2]Mixed surface layer.

Table 7.—Comparison and ranking of occurrences (number of stations) and numbers of larvae of all families and some higher taxa collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343). Taxa arranged in phylogenetic order.

	Cruise 7239						Cruise 7343					
	Occurrences			Number			Occurrences			Number		
Taxa	No.	%	Rank	Actual	Stand.	Rank	No.	%	Rank	Actual	Stand.	Rank
Elopidae	2	3		2	11.5		1	2		1	2.9	
Clupeidae	4	6		9	60.3		2	4		15	61.1	
Engraulidae	3	5		4	20.4		5	11		56	215.1	10
Argentinidae	1	2		1	9.0		1	2		1	3.3	
Bathylagidae	3	5		4	21.5		5	11		10	30.9	
Gonostomatidae	62	96	2	830	5,053.0	2	45	100	1.5	538	1,783.3	2
Stomiatidae	2	3		2	16.2		1	2		1	2.9	
Chauliodontidae	3	5		4	21.0		11	24	15	16	53.1	
Astronesthidae	3	5		3	18.8		4	9		4	13.5	
Melanostomiatidae	2	3		2	12.1		9	20		14	47.7	
Idiacanthidae	1	2		1	5.9		2	4		2	7.8	
Scopeliformes	64	100		1,515	8,811.1		45	100		1,559	5,306.2	
Synodontidae	12	18		25	147.3	13	3	7		8	31.4	
Scopelarchidae	15	23	15	24	139.8	15	21	47	8.5	41	139.1	12
Evermannellidae	10	15		14	93.6		19	42	10	31	107.1	
Paralepididae	46	71	6	108	633.8	8	36	80	3	72	249.2	8
Alepisauridae							2	4		2	6.5	
Myctophidae	64	100	1	1,304	7,559.6	1	45	100	1.5	1,370	4,655.4	1
Chlorophthalmidae	6	9		19	120.3		1	2		1	3.8	
Notosudidae	12	18		16	88.5		3	7		7	22.7	
Anguilliformes	30	47		65	386.9		25	55		45	148.7	
Xenocongridae							2	4		2	5.8	
Muraenidae	10	15		11	59.4		9	20		10	33.8	
Moringuidae	1	2		9	58.0		3	7		3	9.9	
Nettastomidae	2	3		3	19.9		2	4		2	6.2	
Congridae	15	23	15	23	134.9		10	22	15.5	13	42.1	
Ophichthidae	11	17		13	78.5		6	13		14	45.4	
Synaphobranchidae	1	2		1	6.2							
Serrivomeridae	2	3		2	11.3		1	2		1	5.5	
Exocoetidae	2	3		5	27.7		7	15		7	22.4	
Gadidae	2	3		3	19.1							
Bregmacerotidae	37	57	9	108	593.4	9	27	60	6	282	1,116.9	3
Macrouridae							1	2		1	3.6	
Eutaeniophoridae	1	2		1	5.7							
Aulostomidae	2	3		2	11.4		1	2		1	3.1	
Fistulariidae							1	2		1	3.6	
Syngnathidae	1	2		1	2.2		2	4		2	5.9	
Stylephoridae							4	9		4	13.4	
Melamphaidae	6	9		7	48.2		1	2		1	3.3	
Diretmidae							1	2		1	3.4	
Holocentridae	1	2		1	6.2		2	4		8	29.2	
Caproidae							1	2		1	4.1	
Sphyraenidae	10	15		17	102.3							
Polynemidae	1	2		1	4.8							
Serranidae	20	31	10.5	43	224.8	11	10	22	15.5	44	147.1	11
Priacanthidae	8	12		10	62.6		6	13		12	38.0	
Apogonidae	1	2		1	7.7		4	9		6	18.2	
Branchiostegidae	6	9		8	40.5		3	7		3	10.7	
Echeneidae	2	3		2	12.3		1	2		1	3.5	

