# Ichthyoplankton Abundance and Diversity in the Eastern Gulf of Mexico

A report to the Bureau of Land Management
Prepared under Contract No. AA550-CT7-28

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## ABSTRACT

An ichthyoplankton survey, consisting of 17 cruises to the eastern Gulf of Mexico, was carried out from 1971-1974. Objectives of the survey were to determine the kinds and abundances of larval fishes, their distribution and diversity, and the relationship of their occurrence to environmental factors. From the egg and larval distributions, spawning areas and seasons were determined, and in some cases biomasses of adults were estimated. The surveys succeeded in providing important baseline data on the early life stages of fishes in the Gulf of Mexico. A total of 143,034 fish larvae were collected that included 91 families and 173 identified species. Most identified larvae were in the 10 most commonly collected families. The families Clupeidae and Gobiidae dominated larval catches at < 100 m deep stations while the Myctophidae were dominant at > 100 m deep stations. Annual abundances and mortality rates were estimated for the most common species. Adult biomasses of several species were estimated; pelagic fishes apparently have higher biomasses than demersal fishes in the eastern Gulf. There were no significant differences in ichthyoplankton diversity among years, seasons or between north and south sectors of the survey area; but diversity was significantly higher in offshore than in onshore zones. Effects of environmental factors on ichthyoplankton abundance were not clearly demonstrated but the modes and ranges of surface temperature, surface salinities and station depths where common species occurred were clearly defined. Positive affinities of some species with water of Loop Current origin, when it intruded into coastal areas, were demonstrated for several species. Future ichthyoplankton research in the Gulf of Mexico should emphasize the need to recognize many common, but presently unidentified, species and to apply this knowledge in analyses of ichthyoplankton at the community level, where environmental or exploitation effects are most likely to be noticed.

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EXECUTIVE SUMMARY

Planktonic eggs and larvae of fishes were collected on 17 cruises to the eastern Gulf of Mexico in 1971-1974. The survey area extended from latitude 24°45'N to latitude 30°15'N, encompassing the west Florida continental shelf and extending offshore to include continental slope and oceanic sampling areas. Objectives of the program were to determine the kinds and abundances of fish larvae and eggs as a means to understand the importance of the eastern Gulf of Mexico as a spawning area for fishes. Areas and seasons of ichthyoplankton occurrences were described and relationships of environmental variables to ichthyoplankton abundance were examined. Diversity and structure of the larval fish communities also were examined by both area and season. When possible, adult biomasses were estimated based upon estimated annual production of eggs or larvae and fecundities of the species involved. Summarized data and charted distributions of ichthyoplankton which are products of this research, are useful baseline information, to which future ichthyoplankton surveys in the Gulf of Mexico can refer.

A total of 143,034 larvae and 304,620 eggs were collected at 869 sampling stations during the surveys. Ninety-one families of larval fishes were identified, in which 161 genera and 173 species were included. The 10 most common families, in ranked order, were the Clupeidae (sardines and herrings), Gobiidae (gobies), Bothidae (left-eyed flounders), Myctophidae (lanternfishes), Serranidae (seabasses, groupers, sand perches), Carangidae (jacks, pompanoes), Synodontidae (lizardfishes), Ophidiidae (cusk eels, brotulas), Bregmacerotidae (codlets) and Labridae (wrasses). Two-thirds of all larvae that were collected were in those 10 families. Larvae of the Clupeidae (29,290 specimens) and Gobiidae (21,621 specimens) were most common and contributed 35.6% of the total larval catch. They were the dominant families of larval fishes in the eastern Gulf of Mexico in areas < 100 m deep. In areas > 100 m deep, the Myctophidae (7,223 specimens) were the predominant family of larvae. Larvae in some of the most common families (e.g., Gobiidae, Ophidiidae and Labridae) could not be identified to species, because larval stages of eastern Gulf of Mexico species have not been described.

A total of 59,701 larvae were identified to species, which is 41.7% of all larvae that were collected. Ninety of the 173 species that were identified were in the 20 most often collected families and those 90 species contributed 56,992 larvae, which is 95.5% of all larvae that were identified to species. Many more species than those actually identified are present as larvae in the eastern Gulf.

Four species of Clupeidae contributed 28,561 individuals to the collections. The most common clupeids were Spanish sardine *Sardinella anchovia* and Atlantic thread herring *Opisthonema oglinum*. Those two species also were the most common of all identified larvae collected during the surveys.

The 10 most commonly collected species of fish larvae in the eastern Gulf of Mexico were Spanish sardine Sardinella anchovia, Atlantic thread herring Opisthonema oglinum, round scad Decapterus punctatus, sand perch Diplectrum formosum, scaled sardine Harengula jaguana, dusky flounder Syacium papillosum, an undescribed codlet Bregmaceros Type B, the flounder Bothus robinsi, the gray flounder Etropus rimosus and a lightfish Maurolicus muelleri. These 10 species accounted for 46,637 larvae, which is 78.1% of all larvae identified to species. As in most animal communities, a relatively few species of larval fishes dominate the catches of eastern Gulf ichthyoplankton.

Annual abundances of larvae of some common species varied considerably from year to year. For 26 common species that were examined in detail most varied annually in abundance by factors ranging from 2.0 to 3.5 at sizes near metamorphosis. Some species, such as Sardinella anchovia and Bregmaceros Type A, were shown to vary annually by factors $\geq$ 20 times. The decline in abundance of larvae as lengths increased was a measure of apparent mortality rates. For the 26 species, only a single species, Bregmaceros Type B, could be shown to have significantly different apparent mortality rates among the years of the survey. Characteristic apparent mortality rates were associated with the kinds of larvae that were examined. Mortality coefficients, the magnitude of which are measures of the relative rates of mortality, increased among families in the following order: Clupeidae -- 0.3909; Gonostomatidae (lightfishes) -- 0.3947; Bothidae -- 0.4454; Bregmacerotidae -- 0.6244; Myctophidae -- 0.7313; Serranidae -- 0.8372; Scombridae (tunas and mackerels) -- 0.9651; Pomadasyidae (grunts) -- 1.0730; and Carangidae -- 1.0957. Sardine-like, long-bodied larvae, which probably grow in length at the fastest rates, have the lowest apparent mortalities while short-bodied, robust perciform larvae have the highest apparent mortality rates.

Biomasses of adults of a few of the commonest species were estimated based on egg or larval abundances and fecundities of spawning females. Only some clupeid species (e.g. Atlantic thread herring, Opisthonema oglinum, and round herring, Etrumeus teres) and the carangid Decapterus punctatus apparently have biomasses that exceed 100,000 metric tonnes in the eastern Gulf of Mexico. The biomass of the bothid Syacium papillosum is approximately 100,000 metric tonnes. A relatively large biomass (25,000-48,000 metric tonnes) of spawning bluefin tuna Thunnus thynnus was present during 1972 and 1973 in the survey area. From the biomass estimates that were made and available information on larval abundances of other species, it is probable that the total biomass of pelagic fishes in the survey area is between 1.5 and 3.0 million metric tonnes, while demersal species probably have an aggregate biomass less than 1.0 million metric tonnes. If the eggs of more species could be identified, and if fecundity estimates were available, the biomasses of more species could be estimated.

Largest catches of fish eggs and larvae were made in spring and summer. When the 94 most common species were considered, the mean number of species that occurred in cruises during each season was: winter -- 42.5 species; spring -- 57.2 species; summer -- 53.0

species; fall -- 54.3 species. The frequencies of individuals occurring in the various species were examined to determine the diversity of the ichthyoplankton community. There were no significant seasonal differences in larval diversity. Lowest diversity was recorded in summer when dominance of the community by abundant clupeid, bothid and carangid larvae was highest. Highest diversity was noted during fall when larval abundances were relatively low but numbers of species remained high.

Species diversity of ichthyoplankton did not differ significantly in 1971, 1972 and 1973. A mean diversity index value that measures species evenness for the three years was $J = .6927$. The index is the ratio of observed diversity to maximum possible diversity for the s species being considered. The index value, with .95 confidence lies between .6528 and .7326.

The mean number of species collected on cruises was higher in the southern (48.2 species) half of the survey area than in the northern (40.4 species) half. Despite the differences in species present, there were no significant differences in mean diversity between the two sectors. Species diversity values were highest in the southern sector on 6 of 10 cruises.

There were significant differences in ichthyoplankton diversity between areas where depths were < 50 m and > 50 m. Diversity was highest at offshore sites. There were, on average, more species per station present at > 50 m deep sites (9.17 - 10.41 species) than at shallower sites (4.33 - 6.65 species). Speciose families such as Myctophidae, were present offshore as were many kinds of larvae (e.g. Bothidae and Serranidae) that are present in both shallow and deep areas of the eastern Gulf. The mean number of species per cruise collected at > 50 m sites was 44.8, but only 26.9 species per cruise were sampled at < 50 m deep stations. In addition to few species being present at shallow sites, the ichthyoplankton was dominated there on many cruises by a relatively few species, usually clupeids such as Atlantic thread herring O. oglinum.

Ichthyoplankton diversity did not differ between Sanibel Island (latitude 26°30'N) and Tampa Bay (latitude 27°30'N) transects that were sampled on 11 cruises. The mean number of species per station was 8.1 for the Tampa Bay transect and 8.2 for the Sanibel transect.

Simple correlation coefficients between the 94 most common species and environmental variables were calculated. There were no clear linear correlations between abundances of a kind of larva and surface temperature, surface salinity, station depth or zooplankton volume. The choice of environmental variables may not have been the best possible for this analysis. Relationships among the variables probably should not be considered as simple, linear correlations. Another factor that tended to confound the analysis was the presence of Mississippi River flood runoff during summer 1973, which caused abnormally low surface salinities in the eastern Gulf and which could not be adequately accounted for in the analysis that was used.

A second approach was used to relate the occurrence of common larvae to environmental factors. Occurrences of larvae were examined as the cumulative percentage frequency distributions of larval occurrences in relation to the environmental factors. In this way the modes and ranges of temperatures, salinities and depths where the larvae were most often collected were determined. Seasonalities of occurrence were often apparent in the temperature-occurrence data and depth zonation was apparent in the depth-occurrence data. The range of surface temperatures over which eastern Gulf of Mexico larvae were collected usually was broad (10-15$^{o}$C), but most species were commonly collected only within a 5-8$^{o}$C range. Depth distributions were variable. Some species, such as the round scad, D. punctatus, occurred at all depths that were sampled while others, such as some myctophids, occurred only at depths > 100 m; still other species, such as pigfish Orthopristis chrysoptera and some sciaenid larvae, were rarely found at depths > 20 m.

The Loop Current is an important feature of the eastern Gulf of Mexico circulation. Its potential effect on transport or entrainment of oceanic kinds of larvae onto the continental shelf was examined. There was evidence that the Loop Current does influence the distribution of some kinds of larvae. Of 14 species that were examined, 10 of them occurred more frequently than expected in shallow water when Loop Current water was present. But, only six of those species could be shown to be significantly, positively associated with Loop Current water. Species that showed significant Loop Current affinities were the myctophids Myctophum nitidulum and Diogenichthys atlanticus, the gonostomatids Gonostoma elongatum and Vinciguerria nimbaria, and the bregmacerotids Bregmaceros atlanticus and Bregmaceros Type A.

Ichthyoplankton of the eastern Gulf is abundant and diverse. There are several species which serve to characterize the eastern Gulf habitat. Larvae that are particularly common and widespread, and which can serve as good reference species include the bothid flatfish Syacium papillosum, the carangid Decapterus punctatus and the serranid Diplectrum formosum. Other species of larval bothids also are key species in the eastern Gulf of Mexico and some clupeids like Sardinella anchovia or Opisthonema oglinum also fall into that category. For monitoring purposes the bregmacerotids should be included as key species, especially the two previously undescribed kinds, Bregmaceros Type A and Bregmaceros Type B, which occur consistently and in abundance at offshore sampling stations.

Results of this study have significantly increased our knowledge of the kinds and abundances of ichthyoplankton in the eastern Gulf of Mexico and they also have helped us to better understand some environmental conditions that are important to early life stages and for spawning populations of fishes in the region. The study has pointed out the need for additional research on early life stages of fishes in the eastern Gulf. The value of ichthyoplankton surveys in this region would be increased significantly if more kinds of eggs and larvae could be identified at the species level. Better ability to identify species would not only allow us to better delineate the egg or larval distributions of important species but would help us to understand the reproductive biology of adults better and, in some cases, to determine the adult biomasses and fluctuations in biomass that occur from year to year. There should be an attempt in future analyses of ichthyoplankton survey data to determine assemblages of ecologically similar larval fishes in the Gulf region. This approach would help to define communities among the ichthyoplankton and would allow better prediction or interpretation of potential environmental effects on fish communities. The community analysis approach almost certainly would offer a better means to examine influences of major phenomena such as the Loop Current on reproduction and recruitment of fishes in the Gulf of Mexico.

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# INTRODUCTION

Ichthyoplankton surveys were carried out on 17 cruises to the eastern Gulf of Mexico from 1971-1974. The extensive collections which resulted provided material upon which this report is based. A major objective of the report is to document the kinds and abundances of fish larvae that occur in the eastern Gulf and thus provide quantitative baseline information, not only on fish larvae, but also on the spawning areas used by some ecologically and economically important fishes. In addition, seasonality of occurrence and annual variations in larval abundances were considered. Larval abundances were compared among areas and by station depth. The diversity of larval fish assemblages was determined as were the relationships between larval occurrences and some physical-chemical factors. The Loop Current is an important feature of the eastern Gulf's physical oceanography (Maul, 1977) and its possible influence on distribution and transport of some larval fishes was examined. Larval mortality rates and adult biomass estimates (from the abundance of eggs or larvae) were obtained for selected species.

Ichthyoplankton collections upon which this report is based were obtained with financial support of a National Oceanic and Atmospheric Administration (NOAA) Sea Grant to the University of Miami. Objectives of that research were to determine adult biomasses and potential fishery yields of some clupeoid fishes from the eastern Gulf. Thus, only eggs or larvae in the families Clupeidae and Engraulidae were sorted from the samples and used in that research. Identification of all remaining taxa was undertaken as part of the present Bureau of Land Management (BLM) contract and analytical procedures were expanded to obtain a good understanding of factors that affect ichthyoplankton abundance and diversity.

The earliest cruises (1971-1972) were part of the interdisciplinary EGMEX and Western Florida Continental Shelf Program (Rinkel, 1974). Subsequent cruises were carried out by the University of Miami alone, but temperature and salinity data from those cruises and earlier cruises were analyzed and results were reported as part of a BLM MAFLA contract (SUSIO, 1975). Included in that SUSIO report (BLM Contract No. 08550—CT4—16) was a brief summary of the seasonal abundances and distributions of total zooplankton, fish eggs and larvae in the eastern Gulf (Houde, 1975). Houde and Chitty (1976) published results of that preliminary analysis (taxa were not identified) which indicated that there was a distinct seasonal character to variability in zooplankton biomasses and to total production of fish eggs and larvae.

Results of the Sea Grant-supported study on sardine-like fishes and their potential for exploitation also have been published (Houde, 1976). Detailed studies on three clupeid species provided estimates of their biomasses as well as the first information on their early life histories in the eastern Gulf of Mexico (Houde, 1977a, 1977b, 1977c).

Under the present BLM contract two Master's theses were completed by students who assisted on the project. Leak (1977) analyzed the data for larvae in the family Carangidae (jacks) and Dowd (1978) reported on larvae in the family Bothidae (left-eyed flatfish). Their objectives were similar to overall BLM project goals and data from their analyses are incorporated into this report. Because carangid and bothid larvae are among the most abundant in the eastern Gulf, the two theses were important information sources for this report.

Ichthyoplankton can provide a wealth of information about communities of fishes, particularly on early life stages, which are often the most environmentally sensitive and on the oceanographic conditions that are correlated with spawning activity by the fishes. We believe that information contained in this report will not only provide needed baseline information on larval kinds and abundances but also can be used to infer much about the ecology and life history of adult stages. Increasing use by man of continental shelf resources in the eastern Gulf, which includes exploration for hydrocarbons and significant fishing activity, possibly will alter the environment or impact stocks of demersal and pelagic fishes. Should such changes occur, results of our research will provide the means to judge how much the reproductive biology of the stocks has been affected and will help managers to develop sound strategies to manage eastern Gulf of Mexico resources.

# METHODS

## Cruises and Sampling Stations

There were 17 cruises, each of 7 to 19 days duration, in which 13 to 146 stations were sampled for ichthyoplankton (Table 1). The survey area extended from latitude 24°45' N to latitude 30°15' N (Figure 1). Designated sampling stations (except for Cruise GE7101) were on transects spaced at 28 km intervals and were parallel to lines of latitude. The GE7101 cruise, which was a preliminary sampling effort, was anomalous in many respects (for completeness, data from that cruise are included in the report). Stations were spaced at 28 km intervals, except offshore of the shelf break where the interval was increased to 56 km. Stations were located where water depths ranged from < 10 m to > 3000 m. Not all stations (Figure 1) were sampled on each cruise. Stations that were sampled on each cruise are given in Figure 2. Some stations, in addition to those illustrated in Figure 1, at depths < 10 m, were sampled on cruises CL7405 and CL7412 (Figure 2). Additional information about the cruises, ships and stations was given by Rinkel (1974) and, in particular, by Houde et al. (1976).

There were five cruises in 1971, 1972 and 1973 and two in 1974 (Table 1). A relatively stable pattern of sampling was established beginning with cruise IS7205. Prior to this cruise, the sampling effort depended to some extent on needs of other EGMEX investigators and on available ships. The sampling effort beginning with IS7205 was related only to the ichthyoplankton program. Houde et al. (1976) give additional details and the rationale for the sampling plan.

## Sampling

A total of 869 stations was sampled on the 17 cruises. Station data that include station position, depth of tow, volume filtered, surface temperature, surface salinity, zooplankton volume and total numbers of fish eggs and larvae have been summarized and tabulated (Houde et al., 1976). Collections were made with a 61-cm bongo net sampler (Posgay, Marak and Hennemuth, 1968), except for cruise GE7101 and TI7114 in which an ICITA, 1-m diameter, 505 μm mesh plankton net was used. Catches were preserved in 10% seawater formalin and buffered with marble chips. After being brought to the laboratory, catches were transferred to a 5% formalin solution. Fish eggs and larvae were sorted from catches of the 505 μm mesh net on the bongo sampler. Zooplankton volumes (cc per 1000 $m^3$ of water strained) were determined from the bongo net's 333 μm mesh net.

Oblique tows were made to within 5 m of bottom or to 200 m depth at deep stations. For cruises GE7101 through 8B7201 - GE7202 the tow consisted of wire release at 50 m $min^{-1}$ and wire retrieval at 20 m $min^{-1}$. On remaining cruises two types of tow were made, the choice depending on depth of the station. At stations < 55 m deep a 5 min tow was made, consisting of 1 min for wire release to desired depth and 4 min retrieval. This type of tow resulted in an average volume of 100 $m^3$ being sampled. At stations > 55 m deep wire was released at 50 m $min^{-1}$ to desired depth and retrieved at 20 m $min^{-1}$. Volumes filtered in those tows varied from 100-400 $m^3$, depending on the station depth. Houde (1977a) summarized the tow characteristic statistics for the two kinds of tow.

A flowmeter was placed in the mouth of the 505 µm mesh net to estimate the volume filtered. A time-depth recorder was attached to the sampler to record tow characteristics. Towing speed was 3.0-3.5 knots (1.5-1.8 m $sec^{-1}$) in 1971, but was reduced to an average speed of 2.3 knots (1.2 m $sec^{-1}$) in 1972-1974. Tows were made during both day and night; a station was sampled when the ship occupied it. Nets were towed from the side of all vessels except R/V CALANUS, from which tows were made at the vessel's stern (cruises CL7405 and CL7412).

The types of tows that were employed probably are adequate to obtain good quantitative estimates of ichthyoplankton abundance for most species. For some kinds of larvae, such as istiophorids and exocoetids, which inhabit the neuston and which are especially agile swimmers, the bongo net samples may underestimate true larval abundance. Even for these kinds of larvae, the bongo net sampler can produce a good estimate of relative abundance among stations, although the true abundance may not have been determined.

Temperatures and salinities were obtained at each station[1] from surface to 200 m depth. A mechanical bathythermograph (BT) provided a trace of the temperature structure at each station. The BT cast was followed by a hydrocast consisting of 1.7 l Niskin bottles equipped with reversing thermometers or by a salinity-temperature-depth (STD) cast (cruises IS7308 and IS7320 and some stations on IS7311 and IS7313). Rinkel used these data to produce charts of the distribution of temperature, salinity and sigma-t (Rinkel, 1974; SUSIO, 1975) at surface and at 10 m depth intervals. He also illustrated vertical profiles of these properties along selected sampling transects.

<u>Laboratory Procedures</u>

All fish eggs and larvae were sorted from 505 µm mesh net catches. Zooplankton volumes were determined from 333 µm bongo net catches (Houde and Chitty, 1976) using a displacement volume method like that described by Thrailkill (1969) and Kramer <u>et al</u>. (1972). Eggs and larvae of clupeid and engraulid fishes were identified, removed and used for Sea Grant-supported research. The remainder of the ichthyoplankton was counted and stored in 5% formalin. When BLM funding was available in 1977, these larvae were identified and form the basis of this report.

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[1]Data are on file at the National Oceanographic Data Center, Washington, D.C. and can be retrieved from the MAFLA file.

Identifications were made using the extensive descriptive literature collections of the Principal Investigators. Larvae of many fishes from the eastern Gulf of Mexico are undescribed, so that the identification task was difficult. Many larvae could be identified only to the family level. A relatively small number remained as "unidentified larvae." Except for clupeids, no fish eggs were identified. Some could have been identified, but the effort involved would not have been justified by the relatively few identifications that would have resulted. An initial effort was made to identify eggs, but it was abandoned when it was clear that little progress was being made.

Identifications of larvae were made with the aid of binocular microscopes. All larvae that were identified to species were measured to the nearest 0.5 mm standard length using an ocular micrometer.

Eel larvae (Anguilliformes) were identified by Dr. David G. Smith, University of Texas Biomedical Institute and most of the scombrid larvae were identified by Mr. Thomas Potthoff, National Marine Fisheries Service, Miami. Confirmation of our driftfish, Ariommidae, identifications was provided by Dr. John L. Butler, National Marine Fisheries Service, La Jolla.

## Analytical Procedures

Descriptions of analytical procedures used for the clupeid and engraulid research have been published previously (Houde et al., 1976; Houde, 1977a). Many of the techniques used for the present study were adapted from that earlier work and are not given in detail here. A brief summary of those methods is presented.

A computer program "ELSUM" was used to estimate the abundances of larvae that were identified at each taxonomic level for each station that was sampled on each cruise. An index of abundance at each station was the estimated number under 10 $m^2$ of sea surface. This index is

$$n_j = \frac{C_j Z_j}{v_j} \cdot 10$$

where $n_j$ = the number of individuals (eggs or larvae) at station j under 10 $m^2$ of sea surface.

$C_j$ = the catch of eggs or larvae at station j.

$Z_j$ = the depth of tow (in metres) at station j.

$v_j$ = the volume filtered by the net (in cubic metres) at station j.

Total abundance was the number estimated in the area represented by the station. Station total abundances were summed to give the estimated number of larvae in the area represented by the cruise. A cruise index of abundance was the estimated mean number of each taxon under 10 $m^2$ of sea surface for the entire cruise area. This index is

$$N_i = \frac{\sum_{j=1}^{k} n_j a_j}{A_i}$$

where $N_i$ = the mean number of eggs or larvae of a taxon under 10 $m^2$ of sea surface for cruise i.

$n_j$ = the number of eggs or larvae at station j under 10 $m^2$ of sea surface.

$a_j$ = the area (in square metres) representing station j.

$A_i = \sum_{j=1}^{k} a_j$ = the summed station areas = the area representing cruise i (in square metres).

k = the number of stations in cruise i.

A length-frequency distribution (estimated abundances in each 0.5 mm length-class) at each station and for the entire cruise was printed out for all larvae that were identified to species.

Differences in both the index of abundance (number under 10 $m^2$ sea surface) and estimated total abundance were the criteria used to determine if seasonal or annual differences occurred for the most abundant taxa. Charts of the estimated distributions and abundances of important taxa were made to illustrate seasonal and annual shifts in numbers of larvae and areas of occurrence.

Differences in abundances of common species were compared between northern and southern sectors of the survey area and also between onshore and offshore zones. Latitude 27°15' N was the line separating the northern from the southern half of the area, while the 50 m isobath was arbitrarily selected as the dividing line between onshore and offshore zones (Figure 1). Charted distributions of larval abundances and analysis of occurrence data were used as the criteria to delineate important spawning areas and to interpret seasonal or annual changes that were observed. Some interpretations were made at the family level in addition to those for common species.

Biomasses of adults were estimated from the abundances of eggs or earliest stage larvae. If an estimate of eggs or youngest larvae produced annually can be made, and if the fecundity or adult females and sex ratio of adults is known, then biomasses can be estimated from the relationship: $B = P_a F_r^{-1} K^{-1}$, where

B = biomass of adults (grams)

$P_a$ = number of eggs (or youngest larvae) produced annually

$F_r$ = relative fecundity (ova per gram)

K = proportion of adults that is female.

The use of this technique and modifications of it to obtain biomass estimates for eastern Gulf fishes has been discussed by Houde (1977a) for clupeids and by Leak (1977) for carangids. We were able to estimate biomasses for only a few fishes because eggs usually could not be identified and because fecundity estimates were not available for most species.

Measures of diversity were used to examine relationships among kinds and abundances of larvae. Estimates of diversity were used to determine how numbers of species and their abundances in the ichthyoplankton community varied seasonally, annually and between the north-south and onshore-offshore sectors of the survey area. In 1973, when all five cruises sampled the same transects and, with few exceptions, the same stations, diversity was measured at each station. Diversity at stations located on transects off Tampa Bay and Sanibel Island was determined for all cruises where those transects were sampled.

Diversity was estimated using the information theory measure H' (Pielou, 1974; Poole, 1974) and Simpson's measure of diversity C (Simpson, 1949; Poole, 1974; May, 1975). In addition, species richness R (Margalef, 1968) was estimated for 1973 cruises. A taxocene (the group of organisms under study) of 94 species of larvae for which 10 or more individuals had been collected during the 17 cruises was designated and used in all diversity calculations.

Shannon-Weaver diversity was estimated from the equation,

$$H' = -\sum_{i=1}^{s} p_i \log_e p_i$$

where s is the number of species in a collection and $p_i$ is the proportion of individuals in the ith species. Our values for $p_i$ in the diversity estimates were based on the ratio of the estimated abundances of each species in the collections relative to the total estimated abundance of the s species in the collection. The maximum value of H' is $H'_{max} = \log_e s$. The Shannon-Weaver estimator is biased, especially for collections that sample a relatively small part of the habitat, which is the case in ichthyoplankton surveys. Hutcheson (1970) proposed use of the following series to obtain the expected value of H'.

$$H' = -\sum_{i=1}^{s} p_i \log_e p_i - \frac{s-1}{2N} + \ldots\ldots\ldots$$

The first two terms in this series usually are sufficient to correct for sampling bias (Poole, 1974) and we used the above expression to estimate H'. The value of N in the above expression is the total number of individuals of the s species in the collection. Estimates of the variances of H' were made for cruise, north-south and onshore-offshore diversity measures using the equation given by Hutcheson (1970)

$$\mathrm{Var}\,(H') = \frac{\sum_{i=1}^{s} p_i\,(\log_e p_i)^2 - \left(\sum_{i=1}^{s} p_i\,\log_e p_i\right)^2}{N} + \frac{s-1}{2N^2} + \ldots .$$

The evenness of distribution of individuals among s species was estimated from

$$J = {}^{H'}/_{H'_{max}}$$

If individuals of each of the s species in a collection are equally abundant the value of J is 1.0. Lower values of J indicate the degree to which a community may be dominated by some species that are relatively abundant in collections.

Simpson's index of diversity was estimated according to the equation

$$C = \sum_{i=1}^{s} \frac{n_i\,(n-1)}{N\,(N-1)}$$

where $n_i$ is the number of individuals representing the ith species and N is the total number of individuals in the s species. The index estimates the probability of randomly drawing two individuals of the same species in sequence. Thus, a value of C near 1.0 indicates that the community is dominated by one or a few species.

Species richness was estimated only for the November, 1972 and all 1973 cruises. The index was calculated for the cruise, for onshore-offshore zones and for north-south sectors for the six cruises where sampling effort was nearly identical. The estimator is

$$R = s-1/\log_e N$$

where s is the number of species represented and N is the number of individuals in the s species.

Apparent mortality was measured by the decrease in estimated abundances of larvae in successive length classes. For selected species annual estimates of the rate of decline in abundance were made or, for species that were less common, a mean rate of decline for pooled 1971-1973 data was estimated. Rates of decline were estimated from the exponential regressions of estimated abundances of larvae in either 0.5 mm or 1.0 mm length-classes on lengths (Houde, 1977a). These estimates are termed "apparent mortality" because they do not account for increased avoidance capabilities of larvae as they grow, nor do they account for possible changes in growth rates of larvae during development.

Simple linear correlations of $\log_{10}$ abundance of selected fish larvae species with water depth, surface temperature, surface salinity and plankton volume were made. Correlations were carried out only for samples where larvae occurred, because zero occurrences often were from areas where the particular species of larva never occurred. Abundances, expressed as numbers under 10 $m^2$ of sea surface, were transformed to $\log_{10}$ abundances before the correlations were run to help homogenize variances.

Possible effects of Loop Current transport or entrainment of offshore species of fish larvae onto the shelf were examined by relating occurrences of larvae to the presence of $\geq$ 36.5 $^o/oo$ salinity water. Intrusions of such high salinity water represent Loop Current penetration onto the shelf or eddies that have broken away from the Loop and moved across the shelf. Rinkel (SUSIO, 1975) charted the occurrences of such water in the eastern Gulf for the 17 cruises contributing to our study. Transparent overlays of these charts for cruises 8C7113-TI7114, 8C7120-TI7121, 8B7201-GE7202, IS7209 and all 1973 cruises were made which were compared to charted distributions of the larvae of interest. The numbers of positive station occurrences were noted for the species within the $\geq$ 36.5 $^o/oo$ water and at lower salinities in each of three depth zones (< 50 m, 50-100 m, > 100 m). Resulting data were pooled from all cruises and tabulated. Occurrences were tested for independence with respect to salinity and depth in a contingency chi-square analysis. Significant chi-squares were examined to determine if the large components of chi-square resulted from occurrences of a species at shallow stations with $\geq$ 36.5 $^o/oo$ salinity. Such conditions were judged to indicate a Loop Current entrainment effect.

## Computer Programs and Disposition of Data

Station parameter and larval catch data for each cruise have been stored on a program file at the University of Miami computer facility. These data will be transferred to the National Oceanographic Data Center (NODC). Hydrographic data from the 17 cruises have already been processed and are stored at NODC in the MAFLA file. Biological data from the earlier Sea Grant-supported clupeid and engraulid ichthyoplankton research were sent to NODC previously and can be retrieved through Accession Number 761430.

A computer program "ELSUM" was used to list taxa and numbers of observations, calculate estimated abundances and indices of abundance, and print out length-frequency distributions for taxa identified at the species level.

Other programs were written to interface the ELSUM data with standard statistical programs. Using the summarized ELSUM output, diversity and mortality estimates were made in the laboratory on desktop calculators.

Much of the individual station data has not been summarized on a station by station basis for this report. These data include frequencies of occurrence and lengths of larvae that were collected at each station. Detailed analyses of the abundances and size structures of larval populations within the survey area could be undertaken by retrieving these data at some future time.

## Storage of Samples

Most eggs and larvae are being stored in 5% formalin at the University of Miami. Syngnathidae (pipefishes) were sent to Mr. C.E. Dawson, Gulf Coast Research Laboratory, Ocean Springs, Mississippi. Elopidae (tarpon, ladyfish) were sent to Dr. David Smith, University of Texas Biomedical Institute, Galveston, Texas. Larvae of the groupers (Epinephelinae) were sent to Dr. David Johnson, Marine Resources Research Institute, Charleston, South Carolina. Larvae of Ophichthidae (snake eels) and Lutjanidae (snappers) probably will be sent within the next few months to investigators who have requested this material.

# RESULTS

## Kinds and Abundances of Ichthyoplankton

A total of 143,034 larvae and 304,620 eggs was collected at 869 stations in 17 cruises to the eastern Gulf of Mexico between 1971 and 1974 (Table 1). Ninety-one families of larval fishes were identified (Table 2). These families included 130,541 individuals, or 91.3% of all larvae that were collected. Larvae not identified at the family level usually were mutilated too badly to be identified, but in some cases the larvae were not known. The 10 most frequently observed families, in ranked order, are presented in Table 3 for each of the 17 cruises. The 20 most frequently observed families, summed over all cruises, are listed in Table 4. In the identified families, we recognized 161 genera and 173 species (Tables 5–21). Tables 5–21 contain the numbers of observations, estimated total abundances in the cruise area, and mean number under 10 $m^2$ of sea surface for each taxon that was recognized in the 17 cruises. These tables contain the most basic data in the report. For three of the 10 most numerous families, no individuals were identified at the generic or specific level (Table 4).

Most of the larvae were in a relatively few families (Tables 2–4). The 20 most frequently observed families included 82.8% of all larvae that were collected and the 10 most numerous families included 66.6% of all larvae. Families that predominated on individual cruises (Table 3) usually were the same ones that had the highest ranked abundances for all cruises combined, but some differences were observed that reflect seasonality of spawning and also, in some cases, differences in stations that were sampled.

A total of 59,701 larvae were identified to species (Tables 5–21) which is 41.7% of all larvae collected. Ninety of the 173 identified species were in the 20 most common families. Those 90 species included 56,992 individuals which represented 39.8% of all larvae collected and 95.5% of all larvae that were identified to species. Success in identifying larvae varied among families. More than 50% of the larvae in 6 of the 20 most common families were identified to species (Table 4).

Larvae of Clupeidae (sardines and herrings) were most common in eastern Gulf collections, comprising 29,290 individuals, 20.5% of all larvae collected (Tables 2–4). The Gobiidae (gobies) were second in frequency of occurrence, with 21,621 individuals, 15.1% of all larvae. Clupeid larvae usually were identified to species. Gobiids were not identified below the family level. Larvae of Bothidae (left-eyed flounders) were third most common (6.4%) followed by Myctophidae (lanternfishes) (5.1%) and Serranidae (seabasses) (4.9%). The five most common families included more than 50% of all larvae that were collected. In those five families, 44,517 larvae were identified to species, 74.6% of all species identifications.

Other families among the 20 most common (Table 4) which had many individuals identified to species, were Carangidae (jacks) (3.9%), Bregmacerotidae (codlets) (2.6%), Gonostomatidae (lightfishes) (1.7%) and Sparidae (porgies) (1.2%). Some families such as the Scombridae (tunas and mackerels) (0.9%) were not among the 20 most common families (Table 2) but they were common and many individuals were identified to species. Families that occurred most frequently and which also had many species identifications, were selected to describe temporal and areal variability in larval abundances in the eastern Gulf. In this way we gained an understanding of spawning patterns, seasonal trends in ichthyoplankton abundance and diversity, and relationships between larval occurrences and the eastern Gulf environment.

A descriptive account follows on the occurrences and abundances of families for which larvae were collected. Some information also is provided about important species that were identified in each of the families. The account is based on information tabulated for this report, especially in Tables 2–4, 5–21, 22–38, and 39. Some of these species are considered again in later parts of the report that deal with specific aspects of their distribution or biology.

1. Elopidae (6 larvae; 2 genera; 2 species)

Five small larvae of the tarpon Megalops atlantica were collected on two cruises in June-July (GE7117, IS7311) at stations where water depth was > 50 m. A single larva of the ladyfish Elops saurus was collected at a station < 50 m deep in November (IS7209).

2. Clupeidae (29,290 larvae; 5 genera; 4 species)

Larval sardines and herrings were the most common larvae in our collections. Clupeid larvae were included in the 10 most frequently observed families on 15 of the 17 cruises and were the most common family on eight cruises. Most occurred in shelf waters over depths < 30 m, but larvae of Etrumeus teres and sometimes Sardinella anchovia occurred farther offshore. Houde (1977a, 1977b, 1977c) and Houde et al. (1976) have reported on these larvae in earlier publications. The following account gives new information and summarized the published data.

Brevoortia spp. (92 larvae)

Larvae of Brevoortia (menhaden), possibly two species, B. smithi and B. patronus, were collected on four fall and winter cruises and two occurrences were observed on spring cruises. They occurred at < 30 m depths and were less common than any of the other clupeids, suggesting that menhaden populations are relatively small in the eastern Gulf.

Etrumeus teres (1,089 larvae)

Round herring larvae were common on 10 fall, winter and spring cruises, with peak abundances in winter (Figure 3). Larvae of E. teres were among the 20 most frequently observed, identified species on eight of the 17 cruises and also were among the 20 most abundant species (no. under 10 $m^2$) on eight of the cruises, when mean abundances ranged from 1.7 to 21.5 under 10 $m^2$. Most occurrences (75%) were between the 30 and 100 m isobaths (Figures 4 and 5). They are most abundant off Tampa Bay and north of the Tortugas. Houde (1977a) gave a detailed account of round herring larvae and adult biomass in the eastern Gulf.

Harengula jaguana (3,846 larvae)

Scaled sardine larvae were common along the entire coastline at depths < 30 m in spring and summer (Figures 6-8), and occurred rarely in fall and winter cruises in the southernmost part of the survey area. They were collected on 12 of the cruises. Larvae of H. jaguana were among the 20 most frequently observed, identified species on eight of the 17 cruises and were among the 20 most abundant (no. under 10$m^2$) families on six cruises, when mean abundances ranged from 0.4 to 14.4 under 10 $m^2$. They were more abundant in 1973—1974 cruises than in 1971—1972 (Figure 6). Houde (1977c) gave details of scaled sardine larvae and adult biomass in the eastern Gulf.

Opisthonema oglinum (11,315 larvae)

Thread herring were the second most common clupeid larva. Spawning occurs mostly during spring and summer and most larvae (80%) were collected at stations < 30 m deep (Figures 9-11). Larvae of O. oglinum were collected on 11 cruises and were included in the 20 most frequently observed species on each of those cruises. They were the most frequently observed species on six cruises. Thread herring larvae were among the 20 most abundant species on nine cruises, when mean abundances ranged from 0.3 to 172.8 under 10 $m^2$. The abundance of larvae indicates a large adult biomass in the eastern Gulf. Larvae in the eastern Gulf and adult biomasses were discussed by Houde (1977b).

Sardinella anchovia (12,311 larvae)

Spanish sardine was the most common clupeid larva. This species was collected on 15 cruises. A possibly anomalous catch of 4,098 larvae was made on cruise CL7412 (Table 21), which may have inflated numbers of observations and estimated abundances. Annual mean abundances apparently fluctuated greatly during the period 1971—1974. Larvae of S. anchovia were more abundant in 1972 than in other years (Figure 12). Larvae occurred in all months, but late summer apparently is the peak spawning season. In winter, occurrences were noted only in the southern one-fourth of the survey area. Most occurrences (92%) of S. anchovia larvae were at stations < 50 m deep, but these larvae frequently were collected at stations between the 50 and 200 m isobaths (Figures 13 and 14). Spanish sardine larvae occurred over a wider range of depths in the eastern Gulf than did other clupeid larvae. This indicates that the apparently large adult population also is more widely distributed than populations of other clupeid species in the eastern Gulf.

3. Engraulidae (2,880 larvae)

Anchovy larvae were the twelfth most common family, but none were identified to species. Several species may be present. Occurrences were most frequent in waters < 50 m deep but some larvae were collected offshore. Larvae occurred on all 17 cruises and at all seasons, but were most abundant in spring and summer when 88.2% of the larvae were collected. Most engraulid larvae (62.5%) were collected in the northern half of the survey area, implying that adult populations are more abundant in that sector. The relative abundance of engraulid larvae is much less than that of clupeid larvae in shelf waters of the eastern Gulf indicating that adult biomasses of engraulids also may be significantly smaller than those of clupeids.

4. Argentinidae (45 larvae; 3 genera)

Argentine larvae were collected on 10 cruises. Specimens of *Argentina* spp. (31 larvae), *Nansenia* spp. (4 larvae) and *Microstoma* spp. (1 larva) were collected. All, except two larvae of *Nansenia*, occurred at stations > 50 m deep. Argentinids occurred at all seasons. Argentine larvae are uncommon in the eastern Gulf but occurrences are not rare in offshore waters.

5. Bathylagidae (11 larvae; 1 genus)

Deepsea smelts, collected on seven cruises, were represented by *Bathylagus* spp. All specimens were collected at stations where depth was > 50 m and some were collected in all seasons. Larvae are uncommon in the deep shelf and slope waters of the eastern Gulf.

6. Gonostomatidae (2,486 larvae; 11 genera; 12 species)

Lightfishes were the fourteenth most common family observed in the collections. They were collected on 15 cruises and were present on all cruises that sampled stations at depths > 50 m. Occasionally, some larvae were collected at stations < 50 m deep. Gonostomatids were among the 10 most frequently observed families on 5 of the 17 cruises. Four genera were most common: *Cyclothone* — 425 larvae; *Gonostoma* — 169 larvae; *Maurolicus* — 1,102 larvae; *Vinciguerria* — 350 larvae. *Maurolicus muelleri* is one of the most commonly observed and abundant fish larvae in samples from offshore waters of the eastern Gulf.

*Cyclothone* spp. (425 larvae)

Larvae of *Cyclothone* were not identified to species. They were collected on 15 cruises and occurred at offshore stations in all seasons (Figure 15). Mean abundances for the entire cruise area ranged from 1—9 under 10 $m^2$ for cruises where they occurred, except for CL7412 in which only three offshore stations were sampled and in which a single *Cyclothone* spp. larva was collected.

Gonostoma elongatum (161 larvae) and G. atlanticum (4 larvae)

Larvae of G. elongatum were collected on 12 cruises and were common in all seasons at offshore stations (Figures 16 and 17), occurring only rarely at stations < 100 m deep. They were the third most commonly observed gonostomatid larva in the collections. A second species, G. atlanticum (4 larvae) was collected on two summer cruises (IS7205, IS7313). It apparently is far less common than G. elongatum in the eastern Gulf.

Maurolicus muelleri (1,102 larvae)

This is the most abundant gonostomatid larva in our collections. It was observed on 14 of the 17 cruises. Its estimated abundance in 1973 was much higher than in other years (Figure 18) but it was common in all years. Maurolicus muelleri usually occurred at stations > 100 m deep (85% of all occurrences) but occasionally was observed at shallower depths. There was evidence that this species may be most common in summer, but specimens were collected at all seasons (Figures 19 and 20). Larvae of M. muelleri were among the 20 most frequently observed species on 10 cruises and were among the 20 most abundant species on 11 cruises. On those 11 cruises mean abundances ranged from 1.0 to 54.7 larvae under 10 $m^2$ for the entire cruise area. On cruise IS7313, M. muelleri was the most abundant larva identified to the species level.

Vinciguerria spp. (350 larvae)

Three species were identified. Vinciguerria nimbaria (166 larvae) was most common; V. poweriae (127 larvae) was next in abundance; and V. attenuata (51 larvae) was observed the fewest times. All three species usually occurred at stations where water depths were 50 m or deeper (Figures 21-24). There is evidence of seasonality in the occurrence of V. nimbaria; larvae were more abundant in spring-summer when 78.3% were collected, than at other seasons (Figure 25). Distributions and abundances were not plotted by cruises for the two less common species, but tabulated abundances and the plotted seasonal mean abundance of V. poweriae (Figure 26) give no hint of any strong seasonal differences. For cruises where they occurred, mean abundances under 10$m^2$ ranged from 0.1–3.6 for V. nimbaria, 0.1–2.1 for V. poweriae and 0.1–0.9 for V. attenuata. Though common in offshore waters of the eastern Gulf, Vinciguerria spp. larvae were rarely among the 20 most frequently observed species on cruises. This contrasts with Ahlstrom's (1971) data from the eastern tropical Pacific, where Vinciguerria spp. were the second most abundant kind of larva in his collections.

Other gonostomatids (22 larvae)

Seven additional genera (six species identified) were collected. Polymetme (?) Type I (15 larvae) was collected on five cruises, always at stations > 50 m deep. Other gonostomatids were Margrethia obtusirostre (1 larva), Ichthyococcus ovatus (2 larvae), Pollichthys mauli (1 larva), Diplophos spp. (1 larva), Valenciennellus tripunctulatus (1 larva) and Bonapartia pedaliota (1 larva).

7. Sternoptychidae (166 larvae; 3 genera)

Sternoptychids were collected on 10 cruises. Three genera of sternoptychids were recognized but larvae could not be identified to species. Argyropelecus spp. (70 larvae) and Sternoptyx spp. (75 larvae) were most common. Excepting a large catch of Sternoptyx spp. on cruise 8C7120—TI7121 individuals of Argyropelecus spp. were usually about twice as abundant as Sternoptyx spp. The third kind of larva, Polyipnus spp. (3 larvae) occurred only on a single cruise (TI7131—8B7132). There was no indication of seasonality in occurrence or abundance of hatchetfish larvae in the eastern Gulf. A few larvae occurred on most cruises where stations > 50 m deep were sampled. Argyropelecus spp. was observed on 10 cruises and Sternoptyx spp. was observed on eight cruises. All sternoptychids, except one larva, were collected at stations > 50 m deep.

8. Stomiatidae (16 larvae; 1 genus; 1 species)

A single specimen of Stomias affinis was identified. The remaining 15 larvae were Stomias spp. Larvae were collected at all seasons and occurred on nine cruises. All occurrences were at stations > 50 m deep.

9. Chauliodontidae (24 larvae; 1 genus)

All specimens were Chauliodus spp. Larvae occurred on nine cruises; there was no apparent seasonality in their occurrence. Twenty-two of the 24 larvae were collected at > 50 m stations; the two exceptions were collected on cruise GE7101 in the southernmost part of the survey area where the isobaths converge rapidly bringing oceanic waters in close proximity to the shelf.

10. Astronesthidae (1 larva)

A single larva was collected on cruise GE7208 at an offshore station. It was not identified to species.

11. Melanostomiatidae (30 larvae)

Melanostomiatid larvae occurred on nine of the cruises. None were identified to genus or species. Some larvae were collected at all seasons, but 23 of the 30 specimens were taken in fall and winter suggesting that these larvae may be more abundant in those seasons. All larvae occurred at stations > 50 m deep.

12. Synodontidae (4,294 larvae; 2 genera; 2 species)

Lizardfish larvae were the seventh most frequently observed family. Larval synodontids occurred on all 17 cruises. Only 10 specimens, which were transforming or metamorphosed, were identified to species. A directed effort to solve systematic problems on small larvae in this family could result in many larvae being identified. Larvae were collected throughout the survey region and at all seasons although they were most frequently collected in spring-summer (74.5% of the larvae). Larvae occurred with the same frequency in northern and southern sectors of the survey area. Most larvae (67.0%) occurred at stations > 50 m deep. Eight specimens were identified as Saurida brasiliensis and two as Synodus foetens. Other species almost certainly are present in the collections. Larvae of synodontids were abundant at all seasons, with mean abundances exceeding 10 larvae under 10 $m^2$ of sea surface on 12 of the 17 cruises.

13. Aulopidae (5 larvae; 1 genus; 1 species)

Five larvae of Aulopus nanae were collected. A single specimen was taken on each of five cruises; all were collected at stations > 50 m deep.

14. Scopelarchidae (28 larvae)

Scopelarchids were collected on nine cruises; they occurred in all seasons. No attempt was made to identify them to species. All except one larva were taken at stations > 50 m deep.

15. Evermannelidae (6 larvae; 1 genus; 1 species)

A single specimen, Coccorella atrata, was identified to species. The six specimens of evermannelids were collected on five cruises at stations > 50 m deep. No seasonality was apparent.

16. Paralepididae (292 larvae)

Larvae of paralepidids were collected frequently at offshore stations, occurring on 13 of the 17 cruises. They were not identified to species. Paralepidids occurred at all seasons, but 229 of the 292 larvae that were collected were taken in spring-summer. Larvae of paralepidids were collected in near equal numbers at stations in the northern and southern sectors of the survey area. Except for one larva, all were found at stations > 50 m deep.

17. Myctophidae (7,223 larvae; 16 genera; 25 species)

The Myctophidae is a speciose family whose larvae are relatively well known. They were collected on all 15 of the cruises where stations > 50 m deep were sampled. Lanternfishes were the fourth most frequently observed family, even though relatively few offshore stations were sampled compared to stations at < 50 m depth. Myctophid larvae dominated the catches from stations at depths > 100 m. All except 245 myctophid larvae were identified to genus or species. The genus Diaphus was most common in our collections, but identification of its larvae to species was seldom possible. Other common myctophids were Notolychnus valdiviae, Myctophum nitidulum, M. selenops, Ceratoscopelus warmingi, Hygophum reinhardti, Benthosema suborbitale and Diogenichthys atlanticus. These seven species included 1,709 larvae, 23.7% of the myctophids that were collected.

Diaphus spp. (3,646 larvae)

Larvae of Diaphus spp. comprised 50.5% of all myctophids that were collected. They were common during all seasons and it was not unusual to collect small numbers at stations shallower than 50 m (Figures 27 and 28). Several species of Diaphus occur in the eastern Gulf and larvae could not be identified to species. A few transforming or metamorphosed specimens were identified. The most common was D. dumerili (7 specimens); other species, represented by single individuals, are D. lucidus, D. taaningi and D. bertelseni.

Notolychnus valdiviae (267 larvae)

Larvae of N. valdiviae occurred on 12 cruises and were found throughout the eastern Gulf at stations > 100 m deep (Figure 29). A few occurrences (20%) were recorded at 50–100 m depths. Abundances usually were higher in spring-summer than in fall-winter (Figure 30) and distribution of larvae was more confined to the southern half of the survey area in winter months (Figure 31). This species was among the 20 most abundant species on eight cruises, when its mean abundance ranged from 1.2–9.5 larvae under 10 $m^2$ of sea surface. Larvae of N. valdiviae tranform at a smaller size than any other myctophid. Many of our specimens were transforming larvae or juveniles.

Lampadena luminosa (42 larvae)

This species was collected on nine cruises and occurred mostly during spring–summer (37 larvae). Other species of Lampadena have been reported from the Gulf of Mexico, only larvae of L. luminosa, the most abundant species, have deen described and we assumed our specimens to be that species. It was never observed frequently but its overall distribution reflects widespread occurrence in eastern Gulf waters > 50 m (Figure 32).

Lampanyctus spp. (124 larvae)

Seventy-eight larvae were identified to species. Lampanyctus alatus (54 larvae) was most frequently observed. It occurred widely over the outer shelf and at deeper stations (Figure 33) in 10 spring, summer and fall cruises, but was absent from winter collections. Larvae of L. cuprarius (16 larvae) were less common, occurring on only five cruises, but had a similar distribution (Figure 34) and seasonal occurrence to L. alatus. A third species, L. ater, occurred on four cruises and was represented by only eight larvae. One of those larvae was taken on a winter cruise (IS7303). Many Lampanyctus (46 larvae) could not be identified to species. Twenty-six of these occurred during winter cruises.

*Myctophum* spp. (704 larvae)

Four species of *Myctophum* were recognized. Larvae of *M. nitidulum* (613 larvae), which occurred on 13 cruises, were observed most frequently. It was among the 20 most abundant larvae on 11 cruises, when its mean abundance ranged from 0.8–18.0 larvae under 10 $m^2$. *Myctophum nitidulum* also was one of the 20 most frequently observed species on 10 cruises. It occurred at all seasons but was clearly most abundant during spring-summer (Figure 35). Its distribution was widespread in the eastern Gulf. Although most occurrences (70%) were at stations > 100 m deep, it often occurred at relatively shallow stations near the 50 m isobath (Figures 36 and 37). Despite reduced abundances in fall and winter, its distribution remained widespread throughout the year. Larvae of *M. selenops* (84 larvae), which occurred on 11 cruises, were the second most common *Myctophum* larva (Figure 38). They also occurred most frequently on spring–summer cruises. Except for a single occurrence, all *M. selenops* larvae were collected at stations > 50 m deep. Interestingly, they were absent from the area north of latitude 28°30'N and west of 86°W on the August 1971 cruise (8C7120–TI71210), where *M. nitidulum* larvae were abundant (Figure 37). That area was sampled only on that cruise and no conclusions about comparative distributions can be made, but it suggests that *M. selenops* and *M. nitidulum* may have different patterns of occurrence in the northeastern Gulf. Two additional species, *M. obtusirostris* (2 larvae) and *M. asperum* (1 larva) occurred in the collections.

*Ceratoscopelus warmingi* (151 larvae)

*Ceratoscopelus warmingi* is a common myctophid larva in the eastern Gulf that occurred on 14 of the 17 cruises. It is widely distributed (Figure 39) and occurred during all seasons. It was collected occasionally (four instances) at stations < 50 m deep and was not uncommon (23.6% of occurrences) at 50–100 m depth stations. Larvae of *C. warmingi* were among the 20 most abundant species on six cruises when mean abundances ranged from 0.8–5.0 larvae under 10 $m^2$.

*Hygophum* spp. (1,090 larvae)

Larvae of *Hygophum* spp. were among the most commonly collected myctophids but only a few were identified to species. *Hygophum reinhardti* (66 larvae) was collected on 12 cruises; it occurred in all seasons at station > 50 m deep (Figure 40). Two specimens of *H. benoiti* also were identified from two summer cruises (8C7120–TI7121 and IS7313).

*Centrobranchus nigroocellatus* (38 larvae)

Larvae were collected on 10 cruises. They occurred in all seasons. Most *C. nigroocellatus* larvae were collected at stations > 100 m deep (87% of occurrences) (Figure 41). Although not frequently observed, some larvae of this species can be expected to be taken on most cruises that include offshore stations in the eastern Gulf.

Notoscopelus spp. (56 larvae)

Two species of Notoscopelus were identified. Notoscopelus resplendens (13 larvae), though less frequent in occurrence than N. caudispinosus (43 larvae), was collected on 7 cruises while N. caudispinosus was taken only during two winter cruises (GE7101 and IS7303). The observed distribution of N. caudispinosus occurrences (Figure 42) indicates a widespread area of occurrence in the eastern Gulf including stations < 50 m deep. Notoscopelus resplendens larvae also are distributied widely (Figure 43) and perhaps are more consistently present in the eastern Gulf than are N. caudispinosus larvae.