Taxa	Cruise 7239						Cruise 7343					
	Occurrences			Number			Occurrences			Number		
	No.	%	Rank	Actual	Stand.	Rank	No.	%	Rank	Actual	Stand.	Rank
Carangidae	20	31	10.5	59	333.9	10	7	15		60	235.0	9
Bramidae	2	3		2	11.9		7	15		7	24.5	
Coryphaenidae	8	12		9	56.1		2	4		2	5.9	
Lutjanidae	4	6		5	30.8		5	11		7	24.1	
Acanthuridae	11	17		16	90.4		7	15		13	43.7	
Sciaenidae							1	2		2	8.4	
Epigonidae	17	26	12	25	145.9	14	18	40	11	33	110.8	15
Chaetodontidae	5	7		8	50.4		5	11		5	18.0	
Pomacentridae	7	11		10	54.5		2	4		2	6.9	
Labridae	38	59	8	199	1,194.9	5	15	33	13	34	111.9	13.5
Scaridae	51	79	5	442	2,557.3	3	24	53	7	112	376.3	5
Mullidae							2	4		5	16.6	
Chiasmodontidae	8	12		9	55.6		2	4		4	13.3	
Blenniidae							1	2		1	3.6	
Ophidiidae							5	11		7	22.9	
Carapidae	1	2		2	10.5		2	4		3	9.3	
Callionymidae	15	23	15	23	133.3		6	13		6	18.8	
Scombridae	44	68	7	127	756.5	7	13	29	14	25	91.7	
Gempylidae	16	25	13	25	150.3	12	21	47	8.5	34	111.9	13.5
Trichiuridae	5	7		7	41.1		9	20		11	36.7	
Istiophoridae	2	3		3	24.2		1	2		1	3.3	
Nomeidae	6	9		21	120.1		16	36	12	73	256.0	7
Gobiidae	52	81	4	366	1,983.9	4	29	64	4	132	456.5	4
Scorpaenidae	11	17		17	94.1		7	15		12	39.7	
Triglidae							2	4		2	6.5	
Dactylopteridae	2	3		2	12.0		2	4		2	5.8	
Bothidae	53	83	3	179	1,083.4	6	28	62	5	79	267.6	6
Soleidae	1	2		3	19.3							
Cynoglossidae	3	5		3	20.2		3	7		5	18.3	
Gobeisocidae	7	11		11	58.2							
Balistidae	7	11		10	62.2		1	2		1	3.2	
Ostracidae							1	[illegible]		1	3.0	
Tetraodontidae	6	9		16	72.1		8	18		9	33.4	
Diodontidae	10	15		17	98.0							
Lophiiformes	12	18		18	105.7		12	27		15	51.8	
Lophiidae							1	2		1	3.4	
Ogcocephalidae							1	2		1	3.3	
Ceratiidae							1	2		1	2.8	
Linophyrnidae							1	2		1	3.0	
Gigantactidae	2	3		2	11.7							
Fish spp.												
Damaged	62	98		1,045	6,105.3		38	84		476	1,600.3	
Unidentified	45	70		236	1,417.5		30	67		107	367.5	
Total				5,569	32,577.4					3,928	13,481.7	

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 8.—Comparison of occurrences (number of stations) and numbers of gonostomatid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Gonostomatid taxa	Cruise 7239 No. of stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. of stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Gonostomatinae spp.	29	45	107	678.9	39	87	149	487.3
Type "Alpha"	1	2	1	5.0	1	2	1	4.0
Cyclothone spp.	53	83	292	1,749.9	45	100	198	664.4
Diplophos taenia	2	3	2	9.8				
Gonostoma								
spp.	1		1	6.2	1		1	2.9
atlanticum	9		27	160.2	16		21	70.2
elongatum	44		164	1,023.2	19		45	150.5
Total *Gonostoma*	47	73	192	1,189.6	29	64	67	223.6
Woodsia nonsuchae	2	3	2	11.3				
Margrethia obtusirostra	7	11	10	65.8	10	22	11	35.3
Maurolicus muelleri	1	2	1	6.2	2	4	2	7.8
Pollichthys mauli	38	59	134	785.7	18	40	35	115.7
Valenciennellus tripunctulatus					3	7	3	10.6
Yarella blackfordi					1	2	1	3.6
Bonapartia pedaliota	1	2	1	4.9	3	7	3	9.5
Vinciguerria								
nimbaria	25		55	321.9	22		45	144.7
poweriae	2		2	11.8				
attenuata	2		4	31.4	2		2	6.6
Total *Vinciguerria*	28	44	61	365.1	23	51	47	151.3
Total Gonostomatinae	62	96	803	4,872.2	45	100	517	1,713.1
Sternoptychinae								
Argyropelecus spp.	2	6	6	44.1	5	11	5	16.2
Polyipnus spp.	1	2	1	6.9	2	4	5	17.9
Sternoptyx spp.	15	23	20	129.8	11	24	11	36.1
Total Sternoptychinae	16	25	27	180.7	16	35	21	70.2
Total Gonostomatidae	62	96	830	5,053.0	45	100	538	1,783.3

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 9.—Comparison of occurrences (number of stations) and numbers of larvae of scopelarchids, evermannellids, and paralepidids collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Taxa	Cruise 7239 No. stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Scopelarchidae								
Scopelarchus								
analis					1	2	1	3.6
Benthabella								
infans	12	18	19	111.0	19	42	37	125.5
Scopelarchioides								
danae	4	6	5	28.8	3	7	3	10.0
Total Scopelarchidae	15	23	24	139.8	21	47	41	139.1
Evermannellidae								
spp.					1	2	2	6.6
Evermannella								
balbo					7	15	8	27.1
indica	1	1	1	7.7	1	2	2	6.8
Total Evermannella	1	1	1	7.7	8	18	10	33.9
Odontostomops								
normalops	4	6	5	34.3	8	18	8	27.7
Coccorella								
atlantica	7	10	8	51.6	8	42	31	107.1
Total Evermannellidae	10	15	14	93.6	19	42	31	107.1
Paralepididae								
spp.	6	9	7	44.4	5	11	5	16.2
Lestidium spp.	28	43	55	315.1	16	35	24	81.1
Lestidiops spp.	10	15	15	84.8	8	18	10	39.1
Sudis								
hyalina	8	12	13	74.7	17	38	22	75.4
Stemonosudis spp.	5	7	5	32.2	3	7	3	11.1
Pontosudis spp.	2	3	2	13.8	4	9	4	12.4
Lestrolepis spp.	9	14	11	68.8	3	7	4	13.9
Total Paralepididae	46	71	108	633.8	36	80	72	249.2