Lobianchia gemellari (21 larvae)

A few larvae of L. gemellari were collected on 7 cruises. They did not occur on winter cruises and few were observed on November cruises, indicating that spring-summer spawning occurs in the eastern Gulf. They were widely distributed in the eastern Gulf with most occurrences (75%) at stations > 200 m deep (Figure 44).

Benthosema suborbitale (345 larvae)

Benthosema suborbitale larvae were collected on 13 cruises and are abundant in the eastern Gulf. They were among the 20 most abundant species on seven cruises when mean abundances ranged from 0.8–29.6 larvae under 10 $m^2$. They are widely distributed at stations where depths are > 100 m and occasionally occur (17% of occurrences) at stations in the 50–100 m depth zone (Figures 45 and 46). There was no evidence of seasonality in their occurrence, but exceptionally large catches of B. suborbitale larvae on the May cruise, GE7208, give the impression of very great abundance in spring-summer of 1972 (Figure 47). Except for that cruise, B. suborbitale mean abundances ranged from < 1 to 5 under 10 $m^2$ for all cruises where offshore stations were sampled.

Diogenichthys atlanticus (183 larvae)

The distribution of this common myctophid larva in the eastern Gulf is much like that of Benthosema suborbitale (Figures 48 and 49). Larvae of D. atlanticus occurred on 10 cruises. There is no evidence of seasonality in its occurrence, although it seems to have been less abundant in 1971 than in 1972–1973 (Figure 50). Larvae of D. atlanticus were among the 20 most abundant species on seven cruises when mean abundances ranged from 0.9–6.4 larvae under 10 $m^2$. Larvae sometimes occurred over relatively shallow depths at stations in the 50–100 m depth zone (12% of occurrences).

Other myctophids (187 larvae)

Lepidophanes spp. (169 larvae) accounted for most of these larvae. A single transformed specimen from cruise 8C7113–TI7114 was identified as L. guntheri, but the remaining 168 larvae could not be identified to species. Larvae of *Lepidophanes* occurred at all seasons. *Bolinichthys* spp. (5 larvae) was observed from two cruises and *Gonichthys coccoi* (4 larvae) occurred on three cruises. Larvae of *Symbolophorus rufinus* (9 larvae) were collected at four stations on a single cruise (GE7208).

18. Ipnopidae (1 larva)

A single ipnopid larva was collected on cruise GE7101. No attempt was made to identify it to species.

19. Chlorophthalmidae (11 larvae; 1 genus; 1 species)

Eleven larvae of *Chlorophthalmus agassizi* were collected on six of the cruises. There was no apparent seasonality in their occurrences. The larvae were collected at stations > 50 m deep (Figure 51).

20. Notosudidae (2 larvae; 1 genus; 1 species)

Two larvae were collected. One was identified as *Scopelosaurus mauli*; the other was *Scopelosaurus* spp. The identified larva was collected in summer (8C7120—TI7121); the other specimen was collected in winter (GE 7101). The unidentified specimen was taken at a station where water depth was < 50 m, but the station is in the southernmost part of the survey area and deep water was nearby.

21. Giganturidae (1 larva; 1 genus; 1 species)

A single *Gigantura vorax* larva was collected at an offshore station on cruise IS7311.

22. Muraenidae (130 larvae; 2 genera; 2 species)

Seventy-eight leptocephalus larvae were identified to species. Most were *Gymnothorax nigromarginatus* (74 larvae) but *Anarchias yoshiae* (4 larvae) also was present. Larvae of *G. nigromarginatus* occurred on 10 cruises and those of *A. yoshiae* occurred on three cruises. Moray leptocephali were most frequently collected in spring, summer and fall cruises. Few were observed in winter. Leptocephali of *G. nigromarginatus* were widely distributed (Figure 52). They frequently occurred at stations > 50 m deep (58% of all occurrences) but also were well represented at < 50 m deep stations. All four specimens of *A. yoshiae* were collected at stations > 50 m deep.

23. Nettastomidae (90 larvae; 1 genus; 3 species)

Forty-one nettastomid leptocephali were identified to species. All identified specimens are in the genus *Hoplunnis*. *Hoplunnis diomedianus* (32 larvae) was observed most frequently; *H. macrurus* (6 larvae) and *H. tenuis* (3 larvae) were less common. Leptocephali of *H. diomedianus* were collected on 10 cruises; there was no apparent seasonality of occurrence. The two other species each were collected on three cruises, with no apparent seasonality. Seventy-nine of the nettastomid larvae (87.8%) were taken at stations > 50 m deep and 11 were taken at shallower stations. All *H. macrurus* and *H. tenuis* occurred at offshore stations. Most *H. diomedianus* also occurred offshore (93% of occurrences) (Figure 53).

24. Congridae (146 larvae; 7 genera; 5 species)

Conger eel leptocephali were common in eastern Gulf ichthyoplankton collections. Only 26 of the 146 specimens were not identified to either genus or species. Congrid leptocephali occur in offshore waters of the eastern Gulf and there is no apparent seasonality in their occurrence.

*Ariosoma balearicum* (16 larvae)

Leptocephali of *A. balaericum* occurred on seven cruises. All specimens were collected at stations > 50 m deep (Figure 54).

*Uroconger syringinus* (3 larvae)

Three leptocephali were collected on cruise IS7320. Leptocephali occurred at two stations where water depth was > 200 m.

*Paraconger caudilimbatus* (23 larvae)

This species was collected on only two summer cruises. Twenty-two of the 23 leptocephali were from cruise 8C7120—TI7121 and a single specimen was from IS7313. Except for one occurrence, all individuals were taken at stations where depth was > 200 m (Figure 55).

*Hildebrandia* spp. (60 larvae)

Two species of *Hildebrandia* were recognized. Leptocephali of *H. gracilior* (45 larvae) were most common and occurred in catches from 12 of the 17 cruises. Distribution of *H. gracilior* leptocephali is restricted to offshore waters, with most occurrences (87%) at stations > 100 m deep (Figure 56). A second species, *H. flava* (12 larvae) was collected on four cruises; it is less common but it also was restricted to the offshore zone (Figure 57).

Other congrids (18 larvae)

Twelve leptocephali of a congrid assigned to *Nistactichthys* spp. were collected on three cruises. Four specimens of *Gnathophis* spp. were found on three cruises and two leptocephali of *Xenomystax* spp. were taken on cruise GE7208.

25. Ophichthidae (208 larvae; 3 genera; 2 species)

Leptocephali of snake eels were the most frequently observed kind of eel larva. Relatively few could be identified beyond the family level. Ophichthids were widely distributed over the shelf and slope areas in the eastern Gulf.

Myrophis punctatus (16 larvae) occurred on six fall and winter cruises. No leptocephali of this species were found in spring-summer. It has a wide distribution between the 15 m isobath and shelf break at > 200 m depth (Figure 58). Two specimens of Ahlia egmontis were collected on cruise GE7208, one at a station < 50 m deep and the second at a station > 50 m deep. Sixty larvae were identified as Ophichthus spp. They occurred during all seasons.

26. Dysommidae (2 larvae)

A single larva was collected on each of two summer cruises (8C7120—TI7121 and IS7313). Both occurrences were at stations where water depth was > 50 m.

27. Belonidae (6 larvae)

Six larval needlefishes were collected at stations < 50 m deep. They were not identified to species. Occurrences were on five cruises during spring, summer and fall.

28. Hemiramphidae (45 larvae; 3 genera; 4 species)

Larvae of Hyporhamphus unifasciatus (33 larvae), which occurred on nine cruises, were the most frequently collected hemiramphid. Some larvae were taken in all seasons, although most occurred during spring-summer. Except for a single occurrence, all H. unifasciatus larvae were collected at stations < 30 m deep (Figure 59). Hemiramphus brasiliensis (3 larvae) and H. balao (8 larvae) were less frequently observed. Larvae of H. brasiliensis occurred on three spring-summer cruises and those of H. balao on four cruises which indicated that some spawning by this species occurs in all seasons. A single specimen, tentatively identified as Oxyporhamphus micropterus, was collected at a station in summer (8C7120—TI7121) near the Tortugas where water depth was < 50 m. Catches of hemiramphid larvae probably do not reflect the true abundance of halfbeaks in the eastern Gulf. These larvae, which hatch out at large size and are strong, agile swimmers, almost certainly avoid the sampling gear in most instances.

29. Exocoetidae (72 larvae; 4 genera; 3 species)

Flying fish larvae were collected mostly in spring and summer. Prognichthys gibbifrons (28 larvae) was most common. Except for one winter occurrence, which was in the southern half of the survey area, P. gibbifrons occurred on nine spring and summer cruises. The distribution of P. gibbifrons is widespread (Figure 60), but most occurrences (75%) are offshore of the 50 m isobath. Parexocoetus brachypterus (21 larvae) was collected during seven summer and fall cruises. With one exception, it was collected where depths are < 50 m (Figure 61). A single larva of Danichthys rondeleti was collected near the Tortugas in winter (GE7101). Nine larval Cypselurus spp. were taken during spring and summer. Exocoetid larvae, like the hemiramphids, are agile swimmers and most larvae probably avoid the sampling gear, causing their abundances to be underestimated.

30. Gadidae (54 larvae; 1 genus)

All gadid larvae and small juveniles were *Urophycis* spp., possibly *regius* and *floridanus*. These larvae occurred only on five winter and fall cruises. *Urophycis* larvae were widely distributed between the 10 and 200 m depth contours. Thirty larvae were taken where depths were < 50 m and 24 were taken at deeper stations.

31. Bregmacerotidae (3,818 larvae; 1 genus; 4 species)

The codlets were the ninth most frequently occurring family. Four species of *Bregmaceros* larvae were present. Two of these apparently are undescribed species that we have called Type A and Type B. They are the most abundant bregmacerotid larvae in the eastern Gulf. The other species are *B. atlanticus* and *B. macclellandi*. Bregmacerotids were present in most ichthyoplankton samples from the outer shelf and offshore waters during all cruises.

*Bregmaceros* Type B (2,554 larvae)

This species occurred on 15 cruises and is the most often collected codlet larva in our samples. It occurs at stations in the shallowest water and has the widest range of the four species found in the eastern Gulf. Type B larvae often were collected at stations < 50 m deep (36% of all Type B occurrences) and 84% of its occurrences were at stations whose depths were < 100 m (Figures 62 and 63). Some Type B larvae did occur far offshore. A seasonal pattern of occurrence is not well developed but larvae were more abundant during fall than at other seasons (Figure 64). *Bregmaceros* Type B was among the 20 most abundant larvae on 13 cruises, when its abundance ranged from 3.7–42.3 larvae under 10 $m^2$. It was the most frequently observed, identified larva on three cruises and among the 20 most frequently observed larvae on 14 of the 17 cruises.

Two larvae of *Bregmaceros* Type B, 4.0 mm SL and 13.5 mm SL, are illustrated (Figure 65). Although undescribed in the literature it is distinctive. The larvae have relatively little pigment. The occipital ray does not develop until larvae are approximately 6.5 mm SL.

*Bregmaceros* Type A (962 larvae)

This is the second most frequently collected codlet larva. It occurred on 14 cruises. Few occurrences of this species (5%) were recorded from stations < 50 m deep (Figures 66 and 67). Estimated mean abundance was very high in 1972 but the larvae were not abundant in 1973 (Figure 68), indicating that spawning intensity of *Bregmaceros* Type A varies annually in the eastern Gulf. *Bregmaceros* Type A was one of the 20 most abundant larvae on 12 cruises; for those cruises its abundance ranged from 0.9–35.1 under 10 $m^2$. It was one of the 20 most frequently observed, identified species on 10 cruises.

Two larvae of *Bregmaceros* Type A, 3.0 mm SL and 12.5 mm SL, were illustrated (Figure 69). These larvae also are distinctive. They are moderately pigmented, with numerous melanophores over the brain, at the base of the pectoral fins and in the developing pelvic fins. The occipital ray develops at approximately 3.0 mm SL. Several prominent melanophores are present on the filament.

*Bregmaceros atlanticus* (247 larvae)

*Bregmaceros atlanticus* is a darkly pigmented codlet larva that usually is collected farther offshore than *B*. Type A or *B*. Type B, although the distributions of all three species overlap. Larvae of *B*. *atlanticus* occurred on 13 cruises. *Bregmaceros atlanticus* occurred only once at a station where depth was < 50 m (Figures 70 and 71) and 76% of its occurrences were at stations > 100 m deep. There was no apparent seasonality in its occurrence. Although less abundant than Type A or Type B, *B*. *atlanticus* was among the 20 most abundant species that were collected on 9 of the 17 cruises.

*Bregmaceros macclellandi* (33 larvae)

This species is relatively uncommon in the eastern Gulf but it was collected on nine cruises. Its distribution and that of *B*. *atlanticus* are similar, but on average *B*. *macclellandi* occurred even farther offshore (Figures 72 and 71). A single occurrence of *B*. *macclellandi* larvae was recorded at a station < 100 m deep. There were no apparent seasonal trends in its abundance.

32. Macrouridae (4 larvae)

One specimen was collected on each of four cruises. The four specimens occurred at stations > 50 m deep.

33. Fistulariidae (1 larva; 1 genus)

One cornetfish larva, *Fistularia* spp., was collected at a station where depth was < 50 m on cruise CL7412.

34. Macrorhamphosidae (3 larvae; 1 genus; 1 species)

Three larvae of *Macrorhamphosus scolopax* occurred in two winter cruises (GE7101 and IS7303). Station depths were > 50 m.

35. Syngnathidae (247 larvae; 2 genera; 7 species)

Some syngnathids were collected on every cruise except GE7117. Many of the specimens apparently were associated with masses of floating seaweed that were occasionally collected by the sampler. One species of seahorse, *Hippocampus erectus*, and six species of pipefishes, *Syngnathus* spp., were identified.

*Hippocampus erectus* (40 specimens)

Individuals were collected on 14 cruises. Thirty of the 40 specimens were taken during fall and winter, indicating that most reproduction occurs in those seasons. Occurrences were recorded from all parts of the survey area < 100 m deep, but most occurrences (82%) were at stations where depth is < 50 m (Figure 73).

*Syngnathus dunckeri* (2 specimens)

Single individuals were collected on two of the cruises (GE7101 and TI7131—8B7132). One was collected at a station < 50 m and the second at a station > 50 m deep.

*Syngnathus elucens* (52 specimens)

Individuals occurred on 14 cruises. They were most common in spring and summer (36 of 52 specimens) but some occurred in fall and winter. *Syngnathus elucens* occurred throughout the north-south extent of the survey area, mostly at stations < 50 m deep, (86% of occurrences), but occasionally out to depths of 100 m (Figure 74).

*Syngnathus pelagicus* (2 specimens)

Two specimens were collected, one in winter (8B7201—GE7202) and one in late summer (IS7205). Both occurred at stations > 50 m deep.

*Syngnathus springeri* (55 specimens)

This species occurred on 12 cruises. Forty-five of 55 specimens (81.8%) were collected in fall and winter. Except for two instances, larvae occurred inshore of the 50 m isobath and most occurrences were in the northern half of the survey area (Figure 75).

*Syngnathus louisianae* (15 specimens)

This species was collected on five cruises. There was no evidence of seasonality in its occurrences. It occurred throughout the north-south extent of the survey area, but it apparently is confined to shallow waters of the eastern Gulf (Figure 76). Only a single occurrence was at a station > 10 m deep.

*Syngnathus scovelli* (64 specimens)

This pipefish occurred on 11 cruises. It was collected in all seasons. Distribution of *S. scovelli* is the most confined of any species of *Syngnathus* that we observed in the eastern Gulf. Specimens were collected only in the northeast sector of the survey area and never at stations where depth exceeded 20 m (Figure 77).

36. Melamphaeidae (38 larvae; 1 genus)

Larvae of *Melamphaes* spp. were collected on ten cruises. There was no evidence of seasonality in their occurrence. All occurrences were at stations > 50 m deep. None could be identified to species.

37. Holocentridae (34 larvae; 1 genus; 1 species)

A single specimen of *Adioryx vexillarius* was identified from cruise TI7131—8B7132. Remaining squirrelfish larvae were not identified to species. They occurred at all seasons; 27 of the 34 larvae, including the identified *A. vexillarius*, were taken at stations > 50 m deep.

38. Caproidae (42 larvae; 1 genus; 1 species)

Two specimens of *Antigonia capros* were identified, one from 8C7120—TI7121 and one from TI7131—8B7132. Both occurred at stations > 50 m deep. Other larvae were *Antigonia* spp. (40 larvae). Most larvae occurred in fall and winter and the majority (36 out of 40) came from stations > 50 m deep.

39. Mugilidae (252 larvae; 1 genus)

Larvae of mullets were collected on 14 of the cruises. All mullet larvae were classified as *Mugil* spp. It was suspected that larvae collected in fall and winter were *Mugil cephalus* and that most larvae from other months were *M. curema*. But, the descriptions of small mullet larvae were not definitive enough for us to confidently assign individuals to species. Most of the larvae (75.4%) were collected in the southern half of the survey area and most larvae (62.3%) were collected at stations < 50 m deep. For the 165 larvae collected in fall-winter, 90 were caught at stations > 50 m deep. For the 87 larvae caught in spring-summer, only 4 were caught at stations > 50 m deep. The differences in seasonal onshore-offshore distributions may reflect differences in spawning areas of the two major species, *M. cephalus* and *M. curema*, in the eastern Gulf.

40. Atherinidae (45 larvae; 2 genera; 2 species)

*Membras martinicus* (41 larvae) were collected on two cruises (GE7210 and CL7412). They were taken at three stations adjacent to the coast (< 10 m depth). There were two occurrences of *Menidia beryllina* (2 larvae), one on cruise IS7320 and another on CL7405. Both specimens were taken at stations < 10 m deep.

41. Sphyraenidae (34 larvae; 1 genus; 3 species)

Three species of barracudas were collected. *Sphyraena borealis* (15 larvae) occurred from late winter until early summer and was taken on six cruises. In contrast, *Sphyraena barracuda* (16 larvae) occurred only during spring and summer; it was collected on four cruises. The distibutions of the two species differed (Figure 78). With a single exception, all occurrences of *S. barracuda* were at stations > 50 m deep; most *S. borealis* occurrences were at stations < 50 m deep and no larvae occurred at > 100 m depths. A single larva of *S. guachancho* was collected on cruise GE7208. It occurred at a station > 50 m deep.

42. Serranidae (6,949 larvae; 12 genera; 16 species)

The serranids are a speciose family whose larvae are represented in the eastern Gulf by four major subfamilies. The anthiines are stout-bodied larvae with heavy spination on the head and opercular areas; serranine larvae are "typical" perciform larvae with moderate spination on the head and opercular areas; epinephelines have a characteristic melanophore on the tail, moderate spination on head and opercular areas, and greatly elongated spines in the developing first dorsal and pelvic fins; grammistine larvae usually are nearly without melanophores, the short, developing first dorsal fin often has the anteriormost rays extended into flagellae or filaments, and the head and opercular areas are without spination. The serranine types were by far the most frequently collected serranid larvae and one species, Diplectrum formosum, dominated the serranid material. Some kinds of serranid larvae were collected at all stations in the survey area. Unlike other speciose families (e.g. Myctophidae), which were found only offshore, serranids are represented by some species which spawn in virtually every part of the eastern Gulf of Mexico.

Anthiinae

Hemanthias vivanus (395 larvae)

Larvae of H. vivanus occurred on 14 cruises from stations near the 50 m isobath to stations at > 200 m depth (Figures 79 and 80). Larvae were collected infrequently in summer and were most abundant in winter and spring (74.2% of larvae) (Figure 81). Hemanthias vivanus larvae were among the 20 most abundant species that were identified on seven cruises, when their abundance ranged from 0.9 to 8.4 larvae under $10m^2$ and they were included among the most frequently observed species on eight cruises. A single specimen of H. leptus was collected in winter (GE7101).

Pronotogrammus aureorubens (78 larvae)

This species occurred at stations where depth was > 50 m on nine of the cruises (Figure 82). Most larvae (85.9%) were collected during winter and spring. It occurred more frequently in the southern half of the survey area than in the northern half (Figure 82).

Anthias spp. (106 larvae)

Three species (types) of Anthias were collected. Like other anthiines they occurred most frequently in fall through spring and, excepting one species, were less common in summer. These larvae were recognized based on recent descriptions by Kendall (unpublished manuscript). Anthias Type I (60 larvae) occurred on 10 cruises and was most often collected. Fifty-six of 60 larvae occurred on winter—spring cruises. Larvae were collected at stations from near the 100 m isobath to those at > 200 m depth (Figure 83). Only three larvae of Anthias Type II were observed. They occurred at three offshore stations on two of the summer cruises (GE7117 and 8C7120—TI7121). Anthias Type III (29 larvae) were collected on winter-spring cruises at stations where depth was > 100 m (Figure 84). Their distribution and seasons of occurrence were similar to those of Anthias Type I.

Plectranthias garupellus (2 larvae)

Two specimens of P. garupellus were collected on cruise IS7320 at two stations > 50 m deep.

Serraninae

Diplectrum formosum (3,963 larvae)

This is one of the most frequently observed and abundant larvae in the eastern Gulf. All Diplectrum larvae were identified as D. formosum based on the distributions of Diplectrum species adults given by Bortone (1977). Larvae of D. formosum occurred on all 17 cruises. Most larvae occurred from spring to fall, but some were collected in winter, indicating that some spawning takes place in all months. Abundances were greatest in spring and summer (Figure 85). Larvae were widely distributed over the shelf; one-half of the occurrences were at stations < 30 m deep and 90% of occurrences were at station < 60 m deep (Figures 86 and 87). Diplectrum formosum larvae were among the 20 most abundant species that were identified on 15 of the crusies, when their mean abundances ranged from 0.8 to 29.8 larvae under 10 $m^2$ of sea surface. They were among the 20 most observed species of all 17 of the cruises.

Centropristis striata (196 larvae)

Black sea bass larvae occurred from fall to spring and were observed on seven cruises. Most larvae were collected in the northeast corner of the survey area at stations < 30 m deep (Figures 88 and 89). Some larvae that were referred to C. striata, especially those that occurred at stations > 50 m deep, might be other species of Centropristis, since C. ocyura and C. philadelphica have been reported from the eastern Gulf.

Serraniculus pumilio (390 larvae)

Larvae of pygmy sea bass were common and were collected on 13 cruises. They occurred from spring to fall but were most abundant in spring-summer (Figure 90). Larvae apparently were more abundant in 1972 than in other years. They were taken at stations throughout the north-south extent of the survey area (Figures 91 and 92). Except for four occurrences, all larvae were collected at stations < 50 m deep; 50% of occurrences were at stations < 25 m deep. Larvae of S. pumilio were among the 20 most abundant identified species on three cruises and were included in the 20 most frequently observed species on six of the cruises.

Serranus spp. (207 larvae)

Larvae of Serranus were common but could not be identified to species. They occurred in 12 of the cruises. Some Serranus occurred in all seasons.

Epinephelinae

Epinephelus type larvae (146 larvae)

Five advanced larvae were identified as Epinephelus morio. No other grouper larvae could be identified to species. The five E. morio larvae occurred on two spring cruises (8C7113—TI7114 and IS7308) at stations where depths ranged between 50 and 200 m. Most epinepheline larvae were collected in the southern half of the survey area (Figure 93). Larvae occurred between the 10 m and 200 m isobaths, except for one occurrence at a station > 200 m deep.

Grammistinae

Rypticus spp. (181 larvae)

Most larvae of Rypticus were most identified to species. Occurrences were most common in spring and summer when 98% of the Rypticus larvae were collected. Larvae occurred from near the coast out to the 200 m isobath (Figure 94). Six specimens were identified as R. saponaceus. Five of the six larvae were taken in two summer cruises; the remaining larvae was collected in November. All except one R. saponaceus were collected at stations > 50 m deep. A single R. maculatus larva was collected at a station > 50 m deep on cruise 8C7120—TI7121.

Liopropoma spp. (24 larvae)

Scattered occurrences of Liopropoma spp. larvae were observed in seven spring and summer cruises. Most larvae occurred at stations > 50 m deep. Six large specimens, collected on cruises 8C7113—TI7114 and 8C7120—TI7121, resembled the Type I (5 larvae) and Type II (1 larva) Liopropoma discussed by Kendall (unpublished manuscript) and they were given those designations.

43. Priacanthidae (154 larvae; 2 genera; 3 species)

Most priacanthids could not be identified to species. Pseudopriacanthus altus (11 larvae) was recognized and three specimens of Priacanthus arenatus (2 larvae) and P. cruentatus (1 larva) were identified. Larval priacanthids occurred mostly in spring-summer (132 out of 154 specimens) and most larvae (68.8%) were collected at stations > 50 m deep. More priacanthid larvae were collected in the southern half of the survey area (67.5%) than were collected in the northern half.

44. Apogonidae (2,296 larvae)

Larval cardinalfishes were the fifteenth most frequently observed family. They were collected on all 17 cruises. None were identified to species, although some specimens probably could have been identified if time had permitted. Occurrences and abundances of apogonids were highest in spring and summer but some larvae were collected on all cruises. Most larvae (75%) were collected at stations < 50 m deep. They occurred with near equal frequency in the northern and southern sectors of the survey area.

45. Branchiostegidae (26 larvae; 1 genus; 1 species)

Larval tilefishes occurred on 10 cruises. There was no apparent seasonality in their occurrence or abundance and all except one larva were collected at stations > 50 m deep. Most of the larvae were *Caulolatilus* spp. (16 larvae) and two were identified as *C. cyanops*.

46. Echeneidae (3 larvae)

Three remora larvae were collected on two spring-summer cruises (8C7120—TI7121 and GE7208) at stations > 50 m deep. They were not identified to species.

47. Rachycentridae (2 larvae; 1 genus; 1 species)

Two cobia larvae were collected on cruise 8C7120—TI7121. One occurred at a station > 50 m deep and the second at < 50 m depth.

48. Carangidae (5,564 larvae; 10 genera; 8 species)

Carangids were the sixth most frequently occurring family of larvae in our eastern Gulf collections. A more detailed account of their abundance and distribution, based on the same cruises, was given by Leak (1977). Some species of carangids were present in every part of the eastern Gulf. Characteristic depth distributions were noted for some species and seasonality of occurrence was apparent. One species, *Decapterus punctatus*, dominated the carangid catches and also was one of the most abundant of all fish larvae in the eastern Gulf.

*Decapterus punctatus* (4,431 larvae)

Round scad were the most frequently occurring carangid larvae. They were collected on 16 cruises, at all seasons, but their abundance was highest during spring and summer (Figure 95). Abundance of *D. punctatus* larvae apparently was higher in 1972 than in 1971 or 1973. They were among the 20 most abundant identified species on 16 cruises, when mean abundances ranged from 1.9 to 55.3 larvae under 10 $m^2$. They also were among the 20 most frequently observed species on the 16 cruises in which they occurred. Larvae occurred throughout the survey area from spring to fall, but in winter their distribution was restricted to the southern half of the survey area (Figures 96 and 97). Most larvae were collected (68% of occurrences) at stations where depth was < 50 m. Leak (1977) discussed spawning by *D. punctatus*, including an estimate of adult biomass, in the eastern Gulf.

*Trachurus lathami* (185 larvae)

Rough scad *T. lathami* were less common than the round scad. Rough scad larvae were collected on seven cruises during fall, winter and spring. This species apparently does not spawn in summer in the eastern Gulf. *Trachurus lathami* were included in the 20 most abundant species on three cruises; mean abundances on those cruises ranged from 2.8 to 4.3 larvae under 10 $m^2$. They also were among the 20 most frequently observed species in these winter cruises. Distribution of *T. lathami* larvae was mostly restricted to stations where depth exceeded 50 m, but there were some occurrences at shallower stations (Figure 98). More than 70% of occurrences were between the 50 and 200 m isobaths. The larvae occurred along the entire north-south extent of the survey area.

*Chloroscombrus chrysurus* (774 larvae)

Atlantic bumper larvae were common, but were collected only during eight spring and summer cruises, indicating that spawning by this species is confined to the warmest months of the year. On six of those cruises they were among the 20 most frequently observed species that had been identified and on four cruises they were among the 20 most abundant species in the survey area (mean abundance ranging from 0.2 to 3.1 larvae under 10 $m^2$). All *C. chrysurus* larvae occurred nearshore, at stations < 50 m deep (Figure 99). Ninety-five percent of all occurrences were at stations where depth was < 35 m.

*Caranx* spp. (89 larvae)

Only bluerunners *C. crysos* (12 larvae) were identified to species. Larvae of *Caranx* occurred mostly during spring-summer (83 of 89 larvae). All of the identified *C. crysos* were collected on a single cruise (8C7120—TI7121) and all except one larva occurred at stations > 50 m depth. All occurrences of *C. crysos* except one were in the southern half of the survey area, but because larvae were only collected on a single cruise this does not necessarily indicate that spawning is most prevalent there. Unidentified *Caranx* larvae also occurred offshore. Only six occurrences of *Caranx* spp. were recorded at stations < 50 m deep while 38 occurrences were observed at stations > 50 m deep.

*Oligoplites saurus* (14 larvae)

Larvae of the leatherjacket were collected on four spring-summer cruises. All occurrences were at stations < 20 m deep (Figure 100).

Selene vomer (15 larvae)

Larvae of the lookdown occurred on three cruises during summer. Thirteen of these larvae were collected on a single cruise (8C7120—TI7121). Lookdown larvae occur offshore; all occurrences were at stations > 50 m deep (Figure 101).

Seriola spp. (38 larvae)

Larvae of the amberjacks, which were collected on 11 cruises, were not identified to species. Some larvae were collected in all seasons. Most occurrences were at stations > 50 m deep.

Other carangids (11 larvae)

Two specimens of Vomer setapinnis were collected at offshore stations, one in each of two summer cruises. Six Elagatis bipinnulata occurred at a single offshore station on cruise GE7208. Three larvae of Trachinotus spp. were collected during three spring and summer cruises.

49. Bramidae (30 larvae)

Bramid larvae were collected on six cruises in fall, winter and spring. They were not identified to species. Eighteen of the 30 larvae were collected at stations < 50 m deep.

50. Coryphaenidae (17 larvae; 1 genus; 2 species)

Dolphin larvae were not common in our eastern Gulf collections. Occurrences were observed in all seasons, but 16 of the 17 larvae were collected in spring, summer or fall cruises. Coryphaena hippurus (7 larvae) were more frequently observed than C. equiselis (2 larvae); small larvae could not be identified to species and were designated Coryphaena spp. (8 larvae). Fourteen of the 17 larvae that were collected occurred at stations > 50 m deep.

51. Lutjanidae (1,753 larvae; 4 genera; 3 species)

Lutjanids were the nineteenth most abundant family of fish larvae; few could be identified to species. Most of the unidentified snapper larvae probably are in the genera Lutjanus and Rhomboplites. Larger larvae of these two genera can be identified based on meristics but small larvae cannot be distinguished. Some relatively large larvae of Rhomboplites aurorubens were recognized. Several species of Lutjanus occur in the eastern Gulf. Only three larvae could be definitely identified as Lutjanus spp. Larval lutjanids were collected on 16 cruises in all seasons, but they were most abundant in summer when 79% of all lutjanid larvae were collected. Some kinds of lutjanid larvae occurred at all depths in the survey area but most occurrences were between the 30 and 100 m isobaths. Most (76.9%) of the lutjanid larvae were collected in the southern half of the survey area.

*Rhomboplites aurorubens* (34 larvae)

Larvae of vermilion snapper were collected on 10 cruises during all seasons. Thirty-two of the larvae (94%) were taken in summer and fall. Most spawning apparently occurs in summer. Larvae occurred over a wide area of the eastern Gulf within the 200 m isobath. Most occurrences were at stations between 30 and 100 m depths in the southern half of the survey area (Figure 102).

*Pristipomoides aquilonaris* (41 larvae)

Larvae of wenchman occurred at all seasons but most were collected in spring and summer. They occurred farther offshore than most other lutjanid larvae. Most larvae were taken between the 50 and 200 m isobaths (Figure 103). A single larva was collected at a station < 50 m deep.

*Symphysanodon typus* (6 larvae)

The strange larvae of *Symphysanodon typus*, which may not be a true lutjanid, were collected on five cruises. Four of the six larvae were collected in fall; the remaining two individuals came from a spring and a winter cruise. Larvae of *S. typus* occurred at stations > 50 m deep.

52. Acanthuridae (17 larvae; 1 genus)

Larvae of *Acanthurus* spp. (17 larvae) were taken on 9 cruises. There was no apparent seasonality in their occurrence. Fourteen of the 17 larvae were collected at stations > 50 m deep.

53. Gerreidae (1,458 larvae)

Gerreid larvae were collected on each of the 17 cruises, but most (92.7%) larvae were taken in spring and summer. None could be identified to species. Ninety-four percent of all gerreid larvae were collected at stations < 50 m deep and 80.2% of the larvae were collected in the southern half of the survey area.

54. Pomadasyidae (2,933 larvae; 1 genus; 1 species)

Pomadasyid larvae were the eleventh most common family represented in our collections. A single species, *Orthopristis chrysoptera*, was identified. Most of the unidentified pomadasyids probably were *Haemulon* spp. Pomadasyid larvae, other than *O. chrysoptera*, occurred on all 17 cruises but their adundance was highest on late winter and spring cruises (78.4% of the larvae). Most (96.3%) of the unidentified pomadasyids were collected at stations where water depth was < 50 m.

*Orthopristis chrysoptera* (771 larvae)

Pigfish larvae were common in catches of eight winter and spring cruises. They were among the 20 most frequently observed and identified species on five cruises and were among the 20 most abundant species on three cruises, when their mean numbers under 10 $m^2$ ranged from 1.0 to 6.1. Seasonal peaks in abundance clearly show the well defined spawning season (Figure 104). Pigfish spawn in coastal waters; they were more abundant in the northern half of the survey area than in the southern half (Figures 105 and 106). No O. chrysoptera larvae were collected at stations where depth exceeded 31 m and 75% of the larval occurrences were at stations < 20 m deep. The biggest observed catch was on cruise CL7405 when several nearshore stations (< 10 m) were sampled in addition to the usual stations in the survey, indicating that most pigfish spawning may occur closer to the coast than the area represented by our usual survey stations.

55. Sciaenidae (415 larvae; 6 genera; 9 species)

The Sciaenidae were well represented in our samples but they were less abundant than they might have been if the survey area had included more coastal or estuarine stations. Most sciaenids spawn within a few km of the coast. Our larval catches show the coastal distributions of larvae and roughly delineate spawning area in the eastern Gulf.

Cynoscion spp. (89 larvae)

Three species of seatrout (weakfish) larvae were collected. The most common was C. nebulosus (67 larvae). Spotted seatrout larvae were collected on nine cruises and occurred in all seasons. Sixty of the 67 larvae were collected on spring cruises, indicating that spawning is most intense in that season. Most larvae occurred at stations < 10 m deep and all larvae were collected within the 15 m isobath (Figure 107). Cynoscion arenarius (21 larvae) were taken on three cruises in winter, spring and summer. The five station occurrences for this species were all within the 20 m isobath (Figure 108). A single larva of C. nothus was collected on a fall cruise (TI7131—8B7132) at a station of 25 m depth.

Leiostomus xanthurus (192 larvae)

Spot larvae were the most frequently observed sciaenid in our catches. They occurred on 10 of the cruises in fall, winter, and spring. Most of the larvae (64.1%) were collected on spring cruises, indicating peak spawning in that season. Spot larvae were the most widely distributed sciaenid (Figure 109). More than 50% of the larval occurrences were at stations < 15 m deep, but offshore occurrences were not uncommon and one occurrence was observed offshore of the 50 m isobath. Spot larvae were more abundant in the northern half of the survey area than in the southern half (Figure 109).

Menticirrhus spp. (52 larvae)

Two species of Menticirrhus were identified. Larvae of M. saxatilis (27 larvae) were observed on four cruises in winter, spring and summer. All larvae were collected at stations < 20 m deep and all occurrences except one were in the central third of the survey area

(Figure 110). A total of four larvae of M. americanus were collected on a spring (IS7308) and a fall (TI7131—8B7132) cruise. They occurred at stations < 20 m deep. Several Menticirrhus spp. (21 larvae) could not be identified to species.

Micropogon undulatus (16 larvae)

Croaker larvae were collected on five cruises but they were not abundant. They occurred in fall, winter and spring, but 13 of the 16 larvae were taken in November cruises. Larvae were distributed along the entire north-south extent of the survey area and all occurrences were at stations < 30 m deep (Figure 111).

Other sciaenids (5 larvae)

Two larvae of Pogonias cromis were collected nearshore in March (CL7405). Three larvae of Bairdiella chrysura were collected in the last week of June (IS7311) at two stations < 10 m deep. A relatively large number of sciaenid larvae (61) were not identified. Some of these larvae may be small specimens of Stellifer lanceolatus and Sciaenops ocellata.

56. Sparidae (1,683 larvae; 4 genera; 4 species)

Larvae of sparids were the twentieth most frequently observed family. Most larvae occurred during winter and spring cruises; occurrences were uncommon in summer. The most commonly identified sparid was Lagodon rhomboides. Archosargus probatocephalus larvae also were common in the collections. Most sparid larvae could not be identified to species; many probably are Calamus spp. More than 90% of the unidentified sparid larvae were collected at stations < 50 m deep.

Diplodus holbrooki (111 larvae)

Larvae of spottail pinfish were observed on only two cruises during winter (IS7303 and CL7405). The four stations at which they were sampled were in the northeast corner of the survey area and were < 15 m deep (Figure 112).

Lagodon rhomboides (338 larvae)

Pinfish larvae occurred on seven cruises in fall, winter and spring. Most larvae were collected in winter (97.6%). Larval pinfish occurred throughout the north-south extent of the survey area. They were among the 20 most frequently observed, identified species on four cruises and were included in the 20 most abundant species on three cruises, when their mean abundances ranged from 1.3 to 11.7 under 10 $m^2$. More than 60% of the station occurrences were at depths < 30 m but the larvae were relatively widely distributed, with some catches occurring beyond the 50 m isobath (Figure 113). Some small, unidentified sparid larvae may have been L. rhomboides because we could not identify the smallest larvae with certainty and chose not to assign them specific names.

*Pagrus pagrus* (7 larvae)

Larvae of the red porgy were uncommon in our eastern Gulf collections. They were collected on three cruises, all in winter. For the four observed station occurrences, two were at < 50 m depth and two were at > 50 m.

*Archosargus probatocephalus* (322 larvae)

Sheepshead larvae occurred in catches from five cruises in winter and spring. Catches were restricted to nearshore stations; all larvae were collected at stations < 20 m deep (Figure 114). Larvae were more frequently collected and were most abundant in the northern half of the survey area.

57. Mullidae (302 larvae; 1 genus; 1 species)

Larvae of goatfishes were collected on 12 cruises. Most could not be identified to species. Some larvae occurred in all seasons but they were most common in winter and spring (94.4% of larvae). Most mullid larvae (60.9%) were taken at stations where depth was < 50 m, but offshore occurrences were relatively common. A single species, *Mullus auratus* (11 larvae), was recognized from large specimens collected on three spring cruises.

58. Kyphosidae (18 larvae; 1 genus)

A few larvae of *Kyphosus* spp. were collected on seven cruises. Except for a single summer occurrence (1 larva), larvae occurred in fall, winter and spring. Ten of the 18 larvae were collected at stations < 50 m deep.

59. Ephippidae (1 larva; 1 genus; 1 species)

A single larva of *Chaetodipterus faber* was collected in November on cruise IS7320 at a station > 50 m depth.

60. Chaetodontidae (32 larvae)

At least two kinds of chaetodontid larvae were collected. None were identified to species. They occurred on 12 cruises in all seasons. There was no well-developed seasonal pattern in occurrences of chaetodontid larvae, although more were collected in spring-summer than at other seasons. Most chaetodontids (75%) occurred at stations > 50 m deep.

61. Pomacentridae (445 larvae)

Damselfish larvae occurred on 15 of the 17 cruises. None were identified to species, although several larvae were tentatively identified as *Abudefduf saxatilis*. Eggs of fishes in this family are demersal, but larvae are pelagic. Larvae occurred in all seasons but numbers of occurrences were less frequent in winter than at other seasons. Most occurrences (69.0%) were at stations < 50 m deep. Larval occurrences were observed throughout the north-south extent of the survey area.

62. Labridae (3,230 larvae)

The wrasses were the tenth most frequently sampled larvae in our collections. Several kinds were present but they could not be identified to species. Many individuals were believed to be Thalassoma spp. and Hemipteronotus spp. Some labrids were collected on each of the 17 cruises but 85% occurred during spring and summer. Larvae were collected over the entire shelf area in the eastern Gulf but were somewhat more common (59.0% of larvae) at stations < 50 m deep. Labrid larvae occurred more frequently and were more abundant in the northern half of the survey area (69.5% of larvae) than in the southern half.

63. Scaridae (569 larvae)

Larvae of parrotfishes were common but we were unable to identify them to species. They occurred on 16 of the 17 cruises, with most occurrences in summer and fall when 70.8% of the larvae were taken. Parrotfish larvae were distributed widely in the eastern Gulf, but most occurrences were at stations > 50 m. deep (61.0% of the larvae). More larvae were collected in the southern half of the survey area (67.0%) than in the northern half.

64. Opistognathidae (417 larvae)

At least two kinds of jawfish larvae were collected but not identified to species. They occurred on 15 cruises in all seasons but the majority of larvae were collected in spring (78.4% of the larvae). More larvae (63.3%) were taken in the southern half of the survey area than in the northern half. Some jawfish larvae were collected at stations where depth was > 50 m but 89.4% of the larvae were collected at stations < 50 m deep.

65. Uranoscopidae (1 larva; 1 genus; 1 species)

A single larva of the stargazer Astroscopus y-graecum was collected on cruise TI7131—8B7132 at a station < 50 m deep.

66. Blenniidae (1,996 larvae)

Blenny larvae were the eighteenth most common family. No attempt was made to identify them to species. They occurred on all 17 cruises and were most frequently collected in winter-spring when 85.5% of them were taken. The blenniids were more common in the northern half of the survey area, where 78.8% of the larvae were collected. They have a nearshore distribution; 95.8% of the blenny larvae were collected at stations < 50 m deep.

67. Clinidae (502 larvae)

Clinid larvae were collected on all 17 cruises. None were identified to species. There was no apparent seasonality in their occurrences. Larvae were collected throughout the north-south extent of the survey area. Of larvae collected, 78.9% occurred at stations < 50 m deep.

68. Ophidiidae (4,151 larvae)

Cusk-eel and brotulid larvae were the eighth most frequently observed family. Several kinds of these larvae were collected but no attempt to identify them to species was made. Ophidiids occurred on all 17 cruises but were more frequently observed in spring-summer than at other seasons. They occurred throughout the survey area. Although most of the larvae were collected at stations < 50 m deep (75.1%), the estimated mean abundances (no. under 10 $m^2$) were highest offshore on several of the cruises.

69. Carapidae (305 larvae; 2 genera; 2 species)

Two species of carapids were collected. The more common of the two species has been designated Echiodon sp. It was identified based on recent literature describing carapid larvae (Olney and Markle, in press). The larvae are believed to belong to a single species, which, as adults, has been commonly observed in trawl catches from the eastern Gulf (Robert Shipp, personal communication)[1], but which has not been described. The other species, whose larvae were relatively uncommon, is Carapus bermudensis.

Carapus bermudensis (13 larvae)

Larvae occurred in catches from six cruises in spring, summer and fall. Most occurrences were in the southern half of the survey area and occurrences were nearly equal at < 50 m and > 50 m deep stations (Figure 115).

Echiodon sp. (289 larvae)

This species was collected on 15 of the 17 cruises. Larvae occurred in all seasons but 79.2% of them were obtained in summer and fall. The distributions of Echiodon sp. and Carapus bermudensis overlapped but Echiodon occurred over a broader area (Figure 116). Most larval occurrences (> 90%) of Echiodon sp. were at stations > 50 m deep.

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[1] Dr. Robert Shipp, University of Alabama, Dauphin Island Laboratory.

70. Callionymidae (1,605 larvae)

Dragonet larvae were common in collections on all 17 cruises, but most larvae (64.7%) were collected in summer. No callionymids were identified to species. Larvae were widespread over the north-south extent of the survey area and most (86.5%) were collected at stations < 50 m deep. Although they were not identified, the kinds of callionymids that occurred offshore were observed to differ from those taken at nearshore stations.

71. Scombridae (1,266 larvae; 7 genera; 9 species)

Scombrid larvae were common in spring and summer. Three species were observed most frequently and appear to be of near equal abundance in the eastern Gulf; they are *Euthynnus alletteratus*, *Auxis* sp. and *Thunnus atlanticus*. Larvae of *T. thynnus* were observed in each spring cruise, confirming the importance of the eastern Gulf as a spawning area for this species. Few larvae of *Scomberomorus cavalla* were collected, indicating that this species does not use the eastern Gulf as a major spawning area.

*Auxis* sp. (324 larvae)

*Auxis* larvae, possibly a single species, occurred on 12 cruises. Some larvae were observed in all seasons but most (77.5%) were collected in summer when there was a clear peak in their abundance each year (Figure 117). *Auxis* sp. larvae were among the 20 most abundant, identified species on six cruises, when mean abundances ranged from 0.6 to 5.8 under 10 $m^2$ of sea surface. Occurrences of *Auxis* sp. were recorded from all parts of the survey area, except the northeast corner (Figures 118 and 119). Larvae occurred at stations as shallow as 9 m, but most occurrences (> 80%) were at stations > 50 m deep. More than 50% of the *Auxis* sp. occurrences were between the 50 and 150 m isobaths.

*Euthynnus alletteratus* (361 larvae)

Larvae of the little tunny were the most frequently observed scombrid larva in our collections. They occurred on 10 cruises. Except for a single occurrence in winter (8B7201—GE7202), all larvae were collected in spring and summer (Figure 120). Little tunny larvae were among the 20 most abundant, identified species on six cruises, when mean abundances ranged from 0.7 to 6.5 under 10 $m^2$. Distribution of *E. alletteratus* was as widespread as that of *Auxis* sp. Occurrences of *E. alletteratus* were recorded at stations as shallow as 18 m, but most (65%) were at stations where depth was > 50 m (Figure 121 and 122). More than 55% of the *E. alletteratus* larva occurrences were between the 30 and 100 m isobaths, indicating that this species, on average, occurs at shallower depths than does *Auxis*.

*Thunnus* spp. (318 larvae)

Two species of *Thunnus* were identified. Larvae of the blackfin tuna *T. atlanticus* (187 larvae) occurred on five summer cruises and one spring cruise. Bluefin tuna *T. thynnus* (122 larvae) occurred on four May cruises.

Blackfin tuna larvae occurred in much the same areas and same seasons as did *E. alletteratus* and *Auxis* sp. Peak abundances were recorded in summer (Figure 123). For four cruises *T. atlanticus* larvae were among the 20 most abundant, identified species, when mean abundance in the survey area ranged from 2.6 to 6.4 under 10 $m^2$. Larvae were widely distributed, but most occurrences were at stations > 50 m deep (Figures 124 and 125). Only six occurrences, all in the southern half of the survey area, were observed at stations < 50 m deep. Most occurrences (65%) were at stations between the 50 and 200 m isobaths. In summer, abundances of *T. atlanticus*, *E. alletteratus* and *Auxis* sp. all were moderately high and nearly equal (Figures 117, 120 and 123), indicating that spawning adults are abundant in the eastern Gulf.

Bluefin tuna larvae were collected only on May cruises, indicating a short spawning season for this species. On two of the May cruises (GE7208 and IS7308), larvae of *T. thynnus* were among the 20 most abundant species in the survey area, their mean abundances being 17.2 and 7.4 larvae under 10 $m^2$. No occurrences of bluefin tuna larvae were made at stations < 50 m deep and most occurrences were at stations > 100 m deep (Figure 126).

*Katsuwonus pelamis* (39 larvae)

Larvae of skipjack were collected on five cruises in spring and summer. They occurred far offshore. A single occurrence was recorded at a station < 100 m deep and 75% of all occurrences were at stations where depth was > 150 m (Figure 127).

*Scomberomorus* spp. (104 larvae)

Larvae of Spanish mackerel, *S. maculatus* (97 larvae) were relatively common but those of king mackerel, *S. cavalla* (6 larvae) were uncommon in our eastern Gulf collections. Spanish mackerel larvae were observed on six cruises in spring and summer. Some occurrences of *S. maculatus* were observed along the entire Florida Gulf coast (Figure 128). All occurrences were at stations < 50 m deep and most occurrences were at stations < 20 m deep. Larvae of *S. cavalla* were collected on only three cruises in summer and fall. All except one occurrence were at stations < 50 m deep.

*Scomber japonicus* (11 larvae)

Chub mackerel larvae were uncommon in our eastern Gulf catches. Occurrences were recorded on three winter cruises and one spring cruise. Of the seven station occurrences, five were at stations > 50 m deep and the remaining two were at stations near the 50 m isobath.

Acanthocybium solanderi (2 larvae)

Single occurrences of wahoo larvae, one in spring (GE7208) and one in summer (GE7205) were recorded at two stations > 100 m deep.

72. Gempylidae (79 larvae; 3 genera; 3 species)

Gempylid larvae occurred on 14 cruises. Most could not be identified to species. Larvae occurred in all seasons but largest numbers (73.4%) were collected in summer and fall. Occurrences were observed in both the northern and southern half of the survey area. All larvae were collected at stations > 50 m deep. Two larvae of Nesiarchus nasutus were identified, one in winter (GE7101) and one in fall (IS7320). A single Nealotus tripes was collected in winter (IS7303), and one Gempylus serpens was collected in fall (IS7320).

73. Trichiuridae (10 larvae, 1 genus, 1 species)

A few cutlassfish larvae were collected in fall, winter and spring on five of the cruises. All larvae were identified as Diplospinus multistriatus. Seven of the larvae (70%) occurred in the southern half of the survey area and all were collected at stations where depth is > 50 m.

74. Istiophoridae (2 larvae; 1 genus; 1 species)

Only two billfish larvae were collected. A single sailfish Istiophorus platypterus occurred on cruise IS7308 at a station > 200 m deep. The other unidentified istiophorid was collected on cruise IS7205 at a station > 100 m deep. Larvae of billfishes probably are more common in the eastern Gulf than indicated in our survey. Billfish larvae are relatively uncommon, inhabit the sea surface and are agile swimmers. They probably are not effectively sampled by the bongo net gear used in this survey. Such larvae sometimes can be collected in relatively large numbers with neuston nets, although the catches in this gear are difficult to quantify.

75. Stromateidae (37 larvae; 1 genus; 2 species)

Two species of butterfishes were collected. Peprilus paru (25 larvae) was collected on four cruises in summer and fall. Larvae were distributed along the entire north-south extent of the survey area, where all occurrences except one were at stations < 30 m deep (Figure 129). A second species, P. burti (8 larvae) occurred on five cruises in summer, fall and winter. All occurrences of P. burti were in the northern half of the survey area and all except one occurrence were at depths > 50 m (Figure 129).

76. Nomeidae (135 larvae; 2 genera; 3 species)

Most nomeid larvae were Cubiceps pauciradiatus (104 larvae). They were collected on 11 cruises in all seasons. Most of the C.

pauciradiatus larvae (93.3%) were taken in spring and summer cruises. All except three occurrences of C. pauciradiatus were at stations where depth exceeded 50 m; the three exceptions were in the southernmost part of the survey area (Figure 130). The second most common species was Psenes pellucidus (12 larvae). Occurrences were observed on seven cruises in all seasons; there was no apparent seasonality in the few occurrences. All occurrences were at stations > 50 m deep (Figure 131). Psenes cyanophrys (7 larvae) was observed on two cruises in winter and spring. Larvae occurred at three stations > 50 m deep.

77. Ariommidae (95 larvae; 1 genus)

Driftfishes, Ariomma spp., were collected on 12 of the 17 cruises. They occurred in all seasons. These larvae could not be identified to species. Most Ariomma spp. larvae (72.7%) were collected in the southern half of the survey area and 91.6% of the larvae occurred at stations > 50 m deep.

78. Gobiidae (21,621 larvae)

The gobies were the second most frequently observed family of larvae in the eastern Gulf. Only clupeid larvae were more frequently observed. No attempt was made to identify goby larvae because of the uncertain taxonomy of larval stages in this family. Because these larvae are a dominant kind in the eastern Gulf, a detailed systematic study to identify the species would be an important undertaking.

Larval gobies were always among the 10 most frequently observed families in the 17 cruises. They were the most frequently observed family on seven of the cruises. Gobies were common in all seasons but most (78.4%) were collected in spring and summer. Larvae were abundant in both the northern and southern sectors of the survey area. Most goby larvae (69.9%) were collected at stations < 50 m deep, but larvae were common at offshore stations and estimated abundances (number under 10 $m^2$) usually were higher at the offshore (> 50 m) than at onshore stations. If one family of fish larvae were chosen that characterized ichthyoplankton samples from the eastern Gulf, the Gobiidae would be the best representative family.

79. Microdesmidae (39 larvae; 1 genus)

Larvae of wormfishes, Microdesmus spp., were collected in spring on three cruises. All, except one larva, were collected at stations < 50 m deep.

80. Scorpaenidae (2,066 larvae)

Scorpionfish larvae were the seventeenth most frequently observed family. Many of the larger specimens probably could have been identified to genus, but because many species occur in the eastern Gulf ana their larval taxonomy is unknown, no effort was made to identify these larvae other than at the family level. Larval scorpaenids were collected on all 17 cruises. Most of the larvae (75.0%) were taken in spring and summer, but they were common at other seasons. Larvae were widely distributed over the shelf in the eastern Gulf; they were more commonly collected in the southern half of the survey area (60.9% of larvae) than in the northern half. Although scorpaenid larvae were more frequently observed at stations < 50 m deep (54.4% of larvae), estimated abundances (number under 10 $m^2$) were greatest over deeper shelf waters.