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 10.—Comparison of occurrences (number of stations) and numbers of myctophid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

	Cruise 7239				Cruise 7343			
Myctophid taxa	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae
Myctophidae spp.	22	34	65	444.1	29	64	124	425.6
Diaphus								
spp.	60		592	3,350.0	40		613	2,116.1
brachycephalus	1		1	5.3	1		1	2.9
dumerilii	4		5	30.2	1		1	3.3
mollis	2		2	10.4	1		1	3.4
termophilus	3		3	18.2				
problematicus					1		2	6.6
perspicillatus	2		2	13.5				
fragilis	5		5	27.6				
splendidus	4		4	22.8				
luetkeni	1		1	7.7				
Total *Diaphus*	60	94	615	3,485.7	41	91	618	2,132.3
Notolychnus valdivae	17	26	30	178.1	9	20	14	44.5
Lampadena spp.	17	26	28	167.5	10	22	18	56.3
Lampanyctus								
spp.	5		6	30.4	7		12	41.8
alatus					1		1	3.3
cuprarius	5		6	42.9	2		2	6.3
nobilis	19		28	150.1	16		27	92.7
Total *Lampanyctus*	23	36	40	223.4	22	49	42	144.1
Myctophum								
spp.	4		4	24.2	1		1	3.6
affine	8		12	70.8	1		1	2.9
asperum	8		2	12.2	3		3	10.2
nitidulum	13		25	148.7	6		10	35.1
obtusirostre	13		13	80.7	20		38	128.0
selenops	32		52	306.2	15		29	95.8
Total *Myctophum*	47	73	108	642.8	28	62	82	275.6
Bolinichthys								
spp.	10		14	82.4	8		9	29.1
supralatoralis	1		1	7.2				
Total *Bolinichthys*	11	17	15	89.6	8	18	9	29.1
Ceratoscopelus								
spp.	38		244	1,449.6	32		202	692.5
maderensis	5		52	271.6	10		29	95.4
warmingi	9		14	75.4	29		78	255.0
Total *Ceratoscopelus*	41	64	310	1,796.6	41	91	309	1,042.9
Lepidophanes spp.	11	17	21	117.9	4	9	7	21.1
Hygophum								
spp.	2		4	30.2	1		1	2.9
hygomi					3		4	13.0
reinhardtii	7		7	39.0	7		8	26.2
macrochir	4		6	31.1	10		22	73.4
taaningi	22		43	237.8	31		83	274.3
Total *Hygophum*	30	47	60	338.1	38	84	118	389.8
Centrobranchus nigroocellatus	1	2	1	5.3	5	11	6	18.6
Notoscopelus								
resplendens	1		1	6.3	3		3	10.1
caudispinosus					3		8	24.5
Total *Notoscopelus*	1	2	1	6.3	6	13	11	34.6
Lobianchia gemellarii					2	4	5	17.8
Benthosema suborbitale	4	6	4	24.2				
Diogenichthys atlanticus	3	5	4	28.4	3	7	4	12.9
Symbolophorus spp.	1	2	1	5.4	3	7	3	10.2
Loweina rara	1	2	1	6.2				
Total Myctophidae	64	100%	1,304	7,559.6	45	100%	1,370	4,655.4

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 11.—Comparison of relative abundance of larval and adult myctophids in the Caribbean Sea. Larval percentages are of the total actual number of larval myctophid specimens from *Oregon II* cruises 7239 and 7343; adult percentages are from the Woods Hole Oceanographic Institution data of Backus et al. (1977).

Genus	Larvae		Adults	
	%	Rank	%	Rank
Diaphus spp.	47.2	1	31.3	1
Notolychnus valdivae	1.6	7	11.9	3
Lampadena spp.	0.6		0.5	
Lampanyctus nobilis	2.1	5	2.2	7
Lampanyctus cuprarius	0.3		0.1	
Other *Lampanyctus* spp.	1.0	10	5.8	5
Myctophum affine	0.5		0.4	
Myctophum asperum	0.2		0.6	
Myctophum nitidulum	1.3	8	0.1	
Myctophum obtusirostre	1.9	6	0.1	
Myctophum selenops	3.0	4	0.3	
Bolinichthys spp.	0.9		2.2	8
Ceratoscopelus-Lepidophanes	24.8	2	29.6	2
Hygophum hygomi	0.1		0.1	
Hygophum reinhardtii	0.6		0.1	
Hygophum macrochir	1.0	9	2.2	9
Hygophum taaningi	4.7	3	0.3	
Centrobranchus nigroocellatus	0.3		0.1	
Notoscopelus resplendens	0.1		1.7	10
Notoscopelus caudispinosus	0.3		0.1	
Lobianchia gemellarii	0.2		0.7	
Lobianchia dofleini	0		0.5	
Benthosema suborbitale	0.1		6.6	4
Diogenichthys atlanticus	0.3		2.8	6
Symbolophorus spp.	0.1		<0.1	
Loweina rara	<0.1		<0.1	
Taaningichthys spp.	0		<0.1	
Gonichthys coccoi	0		<0.1	

Table 12.—Comparison of the relative numbers (percent) of myctophid larvae identified to genus from the Caribbean Sea (this study), the eastern Gulf of Mexico (Houde et al. text footnote 4), the eastern tropical Pacific Ocean (EASTROPAC I (Ahlstrom 1971) and EASTROPAC II (Ahlstrom 1972)), and the western Indian Ocean (Nellen 1973).

Genus	Caribbean Sea	E. Gulf	EASTROPAC I	EASTROPAC II	W. Indian Ocean
Diaphus	49.6	52.2	6.6	3.9	10.4
Notolychnus	1.8	3.8	2.0	0.8	0.9
Lampadena	1.8	0.6	0.3	0.1	0.4
Lampanyctus	3.3	1.8	13.6	8.5	8.7
Myctophum	7.6	10.1	3.2	3.5	0.8
Bolinichthys	1.0	0.1	—	—	—
Ceratoscopelus	24.9	2.2	2.4	0.6	0.7
Lepidophanes	1.1	2.4	0.4	0.2	0.4
Hygophum	7.2	15.6	4.1	2.3	4.8
Centrobranchus	0.3	0.5	<0.1	<0.1	0.4
Notoscopelus	0.5	0.8	0.6	0.6	0.0
Lobianchia	0.2	0.3	0.1	<0.1	—
Benthosema	0.2	4.9	2.4	1.8	68.8
Diogenichthys	0.3	2.6	58.7	74.9	1.2
Symbolophorus	0.2	0.1	3.4	1.3	1.0
Loweina	<0.1	0.0	0.1	0.1	0.0
Taaningichthys	0.0	0.0	0.0	0	—
Electrona	—	—	0.2	0	1.2
Gonichthys	0.0	0.1	0.5	0.5	—
Protomyctophum	—	—	0.2	0.1	—
Stenobranchius	—	—	—	—	0.0
Triphoturus	—	—	1.2	1.3	0.8

Table 13.—Comparison of occurrences (number of stations) and numbers of eel larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

	Cruise 7239				Cruise 7343			
Leptocephalid Taxa	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae
Leptocephali spp.	3	5	3	18.7				
Xenocongridae								
Kaupichthys sp.					1	2	1	3.3
Robinsia catherinae					1	2	1	2.5
Total Xenocongridae	0	0	0	0	2	4	2	5.8
Muraenidae								
spp.	2	3	2	8.0	1	2	1	3.2
Gymnothorax spp.	4	6	4	21.6	8	18	9	30.6
Anarchias yoshiae	5	7	5	29.8				
Total Muraenidae	10	15	11	59.4	9	20	10	33.8
Moringuidae								
Moringua edwardsi	1	2	9	58.0	2	4	2	6.6
Neoconger mucronatus					1	2	1	3.3
Total Moringuidae	1	2	9	58.0	3	7	3	9.9
Nettastomatidae	2	3	3	19.9	2	4	2	6.2
Congridae spp.	2	3	2	13.6	1	2	1	3.8
Ariosoma								
spp.	7	11	12	65.7	6	13	8	25.1
selonops	1	2	1	5.4				
balearicum	1	2	2	10.8				
Total Ariosoma	8	13	15	81.9	6	13	8	25.1
Conger spp.					1	2	1	3.4
Uroconger syranginus	1	2	1	6.9				
Paraconger caudilimbatus	1	2	1	7.7				
Pseudoxenomystax sp.	1	2	1	5.1				
Hildebrandia sp.	3	5	3	19.7				
flava					3	7	3	9.8
Total Congridae	15	23	23	134.9	10	22	13	42.1
Ophichthidae								
spp.	5	7	6	33.1	6	13	14	45.4
Ahlia egmontis	3	5	3	18.6				
Myrophis spp.	3	5	4	26.8				
Total Ophichthidae	11	17	13	78.5	6	13	14	45.4
Synaphobranchidae	1	2	1	6.2				
Serrivomeridae	2	3	2	11.3	1	2	1	5.5
Total	30	47	65	386.9	25	55	45	148.7