81. Triglidae (2,230 larvae)

Triglid larvae were collected on all 17 crusies. There was no apparent seasonality in their occurrences. They were the sixteenth most frequently observed family of larval fishes. No triglid larvae were identified to species. Occurrences were common in both the northern and southern halves of the survey area. Most of the larvae (79.0%) were collected at stations < 50 m deep but abundances (number under 10 $m^2$) were slightly higher at stations > 50 m deep.

82. Dactylopteridae (1 larva; 1 genus; 1 species)

One larva of *Dactylopterus volitans* was collected on cruise IS7308 at a station > 50 m deep.

83. Bothidae (9,165 larvae; 9 genera; 11 species)

Some kinds of bothid larvae were collected on all 17 cruises. Larval bothids occurred from nearshore to the deepest stations that were sampled. They were the third most frequently observed family of larvae in the eastern Gulf. Bothids were among the 10 most frequently observed families of larvae on 14 of the 17 cruises. Three species were particularly common; they are *Syacium papillosum*, *Bothus robinsi* and *Etropus rimosus*. Larvae of those three species accounted for 77.6% of all bothid larvae that were collected. Larvae of four *Citharichthys* species accounted for another 17.2% of the bothids.

Using part of the data from these cruises, Dowd (1978) presented a detailed account of the distribution and abundance of larval Bothidae in the eastern Gulf during 1971 and 1973. She also discussed larval ecology and adult abundances, and she illustrated some species of bothid larvae that were previously undescribed or poorly known. Because they are frequently collected, relatively easy to identify and their distributions in the eastern Gulf are now well documented, this family is one that could be used to identify possible changes in eastern Gulf ichthyoplankton at some future date. Larvae of *Syacium papillosum* and *Citharichthys cornutus*, both of which were common in our survey, also were among the most common adult fishes collected in bottom trawl samples on BLM eastern Gulf of Mexico cruises (Alexander *et al*., 1977).

*Citharichthys* spp. (1,580 larvae)

Four species of *Citharichthys* were collected; they are *C. cornutus*, *C. gymnorhinus*, *C. macrops* and *C. spilopterus*.

Citharichthys cornutus (585 larvae) was collected on 15 of the cruises. It occurred at all seasons but most larvae (83.6%) were taken in spring and summer (Figure 132). Larvae of C. cornutus were among the 20 most frequently identified larvae on 11 cruises and were among the 20 most abundant species on 12 cruises, when mean abundances ranged from 1.0 to 9.7 larvae under 10 $m^2$ of sea surface. Most of its larvae occurred at offshore stations; 55% of the C. cornutus occurrences were at stations > 100 m deep. A few occurrences were recorded at stations < 50 m deep. Larvae were collected along the entire north-south extent of the survey area (Figures 133 and 134). Larvae of C. gymnorhinus (342 larvae) were collected on 14 cruises. They were present in all seasons with no apparent marked differences in seasonal abundance (Figure 135). Citharichthys gymnorhinus larvae were among the 20 most frequently identified species on eight cruises and were among the 20 most abundant species on six cruises, when their mean abundance ranged from 1.9 to 5.1 larvae under 10 $m^2$. Like C. cornutus, larvae of C. gymnorhinus usually were collected at stations > 50 m deep. However, only 27% of the C. gymnorhinus larval occurrences were at stations > 100 m deep (Figures 136 and 137). Larvae of C. macrops (637 larvae) occurred on all 17 cruises with no apparent differences in seasonal abundances (Figure 138). They were among the 20 most observed species on 13 cruises and among the 20 most abundant species on 10 cruises when their mean abundances ranged from 0.4 to 2.2 larvae under 10 $m^2$. Larvae of C. macrops were collected along the entire north-south extent of the survey area and > 95% of the occurrences were at stations < 50 m deep (Figures 139 and 140). No C. macrops larvae were collected at stations beyond the 200 m isobath. Relatively few C. spilopterus (12 larvae) were collected. They occurred on only two cruises; 11 larvae were collected on summer cruise 8C7120-TI7121 and one larva was observed on a winter cruise, GE7101. Three of the four station occurrences for C. spilopertus were at depths > 100 m; the single winter occurrence was at a station only 25 m deep, near the Dry Tortugas where isobaths converge rapidly.

Cyclopsetta fimbriata (84 larvae)

Larvae occurred on 14 of the 17 cruises. Although not common compared to other bothids, a few larvae were taken on most cruises. The majority (84.5%) occurred in spring-summer cruises. The distribution of C. fimbriata was widespread in the eastern Gulf (Figure 141). More than 70% of all occurrences for this species were at stations < 50 m deep but they were collected frequently at deeper stations.

Etropus rimosus (1,843 larvae)

This species was the third most frequently collected bothid larva in the eastern Gulf. It occurred on all 17 cruises but was most frequently observed in winter and spring, when a distinct spawning peak must occur (Figure 142). Larvae of E. rimosus were included in the 20 most often observed, identified species on 11 cruises and in the 20 most abundant species on 10 cruises, when their mean abundances ranged from 0.7 to 19.2 larvae under 10 $m^2$. The larvae were collected throughout the shelf area, with only two occurrences recorded beyond the 200 m isobath (Figures 143 and 144). More than 65% of the occurrences were at stations < 50 m deep and > 95% were included within the 100 m isobath. Occurrences in summer months tended to be at stations of relatively great depth compared to occurrences at other seasons when a wider distribution was observed.

Syacium papillosum (3,317 larvae)

This species is one of the most frequently collected and widely distributed larval fish in the eastern Gulf of Mexico. Larvae of S. papillosum, the most common bothid, occurred on 16 of the 17 cruises; it was absent on cruise CL7405 when only nearshore stations were sampled. Syacium papillosum larvae were most common in summer, common in fall and spring, and least common in winter (Figure 145). They were among the 20 most frequently collected, identified species on all 16 of the cruises in which they occurred and they were included among the 20 most abundant species on 15 of the cruises, when mean abundances ranged from 2.2 to 54.9 under 10 $m^2$. Larvae were collected at stations as shallow as 5 m and as deep as 2,835 m (Figures 146 and 147). Fifty-two percent of the S. papillosum occurrences were at stations < 50 m deep and 83% were at stations < 100 m deep. Larvae were observed over the entire north-south extent of the survey area, but they were found only in the southern one third of the area during winter, indicating that spawning is restricted to that area during the coldest months.

Bothus robinsi (1,955 larvae)

This was the second most common bothid larva collected in the eastern Gulf. It occurred on all 17 cruises. There were no clear peaks of seasonal abundance (Figure 148), but abundances were highest and larvae most frequently collected in summer and fall. Bothus robinsi larvae were among the 20 most frequently observed and 20 most abundant species on all 17 cruises. Their mean abundance ranged from 0.04 to 24.5 under 10 $m^2$. Larvae of B. robinsi occurred at stations throughout the eastern Gulf (Figures 149 and 150). They were collected at stations only 5 m deep and at stations > 3,000 m deep. Forty-nine percent of the larval occurrences were at stations < 50 m deep and 81% at stations < 100 m deep.

Other bothids (55 larvae)

Monolene sessilicauda (19 larvae) occurred on seven cruises in all seasons. There was no evidence of changes in its seasonal abundance. Larval occurrences were observed at stations as shallow as 35 m but 81% of the occurrences were at station depths > 50 m. Trichopsetta ventralis (2 larvae) was collected at a single station > 50 m deep on cruise 8C7120-TI7121. Larvae of Engyophrys senta (12 larvae) occurred on three summer cruises. The five station occurrences were all at depths > 50 m. Paralichthys spp. (22 larvae) occurred on six cruises in fall, winter and spring. All Paralichthys larvae occurred at stations < 30 m deep. Catches probably would have been higher if more stations < 10 m deep had been sampled in the survey because bothids in this genus apparently spawn in nearshore, coastal waters.

In addition to the identified Bothidae, a large number (331 larvae) could not be identified beyond the family level. Some of these larvae may have been Ancyclopsetta spp. or Gastropsetta spp., but the majority were small or mutilated larvae which, because of their condition, could not be identified.

84. Pleuronectidae (1 larva)

A single pleuronectid flatfish larva was collected on cruise IS7303 at a station > 50 m deep. This specimen, though not identified, possibly is Poecilopsetta beani.

85. Soleidae (41 larvae; 2 genera; 2 species)

Achirus lineatus (27 larvae) was collected on nine cruises. Larvae occured in spring and summer, except for a single larva collected on a winter cruise (8B7201—GE7202). Larvae of A. lineatus occurred at stations < 50 m deep, with the single exception of the one larva collected in winter (Figure 151). More than 80% of all A. lineatus occurrences were at stations < 15 m deep. Gymnachirus melas (12 larvae) occurred on five cruises; it occurred in all seasons but was most common in spring. All except a single occurrence of G. melas were from stations < 50 m deep (Figure 151). Most occurrences of G. melas were at depths greater than those where A. lineatus were collected. The two species apparently overlap little in their spawning areas in the eastern Gulf.

86. Cynoglossidae (815 larvae; 1 genus)

Larvae of tongue soles were collected on 16 of the 17 cruises. All larvae are in the genus Symphurus but none could be identified to species. They occurred in all seasons but were most common in spring and summer when 91.7% of their larvae were collected. Larvae were taken over a broad area in the eastern Gulf, but they were more frequently collected in the southern half of the survey area (65.0%) than in the northern half. Most of the larvae (80.1%) were collected at stations < 50 m deep.

87. Balistidae (2,808 larvae)

Filefishes and triggerfishes were the thirteenth most common family of larvae in our collections. No attempt was made to identify them to species. Several species are represented in the samples. Balistid larvae occurred on all 17 cruises but most of them were collected in spring-summer (86.4%). They occurred throughout the survey area, although more larvae (62.7%) were taken in the southern half than in the northern half of the area. Most larvae were collected at stations < 50 m deep (76.6%), but estimated abundances (number under 10 $m^2$) were greater at offshore stations.

88. Ostraciidae (3 larvae)

Three ostraciid larvae were collected on two summer cruises (8C7120—TI7121 and GE7210). Larvae were not identified to species. They occurred in the southern half of the survey area at stations < 50 m deep.

89. Tetraodontidae (1,139 larvae)

Puffer larvae were common in the eastern Gulf. Most of the larvae were Sphoeroides spp., but no attempt was made to identify them to species. Larval puffers were collected on all 17 cruises. They were most common on spring cruises, but no clear differences in seasonality were apparent. Larvae were widely distributed; although most larvae (65.6%) were collected at stations < 50 m deep, abundances (number under 10 $m^2$) were similar between the < 50 m and > 50 m depth zones.

90. Diodontidae (2 larvae)

Two diodontids, not identified to species, occurred on two cruises, one in summer (8C7120—TI7121) and one in spring (GE7208). Both larvae occurred at stations > 50 m deep.

91. Gobiesocidae (23 larvae)

A few gobiesocids were collected on five cruises. Occurrences were recorded in fall, winter and spring. Larvae were most common (69.6%) in the northern half of the survey area and all occurrences were at stations < 50 m deep.

Estimated Annual Abundances and Apparent Mortality

An estimate of the number of larvae of each species in the survey area by 0.5 mm length-classes was provided by the ELSUM program output. Using the procedure described by Houde (1977a) the annual production of larvae in each length class was estimated for selected species. The decline in estimated production (i.e., annual abundance) as length increased was a measure of apparent mortality. From the exponential regression of annual abundance on length, the instantaneous rate of decline was estimated. The mortality coefficent that was obtained is useful to estimate the abundances of larvae in length-classes that are fully retained by meshes of the sampling gear and in which relatively little avoidance behavior by the larvae occurs. Percent mortality between the smallest and largest categories of larvae that hopefully meet the assumptions can be a useful index of annual variations in overall abundance and in larval survival rates. Changes in the eastern Gulf of Mexico environment presumably would have an impact on larval production and perhaps survival. Future ichthyoplankton surveys, conducted with the gears and methods that we employed, possibly could detect effects of environmental change by comparing abundances and apparent mortalities with data from our 1971-1974 survey.

Estimates of abundance and mortality for 26 species of larvae that are important ecologically or economically in the eastern Gulf are given in Table 40. The declines in abundance over the length classes used in the analyses and the fitted regressions are illustrated in Figures 152-174. The mortality coefficients can be meaningfully compared among years for the same species. For species with similar morphology and growth rates, it also is interesting to compare the coefficients among species. In some cases, when annual data were not adequate to obtain good estimates, a pooled estimate of mortality and abundances over two or more years was made. Information for some of the clupeids came from published accounts in Houde (1977a, 1977b, 1977c). Carangid estimates were previously given by Leak (1977). His estimates have been updated for this report by inclusion of additional data. Some of the 1973 estimates for Bothidae are from the thesis by Dowd (1978).

Annual estimates of the rate of decline in abundance (the mortality coefficient in Table 40) usually were similar among years for those species where yearly estimates were available. In only one species could the annual mortality coefficient estimates be shown to differ among years. Bregmaceros Type B had a significantly lower rate of decline ($P < .05$) in 1972 than in 1971 and 1973. Some other species had relatively large differences in the mortality coefficient among years (e.g., Benthosema suborbitale), which possibly are real, but variability in the data and the relatively few data points to which the regressions were fit (Figures 152-174) made it impossible to judge the coefficients significantly different at the $\alpha = .05$ level.

Each of the major taxonomic groups (orders and families) that was included in this analysis seems to have a characteristic apparent mortality rate. The observed instantaneous rates of decline per mm of growth may be a function of the rates of growth in length of larvae that we selected for the analysis. The means of the apparent mortality coefficients (from Table 40 data) for the taxa used are:

| | |
|---|---|
| Clupeiformes | |
| Clupeidae | $\bar{Z}$ = .3909 |
| Salmoniformes | |
| Gonostomatidae | $\bar{Z}$ = .3947 |
| Pleuronectiformes | |
| Bothidae | $\bar{Z}$ = .4454 |
| Gadiformes | |
| Bregmacerotidae | $\bar{Z}$ = .6244 |
| Myctophiformes | |
| Myctophidae | $\bar{Z}$ = .7313 |
| Perciformes | |
| Serranidae | $\bar{Z}$ = .8372 |
| Scombridae | .9651 |
| Pomadasyidae | 1.0730 |
| Carangidae | 1.0957 |

Long-bodied larvae, like the Clupeidae, usually grow relatively fast in length and thus sustain relatively small losses per mm of growth. The more robust larvae, like those in Perciformes, usually grow relatively slowly in length (but may add big increments of weight per unit length) and thus have high apparent mortality rates. The apparent mortality rates when considered as percentage losses per mm of growth $(1-e^{-z})\cdot 100$ show that the Clupeidae sustain an average of 32.4% loss per mm of growth, the Gonostomatidae a 32.6% loss, the Bothidae a 35.9% loss, the Bregmocerotidae a 46.4% loss, the Myctophidae a 51.9% loss and the families of perciforms a 56.7 to 65.8% loss per mm of growth.

Although the mortality coefficients usually were not significantly different among years for the species in Table 40, there were great differences in estimated abundances (annual production) of some species for the length-classes used in the analysis. Because larvae in the largest length-class for which abundance was estimated were nearing size at transformation, the annual differences in those abundance estimates may be an index of differential larval production among years. For Sardinella anchovia, the estimated number of 15.5 mm SL larvae produced in 1972 was 21 times greater than estimated production in 1971 (Table 40). For the other clupeids, estimated abundances at 15.5 mm SL differed among years by only a factor of three. For the gonostomatid, Maurolicus muelleri, estimated production of 10.5 mm SL larvae in 1973 was 8.5 times as great as 1972 production. For the two myctophids, Myctophum nitidulum and Benthosema suborbitale, annual estimates differed by factors of 2.4 and 3.5, respectively. For the Bregmacerotidae, there were relatively small differences in estimated annual production for Bregmaceros atlanticus (3.5 times) and Bregmaceros Type B (1.8 times), but Bregmaceros Type A was very abundant in 1972 when its estimated abundance at 7.3 mm SL exceeded 1971 abundance at that length by a factor of 22. The serranid, Diplectrum formosum, differed in estimated annual production at 7.8 mm SL by only a factor of 2.1 among the three years. The carangid, Decapterus punctatus, differed in production at 9.3 mm SL by a factor of 2.9 among the three years. For bothids in the genus Citharichthys, annual production estimates differed only by a factor of 2.8 for 13.5 mm SL C. cornutus and 2.7 for 9.5 mm SL C. macrops, but C. gymnorhinus at 11.5 mm SL was 7.5 times more abundant in 1973 than in 1971. The remaining bothids, Etropus rimosus, Syacium papillosum and Bothus robinsi had maximum differences in annual production that ranged from 2.7 to 3.2 for the lengths used in the analysis.

Variations in annual abundances of larvae (Table 40) are not necessarily indices of differences in annual recruitment for these species. In addition to the problem of obtaining accurate and precise estimates because of sampling variability, many of the species collected in the eastern Gulf have open-ended distributions (i.e., only a part of the potential recruit population was sampled). Also, the length of larvae at which annual production was estimated was less than that at which year-class size probably is fixed. The analysis does show that most species in the eastern Gulf vary annually in estimated abundance during the late larval stages by a factor of 2.0 to 3.5 times and that occasional larger fluctuations in abundance (5.0 to 25.0 times) can be observed. The estimated abundances and their yearly variations that we observed can be used in future ichthyoplankton surveys to determine if significant changes in either absolute abundance or apparent survival have occurred for fish larvae in the eastern Gulf of Mexico.

Biomass Estimates

Biomasses were estimated for a few species from either their egg or larval abundances. Relatively few estimates were made because fecundities were unknown for most species and asynchronous spawning by many species made it impossible to determine the spawning season. Estimates for clupeid species were made on previous Sea Grant - supported research (Houde, 1977a, 1977b, 1977c) and are summarized in this report. The 1973 estimate for the bothid, Syacium papillosum, is from Dowd's (1978) thesis, which was written while she participated in the BLM project. The 1971 and 1972 S. papillosum estimates, the estimates for the carangids, Decapterus punctatus, and Trachurus lathami, and those for bluefin tuna, Thunnus thynnus, were made specifically for this report.

Based on the sample of biomass estimates that we have made (Table 41) and the known relative abundances of larvae in the eastern Gulf, it is apparent that most of the common species have biomasses < 100,000 metric tonnes in the survey area. Some of the clupeids and the carangid, D. punctatus, have biomasses in the 100,000 - 700,000 metric tonnes range, but it is doubtful that any species in the eastern Gulf has a biomass of one million metric tonnes. Some of the estimates that were based on larvae (Table 41) are minimal biomass estimates. Biomass estimates for Spanish sardine Sardinella anchovia were not made but, based on larval abundances and probable similar fecundity to Atlantic thread herring Opisthonema oglinum, biomasses of the Spanish sardine probably exceed 200,000 metric tonnes.

A relatively large biomass of bluefin tuna T. thynnus was estimated in 1972 and 1973 (Table 41). This estimated biomass is for a migratory population that is present in the Gulf only from February through May when it spawns. Thus, the biomass is a concentrate of an Atlantic population that is more dispersed at other seasons; it also is only a partial estimate of the biomass in the Gulf of Mexico, because most of the spawning bluefin population is not in the area represented by our ichthyoplankton survey.

The small bothid flatfish, Syacium papillosum, was the most abundant juvenile or adult fish sampled in bottom trawls as part of 1975-76 MAFLA-BLM research (Alexander et al., 1977) and in the Florida Department of Natural Resources HOURGLASS cruises (Topp and Hoff, 1972). Its mean estimated biomass for 1971-1973, based on our larval production estimates, is 102,694 metric tonnes in the eastern Gulf survey area. Larvae of two other bothid species, Bothus robinsi and Etropus rimosus, were nearly as common as S. papillosum larvae in the eastern Gulf. No fecundity estimates were available for those species but, assuming that their relative fecundity is equal to that of S. papillosum (i.e. 690 ova $g^{-1}$), then the following biomasses, averaged for 1971 - 1973, are probable: B. robinsi -- 69,319 metric tonnes; E. rimosus -- 62,724 metric tonnes.

Diversity

Ichthyoplankton in the eastern Gulf of Mexico is relatively diverse. Only 41.7% of the larvae that were collected on the 17 cruises were identified to species, but the 59,701 specimens that were identified included 173 species. If we had been able to identify species in many of the abundant families whose larvae are undescribed (e.g., Gobiidae, Ophidiidae, Synodontidae, Scorpaenidae), the number of species present would be more than double that which we report. As in most communities, a relatively few species dominate the ichthyoplankton of the eastern Gulf of Mexico. The 20 most frequently collected, identified species totaled 53,394 larvae (Table 42), which is 89.4% of all larvae that were identified to species and 37.3% of all larvae that were collected. Within the 20 most common species list, the Clupeidae (4 species), Bothidae (5 species), Serranidae (3 species) and Carangidae (2 species) contained the most individuals (47,031). The four clupeid species alone totaled 28,561 larvae. Other common species certainly are present in the unidentified part of our collections, but based on present knowledge, the 20 species listed in Table 42 comprise the dominant identifiable larvae.

Because the most common species occur in different depth zones, the observed catches, before being standardized to a unit area of sea surface, are not always good indicators of true abundance (i.e., infrequently collected larvae that occur in deep water may be abundant relative to commonly collected larvae that occur in shallow depths. Thus, mean abundances (as numbers under 10 $m^2$) over the 17 cruises of the 20 most often collected species were calculated for < 50 and > 50 m depth zones as well as North and South sectors of the survey area (Table 43) as indices of true abundance. When presented this way it is clear that species which are found offshore often have higher abundances than their ranked order of occurrence in catches (Table 42) would indicate (e.g., compare Myctophum nitidulum to Harengula jaguana). Also, in some instances the estimated abundances (numbers under 10 $m^2$) of species vary greatly among North and South sectors (e.g., Opisthonema oglinum), often more than the observed numbers in catches might imply. In estimating diversity of ichthyoplankton in the eastern Gulf, where station depths varied from < 10 m to > 3000 m, it was necessary to consider species' abundances rather than occurrences to gain a good understanding of how the numbers of species and individuals in those species varied seasonally, annually, and among sectors of the survey area.

A taxocene of 94 species was designated for consideration in all diversity estimates. Those species and the ranges of surface temperatures, surface salinities and station depths where they were collected are listed in Table 44. The taxocene consists of species for which 10 or more individuals were collected on the 17 cruises and for which larvae of all sizes were recognized. Thus, although relatively large specimens of Rhomboplites aurorubens were observed more than 10 times, this species is not in the taxocene because its smallest larvae could not be distinguished from those of other lutjanids.

The number of species in the taxocene that was observed at individual stations is one measure of diversity. The frequency distributions of stations at which numbers of species were observed were examined for the five 1973 cruises, when sampling effort was nearly equal on each cruise (Table 45). For species in the taxocene, the modal class over all cruises is 4—7 species per station (50% of all occurrences fall in this class). Mean numbers of taxocene species per station range from 6.04 to 7.69 for the five cruises with highest values occurring in spring and summer. The maximum number of taxocene species that was observed at a single station was 21 species on cruise IS7308. The frequency distribution of stations that yielded observed numbers of species differed between the < 50 and > 50 m depth zones (Table 45). More taxocene species per station usually were observed at the > 50 m depth stations. Mean numbers per station ranged from 4.33 to 6.65 at < 50 m deep stations but were 9.17 to 10.41 at > 50 m deep stations. Part of the difference in numbers of taxocene species observed per station in the two depth zones resulted from differences in our ability to identify larvae that occur in the two zones, but the result mostly reflects the greater diversity of species that is present in offshore waters of the eastern Gulf.

Estimates of diversity for each cruise were made (Table 46). The species richness component (R) was calculated only for IS7209 and all 1973 cruises, when the sampling plan was uniform. Values of H', J and C were plotted (Figure 175) to show any seasonal or annual trends in diversity which might indicate progressive changes in the ichthyoplankton community. Values for cruise GE7210 were not plotted because only 13 stations, all nearshore, were sampled on that cruise and the estimated coefficients probably misrepresent the real diversity in the ichthyoplankton at that time. For the 16 remaining cruises, only the IS7205 and CL7412 diversities diverge noticeably from the others. Low diversity on those cruises resulted from higher than usual catches of clupeid larvae, particularly Sardinella anchovia. The dominance of the ichthyoplankton community by this species is best shown by Simpson's index (C), which indicates that there was an approximate 25-35% probability of randomly picking in sequence two larvae of the same species from the collections of those two cruises.

The evenness component (J) of diversity measured the evenness of distribution of individuals among the species that were sampled. Values of J are proportions of the maximum possible diversities for s species (i.e., $H'_{max} = \log_e s$), which would be observed if all species were equally abundant. The mean values of J were compared among three years, 1971, 1972, and 1973 in an analysis of variance, in which the variables were the individual cruise estimates of J (Table 47). Mean values of J ranged from .6641 in 1972 to .7080 in 1971. The mean diversities did not differ significantly among the three years ($P > .50$). An analysis of variance on the evenness coefficients also was run to determine if mean ichthyoplankton diversity differed among seasons (Table 48). Mean coefficients ranged from a low value of .6070 in summer, when clupeid, bothid and carangid dominance was most evident, to a high value of .7073 in fall. The mean seasonal, evenness coefficients were not judged to differ significantly ($P > .50$). Within season variability was relativly high compared to any seasonal differences in mean ichthyoplankton diversity. The mean numbers of taxocene species that were collected in each season were similar except in winter when fewer species were observed. The means were: winter -- 42.5 species; spring -- 57.2 species; summer -- 53.0 species (excluding cruise GE7210, which was not representative); fall -- 54.3 species.

Because the mean annual and seasonal evenness coefficients were not significantly different, the pooled mean coefficient for 1971-73 cruises, exclusive of cruise GE7210, may be the best estimator of larval diversity. The two 1974 cruises also were excluded because no (CL7405) or few (CL7412) offshore stations were sampled. The pooled mean evenness coefficient is $J = .6927$. With .95 probability, J ranges from .6528 to .7326. Future ichthyoplankton survey work in the eastern Gulf, in which the same taxocene is examined, can refer to that value to judge if significant changes in diversity have occurred. The value might also be a useful point of reference for ichthyoplankton surveys in other areas for comparing relative diversities, but this would only be true if the same or similar taxocene were available in the two regions.

When the northern and southern sectors of the survey area were compared, there were no clear differences in diversities between the two sectors. The Shannon-Weaver coefficient (H') was higher on most cruises in the southern sector and the Simpson coefficient (C) usually indicated higher species dominance in the northern sector (Table 49; Figure 176). The mean number of taxocene species collected per cruise was higher in the southern sector (48.2 species) than in the northern sector (40.4 species). The greater availability of species in the southern sector can be seen for the six cruises where species richness (R) was calculated (Table 49). It is higher in the south in four of the six cases. Despite an apparent higher diversity in the southern sector there were no significant differences among sectors for 10 cruises in which the evenness coefficients (J) could be compared in a paired-t test ($P > .50$) (Table 50). Evenness was highest in the North on four cruises and in the South on six cruises. More species apparently are present in the southern sector but the abundances of individual species of larvae are distributed with equal evenness among species in both sectors.

Diversity in the ichthyoplankton was highest at offshore stations. All of the coeffcients that were calculated reflected the relatively diverse nature of ichthyoplankton at stations > 50 m deep (Table 51; Figure 177). The mean number of taxocene species present per cruise was 44.8 at > 50 m stations but only 26.9 at < 50 m stations. For the six cruises where applicable, the species richness coefficient (R) showed a particularly good contrast in diversity between offshore and onshore zones (Table 51). A paired-t test was used to compare the evenness coefficients (J) for offshore and onshore zones in 13 cruises (Table 52). The difference in coefficient values was highly significant ($P < .002$), confirming the greater diversity in offshore ichthyoplankton. In addition to fewer species of larvae being present at < 50 m deep stations, a few species of clupeids (e.g., *Opisthonema oglinum* or *Sardinella anchovia*) tended to dominate abundances of larvae in that depth zone, which led to relatively low estimates of ichthyoplankton diversity.

Two transects of our ichthyoplankton survey coincided with transects that were sampled as part of BLM-sponsored, MAFLA research in 1975-76 (Alexander *et al.*, 1977). The first of these transects (MAFLA I) was offshore from Sanibel Island (latitude 26°30'N) and the second (MAFLA II) was off Tampa Bay (latitude 27°30'N). The diversity of ichthyoplankton was examined for stations on those transects.

There were no apparent differences in ichthyoplankton diversity between the Sanibel and Tampa Bay transects for 11 cruises where both transects were sampled. The mean number of taxocene species per station was 8.2 for the Sanibel transect and 8.1 for the Tampa Bay transect. A paired-t test between evenness coefficients (J) for the 11 cruises did not detect any significant differences in diversity between the transects ($P > .20$) (Table 53). Although a species by species comparison was not carried out, the species of larvae that were present on the two transects apparently were similar.

There were significant within cruise diversity differences when the North and South sectors or the < 50 m and > 50 m depth zones were compared. A t test, based on the method outlined in Poole (1974) and Zar (1974) showed that the Shannon-Weaver coefficients (H') differed significantly in every case at $P < .001$ for 13 cruises when < 50 m and > 50 m diversities were compared (Table 54). The > 50 m depth Shannon-Weaver coefficient was always higher than the corresponding coeffficient for < 50 m depths, indicating that the ichthyoplankton community is more diverse offshore. Similar t tests for North vs. South diversities on 10 cruises showed 9 out of 10 within cruise comparisons to differ significantly at the $\alpha = .05$ level (Table 54). The diversity of the ichthyoplankton usually differed significantly between northern and southern sectors at the time of a cruise, but diversity was not consistently higher in either the North or South sector. In three of the cruises diversity was higher in the North sector than in the South sector.

## Larval Abundances and Occurrences in Relation to Environmental Factors

Results of the simple linear correlation analyses, where the logarithm of larval abundance (number under 10 $m^2$) at a station was correlated with surface temperature, surface salinity, station depth, latitude, and the logarithm of zooplankton volume ($cm^3$ 1000 $m^{-3}$), are summarized in Table 55. Only stations that had non-zero catches (i.e. positive stations) of the species being considered were included in the analyses. The analyses were run on the same 94 species that had been considered in the analysis of larval diversity. Only those species with five or more occurrences were used in any of the correlation analyses. Correlation coefficients that were significant at the .05 or .01 level are listed in the tables and non-significant correlations are indicated by a dashed line. Results are presented in three categories: Table 55 includes pooled data from all 17 cruises; Tables 56-60 are seasonal analyses, with data pooled from cruises in the same season over all years; Table 61-77 are the correlation analyses for each of the cruises.

The most striking result of the analysis is the scarcity of significant correlations between larval abundance and the other variables that were considered. Relationships among the variables almost certainly are complex and the simple linear correlations do not detect the multiple or partial correlations that may be present. Two other factors influenced the outcome of the correlation analyses, making results difficult to interpret. The oblique net tows used in these surveys are effective to obtain integrated estimates of larval abundances over the range of depths sampled by the net, but they do not provide explicit information on depths of larval occurrence. Thus, variables such as surface temperature and surface salinity may be poor correlates of larval abundance if the larvae are not concentrated near the surface. A second factor, which particularly affected the larval abundance - surface salinity correlations, was the presence of a 15-m thick lens of low salinity water in the eastern Gulf during summer, 1973, which originated from Mississippi River flood runoff. It resulted in some significant, but probably spurious, negative correlations between larval abundances and surface salinity in correlation analyses for cruises IS7311, IS7313 and the pooled data, correlation analyses. For example, it is not likely that abundances of several species of oceanic fish larvae are significantly greater when low surface salinity conditions prevail in the eastern Gulf. It is probable that many of these larvae actually were collected from beneath the lens of low salinity water (24 -32$^{o}$/oo), but in our analysis, which used surface salinity as the variable to be correlated with larval abundance, an apparent negative correlation could have resulted.

An alternative approach to determine how occurrences of the most commonly collected species of larvae were related to surface temperatures, surface salinities and station depths was taken, in which the percentage cumulative frequencies of station occurrences for the 20 most commonly identified larvae were calculated (Table 78). It is easy to judge what ranges of conditions are most often associated with occurrences of each of the species. Although only the 20 most common species are included in this tabulation, the calculations were completed for the 94 species that had been considered in the diversity analysis. Data for all 94 species are on tape and available if needed. A description of the relationships observed for the 20 most common species is presented here.

1.) Sardinella anchovia: Larvae occurred when surface temperatures ranged from 21.0 - 32.0$^{o}$C, but most occurred at 24.0 - 30.0$^{o}$C. Most larvae were collected where surface salinities were $\geq$ 35.0$^{o}$/oo and 90% of occurrences were at stations $\leq$ 50 m deep.

2.) Opisthonema oglinum: Larvae occurred at surface temperatures from 18.0 - > 31.0$^{o}$C, but mostly at 24.0 - 30.0$^{o}$C. Most larvae were collected at salinities $\geq$ 35.0$^{o}$/oo and most occurrences (77%) were at stations $\leq$ 30 m deep.

3.) Decapterus punctatus: Larvae occurred at surface temperatures from 20.0 - ≥ 32.0°C; most occurrences were at 23.0 - 32.0°C. Most occurrences were at salinities ≥ 35.0°/oo. The larvae were widely distributed but 90% of occurrences were at stations ≤ 90 m deep.

4.) Diplectrum formosum: Larvae were collected over a wide range of surface temperatures, 17.0 - ≥ 32.0°C. Most occurred when surface temperatures ranged from 23.0 - 29.0°C. They usually were found when surface salinities were ≥ 35.0°/oo and station depths ≤ 50 m.

5.) Harengula jaguana: These larvae occurred at surface temperatures from 18.0 - 30.9°C, but usually occurred at 24.0 - 30.0°C. They frequently were observed (31% of occurrences) where salinities were ≤ 35.0°/oo, but most occurrences were at ≥ 35.0°/oo. Most larvae occurred at stations ≤ 30 m deep.

6.) Syacium papillosum: Larvae occurred at 19.0 - 32.0°C surface temperatures but most occurrences were at 25.0 - 31.0°C. They usually occurred at surface salinities ≥ 35°/oo. Larvae of S. papillosum are among the most widely distributed in the eastern Gulf, but only 25% of station occurrences were recorded from depths ≥ 71 m.

7.) Bregmaceros Type B: Larvae were collected at surface temperatures from 19.0 - 31.0°C, but most occurred when temperature was 22.0 - 28.0°C. They usually occurred at surface salinities ≥ 35.0°/oo. Seventy-six percent of the station occurrences of this species were at 31 - 90 m depths, but some larvae were collected at depths > 3000 m.

8.) Bothus robinsi: Larvae occurred at surface temperatures of 17.0 - ≥ 32.0°C, a wide range, but most occurrences were at ≥ 23.0°C. They usually occurred at salinities ≥ 35.0°/oo. Larvae had a widespread distribution but 56% of the occurrences were at depths from 31 - 70 m and only 26% of the occurrences were at depths ≥ 71 m.

9.) Etropus rimosus: Larvae occurred at surface temperatures from 16.0 - 30.9°C, with most occurrences at 22 - 28°C. They usually were collected at salinities ≥ 35.0°/oo. Larval occurrences were most common at stations 11 - 50 m deep, although they frequently were collected at 51 - 90 m depths.

10.) Maurolicus muelleri: Occurrences were observed at 21.0 -30.9°C surface temperatures, with most being in the range 24.0 - 30.0°C. Most occurrences were at surface salinities from 31.0 - 36.9°/oo; the relatively high percentage of occurrences at low salinities (≤ 33.0°/oo) reflects the very large catches made in summer, 1973, when the lens of low salinity water was present at the surface in much of the eastern Gulf. It is not known if M. muelleri larvae actually were in the low salinity lens or resided beneath it, because discrete depth tows were not made. Ninety percent of the occurrences for this species were made at depths ≥ 91 m.

11.) Etrumeus teres: Larvae occurred at surface temperatures from 17.0 - 27.9°C, with the majority of occurrences between 20.0 and 26.0°C. Most occurrences were at salinities ≥ 36.0°/oo and at depths of 31 - 70 m, although 30% of the occurrences were at depths ≥ 71 m.

12.) Bregmaceros Type A: These larvae were collected at surface temperatures from 21.0 - 30.9°C. Most occurrences were at 24.0 - 30.0°C. They occurred most frequently where surface salinities ranged from 34.0 - 36.9°/oo. There was a majority of occurrences at depths from 51 - 110 m, but 42% of the station occurrences were observed at 111 - > 3000 m depths.

13.) Chloroscombrus chrysurus: Occurrences were observed at 24.0 - 31.9°C, but mostly at 27.0 - 31.9°C. Most occurrences were at salinities ≥ 35.0°/oo and at stations < 30 m deep. Seventy-five percent of the occurrences were observed at depths ≤ 20 m deep.

14.) Orthopristis chrysoptera: Larvae occurred at surface temperatures from 15.0 - 25.9°C, with most occurrences from 18.0 - 24.0°C. They commonly occurred where surface salinities were ≥ 32.0°/oo and at stations < 30 m deep. Seventy-five percent of the occurrences were observed at depths < 20 m.

15.) Citharichthys cornutus: Collections were made at surface temperatures from 21.0 - 30.9°C, with most at 24.0 - 30.0°C. These larvae usually occurred at surface salinities ≥ 35.0°/oo. Most larvae (78% of occurrences) occurred at stations 51 -200 m deep.

16.) Citharichthys macrops: There were occurrences of this species at surface temperatures from 17.0 - 30.9°C; most were at 20.0 - 29.0°C. They occurred most often at surface salinties from 33.0 - 36.9°/oo and most occurrences were at depths ≤ 30 m.

17.) Myctophum nitidulum: Larvae occurred at surface temperatures from 18.0 - 30.9°C, but most occurrences were at 24.0 - 30.0°C. Surface salinities of 31.0 - 36.9°/oo usually were associated with M. nitidulum occurrences. Occurrences at low surface salinities were recorded in summer, 1973; it is not known if the larvae were collected in the low salinity lens at the surface or below it where normal salinities (i.e. ≥ 35.0°/oo) prevailed. Eighty-six percent of the station occurrences for this species were between 51 and 1000 m depths.

18.) Hemanthias vivanus: Occurrences were observed at surface temperatures from 22.0 - 30.9°C. Most occurrences were at surface salinities ≥ 35.0°/oo. Most of these larvae occurred at stations in the 51 - 200 m depth range.

19.) *Serraniculus pumilio*: Larvae occurred at surface temperatures from 22.0 - 31.0°C. Most occurrences were at salinities ≥ 35.0‰. All except 3% of occurrences were from stations ≤ 50 m deep and 70% were in the 11 - 30 m depth range.

20.) *Euthynnus alletteratus*: Larvae were collected at surface temperatures from 24.0 - 30.9°C, with most occurrences at 27.0 - 30.9°C. They most often occurred at surface salinities from 31.0 - 36.9‰. The occurrences of *E. alletteratus* at low surface salinities (≤ 33.0‰) were in summer, 1973. Larvae actually may have been captured at higher salinities below the lens of low salinity water, but the collecting method did not allow depth of capture to be estimated. Most occurrences were at stations 31 - 200 m deep.

Loop Current Effects

The Loop Current can transport significant amounts of water from the Caribbean Sea into the Gulf of Mexico and occasionally onto continental shelf areas in the eastern Gulf through intrusions of the Loop or by eddies that spin off the Loop and which are carried over the shelf (Maul, 1977). Plankton populations, including oceanic fish larvae, presumably would be transported to shelf areas and might be useful indicators of Loop Current water on the shelf and the Loop Current might be a source for recruitment of some fishes in the eastern Gulf. Our analysis examined 14 species of larvae that usually occur in offshore waters of the eastern Gulf for evidence of entrainment in the Loop Current. There was some evidence that a few of the species might be entrained, but the analysis was in some respects inconclusive. This should not be interpreted to mean that the Loop Current does not have significant effects on larval fish distribution and abundance, but that our collections and the analysis of the data may not be the best means to interpret Loop Current effects.

Six of the 14 species that were examined in the contingency chi-square analysis showed significant evidence of positive association with $\geq$ 36.5$^{o}$/oo water, when it was present at depths of < 50 to 100 m (Table 79). An additional four species were present in the $\geq$ 36.5$^{o}$/oo water at < 50 to 100 m depths in frequencies greater than expected, but their association with those conditions was not statistically significant (i.e. $P > .05$). Four of the species were negatively associated with conditions defined as Loop Current water when it occurred at < 50 to 100 m depths.

Species that showed strong affinities with Loop Current water when it was present on the shelf include, the gonostomatids, *Gonostoma elongatum* and *Vinciguerria nimbaria*; the myctophids, *Myctophum nitidulum* and *Diogenichthys atlanticus*; and the bregmacerotids, *Bregmaceros atlanticus* and *Bregmaceros* Type A. Non-significant positive association with Loop Current water on the shelf was indicated for the gonostomatid, *Maurolicus muelleri*, the myctophids, *Diaphus* spp. and *Benthosema suborbitale*, and the deep-shelf, slope water serranid, *Hemanthias vivanus*. Species for which a negative association was apparent were the myctophid, *Notolychnus valdiviae*, the bregmacerotids, *Bregmaceros macclellandi* and *Bregmaceros* Type B, and the scombrid, *Auxis* sp. In the case of *N. valdiviae* and *B. macclellandi*, more larvae of these species were collected at < 50 - 100 m deep stations, where no salinities $\geq$ 36.5$^{o}$/oo occurred, than in areas with higher salinity (Loop Current). This unexpected outcome might suggest avoidance by these species of Loop Current water, but a more realistic guess would be that sampling variability was the causitive factor. For *Bregmaceros* Type B and *Auxis* sp. the negative associations may be the result of a poor choice of species for this analysis. Both of these species, although found predominantly at depths > 50 m, are most prevalent at depths < 100 m (84% of occurrences in the case of *Bregmaceros* Type B and 57% of occurrences in the case of *Auxis* sp). Thus, they apparently are fishes that spawn over the deep shelf in the eastern Gulf and usually would not be associated with Loop Current conditions. If those two species are not considered, evidence of positive associations with Loop Current conditions are detectable for 10 of the 12 remaining species.

An example of the technique used to determine numbers of occurrences in Loop Current water is given in Figure 178. The hatched areas show the contoured estimate of presence of ≥ 36.5 °/oo water, indicative of Loop Current influence (SUSIO, 1975). For this cruise (8C7113-TI7114) there was a total of six occurrences of Myctophum nitidulum at ≤ 100 m depth. Four of the six occurrences at those depths were in ≥ 36.5 °/oo water, indicating a possible entrainment of M. nitidulum in Loop Current intrusions onto the shelf. The high salinity water shown in the southeast corner of the survey area (Figure 178) is not due to Loop Current influence but reflects the characteristic high salinity of the Everglades estuary - Florida Bay systems prior to the start of the rainy season.

## DISCUSSION AND CONCLUSIONS

An abundant and diverse ichthyoplankton community was observed in the eastern Gulf of Mexico. Much of the diversity is related to the variety of pelagic habitats that were sampled in our surveys. Samples were collected in coastal areas where water depth was < 5 m and far offshore at depths > 3000 m. As a consequence, a wide variety of ichthyoplankton was sampled. A total of 91 families of fishes occurred in the samples and we identified 173 species. Many more species were present but could not be identified.

The kinds of larvae that predominated in our surveys were similar to those that were important off the Texas coast (Finucane *et al*., 1978) and in the South Atlantic Bight (Powles and Stender, 1976). Larvae of clupeids were relatively more abundant in our eastern Gulf surveys indicating the importance of that family in this area. Other important families, such as Gobiidae, Bothidae, Carangidae, Serranidae and Bregmacerotidae also were important in the South Atlantic Bight and Texas coast studies. Bothid flounder larvae, particularly *Syacium* spp. and *Bothus* spp., were important constituents of the eastern Gulf and South Atlantic samples, but apparently were of lesser importance off the Texas coast. Larvae of Myctophidae were among the most abundant larvae in our eastern Gulf surveys but were less important in the other studies, perhaps because our surveys included a relatively high number of sampling stations at > 100 m depth. Richards (1979) reported on ichthyoplankton from two surveys in the Caribbean. Seven of his 10 most common families were the same as those from the eastern Gulf when only > 50 m deep stations are considered. The Gobiidae and Bothidae were relatively more important in the eastern Gulf than in the Caribbean. The families Synodontidae, Serranidae and Engraulidae (all coastal or shelf fishes) were among the 10 most abundant in the eastern Gulf surveys from > 50 m depths, but were not among the 10 most common families from the Caribbean surveys.

There are several species of fish larvae in the eastern Gulf which might be termed key species because of their abundance, occurrence during several months of the year, and widespread distributions. The frequent occurrences of these species in samples makes them useful as possible indicator species which could be used in the future to determine if changes in ichthyoplankton abundance and diversity have occurred in the eastern Gulf. Such changes would imply that changes in spawning success, spawning areas or larval survival had occurred. Some of the bothid larvae would be ideal for this purpose. *Syacium papillosum* larvae are consistently abundant from spring through fall in the eastern Gulf at depths from 10 m to > 200 m. This species, as juveniles and adults, was the most commonly collected demersal fish in BLM-supported surveys (Alexander *et al*., 1977). It is an important fish in the eastern Gulf ecosystem and its availability to sampling gears at all life stages makes it a good choice as one index species for monitoring surveys. Other bothids, like *Bothus robinsi*, *Etropus rimosus* and the complex of *Citharichthys* species also have many of the attributes required of species that might be used as reference species for future research. The only other demersal species, whose larvae fall into the key species category, is the serranid Diplectrum formosum. The abundant larvae of this fish are virtually all confined within the 100 m isobath. It was one of the most consistently collected larvae at stations < 50 m deep and it occurs commonly from spring through fall, indicating an extensive spawning season in the eastern Gulf. Other important larvae are those whose adults are pelagic. Larvae of the carangid Decapterus punctatus are common, occur in nearly all months, and are distributed widely. Their abundances are nearly equal in < 50 m and > 50 m depth zones. Like Syacium papillosum, this species would be an excellent choice for an index species. Clupeid larvae are abundant but most of the species are not widely distributed in the eastern Gulf. Sardinella anchovia is the most widespread of the clupeids and has the longest spawning season. It, and possibly Opisthonema oglinum, can be considered key species. The abundance and consistent occurrence of two species of bregmacerotids over the outer shelf and at offshore stations was unexpected, but larvae of Bregmaceros Type B and possibly Type A, should be included on key species' lists of ichthyoplankton in the eastern Gulf of Mexico.

A fair understanding of conditions associated with spawning by many common fishes in the eastern Gulf was obtained in this study. The areas and seasons of egg and larvae occurrences are indicative of recent spawning. Houde and Chitty (1976) previously had shown that eggs and larvae of fishes were more abundant in the eastern Gulf during spring and summer than during fall and winter, indicating that peak spawning occurred during the warm months of the year. They did not identify any eggs or larvae in that report. Their conclusions were similar to those of Juarez (1975), who examined ichthyoplankton abundance on the Campeche Bank in the southwestern Gulf.

Spawning by some clupeid fishes in the eastern Gulf was discussed by Houde (1977a, 1977b, 1977c). Both Opisthonema oglinum and Harengula jaguana are spring-summer spawners and most spawning activity is confined to shelf areas where depths are < 30 m. In contrast, Etrumeus teres is a late fall-spring spawner, with most spawning occurring in mid-winter over shelf areas of 30-100 m depth. An area of peak spawning activity for E. teres was noted offshore from Tampa Bay (Houde, 1977a). In this report we analyzed occurrence data for the very abundant Sardinella anchovia larvae and found that some spawning occurred year round, but was most intense in the warmest months of the year, which agrees with observations of Juarez (1975) for S. anchovia on Campeche Bank. We also observed that larvae of S. anchovia had the most widespread distribution of any clupeid larva in the eastern Gulf. Most of its occurrences were at depths < 30 m, but it was not uncommon to collect S. anchovia larvae at 30-70 m depths throughout the north-south extent of the survey area.

The carangid Decapterus punctatus spawns over a wide area of the Gulf of Mexico (Aprieto, 1973; Montolio, 1976; Leak, 1977). Montolio (1976) collected D. punctatus larvae in all parts of the Gulf, including the central region, although she reported it to be most abundant in the northeastern Gulf. Leak's (1977) detailed study of carangid larvae in the eastern Gulf and additional data in this report demonstrated that D. punctatus larvae dominated carangid larvae catches in that area. Larvae occurred at all depths over the shelf, but were most common at 10-70 m depths, indicating that most spawning was in shelf waters and not farther offshore. Both Leak (1977) and Montolio (1976) observed a spring spawning peak for D. punctatus; Leak also observed a major secondary peak in September 1972 and Montolio reported a secondary spawning peak by this species in the fall. Some spawning occurs year round by D. punctatus, but Leak (1977) noted that in winter (Jan-Feb) spawning was confined to areas south of latitude 26°N in the eastern Gulf.

Other carangids were less common, but Chloroscombrus chrysurus was abundant. It is a summer spawner and virtually all larvae (and presumably spawning occurrences) occurred at stations < 30 m deep in the eastern Gulf. Larvae of Trachurus lathami were the only other carangid larva observed in relatively large numbers in our surveys. These larvae, which are morphologically similar to Decapterus punctatus, occurred only in winter and early spring at stations > 50 m deep. Leak (1977) suggested that T. lathami and D. punctatus spawned at different seasons and in different areas of the eastern Gulf to prevent possible competition between their larvae for potentially limiting zooplankton prey. Information on larval occurrences and discussions of probable spawning areas by other carangid fishes in the eastern Gulf can be found in Aprieto (1973), Montolio (1976) and Leak (1977).

Spawning by the most common bothid Syacium papillosum was most intense in spring and especially summer. During the peak spawning season larvae were collected throughout the shelf survey area, with most occurrences between the 10 and 100 m isobaths, indicating that most spawning was in that depth zone. Mean abundances of larvae were highest in the southern half of the survey area and spawning was presumed to be most intense in that sector. Dowd (1978) discussed spawning by S. papillosum and larval occurrences in the eastern Gulf. She reported that the smallest length-classes of S. papillosum did not occur north of latitude 26°N in winter, which indicates that spawning continues in winter, but only in the southern one-third of the survey area. The larvae of Bothus robinsi occurred in the same seasons, areas and depths as S. papillosum, although B. robinsi were relatively more common in winter. Dowd (1978) observed that the smallest B. robinsi larvae (≤ 4.0 mm) were found only south of latitude 26°N in winter, indicating that spawning was restricted to that area in the coldest months. A wider distribution, similar to that in warmer months, was observed for large B. robinsi larvae in winter, which suggests that this species leads a relatively long life in the pelagic larvae stage. The third most common larval bothid, Etropus rimosus, also occurred over a wide area in the eastern Gulf, but its distribution was more restricted than were the distributions of S. papillosum and B. robinsi. Most E. rimosus larvae occurred in the northern half of the survey area and at depths < 50 m. This species spawns at times and in areas when

S. papillosum and B. robinsi spawning activity is at lowest levels. The species of Citharichthys had varied spawning seasons and areas, which Dowd (1978) discussed in detail. Spawning by C. gymnorhinus and C. cornutus occurred mostly at depths > 50 m while C. macrops spawned most at depths < 30 m. More C. cornutus larvae, and presumably spawning, occurred in summer months, although they were common in all seasons. No seasonality was observed for C. gymnorhinus spawning activity. A winter peak in spawning activity for C. macrops was apparent, based on highest larval abundances in that season.

Some kinds of serranids spawned at all seasons and in all parts of the shelf and slope regions of the eastern Gulf. Juarez (1975) also reported spawning by serranids at all seasons on the Campeche Bank, but she observed that spawning by these fishes was confined to a narrow band of "intermediate depths." In our survey we noted seasonality associated with the spawning by serranid subfamilies. The anthiines spawned mostly over the deep shelf and slope waters in fall, winter and spring. Serranines had variable spawning seasons and some species spawned at all depths over the shelf region. Epinephelines spawned mostly in spring over shelf areas of intermediate depths (30-are spring and summer spawners, with most spawning apparently occurring over deep shelf and slope areas.

Occurrences of the abundant serranine, Diplectrum formosum, larvae indicated a year round spawning season, but a pronounced spring-summer peak in activity was observed. In winter, most larvae occurred in the southern half of the survey area. Most larvae occurred at depths < 50 m, over the entire north-south extent of the survey area, although occurrences at stations in the 100-200 m depth zone indicate that some spawning occurs over the deeper shelf waters. A second common serranine, the black seabass Centropristis striata, spawned from fall to spring, also mostly over depths < 50 m. Its larvae were most abundant in the northeast part of the survey area where spawning by this species apparently is most intense.

The only anthiine that occurred in relatively large numbers was Hemanthias vivanus. A majority of its larvae were collected in winter and spring at stations between the 50 and 200 m isobaths, although occasionally occurrences at other seasons indicated some spawning over the deep shelf and slope on a year round basis. Finucane et al. (1978) collected H. vivanus larvae off the Texas coast in July and December.

The few epinepheline larvae that were identified were Epinephelus morio. They occurred on spring cruises, indicating spawning in that season and supporting the gonad maturation analysis evidence that Moe (1969) presented, based on histological examination of E. morio ovaries.

Most lutjanids could not be identified, but the majority of snapper larvae occurred in summer, in the southern half of the survey area, at station depths from 30-100 m. Rhomboplites aurorubens is a peak summer spawner, but some larvae were observed in all seasons. Most of the unidentified larvae probably were Lutjanus spp. and Ocyurus chrysurus, which are generally considered to be summer spawners in Florida waters.

The bregmacerotids spawn year round in the eastern Gulf. There is some segregation by species of major spawning areas, but larvae of all species occurred over the slope and deep Gulf stations. Only Bregmaceros Type B was found commonly at station depths < 50 m, where the presence of small larvae was evidence of some spawning in that depth zone. It had peak larvae abundance in fall, when spawning activity is highest. There were no indications of seasonality in occurrence of larvae or spawning activity for the three other species of Bregmaceros. The smallest larvae of Bregmaceros Type A often occurred at stations depths < 100 m and some spawning apparently occurred on the shelf and slope in the eastern Gulf. The two remaining species, B. atlanticus and B. macclellandi, are oceanic species whose larvae usually occurred at stations > 200 m deep; these species presumably spawn in oceanic areas.

Scombrids, though not among the 20 most common families, were abundant. Because of their economic importance, knowledge of their spawning areas and seasons is important. Most spawning by scombrids in the eastern Gulf is in summer. Catches of Scomberomorus cavalla were not significant and this economically important species does not appear to spawn much in the eastern Gulf. Catches of S. maculatus larvae were larger and distributed along the entire Florida Gulf coast, but the eastern Gulf does not appear to be a major spawning area for this species. Finucane et al. (1978) found larvae of S. cavalla to be common off the Texas coast and S. maculatus larvae less common, but possibly undersampled, because their station pattern did not include nearshore stations. A survey of the northeastern Gulf, off the Florida panhandle to the west of our survey stations, collected numerous S. cavalla and S. maculatus larvae, indicating that that area was important as a spawning area for these species (Dwinell and Futch, 1973). Small catches of Scomber japonicus were made mostly in winter months over deep shelf and slope waters. Finucane et al. (1978) also recorded larvae of this species in winter collections off the Texas coast as did Powles and Stender (1976), who found it to be common in the South Atlantic Bight.

Common scombrid larvae were Euthynnus alletteratus, Auxis sp., Thunnus atlanticus and T. thynnus. Thunnus thynnus occurred only on May cruises, when it was abundant at > 100 m deep stations, indicating significant spawning in the offshore part of our survey area. Larvae of T. thynnus also were abundant in offshore waters near the Campeche Bank in the western Gulf (Juarez, 1975) during spring. The remaining three species were collected in spring and especially summer, when larvae were nearly equally abundant. Spawning by E. alletteratus apparently is mostly in the 30-100 m depth zone, although significant spawning may take place over greater depths. Some larvae of Auxis sp. were collected in all seasons but there was a clear summer peak in abundance that indicated a maximum in spawning activity during summer.

Auxis sp. larvae usually were collected at depths > 50 m. Most spawning may take place between the 50 and 150 m isobaths because the majority of larval occurrences were at stations in that depth range. Thunnus atlanticus larvae occurred in spring and summer, mostly at stations between the 50 and 200 m isobaths, where spawning must occur. Peak spawning apparently takes place in summer. Finucane et al. (1978) also recorded E. alletteratus, Auxis sp. and T. atlanticus in spring-summer from stations off the Texas coast.

Few conclusions can be made from our study concerning seasonality of spawning by midwater fishes which we collected at our offshore stations and occasionally at shallower depths. There were spring-summer peaks in larval abundances for some myctophids and gonostomatids but all of the common species in these families occurred in all seasons. Our survey area only encompassed a fringe of the spawning range for these fishes in the Gulf of Mexico. Myctophid larvae dominated our catches at stations > 100 m deep, but this dominance possibly would have been even better demonstrated if more offshore stations had been included in the survey. If that type of survey had been carried out, spawning seasonality could have been determined for some of the midwater fishes.

We were successful in estimating biomasses of only a few species. The two prerequisites necessary to obtain such estimates from ichthyoplankton abundances often could not be met when we analyzed our Gulf collections. Eggs or smaller larvae usually were unidentified or unavailable and we seldom had estimates of fecundity to use in the estimating procedure. Multiple spawning, over most of the year, is characteristic of many fishes in the subtropics and adds to the difficulty of estimating fecundity. The number of spawnings may vary annually in response to environmental factors that affect the condition of adults in the stock. Another factor to be considered in estimating biomasses from ichthyoplankton abundances is the open-ended distribution of some species, particularly offshore spawners. When only a part of the ichthyoplankton is available for sampling, only a partial estimate of biomass is possible. If the adult population changes its distribution during the course of the spawning season and the proportion of adults in the survey area changes, then inaccurate biomass estimates will be made. Because of this problem it is nearly impossible to obtain good estimates of midwater fish biomass, based on survey areas in which only a part of the population is sampled. The great fluctuations in annual catches of some larvae, such as Maurolicus muelleri and Bregmaceros Type A, in our survey indicate that there may be important changes in annual larval production which possibly reflects great differences in adult biomasses or distributions.

Despite difficulties in determining biomasses, some general conclusions can be made from the few estimates that were made. The largest biomasses apparently are of pelagic fishes in the eastern Gulf. Based on our biomass estimates and relative larval abundances, only some clupeid species and a single carangid, Decapterus punctatus, appear to have biomasses in the 100,000-500,000 tonnes range. The small bothid flounder, Syacium papillosum, which is the most abundant fish taken by demersal trawling in the eastern Gulf (Topp and Hoff, 1972; Alexander et al., 1977) may have a biomass of approximately 100,000 tonnes, based on our larval production estimates. Other common bothids are less abundant and presumably have lower biomasses. Very high catches of goby larvae and larvae of the small serranid, Diplectrum formosum, indicate that these relatively small demersal fishes may have large biomasses in the eastern Gulf, but relative fecundities (i.e., ova produced per gram of somatic tissue) probably are high and their biomasses lower than larval abundances would indicate. Based on relative larval abundances, biomasses of gerreids, sparids, pomadasyids and some other demersal fishes may be substantial in the eastern Gulf but they are unlikely to be as high as those of some pelagic fishes. Our survey did not adequately cover the nearshore spawning areas of many sciaenid fishes, but abundances of their larvae were never high enough to indicate that large biomasses were present in the eastern Gulf. A tentative conclusion, based on our biomass estimates of some abundant species and observed relative larval abundances of other fishes, is that the biomass of pelagic fishes (exclusive of midwater species) lies between 1.5 and 3 million tonnes in the eastern Gulf, while demersal species probably have an aggregate biomass of less than 1 million tonnes.

Apparently, there were no significant, annual or seasonal changes in ichthyoplankton diversity in the eastern Gulf of Mexico. From the 94 species taxocene, a mean of 49.8 species per cruise was observed. The kinds of larvae that were present changed seasonally but the distribution of individuals among species apparently was relatively constant from month to month. Changes in species were most apparent at nearshore stations where seasonal spawning patterns were best expressed. The great abundances of clupeid larvae in spring and summer at coastal sampling sites caused diversity in those seasons to be lower than might be expected if only the number of species was considered.

No overall difference in diversity was detected between the northern and southern sectors of the sampling areas when all cruises were considered, but on individual cruises the differences usually were significant. In some cruises diversity was highest in the north and in other cruises in the south. The number of taxocene species usually was greater in the southern half of the survey area but dominance of the community by abundant species (often clupeids) sometimes made the diversity estimates for that sector lower than might have been expected.

There were clear differences in diversity between onshore and offshore zones of the survey area. Ichthyoplankton diversity is highest in the offshore zone. The evenness component (J) of diversity, which gives an estimate that is independent of the number of species present, was always highest at > 50 m depths. Nearshore collections often were dominated by single species of clupeids or by a few species of larvae, while at deeper stations the number of species increased and usually no single species dominated the catch. The family Myctophidae did dominate offshore catches, just as Clupeidae often dominated nearshore collections. But, the Myctophidae is a speciose family and the presence of several species in this family contributed to an increase in ichthyoplankton diversity at offshore stations. In contrast, the Clupeidae has relatively few species in the eastern Gulf and, when present in large numbers, they caused ichthyoplankton diversity to be low.

It is not clear how identification and inclusion of larval Gobiidae in diversity analyses would affect estimates of diversity at onshore and offshore stations. Gobiids are abundant, apparently speciose, and they occur commonly at nearshore and offshore stations. It is clear that at the family level the Clupeidae and Gobiidae contributed 35.6% of all larvae collected and that those families dominated eastern Gulf ichthyoplankton. Without knowing how many or what species of gobies are present, and their distribution by depth zone, it is impossible to know how diversity estimates in the onshore vs offshore zone might change with inclusion of these larvae in the analyses.

The attempt to correlate abundances of larval fishes with some environmental variables in a simple linear correlation analysis was unsuccessful. There were several possible reasons. Surface temperatures and salinities were used in the analyses. These variables may have been poor correlates of larval fish abundance if the larvae were actually collected at depths where temperatures and salinities differed significantly from those at the surface. Oblique tows of the plankton sampler did not provide us with knowledge of the depth distribution of larvae, but gave an integrated abundance estimate for the entire water column that was sampled by the gear. Several species of oceanic fish larvae had significant negative correlations with surface salinities, which probably were spurious. They resulted from apparent positive associations of larvae with the low surface salinities in the eastern Gulf of Mexico during summer 1973 as record Mississippi River flood runoff "floated" in a 15 m thick lens across the west Florida shelf and slope waters. It is probable that larvae which are usually associated with high salinity water actually were sampled from below the 15 m lens in waters of relatively high salinity, but the oblique tow sampling method could not detect their actual depth distribution. The lack of significant correlations between larvae and zooplankton volumes (Tables 55-77) perhaps is not surprising since specific kinds of plankton that might serve as prey for larvae were not correlated with the larval abundances. Houde and Chitty (1976) found evidence that total fish egg and larvae abundances usually were positively correlated with zooplankton volumes from collections used in this study. Because plankton-eating adult fishes are important spawners in the eastern Gulf, it is possible that positive correlations of eggs or larvae with zooplankton volumes are related to presence of spawning and feeding adults in rich feeding areas and bear no relation to larval food habits or needs.

By examining cumulative frequency distributions of station occurrences for larvae in relation to surface temperatures, surface salinities and station depths it was possible to delineate the most favorable conditions for occurrence of many larvae. Depth zones of maximum occurrence and ranges of favored surface temperatures were determined from the frequency distributions of occurrences. Most eastern Gulf species occurred over wide (10-15°C) ranges of surface temperatures, but favored temperatures were usually in a narrower range (5-8°C). The relationship of larval occurrences to station depth varied among species, with some species, like *Decapterus punctatus*, occurring at all depths in the survey area and others, such as *Chloroscombrus chrysurus*, being restricted to narrow depth zones. Relationships between larval occurrences and surface salinities were not clear, in part due to the unusual, summer 1973 low salinity conditions, but mostly due to the low range of salinities usually present over shelf waters of the eastern Gulf.

The Loop Current has a strong influence on circulation in the eastern Gulf of Mexico (Maul, 1977; Molinari *et al*., 1977). Intrusions of the Loop onto the shelf are common and eddies that break away from the Loop are sometimes entrained into the shelf circulation. The presence of the Loop could have significant effects on spawning by fishes, either by altering distribution and spawning behavior of adults or by affecting the potential for survival of larvae. The entrainment of larvae normally associated with oceanic conditions into shelf waters could be a consequence of Loop intrusions. It also is possible that Loop Current transport can act as a recruitment mechanism for tropical fishes sometimes found in the northeastern Gulf of Mexico. Our analysis of occurrences of 14 species of larval fishes that normally occurred at stations > 50 m deep provided evidence that some of these species were more frequently associated with water derived from the Loop Current when they occurred at depths < 100 m than would be expected by chance alone. There was a strong indication of entrainment in Loop Current water for six of the species and a positive association for 10 of the 14 species. Two of the species that showed no Loop Current association probably are not species normally found in Loop Current water. When they were not considered, 10 of the 12 remaining species had positive associations with Loop Current water when it was present on the shelf.

Another approach to determine effects of the Loop Current on ichthyoplankton and perhaps to use the ichthyoplankton as a source of indicator organisms that provide evidence of Loop Current influence is to undertake an analysis of fish larvae at the community level. Rather than examining single species, whose abundances are subject to a relatively large amount of sampling variability, related kinds of larvae could be classified into assemblages. Through the use of clustering analyses or other classification methods, the influence of Loop Current circulation on the structure of ichthyoplankton communities could be determined. The classification of larvae into closely related groups or assemblages in the eastern Gulf would have wider applicability than only to investigate Loop Current influences. Using this approach, conditions associated with spawning by functionally related kinds of fishes could be clearly delineated in the eastern Gulf of Mexico. Also, the potential impacts of an altered environment on ichthyoplankton could be investigated at the community level, which might be more valuable than trying to evaluate such impacts on a species by species basis.

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Table 1. Summary information for 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

| Cruise | Dates | Number of stations | Area represented by the cruise ($m^2 \times 10^9$) | Number collected | |
|---|---|---|---|---|---|
| | | | | Eggs | Larvae |
| GE 7101[1] | 1-8 Feb 1971 | 20 | 25.79 | 47,753 | 8,615 |
| 8C 7113-TI 7114[1] | 7-18 May 1971 | 123 | 120.48 | 27,385 | 19,229 |
| GE 7117 | 26 Jun - 4 Jul 1971 | 27 | 101.10 | 3,594 | 2,149 |
| 8C 7120-TI 7121 | 7-25 Aug 1971 | 146 | 189.43 | 21,567 | 18,037 |
| TI 7131-8B 7132 | 7-16 Nov 1971 | 64 | 72.99 | 4,225 | 3,979 |
| 8B 7201-GE 7202 | 1-11 Feb 1972 | 30 | 148.85 | 5,068 | 2,290 |
| GE 7208 | 1-10 May 1972 | 30 | 124.88 | 15,627 | 7,450 |
| GE 7210 | 12-18 Jun 1972 | 13 | 48.43 | 6,165 | 2,239 |
| IS 7205 | 9-17 Sept 1972 | 34 | 104.59 | 9,245 | 10,872 |
| IS 7209 | 8-16 Nov 1972 | 50 | 149.80 | 7,487 | 4,511 |
| IS 7303 | 19-27 Jan 1973 | 51 | 149.80 | 12,378 | 4,642 |

Table 1. Continued.

| Cruise | Dates | Number of stations | Area represented by the cruise ($m^2 \times 10^9$) | Number collected | |
|---|---|---|---|---|---|
| | | | | Eggs | Larvae |
| IS 7308 | 9-17 May 1973 | 49 | 151.42 | 26,103 | 13,652 |
| IS 7311 | 27 Jun - 6 Jul 1973 | 51 | 156.50 | 14,523 | 10,881 |
| IS 7313 | 3-13 Aug 1973 | 50 | 153.18 | 24,798 | 10,419 |
| IS 7320 | 6-14 Nov 1973 | 51 | 153.89 | 5,452 | 4,999 |
| CL 7405 | 28 Feb - 9 Mar 1974 | 36 | 52.00 | 16,020 | 2,216 |
| CL 7412 | 1-9 May 1974 | 44 | 91.33 | 57,230 | 16,854 |

[1] On cruise GE 7101 and TI 7114 an ICITA, one-meter plankton net was used. On all other cruises a 61-cm bongo net sampler was used.

Ship Codes: GE = R/V GERDA; 8C = R/V DAN BRAMAN; TI = R/V TURSIOPS; 8B = R/V BELLOWS; IS = R/V COLUMBUS ISELIN; CL = R/V CALANUS

Table 2. Ninety-one families of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974. Numbers of individuals, percent of total larvae collected and ranked observed number.

| Family | Number of individuals | Percent of larvae | Family rank |
|---|---|---|---|
| Elopidae | 6 | 0.004 | 72 |
| Clupeidae | 29,290 | 20.478 | 1 |
| Engraulidae | 2,880 | 2.014 | 12 |
| Argentinidae | 45 | 0.031 | 48 |
| Bathylagidae | 11 | 0.008 | 68.5 |
| Gonostomatidae | 2,486 | 1.738 | 14 |
| Sternoptychidae | 166 | 0.116 | 37 |
| Stomiatidae | 16 | 0.011 | 67 |
| Chauliodontidae | 24 | 0.017 | 62 |
| Astronesthidae | 1 | 0.001 | 87.5 |
| Melanostomiatidae | 30 | 0.021 | 58.5 |
| Synodontidae | 4,294 | 3.002 | 7 |
| Aulopidae | 5 | 0.003 | 74 |
| Scopelarchidae | 28 | 0.020 | 60 |
| Evermannelidae | 6 | 0.004 | 72 |
| Paralepididae | 292 | 0.204 | 33 |
| Myctophidae | 7,223 | 5.050 | 4 |
| Ipnopidae | 1 | 0.001 | 87.5 |
| Chlorophthalmidae | 11 | 0.008 | 68.5 |
| Scopelosauridae | 2 | 0.001 | 81 |
| Giganturidae | 1 | 0.001 | 87.5 |
| Muraenidae | 130 | 0.091 | 41 |
| Nettastomidae | 90 | 0.063 | 43 |
| Congridae | 146 | 0.102 | 39 |
| Ophichthidae | 208 | 0.145 | 36 |
| Dysommidae | 2 | 0.001 | 81 |
| Belonidae | 6 | 0.004 | 72 |
| Hemiramphidae | 45 | 0.031 | 48 |
| Exocoetidae | 72 | 0.050 | 45 |

Table 2. Continued.

| Family | Number of individuals | Percent of larvae | Family rank |
|---|---|---|---|
| Gadidae | 54 | 0.038 | 46 |
| Bregmacerotidae | 3,818 | 2.669 | 9 |
| Macrouridae | 4 | 0.003 | 75 |
| Fistulariidae | 1 | 0.001 | 87.5 |
| Macrorhamphosidae | 3 | 0.002 | 77 |
| Syngnathidae | 247 | 0.173 | 35 |
| Melamphaeidae | 38 | 0.027 | 53 |
| Holocentridae | 34 | 0.024 | 55.5 |
| Caproidae | 42 | 0.029 | 50 |
| Mugilidae | 252 | 0.176 | 34 |
| Atherinidae | 45 | 0.031 | 48 |
| Sphyraenidae | 34 | 0.024 | 55.5 |
| Serranidae | 6,949 | 4.858 | 5 |
| Priacanthidae | 154 | 0.108 | 38 |
| Apogonidae | 2,296 | 1.605 | 15 |
| Branchiostegidae | 26 | 0.018 | 61 |
| Echeneidae | 3 | 0.002 | 77 |
| Rachycentridae | 2 | 0.001 | 81 |
| Carangidae | 5,564 | 3.890 | 6 |
| Bramidae | 30 | 0.021 | 58.5 |
| Coryphaenidae | 17 | 0.012 | 65.5 |
| Lutjanidae | 1,753 | 1.226 | 19 |
| Acanthuridae | 17 | 0.012 | 65.5 |
| Gerreidae | 1,458 | 1.019 | 22 |
| Pomadasyidae | 2,933 | 2.051 | 11 |
| Sciaenidae | 415 | 0.290 | 30 |
| Sparidae | 1,683 | 1.177 | 20 |
| Mullidae | 302 | 0.211 | 32 |
| Kyphosidae | 18 | 0.013 | 64 |

Table 2. Continued.

| Family | Number of individuals | Percent of larvae | Family rank |
|---|---|---|---|
| Ephippidae | 1 | 0.001 | 87.5 |
| Chaetodontidae | 32 | 0.022 | 57 |
| Pomacentridae | 445 | 0.311 | 28 |
| Labridae | 3,230 | 2.258 | 10 |
| Scaridae | 569 | 0.398 | 26 |
| Opistognathidae | 417 | 0.292 | 29 |
| Uranoscopidae | 1 | 0.001 | 87.5 |
| Blenniidae | 1,996 | 1.395 | 18 |
| Clinidae | 502 | 0.351 | 27 |
| Ophidiidae | 4,151 | 2.902 | 8 |
| Carapidae | 305 | 0.213 | 31 |
| Callionymidae | 1,605 | 1.122 | 21 |
| Scombridae | 1,266 | 0.885 | 23 |
| Gempylidae | 79 | 0.055 | 44 |
| Trichiuridae | 10 | 0.007 | 70 |
| Istiophoridae | 2 | 0.001 | 81 |
| Stromateidae | 37 | 0.026 | 54 |
| Nomeidae | 135 | 0.094 | 40 |
| Ariommidae | 95 | 0.066 | 42 |
| Gobiidae | 21,621 | 15.116 | 2 |
| Microdesmidae | 39 | 0.027 | 52 |
| Scorpaenidae | 2,066 | 1.444 | 17 |
| Triglidae | 2,230 | 1.559 | 16 |
| Dactylopteridae | 1 | 0.001 | 87.5 |
| Bothidae | 9,165 | 6.408 | 3 |
| Pleuronectidae | 1 | 0.001 | 87.5 |
| Soleidae | 41 | 0.028 | 51 |
| Cynoglossidae | 815 | 0.570 | 25 |
| Balistidae | 2,808 | 1.963 | 13 |
| Ostraciidae | 3 | 0.002 | 77 |

Table 2. Continued.

| Family | Number of individuals | Percent of larvae | Family rank |
|---|---|---|---|
| Tetraodontidae | 1,139 | 0.796 | 24 |
| Diodontidae | 2 | 0.001 | 81 |
| Gobiesocidae | 23 | 0.016 | 63 |
| Unidentified at Family level | 12,493 | 8.734 | |
| Total larvae | 143,034 | 100.000 | |

Table 3. Numbers of individuals in the 10 most frequently observed families collected in each of 17 cruises to the eastern Gulf of Mexico, 1971-1974.

| Cruise | Family | Number of larvae | Cruise | Family | Number of larvae |
|---|---|---|---|---|---|
| GE 7101 | Clupeidae | 1,713 | 8C 7113- | Gobiidae | 2,976 |
| | Serranidae | 823 | TI 7114 | Myctophidae | 2,129 |
| | Gobiidae | 784 | | Serranidae | 1,669 |
| | Pomadasyidae | 448 | | Clupeidae | 1,613 |
| | Bothidae | 350 | | Bothidae | 1,356 |
| | Sparidae | 334 | | Ophidiidae | 1,153 |
| | Labridae | 282 | | Pomadasyidae | 950 |
| | Carangidae | 276 | | Synodontidae | 875 |
| | Ophidiidae | 206 | | Engraulidae | 811 |
| | Tetraodontidae | 186 | | Carangidae | 608 |
| GE 7117 | Gobiidae | 312 | 8C 7120- | Gobiidae | 2,799 |
| | Bothidae | 287 | TI 7121 | Bothidae | 2,184 |
| | Synodontidae | 246 | | Clupeidae | 1,561 |
| | Clupeidae | 190 | | Myctophidae | 1,352 |
| | Bregmacerotidae | 113 | | Synodontidae | 1,127 |
| | Myctophidae | 91 | | Labridae | 846 |
| | Ophidiidae | 77 | | Carangidae | 781 |
| | Scorpaenidae | 61 | | Bregmacerotidae | 624 |
| | Scombridae | 53 | | Scombridae | 582 |
| | Gonostomatidae | 53 | | Engraulidae | 503 |

Table 3. Continued.

| Cruise | Family | Number of larvae | Cruise | Family | Number of larvae |
|---|---|---|---|---|---|
| TI 7131 | Gobiidae | 570 | 8B 7201- | Clupeidae | 270 |
| 8B 7132 | Bregmacerotidae | 474 | GE 7202 | Gobiidae | 249 |
| | Bothidae | 422 | | Bothidae | 237 |
| | Synodontidae | 289 | | Sparidae | 177 |
| | Triglidae | 261 | | Synodontidae | 137 |
| | Myctophidae | 220 | | Serranidae | 97 |
| | Serranidae | 183 | | Myctophidae | 91 |
| | Carangidae | 153 | | Bregmacerotidae | 82 |
| | Clupeidae | 129 | | Carangidae | 69 |
| | Ophidiidae | 122 | | Pomadasyidae | 48 |
| GE 7208 | Myctophidae | 908 | GE 7210 | Clupeidae | 1,230 |
| | Clupeidae | 854 | | Gobiidae | 204 |
| | Gobiidae | 657 | | Carangidae | 118 |
| | Serranidae | 510 | | Balistidae | 58 |
| | Carangidae | 373 | | Serranidae | 57 |
| | Balistidae | 321 | | Ophidiidae | 47 |
| | Bothidae | 274 | | Lutjanidae | 46 |
| | Synodontidae | 233 | | Bothidae | 40 |
| | Engraulidae | 220 | | Apogonidae | 32 |
| | Ophidiidae | 214 | | Callionymidae | 31 |

Table 3. Continued.

| Cruise | Family | Number of larvae | Cruise | Family | Number of larvae |
|---|---|---|---|---|---|
| IS 7205 | Clupeidae | 3,850 | IS 7209 | Gobiidae | 1,292 |
| | Gobiidae | 1,631 | | Bothidae | 541 |
| | Carangidae | 720 | | Bregmacerotidae | 399 |
| | Bothidae | 619 | | Ophidiidae | 258 |
| | Serranidae | 562 | | Triglidae | 161 |
| | Ophidiidae | 413 | | Myctophidae | 151 |
| | Lutjanidae | 267 | | Carangidae | 146 |
| | Callionymidae | 264 | | Scorpaenidae | 115 |
| | Gerreidae | 239 | | Balistidae | 99 |
| | Bregmacerotidae | 238 | | Gonostomatidae | 94 |
| IS 7303 | Bothidae | 617 | IS 7308 | Clupeidae | 3,589 |
| | Gobiidae | 603 | | Gobiidae | 2,539 |
| | Myctophidae | 396 | | Serranidae | 889 |
| | Clupeidae | 308 | | Carangidae | 579 |
| | Serranidae | 292 | | Bothidae | 552 |
| | Bregmacerotidae | 260 | | Balistidae | 401 |
| | Sparidae | 249 | | Pomadasyidae | 391 |
| | Synodontidae | 225 | | Myctophidae | 387 |
| | Gonostomatidae | 163 | | Blenniidae | 316 |
| | Carangidae | 150 | | Ophidiidae | 311 |

Table 3. Continued.

| Cruise | Family | Number of larvae | Cruise | Family | Number of larvae |
|---|---|---|---|---|---|
| IS 7311 | Clupeidae | 4,218 | IS 7313 | Clupeidae | 2,350 |
| | Gobiidae | 1,291 | | Gobiidae | 1,889 |
| | Myctophidae | 820 | | Bothidae | 524 |
| | Gonostomatidae | 521 | | Carangidae | 480 |
| | Bothidae | 322 | | Gonostomatidae | 383 |
| | Carangidae | 271 | | Lutjanidae | 346 |
| | Lutjanidae | 253 | | Engraulidae | 322 |
| | Callionymidae | 251 | | Myctophidae | 281 |
| | Serranidae | 220 | | Apogonidae | 270 |
| | Labridae | 205 | | Callionymidae | 250 |
| IS 7320 | Gobiidae | 919 | CL 7405 | Pomadasyidae | 347 |
| | Bothidae | 579 | | Gobiidae | 249 |
| | Bregmacerotidae | 462 | | Blenniidae | 245 |
| | Ophidiidae | 276 | | Sparidae | 205 |
| | Triglidae | 244 | | Engraulidae | 211 |
| | Carangidae | 230 | | Serranidae | 155 |
| | Synodontidae | 219 | | Clupeidae | 152 |
| | Myctophidae | 203 | | Triglidae | 93 |
| | Scorpaenidae | 165 | | Ophidiidae | 92 |
| | Callionymidae | 102 | | Sciaenidae | 56 |

Table 3. Continued.

| Cruise | Family | Number of larvae | Cruise | Family | Number of larvae |
|---|---|---|---|---|---|
| CL 7412 | Clupeidae | 7,189 | | | |
| | Gobiidae | 3,439 | | | |
| | Carangidae | 588 | | | |
| | Balistidae | 575 | | | |
| | Serranidae | 564 | | | |
| | Ophidiidae | 372 | | | |
| | Labridae | 333 | | | |
| | Apogonidae | 325 | | | |
| | Pomadasyidae | 305 | | | |
| | Bothidae | 215 | | | |

Table 4. Numbers of genera and species identified and the numbers of larvae identified to species in the 20 most frequently observed families from 17 ichthyoplankton cruises to the eastern Gulf of Mexico.

| Rank | Family | Number of specimens | Number of genera identified | Number of species identified | Identified to species | |
|---|---|---|---|---|---|---|
| | | | | | Number | Percent |
| 1 | Clupeidae | 29,290 | 5 | 4 | 28,561 | 97.51 |
| 2 | Gobiidae | 21,621 | 0 | 0 | 0 | 0 |
| 3 | Bothidae | 9,165 | 9 | 11 | 8,808 | 97.16 |
| 4 | Myctophidae | 7,223 | 16 | 25 | 1,980 | 27.41 |
| 5 | Serranidae | 6,949 | 12 | 16 | 5,168 | 74.37 |
| 6 | Carangidae | 5,564 | 10 | 8 | 5,439 | 97.75 |
| 7 | Synodontidae | 4,294 | 2 | 2 | 10 | 0.23 |
| 8 | Ophidiidae | 4,151 | 0 | 0 | 0 | 0 |
| 9 | Bregmacerotidae | 3,784 | 1 | 4 | 3,762 | 99.44 |
| 10 | Labridae | 3,230 | 0 | 0 | 0 | 0 |
| 11 | Pomadasyidae | 2,933 | 1 | 1 | 771 | 26.29 |
| 12 | Engraulidae | 2,880 | 0 | 0 | 0 | 0 |
| 13 | Balistidae | 2,808 | 0 | 0 | 0 | 0 |
| 14 | Gonostomatidae | 2,486 | 11 | 12 | 1,634 | 65.73 |
| 15 | Apogonidae | 2,296 | 0 | 0 | 0 | 0 |
| 16 | Triglidae | 2,230 | 0 | 0 | 0 | 0 |
| 17 | Scorpaenidae | 2,066 | 0 | 0 | 0 | 0 |

Table 4. Continued.

| Rank | Family | Number of specimens | Number of genera identified | Number of species identified | Identified to species Number | Identified to species Percent |
|---|---|---|---|---|---|---|
| 18 | Blenniidae | 1,996 | 0 | 0 | 0 | 0 |
| 19 | Lutjanidae | 1,753 | 4 | 3 | 81 | 4.62 |
| 20 | Sparidae | 1,683 | 4 | 4 | 778 | 46.23 |
| | TOTALS | 118,401 | 75 | 90 | 56,992 | |

Table 5. Cruise GE 7101. Numbers of larvae, estimated total abundance in the area represented by the cruise ($25.79 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 1 | 2.0083 | 0.779 |
| Clupeidae | 30 | 0.8726 | 0.338 |
| Etrumeus teres | 310 | 26.0932 | 10.118 |
| Sardinella anchovia | 1,373 | 47.0526 | 18.245 |
| Engraulidae | 20 | 0.58201 | 0.226 |
| Argentinidae | | | |
| Microstoma spp. | 1 | 0.0220 | 0.009 |
| Gonostomatidae | 1 | 0.0125 | 0.005 |
| Cyclothone spp. | 12 | 14.1682 | 5.494 |
| Maurolicus muelleri | 6 | 12.0498 | 4.672 |
| Vinciguerria nimbaria | 5 | 4.1205 | 1.598 |
| Sternoptychidae | | | |
| Argyropelecus spp. | 1 | 2.0083 | 0.779 |
| Stomiatidae | | | |
| Stomias spp. | 2 | 0.1174 | 0.046 |
| Chauliodontidae | | | |
| Chauliodus spp. | 3 | 2.0333 | 0.788 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Melanostomiatidae | 4 | 8.0332 | 3.115 |
| Synodontidae | 132 | 9.7065 | 3.764 |
| Scopelarchidae | 1 | 0.0125 | 0.005 |
| Paralepididae | 4 | 8.0332 | 3.115 |
| Myctophidae | 28 | 52.2975 | 20.278 |
| Diaphus spp. | 76 | 85.7173 | 33.237 |
| Lampadena luminosa | 1 | 0.0376 | 0.015 |
| Lampanyctus spp. | 3 | 4.0673 | 1.577 |
| Myctophum nitidulum | 5 | 2.1044 | 0.816 |
| Ceratoscopelus warmingi | 2 | 2.0557 | 0.797 |
| Hygophum spp. | 1 | 0.0125 | 0.005 |
| Centrobranchus nigroocellatus | 1 | 0.0587 | 0.023 |
| Lepidophanes spp. | 7 | 4.2277 | 1.639 |
| Notoscopelus caudispinosus | 24 | 40.2158 | 15.594 |
| Notoscopelus resplendens | 1 | 0.0409 | 0.016 |
| Benthosema suborbitale | 1 | 2.0083 | 0.779 |
| Ipnopidae | 1 | 0.0220 | 0.009 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 2 | 0.0982 | 0.038 |
| Notosudidae | | | |
| Scopelosaurus spp. | 1 | 0.0125 | 0.005 |
| Anguilliformes | 3 | 0.1298 | 0.050 |
| Nettastomidae | 2 | 2.0208 | 0.784 |
| Hoplunnis macrurus | 1 | 0.0125 | 0.005 |
| Ophichthidae | 1 | 0.0125 | 0.005 |
| Ophichthus spp. | 1 | 0.0224 | 0.009 |
| Myrophis punctatus | 1 | 0.0326 | 0.013 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 1 | 0.0237 | 0.009 |
| Hemiramphus balao | 1 | 0.0220 | 0.009 |
| Exocoetidae | 5 | 0.0834 | 0.032 |
| Danichthys rondeletti | 1 | 0.0220 | 0.009 |
| Prognichthys gibbifrons | 1 | 0.0220 | 0.009 |
| Gadidae | | | |
| Urophycis spp. | 18 | 0.6144 | 0.238 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 5 | 0.0624 | 0.024 |
| Bregmaceros Type A | 12 | 2.3331 | 0.905 |
| Bregmaceros Type B | 100 | 9.5140 | 3.689 |
| Bregmaceros Macclellandi | 2 | 0.0250 | 0.010 |
| Macrorhamphosidae | | | |
| Macrorhamphosus scolopax | 2 | 0.0982 | 0.038 |
| Syngnathidae | | | |
| Hippocampus erectus | 5 | 0.0664 | 0.026 |
| Syngnathus spp. | 4 | 0.0436 | 0.017 |
| Syngnathus dunckeri | 1 | 0.0125 | 0.005 |
| Syngnathus elucens | 8 | 0.1571 | 0.061 |
| Syngnathus springeri | 7 | 0.1836 | 0.071 |
| Syngnathus louisianae | 2 | 0.0353 | 0.014 |
| Syngnathus scovelli | 3 | 0.0394 | 0.015 |
| Holocentridae | 2 | 0.0534 | 0.021 |
| Caproidae | | | |
| Antigonia spp. | 6 | 4.2127 | 1.634 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Mugilidae | | | |
| Mugil spp. | 89 | 3.8093 | 1.477 |
| Sphyraenidae | | | |
| Sphyraena borealis | 2 | 0.0345 | 0.013 |
| Serranidae | 333 | 22.1493 | 8.588 |
| Diplectrum formosum | 384 | 11.4070 | 4.423 |
| Epinephelus spp. | 15 | 0.7377 | 0.286 |
| Serranus spp. | 19 | 0.8866 | 0.344 |
| Hemanthias vivanus | 15 | 0.3020 | 0.117 |
| Hemanthias leptus | 1 | 0.0505 | 0.020 |
| Pronotogrammus aurorubens | 10 | 0.2577 | 0.100 |
| Anthias spp. | 1 | 0.0587 | 0.022 |
| Anthias Type 1 | 25 | 0.9114 | 0.353 |
| Anthias Type 3 | 18 | 0.2880 | 0.112 |
| Rypticus spp. | 2 | 0.0630 | 0.024 |
| Priacanthidae | 2 | 0.0632 | 0.024 |
| Priacanthus arenatus | 1 | 0.0125 | 0.005 |
| Apogonidae | 97 | 3.5554 | 1.379 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Branchiostegidae | 1 | 0.0376 | 0.015 |
| Carangidae | | | |
| Caranx spp. | 3 | 0.1169 | 0.045 |
| Decapterus punctatus | 200 | 10.1797 | 3.947 |
| Seriola spp. | 1 | 0.0475 | 0.018 |
| Trachurus lathami | 72 | 8.9558 | 3.473 |
| Bramidae | 4 | 4.0416 | 1.567 |
| Coryphaenidae | | | |
| Coryphaena hippurus | 1 | 0.0475 | 0.018 |
| Lutjanidae | 1 | 0.0475 | 0.018 |
| Pristipomoides aquilonaris | 2 | 0.1174 | 0.046 |
| Acanthuridae | | | |
| Acanthurus spp. | 4 | 2.0838 | 0.808 |
| Gerreidae | 18 | 0.6048 | 0.235 |
| Pomadasyidae | 261 | 8.7895 | 3.408 |
| Orthopristis chrysoptera | 187 | 2.5179 | 0.976 |
| Sciaenidae | 5 | 0.0980 | 0.038 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sparidae | 272 | 9.0211 | 3.498 |
| Lagodon rhomboides | 59 | 1.6666 | 0.646 |
| Pagrus pagrus | 3 | 0.1760 | 0.068 |
| Mullidae | 82 | 6.7759 | 2.627 |
| Kyphosidae | | | |
| Kyphosus spp. | 4 | 2.1506 | 0.834 |
| Chaetodontidae | 7 | 4.2014 | 1.629 |
| Pomacentridae | 20 | 0.7443 | 0.289 |
| Labridae | 282 | 19.2439 | 7.462 |
| Scaridae | 22 | 4.6638 | 1.808 |
| Opistognathidae | 43 | 1.6122 | 0.625 |
| Blenniidae | 183 | 6.3827 | 2.475 |
| Clinidae | 38 | 0.9346 | 0.362 |
| Ophidiidae | 206 | 7.5587 | 2.931 |
| Carapidae | | | |
| Echiodon sp. | 9 | 2.1846 | 0.847 |
| Callionymidae | 61 | 5.1757 | 2.007 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Scombridae | 1 | 0.0505 | 0.020 |
| Auxis sp. | 1 | 0.0409 | 0.016 |
| Scomber japonicus | 4 | 0.2024 | 0.079 |
| Gempylidae | 1 | 0.0587 | 0.023 |
| Nesiarchus nasutus | 1 | 2.0083 | 0.779 |
| Trichiuridae | | | |
| Diplospinus multistriatus | 1 | 2.0083 | 0.779 |
| Nomeidae | | | |
| Psenes spp. | 1 | 2.0083 | 0.779 |
| Psenes pellucidus | 5 | 10.0415 | 3.894 |
| Ariommidae | | | |
| Ariomma spp. | 7 | 0.3322 | 0.129 |
| Gobiidae | 784 | 36.1857 | 14.031 |
| Scorpaenidae | 123 | 5.3540 | 2.076 |
| Triglidae | 163 | 5.9331 | 2.301 |
| Bothidae | 104 | 3.0246 | 1.173 |
| Citharichthys spp. | 1 | 0.0125 | 0.005 |
| Citharichthys cornutus | 12 | 0.3194 | 0.124 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Citharichthys macrops | 119 | 2.6532 | 1.029 |
| Citharichthys spilopterus | 1 | 0.0125 | 0.005 |
| Citharichthys gymnorhinus | 3 | 0.1219 | 0.047 |
| Cyclopsetta fimbriata | 1 | 0.0474 | 0.018 |
| Etropus rimosus | 120 | 5.6753 | 2.200 |
| Syacium papillosum | 34 | 1.3099 | 0.508 |
| Monolene sessilicauda | 3 | 0.0659 | 0.026 |
| Bothus robinsi | 66 | 8.1944 | 3.177 |
| Paralichthys spp. | 3 | 0.8998 | 0.349 |
| Soleidae | 1 | 0.0125 | 0.005 |
| Gymnachirus melas | 1 | 0.0409 | 0.016 |
| Cynoglossidae | | | |
| Symphurus spp. | 26 | 1.0607 | 0.411 |
| Balistidae | 120 | 4.7733 | 1.851 |
| Tetraodontidae | 186 | 6.1626 | 2.390 |
| Lophiiformes | 2 | 0.1014 | 0.039 |

Table 5. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Unidentified Larvae | 1,396 | 187.2175 | 72.593 |
| Total Larvae | 8,615 | 789.7316 | 306.216 |
| NUMBER OF FAMILIES: 66 | | | |
| NUMBER OF SPECIES: 60 | | | |

Table 6. Cruise 8C 7113-TI 7114. Numbers of larvae, estimated total abundance in the area represented by the cruises ($120.48 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeidae | 48 | 12.6835 | 1.0537 |
| Etrumeus teres | 102 | 41.2308 | 3.422 |
| Harengula jaguana | 243 | 81.0659 | 6.729 |
| Opisthonema oglinum | 1,213 | 334.6204 | 27.774 |
| Sardinella anchovia | 7 | 4.4498 | 0.369 |
| Engraulidae | 811 | 297.765 | 24.715 |
| Argentinidae | 1 | 0.3698 | 0.031 |
| Argentina spp. | 8 | 2.7864 | 0.231 |
| Nansenia spp. | 1 | 0.2770 | 0.023 |
| Bathylagidae | | | |
| Bathylagus spp. | 2 | 0.7278 | 0.060 |
| Gonostomatidae | 8 | 4.0979 | 0.340 |
| Cyclothone spp. | 36 | 9.5734 | 0.795 |
| Gonostoma elongatum | 1 | 0.3698 | 0.031 |
| Maurolicus muelleri | 94 | 36.0159 | 2.989 |
| Vinciguerria spp. | 2 | 0.5509 | 0.046 |
| Vinciguerria nimbaria | 33 | 9.0991 | 0.755 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria poweriae | 38 | 16.8936 | 1.402 |
| Vinciguerria attenuata | 19 | 6.8395 | 0.489 |
| Chauliodontidae | | | |
| Chauliodus spp. | 1 | 0.1484 | 0.012 |
| Synodontidae | 873 | 264.4032 | 21.946 |
| Saurida brasiliensis | 2 | 0.5075 | 0.042 |
| Aulopidae | | | |
| Aulopus nanae | 1 | 0.2770 | 0.023 |
| Paralepididae | 20 | 6.9775 | 0.579 |
| Myctophidae | 2 | 0.5314 | 0.044 |
| Diaphus spp. | 1,078 | 387.3126 | 32.148 |
| Notolychnus valdiviae | 17 | 7.5212 | 0.624 |
| Lampanyctus alatus | 10 | 5.1554 | 0.428 |
| Lampanyctus ater | 4 | 1.2386 | 0.103 |
| Lampanyctus cuprarius | 2 | 0.8599 | 0.071 |
| Myctophum nitidulum | 106 | 46.3611 | 3.848 |
| Myctophum selenops | 2 | 0.5483 | 0.046 |
| Ceratoscopelus warmingi | 50 | 14.9784 | 1.243 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Hygophum spp. | 770 | 247.461 | 20.540 |
| Hygophum reinhardti | 6 | 1.6585 | 0.138 |
| Centrobranchus nigrocellatus | 2 | 1.0007 | 0.083 |
| Gonichthys coccoi | 2 | 0.6600 | 0.055 |
| Lepidophanes spp. | 20 | 6.0847 | 0.505 |
| Lepidophanes guntheri | 1 | 0.2770 | 0.023 |
| Notoscopelus resplendens | 1 | 0.2770 | 0.101 |
| Benthosema suborbitale | 23 | 10.7820 | 0.895 |
| Diogenichthys atlanticus | 24 | 7.2747 | 0.604 |
| Anguilliformes | 8 | 1.6260 | 0.135 |
| Muraenidae | 8 | 1.3310 | 0.110 |
| Gymnothorax nigromarginatus | 10 | 2.9636 | 0.246 |
| Anarchias yoshiae | 1 | 0.3698 | 0.031 |
| Nettastomidae | 4 | 0.8686 | 0.072 |
| Hoplunnis diomedianus | 5 | 2.3668 | 0.197 |
| Congridae | 2 | 0.3840 | 0.032 |
| Hildebrandia gracilior | 2 | 0.5483 | 0.046 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Ophichthidae | 7 | 4.5158 | 0.375 |
| Ophichthus spp. | 5 | 1.2135 | 0.101 |
| Belonidae | 1 | 0.4176 | 0.035 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 3 | 1.2528 | 0.104 |
| Exocoetidae | 1 | 0.2541 | 0.021 |
| Cypselurus spp. | 2 | 0.2751 | 0.023 |
| Prognichthys gibbifrons | 4 | 0.7181 | 0.060 |
| Bregmacerotidae | | | |
| Bregmaceros spp. | 19 | 5.2150 | 0.433 |
| Bregmaceros atlanticus | 5 | 1.8175 | 0.151 |
| Bregmaceros Type A | 137 | 39.7548 | 3.300 |
| Bregmaceros Type B | 198 | 118.6699 | 9.850 |
| Bregmaceros macclellandi | 2 | 1.9119 | 0.159 |
| Macrouridae | 1 | 0.2770 | 0.023 |
| Syngnathidae | | | |
| Hippocampus erectus | 3 | 0.6201 | 0.052 |
| Syngnathus spp. | 1 | 0.2626 | 0.022 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Syngnathus elucens | 4 | 0.7202 | 0.060 |
| Syngnathus springeri | 3 | 0.8895 | 0.074 |
| Syngnathus louisianae | 2 | 0.8352 | 0.069 |
| Melamphaeidae | | | |
| Melamphaes spp. | 2 | 0.9314 | 0.077 |
| Holocentridae | 4 | 0.7334 | 0.061 |
| Caproidae | | | |
| Antigonia spp. | 4 | 1.0063 | 0.084 |
| Mugilidae | | | |
| Mugil spp. | 28 | 5.8649 | 0.487 |
| Sphyraenidae | | | |
| Sphyraena borealis | 5 | 1.2595 | 0.104 |
| Serranidae | 158 | 42.9964 | 3.569 |
| Diplectrum spp. | 7 | 1.4905 | 0.124 |
| Diplectrum formosum | 1,170 | 358.4440 | 29.751 |
| Epinephelus spp. | 31 | 9.4440 | 0.524 |
| Epinephelus morio | 1 | 0.2744 | 0.023 |
| Serranus spp. | 27 | 14.3285 | 1.189 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Centropristis striata | 93 | 27.0710 | 2.247 |
| Hemanthias vivanus | 113 | 38.8770 | 3.227 |
| Pronotogrammus aurorubens | 29 | 6.6632 | 0.553 |
| Serraniculus pumilio | 35 | 11.9422 | 0.991 |
| Liopropoma Type 1 | 1 | 0.3447 | 0.029 |
| Anthias Type 1 | 2 | 0.8023 | 0.067 |
| Rypticus spp. | 2 | 0.4940 | 0.041 |
| Priacanthidae | 1 | 0.2624 | 0.022 |
| Apogonidae | 226 | 61.7724 | 5.127 |
| Branchiostegidae | | | |
| Caulocaticus spp. | 3 | 0.6828 | 0.057 |
| Carangidae | | | |
| Chloroscombrus chrysurus | 3 | 1.2528 | 0.104 |
| Decapterus punctatus | 587 | 160.8033 | 13.347 |
| Seriola spp. | 3 | 2.0870 | 0.173 |
| Trachinotus spp. | 1 | 0.4176 | 0.035 |
| Trachurus lathami | 14 | 2.8548 | 0.237 |
| Bramidae | 18 | 2.9308 | 0.243 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Coryphaenidae | | | |
| Coryphaena spp. | 1 | 0.3447 | 0.029 |
| Coryphaena equiselus | 2 | 0.3072 | 0.026 |
| Coryphaena hippurus | 1 | 0.1358 | 0.011 |
| Lutjanidae | 24 | 6.1352 | 0.509 |
| Pristipomoides aquilonaris | 1 | 0.2055 | 0.017 |
| Rhomboplites aurorubens | 1 | 0.2707 | 0.023 |
| Gerreidae | 45 | 12.7346 | 1.057 |
| Pomadasyidae | 483 | 164.1746 | 13.627 |
| Orthopristis chrysoptera | 149 | 34.8936 | 2.896 |
| Sciaenidae | 15 | 4.4984 | 0.373 |
| Cynoscion nebulosus | 6 | 1.3660 | 0.113 |
| Leiostomus xanthurus | 3 | 0.7670 | 0.064 |
| Menticirrhus saxatilis | 3 | 1.2986 | 0.108 |
| Micropogon undulatus | 1 | 0.2573 | 0.021 |
| Sparidae | 118 | 32.3933 | 2.689 |
| Archosargus probatocephalus | 272 | 78.6150 | 6.525 |
| Mullidae | 61 | 12.8767 | 1.069 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Mulius auratus | 8 | 2.0373 | 0.169 |
| Chaetodontidae | 1 | 0.1626 | 0.014 |
| Pomacentridae | 103 | 25.6636 | 2.130 |
| Labridae | 536 | 145.8586 | 12.107 |
| Scaridae | 13 | 3.3026 | 0.274 |
| Opistognathidae | 69 | 16.7087 | 1.387 |
| Blenniidae | 605 | 177.9146 | 14.711 |
| Clinidae | 74 | 25.4920 | 2.1160 |
| Ophidiidae | 1,153 | 324.8480 | 26.963 |
| Carapidae | | | |
| Echiodon sp. | 26 | 7.0988 | 0.589 |
| Callionymidae | 98 | 30.4623 | 2.528 |
| Scombridae | | | |
| Auxis sp. | 16 | 6.6579 | 0.553 |
| Euthynnus alletteratus | 3 | 1.0522 | 0.087 |
| Katsuwonus pelamis | 2 | 0.7395 | 0.061 |
| Thunnus thynnus | 3 | 0.8212 | 0.068 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Scomber japonicus | 3 | 1.9763 | 0.164 |
| Scomberomorus maculatus | 1 | 0.3768 | 0.031 |
| Gempylidae | 2 | 0.8330 | 0.069 |
| Trichiuridae | | | |
| Diplospinus multistriatus | 2 | 0.2968 | 0.025 |
| Ariommidae | | | |
| Ariomma spp. | 7 | 3.2507 | 0.270 |
| Gobiidae | 2,194 | 551.3482 | 45.763 |
| Microdesmidae | | | |
| Microdesmus spp. | 13 | 4.1936 | 0.348 |
| Scorpaenidae | 305 | 94.0073 | 7.803 |
| Triglidae | 357 | 110.5747 | 9.178 |
| Pleuronectiformes | 21 | 6.2720 | 0.521 |
| Bothidae | 47 | 14.0822 | 1.170 |
| Citharichthys cornutus | 132 | 42.1605 | 3.499 |
| Citharichthys macrops | 83 | 26.2478 | 2.179 |
| Citharichthys gymnorhinus | 57 | 12.5806 | 1.044 |
| Cyclopsetta fimbriata | 5 | 0.6908 | 0.057 |

Table 6. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Etropus rimosus | 873 | 231.1126 | 19.183 |
| Syacium papillosum | 102 | 26.8168 | 2.226 |
| Monolene sessilicauda | 3 | 0.5531 | 0.046 |
| Bothus robinsi | 54 | 12.7494 | 1.058 |
| Soleidae | | | |
| Achirus lineatus | 1 | 0.2573 | 0.021 |
| Gymnachirus melas | 6 | 2.0093 | 0.167 |
| Cynoglossidae | | | |
| Symphurus spp. | 116 | 32.7088 | 2.715 |
| Balistidae | 312 | 84.2502 | 6.993 |
| Tetraodontidae | 218 | 59.0524 | 4.901 |
| Gobiesocidae | 12 | 2.4955 | 0.207 |
| Lophiiformes | 35 | 9.4919 | 0.788 |
| Unidentified Larvae | 1,149 | 335.3129 | 27.831 |
| Total Larvae | 19,229 | 5,747.5546 | 477.055 |

NUMBER OF FAMILIES: 63

NUMBER OF SPECIES: 81

Table 7. Cruise GE 7117. Numbers of larvae, estimated total abundance in the area represented by the cruise (101.10 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Elopidae | | | |
| Megalops atlantica | 4 | 6.0953 | 0.603 |
| Clupeidae | 8 | 3.5505 | 0.351 |
| Opisthonema oglinum | 182 | 179.5309 | 17.758 |
| Engraulidae | 46 | 54.9602 | 5.436 |
| Argentinidae | | | |
| Argentina spp. | 3 | 6.6652 | 0.659 |
| Gonostomatidae | 5 | 20.4081 | 2.019 |
| Cyclothone spp. | 4 | 23.6607 | 2.340 |
| Maurolicus muelleri | 44 | 92.2480 | 9.124 |
| Chauliodontidae | | | |
| Chauliodus spp. | 1 | 1.7456 | 0.173 |
| Synodontidae | 246 | 284.4779 | 28.138 |
| Myctophidae | 2 | 3.5462 | 0.351 |
| Diaphus spp. | 80 | 88.3256 | 8.737 |
| Lampanyctus alatus | 1 | 1.7456 | 0.173 |
| Myctophum nitidulum | 3 | 5.0317 | 0.498 |

Table 7. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Ceratoscopelus warmingi | 3 | 8.7127 | 0.862 |
| Hygophum reinhardti | 2 | 5.8085 | 0.575 |
| Anguilliformes | 1 | 2.9042 | 0.288 |
| Muraenidae | 2 | 11.1045 | 1.098 |
| Gymnothorax nigromarginatus | 6 | 15.5674 | 1.540 |
| Nettastomidae | 2 | 2.8093 | 0.278 |
| Congridae | | | |
| Hildebrandia gracilior | 2 | 1.4986 | 0.148 |
| Ophichthidae | 9 | 10.6940 | 1.058 |
| Exocoetidae | | | |
| Parexocoetus brachypterus | 4 | 2.0622 | 0.204 |
| Prognichthys gibbifrons | 1 | 0.3426 | 0.034 |
| Bregmacerotidae | | | |
| Bregmaceros Type A | 6 | 9.0204 | 0.892 |
| Bregmaceros Type B | 107 | 266.0330 | 26.314 |
| Mugilidae | | | |
| Mugil spp. | 2 | 1.9081 | 0.189 |
| Atherinidae | 2 | 5.1041 | 0.505 |

Table 7. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Serranidae | 10 | 44.4583 | 4.398 |
| Diplectrum formosum | 10 | 8.5387 | 0.845 |
| Serranus spp. | 2 | 2.1274 | 0.210 |
| Hemanthias vivanus | 5 | 9.1995 | 0.910 |
| Pronotogrammus aureorubens | 1 | 0.8567 | 0.085 |
| Serraniculus pumilio | 3 | 8.0410 | 0.795 |
| Anthias Type 1 | 1 | 1.7456 | 0.173 |
| Anthias Type 2 | 2 | 4.6498 | 0.460 |
| Rypticus spp. | 7 | 8.3296 | 0.824 |
| Priacanthidae | 8 | 9.5715 | 0.947 |
| Apogonidae | 38 | 41.8336 | 4.138 |
| Branchiostegidae | 1 | 1.0637 | 0.105 |
| Carangidae | | | |
| Caranx spp. | 2 | 3.3553 | 0.332 |
| Decapterus punctatus | 24 | 47.6104 | 4.709 |
| Coryphaenidae | | | |
| Coryphaena spp. | 2 | 3.4911 | 0.345 |