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 14.—Comparison of occurrences (number of stations) and numbers of bregmacerotid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Taxa	Cruise 7239 No. stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Bregmaceros								
macclellandii	26	41	37	215.0	18	40	31	103.2
atlanticus	17	26	43	230.5	12	27	31	104.4
Type A	3	5	15	65.8				
Type B	4	6	7	43.5	4	9	213	886.4
spp.	5	7	6	38.6	5	11	7	22.9
Total	37	57	108	593.4	27	60	282	1,116.9

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 15.—Comparison of occurrences (number of stations) and numbers of labrid and scarid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Taxa	Cruise 7239 No. stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Labridae								
spp.	5	7	8	51.0	1	2	1	3.1
Bodianus sp.	1	2	1	6.1	1	2	1	3.5
Halichoeres maculipinna	1	2	1	5.3	1	2	1	3.2
Thalassoma bifasciatum	5	7	7	46.5	3	7	3	10.0
Xyrichthys sp.								
Type A	34	53	153	911.7	11	24	23	76.0
Type H	15	23	23	140.7				
Type C					4	9	5	16.1
Type J	1	2	2	10.6				
Type K	1	2	2	13.1				
Type L	1	2	2	9.9				
Total Labridae	38	59	199	1,194.9	15	33	34	111.9
Scaridae	51	79	442	2,557.3	24	53	112	376.3

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 16.—Meristic characters of labrids and scarids from the tropical western Atlantic Ocean.

	Vertebral number			Fin rays			
Species	Precaudal	Caudal	Total	Dorsal spines	Dorsal soft rays	Anal spines	Anal soft rays
Labridae							
Lachnolaimus							
maximus	12	17	29	14	11-12	3	11
Bodianus							
rufus	11	17	28	9-12	8-10	3	11-12
pulchellus	11	17	28	11-12	10-11	3	11-12
Decodon							
puellaris	12	16	28	11	10	3	10
Clepticus							
parrae	10	17	27	12	10	3	12
Halichoeres							
bathyphilus	10	15	25	9	11	3	12
bivittatus	10	15	25	9	11	3	12
caudalis	10	15	25	9	11	3	12
cyanocephalus	10	15	25	9	12	3	12
garnoti	10	15	25	9	11	3	12
maculipinna	10	15	25	9	11	3	11
pictus	10	15	25	9	11	3	12
poeyi	10	15	25	9	11	3	12
radiatus	10	15	25	9	11	3	12
Thalassoma							
bifasciatum	11	14	25	8	12-13	3	10-11
Doratonotus							
megalepis	9	16	25	9	10	3	9
Xyrichthys							
novacula	9	16	25	9	12	3	12
splendens	9	16	25	9	12	3	12
martinicensis	9	16	25	9	12	3	12
Scaridae	9-11	14-16	25	9	10	3	9

Table 17.—Comparison of occurrences (number of stations) and numbers of scombrid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

	Cruise 7239				Cruise 7343			
Scombrid taxa	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae	No. stations	% occurrence	Actual no. larvae	Stand. no. larvae
Scombridae spp.	5	8	11	45.5	1	2	1	2.9
Auxis spp.	5	8	16	78.4	2	3	10	38.6
Euthynnus alletteratus	3	5	3	12.0	1	2	1	4.2
Katsuwonus pelamis	27	42	34	205.3	6	13	6	21.1
Thunnus								
spp.	18	28	52	337.7	1	2	1	3.1
atlanticus	6	9	8	56.0	3	7	3	9.8
alalunga					1	2	1	3.6
Scomber japonicus	1	2	1	7.7				
Acanthocybium solandri	2	3	2	13.9				
Sarda sarda					1	2	2	8.4
Total Scombridae	44	68	127	756.5	13	29	25	91.7
Gempylidae								
Promethichthys prometheus					4	9	8	28.8
Gempylus serpens	7	11	9	55.1	12	27	13	41.3
Scombrolabrax heterolepis	5	8	8	41.8	6	13	10	30.1
Nesiarchus nasutus	6	9	8	53.4	2	4	2	7.6
Thyrsites atun					1	2	1	4.1
Total Gempylidae	16	25	25	150.3	21	47	34	111.9
Trichiuridae								
spp.					1	2	2	6.7
Benthodesmus								
tenuis					1	2	1	3.3
elongatus					1	2	1	3.3
Diplospinus multistriatus	5	7	7	41.1	7	16	7	23.4
Total Trichuridae	5	7	7	41.1	10	20	11	36.7

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 18.—Comparison of occurrences (number of stations) and numbers of larvae of serranids, lutjanids, carangids, and nomeids collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Taxa	Cruise 7239 No. stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Serranidae								
spp	4	6	5	23.2	10	22	43	144.3
Epinephalus spp.	6	9	9	48.6	1	2	1	2.8
Hemanthias spp.	4	6	5	23.6				
Liopropoma spp.	13	20	22	117.9				
Pseudogramma gregoryi	1	2	2	11.5	—	—	—	—
Total Serranidae	20	31	43	224.8	10	22	44	147.1
Lutjanidae								
spp.	1	2	2	12.9	2	4	3	9.9
Rhomboplites aurorubens	1	2	1	5.0				
Symphosanodon spp.	2	3	2	12.9	2	4	3	10.9
Lutjanus sp.	—	—	—	—	1	2	1	3.3
Total Lutjanidae	4	6	5	30.8	5	11	7	24.1
Carangidae								
spp.	2	3	7	34.0				
Caranx spp.	11	17	22	126.3				
crysos	1	2	1	6.4				
Decapturus spp.	6	9	7	43.6	3	7	8	31.2
Naucrates ductor	1	2	1	3.1				
Seriola spp.					2	4	3	9.0
Selene vomer	1	2	1	5.6				
Trachurus spp.	8	12	20	114.9	5	11	49	194.8
Total Carangidae	20	31	59	333.9	7	15	60	235.0
Nomeidae								
spp.					1	2	1	3.3
Cubiceps spp.					2	4	9	37.1
pauciradiatus	6	9	21	120.1	15	33	63	215.6
Total Nomeidae	6	9	21	120.1	16	36	73	256.0

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 19.—Comparison of occurrences (number of stations) and numbers of bothid larvae collected in bongo nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7343).

Taxa	Cruise 7239 No. stations	Cruise 7239 % occurrence	Cruise 7239 Actual no. larvae	Cruise 7239 Stand. no. larvae	Cruise 7343 No. stations	Cruise 7343 % occurrence	Cruise 7343 Actual no. larvae	Cruise 7343 Stand. no. larvae
Bothidae spp.	1	2	1	6.7	4	9	5	16.6
Citharichthys spp.	3	5	5	25.9	3	7	3	10.4
Syacium spp.	14	22	24	157.1	9	20	22	73.6
Engyrophrys senta	2	3	3	14.9	4	9	5	17.4
Trichopsetta ventralis					1	2	1	4.1
Bothus								
lunatus					1	2	1	3.2
ocellatus	52	81	146	878.8	20	44	41	139.0
maculiferus	—	—	—	—	1	2	1	3.3
Total Bothidae	53	83	179	1,083.4	28	62	79	267.6

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Table 20.—Comparison and ranking of occurrences (number of stations) and numbers of larvae of all families and some higher and lower taxa collected in neuston nets in the Caribbean Sea during MARMAP OTP[1] I and II cruises (*Oregon II* cruises 7239 and 7345). Taxa arranged in phylogenetic order.

	Cruise 7239					Cruise 7343				
	Occurrences			Number/family		Occurrences			Number/family	
Taxa	No. of stations	%	Rank	Actual	Rank	No. of stations	%	Rank	Actual	Rank
Abulidae										
Albula vulpes	1	2		1		1	4		1	
Clupeidae	2	3		2		3	11		87	8
Engraulidae						3	11		6	
Gonostomatidae	10	16		15		5	18	14.5	8	
Synodontidae	5	8		11						
Astronesthidae						2	7		2	
Paralepididae	2	3		2		2	7		6	
Myctophidae	26	43	5.5	1,114	1	15	54	4	235	5
Chlorophthalmidae	2	3		21						
Eel leptocephali	13	21	14	567	3	6	21	12.5	10	
Belonidae	7	11		11		1	4		8	
Scombreresocidae	1	2		1						
Hemiramphidae	25	41	7	376	4	8	29	10	14	
Exocoetidae	52	85	1	1,093	2	26	93	1	311	3
Bregmacerotidae						1	4		2	
Syngnathidae	16	26	11	25	14.5	3	11		6	
Holocentridae	9	15		16		2	7		2	
Berycidae						1	4		1	
Mugilidae	12	20	15	34	13	9	32	8.5	716	2
Sphyraenidae	5	18		12						
Polynemidae	1	2		1						
Serranidae	2	3		2		4	14		7	
Priacanthidae						4	14		23	15
Apogonidae	1	2		1						
Branchiostegidae	1	2		1						
Carangidae	32	52	2	220	6	17	61	2	64	10
Bramidae	1	2		1		1	4		1	
Coryphaenidae	27	44	4	72	10	16	57	3	41	12
Coryphaena equiselis	17			44		11			16	
C. hippurus	16			28		8			21	
Lobotidae	3	5		3		1	4		1	
Pomadasyidae	3	5		8		4	14		12	
Mullidae	26	43	5.5	163	7	12	43	5	1,216	1
Sparidae						3	11		4	
Epigonidae	2	3		3		3	11		4	
Chaetodontidae	2	3		2		3	11		6	
Pomacentridae	3	5		7		1	4		1	
Labridae	5	8		11		3	11		3	
Scaridae						5	18	14.5	79	9