Table 7. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lutjanidae | 31 | 54.0492 | 5.346 |
| Pristipomoides aquilonaris | 1 | 9.9499 | 0.984 |
| Gerreidae | 5 | 11.5594 | 1.143 |
| Pomadasyidae | 3 | 2.6518 | 0.262 |
| Sparidae | 4 | 5.2593 | 0.520 |
| Pomacentridae | 8 | 9.1254 | 0.903 |
| Labridae | 24 | 37.8708 | 3.746 |
| Scaridae | 2 | 1.5761 | 0.156 |
| Opistognathidae | 3 | 2.9415 | 0.291 |
| Blenniidae | 1 | 1.1546 | 0.114 |
| Clinidae | 10 | 11.3253 | 1.120 |
| Ophidiidae | 77 | 84.8527 | 8.393 |
| Carapidae | | | |
| Echiodon sp. | 3 | 3.4423 | 0.341 |
| Callionymidae | 10 | 10.8374 | 1.072 |
| Scombridae | 3 | 5.2367 | 0.518 |
| Auxis sp. | 7 | 11.6485 | 1.152 |

Table 7. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Euthynnus alletteratus | 32 | 36.8370 | 3.644 |
| Thunnus atlanticus | 11 | 64.6038 | 6.390 |
| Gempylidae | 2 | 1.2839 | 0.127 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 1 | 1.7456 | 0.173 |
| Ariommidae | | | |
| Ariomma spp. | 8 | 8.8933 | 0.880 |
| Gobiidae | 312 | 375.2727 | 37.119 |
| Scorpaenidae | 61 | 73.8556 | 7.305 |
| Triglidae | 10 | 8.9223 | 0.882 |
| Bothidae | 12 | 18.8913 | 1.869 |
| Citharichthys cornutus | 60 | 98.4994 | 9.743 |
| Citharichthys macrops | 2 | 5.1041 | 0.505 |
| Citharichthys gymnorhinus | 10 | 20.7040 | 2.048 |
| Etropus rimosus | 28 | 28.0177 | 2.771 |
| Syacium papillosum | 121 | 268.3875 | 26.547 |
| Bothus robinsi | 51 | 63.8224 | 6.313 |
| Paralichthys spp. | 3 | 1.9258 | 0.191 |

Table 7. Continued.

| Taxa | Number of larvae | Abundance $(x\ 10^9)$ | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Balistidae | 29 | 40.3916 | 3.995 |
| Tetraodontidae | 38 | 44.0157 | 4.354 |
| Tetraodontidae | 38 | 44.0157 | 4.354 |
| Lophiiformes | 21 | 34.0839 | 3.371 |
| Unidentified Larvae | 251 | 310.2394 | 30.686 |
| Total Larvae | 2,149 | 3,079.4102 | 304.591 |

NUMBER OF FAMILIES: 45

NUMBER OF SPECIES: 32

Table 8. Cruise 8C 7120-TI 7121. Numbers of larvae, estimated total abundance in the area represented by the cruise ($189.43 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 1 | 0.4314 | 0.023 |
| Clupeidae | 58 | 14.6986 | 0.776 |
| Harengula jaguana | 13 | 3.8911 | 0.205 |
| Opisthonema oglinum | 1,101 | 209.8179 | 11.076 |
| Sardinella anchovia | 389 | 79.4919 | 4.196 |
| Engraulidae | 503 | 270.5702 | 14.283 |
| Bathylagidae | 1 | 1.2381 | 0.065 |
| Gonostomatidae | 64 | 71.8481 | 3.793 |
| Cyclothone spp. | 122 | 113.5732 | 5.996 |
| Gonostoma elongatum | 32 | 35.1085 | 1.853 |
| Margrethia obtusirostra | 1 | 1.4766 | 0.078 |
| Maurolicus muelleri | 131 | 101.6345 | 5.365 |
| Polymetme (?) Type I | 5 | 9.4732 | 0.500 |
| Vinciguerria spp. | 3 | 3.9040 | 0.206 |
| Vinciguerria nimbaria | 31 | 42.1581 | 2.226 |
| Vinciguerria poweriae | 12 | 9.6291 | 0.508 |
| Vinciguerria attenuata | 10 | 9.2752 | 0.490 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sternoptychidae | 4 | 3.8388 | 0.203 |
| Argyropelecus spp. | 24 | 26.0583 | 1.376 |
| Sternoptyx spp. | 50 | 57.4904 | 3.035 |
| Stomiatidae | | | |
| Stomias spp. | 3 | 3.6213 | 0.191 |
| Chauliodontidae | | | |
| Chauliodus spp. | 2 | 2.9137 | 0.154 |
| Melanostomiatidae | 2 | 2.0664 | 0.109 |
| Synodontidae | 1,124 | 395.7673 | 20.893 |
| Saurida brasiliensis | 3 | 0.6147 | 0.033 |
| Aulopidae | | | |
| Aulopus nanae | 1 | 0.5023 | 0.027 |
| Scopelarchidae | 3 | 3.0464 | 0.161 |
| Evermannelidae | | | |
| Coccorella atrata | 1 | 1.5174 | 0.080 |
| Paralepididae | 71 | 66.2485 | 3.497 |
| Myctophidae | 77 | 84.5899 | 4.466 |
| Bolinichthys spp. | 4 | 1.6018 | 0.085 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Diaphus spp. | 850 | 585.3945 | 30.903 |
| Diaphus dumerili | 7 | 8.1269 | 0.429 |
| Diaphus lucidus | 1 | 1.5460 | 0.082 |
| Diaphus taaningi | 1 | 0.8541 | 0.045 |
| Diaphus bertelseni | 1 | 1.5174 | 0.080 |
| Notolychnus valdiviae | 42 | 41.9692 | 2.216 |
| Lampadena luminosa | 16 | 17.1013 | 0.903 |
| Lampanyctus spp. | 12 | 13.8558 | 0.731 |
| Lampanyctus alatus | 13 | 13.1421 | 0.694 |
| Lampanyctus cuprarius | 4 | 5.2859 | 0.279 |
| Myctophum nitidulum | 159 | 148.3084 | 7.829 |
| Myctophum selenops | 25 | 27.2061 | 1.436 |
| Ceratoscopelus warmangi | 10 | 9.5497 | 0.504 |
| Hygophum spp. | 29 | 27.4576 | 1.450 |
| Hygophum reinhardti | 4 | 4.0309 | 0.213 |
| Hygophum benoiti | 1 | 1.0800 | 0.057 |
| Centrobranchus nigroocellatus | 9 | 10.9264 | 0.577 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gonichthys coccoi | 1 | 0.9879 | 0.052 |
| Lepidophanes spp. | 33 | 27.9391 | 1.475 |
| Notoscopelus resplendens | 1 | 0.9879 | 0.052 |
| Lobiancha gemellari | 3 | 3.2634 | 0.172 |
| Benthosema suborbitale | 33 | 33.8065 | 1.785 |
| Diogenichthy atlanticus | 16 | 18.0489 | 0.953 |
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 3 | 3.0826 | 0.163 |
| Notosudidae | | | |
| Scopelosaurus mauli | 1 | 0.8688 | 0.046 |
| Anguilliformes | 12 | 12.2980 | 0.649 |
| Muraenidae | 10 | 4.6948 | 0.248 |
| Gymnothorax nigromarginatus | 26 | 7.5460 | 0.398 |
| Nettastomidae | 12 | 11.0613 | 0.584 |
| Hoplunnis diomedianus | 9 | 2.7003 | 0.143 |
| Hoplunnis macrurus | 4 | 1.8404 | 0.097 |
| Congridae | 6 | 2.5106 | 0.158 |
| Ariosoma balearicum | 2 | 3.0028 | 0.159 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Paraconger caudilimbatus | 22 | 15.3633 | 0.811 |
| Hildebrancia gracilior | 20 | 16.0498 | 0.847 |
| Nistactichthys spp. | 5 | 1.1201 | 0.059 |
| Ophichthidae | 21 | 8.9492 | 0.472 |
| Ophichthys spp. | 26 | 11.5442 | 0.609 |
| Dysommidae | 1 | 0.7042 | 0.037 |
| Belonidae | 1 | 0.3698 | 0.020 |
| Hemiramphidae | | | |
| Hemiramphus balao | 5 | 2.0439 | 0.108 |
| Oxyporhamphus micropterus | 1 | 0.2221 | 0.012 |
| Exocoetidae | 3 | 1.1707 | 0.062 |
| Parexocoetus brachypterus | 6 | 1.0005 | 0.053 |
| Cypselurus spp. | 4 | 1.8199 | 0.096 |
| Prognichthys gibbifrons | 7 | 3.7621 | 0.199 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 74 | 68.1572 | 3.598 |
| Bregmaceros Type A | 169 | 46.5787 | 2.459 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bregmaceros Type B | 370 | 100.2908 | 5.294 |
| Bregmaceros macclellandi | 11 | 12.8030 | 0.676 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.0480 | 0.003 |
| Syngnathus spp. | 1 | 0.0946 | 0.005 |
| Syngnathus elucens | 7 | 0.9712 | 0.051 |
| Melamphaeidae | | | |
| Melamphaes spp. | 7 | 8.4706 | 0.447 |
| Holocentridae | 2 | 0.8229 | 0.043 |
| Caproidae | | | |
| Antigonia spp. | 7 | 2.3988 | 0.127 |
| Antigonia capros | 1 | 0.2115 | 0.011 |
| Mugilidae | | | |
| Mugil spp. | 2 | 0.4624 | 0.024 |
| Sphyraenidae | | | |
| Sphyraena barracuda | 8 | 3.3486 | 0.177 |
| Serranidae | 63 | 22.0962 | 1.166 |
| Diplectrum formosum | 199 | 54.2876 | 2.866 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Serranus spp. | 3 | 1.7467 | 0.092 |
| Hemanthias vivanus | 8 | 2.5570 | 0.135 |
| Pronotogrammus aureorubens | 3 | 1.5441 | 0.082 |
| Serraniculus pumilio | 56 | 16.6765 | 0.880 |
| Liopropoma spp. | 6 | 6.5444 | 0.346 |
| Liopropoma Type 1 | 4 | 2.4925 | 0.132 |
| Liopropoma Type 2 | 1 | 1.2381 | 0.065 |
| Anthias Type 1 | 2 | 0.8047 | 0.042 |
| Anthias Type 2 | 1 | 0.3262 | 0.017 |
| Rypticus spp. | 43 | 10.5891 | 0.559 |
| Rypticus saponaceus | 4 | 1.0525 | 0.056 |
| Rypticus maculatus | 1 | 0.3862 | 0.020 |
| Priacanthidae | 36 | 13.1422 | 0.694 |
| Priacanthus arenatus | 1 | 0.2115 | 0.011 |
| Pseudopriacanthus altus | 7 | 2.9490 | 0.156 |
| Apogonidae | 341 | 88.4145 | 4.667 |
| Branchiostegidae | 1 | 1.4766 | 0.078 |
| Caulolatilus spp. | 6 | 1.2690 | 0.067 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Echeneidae | 2 | 0.5074 | 0.027 |
| Rachycentridae | | | |
| Rachycentron canadum | 2 | 0.4179 | 0.022 |
| Carangidae | 5 | 6.3645 | 0.336 |
| Caranx spp. | 31 | 29.8920 | 1.578 |
| Caranx crysos | 12 | 4.7520 | 0.251 |
| Chloroscombrus chrysurus | 312 | 95.7282 | 5.054 |
| Decapterus punctatus | 406 | 123.7808 | 6.534 |
| Selene vomer | 13 | 11.1354 | 0.588 |
| Trachinotus spp. | 1 | 0.0994 | 0.005 |
| Vomer setapinnis | 1 | 0.5925 | 0.031 |
| Coryphaenidae | | | |
| Coryphaena hippurus | 1 | 0.9879 | 0.052 |
| Lutjanidae | 418 | 119.2489 | 6.295 |
| Pristipomoides aquilonaris | 13 | 7.8687 | 0.415 |
| Rhomboplites aurorubens | 10 | 2.4620 | 0.130 |
| Acanthuridae | | | |
| Acanthurus spp. | 1 | 2.2261 | 0.118 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gerreidae | 187 | 39.8076 | 0.210 |
| Pomadasyidae | 59 | 12.6966 | 0.670 |
| Sciaenidae | 1 | 0.0843 | 0.084 |
| Cynoscion nebulosus | 3 | 0.6639 | 0.035 |
| Sparidae | 5 | 2.0539 | 0.108 |
| Mullidae | 2 | 0.5140 | 0.027 |
| Chaetodontidae | 1 | 0.4267 | 0.022 |
| Pomacentridae | 20 | 9.2346 | 0.488 |
| Labridae | 846 | 506.2123 | 26.723 |
| Scaridae | 62 | 68.3652 | 3.609 |
| Blenniidae | 120 | 11.9689 | 0.632 |
| Clinidae | 41 | 10.8472 | 0.573 |
| Ophidiidae | 191 | 66.5163 | 3.511 |
| Carapidae | | | |
| Carapus bermudensis | 5 | 1.5024 | 0.079 |
| Echiodon sp. | 72 | 24.8320 | 1.311 |
| Callionymidae | 32 | 63.5615 | 3.355 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Scombridae | 74 | 48.8695 | 2.580 |
| Auxis sp. | 172 | 107.0895 | 5.653 |
| Euthynnus alletteratus | 176 | 97.0290 | 5.122 |
| Katsuwonus pelamis | 22 | 23.8850 | 1.261 |
| Thunnus spp. | 9 | 7.6738 | 0.405 |
| Thunnus atlanticus | 127 | 81.3012 | 4.292 |
| Scomberomorus maculatus | 2 | 0.6670 | 0.035 |
| Gempylidae | 10 | 11.4926 | 0.607 |
| Stromateidae | | | |
| Peprilus paru | 1 | 0.3782 | 0.020 |
| Peprilus burti | 2 | 1.1797 | 0.062 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 53 | 64.1235 | 3.385 |
| Psenes spp. | 4 | 3.8251 | 0.202 |
| Ariommidae | | | |
| Ariomma spp. | 16 | 11.2807 | 0.596 |
| Gobiidae | 2,799 | 778.0021 | 41.071 |
| Scorpaenidae | 311 | 92.8222 | 4.900 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Triglidae | 114 | 33.1600 | 1.751 |
| Pleuronectiformes | 2 | 2.4514 | 0.129 |
| Bothidae | 16 | 9.5678 | 0.505 |
| Citharichthys spp. | 1 | 0.3690 | 0.020 |
| Citharichthys cornutus | 181 | 76.3641 | 4.031 |
| Citharichthys macrops | 27 | 7.7705 | 0.410 |
| Citharichthys spilopterus | 11 | 9.5788 | 0.506 |
| Citharichthys gymnorhinus | 104 | 23.9275 | 1.263 |
| Cyclopsetta fimbriata | 15 | 6.6794 | 0.353 |
| Etropus rimosus | 26 | 8.7177 | 0.460 |
| Syacium papillosum | 1,359 | 507.1625 | 26.773 |
| Engyophrys senta | 9 | 5.1618 | 0.273 |
| Monolene sessilicauda | 4 | 1.1297 | 0.060 |
| Trichopsetta ventralis | 2 | 3.0953 | 0.163 |
| Bothus robinsi | 429 | 162.7166 | 8.590 |
| Soleidae | | | |
| Achirus lineatus | 2 | 0.5109 | 0.027 |

Table 8. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Cynoglossidae | | | |
| Symphurus spp. | 253 | 80.4855 | 4.249 |
| Balistidae | 293 | 72.7517 | 3.841 |
| Ostraciidae | 2 | 0.2356 | 0.012 |
| Tetraodontidae | 98 | 24.3759 | 1.287 |
| Diodontidae | 1 | 0.3262 | 0.017 |
| Lophiiformes | 247 | 106.9340 | 5.645 |
| Unidentified Larvae | 1,236 | 305.6079 | 16.133 |
| Total Larvae | 18,037 | 7,221.1314 | 381.203 |

NUMBER OF FAMILIES: 70

NUMBER OF SPECIES: 96

Table 9. Cruise TI 7131-8B 7132. Numbers of larvae, estimated total abundance in the area represented by the cruises (72.99 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 1 | 0.3192 | 0.044 |
| Clupeidae | 1 | 0.2381 | 0.033 |
| Brevoortia spp. | 1 | 0.4013 | 0.055 |
| Etrumeus teres | 72 | 29.3876 | 4.026 |
| Sardinella anchovia | 55 | 29.0593 | 3.981 |
| Engraulidae | 72 | 24.0410 | 3.294 |
| Argentinidae | | | |
| Argentina spp. | 13 | 3.9432 | 0.540 |
| Nansenia spp. | 1 | 0.4718 | 0.065 |
| Bathylagidae | 2 | 0.7454 | 0.102 |
| Gonostomatidae | 22 | 7.3770 | 1.011 |
| Cyclothone spp. | 32 | 13.0885 | 1.793 |
| Gonostoma spp. | 3 | 1.1180 | 0.153 |
| Gonostoma elongatum | 24 | 10.3076 | 1.412 |
| Ichthyococus ovatus | 1 | 0.2801 | 0.038 |
| Maurolicus muelleri | 17 | 6.9854 | 0.957 |
| Pollichthys mauli | 1 | 0.2800 | 0.038 |
| Polymetme (?) Type I | 2 | 0.9435 | 0.129 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria spp. | 1 | 0.3727 | 0.051 |
| Vinciguerria nimbaria | 6 | 1.7952 | 0.246 |
| Vinciguerria poweriae | 14 | 4.0382 | 0.553 |
| Vinciguerria attenuata | 3 | 0.8888 | 0.122 |
| Sternoptychidae | 1 | 0.3918 | 0.054 |
| Argyropelecus spp. | 2 | 2.4148 | 0.331 |
| Polyipnus spp. | 3 | 0.9860 | 0.135 |
| Stomiatidae | | | |
| Stomias spp. | 2 | 2.4546 | 0.336 |
| Chauliodontidae | | | |
| Chauliodus spp. | 1 | 0.3685 | 0.051 |
| Melanostomiatidae | 2 | 0.5695 | 0.078 |
| Synodontidae | 289 | 93.3248 | 12.786 |
| Scopelarchidae | 4 | 1.4754 | 0.202 |
| Evermannellidae | 1 | 0.3685 | 0.051 |
| Paralepididae | 24 | 7.7494 | 1.062 |
| Myctophidae | 24 | 7.3209 | 1.132 |
| Diaphus spp. | 40 | 20.9216 | 2.866 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Notolychnus valdiviae | 19 | 5.7420 | 0.787 |
| Lampadena luminosa | 2 | 0.4341 | 0.060 |
| Lampanyctus alatus | 5 | 2.2752 | 0.312 |
| Myctophum asperum | 1 | 0.2801 | 0.038 |
| Myctophum nitidulum | 15 | 6.7891 | 0.930 |
| Myctophum selenops | 5 | 1.7772 | 0.244 |
| Ceratoscopelus warmingi | 1 | 2.0861 | 0.286 |
| Hygophum spp. | 20 | 9.6984 | 1.329 |
| Hygophum reinhardti | 13 | 6.4757 | 0.887 |
| Centrobranchus nigroocellatus | 4 | 1.3663 | 0.187 |
| Lepidophanes spp. | 30 | 16.5148 | 2.263 |
| Benthosema suborbitale | 22 | 6.9636 | 0.954 |
| Diogenichthys atlanticus | 18 | 7.3841 | 1.012 |
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 1 | 0.3918 | 0.054 |
| Anguilliformes | 6 | 4.1340 | 0.566 |
| Muraenidae | 3 | 1.0961 | 0.150 |
| Gymnothorax nigromarginatus | 6 | 1.1994 | 0.164 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Nettastomidae | 2 | 0.5320 | 0.073 |
| Hoplunnis diomedianus | 1 | 0.1526 | 0.021 |
| Hoplunnis tenuis | 1 | 0.3287 | 0.045 |
| Congridae | 2 | 0.7411 | 0.102 |
| Gnathophis spp. | 2 | 0.5992 | 0.082 |
| Hildebrandia flava | 2 | 0.6383 | 0.088 |
| Hildebrandia gracilior | 5 | 5.7737 | 0.791 |
| Nystactichthys spp. | 2 | 0.9526 | 0.131 |
| Ophichthidae | 7 | 2.5314 | 0.347 |
| Ophichthus spp. | 1 | 0.2178 | 0.030 |
| Myrophis punctatus | 8 | 5.6675 | 0.776 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 2 | 1.023 | 0.140 |
| Exocoetidae | | | |
| Prognichthys gibbifrons | 1 | 0.3287 | 0.045 |
| Gadidae | | | |
| Urophycis spp. | 5 | 1.613 | 0.221 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bregmacerotidae | | | |
| Bregmaceros spp. | 1 | 0.3918 | 0.054 |
| Bregmaceros atlanticus | 51 | 19.8107 | 2.714 |
| Bregmaceros Type A | 84 | 29.0932 | 3.986 |
| Bregmaceros Type B | 335 | 102.3036 | 14.016 |
| Bregmaceros macclellandi | 3 | 1.0561 | 0.145 |
| Macrouridae | 1 | 0.3287 | 0.045 |
| Syngnathidae | | | |
| Hippocampus erectus | 3 | 1.6230 | 0.222 |
| Syngnathus spp. | 1 | 0.7268 | 0.110 |
| Syngnathus dunckeri | 1 | 0.6569 | 0.090 |
| Syngnathus springeri | 2 | 0.5626 | 0.077 |
| Syngnathus scovelli | 6 | 0.8165 | 0.112 |
| Melamphaeidae | | | |
| Melamphaes spp. | 5 | 1.7114 | 0.235 |
| Holocentridae | | | |
| Adioryx vexillarius | 1 | 2.0861 | 0.286 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Caproidae | | | |
| Antigonia spp. | 21 | 6.3508 | 0.870 |
| Antigonia capros | 1 | 0.3192 | 0.044 |
| Mugilidae | | | |
| Mugil spp. | 2 | 1.7281 | 0.237 |
| Serranidae | 51 | 21.9570 | 3.008 |
| Diplectrum formosum | 14 | 5.3908 | 0.739 |
| Serranus spp. | 17 | 6.2894 | 0.862 |
| Centropristis striata | 12 | 7.5052 | 1.028 |
| Hemanthias vivanus | 68 | 22.6034 | 3.097 |
| Serraniculus pumilio | 3 | 0.7711 | 0.106 |
| Anthias Type 1 | 15 | 3.9178 | 0.537 |
| Anthias Type 3 | 2 | 0.7369 | 0.101 |
| Rypticus saponaceus | 1 | 0.2167 | 0.030 |
| Apogonidae | 18 | 6.1910 | 0.848 |
| Carangidae | | | |
| Decapterus punctatus | 145 | 61.0384 | 8.363 |
| Seriola spp. | 4 | 1.5705 | 0.215 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Trachurus lathami | 4 | 1.9979 | 0.274 |
| Bramidae | 1 | 0.2609 | 0.036 |
| Lutjanidae | 7 | 1.8331 | 0.251 |
| Pristipomoides aquilonaris | 1 | 0.2800 | 0.038 |
| Rhomboplites aurorubens | 6 | 1.2246 | 0.168 |
| Symphysanodon typus | 2 | 0.7369 | 0.101 |
| Acanthuridae | | | |
| Acanthurus spp. | 3 | 0.9772 | 0.134 |
| Gerreidae | 7 | 1.8617 | 0.255 |
| Pomadasyidae | 4 | 1.8028 | 0.247 |
| Sciaenidae | 5 | 2.4310 | 0.333 |
| Cynoscion nothus | 1 | 0.3022 | 0.041 |
| Leiostomus xanthurus | 10 | 3.9120 | 0.536 |
| Menticirrhus americanus | 2 | 0.9724 | 0.133 |
| Micropogon undulatus | 4 | 1.7633 | 0.242 |
| Sparidae | 9 | 4.9192 | 0.674 |
| Lagodon rhomboides | 2 | 0.4662 | 0.064 |
| Mullidae | 1 | 0.4718 | 0.065 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Kyphosidae | | | |
| Kyphosus spp. | 2 | 0.5219 | 0.072 |
| Chaetodontidae | 1 | 0.3727 | 0.051 |
| Pomacentridae | 15 | 8.3056 | 1.138 |
| Labridae | 39 | 27.1361 | 3.718 |
| Scaridae | 37 | 12.6697 | 1.736 |
| Opistognathidae | 3 | 0.9648 | 0.135 |
| Uranoscopidae | | | |
| Astroscopus y-graecum | 1 | 0.1604 | 0.022 |
| Blenniidae | 21 | 7.4940 | 1.027 |
| Clinidae | 33 | 11.8556 | 1.624 |
| Ophidiidae | 122 | 43.9807 | 6.026 |
| Carapidae | | | |
| Carapus bermudensis | 1 | 0.1933 | 0.026 |
| Echiodon sp. | 24 | 11.2768 | 1.545 |
| Callionymidae | 56 | 16.8800 | 2.313 |
| Scombridae | | | |
| Auxis sp. | 1 | 0.3110 | 0.043 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gempylidae | 18 | 5.4731 | 0.750 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 1 | 0.7268 | 0.110 |
| Psenes pellucidus | 1 | 0.2800 | 0.038 |
| Ariommidae | | | |
| Ariomma spp. | 7 | 2.2875 | 0.313 |
| Gobiidae | 570 | 191.7677 | 26.273 |
| Scorpaenidae | 77 | 27.9653 | 1.831 |
| Triglidae | 261 | 110.0949 | 15.084 |
| Bothidae | 33 | 9.7982 | 1.342 |
| Citharichthys cornutus | 17 | 8.0249 | 1.099 |
| Citharichthys macrops | 13 | 6.6344 | 0.909 |
| Citharichthys gymnorhinus | 6 | 1.5868 | 0.217 |
| Etropus rimosus | 133 | 50.6006 | 6.933 |
| Syacium papillosum | 62 | 20.8997 | 2.863 |
| Monolene sessilicauda | 2 | 4.1723 | 0.572 |
| Bothus robinsi | 152 | 79.2961 | 10.864 |
| Paralichthys spp. | 4 | 2.0588 | 0.282 |

Table 9. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Cynoglossidae | | | |
| *Symphurus* spp. | 6 | 1.7197 | 0.236 |
| Balistidae | 3 | 1.7270 | 0.237 |
| Tetraodontidae | 18 | 7.3629 | 1.009 |
| Gobiesocidae | 1 | 0.3161 | 0.043 |
| Lophiiformes | 76 | 21.1646 | 2.900 |
| Unidentified Larvae | 271 | 111.1779 | 15.232 |
| Total Larvae | 3,974 | 1,514.1253 | 207.443 |

NUMBER OF SPECIES: 69

NUMBER OF FAMILIES: 66

Table 10. Cruise 8B 7201-GE 7202. Numbers of larvae, estimated total abundance in the area represented by the cruise (148.85 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeidae | 10 | 13.8444 | 0.930 |
| Brevoortia spp. | 2 | 1.7031 | 0.114 |
| Etrumeus teres | 190 | 269.9549 | 18.136 |
| Sardinella anchovia | 68 | 69.5307 | 4.671 |
| Engraulidae | 8 | 5.8271 | 0.392 |
| Gonostomatidae | 5 | 10.7474 | 0.722 |
| Cyclothone spp. | 12 | 15.2119 | 1.022 |
| Gonostoma elongatum | 2 | 4.2314 | 0.284 |
| Icthyococcus ovatus | 1 | 1.9452 | 0.131 |
| Maurolicus muelleri | 10 | 19.4515 | 1.307 |
| Vinciguerria nimbaria | 9 | 11.2375 | 0.754 |
| Vinciguerria poweriae | 1 | 1.9452 | 0.131 |
| Stomiatidae | | | |
| Stomias spp. | 1 | 1.0321 | 0.0693 |
| Synodontidae | 137 | 201.6463 | 13.547 |
| Paralepididae | 10 | 12.4177 | 0.834 |
| Myctophidae | 6 | 15.2659 | 1.026 |
| Diaphus spp. | 49 | 66.0673 | 4.439 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Notolychnus valdiviae | 3 | 6.8587 | 0.461 |
| Lampanyctus spp. | 3 | 3.6113 | 0.243 |
| Myctophum nitidulum | 7 | 18.8876 | 1.269 |
| Myctophum selenops | 1 | 2.2862 | 0.154 |
| Ceratoscopelus warmingi | 1 | 0.7232 | 0.049 |
| Hygophum reinhardti | 6 | 13.4243 | 0.902 |
| Lepidophanes spp. | 10 | 9.8587 | 0.662 |
| Notoscopelus resplendens | 2 | 3.9058 | 0.262 |
| Benthosema suborbitale | 3 | 6.5176 | 0.438 |
| Anguilliformes | 1 | 2.862 | 0.154 |
| Nettastomidae | 5 | 7.3016 | 0.491 |
| Hoplunnis diomedianus | 4 | 5.9820 | 0.402 |
| Congridae | | | |
| Ariosoma balearicum | 1 | 2.2862 | 0.154 |
| Hildebrandia gracilior | 2 | 1.4465 | 0.097 |
| Ophichthidae | 11 | 20.3396 | 1.366 |
| Ophichthus spp. | 1 | 1.3296 | 0.089 |
| Myrophis punctatus | 2 | 3.6159 | 0.243 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Hemiramphidae | | | |
| Hyporamphus unifasciatus | 2 | 2.4831 | 0.167 |
| Exocoetidae | | | |
| Parexocoetus brachypterus | 1 | 0.9300 | 0.063 |
| Gadidae | | | |
| Urophycis spp. | 12 | 22.5033 | 1.512 |
| Bregmacerotidae | | | |
| Bregmaceros spp. | 2 | 3.6514 | 0.245 |
| Bregmaceros atlanticus | 6 | 10.8056 | 0.726 |
| Bregmaceros Type a | 14 | 21.9474 | 1.475 |
| Bregmaceros Type B | 60 | 89.6620 | 6.024 |
| Syngnathidae | | | |
| Syngnathus elucens | 1 | 1.3240 | 0.089 |
| Syngnathus pelagicus | 1 | 2.2862 | 0.154 |
| Syngnathus springeri | 2 | 1.8373 | 0.123 |
| Mugilidae | | | |
| Mugil spp. | 17 | 17.1987 | 1.155 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Serranidae | 54 | 38.0142 | 2.651 |
| Diplectrum formosum | 14 | 17.5192 | 1.177 |
| Epinephelus spp. | 1 | 1.0321 | 1.678 |
| Serranus spp. | 3 | 6.8587 | 0.461 |
| Centropristis striata | 15 | 15.5541 | 1.045 |
| Hemanthias vivanus | 1 | 0.7232 | 0.049 |
| Pronotogrammus aureorubens | 5 | 7.2992 | 0.490 |
| Anthias spp. | 3 | 4.5311 | 0.304 |
| Anthias Type 3 | 1 | 0.6626 | 0.044 |
| Apogonidae | 28 | 24.9801 | 1.678 |
| Branchiostegidae | | | |
| Caulolatilus spp. | 1 | 1.6195 | 0.109 |
| Carangidae | 1 | 0.6591 | 0.044 |
| Caranx spp. | 1 | 2.2862 | 0.154 |
| Decapterus punctatus | 33 | 27.7672 | 1.865 |
| Seriola spp. | 1 | 0.9300 | 0.063 |
| Trachurus lathami | 33 | 42.0272 | 2.824 |
| Bramidae | 1 | 0.7232 | 0.049 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lutjanidae | 1 | 0.6591 | 0.044 |
| Symphysanodon typus | 1 | 1.0321 | 0.069 |
| Acanthuridae | | | |
| Acanthurus spp. | 1 | 0.7232 | 0.049 |
| Gerreidae | 10 | 11.7422 | 0.789 |
| Pomadasyidae | 43 | 40.6031 | 2.728 |
| Orthopristis chrysoptera | 5 | 3.9376 | 0.264 |
| Sciaenidae | | | |
| Cynoscion nebulosus | 1 | 1.1647 | 0.078 |
| Leiostomus xanthurus | 8 | 9.6762 | 0.650 |
| Sparidae | 11 | 8.1081 | 4.152 |
| Lagodon rhomboides | 120 | 174.5743 | 11.728 |
| Pagrus pagrus | 3 | 2.4494 | 0.165 |
| Mullidae | 34 | 45.2285 | 3.039 |
| Pomacentridae | 10 | 9.9206 | 0.666 |
| Labridae | 38 | 44.9950 | 3.023 |
| Scaridae | 16 | 17.5285 | 1.178 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Opistognathidae | 6 | 7.1040 | 0.477 |
| Blenniidae | 22 | 26.4104 | 1.774 |
| Clinidae | 9 | 11.8763 | 0.798 |
| Ophidiidae | 38 | 49.3893 | 3.320 |
| Carapidae | | | |
| Echiodon sp. | 3 | 2.5986 | 0.175 |
| Callionymidae | 14 | 1.4722 | 0.989 |
| Scombridae | | | |
| Auxis sp. | 3 | 2.7267 | 0.183 |
| Euthynnus alletteratus | 1 | 0.6591 | 0.044 |
| Scomber japonicus | 2 | 2.4255 | 0.163 |
| Gempylidae | 1 | 0.6626 | 0.044 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 3 | 2.6456 | 0.178 |
| Psenes cyanophrys | 1 | 0.6626 | 0.045 |
| Psenes pellucidus | 1 | 0.6626 | 0.045 |
| Ariommidae | | | |
| Ariomma spp. | 6 | 5.8230 | 0.391 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gobiidae | 249 | 342.0611 | 22.980 |
| Scorpaenidae | 30 | 32.0859 | 2.156 |
| Triglidae | 34 | 48.3453 | 3.248 |
| Bothidae | 8 | 10.8403 | 0.728 |
| Citharichthys cornutus | 6 | 15.1173 | 1.016 |
| Citharichthys macrops | 7 | 7.2236 | 0.485 |
| Citharichthys gymnorhinus | 21 | 30.3619 | 2.040 |
| Cyclopsetta fimbriata | 1 | 0.6591 | 0.044 |
| Etropus rimosus | 116 | 173.8785 | 11.682 |
| Syacium papillosum | 58 | 38.2253 | 2.568 |
| Bothus robinsi | 20 | 21.7582 | 1.462 |
| Soleidae | | | |
| Achirus lineatus | 1 | 1.0321 | 0.069 |
| Cynoglossidae | | | |
| Symphurus spp. | 1 | 1.3240 | 0.089 |
| Balistidae | 41 | 53.1917 | 3.574 |
| Tetraodontidae | 36 | 52.7788 | 3.546 |

Table 10. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lophiiformes | 2 | 5.2378 | 0.352 |
| Unidentified Larvae | 307 | 415.9357 | 27.943 |
| Total Larvae | 2,290 | 3,006.6007 | 201.989 |

NUMBER OF FAMILIES: 47

NUMBER OF SPECIES: 54

Table 11. Cruise GE 7208. Numbers of larvae, estimated total abundance in the area represented by the cruise (124.88 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 3 | 4.7997 | 0.384 |
| Clupeidae | 3 | 1.3840 | 0.111 |
| Etrumeus teres | 4 | 6.4008 | 0.513 |
| Harengula jaguana | 95 | 18.7910 | 1.507 |
| Opisthonema oglinum | 634 | 205.2583 | 16.436 |
| Sardinella anchovia | 118 | 64.0501 | 5.129 |
| Engraulidae | 220 | 112.8559 | 9.037 |
| Argentinidae | 2 | 4.4200 | 0.354 |
| Gonostomatidae | 41 | 92.1588 | 7.380 |
| Cyclothone spp. | 56 | 112.2859 | 8.992 |
| Gonostoma elongatum | 9 | 22.7617 | 1.823 |
| Maurolicus muelleri | 1 | 1.7854 | 0.143 |
| Polymetme (?) Type I | 2 | 5.3939 | 0.432 |
| Vinciguerria spp. | 17 | 43.3219 | 0.346 |
| Vinciguerria nimbaria | 22 | 45.2934 | 3.627 |
| Vinciguerria poweriae | 13 | 25.9692 | 2.080 |
| Vinciguerria attenuata | 3 | 9.9517 | 0.797 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sternoptychidae | | | |
| Argyropelecus spp. | 2 | 3.6336 | 0.291 |
| Sternoptyx spp. | 4 | 11.3654 | 0.910 |
| Stomiatidae | | | |
| Stomias spp. | 2 | 3.6669 | 0.294 |
| Astronesthidae | 1 | 1.8168 | 0.146 |
| Melanostomiatidae | 2 | 3.6336 | 0.291 |
| Synodontidae | 233 | 247.9351 | 19.854 |
| Aulopidae | | | |
| Aulopus nanae | 1 | 1.0262 | 0.082 |
| Scopelarchidae | 1 | 1.8168 | 0.146 |
| Evarmannellidae | 2 | 6.6344 | 0.531 |
| Paralepididae | 34 | 62.2509 | 4.985 |
| Myctophidae | 51 | 84.6991 | 6.782 |
| Diaphus spp. | 192 | 298.5779 | 23.909 |
| Notolychnus valdiviae | 49 | 118.3478 | 9.477 |
| Lampadena luminosa | 9 | 15.1175 | 1.211 |
| Lampanyctus spp. | 8 | 14.2649 | 1.142 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lampanyctus alatus | 3 | 6.4745 | 0.519 |
| Lampanyctus ater | 2 | 3.6336 | 0.291 |
| Lampanyctus cuprarius | 3 | 4.3879 | 0.351 |
| Myctophum spp. | 2 | 2.5394 | 0.203 |
| Myctophum nitidulum | 104 | 225.1198 | 18.027 |
| Myctophum selenops | 35 | 85.0125 | 6.808 |
| Ceratoscopelus warmingi | 38 | 62.6800 | 5.019 |
| Hygophum spp. | 109 | 195.9784 | 15.693 |
| Hygophum reinhardti | 8 | 17.7136 | 1.419 |
| Centrobranchus nigroocellatus | 6 | 14.9990 | 1.201 |
| Gonichthys coccoi | 1 | 3.3172 | 0.266 |
| Lepidophanes spp. | 91 | 183.1031 | 14.662 |
| Notoscopelus resplendens | 2 | 2.5394 | 0.203 |
| Lobianchia gemellari | 8 | 16.4173 | 1.315 |
| Benthosema suborbitale | 144 | 370.3809 | 29.659 |
| Diogenichthys atlanticus | 34 | 79.5582 | 6.371 |
| Symbolophorus rufinus | 9 | 18.2886 | 1.464 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 3 | 7.6264 | 0.611 |
| Anguilliformes | 5 | 9.1993 | 0.737 |
| Muraenidae | 4 | 9.4029 | 0.753 |
| Gymnothorax spp. | 1 | 1.0559 | 0.085 |
| Nettastomidae | 3 | 4.5970 | 0.368 |
| Hoplunnis diomedianus | 1 | 1.8642 | 0.149 |
| Hoplunnis macrurus | 1 | 1.8168 | 0.146 |
| Congridae | 1 | 1.8642 | 0.149 |
| Xenomystax spp. | 2 | 3.6336 | 0.291 |
| Ophichthidae | 2 | 2.4920 | 0.120 |
| Ahlia egmontis | 2 | 1.2028 | 0.096 |
| Exocoetidae | 1 | 1.0559 | 0.085 |
| Prognichthys gibbifrons | 3 | 2.1529 | 0.172 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 23 | 61.7324 | 4.943 |
| Bregmaceros Type A | 52 | 110.4760 | 8.847 |
| Bregmaceros Type B | 19 | 18.9033 | 1.514 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.4762 | 0.038 |
| Syngnathus elucens | 2 | 0.8632 | 0.069 |
| Syngnathus springeri | 1 | 0.3266 | 0.026 |
| Syngnathus scovelli | 4 | 0.6399 | 0.051 |
| Melamphaeidae | | | |
| Melamphaes spp. | 8 | 16.6789 | 1.336 |
| Holocentridae | 15 | 46.7261 | 3.742 |
| Mugilidae | | | |
| Mugil spp. | 13 | 4.1812 | 0.335 |
| Sphyraenidae | | | |
| Sphyraena barracuda | 1 | 3.3172 | 0.266 |
| Sphyraena borealis | 3 | 2.1642 | 0.173 |
| Sphyraena guachancho | 1 | 1.0262 | 0.082 |
| Serranidae | 25 | 33.8362 | 2.710 |
| Diplectrum formosum | 374 | 194.4743 | 15.573 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Epinephelus spp. | 29 | 20.6294 | 1.652 |
| Serranus spp. | 7 | 14.5788 | 1.167 |
| Hemanthias vivanus | 50 | 49.0193 | 3.925 |
| Pronotogrammus aureorubens | 11 | 12.7316 | 1.020 |
| Serraniculus pumilio | 12 | 4.2296 | 0.339 |
| Liopropoma spp. | 1 | 3.3172 | 0.266 |
| Rypticus spp. | 1 | 0.3773 | 0.030 |
| Priacanthidae | 8 | 7.6778 | 0.615 |
| Priacanthus cruentatus | 1 | 3.3172 | 0.266 |
| Apogonidae | 163 | 95.1710 | 7.621 |
| Echeneidae | 1 | 1.8168 | 0.146 |
| Carangidae | | | |
| Caranx spp. | 1 | 0.8255 | 0.066 |
| Chloroscombrus chrysurus | 3 | 0.1376 | 0.011 |
| Decapterus punctatus | 352 | 238.6873 | 19.113 |
| Elegatis bipinnulata | 6 | 6.3357 | 0.507 |
| Seriola spp. | 3 | 6.1645 | 0.494 |
| Trachurus lathami | 8 | 10.4582 | 0.838 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bramidae | 2 | 3.6336 | 0.291 |
| Coryphaenidae | | | |
| *Coryphaena* spp. | 2 | 2.8473 | 0.228 |
| Lutjanidae | 41 | 32.1108 | 2.571 |
| *Lutjanus* spp. | 2 | 2.7685 | 0.222 |
| Acanthuridae | | | |
| *Acanthurus* spp. | 2 | 4.3434 | 0.348 |
| Gerreidae | 193 | 27.8538 | 2.230 |
| Pomadasyidae | 202 | 75.2630 | 6.027 |
| *Orthopristis chrysoptera* | 2 | 0.3199 | 0.026 |
| Sciaenidae | | | |
| *Cynoscion nebulosus* | 37 | 5.8046 | 0.465 |
| *Leiostomus xanthurus* | 26 | 4.1591 | 0.333 |
| *Micropogon undulatus* | 1 | 0.1600 | 0.013 |
| Sparidae | 38 | 19.1074 | 1.530 |
| *Lagodon rhomboides* | 1 | 0.1600 | 0.013 |
| Mullidae | 47 | 28.8256 | 2.308 |
| *Mullus auratus* | 2 | 1.0065 | 0.081 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Chaetodontidae | 4 | 3.5324 | 0.283 |
| Pomacentridae | 52 | 65.4344 | 5.240 |
| Labridae | 159 | 145.8946 | 11.683 |
| Scaridae | 77 | 91.3695 | 7.317 |
| Opistognathidae | 59 | 27.3802 | 2.193 |
| Blenniidae | 104 | 61.3080 | 4.909 |
| Clinidae | 41 | 23.7295 | 1.900 |
| Ophidiidae | 214 | 138.7797 | 11.113 |
| Carapidae | | | |
| Carapus bermudensis | 1 | 3.3172 | 0.266 |
| Echiodon sp. | 2 | 5.1340 | 0.411 |
| Callionymidae | 28 | 36.9887 | 2.962 |
| Scombridae | | | |
| Auxis sp. | 37 | 44.6725 | 3.577 |
| Euthynnus alleteratus | 10 | 23.8967 | 1.914 |
| Katsuwonus pelamis | 13 | 23.3509 | 1.870 |
| Thunnus atlanticus | 5 | 9.5229 | 0.763 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Thunnus thynnus | 77 | 215.0550 | 17.221 |
| Scomberomorous maculatus | 2 | 0.8468 | 0.068 |
| Acanthocybium solanderi | 1 | 2.0767 | 0.166 |
| Gempylidae | 8 | 12.3373 | 0.988 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 10 | 15.4548 | 1.238 |
| Psenes pellucidus | 1 | 1.0262 | 0.082 |
| Ariommidae | | | |
| Ariomma spp. | 11 | 22.6366 | 1.813 |
| Gobiidae | 657 | 426.8858 | 34.184 |
| Scorpaenidae | 131 | 99.7413 | 7.987 |
| Triglidae | 66 | 35.0485 | 2.807 |
| Bothidae | 4 | 5.0542 | 0.405 |
| Citharichthys cornutus | 53 | 95.4699 | 7.645 |
| Citharichthys macrops | 11 | 3.4362 | 0.275 |
| Citharichthys gymnorhinus | 4 | 2.2322 | 0.179 |
| Cyclopsetta fimbriata | 6 | 2.7291 | 0.219 |

Table 11. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Etropus rimosus | 47 | 27.1966 | 2.178 |
| Syacium papillosum | 102 | 94.1521 | 7.539 |
| Monolene sessilicauda | 3 | 4.5539 | 0.365 |
| Bothus robinsi | 44 | 53.2162 | 4.261 |
| Soleidae | | | |
| Achirus lineatus | 2 | 0.3199 | 0.013 |
| Cynoglossidae | | | |
| Symphurus spp. | 68 | 34.2732 | 2.744 |
| Balistidae | 321 | 175.7871 | 14.077 |
| Tetraodontidae | 58 | 33.7350 | 2.701 |
| Diodontidae | 1 | 1.8168 | 0.146 |
| Lophiiformes | 27 | 35.4842 | 2.842 |
| Unidentified Larvae | 670 | 623.1916 | 49.903 |
| Total Larvae | 7,450 | 6,899.5027 | 552.491 |

NUMBER OF FAMILIES: 63

NUMBER OF SPECIES: 77

Table 12. Cruise GE 7210. Numbers of larvae, estimated total abundance in the area represented by the cruise (48.43 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeidae | 10 | 6.3027 | 1.301 |
| Harengula jaguana | 110 | 29.1211 | 6.013 |
| Opisthonema oglinum | 1,016 | 836.8930 | 172.805 |
| Sardinella anchovia | 94 | 98.8491 | 20.411 |
| Engraulidae | 12 | 8.4291 | 1.741 |
| Synodontidae | 37 | 23.3856 | 4.829 |
| Muraenidae | | | |
| Gymnothorax nigromarginatus | 4 | 2.7714 | 0.572 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 2 | 0.5652 | 0.117 |
| Hemiramphus brasiliensis | 1 | 0.5980 | 0.124 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.3388 | 0.070 |
| Syngnathus scovelli | 2 | 0.5108 | 0.106 |
| Mugilidae | | | |
| Mugil spp. | 1 | 0.5980 | 0.124 |
| Atherinidae | | | |
| Membras martinicus | 37 | 8.3764 | 1.730 |

Table 12. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Serranidae | | | |
| Diplectrum formosum | 51 | 27.5778 | 5.694 |
| Serraniculus pumilio | 6 | 2.8643 | 0.591 |
| Priacanthidae | 2 | 2.2250 | 0.459 |
| Apogonidae | 32 | 25.1453 | 5.192 |
| Carangidae | | | |
| Decapterus punctatus | 117 | 84.8085 | 17.512 |
| Oligoplites saurus | 1 | 0.2264 | 0.047 |
| Lutjanidae | 45 | 35.7947 | 7.391 |
| Rhomboplites aurorubens | 1 | 1.0443 | 0.216 |
| Gerreidae | 22 | 9.2763 | 1.920 |
| Pomadasyidae | 27 | 16.5817 | 3.424 |
| Sparidae | 7 | 4.2915 | 0.886 |
| Pomacentridae | 3 | 1.9986 | 0.413 |
| Labridae | 5 | 5.2640 | 1.087 |
| Scaridae | 6 | 4.8894 | 1.010 |
| Opistognathidae | 6 | 5.0346 | 1.040 |
| Blenniidae | 21 | 8.3474 | 1.724 |

Table 12. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clinidae | 25 | 6.5589 | 1.354 |
| Ophidiidae | 47 | 39.1869 | 8.092 |
| Callionymidae | 31 | 14.0542 | 2.902 |
| Scombridae | | | |
| Auxis sp. | 3 | 2.6747 | 0.552 |
| Euthynnus alletteratus | 5 | 3.4220 | 0.707 |
| Gobiidae | 204 | 159.6969 | 32.975 |
| Scorpaenidae | 25 | 19.4112 | 4.008 |
| Triglidae | 9 | 5.8137 | 1.200 |
| Bothidae | | | |
| Citharichthys macrops | 9 | 3.7573 | 0.776 |
| Cyclopsetta fimbriata | 2 | 1.9874 | 0.410 |
| Etropus rimosus | 3 | 3.1548 | 0.651 |
| Syacium papillosum | 22 | 17.8605 | 3.688 |
| Bothus robinsi | 4 | 4.0651 | 0.839 |
| Soleidae | | | |
| Gymnachirus melas | 1 | 0.6507 | 0.134 |

Table 12. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Cynoglossidae | | | |
| *Symphurus* spp. | 16 | 13.3302 | 2.753 |
| Balistidae | 58 | 42.2547 | 8.725 |
| Ostraciidae | 1 | 0.4261 | 0.088 |
| Tetraodontidae | 16 | 10.5470 | 2.178 |
| Lophiiformes | 6 | 3.9664 | 0.819 |
| Unidentified Larvae | 71 | 31.7841 | 6.563 |
| Total Larvae | 2,239 | 1,637.9448 | 338.209 |

NUMBER OF FAMILIES: 34

NUMBER OF SPECIES: 23

Table 13. Cruise IS 7205. Numbers of larvae, estimated total abundance in the area represented by the cruise ($104.59 \times 10^9\ m^2$), and estimated mean number under $10\ m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under $10\ m^2$ |
|---|---|---|---|
| Clupeidae | 43 | 26.1144 | 2.497 |
| Harengula jaguana | 5 | 1.6629 | 0.159 |
| Opisthonema oglinum | 76 | 11.0083 | 1.053 |
| Sardinella anchovia | 3,726 | 2,241.3012 | 214.294 |
| Engraulidae | 28 | 20.7727 | 1.986 |
| Gonostomatidae | | | |
| Cyclothone spp. | 10 | 25.6030 | 2.448 |
| Gonostoma atlanticum | 2 | 4.1059 | 0.393 |
| Gonostoma elongatum | 5 | 10.2647 | 0.981 |
| Maurolicus muelleri | 1 | 3.5409 | 0.339 |
| Vinciguerria nimbaria | 5 | 13.3613 | 1.278 |
| Synodontidae | 145 | 159.0368 | 15.206 |
| Aulopidae | | | |
| Aulopus nanae | 1 | 2.0529 | 0.196 |
| Scopelarchidae | 1 | 2.0529 | 0.196 |
| Paralepididae | 1 | 2.8573 | 0.273 |
| Myctophidae | | | |
| Bolinichthys spp. | 1 | 1.8092 | 0.173 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Diaphus spp. | 25 | 63.8289 | 6.103 |
| Notolychnus valdiviae | 2 | 6.3982 | 0.612 |
| Myctophum nitidulum | 2 | 3.5758 | 0.3429 |
| Myctophum selenops | 1 | 2.0529 | 0.196 |
| Ceratoscopelus warmingi | 1 | 3.5409 | 0.339 |
| Hygophum spp. | 2 | 4.9102 | 0.470 |
| Lepidophanes spp. | 10 | 30.7544 | 2.941 |
| Benthosema suborbitale | 2 | 5.5938 | 0.535 |
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 1 | 3.2296 | 0.309 |
| Anguilliformes | 14 | 22.2647 | 2.1292 |
| Muraenidae | 4 | 4.1837 | 0.400 |
| Gymnothorax nigromarginatus | 9 | 10.8882 | 1.041 |
| Anarchias yoshiae | 2 | 4.1059 | 0.393 |
| Nettastomidae | 1 | 0.3474 | 0.033 |
| Hoplunnis diomedianus | 2 | 1.8502 | 0.177 |
| Congridae | 3 | 4.0385 | 0.386 |
| Ariosoma balearicum | 2 | 4.3802 | 0.419 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Hildebrandia gracilior | 1 | 3.5409 | 0.339 |
| Ophichthidae | 14 | 16.9283 | 1.619 |
| Ophichthus spp. | 10 | 10.2344 | 0.979 |
| Exocoetidae | 1 | 0.3992 | 0.038 |
| Parexocoetus brachypterus | 3 | 2.5836 | 0.247 |
| Cypselurus spp. | 2 | 3.8512 | 0.368 |
| Prognichthys gibbifrons | 1 | 1.8092 | 0.173 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 10 | 27.1952 | 2.600 |
| Bregmaceros Type A | 126 | 366.6907 | 35.060 |
| Bregmaceros Type B | 101 | 176.3427 | 16.860 |
| Bregmaceros macclellandi | 1 | 2.0529 | 0.196 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.0207 | 0.002 |
| Syngnathus elucens | 1 | 0.3149 | 0.030 |
| Syngnathus pelagicus | 1 | 1.5229 | 0.146 |
| Syngnathus springeri | 2 | 1.0826 | 0.104 |
| Syngnathus scovelli | 2 | 0.1281 | 0.012 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Melamphaeidae | | | |
| Melamphaes spp. | 1 | 3.5409 | 0.339 |
| Holocentridae | 1 | 1.4556 | 0.139 |
| Mugilidae | | | |
| Mugil spp. | 2 | 1.7153 | 0.164 |
| Sphyraenidae | | | |
| Sphyraena spp. | 1 | 1.8092 | 0.173 |
| Sphyraena barracuda | 6 | 15.2991 | 1.463 |
| Serranidae | 90 | 36.4416 | 3.484 |
| Diplectrum formosum | 218 | 142.2927 | 13.605 |
| Epinephelus spp. | 24 | 38.6798 | 3.698 |
| Centropristis striata | 1 | 0.3992 | 0.038 |
| Hemanthias vivanus | 6 | 13.1220 | 1.255 |
| Serraniculus pumilio | 152 | 48.1961 | 4.608 |
| Liopropoma spp. | 2 | 4.1059 | 0.393 |
| Rypticus spp. | 68 | 32.7481 | 3.131 |
| Rypticus saponaceus | 1 | 0.1831 | 0.018 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Priacanthidae | 27 | 60.4279 | 5.778 |
| Pseudopriacanthus altus | 1 | 0.6815 | 0.065 |
| Apogonidae | 248 | 167.0090 | 15.968 |
| Branchiostegidae | | | |
| Caulolatilus cyanops | 1 | 1.8092 | 0.173 |
| Carangidae | | | |
| Chloroscombrus chrysurus | 136 | 32.7290 | 3.129 |
| Decapterus punctatus | 581 | 578.0261 | 55.266 |
| Seriola spp. | 3 | 3.6593 | 0.350 |
| Lutjanidae | 253 | 258.2800 | 24.695 |
| Pristipomoides aquilonaris | 13 | 31.7112 | 3.032 |
| Rhomboplites aurorubens | 1 | 0.4297 | 0.041 |
| Acanthuridae | | | |
| Acanthurus spp. | 3 | 6.1588 | 0.589 |
| Gerreidae | 239 | 113.6930 | 10.870 |
| Pomadasyidae | 49 | 26.5909 | 2.542 |
| Sciaenidae | 2 | 0.9126 | 0.087 |
| Cynoscion nebulosus | 1 | 0.0207 | 0.002 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sparidae | 1 | 1.9277 | 0.184 |
| Chaetodontidae | 3 | 4.2889 | 0.410 |
| Pomacentridae | 34 | 39.8119 | 3.807 |
| Labridae | 162 | 202.5500 | 19.366 |
| Scaridae | 61 | 85.2411 | 8.150 |
| Opistognathidae | 6 | 2.9788 | 0.285 |
| Blenniidae | 12 | 6.6111 | 0.632 |
| Clinidae | 17 | 15.9451 | 1.525 |
| Ophidiidae | 413 | 235.4780 | 22.514 |
| Carapidae | | | |
| Carapus bermudensis | 3 | 7.3921 | 0.707 |
| Echiodon sp. | 12 | 33.6570 | 3.218 |
| Callionymidae | 264 | 103.2080 | 9.868 |
| Scombridae | 5 | 6.6186 | 0.633 |
| Auxis sp. | 32 | 60.7573 | 5.809 |
| Euthynnus alletteratus | 30 | 49.8512 | 4.766 |
| Katsuwonus pelamis | 1 | 2.8573 | 0.273 |
| Thunnus atlanticus | 18 | 50.2049 | 4.800 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Scomberomorus cavalla | 1 | 1.4004 | 0.134 |
| Scomberomorus maculatus | 12 | 4.7231 | 0.452 |
| Acanthocybium solanderi | 1 | 2.8573 | 0.273 |
| Gempylidae | 1 | 2.0529 | 0.196 |
| Istiophoridae | 1 | 2.8573 | 0.273 |
| Stromateidae | 4 | 0.8466 | 0.081 |
| Peprilus paru | 10 | 2.8400 | 0.272 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 1 | 1.4556 | 0.139 |
| Psenes pellucidus | 2 | 4.1059 | 0.393 |
| Gobiidae | 1,631 | 1,500.5400 | 143.469 |
| Scorpaenidae | 208 | 245.3890 | 23.462 |
| Triglidae | 83 | 49.3282 | 4.716 |
| Bothidae | 7 | 5.2375 | 0.501 |
| Citharichthys cornutus | 9 | 27.7664 | 2.655 |
| Citharichthys macrops | 55 | 23.3254 | 2.234 |
| Citharichthys gymnorhinus | 4 | 7.4860 | 0.716 |