Table 20.—*Continued.*

Taxa	Cruise 7239					Cruise 7343				
	Occurrences			Number/family		Occurrences			Number/family	
	No. of stations	%	Rank	Actual	Rank	No. of stations	%	Rank	Actual	Rank
Blenniidae	1	2		2		1	4		36	13
Ophidiidae	1	2		1						
Callionymidae	3	5		3		3	11		5	
Scombridae	15	25	12	110	8	3	11		248	4
Auxis sp.	1			10		2			246	
Euthynnus alletteratus	1			1						
Katsuwonus pelamis	4			6		1			1	
Thunnus sp.	8			67						
atlanticus	4			19						
Sarda sarda						1			1	
Gempylidae	6	10		21		4	14		4	
Trichiuridae	1	2		1						
Istiophoridae	17	28	10	43	12	1	4		1	
sp.	1			1		1			1	
Istiophorus platypterus	9			27						
Makaira nigricans	8			15						
Xiphiidae										
Xiphias gladius	9	15		13		2	7		2	
Nomeidae	8	13		22		2	7		2	
Gobiidae	1	2		1		6	21	12.5	96	7
Dactylopteridae										
Dactylopterus volitans	19	31	8.5	231	5	11	39	6.5	226	6
Scorpaenidae						4	14		7	
Bothidae	10	16		21		7	25	11	18	
Cynogiossidae						1	4		2	
Balistidae	29	48	3	96	9	11	39	6.5	32	14
Ostracidae	3	5		3		1	4		1	
Tetraodontidae	19	31	8.5	66	11	9	32	8.5	59	11
Diodontidae	14	23	13	25	14.5	2	7		16	
Diodon										
holocanthus	10			11						
hystrix	8			13		2			16	
eydouxi	1			1						
Lophiidae	1	2		1						
Antennariidae	6	10		11		4	14		7	
Histrio histrio	5			10		4			7	
Unidentified	22			220		13			84	
Total	61			4,687		28			3,723	

[1]Marine Mapping, Assessment and Prediction Operational Test Phase.

Appendix Table 1.—Station data for OTP 1 *Oregon II* cruise 7239.

Station no.	Lat. N °	Lat. N ′	Long. W °	Long. W ′	Day	Month	Local time	Standard haul factor	Depth of tow (mm)	Type of tow
1	13	00	060	00	13	07	04 30	4.88	260	Bongo/Neuston
2	14	00	060	00	13	07	12 25	6.69	325	″
4	15	05	060	04	13	07	20 55	4.84	293	″
6	15	58	059	51	14	07	04 26	6.22	293	Bongo only
8	16	55	059	59	14	07	13 50	6.18	260	Bongo/Neuston
10	18	00	059	59	14	07	21 35	5.41	205	″
11	17	25	063	00	15	07	15 48	6.45	275	″
13	16	37	063	00	15	07	22 04	3.08	223	
15	15	50	063	00	16	07	04 58	4.96	187	
17	15	03	062	55	16	07	11 42	5.18	223	″
18	15	00	065	00	17	07	00 35	5.63	187	Bongo only
20	15	56	064	46	17	07	08 35	5.68	223	″
22	17	02	065	02	17	07	16 37	5.50	200	″
24	18	00	065	00	17	07	23 35	4.84	167	Bongo/Neuston
25	17	52	067	00	18	07	11 38	6.45	225	″
27	17	08	066	57	18	07	18 20	6.22	250	″
29	16	04	066	58	19	07	02 35	6.54	235	″
31	15	00	066	58	19	07	10 42	5.26	243	″
32	14	55	070	04	20	07	02 50	6.99	223	″
34	16	00	070	00	20	07	10 54	5.49	240	″
36	17	08	069	58	20	07	18 10	5.61	200	″
38	18	00	069	57	21	07	00 20	5.49	190	″
39	18	00	073	00	21	07	19 32	5.84	195	″
43	16	00	073	00	22	07	10 54	7.21	230	″
45	15	03	073	01	22	07	17 57	6.13	210	″
46	18	07	078	41	28	07	22 00	6.93	260	″
48	17	26	079	23	29	07	04 43	4.78	170	″
50	16	50	080	13	29	07	12 23	4.94	200	″
52	17	47	080	16	29	07	19 14	5.07	223	″
54	18	58	080	09	30	07	03 20	5.92	185	″
56	20	00	080	13	30	07	10 31	5.73	223	″
58	21	01	080	14	30	07	17 37	7.36	255	″
59	21	10	082	51	31	07	07 00	6.22	230	″
61	20	26	083	30	31	07	14 03	4.57	195	″
63	19	41	084	13	31	07	21 14	4.94	180	″
65	18	55	084	41	01	08	04 08	3.65	180	″
67	18	17	085	35	01	08	10 46	6.26	227	″
68	21	49	085	09	02	08	08 05	5.93	235	″
69	21	43	085	22	02	08	11 14	6.47	240	″
70	21	35	085	35	02	08	14 17	5.07	190	″
71	21	36	085	49	02	08	17 30	6.77	220	″
72	21	33	086	02	02	08	21 19	7.69	223	″
73	21	31	086	14	03	08	00 28	8.42	223	″
74	21	31	086	25	03	08	03 23	8.24	145	″
130	22	49	087	32	05	08	03 02	2.19	20	″
132	23	10	086	26	05	08	10 04	7.72	260	″
134	23	27	085	23	05	08	16 58	6.26	223	″
136	23	45	084	20	05	08	22 55	7.24	226	″
138	24	06	083	14	06	08	05 00	9.46	255	″
140	24	19	082	20	06	08	10 21	6.86	187	″
141	24	08	082	20	06	08	13 03	7.93	240	″
142	23	56	082	21	06	08	16 04	8.12	250	″
143	23	45	082	21	06	08	19 25	8.46	250	″
144	23	34	082	22	06	08	22 13	5.59	200	″
145	23	23	082	22	07	08	00 46	5.31	200	″
146	23	12	079	50	07	08	14 06	6.91	185	″
147	23	18	079	38	07	08	16 11	7.03	190	″
148	23	24	079	26	07	08	18 32	6.74	225	″
149	23	29	079	13	07	08	21 00	6.55	225	″
150	23	34	079	05	07	08	22 55	8.31	225	″
151	24	42	079	14	08	08	06 46	8.08	187	″
152	24	49	079	32	08	08	10 06	6.94	210	″
153	24	55	079	50	08	08	13 20	8.97	225	″
154	25	02	080	08	08	08	16 28	9.55	220	″