Table 13. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Cyclopsetta fimbriata | 11 | 9.8011 | 0.937 |
| Etropus rimosus | 8 | 4.3048 | 0.412 |
| Syacium papillosum | 352 | 574.0030 | 54.881 |
| Monolene sessilicauda | 1 | 3.5409 | 0.339 |
| Bothus robinsi | 172 | 256.0580 | 24.482 |
| Soleidae | | | |
| Achirus lineatus | 2 | 0.3212 | 0.031 |
| Cynoglossidae | | | |
| Symphurus spp. | 100 | 56.6090 | 5.413 |
| Balistidae | 190 | 148.8260 | 14.230 |
| Tetraodontidae | 29 | 21.5280 | 2.058 |
| Lophiiformes | 89 | 125.2542 | 11.976 |
| Unidentified Larvae | 284 | 358.3463 | 34.262 |
| Total Larvae | 10,872 | 9,300.3952 | 889.224 |

NUMBER OF FAMILIES: 55

NUMBER OF SPECIES: 64

Table 14. Cruise IS 7209. Numbers of larvae, estimated total abundance in the area represented by the cruise ($149.80 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Elopidae | | | |
| Elops saurus | 1 | 0.2848 | 0.019 |
| Clupeidae | | | |
| Etrumeus teres | 15 | 26.9938 | 1.802 |
| Harengula jaguana | 2 | 3.5917 | 0.240 |
| Sardinella anchovia | 8 | 13.1863 | 0.880 |
| Engraulidae | 10 | 4.7229 | 0.315 |
| Argentinidae | | | |
| Argentina spp. | 2 | 3.4537 | 0.231 |
| Nansenia spp. | 1 | 1.7959 | 0.120 |
| Gonostomatidae | 8 | 18.3686 | 1.226 |
| Cyclothone spp. | 20 | 34.1016 | 2.277 |
| Gonostoma elongatum | 1 | 50.6871 | 3.384 |
| Maurolicus muelleri | 38 | 66.8160 | 4.460 |
| Polymetme (?) Type I | 4 | 7.7462 | 0.517 |
| Vinciguerria spp. | 1 | 1.6657 | 0.111 |
| Vinciguerria nimbaria | 1 | 1.6670 | 0.111 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria poweriae | 2 | 3.4441 | 0.230 |
| Sternoptychidae | | | |
| Argyropelecus spp. | 3 | 6.8784 | 0.459 |
| Sternoptyx spp. | 1 | 1.6657 | 0.111 |
| Stomiatidae | | | |
| Stomias spp. | 1 | 1.6670 | 0.111 |
| Chauliodontidae | | | |
| Chauliodus spp. | 2 | 4.4110 | 0.294 |
| Melanostomiatidae | 3 | 4.9823 | 0.333 |
| Synodontidae | 81 | 112.4073 | 7.504 |
| Saurida brasiliensis | 1 | 0.3651 | 0.024 |
| Synodus foetens | 1 | 0.3473 | 0.023 |
| Evermannellidae | 1 | 2.9439 | 0.197 |
| Paralepididae | 12 | 26.6303 | 1.778 |
| Myctophidae | 4 | 7.6900 | 0.513 |
| Diaphus spp. | 60 | 113.1696 | 7.555 |
| Notolychnus valdiviae | 12 | 22.3216 | 1.490 |
| Lampadena luminosa | 2 | 3.4768 | 0.232 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lampanyctus spp. | 2 | 5.3074 | 0.354 |
| Lampanyctus alatus | 2 | 5.4363 | 0.363 |
| Lampanyctus ater | 1 | 1.6670 | 0.111 |
| Lampanyctus cuprarius | 1 | 2.7452 | 0.183 |
| Myctophum spp. | 1 | 1.6483 | 0.110 |
| Myctophum nitidulum | 14 | 24.6060 | 1.643 |
| Myctophum selenops | 4 | 8.6414 | 0.577 |
| Ceratoscopelus warmingi | 3 | 5.2715 | 0.352 |
| Hygophum spp. | 11 | 25.7763 | 1.721 |
| Hygophum reinhardti | 1 | 1.6657 | 0.111 |
| Lepidophanes spp. | 9 | 13.1665 | 0.879 |
| Lobianchia gemellari | 2 | 5.8877 | 0.393 |
| Benthosema suborbitale | 15 | 32.6875 | 2.182 |
| Diogenichthys atlanticus | 7 | 14.1653 | 0.946 |
| Anguilliformes | 3 | 3.9209 | 0.262 |
| Muraenidae | | | |
| Gymnothorax nigromarginatus | 5 | 3.5962 | 0.240 |
| Anarchias yoshiae | 1 | 1.8233 | 0.122 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Nettastomidae | 3 | 6.2679 | 0.418 |
| Hoplunnis diomedianus | 2 | 3.6057 | 0.241 |
| Congridae | 4 | 8.0039 | 0.534 |
| Hildebrandia gracilior | 2 | 4.4720 | 0.299 |
| Ophicthidae | 11 | 14.2641 | 0.952 |
| Ophichthus spp. | 2 | 1.0509 | 0.070 |
| Myrophis punctatus | 3 | 3.3756 | 0.225 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 2 | 0.4274 | 0.029 |
| Hemiramphus balao | 1 | 1.6483 | 0.110 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 2 | 3.4616 | 0.231 |
| Bregmaceros Type A | 169 | 340.5906 | 22.736 |
| Bregmaceros Type B | 227 | 331.3417 | 22.119 |
| Bregmaceros macclellandi | 1 | 2.7452 | 0.183 |
| Syngnathidae | | | |
| Hippocampus erectus | 4 | 0.7405 | 0.049 |
| Syngnathus spp. | 2 | 1.0694 | 0.071 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Syngnathus elucens | 3 | 2.9013 | 0.194 |
| Syngnathus springeri | 20 | 6.8202 | 0.455 |
| Syngnathus scovelli | 3 | 0.6143 | 0.041 |
| Melamphaeidae | | | |
| Melamphaes spp. | 1 | 1.6483 | 0.110 |
| Holocentridae | 1 | 1.8233 | 0.122 |
| Caproidae | | | |
| Antigonia spp. | 1 | 2.7452 | 0.183 |
| Serranidae | 9 | 13.7803 | 0.920 |
| Diplectrum formosum | 7 | 4.1158 | 0.275 |
| Epinephelus spp. | 1 | 1.7439 | 0.116 |
| Serranus spp. | 2 | 6.3856 | 0.426 |
| Hemanthias vivanus | 12 | 34.4474 | 2.300 |
| Pronotogrammus aureorubens | 7 | 13.6916 | 0.914 |
| Serraniculus pumilio | 1 | 0.3651 | 0.024 |
| Anthias Type 1 | 8 | 24.4235 | 1.630 |
| Anthias Type 3 | 6 | 12.5455 | 0.838 |
| Priacanthidae | 9 | 13.3762 | 0.893 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Apogonidae | 49 | 37.2246 | 2.485 |
| Carangidae | | | |
| Decapterus punctatus | 131 | 109.6204 | 7.318 |
| Seriola spp. | 15 | 24.7429 | 1.652 |
| Coryphaenidae | | | |
| Coryphaena hippurus | 1 | 1.6483 | 0.110 |
| Lutjanidae | 60 | 59.7593 | 3.989 |
| Lutjanus spp. | 1 | 1.8099 | 0.121 |
| Pristipomoides aquilonaris | 3 | 4.8842 | 0.326 |
| Rhomboplites aurorubens | 8 | 11.7038 | 0.781 |
| Symphysanodon typus | 1 | 1.6483 | 0.110 |
| Acanthuridae | | | |
| Acanthurus spp. | 1 | 1.6670 | 0.111 |
| Gerreidae | 34 | 18.0928 | 1.208 |
| Pomadasyidae | 27 | 10.8928 | 0.727 |
| Sciaenidae | 2 | 0.5796 | 0.039 |
| Leiostomus xanthurus | 18 | 7.6715 | 0.512 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sparidae | 8 | 9.2494 | 0.617 |
| Lagodon rhomboides | 5 | 5.7262 | 0.382 |
| Mullidae | 3 | 4.6588 | 0.311 |
| Kyphosidae | | | |
| Kyphosus spp. | 1 | 0.2540 | 0.017 |
| Chaetodontidae | 2 | 3.0796 | 0.206 |
| Pomacentridae | 25 | 27.4931 | 1.835 |
| Labridae | 24 | 42.4341 | 2.833 |
| Scaridae | 78 | 104.9861 | 7.008 |
| Opistognathidae | 5 | 6.0384 | 0.403 |
| Blenniidae | 37 | 17.3213 | 1.156 |
| Clinidae | 50 | 27.9170 | 1.864 |
| Ophidiidae | 258 | 140.8773 | 9.404 |
| Carapidae | | | |
| Echiodon sp. | 11 | 19.6527 | 1.312 |
| Callionymidae | 58 | 80.0249 | 5.342 |
| Gempylidae | 12 | 34.0820 | 2.275 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Stromateidae | | | |
| Peprilus burti | 1 | 1.5052 | 0.100 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 1 | 1.6657 | 0.111 |
| Ariommidae | | | |
| Ariomma spp. | 1 | 1.7268 | 0.115 |
| Gobiidae | 1,292 | 1,282.4408 | 85.610 |
| Scorpaenidae | 115 | 71.5495 | 4.776 |
| Triglidae | 161 | 77.8408 | 5.198 |
| Bothidae | 14 | 7.0354 | 0.470 |
| Citharichthys cornutus | 15 | 39.0462 | 2.607 |
| Citharichthys macrops | 64 | 20.7756 | 1.387 |
| Citharichthys gymnorhinus | 33 | 75.3685 | 5.031 |
| Cyclopsetta fimbriata | 3 | 2.3349 | 0.156 |
| Etropus rimosus | 106 | 95.7710 | 6.393 |
| Syacium papillosum | 100 | 99.9294 | 6.671 |
| Bothus robinsi | 206 | 206.4729 | 13.783 |

Table 14. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Cynoglossidae | | | |
| Symphurus spp. | 7 | 5.2902 | 0.353 |
| Balistidae | 99 | 75.1763 | 5.018 |
| Tetraodontidae | 34 | 36.1695 | 2.414 |
| Gobiesocidae | 1 | 0.9907 | 0.066 |
| Lophiiformes | 39 | 54.6636 | 3.649 |
| Unidentified Larvae | 347 | 394.7997 | 26.355 |
| Total Larvae | 4,511 | 4,985.2922 | 332.797 |

NUMBER OF FAMILIES: 58

NUMBER OF SPECIES: 60

Table 15. Cruise IS 7303. Numbers of larvae, estimated total abundance in the area represented by the cruise (149.80 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 5 | 10.5376 | 0.703 |
| Clupeidae | | | |
| Brevoortia spp. | 12 | 1.4331 | 0.096 |
| Etrumeus teres | 293 | 327.2924 | 21.849 |
| Harengula jaguana | 1 | 0.0791 | 0.005 |
| Sardinella anchovia | 2 | 1.2428 | 0.083 |
| Engraulidae | 27 | 16.6853 | 1.114 |
| Argentinidae | 1 | 2.6698 | 0.178 |
| Bathylagidae | 2 | 3.9563 | 0.264 |
| Gonostomatidae | 70 | 140.6143 | 9.387 |
| Cyclothone spp. | 22 | 38.4568 | 2.567 |
| Diplophos spp. | 1 | 1.7259 | 0.115 |
| Gonostoma spp. | 1 | 1.7370 | 0.116 |
| Gonostoma elongatum | 37 | 102.3180 | 6.830 |
| Ichthyococcus ovatus | 1 | 1.2866 | 0.087 |
| Maurolicus muelleri | 4 | 5.7778 | 0.386 |
| Polymetme (?) Type I | 2 | 3.2047 | 0.214 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria spp. | 6 | 12.7097 | 0.848 |
| Vinciguerria nimbaria | 7 | 10.1858 | 0.680 |
| Vinciguerria poweriae | 6 | 13.3421 | 0.891 |
| Vinciguerria attenuata | 6 | 13.1515 | 0.875 |
| Sternoptychidae | 10 | 26.6977 | 1.782 |
| Argyropelecus spp. | 7 | 19.0642 | 1.273 |
| Sternoptyx spp. | 5 | 15.4604 | 1.032 |
| Stomiatidae | | | |
| Stomias spp. | 3 | 4.1755 | 0.279 |
| Chauliodontidae | | | |
| Chauliodus spp. | 7 | 10.8081 | 0.722 |
| Melanostomiatidae | 1 | 1.7371 | 0.116 |
| Synodontidae | 224 | 265.0115 | 17.691 |
| Saurida brasiliensis | 1 | 1.6544 | 0.110 |
| Aulopidae | | | |
| Aulopus nanae | 1 | 2.6698 | 0.178 |
| Scopelarchidae | 1 | 1.2641 | 0.084 |
| Evermannellidae | 1 | 1.7370 | 0.116 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Paralepididae | 4 | 6.4759 | 0.432 |
| Myctophidae | 16 | 33.9807 | 2.268 |
| Diaphus spp. | 199 | 352.2229 | 23.513 |
| Notolychnus valdiviae | 12 | 18.0490 | 1.205 |
| Lampanyctus spp. | 20 | 33.8514 | 2.260 |
| Lampanyctus ater | 1 | 1.2866 | 0.086 |
| Myctophum nitidulum | 20 | 32.1061 | 2.143 |
| Myctophum selenops | 3 | 4.0409 | 0.270 |
| Ceratoscopelus warmingi | 8 | 17.2175 | 1.149 |
| Hygophum spp. | 17 | 25.1520 | 1.679 |
| Hygophum reinhardti | 5 | 8.2441 | 0.550 |
| Centrobranchus nigroocellatus | 3 | 4.8070 | 0.321 |
| Lepidophanes spp. | 17 | 28.7814 | 1.921 |
| Notoscopelus caudispinosus | 19 | 34.5669 | 2.308 |
| Notoscopelus resplendens | 3 | 8.7525 | 0.584 |
| Benthosema suborbitale | 33 | 65.3635 | 4.363 |
| Diogenichthys atlanticus | 20 | 45.4054 | 3.031 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Anguilliformes | 6 | 8.7541 | 0.584 |
| Muraenidae | 1 | 1.2871 | 0.086 |
| Nettastomidae | 7 | 8.8557 | 0.591 |
| Hoplunnis diomedianus | 4 | 6.3829 | 0.426 |
| Congridae | 3 | 10.4271 | 0.696 |
| Gnathophis spp. | 1 | 4.4283 | 0.296 |
| Hildebrandia gracilior | 2 | 3.2047 | 0.214 |
| Ophichthidae | 2 | 1.7860 | 0.119 |
| Ophichthus spp. | 5 | 3.5436 | 0.237 |
| Myrophis punctatus | 4 | 1.6266 | 0.109 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 1 | 0.1019 | 0.007 |
| Gadidae | | | |
| Urophycis spp. | 13 | 9.7476 | 0.654 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 11 | 17.2316 | 1.150 |
| Bregmaceros Type A | 99 | 187.8694 | 12.541 |
| Bregmaceros Type B | 143 | 157.0504 | 10.484 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance $(x\ 10^9)$ | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bregmaceros macclellandi | 7 | 9.0060 | 0.601 |
| Macrorhamphosidae | | | |
| Macrorhamphosus scolopax | 1 | 1.5704 | 0.105 |
| Syngnathidae | | | |
| Hippocampus erectus | 3 | 2.4973 | 0.167 |
| Syngnathus spp. | 1 | 0.1721 | 0.012 |
| Syngnathus springeri | 8 | 3.2092 | 0.214 |
| Melamphaeidae | | | |
| Melamphaes spp. | 7 | 10.2860 | 0.687 |
| Mugilidae | | | |
| Mugil spp. | 49 | 124.6085 | 8.318 |
| Serranidae | 45 | 56.7855 | 3.791 |
| Diplectrum formosum | 78 | 55.3665 | 3.696 |
| Epinephelus spp. | 1 | 0.6214 | 0.042 |
| Serranus spp. | 110 | 98.8185 | 6.597 |
| Centropristis striata | 10 | 8.0170 | 0.535 |
| Hemanthias vivanus | 35 | 77.8383 | 5.196 |
| Pronotogrammus aureorubens | 7 | 14.6627 | 0.979 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Anthias spp. | 1 | 1.5586 | 0.104 |
| Anthias Type 1 | 4 | 8.6470 | 0.577 |
| Anthias Type 3 | 1 | 1.7371 | 0.116 |
| Priacanthidae | 1 | 1.6544 | 0.110 |
| Priacanthus spp. | 1 | 1.2641 | 0.084 |
| Apogonidae | 12 | 16.3601 | 1.092 |
| Branchiostegidae | 2 | 3.4629 | 0.231 |
| Caulolatilus spp. | 3 | 4.6994 | 0.314 |
| Caulolatilus cyanops | 1 | 1.7371 | 0.116 |
| Carangidae | | | |
| Caranx spp. | 1 | 1.0317 | 0.069 |
| Decapterus punctatus | 97 | 75.9254 | 5.069 |
| Seriola spp. | 1 | 2.6698 | 0.178 |
| Trachurus lathami | 51 | 64.8355 | 4.328 |
| Bramidae | 4 | 6.9805 | 0.466 |
| Lutjanidae | 2 | 2.5512 | 0.170 |
| Rhomboplites aurorubens | 1 | 1.5586 | 0.104 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Acanthuridae | | | |
| Acanthurus spp. | 1 | 1.7370 | 0.116 |
| Gerreidae | 6 | 6.0530 | 0.404 |
| Pomadasyidae | 18 | 17.7849 | 1.187 |
| Orthopristis chrysoptera | 75 | 12.6239 | 0.843 |
| Sciaenidae | 4 | 3.0162 | 0.201 |
| Leiostomus xanthurus | 23 | 9.7961 | 0.654 |
| Micropogon undulatus | 1 | 0.4312 | 0.029 |
| Sparidae | 121 | 121.1697 | 8.089 |
| Diplodus holbrooki | 13 | 1.3247 | 0.088 |
| Lagodon rhomboides | 113 | 63.0293 | 4.208 |
| Pagrus pagrus | 1 | 1.0317 | 0.069 |
| Archosargus probatocephalus | 1 | 0.1506 | 0.010 |
| Mullidae | 19 | 24.8787 | 1.661 |
| Kyphosidae | | | |
| Kyphosus spp. | 1 | 1.2641 | 0.084 |
| Chaetodontidae | 2 | 3.0241 | 0.202 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Labridae | 28 | 24.0745 | 1.607 |
| Scaridae | 18 | 23.1325 | 1.544 |
| Opistognathidae | 1 | 1.3008 | 0.087 |
| Blenniidae | 19 | 11.4093 | 0.762 |
| Clinidae | 1 | 1.0317 | 0.069 |
| Ophidiidae | 130 | 118.7107 | 7.925 |
| Carapidae | | | |
| Echiodon sp. | 9 | 12.1314 | 0.810 |
| Callionymidae | 22 | 33.8643 | 2.261 |
| Scombridae | | | |
| Auxis sp. | 1 | 1.9460 | 0.130 |
| Scomber japonicus | 2 | 3.3089 | 0.221 |
| Gemplyidae | 6 | 10.8632 | 0.725 |
| Nealotus tripes | 1 | 1.2641 | 0.084 |
| Trichiuridae | | | |
| Diplospinus multistriatus | 1 | 1.2641 | 0.084 |
| Stromateidae | | | |
| Peprilus burti | 2 | 2.0633 | 0.138 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Nomeidae | | | |
| Cubiceps pauciradiatus | 2 | 2.2500 | 0.150 |
| Psenes pellucidus | 1 | 1.2871 | 0.086 |
| Ariommidae | | | |
| Ariomma spp. | 17 | 35.7801 | 2.389 |
| Gobiidae | 603 | 527.5737 | 35.218 |
| Scorpaenidae | 5 | 6.8838 | 0.460 |
| Triglidae | 142 | 162.1076 | 10.822 |
| Pleuronectiformes | 1 | 0.2898 | 0.019 |
| Bothidae | 15 | 12.7978 | 0.854 |
| Citharichthys cornutus | 27 | 45.2853 | 3.023 |
| Citharichthys macrops | 38 | 21.3290 | 1.424 |
| Citharichthys gymnorhinus | 4 | 75.8631 | 5.064 |
| Cyclopsetta fimbriata | 1 | 1.2641 | 0.084 |
| Etropus rimosus | 336 | 168.5843 | 11.254 |
| Syacium papillosum | 72 | 49.6251 | 3.313 |
| Bothus robinsi | 79 | 80.5014 | 5.374 |
| Paralichthys spp. | 5 | 0.5006 | 0.033 |

Table 15. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Pleuronectidae | 1 | 1.5587 | 0.104 |
| Cynoglossidae | | | |
| *Symphurus* spp. | 13 | 10.2375 | 0.683 |
| Balistidae | 32 | 33.3588 | 2.227 |
| Tetraodontidae | 43 | 55.5839 | 3.711 |
| Lophiiformes | 5 | 7.6759 | 0.512 |
| Unidentified Larvae | 506 | 704.4244 | 47.024 |
| Total Larvae | 4,642 | 5,311.8627 | 354.597 |

NUMBER OF FAMILIES: 64

NUMBER OF SPECIES: 66

Table 16. Cruise IS 7308. Numbers of larvae, estimated total abundance in the area represented by the cruise ($151.42 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 7 | 16.0019 | 1.057 |
| Clupeidae | 50 | 13.8217 | 0.913 |
| *Brevoortia* spp. | 1 | 0.4890 | 0.032 |
| *Etrumeus teres* | 25 | 39.9253 | 2.637 |
| *Harengula jaguana* | 1,282 | 141.6722 | 9.356 |
| *Opisthonema oglinum* | 1,434 | 528.2082 | 34.884 |
| *Sardinella anchovia* | 797 | 424.0314 | 28.004 |
| Engraulidae | 205 | 92.4186 | 6.104 |
| Argentinidae | 1 | 3.6291 | 0.240 |
| *Argentina* spp. | 2 | 3.4694 | 0.229 |
| Bathylagidae | | | |
| *Bathylagus* spp. | 2 | 5.2188 | 0.345 |
| Gonostomatidae | 10 | 16.9682 | 1.121 |
| *Cyclothone* spp. | 39 | 110.4838 | 7.297 |
| *Gonostoma elongatum* | 9 | 18.4104 | 1.216 |
| *Maurolicus muelleri* | 98 | 199.7368 | 13.191 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria spp. | 1 | 3.6562 | 0.242 |
| Vinciguerria nimbaria | 5 | 15.8524 | 1.047 |
| Vinciguerria poweriae | 5 | 17.6052 | 1.163 |
| Vinciguerria attenuata | 4 | 7.9179 | 0.523 |
| Sternoptychidae | 2 | 3.4975 | 0.231 |
| Argyropelecus spp. | 8 | 13.9055 | 0.918 |
| Sternoptyx spp. | 5 | 12.4763 | 0.824 |
| Stomiatidae | | | |
| Stomias affinis | 1 | 4.4204 | 0.292 |
| Chauliodontidae | | | |
| Chauliodus spp. | 5 | 22.1022 | 1.460 |
| Melanostomiatidae | 3 | 6.8816 | 0.455 |
| Synodontidae | 153 | 190.9160 | 12.608 |
| Scopelarchidae | 1 | 1.7487 | 0.116 |
| Paralepididae | 12 | 29.2513 | 1.932 |
| Myctophidae | 28 | 72.9960 | 4.821 |
| Diaphus spp. | 147 | 402.0803 | 26.554 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Notolychnus valdiviae | 24 | 70.3659 | 4.647 |
| Lampadena luminosa | 2 | 8.8409 | 0.584 |
| Lampanyctus alatus | 2 | 6.1551 | 0.407 |
| Lampanyctus cuprarius | 3 | 5.2462 | 0.347 |
| Myctophum spp. | 1 | 1.7487 | 0.116 |
| Myctophum nitidulum | 81 | 225.5809 | 14.898 |
| Myctophum obtusirostris | 1 | 4.4204 | 0.292 |
| Myctophum selenops | 3 | 10.8873 | 0.719 |
| Ceratoscopelus warmingi | 13 | 45.7426 | 3.021 |
| Hygophum spp. | 24 | 45.2004 | 2.985 |
| Hygophum reinhardti | 10 | 30.3522 | 2.004 |
| Centrobranchus nigroocellatus | 2 | 3.4975 | 0.231 |
| Lepidophanes spp. | 8 | 21.9487 | 1.450 |
| Lobianchia gemellari | 3 | 10.5896 | 0.699 |
| Benthosema suborbitale | 17 | 44.3032 | 2.926 |
| Diogenichthys atlanticus | 18 | 61.4332 | 4.057 |
| Chlorophthalmidae | | | |
| Chlorophthalmus agassizi | 1 | 1.5038 | 0.099 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Anguilliformes | 2 | 2.3426 | 0.155 |
| Muraenidae | 3 | 3.3963 | 0.224 |
| Gymnothorax nigromarginatus | 1 | 0.9567 | 0.063 |
| Nettastomidae | | | |
| Hoplunnis diomedianus | 2 | 4.1264 | 0.272 |
| Congridae | | | |
| Ariosoma balearicum | 1 | 1.5038 | 0.099 |
| Hildebrandia gracilior | 2 | 4.1264 | 0.272 |
| Ophichthidae | 5 | 6.6922 | 0.442 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 2 | 0.2531 | 0.017 |
| Hemiramphus brasiliensis | 1 | 0.8970 | 0.059 |
| Exocoetidae | | | |
| Prognichthys gibbifrons | 3 | 3.7227 | 0.246 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 23 | 55.1883 | 3.644 |
| Bregmaceros Type A | 75 | 134.4331 | 8.878 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bregmaceros Type B | 130 | 288.9132 | 19.080 |
| Bregmaceros macclellandi | 4 | 10.5107 | 0.694 |
| Macrouridae | 1 | 1.5038 | 0.099 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.1989 | 0.013 |
| Syngnathus elucens | 6 | 2.4569 | 0.162 |
| Syngnathus springeri | 1 | 0.1983 | 0.013 |
| Syngnathus louisianae | 1 | 0.0972 | 0.006 |
| Syngnathus scovelli | 1 | 0.0542 | 0.004 |
| Melamphaeidae | | | |
| Melamphaes spp. | 2 | 6.1692 | 0.407 |
| Holocentridae | 3 | 3.0163 | 0.199 |
| Mugilidae | | | |
| Mugil spp. | 35 | 18.0064 | 1.189 |
| Sphyraenidae | | | |
| Sphyraena barracuda | 1 | 0.5279 | 0.035 |
| Serranidae | 60 | 65.8290 | 4.347 |
| Diplectrum formosum | 675 | 342.3026 | 22.606 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Epinephelus spp. | 22 | 18.2138 | 1.203 |
| Epinephelus morio | 4 | 6.3589 | 0.420 |
| Hemanthias spp. | 1 | 1.7487 | 0.116 |
| Hemanthias vivanus | 78 | 127.0088 | 8.388 |
| Pronotogrammus aureorubens | 5 | 7.5188 | 0.497 |
| Serraniculus pumilio | 15 | 6.0414 | 0.399 |
| Anthias spp. | 9 | 13.5339 | 0.894 |
| Anthias Type 1 | 21 | 48.4318 | 3.198 |
| Anthias Type 3 | 1 | 1.5038 | 0.099 |
| Rypticus spp. | 3 | 2.9186 | 0.193 |
| Pseudogramma gregoryi | 4 | 4.8521 | 0.320 |
| Priacanthidae | 2 | 2.4605 | 0.162 |
| Apongonidae | 234 | 188.9121 | 12.476 |
| Branchiostegidae | | | |
| Caulolatilus spp. | 2 | 5.2452 | 0.346 |
| Carangidae | | | |
| Caranx spp. | 2 | 3.2525 | 0.215 |
| Chloroscombrus chrysurus | 35 | 12.1222 | 0.801 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Decapterus punctatus | 539 | 295.4831 | 19.514 |
| Seriola spp. | 2 | 1.9330 | 0.128 |
| Coryphaenidae | | | |
| Coryphaena spp. | 1 | 1.5038 | 0.099 |
| Lutjanidae | 131 | 85.0568 | 5.617 |
| Pristipomoides aquilonaris | 1 | 4.4204 | 0.292 |
| Symphysanodon typus | 1 | 1.5038 | 0.099 |
| Gerreidae | 273 | 123.7238 | 8.171 |
| Pomadasyidae | 379 | 150.0492 | 9.910 |
| Orthopristis chrysoptera | 12 | 2.9439 | 0.194 |
| Sciaenidae | 3 | 1.3990 | 0.092 |
| Cynoscion nebulosus | 8 | 0.8796 | 0.058 |
| Leiostomus xanthurus | 81 | 8.9951 | 0.594 |
| Menticirrhus americanus | 2 | 0.1945 | 0.013 |
| Sparidae | 63 | 31.7423 | 2.096 |
| Archosargus probatocephalus | 39 | 6.2522 | 0.413 |
| Mullidae | 15 | 22.0709 | 1.458 |
| Mullus auratus | 1 | 1.2258 | 0.081 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Kyphosidae | | | |
| Kyphosus spp. | 6 | 6.4444 | 0.426 |
| Chaetodontidae | 1 | 3.6291 | 0.240 |
| Pomacentridae | 18 | 21.2776 | 1.405 |
| Labridae | 256 | 155.3116 | 7.615 |
| Scaridae | 8 | 7.9548 | 0.525 |
| Opistognathidae | 55 | 33.1039 | 2.186 |
| Blenniidae | 316 | 88.1738 | 5.823 |
| Clinidae | 37 | 28.1439 | 1.859 |
| Ophidiidae | 311 | 159.0815 | 10.506 |
| Carapidae | | | |
| Echiodon sp. | 8 | 17.0471 | 1.126 |
| Callionymidae | 22 | 16.2644 | 1.074 |
| Scombridae | 11 | 17.7838 | 1.174 |
| Auxis sp. | 14 | 19.8357 | 1.310 |
| Euthynnus alletteratus | 3 | 4.9159 | 0.325 |
| Katsuwonus pelamis | 1 | 4.4204 | 0.292 |
| Thunnus thynnus | 41 | 112.5053 | 7.430 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gempylidae | 1 | 3.6291 | 0.240 |
| Trichiuridae | | | |
| Diplospinus multistriatus | 3 | 9.6393 | 0.637 |
| Istiophoridae | | | |
| Istiophorus platypterus | 1 | 1.7487 | 0.116 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 27 | 96.1505 | 6.350 |
| Psenes cyanophrys | 6 | 12.3728 | 0.817 |
| Ariommidae | | | |
| Ariomma spp. | 6 | 9.2676 | 0.612 |
| Gobiidae | 2,539 | 1,590.6635 | 105.050 |
| Microdesmidae | | | |
| Microdesmus spp. | 21 | 10.1130 | 0.668 |
| Scorpaenidae | 140 | 161.9459 | 10.695 |
| Triglidae | 139 | 71.0596 | 4.693 |
| Peristedion spp. | 1 | 1.7347 | 0.115 |
| Dactylopteridae | | | |
| Dactylopterus volitans | 1 | 1.7347 | 0.115 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bothidae | 14 | 6.3631 | 0.420 |
| Citharichthys spp. | 2 | 8.8409 | 0.584 |
| Citharichthys cornutus | 27 | 78.8845 | 5.210 |
| Citharichthys macrops | 73 | 37.9344 | 2.505 |
| Citharichthys gymnorhinus | 15 | 23.1980 | 1.532 |
| Cyclopsetta fimbriata | 8 | 7.2305 | 0.478 |
| Etropus rimosus | 44 | 43.5782 | 2.878 |
| Syacium papillosum | 162 | 195.0288 | 12.880 |
| Monolene sessilicauda | 3 | 6.7226 | 0.444 |
| Bothus robinsi | 204 | 265.3865 | 17.527 |
| Soleidae | | | |
| Achirus spp. | 1 | 0.0258 | 0.002 |
| Achirus lineatus | 1 | 0.0258 | 0.002 |
| Cynoglossidae | | | |
| Symphurus spp. | 22 | 14.6307 | 0.966 |
| Balistidae | 401 | 319.4250 | 21.0953 |
| Tetraodontidae | 115 | 99.7187 | 6.586 |

Table 16. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lophiiformes | 6 | 7.5322 | 0.497 |
| Unidentified Larvae | 978 | 548.5188 | 36.225 |
| Total Larvae | 13,652 | 9,493.5334 | 626.967 |

NUMBER OF FAMILIES: 67

NUMBER OF SPECIES: 78

Table 17. Cruise IS 7311. Numbers of larvae, estimated total abundance in the area represented by the cruise (156.50 z $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Elopidae | | | |
| Megalops atlantica | 1 | 2.8719 | 0.184 |
| Clupeidae | 65 | 22.5689 | 1.442 |
| Harengula jaguana | 61 | 9.7261 | 0.622 |
| Opisthonema oglinum | 3,679 | 1,078.6853 | 68.926 |
| Sardinella anchovia | 413 | 320.0663 | 20.452 |
| Engraulidae | 204 | 227.2337 | 14.520 |
| Argentinidae | 1 | 1.6868 | 0.108 |
| Argentina spp. | 1 | 1.5637 | 0.100 |
| Nansenia spp. | 1 | 1.5637 | 0.100 |
| Bathylagidae | | | |
| Bathylagus spp. | 1 | 1.8913 | 0.121 |
| Gonostomatidae | 136 | 246.6270 | 15.759 |
| Cyclothone spp. | 31 | 60.4377 | 3.862 |
| Gonostoma elongatum | 9 | 15.9539 | 1.019 |
| Maurolicus muelleri | 296 | 572.1120 | 36.557 |
| Valenciennellus tripunctulatus | 1 | 1.7537 | 0.112 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Bonapartia pedaliota | 1 | 1.8913 | 0.121 |
| Polymetme (?) Type I | 1 | 1.7892 | 0.114 |
| Vinciguerria spp. | 4 | 5.0876 | 0.325 |
| Vinciguerria nimbaria | 21 | 65.4505 | 4.182 |
| Vinciguerria poweriae | 18 | 23.6210 | 1.509 |
| Vinciguerria attenuata | 3 | 3.8106 | 0.203 |
| Sternoptychidae | | | |
| Argygropelecus spp. | 9 | 34.9608 | 2.234 |
| Sternoptyx spp. | 3 | 4.8053 | 0.307 |
| Chauliodontidae | | | |
| Chauliodus spp. | 2 | 12.9847 | 0.830 |
| Synodontidae | 163 | 232.8934 | 14.881 |
| Paralepididae | 66 | 157.1190 | 10.040 |
| Myctophidae | 15 | 31.0731 | 1.986 |
| Diaphus spp. | 587 | 1,154.2700 | 73.755 |
| Diaphus dumerili | 1 | 1.7537 | 0.112 |
| Notolychnus valdiviae | 37 | 95.8191 | 6.123 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lampadena luminosa | 6 | 10.6753 | 0.682 |
| Lampanyctus alatus | 15 | 31.0731 | 1.986 |
| Lampanyctus cuprarius | 3 | 5.3675 | 0.343 |
| Myctophum nitidulum | 73 | 198.6675 | 12.699 |
| Myctophum selenops | 4 | 7.9991 | 0.511 |
| Ceratoscopelus warmingi | 6 | 10.9393 | 0.699 |
| Hygophum spp. | 15 | 28.4294 | 1.817 |
| Hygophum reinhardti | 6 | 10.9946 | 0.703 |
| Centrobranchus nigroocellatus | 7 | 12.9906 | 0.830 |
| Lepidophanes spp. | 7 | 17.2586 | 1.103 |
| Notoscopelus resplendens | 3 | 5.2966 | 0.338 |
| Lobianchia gemellari | 3 | 5.3320 | 0.341 |
| Benthosema suborbitale | 15 | 28.1169 | 1.797 |
| Diogenichthys atlanticus | 17 | 28.8923 | 1.846 |
| Giganturidae | | | |
| Gigantura vorax | 1 | 1.7537 | 0.112 |
| Anguilliformes | 4 | 8.5358 | 0.545 |
| Muraenidae | 5 | 3.6914 | 0.236 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Nettastomidae | 2 | 2.0532 | 0.131 |
| Hoplunnis tenuis | 1 | 2.8719 | 0.184 |
| Congridae | | | |
| Ariosoma balearicum | 7 | 14.1288 | 0.903 |
| Hildebrandia flava | 1 | 1.3503 | 0.086 |
| Hildebrandia gracilior | 3 | 5.0865 | 0.325 |
| Ophichthidae | 5 | 10.6168 | 0.678 |
| Ophichthus spp. | 2 | 3.8006 | 0.243 |
| Hemiramphidae | | | |
| Hemiramphus brasiliensis | 1 | 0.0970 | 0.006 |
| Exocoetidae | 1 | 0.3032 | 0.019 |
| Parexocoetus brachypterus | 3 | 1.7443 | 0.112 |
| Prognichthys gibbifrons | 6 | 18.3739 | 1.174 |
| Bregmaceros atlanticus | 17 | 34.0716 | 2.177 |
| Bregmaceros Type A | 14 | 29.5519 | 1.888 |
| Bregmaceros Type B | 68 | 96.8858 | 6.191 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.3758 | 0.024 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Syngnathus spp. | 2 | 0.5721 | 0.037 |
| Syngnathus elucens | 3 | 1.2070 | 0.077 |
| Melamphaeidae | | | |
| Melamphaes spp. | 4 | 6.4569 | 0.412 |
| Sphyraenidae | | | |
| Sphyraena borealis | 1 | 1.1055 | 0.071 |
| Serranidae | 91 | 56.5205 | 3.612 |
| Diplectrum formosum | 93 | 37.5988 | 2.403 |
| Epinephelus spp. | 4 | 3.6005 | 0.230 |
| Hemanthias vivanus | 2 | 2.7005 | 0.173 |
| Serraniculus pumilio | 26 | 12.2829 | 0.785 |
| Liopropoma spp. | 3 | 4.4366 | 0.284 |
| Anthias Type 1 | 1 | 1.7892 | 0.114 |
| Rypticus spp. | 13 | 8.6750 | 0.554 |
| Pseudogramma gregoryi | 9 | 11.8758 | 0.759 |
| Priacanthidae | 10 | 14.7611 | 0.943 |
| Apogonidae | 147 | 135.9477 | 8.687 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Carangidae | | | |
| Caranx spp. | 15 | 45.1948 | 2.888 |
| Chloroscombrus chrysurus | 69 | 13.5971 | 0.869 |
| Decapterus punctatus | 176 | 112.9175 | 7.215 |
| Oligoplites saurus | 3 | 0.5633 | 0.036 |
| Selene vomer | 1 | 1.3502 | 0.086 |
| Seriola spp. | 3 | 1.0959 | 0.070 |
| Vomer setapinnis | 1 | 2.1725 | 0.139 |
| Coryphaenidae | | | |
| Coryphaena spp. | 1 | 2.8719 | 0.184 |
| Lutjanidae | 249 | 168.4508 | 10.764 |
| Rhomboplites aurorubens | 4 | 2.5571 | 0.163 |
| Gerreidae | 115 | 40.3848 | 2.581 |
| Pomadasyidae | 104 | 29.8323 | 1.906 |
| Sciaenidae | 2 | 0.0694 | 0.004 |
| Bairdiella chrysura | 3 | 0.2286 | 0.015 |
| Sparidae | 1 | 0.5610 | 0.036 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Kyphosidae | | | |
| Kyphosus spp. | 1 | 0.2689 | 0.017 |
| Chaetodontidae | 6 | 8.1508 | 0.521 |
| Pomacentridae | 16 | 15.9699 | 1.020 |
| Labridae | 205 | 190.4320 | 12.168 |
| Scaridae | 13 | 17.1761 | 1.098 |
| Opistognathidae | 3 | 2.2635 | 0.145 |
| Blenniidae | 10 | 4.4053 | 0.282 |
| Clinidae | 3 | 2.8644 | 0.183 |
| Ophidiidae | 189 | 221.1037 | 14.128 |
| Carapidae | | | |
| Carapus bermudensis | 2 | 1.8351 | 0.117 |
| Echiodon sp. | 24 | 41.5963 | 2.658 |
| Callionymidae | 251 | 79.6953 | 5.092 |
| Scombridae | 4 | 8.0736 | 0.516 |
| Auxis sp. | 7 | 15.0218 | 0.960 |
| Euthynnus alletteratus | 43 | 67.6493 | 4.323 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Thunnus atlanticus | 6 | 9.9783 | 0.638 |
| Scomberomorus spp. | 1 | 0.2398 | 0.015 |
| Scomberomorus cavalla | 3 | 2.9848 | 0.191 |
| Scomberomorus maculatus | 71 | 18.7273 | 1.197 |
| Gempylidae | 5 | 10.0952 | 0.645 |
| Stromateidae | | | |
| Peprilus burti | 1 | 1.3503 | 0.086 |
| Nomeidae | 3 | 1.2775 | 0.082 |
| Cubiceps pauciradiatus | 4 | 7.4632 | 0.477 |
| Ariommidae | | | |
| Ariomma spp. | 6 | 11.9082 | 0.761 |
| Gobiidae | 1,291 | 1,365.7200 | 87.266 |
| Scorpaenidae | 116 | 124.3386 | 7.945 |
| Triglidae | 62 | 27.6471 | 1.767 |
| Bothidae | 1 | 0.5366 | 0.034 |
| Citharichthys cornutus | 17 | 26.4746 | 1.692 |
| Citharichthys macrops | 20 | 14.5840 | 0.932 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Citharichthys gymnorhinus | 10 | 16.4881 | 1.0536 |
| Cyclopsetta fimbriata | 12 | 10.6584 | 0.681 |
| Etropus rimosus | 2 | 3.0235 | 0.193 |
| Syacium papillosum | 172 | 194.6120 | 12.435 |
| Engyophrys senta | 1 | 1.3503 | 0.086 |
| Bothus robinsi | 87 | 118.8408 | 7.594 |
| Soleidae | | | |
| Achirus lineatus | 2 | 0.1317 | 0.008 |
| Cynoglossidae | | | |
| Symphurus spp. | 29 | 10.5879 | 0.677 |
| Balistidae | 136 | 109.1826 | 6.977 |
| Tetraodontidae | 31 | 31.7577 | 2.029 |
| Lophiiformes | 40 | 43.7893 | 2.798 |
| Unidentified Larvae | 667 | 918.0455 | 58.661 |
| Total Larvae | 10,881 | 9,481.9121 | 605.873 |

Table 17. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|

NUMBER OF FAMILIES: 57

NUMBER OF SPECIES: 70

Table 18. Cruise IS 7313. Numbers of larvae, estimated total abundance in the area represented by the cruise ($153.18 \times 10^9 m^2$), and estimated mean number under $10 m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under $10 m^2$ |
|---|---|---|---|
| Clupeidae | 103 | 30.5528 | 1.995 |
| Harengula jaguana | 580 | 166.8235 | 10.891 |
| Opisthonema oglinum | 527 | 94.8178 | 6.190 |
| Sardinella anchovia | 1,140 | 469.8157 | 30.671 |
| Engraulidae | 322 | 573.0606 | 37.411 |
| Argentinidae | | | |
| Argentina spp. | 5 | 10.9566 | 0.715 |
| Bathylagidae | | | |
| Bathylagus spp. | 1 | 1.8442 | 0.120 |
| Gonostomatidae | 2 | 8.6781 | 0.566 |
| Cyclothone spp. | 9 | 19.5612 | 1.277 |
| Gonostoma atlanticum | 2 | 8.7877 | 0.574 |
| Gonostoma elongatum | 7 | 33.9370 | 2.216 |
| Maurolicus muelleri | 340 | 837.4638 | 54.672 |
| Vinciguerria spp. | 2 | 4.4538 | 0.291 |
| Vinciguerria nimbaria | 13 | 29.9330 | 1.954 |
| Vinciguerria poweriae | 6 | 18.2731 | 0.083 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Vinciguerria attenuata | 2 | 4.0258 | 0.263 |
| Sternoptychidae | 1 | 2.0917 | 0.137 |
| Argyropelecus spp. | 9 | 55.6600 | 3.634 |
| Sternoptyx spp. | 2 | 13.3921 | 0.874 |
| Synodontidae | 146 | 169.7471 | 11.082 |
| Saurida brasiliensis | 1 | 1.3043 | 0.085 |
| Synodus foetens | 1 | 0.0916 | 0.006 |
| Scopelarchidae | 4 | 9.1124 | 0.595 |
| Paralepididae | 25 | 69.1924 | 4.517 |
| Myctophidae | 4 | 8.8281 | 0.576 |
| Diaphus spp. | 201 | 486.0554 | 31.731 |
| Notolychnus valdiviae | 13 | 47.2945 | 3.088 |
| Lampadena luminosa | 2 | 3.7748 | 0.2464 |
| Lampanyctus alatus | 4 | 8.7888 | 0.5738 |
| Myctophum nitidulum | 19 | 45.3400 | 2.960 |
| Myctophum selenops | 1 | 3.4327 | 0.224 |
| Ceratoscopelus warmingi | 3 | 5.4314 | 0.355 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Hygophum spp. | 2 | 5.6397 | 0.368 |
| Hygophum reinhardti | 2 | 4.7376 | 0.309 |
| Hygophum benoiti | 1 | 6.6960 | 0.437 |
| Centrobranchus nigroocellatus | 1 | 2.2070 | 0.144 |
| Lepidophanes spp. | 2 | 3.8901 | 0.254 |
| Lobianchia gemellari | 1 | 2.5306 | 0.165 |
| Benthosema suborbitale | 19 | 58.3663 | 3.810 |
| Diogenichthys atlanticus | 6 | 23.0755 | 1.506 |
| Anguilliformes | 19 | 17.5050 | 1.143 |
| Muraenidae | 6 | 6.7942 | 0.444 |
| Gymnothorax nigromarginatus | 3 | 2.7357 | 0.179 |
| Nettastomidae | 2 | 4.0512 | 0.264 |
| Hoplunnis diomedianus | 2 | 2.6540 | 0.173 |
| Congridae | 4 | 4.9767 | 0.325 |
| Ariosoma balearicum | 1 | 6.6960 | 0.437 |
| Paraconger caudilimbatus | 1 | 2.2070 | 0.144 |
| Gnathophis spp. | 1 | 2.2070 | 0.144 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Hildebrandia flava | 2 | 13.3921 | 0.874 |
| Hildebrandia gracilior | 2 | 3.7483 | 0.245 |
| Nystactichthys spp. | 5 | 4.2758 | 0.279 |
| Ophichthidae | 12 | 12.2815 | 0.802 |
| Ophichthus spp. | 3 | 4.1106 | 0.268 |
| Dysommidae | 1 | 1.8442 | 0.120 |
| Belonidae | 1 | 0.1607 | 0.010 |
| Hemiramphidae | | | |
| Hyporhampus unifasciatus | 8 | 1.4192 | 0.093 |
| Hemiramphus balao | 1 | 0.1607 | 0.010 |
| Exocoetidae | 1 | 0.1377 | 0.009 |
| Parexocoetus brachypterus | 2 | 0.9841 | 0.064 |
| Prognichthys gibbifrons | 1 | 6.6960 | 0.437 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 15 | 43.9432 | 2.869 |
| Bregamaceros Type A | 1 | 1.3043 | 0.085 |
| Bregmaceros Type B | 205 | 338.9609 | 22.128 |
| Macrouridae | 1 | 1.8442 | 0.120 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Syngnathidae | | | |
| Syngnathus elucens | 3 | 1.4455 | 0.094 |
| Syngnathus scovelli | 2 | 0.3214 | 0.021 |
| Holocentridae | 4 | 4.7737 | 0.312 |
| Mugilidae | | | |
| Mugil spp. | 1 | 1.0275 | 0.067 |
| Serranidae | 60 | 19.2910 | 1.259 |
| Diplectrum formosum | 78 | 47.1286 | 3.077 |
| Epinephelus spp. | 1 | 0.6542 | 0.043 |
| Serranus spp. | 13 | 17.4625 | 1.140 |
| Serraniculus pumilio | 49 | 20.4359 | 1.334 |
| Liopropoma spp. | 5 | 13.7707 | 0.899 |
| Rypticus spp. | 34 | 26.2048 | 1.711 |
| Priacanthidae | 25 | 26.3347 | 1.719 |
| Pseudopriacanthus altus | 3 | 3.3510 | 0.219 |
| Apogonidae | 270 | 214.0514 | 13.974 |
| Branchiostegidae | | | |
| Caulolatilus spp. | 1 | 1.4363 | 0.094 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Carangidae | | | |
| Caranx spp. | 21 | 39.7296 | 2.594 |
| Chloroscombrus chrysurus | 196 | 52.3534 | 3.418 |
| Decapterus punctatus | 254 | 140.5420 | 9.175 |
| Oligoplites saurus | 6 | 1.6092 | 0.105 |
| Selene vomer | 1 | 2.0917 | 0.137 |
| Seriola spp. | 1 | 1.2177 | 0.080 |
| Trachinotus spp. | 1 | 0.3116 | 0.020 |
| Lutjanidae | 343 | 252.4043 | 16.478 |
| Pristipomoides aquilonaris | 2 | 2.8727 | 0.188 |
| Rhomboplites aurorubens | 1 | 1.3043 | 0.085 |
| Gerreidae | 157 | 65.9685 | 4.307 |
| Pomadasyidae | 138 | 51.0713 | 3.334 |
| Sciaenidae | 4 | 0.7338 | 0.048 |
| Cynoscion arenarius | 4 | 0.8295 | 0.054 |
| Menticirrhus saxatilis | 6 | 0.5496 | 0.036 |
| Sparidae | 1 | 0.7274 | 0.048 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Mullidae | 2 | 2.9332 | 0.192 |
| Chaetodontidae | 2 | 3.0205 | 0.197 |
| Pomacentridae | 11 | 7.7385 | 0.505 |
| Labridae | 231 | 210.3111 | 13.730 |
| Scaridae | 49 | 57.9209 | 3.781 |
| Blenniidae | 29 | 7.9104 | 0.516 |
| Clinidae | 17 | 13.7409 | 0.897 |
| Ophidiidae | 89 | 89.1370 | 5.819 |
| Carapidae | 1 | 1.8306 | 0.120 |
| Echiodon sp. | 15 | 24.0885 | 1.573 |
| Callionymidae | 250 | 87.3465 | 5.702 |
| Scombridae | 8 | 11.4828 | 0.750 |
| Auxis sp. | 30 | 61.8761 | 4.235 |
| Euthynnus alletteratus | 58 | 100.2041 | 6.542 |
| Thunnus atlanticus | 20 | 40.0223 | 2.613 |
| Scomberomorus maculatus | 9 | 2.1400 | 0.140 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gempylidae | 3 | 5.4740 | 0.357 |
| Stromateidae | | | |
| Peprilus paru | 13 | 3.3029 | 0.216 |
| Nomeidae | | | |
| Cubiceps pauciradiatus | 1 | 2.2070 | 0.144 |
| Psenes spp. | 3 | 6.6211 | 0.432 |
| Ariommidae | | | |
| Ariomma spp. | 3 | 6.7140 | 0.438 |
| Gobiidae | 1,889 | 1,846.2472 | 120.528 |
| Scorpaenidae | 116 | 138.0947 | 9.015 |
| Triglidae | 89 | 35.6825 | 2.330 |
| Bothidae | 7 | 7.0529 | 0.460 |
| Citharichthys cornutus | 10 | 15.9958 | 1.044 |
| Citharichthys macrops | 15 | 6.3624 | 0.415 |
| Citharichthys gymnorhinus | 14 | 24.9288 | 1.627 |
| Cyclopsetta fimbriata | 8 | 8.1309 | 0.531 |
| Etropus rimosus | 2 | 3.0483 | 0.199 |
| Syacium papillosum | 310 | 373.0274 | 24.352 |

Table 18. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Engyophrys senta | 2 | 3.0051 | 0.196 |
| Bothus robinsi | 156 | 204.3003 | 13.337 |
| Soleidae | | | |
| Achirus lineatus | 3 | 0.7580 | 0.050 |
| Cynoglossidae | | | |
| Symphurus spp. | 42 | 15.1243 | 0.987 |
| Balistidae | 111 | 70.6745 | 4.614 |
| Tetraodontidae | 25 | 33.1790 | 2.166 |
| Lophiiformes | 40 | 57.4405 | 3.750 |
| Unidentified Larvae | 1,220 | 1,294.1816 | 84.488 |
| Total Larvae | 10,419 | 9,370.0147 | 635.201 |

NUMBER OF FAMILIES: 57

NUMBER OF SPECIES: 65

Table 19. Cruise IS 7320. Numbers of larvae, estimated total abundance in the area represented by the cruises ($153.89 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeiformes | 4 | 9.0687 | 0.589 |
| Clupeidae | 1 | 0.8235 | 0.054 |
| Brevoortia spp. | 4 | 0.8823 | 0.057 |
| Etrumeus teres | 21 | 26.0960 | 1.696 |
| Sardinella anchovia | 23 | 7.5236 | 0.489 |
| Engraulidae | 11 | 7.0351 | 0.457 |
| Gonostomatidae | 10 | 17.4012 | 1.131 |
| Cyclothone spp. | 19 | 40.9057 | 2.658 |
| Gonostoma elongatum | 25 | 52.1262 | 3.387 |
| Maurolicus muelleri | 22 | 41.4453 | 2.693 |
| Vinciguerria spp. | 2 | 4.4031 | 0.286 |
| Vinciguerria nimbaria | 8 | 18.9065 | 1.229 |
| Vinciguerria poweriae | 12 | 25.7835 | 1.675 |
| Vinciguerria attenuata | 1 | 1.9601 | 0.127 |
| Sternoptychidae | | | |
| Argyropelecus spp. | 5 | 13.0181 | 0.846 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sternoptyx | 5 | 12.4016 | 0.806 |
| Stomiatidae | | | |
| Stomias spp. | 1 | 1.7916 | 0.116 |
| Melanostomiatidae | 13 | 22.1701 | 1.441 |
| Synodontidae | 219 | 323.5051 | 21.022 |
| Scopelarchidae | 12 | 30.3574 | 1.973 |
| Paralepididae | 9 | 17.1591 | 1.115 |
| Myctophidae | 11 | 24.0840 | 1.565 |
| Diaphus spp. | 45 | 83.0560 | 5.397 |
| Notolychnus valdiviae | 37 | 69.7904 | 4.535 |
| Lampanyctus spp. | 2 | 3.6581 | 0.238 |
| Lampanyctus alatus | 5 | 10.5822 | 0.688 |
| Myctophum nitidulum | 5 | 12.4625 | 0.810 |
| Myctophum obtusirostris | 1 | 1.9528 | 0.127 |
| Ceratoscopelus warmingi | 12 | 27.2393 | 1.770 |
| Hygophum spp. | 22 | 46.9978 | 3.054 |
| Hygophum reinhardti | 3 | 5.2887 | 0.344 |
| Centrobranchus nigroocellatus | 3 | 4.2882 | 0.279 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Lepidophanes spp. | 15 | 27.5704 | 1.792 |
| Lobianchia gemellari | 1 | 1.2578 | 0.082 |
| Benthosema suborbitale | 18 | 36.1398 | 2.348 |
| Diogenichthys atlanticus | 23 | 58.4322 | 3.797 |
| Anguilliformes | 9 | 12.6258 | 0.820 |
| Muraenidae | 2 | 1.7299 | 0.112 |
| Gymnothorax nigromarginatus | 4 | 3.6730 | 0.239 |
| Nettastomidae | 3 | 4.7303 | 0.307 |
| Hoplunnis tenuis | 1 | 1.2578 | 0.082 |
| Congridae | 1 | 1.2483 | 0.081 |
| Ariosoma balearicum | 2 | 2.5156 | 0.164 |
| Uroconger syringinus | 3 | 5.1192 | 0.333 |
| Hildebrandia spp. | 3 | 5.8584 | 0.381 |
| Hildebrandia flava | 7 | 18.2254 | 1.184 |
| Hildebrandia gracilior | 2 | 3.8614 | 0.251 |
| Ophichthidae | 12 | 16.8437 | 1.094 |
| Ophichthus spp. | 3 | 2.2214 | 0.144 |
| Myrophis punctatus | 8 | 11.8662 | 0.771 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Belonidae | 1 | 0.4936 | 0.032 |
| Hemiramphidae | | | |
| Hyporhamphus unifasciatus | 10 | 3.2378 | 0.210 |
| Exocoetidae | | | |
| Parexocoetus brachypterus | 2 | 3.7290 | 0.242 |
| Gadidae | | | |
| Urophycis spp. | 6 | 8.6887 | 0.565 |
| Bregmacerotidae | | | |
| Bregmaceros atlanticus | 5 | 10.2577 | 0.667 |
| Bregmaceros Type A | 4 | 6.5347 | 0.425 |
| Bregmaceros Type B | 451 | 651.2226 | 42.317 |
| Bregmaceros macclellandi | 2 | 2.5156 | 0.164 |
| Syngnathidae | | | |
| Hippocampus erectus | 10 | 3.5076 | 0.228 |
| Syngnathus spp. | 1 | 0.2858 | 0.019 |
| Syngnathus elucens | 3 | 0.8540 | 0.056 |
| Syngnathus springeri | 5 | 1.6693 | 0.109 |
| Syngnathus scovelli | 9 | 1.2079 | 0.079 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Melamphaeidae | | | |
| Melamphaes spp. | 1 | 1.2578 | 0.082 |
| Holocentridae | 1 | 1.2578 | 0.082 |
| Caproidae | | | |
| Antigonia spp. | 1 | 1.2578 | 0.082 |
| Mugilidae | | | |
| Mugil spp. | 8 | 13.6304 | 0.886 |
| Atherinidae | | | |
| Menidia berrylina | 1 | 0.5332 | 0.035 |
| Serranidae | 21 | 28.6705 | 1.863 |
| Diplectrum formosum | 37 | 25.0986 | 1.631 |
| Serranus spp. | 2 | 5.9365 | 0.386 |
| Centropristis striata | 7 | 1.1634 | 0.076 |
| Hemanthias vivanus | 1 | 2.6036 | 0.169 |
| Serraniculus pumilio | 3 | 1.1781 | 0.077 |
| Plectranthias garrupellus | 2 | 2.9215 | 0.190 |
| Anthias Type 1 | 1 | 1.7916 | 0.116 |
| Rypticus spp. | 1 | 1.8164 | 0.118 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Priacanthidae | 8 | 13.8249 | 0.898 |
| Apongonidae | 62 | 42.6579 | 2.772 |
| Branchiostegidae | 3 | 3.7734 | 0.245 |
| Carangidae | | | |
| Caranx spp. | 1 | 1.7916 | 0.116 |
| Decapterus punctatus | 226 | 218.8237 | 14.220 |
| Trachurus lathami | 3 | 4.3320 | 0.282 |
| Coryphaenidae | | | |
| Coryphaena spp. | 1 | 2.6036 | 0.169 |
| Coryphaena hippurus | 3 | 5.1162 | 0.332 |
| Lutjanidae | 34 | 42.0018 | 2.729 |
| Pristipomoides aquilonaris | 4 | 6.7572 | 0.439 |
| Rhomboplites aurorubens | 1 | 1.2483 | 0.081 |
| Symphysanodon typus | 1 | 1.6656 | 0.108 |
| Acanthuridae | | | |
| Acanthurus spp. | 1 | 1.7916 | 0.116 |
| Gerreidae | 20 | 10.9443 | 0.711 |
| Pomadasyidae | 54 | 16.9884 | 1.104 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sciaenidae | 1 | 1.2370 | 0.080 |
| Cynoscion nebulosus | 1 | 0.1617 | 0.011 |
| Leiostomus xanthurus | 5 | 1.1029 | 0.072 |
| Micropogon undulatus | 9 | 1.9286 | 0.125 |
| Sparidae | 16 | 13.9473 | 0.906 |
| Mullidae | 9 | 15.0992 | 0.981 |
| Kyphosidae | | | |
| Kyphosus spp. | 3 | 4.3012 | 0.280 |
| Ephippidae | 1 | 1.8645 | 0.121 |
| Chaetodontidae | 2 | 3.1223 | 0.203 |
| Pomacentridae | 55 | 63.7748 | 4.144 |
| Labridae | 29 | 44.1902 | 2.872 |
| Scaridae | 95 | 140.6166 | 9.138 |
| Opistognathidae | 1 | 1.8645 | 0.121 |
| Blenniidae | 38 | 9.8276 | 0.639 |
| Clinidae | 57 | 56.0024 | 3.639 |
| Ophidiidae | 276 | 220.8190 | 14.349 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Carapidae | 2 | 3.3312 | 0.216 |
| Carapus bermudensis | 1 | 1.7916 | 0.116 |
| Echiodon sp. | 68 | 110.2504 | 7.164 |
| Callionymidae | 102 | 66.1848 | 4.301 |
| Scombridae | | | |
| Scomberomorus cavalla | 2 | 2.4238 | 0.158 |
| Gempylidae | 5 | 13.0181 | 0.846 |
| Gempylus serpens | 1 | 4.1449 | 0.269 |
| Nesiarchus nasutus | 1 | 4.1449 | 0.269 |
| Trichiuridae | | | |
| Diplospinus multistriatus | 3 | 6.6604 | 0.433 |
| Stromateidae | | | |
| Peprilus paru | 1 | 1.2756 | 0.083 |
| Peprilus burti | 2 | 1.8228 | 0.118 |
| Nomeidae | | | |
| Psenes spp. | 1 | 1.2756 | 0.083 |
| Psenes pellucidus | 1 | 1.7916 | 0.116 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Gobiidae | 919 | 1,034.7551 | 67.240 |
| Scorpaenidae | 165 | 227.4475 | 14.780 |
| Triglidae | 244 | 168.9612 | 10.979 |
| Pleuronectiformes | 4 | 4.0322 | 0.262 |
| Bothidae | | | |
| Citharichthys cornutus | 19 | 31.1891 | 2.027 |
| Citharichthys macrops | 33 | 13.8340 | 0.808 |
| Citharichthys gymnorhinus | 17 | 28.8006 | 1.872 |
| Cyclopsetta fimbriata | 7 | 8.3609 | 0.543 |
| Etropus rimosus | 76 | 47.2841 | 3.073 |
| Syacium papillosum | 229 | 272.6172 | 17.715 |
| Bothus robinsi | 196 | 256.8458 | 16.690 |
| Paralichthys spp. | 2 | 0.1314 | 0.008 |
| Soleidae | | | |
| Gymnachirus melas | 1 | 0.5332 | 0.035 |
| Cynoglossidae | | | |
| Symphurus spp. | 7 | 3.8404 | 0.250 |

Table 19. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Balistidae | 75 | 56.5013 | 3.672 |
| Tetraodontidae | 43 | 52.0149 | 3.380 |
| Lophiiformes | 44 | 57.2209 | 3.718 |
| Unidentified Larvae | 422 | 571.1095 | 37.112 |
| Total Larvae | 4,999 | 5,970.0656 | 387.944 |

NUMBER OF FAMILIES: 64

NUMBER OF SPECIES: 67

Table 20. Cruise CL 7405. Numbers of larvae, estimated total abundance in the area represented by the cruises (52.00 x $10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeidae | 24 | 0.8259 | 0.159 |
| Brevoortia spp. | 71 | 4.6812 | 0.900 |
| Harengula jaguana | 25 | 2.0233 | 0.389 |
| Opisthonema oglinum | 32 | 1.6192 | 0.311 |
| Engraulidae | 211 | 18.7803 | 3.612 |
| Synodontidae | 5 | 0.9856 | 0.190 |
| Syngnathidae | | | |
| Hippocampus erectus | 5 | 0.3092 | 0.060 |
| Syngnathus spp. | 3 | 0.0671 | 0.013 |
| Syngnathus elucens | 1 | 0.2514 | 0.048 |
| Syngnathus springeri | 1 | 0.2908 | 0.056 |
| Syngnathus louisianae | 4 | 0.1726 | 0.034 |
| Syngnathus scovelli | 6 | 0.1936 | 0.037 |
| Atherinidae | | | |
| Menidia berrylina | 1 | 0.1237 | 0.024 |
| Sphyraenidae | | | |
| Sphyraena borealis | 1 | 0.3045 | 0.059 |

Table 20. Continued.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Serranidae | 8 | 1.8925 | 0.364 |
| Diplectrum formosum | 89 | 23.1829 | 4.458 |
| Centropristis striata | 58 | 6.8604 | 1.319 |
| Apogonidae | 6 | 1.4721 | 0.283 |
| Gerreidae | 11 | 1.7978 | 0.346 |
| Pomadasyidae | 16 | 4.3443 | 0.834 |
| Orthopristis chrysoptera | 331 | 31.8656 | 6.128 |
| Sciaenidae | 6 | 0.8178 | 0.157 |
| Cynoscion arenarius | 15 | 1.1974 | 0.230 |
| Cynoscion nebulosus | 1 | 0.0480 | 0.009 |
| Leiostomus xanthurus | 5 | 0.2782 | 0.054 |
| Menticirrhus saxatilis | 6 | 0.6639 | 0.128 |
| Pogonias cromis | 2 | 0.0959 | 0.018 |
| Sparidae | 60 | 8.0914 | 1.560 |
| Diplodus holbrooki | 98 | 11.9585 | 2.300 |
| Lagodon rhomboides | 38 | 6.9013 | 1.327 |
| Archosargus probatocephalus | 9 | 1.2563 | 0.242 |

Table 20. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Labridae | 33 | 7.7973 | 1.500 |
| Opistognathidae | 13 | 2.7439 | 0.335 |
| Blenniidae | 245 | 38.7069 | 7.444 |
| Clinidae | 3 | 0.6036 | 0.116 |
| Ophidiidae | 65 | 12.1026 | 2.327 |
| Callionymidae | 37 | 6.9858 | 1.343 |
| Gobiidae | 249 | 47.3927 | 9.114 |
| Scorpaenidae | 1 | 0.2312 | 0.044 |
| Triglidae | 93 | 8.4435 | 1.624 |
| Bothidae | 19 | 4.1782 | 0.804 |
| Citharichthys macrops | 11 | 1.9746 | 0.380 |
| Etropus rimosus | 10 | 3.6939 | 0.710 |
| Bothus robinsi | 1 | 0.2312 | 0.044 |
| Paralichthys spp. | 5 | 0.6576 | 0.126 |
| Cynoglossidae | | | |
| Symphurus spp. | 8 | 0.7584 | 0.146 |
| Balistidae | 12 | 2.2961 | 0.442 |

Table 20. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Tetraodontidae | 16 | 3.2612 | 0.627 |
| Gobiesocidae | 7 | 0.3210 | 0.062 |
| Unidentified Larvae | 241 | 29.4619 | 5.666 |
| Total Larvae | 2,216 | 306.0260 | 58.851 |

NUMBER OF FAMILIES: 26

NUMBER OF SPECIES: 23

Table 21. Cruise CL 7412. Numbers of larvae, estimated total abundance in the area represented by the cruise ($91.33 \times 10^9$ $m^2$), and estimated mean number under 10 $m^2$ of sea surface for larvae in each of the designated taxa.

| Taxa | Number of larvae | Abundance ($\times 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Clupeidae | 183 | 53.1284 | 5.817 |
| Brevoortia spp. | 1 | 0.0537 | 0.006 |
| Etrumeus teres | 57 | 50.8905 | 5.572 |
| Harengula jaguana | 1,429 | 132.0856 | 14.462 |
| Opisthonema oglinum | 1,421 | 281.5973 | 30.833 |
| Sardinella anchovia | 4,098 | 1,316.8873 | 144.190 |
| Engraulidae | 170 | 23.1638 | 2.533 |
| Gonostomatidae | | | |
| Cyclothone spp. | 1 | 0.8928 | 0.098 |
| Synodontidae | 77 | 44.2929 | 4.850 |
| Myctophidae | | | |
| Diaphus spp. | 6 | 3.9832 | 0.436 |
| Anguilliformes | 2 | 1.1905 | 0.130 |
| Muraenidae | 3 | 2.5609 | 0.280 |
| Nettastomidae | 1 | 0.8928 | 0.098 |
| Ophichthidae | 1 | 0.9586 | 0.105 |
| Ophichthus spp. | 1 | 0.5919 | 0.065 |

Table 21. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Belonidae | 2 | 0.2369 | 0.026 |
| Exocoetidae | | | |
| Cypselurus spp. | 1 | 0.8928 | 0.098 |
| Bregmacerotidae | | | |
| Bregmaceros Type B | 40 | 45.1484 | 4.943 |
| Fistulariidae | | | |
| Fistularia spp. | 1 | 0.8928 | 0.098 |
| Syngnathidae | | | |
| Hippocampus erectus | 1 | 0.1302 | 0.014 |
| Syngnathus spp. | 1 | 0.7904 | 0.087 |
| Syngnathus elucens | 8 | 2.3378 | 0.256 |
| Syngnathus springeri | 3 | 1.3175 | 0.144 |
| Syngnathus louisianae | 6 | 0.5294 | 0.058 |
| Syngnathus scovelli | 26 | 0.7518 | 0.082 |
| Mugilidae | | | |
| Mugil spp. | 3 | 1.3164 | 0.144 |
| Atherinidae | | | |
| Membras martinicus | 4 | 0.1300 | 0.142 |

Table 21. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Sphyraenidae | | | |
| Sphyraena spp. | 1 | 0.0820 | 0.009 |
| Sphyraena borealis | 3 | 2.2910 | 0.251 |
| Serranidae | 47 | 21.7230 | 2.378 |
| Diplectrum formosum | 472 | 202.8329 | 22.209 |
| Epinephelus spp. | 12 | 8.8873 | 0.973 |
| Serranus spp. | 2 | 1.3982 | 0.153 |
| Hemanthias vivanus | 1 | 0.8928 | 0.098 |
| Serraniculus pumilio | 29 | 6.7338 | 0.737 |
| Liopropoma spp. | 1 | 9.9586 | 0.105 |
| Apogonidae | 325 | 202.8329 | 22.209 |
| Carangidae | | | |
| Chloroscombrus chrysurus | 20 | 2.0124 | 0.220 |
| Decapterus punctatus | 563 | 219.4414 | 24.027 |
| Oligoplites saurus | 4 | 0.4757 | 0.052 |
| Seriola spp. | 1 | 0.1189 | 0.013 |
| Lutjanidae | 29 | 12.9643 | 1.420 |
| Gerreidae | 116 | 22.9909 | 2.517 |

Table 21. Continued.

| Taxa | Number of larvae | Abundance (x $10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Pomadasyidae | 295 | 74.5848 | 8.167 |
| Orthopristis chrysoptera | 10 | 1.1535 | 0.126 |
| Sciaenidae | 11 | 1.1344 | 0.124 |
| Cynoscion arenarius | 2 | 0.1459 | 0.016 |
| Cynoscion nebulosus | 9 | 0.8440 | 0.092 |
| Leiostomus xanthurus | 13 | 0.7805 | 0.086 |
| Menticirrhus saxatilis | 12 | 1.5587 | 0.171 |
| Sparidae | 170 | 37.8555 | 4.145 |
| Archosargus probatocephalus | 1 | 0.1552 | 0.017 |
| Mullidae | 16 | 11.3314 | 1.241 |
| Pomacentridae | 55 | 28.3649 | 3.106 |
| Labridae | 333 | 120.8971 | 13.237 |
| Scaridae | 12 | 7.6904 | 0.842 |
| Opistognathidae | 144 | 50.9664 | 5.581 |
| Blenniidae | 213 | 47.8777 | 5.242 |
| Clinidae | 46 | 9.1328 | 1.000 |
| Ophidiidae | 372 | 178.2010 | 19.512 |

Table 21. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under 10 $m^2$ |
|---|---|---|---|
| Carapidae | | | |
| Echiodon sp. | 3 | 2.4951 | 0.273 |
| Callionymidae | 69 | 15.7334 | 1.723 |
| Scombridae | 1 | 0.8928 | 0.098 |
| Thunnus thynnus | 1 | 0.5952 | 0.065 |
| Gobiidae | 3,439 | 1,243.0859 | 136.109 |
| Microdesmidae | | | |
| Microdesmus spp. | 5 | 0.5741 | 0.063 |
| Scorpaenidae | 137 | 111.6603 | 12.226 |
| Triglidae | 203 | 50.2689 | 5.504 |
| Bothidae | 30 | 6.7229 | 0.736 |
| Citharichthys macrops | 57 | 9.0622 | 0.992 |
| Cyclopsetta fimbriata | 4 | 1.8054 | 0.198 |
| Etropus rimosus | 30 | 29.6788 | 3.250 |
| Syacium papillosum | 60 | 46.1068 | 5.048 |
| Bothus robinsi | 34 | 29.0781 | 3.184 |
| Soleidae | | | |
| Achirus lineatus | 13 | 2.2217 | 0.243 |

Table 21. Continued.

| Taxa | Number of larvae | Abundance ($x 10^9$) | Mean Number under $10 m^2$ |
|---|---|---|---|
| Gymnachirus melas | 3 | 1.1336 | 0.124 |
| Cynoglossidae | | | |
| Symphurus spp. | 101 | 31.0073 | 3.395 |
| Balistidae | 575 | 157.7398 | 17.271 |
| Tetraodontidae | 135 | 61.1013 | 6.690 |
| Gobiesocidae | 2 | 0.2756 | 0.030 |
| Lophiiformes | 16 | 11.6042 | 1.271 |
| Unidentified Larvae | 1,049 | 262.3692 | 28.728 |
| Total Larvae | 16,854 | 5,281.6068 | 578.292 |

NUMBER OF FAMILIES: 44

NUMBER OF SPECIES: 32

Table 22. Cruise GE 7101. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Sardinella anchovia | 1,373 | - | - |
| 2 | Diplectrum formosum | 384 | 2.1 - 12.0 | 3.1 - 4.0 |
| 3 | Etrumeus teres | 310 | - | - |
| 4 | Decapterus punctatus | 200 | 1.1 - 22.0 | 2.1 - 3.0 |
| 5 | Orthopristis chrysoptera | 187 | 1.1 - 7.0 | 3.1 - 4.0 |
| 6 | Citharichthys macrops | 119 | 2.1 - 15.0 | 4.1 - 5.0 |
| 7 | Bregmaceros Type B | 100 | 1.1 - 13.0 | 2.1 - 3.0 |
| 8 | Trachurus lathami | 72 | 1.1 - 8.0 | 2.1 - 3.0 |
| 9 | Bothus robinsi | 66 | 2.1 - 20.0 | 3.1 - 4.0 |
| 10 | Lagodon rhomboides | 59 | 2.1 - 13.0 | 4.1 - 5.0 |
| 11 | Syacium papillosum | 34 | 1.1 - 11.0 | 2.1 - 3.0 |
| 12 | Anthias Type 1 | 25 | 2.1 - 5.0 | 2.1 - 3.0 |
| 13 | Notoscopelus caudispinosus | 24 | 2.1 - 15.0 | 3.1 - 4.0 |
| 14 | Anthias Type 2 | 18 | 2.1 - 5.0 | 3.1 - 4.0 |
| 15 | Hemanthias vivanus | 15 | 2.1 - 5.0 | 2.1 - 3.0 |
| 16 | Citharichthys cornutus | 12 | 2.1 - 7.0 | 3.1 - 4.0 |
| 17 | Pronotogrammus aureorubens | 10 | 2.1 - 5.0 | 2.1 - 3.0 |
| 18 | Echiodon sp. | 9 | 3.1 - 46.0 | 3.1 - 4.0 |
| 19 | Sygnathus elucens | 8 | 7.1 - 20.0 | - |
| 20 | Sygnathus springeri | 7 | 12.1 - >50.0 | - |

Table 23. Cruise 8C 7113 - TI 7114. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 1,213 | 1.1 - 23.0 | 4.1 - 5.0 |
| 2 | Diplectrum formosum | 1,170 | 1.1 - 13.0 | 2.1 - 3.0 |
| 3 | Etropus rimosus | 873 | 1.1 - 18.0 | 4.1 - 5.0 |
| 4 | Decapterus punctatus | 587 | 1.1 - 22.0 | 2.1 - 3.0 |
| 5 | Archosargus probatocephalus | 272 | 1.1 - 11.0 | 3.1 - 4.0 |
| 6 | Harengula jaguana | 243 | 3.1 - 13.0 | 5.1 - 6.0 |
| 7 | Bregmaceros Type B | 198 | 1.1 - 30.0 | 2.1 - 3.0 |
| 8 | Orthopristis chrysoptera | 149 | 2.1 - 9.0 | 5.1 - 6.0 |
| 9 | Bregmaceros Type A | 137 | 1.1 - 17.0 | 2.1 - 3.0 |
| 10 | Citharichthys cornutus | 132 | 2.1 - 22.0 | 4.1 - 5.0 |
| 11 | Hemanthias vivanus | 113 | 1.1 - 14.0 | 3.1 - 4.0 |
| 12 | Myctophum nitidulum | 106 | 2.1 - 14.0 | 3.1 - 4.0 |
| 13 | Etrumeus teres | 102 | 3.1 - 25.0 | 5.1 - 6.0 |
| 14 | Syacium papillosum | 102 | 1.1 - 11.0 | 2.1 - 3.0 |
| 15 | Maurolicus muelleri | 94 | 2.1 - 16.0 | 5.1 - 6.0 |
| 16 | Centropristis striata | 93 | 2.1 - 10.0 | 4.1 - 5.0 |
| 17 | Citharichthys macrops | 83 | 2.1 - 10.0 | 3.1 - 4.0 |
| 18 | Citharichthys gymnorhinus | 57 | 2.1 - 17.0 | 3.1 - 4.0 |
| 19 | Bothus robinsi | 54 | 2.1 - 24.0 | 4.1 - 5.0 |
| 20 | Ceratoscopelus warmingi | 50 | 2.1 - 17.0 | 5.1 - 6.0 |

Table 24. Cruise GE 7117. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 182 | 3.1 - 15.0 | 7.0 - 8.0 |
| 2 | Syacium papillosum | 121 | 1.1 - 14.0 | 2.1 - 3.0 |
| 3 | Bregmaceros Type B | 107 | 1.1 - 7.0 | 2.1 - 3.0 |
| 4 | Citharichthys cornutus | 60 | 2.0 - 21.0 | 5.1 - 6.0 |
| 5 | Bothus robinsi | 51 | 2.1 - 19.0 | 3.1 - 4.0 |
| 6 | Maurolicus muelleri | 44 | 3.1 - 5.0 | 3.1 - 4.0 |
| 7 | Euthynnus alletteratus | 32 | 2.1 - 19.0 | 3.1 - 4.0 |
| 8 | Etropus rimosus | 28 | 2.1 - 10.0 | 3.1 - 4.0 |
| 9 | Decapterus punctatus | 24 | 1.1 - 4.0 | 2.1 - 3.0 |
| 10 | Thunnus atlanticus | 11 | 2.1 - 6.0 | 3.1 - 4.0 |
| 11 | Diplectrum formosum | 10 | 2.1 - 5.0 | 3.1 - 4.0 |
| 12 | Citharichthys gymnorhinus | 10 | 2.1 - 10.0 | 5.1 - 6.0 |
| 13 | Auxis sp. | 7 | 2.1 - 5.0 | 3.1 - 4.0 |
| 14 | Bregmaceros Type A | 6 | 1.1 - 6.0 | 3.1 - 4.0 |
| 15 | Gymnothorax nigromarginatus | 6 | 35.0 - >50.0 | - |
| 16 | Hemanthias vivanus | 5 | 1.1 - 4.0 | 1.1 - 3.0 |
| 17 | Megalops atlantica | 4 | 5.1 - 10.0 | - |
| 18 | Parexocoetus brachypterus | 4 | 2.1 - 3.0 | - |
| 19–20 | Myctophum nitidulum | 3 | 2.1 - 6.0 | - |
| 19–20 | Ceratoscopelus warmingi | 3 | 3.1 - 8.0 | - |
| 19–20 | Serraniculus pumilio | 3 | 2.1 - 7.0 | - |
| 19–20 | Echiodon sp. | 3 | 4.1 - 14.0 | 4.1 - 5.0 |

Table 25. Cruise 8C 7120 - TI 7121. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Syacium papillosum | 1,359 | 1.1 - 19.0 | 3.1 - 4.0 |
| 2 | Opisthonema oglinum | 1,101 | 2.1 - 17.0 | 5.1 - 6.0 |
| 3 | Bothus robinsi | 429 | 2.1 - 20.0 | 4.1 - 5.0 |
| 4 | Decapterus punctatus | 406 | 1.1 - 23.0 | 2.1 - 3.0 |
| 5 | Sardinella anchovia | 389 | 1.1 - 16.0 | 3.1 - 4.0 |
| 6 | Bregmaceros Type B | 370 | 1.1 - 21.0 | 2.1 - 3.0 |
| 7 | Chloroscombrus chrysurus | 312 | 1.1 - 13.0 | 2.1 - 3.0 |
| 8 | Diplectrum formosum | 199 | 1.1 - 11.0 | 2.1 - 3.0 |
| 9 | Citharichthys cornutus | 181 | 2.1 - 22.0 | 5.1 - 6.0 |
| 10 | Euthynnus alletteratus | 176 | 2.1 - 8.0 | 3.1 - 4.0 |
| 11 | Auxis sp. | 172 | 1.1 - 10.0 | 2.1 - 3.0 |
| 12 | Bregmaceros Type A | 169 | 1.1 - 8.0 | 2.1 - 3.0 |
| 13 | Myctophum nitidulum | 159 | 2.1 - 33.0 | 4.1 - 5.0 |
| 14 | Maurolicus muelleri | 131 | 3.1 - 28.0 | 6.1 - 7.0 |
| 15 | Thunnus atlanticus | 127 | 2.1 - 10.0 | 3.1 - 4.0 |
| 16 | Citharichthys gymnorhinus | 104 | 2.1 - 17.0 | 3.1 - 4.0 |
| 17 | Bregmaceros atlanticus | 74 | 1.1 - 26.0 | 2.1 - 3.0 |
| 18 | Echiodon sp. | 72 | 3.1 - >50.0 | 9.1 - 10.0 |
| 19 | Serraniculus pumilio | 56 | 2.1 - 7.0 | 2.1 - 3.0 |
| 20 | Cubiceps pauciradiatus | 53 | 1.1 - 5.0 | 2.1 - 3.0 |

Table 26. Cruise TI 7131 - 8B 7132. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Bregmaceros Type B | 335 | 1.1 - 21.0 | 2.1 - 3.0 |
| 2 | Bothus robinsi | 152 | 2.1 - 17.0 | 5.1 - 6.0 |
| 3 | Decapterus punctatus | 145 | 1.1 - >30.0 | 3.1 - 4.0 |
| 4 | Etropus rimosus | 133 | 2.1 - 12.0 | 3.1 - 4.0 |
| 5 | Bregmaceros Type A | 84 | 1.1 - 5.0 | 2.1 - 3.0 |
| 6 | Etrumeus teres | 72 | 3.1 - 15.0 | 4.1 - 5.0 |
| 7 | Hemanthias vivanus | 68 | 1.1 - 7.0 | 2.1 - 3.0 |
| 8 | Syacium papillosum | 62 | 2.1 - 17.0 | 6.1 - 7.0 |
| 9 | Sardinella anchovia | 55 | 2.1 - 30.0 | 5.1 - 6.0 |
| 10 | Bregmaceros atlanticus | 51 | 2.1 - 14.0 | 2.1 - 3.0 |
| 11 | Gonostoma elongatum | 24 | 5.1 - 19.0 | 8.1 - 9.0 |
| 12 | Echiodon sp. | 24 | 3.1 - 47.0 | 6.1 - 7.0 |
| 13 | Benthosema suborbitale | 22 | 3.1 - 10.0 | 4.1 - 5.0 |
| 14 | Notolychnus valdiviae | 19 | 3.1 - 9.0 | 4.1 - 5.0 |
| 15 | Diogenichthys atlanticus | 18 | 2.1 - 7.0 | 3.1 - 4.0 |
| 16 | Maurolicus muelleri | 17 | 4.1 - 16.0 | 9.1 - 10.0 |
| 17 | Citharichthys cornutus | 17 | 3.1 - 12.0 | 3.1 - 4.0 |
| 18 | Myctophum nitidulum | 15 | 3.1 - 7.0 | 3.1 - 4.0 |
| 19 | Anthias Type I | 15 | 1.1 - 5.0 | 2.1 - 3.0 |
| 20 | { Vinciguerria poweriae | 14 | 7.1 - 20.0 | 10.1- 11.0 |
| | { Diplectrum formosum | 14 | 2.1 - 9.0 | 4.1 - 5.0 |

Table 27. Cruise 8B 7201 - GE 7202. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Range | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Etrumeus teres | 190 | 3.1 - 20.0 | 5.1 - 6.0 |
| 2 | Lagodon rhomboides | 120 | 2.1 - 10.0 | 3.1 - 4.0 |
| 3 | Etropus rimosus | 116 | 2.1 - 11.0 | 3.1 - 4.0 |
| 4 | Sardinella anchovia | 68 | 4.1 - 23.0 | 7.1 - 8.0 |
| 5 | Bregmaceros Type B | 60 | 1.1 - 15.0 | 2.1 - 3.0 |
| 6 | Syacium papillosum | 58 | 2.1 - 8.0 | 3.1 - 4.0 |
| 7 | Decapterus punctatus | 33 | 2.1 - 8.0 | 3.1 - 4.0 |
| 8 | Trachurus lathami | 33 | 2.1 - 6.0 | 2.1 - 3.0 |
| 9 | Citharichthys gymnorhinus | 21 | 3.1 - 13.0 | 4.1 - 5.0 |
| 10 | Bothus robinsi | 20 | 3.1 - 17.0 | 3.1 - 4.0 |
| 11 | Centropristis striata | 15 | 2.1 - 8.0 | 4.1 - 5.0 |
| 12 | Bregmaceros Type A | 14 | 1.1 - 7.0 | 1.1 - 2.0 |
| 13 | Diplectrum formosum | 14 | 1.1 - 8.0 | 3.1 - 4.0 |
| 14 | Maurolicus muelleri | 10 | 3.1 - 5.0 | 4.1 - 5.0 |
| 15 | Vinciguerria nimbaria | 9 | 2.1 - 13.0 | - |
| 16 | Myctophum nitidulum | 7 | 3.1 - 10.0 | 3.1 - 4.0 |
| 17 | Citharichthys macrops | 7 | 3.1 - 8.0 | 4.1 - 5.0 |
| 18 | Hygophum reinhardti | 6 | 2.1 - 5.0 | 3.1 - 4.0 |
| 19 | Citharichthys cornutus | 6 | 4.1 - 15.0 | 4.1 - 5.0 |
| 20 | Bregmaceros atlanticus | 6 | 3.1 - 19.0 | - |

Table 28. Cruise GE 7208. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 634 | 2.1 - 15.0 | 3.1 - 4.0 |
| 2 | Diplectrum formosum | 374 | 1.1 - 11.0 | 2.1 - 3.0 |
| 3 | Decapterus punctatus | 352 | 1.1 - 20.0 | 3.1 - 4.0 |
| 4 | Benthosema suborbitale | 144 | 2.1 - 9.0 | 3.1 - 4.0 |
| 5 | Sardinella anchovia | 118 | 3.1 - 20.0 | 7.1 - 8.0 |
| 6 | Myctophum nitidulum | 104 | 1.1 - 9.0 | 3.1 - 4.0 |
| 7 | Syacium papillosum | 102 | 2.1 - 14.0 | 3.1 - 4.0 |
| 8 | Harengula jaguana | 95 | 3.1 - 14.0 | 7.1 - 8.0 |
| 9 | Thunnus thynnus | 77 | 2.1 - 9.0 | 2.1 - 3.0 |
| 10 | Citharichthys cornutus | 53 | 2.1 - 18.0 | 3.1 - 4.0 |
| 11 | Bregmaceros Type A | 52 | 2.1 - 21.0 | 2.1 - 3.0 |
| 12 | Hemanthias vivanus | 50 | 2.1 - 9.0 | 3.1 - 4.0 |
| 13 | Notolychnus valdiviae | 49 | 3.1 - 8.0 | 4.1 - 6.0 |
| 14 | Etropus rimosus | 47 | 2.1 - 10.0 | 3.1 - 4.0 |
| 15 | Bothus robinsi | 44 | 1.1 - 22.0 | - |
| 16 | Ceratoscopelus warmingi | 38 | 3.1 - 12.0 | 5.1 - 6.0 |
| 17 | Cynoscion nebulosus | 37 | 1.1 - 4.0 | 2.1 - 3.0 |
| 18 | Auxis sp. | 37 | 2.1 - 5.0 | 3.1 - 4.0 |
| 19 | Myctophum selenops | 35 | 2.1 - 6.0 | 3.1 - 4.0 |
| 20 | Diogenichthys atlanticus | 34 | 2.1 - 5.0 | 3.1 - 4.0 |

Table 29. Cruise GE 7210. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 1,016 | 1.1 - 23.0 | 7.1 - 8.0 |
| 2 | Decapterus punctatus | 117 | 1.1 - 17.0 | 2.1 - 3.0 |
| 3 | Harengula jaguana | 110 | 1.1 - 14.0 | 3.1 - 4.0 |
| 4 | Sardinella anchovia | 94 | 3.1 - 9.0 | 4.1 - 5.0 |
| 5 | Diplectrum formosum | 51 | 2.1 - 11.0 | 2.1 - 3.0 |
| 6 | Membras martinicus | 37 | 4.1 - 7.0 | 5.1 - 6.0 |
| 7 | Syacium papillosum | 22 | 2.1 - 15.0 | 2.1 - 3.0 |
| 8 | Citharichthys macrops | 9 | 3.1 - 7.0 | 4.1 - 5.0 |
| 9 | Serraniculus pumilio | 6 | 2.1 - 4.0 | 3.1 - 4.0 |
| 10 | Euthynnus alletteratus | 5 | 2.1 - 6.0 | 4.1 - 5.0 |
| 11 | Gymnothorax nigromarginatus | 4 | 15.1 - >50.0 | - |
| 12 | Bothus robinsi | 4 | 4.1 - 13.0 | - |
| 13 | Auxis sp. | 3 | 2.1 - 5.0 | - |
| 14 | Etropus rimosus | 3 | 2.1 - 8.0 | - |
| 15 | Hyporhamphus unifasciatus | 2 | 5.1 - 7.0 | - |
| 16 | Syngnathus elucens | 2 | 11.1 - 18.0 | - |
| 17 | Syngnathus scovelli | 2 | 11.1 - >50.0 | - |
| 18 | Cyclopsetta fimbriata | 2 | 5.1 - 9.0 | - |
| 19–20 | Hemiramphus brasiliensis | 1 | 10.1 - 11.0 | - |
| 19–20 | Hippocampus erectus | 1 | 7.1 - 8.0 | - |
| 19–20 | Oligoplites saurus | 1 | 2.1 - 3.0 | - |
| 19–20 | Rhomboplites aurorubens | 1 | 12.1 - 13.0 | - |
| 19–20 | Gymnachirus melas | 1 | 3.1 - 4.0 | - |

Table 30. Cruise IS 7205. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Sardinella anchovia | 3,726 | 1.1 - 24.0 | 6.1 - 7.0 |
| 2 | Decapterus punctatus | 581 | 1.1 - 12.0 | 2.1 - 3.0 |
| 3 | Syacium papillosum | 352 | 1.1 - 15.0 | 2.1 - 3.0 |
| 4 | Diplectrum formosum | 218 | 1.1 - 8.0 | 2.1 - 3.0 |
| 5 | Bothus robinsi | 172 | 1.1 - 19.0 | 3.1 - 4.0 |
| 6 | Serraniculus pumilio | 152 | 1.1 - 8.0 | 2.1 - 3.0 |
| 7 | Chloroscombrus chrysurus | 136 | 1.1 - 12.0 | 2.1 - 3.0 |
| 8 | Bregmaceros Type A | 126 | 1.1 - 9.0 | 2.1 - 3.0 |
| 9 | Bregmaceros Type B | 101 | 1.1 - 26.0 | 2.1 - 3.0 |
| 10 | Opisthonema oglinum | 76 | 7.1 - 24.0 | 10.1 - 11.0 |
| 11 | Citharichthys macrops | 55 | 1.1 - 11.0 | 3.1 - 4.0 |
| 12 | Auxis sp. | 32 | 2.1 - 6.0 | 2.1 - 3.0 |
| 13 | Euthynnus alletteratus | 30 | 2.1 - 6.0 | 3.1 - 4.0 |
| 14 | Thunnus atlanticus | 18 | 2.1 - 8.0 | 3.1 - 4.0 |
| 15 | Pristipomoides aquilonaris | 13 | 4.1 - 10.0 | 4.1 - 5.0 |
| 16 | Echiodon sp. | 12 | 2.1 - 18.0 | - |
| 17 | Scomberomorus maculatus | 12 | 1.1 - 4.0 | 2.1 - 3.0 |
| 18 | Cyclopsetta fimbriata | 11 | 3.1 - 11.0 | 6.1 - 7.0 |
| 19 | Bregmaceros atlanticus | 10 | 2.1 - 8.0 | 2.1 - 3.0 |
| 20 | Peprilus paru | 10 | 1.1 - 4.0 | 2.1 - 3.0 |

Table 31. Cruise IS 7209. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Bregmaceros Type B | 227 | 1.1 - 35.0 | 2.1 - 3.0 |
| 2 | Bothus robinsi | 206 | 1.1 - 24.0 | 3.1 - 5.0 |
| 3 | Bregmaceros Type A | 169 | 1.1 - 8.0 | 1.1 - 2.0 |
| 4 | Decapterus punctatus | 131 | 1.1 - 11.0 | 2.1 - 3.0 |
| 5 | Etropus rimosus | 106 | 1.1 - 21.0 | 3.1 - 4.0 |
| 6 | Syacium papillosum | 100 | 1.1 - 16.0 | 2.1 - 3.0 |
| 7 | Citharichthys macrops | 64 | 2.1 - 16.0 | 3.1 - 4.0 |
| 8 | Maurolicus muelleri | 38 | 2.1 - 9.0 | 3.1 - 4.0 |
| 9 | Citharichthys gymnorhinus | 33 | 2.1 - 10.0 | 3.1 - 4.0 |
| 10 | Gonostoma elongatum | 20 | 4.1 - 14.0 | 4.1 - 5.0 |
| 11 | Sygnathus springeri | 20 | 9.1 - >50.0 | - |
| 12 | Leiostomus xanthurus | 18 | 1.1 - 4.0 | 2.1 - 3.0 |
| 13 | Etrumeus teres | 15 | 2.1 - 5.0 | 4.1 - 5.0 |
| 14 | Benthosema suborbitale | 15 | 2.1 - 5.0 | 3.1 - 4.0 |
| 15 | Citharichthys cornutus | 15 | 2.1 - 10.0 | 2.1 - 3.0 |
| 16 | Myctophum nitidulum | 14 | 2.1 - 6.0 | 3.1 - 4.0 |
| 17 | Notolychnus valdiviae | 12 | 3.1 - 6.0 | 3.1 - 4.0 |
| 18 | Hemanthias vivanus | 12 | 2.1 - 5.0 | 2.1 - 3.0 |
| 19 | Echiodon sp. | 11 | 4.1 - 35.0 | - |
| 20 | Sardinella anchovia | 8 | 3.1 - 5.0 | 3.1 - 4.0 |
| 20 | Anthias Type 1 | 8 | - | - |
| 20 | Rhomboplites aurorubens | 8 | 5.1 - 9.0 | 6.1 - 7.0 |

Table 32. Cruise IS 7303. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Etropus rimosus | 336 | 2.1 - 15.0 | 4.1 - 5.0 |
| 2 | Etrumeus teres | 293 | 2.1 - 30.0 | 4.1 - 5.0 |
| 3 | Bregmaceros Type B | 143 | 1.1 - 24.0 | 2.1 - 3.0 |
| 4 | Lagodon rhomboides | 113 | 2.1 - 12.0 | 5.1 - 6.0 |
| 5 | Bregmaceros Type A | 99 | 1.1 - 8.0 | 2.1 - 3.0 |
| 6 | Decapterus punctatus | 97 | 2.1 - 9.0 | 2.1 - 3.0 |
| 7 | Bothus robinsi | 79 | 3.1 - 23.0 | 4.1 - 5.0 |
| 8 | Diplectrum formosum | 78 | 2.1 - 8.0 | 2.1 - 3.0 |
| 9 | Orthopristis chrysoptera | 75 | 2.1 - 9.0 | 4.1 - 5.0 |
| 10 | Syacium papillosum | 72 | 1.1 - 10.0 | 2.1 - 3.0 |
| 11 | Trachurus lathami | 51 | 1.1 - 13.0 | 2.1 - 3.0 |
| 12 | Citharichthys gymnorhinus | 44 | 3.1 - 17.0 | 4.1 - 5.0 |
| 13 | Citharichthys macrops | 38 | 3.1 - 12.0 | 5.1 - 6.0 |
| 14 | Gonostoma elongatum | 37 | 3.1 - 12.0 | 4.1 - 5.0 |
| 15 | Hemanthias vivanus | 35 | 1.1 - 5.0 | 2.1 - 3.0 |
| 16 | Benthosema suborbitale | 33 | 2.1 - 7.0 | 4.1 - 6.0 |
| 17 | Citharichthys cornutus | 27 | 3.1 - 17.0 | 3.1 - 4.0 |
| 18 | Leiostomus xanthurus | 23 | 3.1 - 10.0 | 4.1 - 5.0 |
| 19 | Myctophum nitidulum | 20 | 2.1 - 13.0 | 2.1 - 4.0 |
| 20 | Diogenichthys atlanticus | 20 | 3.1 - 8.0 | 3.1 - 4.0 |

Table 33. Cruise IS 7308. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 1,434 | 2.1 - 22.0 | 3.1 - 4.0 |
| 2 | Harengula jaguana | 1,282 | 1.1 - 20.0 | 3.1 - 4.0 |
| 3 | Sardinella anchovia | 797 | 2.1 - 22.0 | 7.1 - 8.0 |
| 4 | Diplectrum formosum | 675 | 1.1 - 11.0 | 2.1 - 3.0 |
| 5 | Decapterus punctatus | 539 | 1.1 - 13.0 | 2.1 - 3.0 |
| 6 | Bothus robinsi | 204 | 2.1 - 16.0 | 3.1 - 4.0 |
| 7 | Syacium papillosum | 162 | 1.1 - 12.0 | 3.1 - 4.0 |
| 8 | Bregmaceros Type B | 130 | 1.1 - 27.0 | 2.1 - 3.0 |
| 9 | Maurolicus muelleri | 98 | 2.1 - 11.0 | 2.1 - 3.0 |
| 10 | Myctophum nitidulum | 81 | 2.1 - 9.0 | 4.1 - 5.0 |
| 11 | Leiostomus xanthurus | 81 | 1.1 - 10.0 | 2.1 - 3.0 |
| 12 | Hemanthias vivanus | 78 | 2.1 - 6.0 | 3.1 - 4.0 |
| 13 | Bregmaceros Type A | 75 | 1.1 - 4.0 | 2.1 - 3.0 |
| 14 | Citharichthys macrops | 73 | 2.1 - 14.0 | 3.1 - 4.0 |
| 15 | Etropus rimosus | 44 | 2.1 - 12.0 | 3.1 - 4.0 |
| 16 | Thunnus thynnus | 41 | 2.1 - 8.0 | 6.1 - 7.0 |
| 17 | Archosargus probatocephalus | 39 | 2.1 - 10.0 | 3.1 - 4.0 |
| 18 | Chloroscombrus chrysurus | 35 | 2.1 - 4.0 | 3.1 - 4.0 |
| 19 | Cubiceps pauciradiatus | 27 | 2.1 - 6.0 | 2.1 - 3.0 |
| 20 | Citharichthys cornutus | 27 | 2.1 - 16.0 | 4.1 - 5.0 |

Table 34. Cruise IS 7311. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Opisthonema oglinum | 3,679 | 2.1 - 17.0 | 3.1 - 4.0 |
| 2 | Sardinella anchovia | 413 | 2.1 - 30.0 | 3.1 - 4.0 |
| 3 | Maurolicus muelleri | 296 | 2.1 - 11.0 | 4.1 - 5.0 |
| 4 | Decapterus punctatus | 176 | 1.1 - 10.0 | 2.1 - 3.0 |
| 5 | Syacium papillosum | 172 | 2.1 - 12.0 | 3.1 - 4.0 |
| 6 | Diplectrum formosum | 93 | 1.1 - 16.0 | 2.1 - 3.0 |
| 7 | Bothus robinsi | 87 | 2.1 - 23.0 | 4.1 - 5.0 |
| 8 | Myctophum nitidulum | 73 | 2.1 - 15.0 | 3.1 - 4.0 |
| 9 | Scomberomorus maculatus | 71 | 1.1 - 8.0 | 3.1 - 4.0 |
| 10 | Chloroscombrus chrysurus | 69 | 1.1 - 4.0 | 2.1 - 3.0 |
| 11 | Bregmaceros Type B | 68 | 1.1 - 16.0 | 2.1 - 3.0 |
| 12 | Harengula jaguana | 61 | 1.1 - 30.0 | 1.1 - 2.0 |
| 13 | Euthynnus alletteratus | 43 | 1.1 - 8.0 | 3.1 - 4.0 |
| 14 | Notolychnus valdiviae | 37 | 2.1 - 20.0 | 3.1 - 4.0 |
| 15 | Serraniculus pumilio | 26 | 2.1 - 5.0 | 2.1 - 3.0 |
| 16 | Echiodon sp. | 24 | 3.1 - 26.0 | 8.1 - 9.0 |
| 17 | Vinciguerria nimbaria | 21 | 4.1 - 10.0 | 6.1 - 7.0 |
| 18 | Citharichthys macrops | 20 | 2.1 - 11.0 | 3.1 - 4.0 |
| 19 | Vinciguerria poweriae | 18 | 6.1 - 19.0 | 9.1 - 10.0 |
| 20 | Bregmaceros atlanticus | 17 | 1.1 - 12.0 | 3.1 - 4.0 |

Table 35. Cruise IS 7313. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Sardinella anchovia | 1,140 | 1.1 - 18.0 | 5.1 - 6.0 |
| 2 | Harengula jaguana | 580 | 1.1 - 17.0 | 2.1 - 3.0 |
| 3 | Opisthonema oglinum | 527 | 2.1 - 18.0 | 3.1 - 4.0 |
| 4 | Maurolicus muelleri | 340 | 2.1 - 8.0 | 2.1 - 3.0 |
| 5 | Syacium papillosum | 310 | 1.1 - 14.0 | 2.1 - 3.0 |
| 6 | Decapterus punctatus | 254 | 1.1 - 8.0 | 2.1 - 3.0 |
| 7 | Bregmaceros Type B | 205 | 1.1 - 9.0 | 2.1 - 3.0 |
| 8 | Chloroscombrus chrysurus | 196 | 1.1 - 24.0 | 2.1 - 3.0 |
| 9 | Bothus robinsi | 156 | 1.1 - 18.0 | 4.1 - 5.0 |
| 10 | Diplectrum formosum | 78 | 1.1 - 11.0 | 2.1 - 3.0 |
| 11 | Euthynnus alletteratus | 58 | 2.1 - 9.0 | 3.1 - 4.0 |
| 12 | Serraniculus pumilio | 49 | 1.1 - 5.0 | 2.1 - 3.0 |
| 13 | Auxis sp. | 30 | 2.1 - 7.0 | 2.1 - 3.0 |
| 14 | Thunnus atlanticus | 20 | 1.1 - 7.0 | 2.1 - 3.0 |
| 15 | Myctophum nitidulum | 19 | 2.1 - 10.0 | 3.1 - 4.0 |
| 16 | Benthosema suborbitale | 19 | 2.1 - 9.0 | 4.1 - 5.0 |
| 17 | Bregmaceros atlanticus | 15 | 1.1 - 10.0 | 2.1 - 3.0 |
| 18 | Citharichthys macrops | 15 | 2.1 - 11.0 | 3.1 - 4.0 |
| 19 | Echiodon sp. | 15 | 3.1 - 46.0 | - |
| 20 | Citharichthys gymnorhinus | 14 | 3.1 - 13.0 | 4.1 - 5.0 |

Table 36. Cruise IS 7320. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Bregmaceros Type B | 451 | 1.1 - 21.0 | 2.1 - 3.0 |
| 2 | Syacium papillosum | 229 | 1.1 - 11.0 | 2.1 - 3.0 |
| 3 | Decapterus punctatus | 226 | 1.1 - 23.0 | 3.1 - 4.0 |
| 4 | Bothus robinsi | 196 | 1.1 - 26.0 | 4.1 - 5.0 |
| 5 | Etropus rimosus | 76 | 2.1 - 12.0 | 3.1 - 4.0 |
| 6 | Echiodon sp. | 68 | 2.1 - 39.0 | 6.1 - 8.0 |
| 7 | Notolychnus valdiviae | 37 | 2.1 - 9.0 | 3.1 - 4.0 |
| 8 | Diplectrum formosum | 37 | 1.1 - 12.0 | 3.1 - 4.0 |
| 9 | Citharichthys macrops | 33 | 2.1 - 17.0 | 3.1 - 4.0 |
| 10 | Gonostoma elongatum | 25 | 4.1 - 14.0 | 8.1 - 9.0 |
| 11 | Sardinella anchovia | 23 | 3.1 - 11.0 | 7.1 - 8.0 |
| 12 | Diogenichthys atlanticus | 23 | 2.1 - 8.0 | 3.1 - 4.0 |
| 13 | Maurolicus muelleri | 22 | 4.1 - 11.0 | 9.1 - 10.0 |
| 14 | Etrumeus teres | 21 | 3.1 - 8.0 | 4.1 - 5.0 |
| 15 | Citharichthys cornutus | 19 | 3.1 - 16.0 | 3.1 - 4.0 |
| 16 | Benthosema suborbitale | 18 | 2.1 - 9.0 | 4.1 - 5.0 |
| 17 | Citharichthys gymnorhinus | 17 | 3.1 - 11.0 | 3.1 - 4.0 |
| 18 | Vinciguerria poweriae | 12 | 5.1 - 11.0 | 7.1 - 8.0 |
| 19 | Ceratoscopelus warmingi | 12 | 3.1 - 10.0 | 3.1 - 4.0 |
| 20 | Hyporhamphus unifasciatus | 10 | 8.1 - 24.0 | 13.1 - 14.0 |
|  | Hippocampus erectus | 10 | 5.1 - 23.0 | - |