Appendix Table 2.—Station data for OTP I *Oregon II* cruise 7343.

Station no.	Lat. N °	Lat. N ′	Long. W °	Long. W ′	Day	Month	Local time	Standard haul factor	Depth of tow (mm)	Type of tow
7	23	55	067	54	09	02	03 07	5.49	245	Bongo only
9	22	59	068	00	09	02	10 00	3.83	245	"
11	22	00	068	00	09	02	17 00	3.12	197	Bongo/Neuston
13	20	59	067	59	10	02	22 38	3.15	212	Bongo only
15	20	00	067	58	10	02	07 56	3.20	220	"
17	18	58	068	00	10	02	14 46	4.13	200	"
18	19	08	064	57	11	02	07 30	3.27	200	"
76	13	00	060	00	13	02	18 02	3.97	230	Bongo/Neuston
78	14	03	060	08	14	02	01 56	2.49	170	"
80	15	04	059	59	14	02	09 45	3.12	207	Bongo only
82	16	02	060	00	14	02	17 10	2.90	220	"
84	16	59	060	04	15	02	01 15	3.62	230	"
86	17	59	059	58	15	02	08 30	3.66	235	"
90	18	00	065	00	17	02	20 35	3.22	215	Bongo/Neuston
92	16	57	065	01	17	02	03 09	3.38	225	"
94	16	01	065	01	17	02	09 33	3.59	240	Bongo only
96	15	01	065	05	17	02	16 09	3.85	230	"
98	14	02	065	03	18	02	22 05	3.54	225	Bongo/Neuston
100	13	04	065	02	18	02	06 09	3.02	194	Bongo only
102	11	59	065	05	18	02	13 35	3.59	230	Bongo/Neuston
104	11	00	065	00	19	02	20 42	4.19	110	"
130	13	00	070	00	28	02	17 09	4.13	225	"
132	14	00	070	12	01	03	00 21	3.36	220	"
135	15	10	070	01	01	03	09 10	3.59	210	Bongo only
137	16	01	070	02	01	03	15 05	2.92	200	Bongo/Neuston
139	17	00	070	00	02	03	21 00	3.31	220	"
141	17	29	072	29	02	03	11 40	2.80	200	"
142	19	41	075	00	03	03	08 25	3.43	225	"
144	18	58	075	00	03	03	13 05	2.94	205	"
146	18	00	075	00	04	03	19 50	3.36	215	"
148	17	00	075	00	04	03	02 45	3.62	235	"
150	15	59	074	56	04	03	09 17	3.28	225	"
152	15	00	075	01	04	03	16 00	4.19	250	Bongo only
154	14	00	075	00	05	03	23 10	2.52	180	Bongo/Neuston
156	13	06	075	04	05	03	06 30	3.10	210	Bongo only
158	11	59	075	01	05	03	14 15	3.01	193	"
160	11	10	075	00	06	03	20 00	3.30	200	"
161	15	10	080	00	08	03	01 05	2.93	190	Bongo/Neuston
163	16	10	080	00	08	03	09 45	3.75	240	"
165	17	00	079	57	08	03	15 00	2.79	210	"
166	21	30	085	00	10	03	22 15	3.80	220	"
167	21	30	085	16	10	03	01 27	2.89	220	"
169	21	29	085	32	10	03	05 26	3.54	215	Bongo only
170	21	30	085	47	10	03	08 10	3.06	205	Bongo/Neuston
171	21	29	086	04	10	03	10 35	3.52	225	"

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