Table 37. Cruise CL 7405. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Orthopristis chrysoptera | 331 | 1.6 - 9.0 | 5.1 - 6.0 |
| 2 | Diplodus holbrooki | 98 | 2.1 - 9.0 | 4.1 - 5.0 |
| 3 | Diplectrum formosum | 89 | 2.1 - 6.0 | 3.1 - 4.0 |
| 4 | Centropristis striata | 58 | 2.1 - 12.0 | 3.1 - 4.0 |
| 5 | Lagodon rhomboides | 38 | 2.1 - 12.0 | 5.1 - 6.0 |
| 6 | Opisthonema oglinum | 32 | 4.1 - 16.0 | 6.1 - 7.0 |
| 7 | Harengula jaguana | 25 | 4.1 - 15.0 | 6.1 - 7.0 |
| 8 | Cynoscion arenarius | 15 | 1.6 - 3.0 | 2.1 - 3.0 |
| 9 | Citharichthys macrops | 11 | 3.1 - 11.0 | 5.1 - 6.0 |
| 10 | Etropus rimosus | 10 | 2.1 - 6.0 | - |
| 11 | Archosargus probatocephalus | 9 | 2.1 - 8.0 | 2.1 - 3.0 |
| 12 | Syngnathus scovelli | 6 | 8.1 - 24.0 | - |
| 13 | Menticirrhus saxatilis | 6 | 1.1 - 3.0 | 2.1 - 3.0 |
| 14 | Hippocampus erectus | 5 | 6.1 - 31.0 | 6.1 - 7.0 |
| 15 | Leiostomus xanthurus | 5 | 2.1 - 5.0 | 3.1 - 5.0 |
| 16 | Syngnathus louisianae | 4 | 7.1 - 10.0 | - |
| 17 | Pogonias cromis | 2 | 2.1 - 3.0 | 2.1 - 3.0 |
| | Syngnathus elucens | 1 | 18.1 - 19.0 | - |
| 18 | Syngnathus springeri | 1 | 24.1 - 25.0 | - |
| | Menidia berylina | 1 | 40.1 - 41.0 | - |
| 19 | Sphyraena borealis | 1 | 4.1 - 5.0 | - |
| 20 | Cynoscion nebulosus | 1 | 2.1 - 3.0 | - |
| | Bothus robinsi | 1 | 17.1 - 18.0 | - |

Table 38. Cruise CL 7412. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

| Rank | Species | Number of larvae | Length-range (mm) | Modal length (mm) |
|---|---|---|---|---|
| 1 | Sardinella anchovia | 4,098 | 1.1 - 20.0 | 6.1 - 7.0 |
| 2 | Harengula jaguana | 1,429 | 1.1 - 19.0 | 2.1 - 3.0 |
| 3 | Opisthonema oglinum | 1,421 | 1.6 - 19.0 | 3.1 - 4.0 |
| 4 | Decapterus punctatus | 563 | 1.1 - 14.0 | 2.1 - 3.0 |
| 5 | Diplectrum formosum | 472 | 1.1 - 12.0 | 2.1 - 3.0 |
| 6 | Syacium papillosum | 60 | 2.1 - 7.0 | 3.1 - 4.0 |
| 7 | Etrumeus teres | 57 | 3.1 - 7.0 | 4.1 - 5.0 |
| 8 | Citharichthys macrops | 57 | 2.1 - 8.0 | 3.1 - 4.0 |
| 9 | Bregmaceros Type B | 40 | 1.1 - 18.0 | 2.1 - 3.0 |
| 10 | Bothus robinsi | 34 | 2.1 - 13.0 | 3.1 - 4.0 |
| 11 | Etropus rimosus | 30 | 2.1 - 9.0 | 3.1 - 4.0 |
| 12 | Serraniculus pumilio | 29 | 2.1 - 5.0 | 2.1 - 3.0 |
| 13 | Syngnathus scovelli | 26 | 11.1 - >50.0 | 13.1 - 14.0 |
| 14 | Chloroscombrus chrysurus | 20 | 2.1 - 5.0 | 2.1 - 3.0 |
| 15 | Leiostomus xanthurus | 13 | 1.1 - 4.0 | 2.1 - 3.0 |
| 16 | Achirus lineatus | 13 | 1.1 - 4.0 | 2.1 - 3.0 |
| 17 | Menticirrhus saxatilis | 12 | 1.1 - 4.0 | 2.1 - 3.0 |
| 18 | Orthopristis chrysoptera | 10 | 1.1 - 6.0 | 2.1 - 3.0 |
| 19 | Cynoscion nebulosus | 9 | 1.1 - 4.0 | 2.1 - 3.0 |
| 20 | Syngnathus elucens | 8 | 8.1 - 18.0 | - |

Table 39. The 20 most abundant species of larvae collected on 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Abundance is expressed as the estimated mean number of larvae under 10 $m^2$ of sea surface.

| | Cruise GE 7101 | | | Cruise 8C 7113 - TI 7114 | |
|---|---|---|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ | Rank | Species | Mean number under 10 $m^2$ |
| 1 | Sardinella anchovia | 18.2445 | 1 | Diplectrum formosum | 29.7513 |
| 2 | Notoscopelus caudispinosus | 15.5936 | 2 | Opisthonema oglinum | 27.7739 |
| 3 | Etrumeus teres | 10.1175 | 1 | Etropus rimosus | 19.1827 |
| 4 | Maurolicus muelleri | 4.6723 | 1 | Decapterus punctatus | 13.3469 |
| 5 | Diplectrum formosum | 4.4230 | 5 | Bregmaceros Type B | 9.8498 |
| 6 | Decapterus punctatus | 3.9471 | 6 | Harengula jaguana | 6.7286 |
| 7 | Psenes pellucidus | 3.8936 | 7 | Archosargus probatocephalus | 6.5251 |
| 8 | Bregmaceros Type B | 3.6890 | 8 | Myctophum nitidulum | 3.8480 |
| 9 | Trachurus lathami | 3.4726 | 9 | Citharichthys cornutus | 3.4994 |
| 10 | Bothus robinsi | 3.1773 | 10 | Etrumeus teres | 3.4222 |
| 11 | Vinciguerria nimbaria | 1.5977 | 11 | Bregmaceros Type A | 3.2997 |
| 12 | Citharichthys macrops | 1.0288 | 12 | Hemanthias vivanus | 3.2268 |
| 13 | Orthopristis chrysoptera | 0.9763 | 13 | Maurolicus muelleri | 2.9894 |
| 14 | Bregmaceros Type A | 0.9047 | 14 | Orthopristis chrysoptera | 2.8962 |
| 15 | Myctophum nitidulum | 0.8160 | 15 | Centropristis striatus | 2.2469 |
| 16 | Ceratoscopelus warmingi | 0.7971 | 16 | Syacium papillosum | 2.2258 |
| 17 | Benthosema suborbitale | 0.7787 | 17 | Citharichthys macrops | 2.1786 |
| 18 | Nesiarchus nasutus | 0.7787 | 18 | Vinciguerria poweriae | 1.4022 |
| 19 | Diplospinus multistriatus | 0.7787 | 19 | Ceratoscopelus warmingi | 1.2432 |
| 20 | Lagodon rhomboides | 0.6462 | 20 | Bothus robinsi | 1.0582 |

Table 39. Continued.

| Rank | Cruise GE 7117 Species | Mean number under 10 $m^2$ | Rank | Cruise 8C 7120 - TI 7121 Species | Mean number under 10 $m^2$ |
|---|---|---|---|---|---|
| 1 | Syacium papillosum | 26.5467 | 1 | Syacium papillosum | 26.7731 |
| 2 | Bregmaceros Type B | 26.3138 | 2 | Opisthonema oglinum | 11.0763 |
| 3 | Opisthonema oglinum | 17.7578 | 3 | Bothus robinsi | 8.5898 |
| 4 | Citharichthys cornutus | 9.7428 | 4 | Myctophum nitidulum | 7.8292 |
| 5 | Maurolicus muelleri | 9.1244 | 5 | Decapterus punctatus | 6.5344 |
| 6 | Thunnus atlanticus | 6.3901 | 6 | Auxis sp. | 5.6533 |
| 7 | Bothus robinsi | 6.3128 | 7 | Maurolicus muelleri | 5.3653 |
| 8 | Decapterus punctatus | 4.7092 | 8 | Bregmaceros Type B | 5.2943 |
| 9 | Euthynnus alletteratus | 3.6436 | 9 | Euthynnus alletteratus | 5.1221 |
| 10 | Etropus rimosus | 2.7713 | 10 | Chloroscombrus chrysurus | 5.0535 |
| 11 | Citharichthys gymnorhinus | 2.0479 | 11 | Thunnus atlanticus | 4.2919 |
| 12 | Gymnothorax nigromarginatus | 1.5398 | 12 | Sardinella anchovia | 4.1964 |
| 13 | Auxis sp. | 1.1522 | 13 | Citharichthys cornutus | 4.0312 |
| 14 | Pristipomoides aquilonaris | 0.9842 | 14 | Bregmaceros atlanticus | 3.5980 |
| 15 | Hemanthias vivanus | 0.9099 | 15 | Cubiceps pauciradiatus | 3.3850 |
| 16 | Bregmaceros Type A | 0.8922 | 16 | Diplectrum formosum | 2.8658 |
| 17 | Ceratoscopelus warmingi | 0.8618 | 17 | Bregmaceros Type A | 2.4589 |
| 18 | Diplectrum formosum | 0.8446 | 18 | Vinciguerria nimbaria | 2.2255 |
| 19 | Serraniculus pumilio | 0.7954 | 19 | Notolychnus valdiviae | 2.2156 |
| 20 | Hygophum reinhardti | 0.5745 | 20 | Gonostoma elongatum | 1.8534 |

Table 39. Continued.

| | Cruise TI 7131 - 8B 7132 | | | Cruise 8B 7201 - GE 7202 | |
|---|---|---|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ | Rank | Species | Mean number under 10 $m^2$ |
| 1 | Bregmaceros Type B | 14.0161 | 1 | Etrumeus teres | 18.1360 |
| 2 | Bothus robinsi | 10.8640 | 2 | Lagodon rhomboides | 11.7282 |
| 3 | Decapterus punctatus | 8.3626 | 3 | Etropus rimosus | 11.6815 |
| 4 | Etropus rimosus | 6.9325 | 4 | Bregmaceros Type B | 6.0236 |
| 5 | Etrumeus teres | 4.0262 | 5 | Sardinella anchovia | 4.6712 |
| 6 | Bregmaceros Type A | 3.9859 | 6 | Trachurus lathami | 2.8235 |
| 7 | Sardinella anchovia | 3.9813 | 7 | Syacium papillosum | 2.5680 |
| 8 | Hemanthias vivanus | 3.0968 | 8 | Citharichthys gymnorhinus | 2.0398 |
| 9 | Syacium papillosum | 2.8634 | 9 | Decapterus punctatus | 1.8654 |
| 10 | Bregmaceros atlanticus | 2.7142 | 10 | Diplectrum formosum | 1.1770 |
| 11 | Gonostoma elongatum | 1.4122 | 11 | Bregmaceros Type A | 1.4745 |
| 12 | Citharichthys cornutus | 1.0994 | 12 | Bothus robinsi | 1.4618 |
| 13 | Centropristis striata | 1.0282 | 13 | Maurolicus muelleri | 1.3068 |
| 14 | Diogenichthys atlanticus | 1.0117 | 14 | Myctophum nitidulum | 1.2689 |
| 15 | Maurolicus muelleri | 0.9570 | 15 | Centropristis striata | 1.0450 |
| 16 | Benthosema suborbitale | 0.9540 | 16 | Citharichthys cornutus | 1.0156 |
| 17 | Myctophum nitidulum | 0.9301 | 17 | Hygophum reinhardti | 0.9019 |
| 18 | Citharichthys macrops | 0.9089 | 18 | Vinciguerria nimbaria | 0.7543 |
| 19 | Hygophum reinhardti | 0.8872 | 19 | Bregmaceros atlanticus | 0.7259 |
| 20 | Hildebrandia gracilior | 0.7910 | 20 | Leiostomus xanthurus | 0.6501 |

Table 39. Continued.

| | Cruise GE 7208 | | | Cruise GE 7210 | |
|---|---|---|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ | Rank | Species | Mean number under 10 $m^2$ |
| 1 | Benthosema suborbitale | 29.6589 | 1 | Opisthonema oglinum | 172.8047 |
| 2 | Decapterus punctatus | 19.1133 | 2 | Sardinella anchovia | 20.4107 |
| 3 | Myctophum nitidulum | 18.0269 | 3 | Decapterus punctatus | 17.5116 |
| 4 | Thunnus thynnus | 17.2209 | 4 | Harengula jaguana | 6.0130 |
| 5 | Opisthonema oglinum | 16.4364 | 5. | Diplectrum formosum | 5.6944 |
| 6 | Diplectrum formosum | 15.5729 | 6. | Syacium papillosum | 3.6879 |
| 7 | Notolychnus valdiviae | 9.4769 | 7 | Membras martinicus | 1.7296 |
| 8 | Bregmaceros Type A | 8.8466 | 8 | Bothus robinsi | 0.8394 |
| 9 | Citharichthys cornutus | 7.6450 | 9 | Citharichthys macrops | 0.7758 |
| 10 | Syacium papillosum | 7.5394 | 10 | Euthynnus alletteratus | 0.7066 |
| 11 | Myctophum selenops | 6.8075 | 11 | Etropus rimosus | 0.6514 |
| 12 | Diogenichthys atlanticus | 6.3708 | 12 | Serraniculus pumilio | 0.5914 |
| 13 | Sardinella anchovia | 5.1289 | 13 | Gymnothorax nigromarginatus | 0.5722 |
| 14 | Ceratoscopelus warmingi | 5.0192 | 14 | Auxis sp. | 0.5523 |
| 15 | Bregmaceros atlanticus | 4.9433 | 15 | Cyclopsetta fimbriata | 0.4104 |
| 16 | Bothus robinsi | 4.2614 | 16 | Syngnathus elucens | 0.2506 |
| 17 | Hemanthias vivanus | 3.9253 | 17 | Rhomboplites aurorubens | 0.2156 |
| 18 | Vinciguerria nimbaria | 3.6270 | 18 | Gymnachirus melas | 0.1344 |
| 19 | Auxis sp. | 3.5772 | 19 | Hemiramphus brasiliensis | 0.1235 |
| 20 | Etropus rimosus | 2.1778 | 20 | Hyporhamphus unifasciatus | 0.1167 |

Table 39. Continued.

| | Cruise IS 7205 | | | Cruise IS 7209 | |
|---|---|---|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ | Rank | Species | Mean number under 10 $m^2$ |
| 1 | Sardinella anchovia | 214.2940 | 1 | Bregmaceros Type A | 22.7364 |
| 2 | Decapterus punctatus | 55.2659 | 2 | Bregmaceros Type B | 22.1189 |
| 3 | Syacium papillosum | 54.8813 | 3 | Bothus robinsi | 13.7832 |
| 4 | Bregmaceros Type A | 35.0598 | 4 | Decapterus punctatus | 7.3178 |
| 5 | Bothus robinsi | 24.4821 | 5 | Syacium papillosum | 6.6709 |
| 6 | Bregmaceros Type B | 16.8604 | 6 | Etropus rimosus | 6.3933 |
| 7 | Diplectrum formosum | 13.6048 | 7 | Citharichthys gymnorhinus | 5.0313 |
| 8 | Auxis sp. | 5.8091 | 8 | Maurolicus muelleri | 4.4603 |
| 9 | Thunnus atlanticus | 4.8002 | 9 | Gonostoma elongatum | 3.3840 |
| 10 | Euthynnus alletteratus | 4.7663 | 10 | Citharichthys cornutus | 2.6606 |
| 11 | Serraniculus pumilio | 4.6081 | 11 | Benthosema suborbitale | 2.1821 |
| 12 | Echiodon sp. | 3.2180 | 12 | Etrumeus teres | 1.8020 |
| 13 | Chloroscombrus chrysurus | 3.1285 | 13 | Myctophum nitidulum | 1.6426 |
| 14 | Pristipomoides aquilonaris | 3.0320 | 14 | Anthias Type 1 | 1.6304 |
| 15 | Citharichthys cornutus | 2.6548 | 15 | Notolychnus valdiviae | 1.4901 |
| 16 | Bregmaceros atlanticus | 2.6002 | 16 | Citharichthys macrops | 1.3869 |
| 17 | Citharichthys macrops | 2.2340 | 17 | Echiodon sp. | 1.3119 |
| 18 | Sphyraena barracuda | 1.4628 | 18 | Diogenichthys atlanticus | 0.9456 |
| 19 | Vinciguerria nimbaria | 1.2775 | 19 | Pronotogrammus aurorubens | 0.9140 |
| 20 | Hemanthias vivanus | 1.2546 | 20 | Anthias Type 3 | 0.8375 |

Table 39. Continued.

| Rank | Cruise IS 7303 Species | Mean number under 10 $m^2$ | Rank | Cruise IS 7308 Species | Mean number under 10 $m^2$ |
|---|---|---|---|---|---|
| 1 | Etrumeus teres | 21.8486 | 1 | Opisthonema oglinum | 34.8836 |
| 2 | Bregmaceros Type A | 12.5413 | 2 | Sardinella anchovia | 28.0037 |
| 3 | Etropus rimosus | 11.2540 | 3 | Diplectrum formosum | 22.6062 |
| 4 | Bregmaceros Type B | 10.4840 | 4 | Decapterus punctatus | 19.5141 |
| 5 | Gonostoma elongatum | 6.8303 | 5 | Bregmaceros Type B | 19.0800 |
| 6 | Bothus robinsi | 5.3739 | 6 | Bothus robinsi | 17.5265 |
| 7 | Hemanthias vivanus | 5.1961 | 7 | Myctophum nitidulum | 14.8977 |
| 8 | Decapterus punctatus | 5.0685 | 8 | Maurolicus muelleri | 13.1905 |
| 9 | Citharichthys gymnorhinus | 5.0643 | 9 | Syacium papillosum | 12.800 |
| 10 | Benthosema suborbitale | 4.3634 | 10 | Harengula jaguana | 9.3562 |
| 11 | Trachurus lathami | 4.3281 | 11 | Bregmaceros Type A | 8.8782 |
| 12 | Lagodon rhomboides | 4.2076 | 12 | Hemanthias vivanus | 8.3878 |
| 13 | Diplectrum formosum | 3.6960 | 13 | Thunnus thynnus | 7.4300 |
| 14 | Syacium papillosum | 3.3128 | 14 | Cubiceps pauciradiatus | 6.3500 |
| 15 | Diogenichthys atlanticus | 3.0311 | 15 | Citharichthys cornutus | 5.2097 |
| 16 | Citharichthys cornutus | 3.0231 | 16 | Notolychnus valdiviae | 4.6471 |
| 17 | Notoscopelus caudispinosus | 2.3075 | 17 | Diogenichthys atlanticus | 4.0571 |
| 18 | Myctophum nitidulum | 2.1433 | 18 | Bregmaceros atlanticus | 3.6445 |
| 19 | Citharichthys macrops | 1.4238 | 19 | Anthias Type I | 3.1985 |
| 20 | Notolychnus valdiviae | 1.2049 | 20 | Ceratoscopelus warmingi | 3.0209 |

Table 39. Continued.

| Rank | Cruise IS 7311 Species | Mean number under 10 $m^2$ | Rank | Cruise IS 7313 Species | Mean number under 10 $m^2$ |
|---|---|---|---|---|---|
| 1 | Opisthonema oglinum | 68.9256 | 1 | Maurolicus muelleri | 54.6719 |
| 2 | Maurolicus muelleri | 36.5567 | 2 | Sardinella anchovia | 30.6708 |
| 3 | Sardinella anchovia | 20.4515 | 3 | Syacium papillosum | 24.3522 |
| 4 | Myctophum nitidulum | 12.6994 | 4 | Bregmaceros Type B | 22.1283 |
| 5 | Syacium papillosum | 12.4353 | 5 | Bothus robinsi | 13.3373 |
| 6 | Bothus robinsi | 7.5937 | 6 | Harengula jaguana | 10.8907 |
| 7 | Decapterus punctatus | 7.2152 | 7 | Decapterus punctatus | 9.1750 |
| 8 | Bregmaceros Type B | 6.1908 | 8 | Euthynnus alletteratus | 6.5416 |
| 9 | Notolychnus valdiviae | 6.1226 | 9 | Opisthonema oglinum | 6.1900 |
| 10 | Euthynnus alletteratus | 4.3226 | 10 | Auxis sp. | 4.2353 |
| 11 | Vinciguerria nimbaria | 4.1821 | 11 | Benthosema suborbitale | 3.8103 |
| 12 | Echiodon sp. | 2.6579 | 12 | Chloroscombrus chrysurus | 3.4178 |
| 13 | Diplectrum formosum | 2.4025 | 13 | Notolychnus valdiviae | 3.0875 |
| 14 | Bregmaceros atlanticus | 2.1771 | 14 | Diplectrum formosum | 3.0767 |
| 15 | Lampanyctus alatus | 1.9855 | 15 | Myctophum nitidulum | 2.9599 |
| 16 | Bregmaceros Type A | 1.8883 | 16 | Bregmaceros atlanticus | 2.8687 |
| 17 | Diogenichthys atlanticus | 1.8462 | 17 | Thunnus atlanticus | 2.6128 |
| 18 | Benthosema suborbitale | 1.7966 | 18 | Vinciguerria nimbaria | 1.9541 |
| 19 | Citharichthys cornutus | 1.6917 | 19 | Citharichthys gymnorhinus | 1.6274 |
| 20 | Vinciguerria poweriae | 1.5093 | 20 | Diogenichthys atlanticus | 1.5064 |

Table 39. Continued.

| Cruise IS 7320 | | | Cruise CL 7405 | | |
|---|---|---|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ | Rank | Species | Mean number under 10 $m^2$ |
| 1 | Bregmaceros Type B | 42.3174 | 1 | Orthopristis chrysoptera | 6.1280 |
| 2 | Syacium papillosum | 17.7151 | 2 | Diplectrum formosum | 4.4583 |
| 3 | Bothus robinsi | 16.6902 | 3 | Diplodus holbrooki | 2.2997 |
| 4 | Decapterus punctatus | 14.2195 | 4 | Lagodon rhomboides | 1.3272 |
| 5 | Echiodon sp. | 7.1642 | 5 | Centropristis striata | 1.3193 |
| 6 | Notolychnus valdiviae | 4.5351 | 6 | Etropus rimosus | 0.7104 |
| 7 | Diogenichthys atlanticus | 3.7970 | 7 | Harengula jaguana | 0.3891 |
| 8 | Gonostoma elongatum | 3.3872 | 8 | Citharichthys macrops | 0.3797 |
| 9 | Etropus rimosus | 3.0726 | 9 | Opisthonema oglinum | 0.3114 |
| 10 | Maurolicus muelleri | 2.6932 | 10 | Archosargus probatocephalus | 0.2416 |
| 11 | Benthosema suborbitale | 2.3484 | 11 | Cynoscion arenarius | 0.2303 |
| 12 | Citharichthys cornutus | 2.0267 | 12 | Menticirrhus saxatilis | 0.1277 |
| 13 | Citharichthys gymnorhinus | 1.8715 | 13 | Hippocampus erectus | 0.0595 |
| 14 | Ceratoscopelus warmingi | 1.7700 | 14 | Sphyraena borealis | 0.0586 |
| 15 | Etrumeus teres | 1.6958 | 15 | Syngnathus springeri | 0.0559 |
| 16 | Vinciguerria poweriae | 1.6754 | 16 | Leiostomus xanthurus | 0.0535 |
| 17 | Diplectrum formosum | 1.6309 | 17 | Syngnathus elucens | 0.0483 |
| 18 | Vinciguerria nimbaria | 1.2286 | 18 | Bothus robinsi | 0.0445 |
| 19 | Hildebrandia flava | 1.1843 | 19 | Syngnathus scovelli | 0.0372 |
| 20 | Citharichthys macrops | 0.8085 | 20 | Syngnathus louisianae | 0.0339 |

Table 39. Continued.

| | Cruise CL 7412 | |
|---|---|---|
| Rank | Species | Mean number under 10 $m^2$ |
| 1 | Sardinella anchovia | 144.1900 |
| 2 | Opisthonema oglinum | 30.8329 |
| 3 | Decapterus punctatus | 24.0273 |
| 4 | Diplectrum formosum | 22.2088 |
| 5 | Harengula jaguana | 14.4625 |
| 6 | Etrumeus teres | 5.5722 |
| 7 | Syacium papillosum | 5.0484 |
| 8 | Bregmaceros Type B | 4.9434 |
| 9 | Etropus rimosus | 3.2496 |
| 10 | Bothus robinsi | 3.1838 |
| 11 | Citharichthys macrops | 0.9922 |
| 12 | Serraniculus pumilio | 0.7373 |
| 13 | Echiodon sp. | 0.2732 |
| 14 | Syngnathus elucens | 0.2560 |
| 15 | Sphyraena borealis | 0.2509 |
| 16 | Achirus lineatus | 0.2433 |
| 17 | Chloroscombrus chrysurus | 0.2203 |
| 18 | Cyclopsetta fimbriata | 0.1977 |
| 19 | Menticirrhus saxatilis | 0.1707 |
| 20 | Membras martinicus | 0.1420 |

Table 40. Estimated apparent mortalities, abundances at selected lengths and percent mortalities between the two selected lengths for some common species of larval fishes collected in the eastern Gulf of Mexico. Estimates are based on exponential regressions of abundances on the standard lengths in the table.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances ($X 10^9$) | Percent mortality |
|---|---|---|---|---|---|
| Sardinella anchovia | 1971 | .4511 | 6.1-16.0 | $N_{6.5}$ = 1513.9 | 98.27 |
| | | | | $N_{15.5}$ = 26.1 | |
| | 1972 | .5166 | 6.1-16.0 | $N_{6.5}$ = 58,340.4 | 99.04 |
| | | | | $N_{15.5}$ = 558.3 | |
| | 1973 | .4675 | 6.1-16.0 | $N_{6.5}$ = 15,736.3 | 98.51 |
| | | | | $N_{15.5}$ = 234.1 | |
| Etrumeus teres (Houde, 1977a) | 1971-72 | .2269 | 5.1-16.0 | $N_{6.5}$ = 5216.7 | 87.02 |
| | | | | $N_{15.5}$ = 676.9 | |
| | 1972-73 | .3647 | 4.1-16.0 | $N_{6.5}$ = 5486.3 | 96.25 |
| | | | | $N_{15.5}$ = 206.0 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| Opisthonema oglinum (Houde, 1977b) | 1971 | .3545 | 4.1-19.0 | $N_{6.5}$ = 13,734.3 | 95.88 |
| | | | | $N_{15.5}$ = 565.2 | |
| | 1973 | .3942 | 5.1-20.0 | $N_{6.5}$ = 13,824.1 | 97.12 |
| | | | | $N_{15.5}$ = 398.0 | |
| Harengula jaguana (Houde, 1977c) | 1973 | .3829 | 3.1-20.0 | $N_{6.5}$ = 1119.0 | 96.81 |
| | | | | $N_{15.5}$ = 35.7 | |
| Maurolicus muelleri | 1971 | .2644 | 4.1-11.0 | $N_{4.5}$ = 2889.0 | 79.53 |
| | | | | $N_{10.5}$ = 591.4 | |
| | 1972 | .4500 | 4.1-11.0 | $N_{4.5}$ = 1610.9 | 93.28 |
| | | | | $N_{10.5}$ = 108.3 | |
| | 1973 | .4696 | 4.1-11.0 | $N_{4.5}$ = 15,514.5 | 94.03 |
| | | | | $N_{10.5}$ = 927.0 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| Notolychnus valdiviae | 1971-1973 | .6051 | 3.1-10.0 | $N_{3.5}$ = 18,479.8 | 97.35 |
| | | | | $N_{9.5}$ = 489.6 | |
| Myctophum nitidulum | 1971 | .6637 | 3.1-10.0 | $N_{3.5}$ = 8271.3 | 98.14 |
| | | | | $N_{9.5}$ = 154.2 | |
| | 1972 | .7050 | 3.1-10.0 | $N_{3.5}$ = 11,668.6 | 98.54 |
| | | | | $N_{9.5}$ = 169.9 | |
| | 1973 | .8997 | 3.1-10.0 | $N_{3.5}$ = 15,603.3 | 99.55 |
| | | | | $N_{9.5}$ = 70.6 | |
| Benthosema suborbitale | 1971 | .6408 | 3.1-8.0 | $N_{3.5}$ = 2091.9 | 92.29 |
| | | | | $N_{7.5}$ = 161.2 | |
| | 1972 | 1.0893 | 3.1-8.0 | $N_{3.5}$ = 29,352.9 | 98.72 |
| | | | | $N_{7.5}$ = 376.1 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| | 1973 | .6366 | 3.1-8.0 | $N_{3.5}$ = 7243.6 | 92.16 |
| | | | | $N_{7.5}$ = 567.6 | |
| Diogenichthys atlanticus | 1971-1973 | .7751 | 3.1-10.0 | $N_{3.5}$ = 13,912.9 | 99.04 |
| | | | | $N_{9.5}$ = 133.0 | |
| Bregmaceros atlanticus | 1971 | .5616 | 2.6-8.5 | $N_{2.8}$ = 1035.9 | 95.44 |
| | | | | $N_{8.3}$ = 47.2 | |
| | 1972 | .3937 | 2.6-8.5 | $N_{2.8}$ = 1420.0 | 88.53 |
| | | | | $N_{8.3}$ = 162.9 | |
| | 1973 | .4939 | 2.6-8.5 | $N_{2.8}$ = 1359.3 | 93.39 |
| | | | | $N_{8.3}$ = 89.9 | |
| Bregmaceros macclellandi | 1971-1973 | .5861 | 2.6-5.5 | $N_{2.8}$ = 591.2 | 76.90 |
| | | | | $N_{5.3}$ = 136.6 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| Bregmaceros Type A | 1971 | .8847 | 1.6-8.5 | $N_{1.8}$ = 4482.6 | 99.23 |
| | | | | $N_{7.3}$ = 34.5 | |
| | 1972 | .5262 | 1.6-8.5 | $N_{1.8}$ = 13,597.8 | 94.47 |
| | | | | $N_{7.3}$ = 752.4 | |
| | 1973 | .8796 | 1.6-8.5 | $N_{1.8}$ = 9001.8 | 99.21 |
| | | | | $N_{7.3}$ = 71.3 | |
| Bregmaceros Type B | 1971 | .7100 | 2.1-9.0 | $N_{2.3}$ = 17,101.5 | 98.59 |
| | | | | $N_{8.3}$ = 241.6 | |
| | 1972 | .4533 | 2.1-9.0 | $N_{2.3}$ = 6620.6 | 93.41 |
| | | | | $N_{8.3}$ = 436.2 | |
| | 1973 | .8314 | 2.1-9.0 | $N_{2.3}$ = 34,427.4 | 99.32 |
| | | | | $N_{8.3}$ = 234.7 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| *Diplectrum formosum* | 1971 | .7664 | 2.6-8.5 | $N_{2.8}$ = 8657.4 | 97.83 |
| | | | | $N_{7.8}$ = 187.5 | |
| | 1972 | .9016 | 2.6-8.5 | $N_{2.8}$ = 7930.6 | 98.90 |
| | | | | $N_{7.8}$ = 87.4 | |
| | 1973 | .8436 | 2.6-8.5 | $N_{2.8}$ = 9437.4 | 98.53 |
| | | | | $N_{7.8}$ = 139.0 | |
| *Decapterus punctatus* | 1971 | .8709 | 3.1-9.5 | $N_{3.3}$ = 7483.4 | 99.46 |
| | | | | $N_{9.3}$ = 40.3 | |
| | 1972 | 1.0668 | 3.1-9.5 | $N_{3.3}$ = 16,435.9 | 99.83 |
| | | | | $N_{9.3}$ = 27.3 | |
| | 1973 | .8281 | 3.1-9.5 | $N_{3.3}$ = 11,240.2 | 99.30 |
| | | | | $N_{9.3}$ = 78.2 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| Trachurus lathami | 1971-1973 | 1.0600 | 2.6-9.5 | $N_{2.8}$ = 3978.2 | 99.90 |
| | | | | $N_{9.3}$ = 4.1 | |
| Chloroscombrus chrysurus | 1971-1973 | 1.3051 | 2.6-5.5 | $N_{2.8}$ = 3039.6 | 96.17 |
| | | | | $N_{5.3}$ = 116.4 | |
| Orthopristis chrysoptera | 1971-1973 | 1.0730 | 5.6-9.0 | $N_{5.8}$ = 882.5 | 96.00 |
| | | | | $N_{8.8}$ = 35.3 | |
| Euthynnus alletteratus | 1971-1973 | .8963 | 3.1-9.0 | $N_{3.5}$ = 14,328.9 | 98.87 |
| | | | | $N_{8.5}$ = 162.2 | |
| Thunnus atlanticus | 1971-1973 | 1.0339 | 3.1-9.0 | $N_{3.5}$ = 10,783.8 | 99.43 |
| | | | | $N_{8.5}$ = 61.3 | |
| Citharichthys cornutus | 1971 | 0.4702 | 4.1-14.0 | $N_{4.5}$ = 5558.0 | 98.55 |
| | | | | $N_{13.5}$ = 80.7 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances ($X\ 10^9$) | Percent mortality |
|---|---|---|---|---|---|
| | 1972 | .2645 | 4.1-14.0 | $N_{4.5}$ = 2457.5 | 90.75 |
| | | | | $N_{13.5}$ = 227.3 | |
| | 1973 (Dowd, 1978) | .3249 | 41.-14.0 | $N_{4.5}$ = 3067.6 | 94.63 |
| | | | | $N_{13.5}$ = 164.8 | |
| Citharichthys macrops | 1971 | .5625 | 4.1-10.0 | $N_{4.5}$ = 1391.4 | 94.00 |
| | | | | $N_{9.5}$ = 83.5 | |
| | 1972 | .4114 | 4.1-10.0 | $N_{4.5}$ = 816.7 | 87.23 |
| | | | | $N_{9.5}$ = 104.4 | |
| | 1973 (Dowd, 1978) | .3875 | 4.1-10.0 | $N_{4.5}$ = 1559.4 | 85.59 |
| | | | | $N_{9.5}$ = 224.7 | |
| Citharichthys gymnorhinus | 1971 | .4443 | 4.1-12.0 | $N_{4.5}$ = 1078.0 | 95.54 |
| | | | | $N_{11.5}$ = 48.1 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances (X $10^9$) | Percent mortality |
|---|---|---|---|---|---|
| | 1972 | .4032 | 4.1-13.0 | $N_{4.5}$ = 1561.4 | 94.05 |
| | | | | $N_{11.5}$ = 92.8 | |
| | 1973 (Dowd, 1978) | .2741 | 4.1-12.0 | $N_{4.5}$ = 2455.5 | 88.32 |
| | | | | $N_{11.5}$ = 360.5 | |
| Etropus rimosus | 1971 | .4920 | 4.1-12.0 | $N_{4.5}$ = 10,594.1 | 96.81 |
| | | | | $N_{11.5}$ = 338.2 | |
| | 1972 | .5058 | 4.1-11.0 | $N_{4.5}$ = 5324.0 | 97.10 |
| | | | | $N_{11.5}$ = 154.3 | |
| | 1973 | .4393 | 4.1-12.0 | $N_{4.5}$ = 9108.0 | 95.38 |
| | | | | $N_{11.5}$ = 420.7 | |
| Syacium papillosum | 1971 | .5923 | 3.1-12.0 | $N_{3.3}$ = 12,576.9 | 99.13 |
| | | | | $N_{11.3}$ = 110.1 | |

Table 40. Continued.

| Species | Year | Mortality coefficient (Z) | Standard lengths (mm) | Estimated[a] abundances ($X 10^9$) | Percent mortality |
|---|---|---|---|---|---|
| | 1972 | .5748 | 3.1-12.0 | $N_{3.3}$ = 8554.2 | 98.99 |
| | | | | $N_{11.3}$ = 86.1 | |
| | 1973 (Dowd, 1978) | .5832 | 3.1-12.0 | $N_{3.3}$ = 28,567.9 | 99.06 |
| | | | | $N_{11.3}$ = 268.9 | |
| Bothus robinsi | 1971 | .4595 | 5.1-16.0 | $N_{5.5}$ = 4903.0 | 98.99 |
| | | | | $N_{15.5}$ = 49.5 | |
| | 1973 (Dowd, 1978) | .3983 | 5.1-16.0 | $N_{5.5}$ = 8587.4 | 98.14 |
| | | | | $N_{15.5}$ = 160.0 | |

[a]The subscripted numbers are the length-classes (mm) for which the abundance estimates are made.

Table 41. Estimates of biomass of some common fishes from the eastern Gulf of Mexico, based on egg or larval production estimates. Eggs and larvae were collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974.

| Species | Reference | Estimate from eggs or larvae | Year | Biomass estimates (metric tons) |
|---|---|---|---|---|
| Etrumeus teres | Houde, 1977a | Eggs | 1971-72 | 717,815 |
| E. teres | " | " | 1972-73 | 131,136 |
| Opisthonema oglinum | Houde, 1977b | Eggs | 1971 | 110,024 |
| O. oglinum | " | " | 1972 | 47,316 |
| O. oglinum | " | " | 1973 | 372,367 |
| Harengula jaguana | Houde, 1977c | Eggs | 1971 | 16,282 |
| H. jaguana | " | " | 1972 | 93,168 |
| H. jaguana | " | " | 1973 | 330,334 |
| Decapterus punctatus | Leak, 1977 | Larvae | 1971 | 83,942 |
| D. punctatus | " | " | 1972 | 248,666 |
| D. punctatus | " | " | 1973 | 147,394 |

Table 41. Continued.

| Species | Reference | Estimate from eggs or larvae | Year | Biomass estimates (metric tons) |
|---|---|---|---|---|
| Trachurus lathami | Leak, 1977 | Larvae | 1971-72 | 21,440 |
| T. lathami | " | " | 1972-73 | 27,700 |
| Syacium papillosum | | Larvae | 1971 | 78,730 |
| S. papillosum | | " | 1972 | 52,352 |
| S. papillosum | Dowd, 1978 | " | 1973 | 177,000 |
| Thunnus thynnus | | Larvae | 1972 | 48,416 |
| T. thynnus | | " | 1973 | 25,328 |

Table 42. The 20 most frequently collected, identified species of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974. These 20 species comprise 89.4% of all larvae that were identified to species and 37.3% of all larvae that were collected.

| Rank | Species | Number of larvae |
|---|---|---|
| 1 | Sardinella anchovia | 12,311 |
| 2 | Opisthonema oglinum | 11,315 |
| 3 | Decapterus punctatus | 4,431 |
| 4 | Diplectrum formosum | 3,963 |
| 5 | Harengula jaguana | 3,846 |
| 6 | Syacium papillosum | 3,317 |
| 7 | Bregmaceros Type B | 2,554 |
| 8 | Bothus robinsi | 1,955 |
| 9 | Etropus rimosus | 1,843 |
| 10 | Maurolicus muelleri | 1,102 |
| 11 | Etrumeus teres | 1,089 |
| 12 | Bregmaceros Type A | 962 |
| 13 | Chloroscombrus chrysurus | 774 |
| 14 | Orthopristis chrysoptera | 771 |
| 15 | Citharichthys cornutus | 765 |
| 16 | Citharichthys macrops | 637 |
| 17 | Myctophum nitidulum | 613 |
| 18 | Hemanthias vivanus | 395 |
| 19 | Serraniculus pumilio | 390 |
| 20 | Euthynnus alletteratus | 361 |
| | TOTAL | 53,394 |

Table 43. Estimated, weighted mean abundances for the 20 most frequently collected, identified fish larvae from 17 cruises to the eastern Gulf of Mexico, 1971-1974. The mean numbers under 10 $m^2$ of sea surface are given for <50 and >50 m depth zones and for the northern and southern sectors of the survey area. The weighting factors are the areas represented in each of the zones on each cruise.

| Species | Weighted Mean Abundance (number under 10 $m^2$) | | | |
|---|---|---|---|---|
| | <50 m | >50 m | North | South |
| Sardinella anchovia | 42.1144 | 0.7612 | 20.3615 | 30.9964 |
| Opisthonema oglinum | 30.7094 | 0.2980 | 6.6870 | 30.5058 |
| Decapterus punctatus | 12.5488 | 11.8138 | 9.5610 | 15.0375 |
| Diplectrum formosum | 11.5214 | 1.9116 | 5.6098 | 9.8125 |
| Harengula jaguana | 4.7855 | 0.0967 | 4.5759 | 1.2844 |
| Syacium papillosum | 6.5943 | 24.9596 | 10.4485 | 17.0807 |
| Bregmaceros Type B | 2.8984 | 31.6744 | 16.1689 | 11.5056 |
| Bothus robinsi | 4.0250 | 16.4701 | 5.7597 | 12.2956 |
| Etropus rimosus | 5.2858 | 3.6205 | 5.8299 | 3.3688 |
| Maurolicus muelleri | 0.0721 | 24.5544 | 14.5922 | 5.4154 |
| Etrumeus teres | 2.1029 | 7.1858 | 5.7524 | 4.2940 |
| Bregmaceros Type A | 0.0290 | 16.3308 | 3.8711 | 9.3690 |
| Chloroscombrus chrysurus | 1.6957 | 0.0000 | 0.3441 | 1.7315 |
| Orthopristis chrysoptera | 0.7378 | 0.0000 | 0.7184 | 0.2120 |
| Citharichthys cornutus | 0.1269 | 7.2283 | 2.1550 | 3.8988 |
| Citharichthys macrops | 1.8281 | 0.3340 | 0.8457 | 1.2677 |
| Myctophum nitidulum | 0.0802 | 12.1857 | 7.0138 | 4.3552 |
| Hemanthias vivanus | 0.0214 | 5.2881 | 0.6626 | 3.1154 |
| Serraniculus pumilio | 0.9595 | 0.0310 | 0.4841 | 0.6975 |
| Euthynnus alletteratus | 0.4233 | 4.1264 | 2.1344 | 1.6857 |

Table 44. Ninety-four species of larval fishes included in the taxocene used for diversity estimation. Individuals of these species were observed 10 or more times during the 17 cruises. Also given are the minimum and maximum surface temperatures, surface salinities and depths of occurrence for each of the species.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| Clupeidae | Etrumeus teres | 17 | 27 | 34 | 36 | 15 | 823 |
| | Opisthonema oglinum | 18 | 31 | 27 | 37 | 4 | 101 |
| | Harengula jaguana | 18 | 30 | 27 | 37 | 4 | 155 |
| | Sardinella anchovia | 21 | 32 | 27 | 36 | 4 | 146 |
| Gonostomatidae | Gonostoma elongatum | 21 | 30 | 23 | 36 | 46 | 3,329 |
| | Maurolicus muelleri | 21 | 30 | 23 | 36 | 46 | 3,292 |
| | Polymetme (?) Type I | 22 | 30 | 34 | 36 | 62 | 3,292 |
| | Vinciguerria nimbaria | 21 | 30 | 25 | 36 | 25 | 3,329 |
| | V. poweriae | 21 | 30 | 27 | 36 | 51 | 3,329 |
| | V. attenuata | 23 | 30 | 25 | 36 | 46 | 3,329 |
| Myctophidae | Notolychnus valdiviae | 23 | 30 | 26 | 37 | 48 | 3,329 |
| | Lampadena luminosa | 23 | 30 | 23 | 36 | 31 | 3,329 |
| | Lampanyctus alatus | 22 | 30 | 25 | 36 | 57 | 3,329 |
| | L. cuprarius | 24 | 30 | 32 | 36 | 66 | 2,926 |
| | Myctophum nitidulum | 18 | 30 | 23 | 36 | 25 | 3,329 |
| | M. selenops | 21 | 30 | 27 | 36 | 46 | 3,329 |

Table 44. Continued.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| | Hygophum reinhardti | 21 | 30 | 31 | 36 | 53 | 3,329 |
| | Ceratoscopelus warmingi | 22 | 30 | 31 | 36 | 40 | 3,292 |
| | Centrobranchus nigroocellatus | 22 | 30 | 31 | 36 | 64 | 3,329 |
| | Notoscopelus caudispinosus | 21 | 25 | 36 | 36 | 25 | 677 |
| | N. resplendens | 21 | 30 | 32 | 36 | 35 | 3,329 |
| | Lobiancha gemerelli | 25 | 30 | 31 | 36 | 71 | 3,329 |
| | Benthosema suborbitale | 21 | 30 | 23 | 36 | 51 | 3,329 |
| | Diogenichthys atlanticus | 22 | 30 | 23 | 36 | 49 | 3,329 |
| | Symbolophorus rufinus | 25 | 27 | 36 | 36 | 62 | 677 |
| Chlorophthalmidae | Chlorophthalmus agassizi | 23 | 29 | 34 | 36 | 46 | 3,256 |
| Muraenidae | Gymnothorax nigromarginatus | 23 | 30 | 32 | 37 | 15 | 2,926 |
| Nettastomidae | Hoplunnis diomedianus | 21 | 30 | 32 | 36 | 46 | 165 |
| Congridae | Ariosoma balearicum | 24 | 30 | 26 | 36 | 64 | 2,926 |
| | Paraconger caudilimbatus | 28 | 30 | 31 | 36 | 35 | 2,926 |
| | Hildebrandia flava | 26 | 30 | 26 | 36 | 146 | 677 |
| | H. gracilior | 22 | 30 | 31 | 36 | 57 | 2,926 |

Table 44. Continued.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| Ophichthidae | Myrophis punctatus | 16 | 26 | 34 | 36 | 16 | 823 |
| Hemiramphidae | Hyporhamphus unifasciatus | 16 | 30 | 27 | 36 | 9 | 155 |
| Exocoetidae | Parexocoetus brachypterus | 24 | 30 | 34 | 36 | 20 | 60 |
| | Prognichthys gibbifrons | 23 | 31 | 26 | 37 | 20 | 823 |
| Bregmacerotidae | Bregmaceros atlanticus | 21 | 30 | 23 | 36 | 25 | 3,292 |
| | B. type A | 21 | 30 | 32 | 36 | 25 | 3,256 |
| | B. Type B | 19 | 30 | 25 | 37 | 16 | 3,329 |
| | B. macclellandi | 22 | 30 | 31 | 36 | 25 | 3,292 |
| Syngnathidae | Hippocampus erectus | 16 | 29 | 30 | 36 | 7 | 66 |
| | Syngnathus elucens | 19 | 30 | 31 | 36 | 9 | 77 |
| | S. springeri | 16 | 29 | 33 | 36 | 9 | 53 |
| | S. louisianae | 17 | 25 | 31 | 37 | 5 | 15 |
| | S. scovelli | 17 | 30 | 27 | 36 | 4 | 20 |
| Atherinidae | Membras martinicus | 24 | 27 | 30 | 35 | 5 | 9 |
| Sphyraenidae | Sphyraena barracuda | 23 | 29 | 35 | 36 | 26 | 2,926 |
| | S. borealis | 20 | 29 | 33 | 36 | 9 | 165 |

Table 44. Continued.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| Serranidae | Anthias Type 1 | 22 | 29 | 34 | 36 | 24 | 677 |
| | A. Type 3 | 23 | 27 | 35 | 36 | 25 | 677 |
| | Diplectrum formosum | 17 | 32 | 31 | 37 | 9 | 155 |
| | Centropristis striata | 16 | 28 | 32 | 36 | 4 | 188 |
| | Hemanthias vivanus | 22 | 30 | 31 | 36 | 15 | 677 |
| | Pronotogrammus aurorubens | 21 | 30 | 31 | 36 | 22 | 677 |
| | Serraniculus pumilio | 22 | 31 | 33 | 37 | 9 | 155 |
| Carangidae | Caranx crysos | 29 | 30 | 31 | 36 | 46 | 1,646 |
| | Chloroscombrus chrysurus | 24 | 31 | 27 | 37 | 9 | 40 |
| | Decapterus punctatus | 20 | 32 | 27 | 37 | 9 | 3,292 |
| | Oligoplites saurus | 25 | 30 | 32 | 37 | 9 | 15 |
| | Selene vomer | 29 | 30 | 23 | 33 | 60 | 2,926 |
| | Trachurus lathami | 18 | 26 | 35 | 36 | 20 | 219 |
| Lutjanidae | Pristipomoides aquilonaris | 24 | 30 | 31 | 36 | 46 | 677 |
| Pomadasyidae | Orthopristis chrysoptera | 15 | 25 | 30 | 36 | 4 | 31 |

Table 44. Continued.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| Sciaenidae | Cynoscion arenarius | 18 | 30 | 32 | 36 | 5 | 16 |
| | C. nebulosus | 18 | 29 | 30 | 37 | 5 | 15 |
| | Leiostomus xanthurus | 15 | 27 | 30 | 36 | 4 | 58 |
| | Menticirrhus saxatilis | 19 | 29 | 33 | 36 | 7 | 20 |
| | Micropogon undulatus | 16 | 27 | 33 | 36 | 9 | 29 |
| Sparidae | Diplodus holbrooki | 16 | 18 | 34 | 35 | 4 | 15 |
| | Lagodon rhomboides | 15 | 26 | 33 | 36 | 7 | 64 |
| | Archosargus probatocephalus | 17 | 27 | 31 | 36 | 9 | 20 |
| Carapidae | Carapus bermudensis | 25 | 29 | 31 | 36 | 27 | 161 |
| | Echiodon sp. | 21 | 30 | 25 | 36 | 25 | 677 |
| Scombridae | Auxis sp. | 22 | 30 | 25 | 36 | 9 | 3,292 |
| | Euthynnus alletteratus | 24 | 30 | 23 | 36 | 18 | 2,926 |
| | Katsuwonus pelamis | 25 | 30 | 32 | 36 | 79 | 3,292 |
| | Thunnus atlanticus | 26 | 30 | 23 | 36 | 20 | 3,292 |
| | T. thynnus | 24 | 27 | 36 | 36 | 62 | 3,292 |
| | Scomberomorus maculatus | 23 | 30 | 27 | 36 | 9 | 46 |

Table 44. Continued.

| Family | Species | Temperature (°C) | | Salinity (°/oo) | | Depth (m) | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max |
| Stromateidae | Peprilus paru | 25 | 30 | 35 | 36 | 9 | 64 |
| Nomeidae | Cubiceps pauciradiatus | 22 | 30 | 30 | 36 | 27 | 3,292 |
| | Psenes pellucidus | 24 | 29 | 35 | 36 | 53 | 219 |
| Bothidae | Citharichthys cornutus | 21 | 30 | 25 | 36 | 22 | 3,329 |
| | C. macrops | 17 | 30 | 27 | 37 | 9 | 3,384 |
| | C. spilopterus | 23 | 30 | 32 | 36 | 25 | 2,926 |
| | C. gymnorhinus | 19 | 30 | 25 | 36 | 15 | 677 |
| | Cyclopsetta fimbriata | 23 | 30 | 30 | 37 | 9 | 2,698 |
| | Etropus rimosus | 16 | 30 | 31 | 37 | 9 | 329 |
| | Syacium papillosum | 19 | 32 | 25 | 37 | 5 | 2,835 |
| | Engyophrys senta | 29 | 30 | 25 | 34 | 64 | 1,646 |
| | Monolene sessilicauda | 23 | 29 | 35 | 36 | 25 | 188 |
| | Bothus robinsi | 17 | 32 | 25 | 37 | 5 | 3,329 |
| Soleidae | Achirus lineatus | 24 | 30 | 27 | 37 | 9 | 73 |
| | Gymnachirus melas | 22 | 27 | 33 | 36 | 15 | 53 |

Table 45. Frequency distribution of stations for species of larval fishes collected on five cruises to the eastern Gulf of Mexico in 1973. Frequencies are based only on the 94 relatively common species included in the taxocene used for diversity estimation. Frequencies and mean numbers of species per station are given for all stations and for stations in the < 50 and > 50 m depth zones. A summary distribution, based on all five cruises combined, also is presented.

| Cruise | Numbers of Species and Stations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | All stations | | | <50 m stations | | | >50 m stations | | |
| | Number of species | Number of stations | Mean species per station | Number of species | Number of stations | Mean species per station | Number of species | Number of stations | Mean species per station |
| IS 7303 | 0- 3 | 12 | | 0- 3 | 11 | | 0- 3 | 1 | |
| | 4- 7 | 22 | 6.43 | 4- 7 | 19 | 4.56 | 4- 7 | 3 | 10.18 |
| | 8-11 | 10 | | 8-11 | 4 | | 8-11 | 6 | |
| | 12-15 | 7 | | 12-15 | 0 | | 12-15 | 7 | |
| IS 7308 | 0- 3 | 2 | | 0- 3 | 2 | | 0- 3 | 0 | |
| | 4- 7 | 28 | | 4- 7 | 24 | | 4- 7 | 4 | |
| | 8-11 | 12 | 7.69 | 8-11 | 6 | 6.65 | 8-11 | 6 | 10.07 |
| | 12-15 | 4 | | 12-15 | 2 | | 12-15 | 2 | |
| | 16-19 | 1 | | 16-19 | 0 | | 16-19 | 1 | |
| | 20-23 | 2 | | 20-23 | 0 | | 20-23 | 2 | |
| IS 7311 | 0- 3 | 11 | | 0- 3 | 11 | | 0- 3 | 0 | |
| | 4- 7 | 26 | | 4- 7 | 19 | | 4- 7 | 7 | |
| | 8-11 | 5 | 7.43 | 8-11 | 4 | 5.94 | 8-11 | 1 | 10.41 |
| | 12-15 | 8 | | 12-15 | 0 | | 12-15 | 8 | |
| | 16-19 | 1 | | 16-19 | 0 | | 16-19 | 1 | |

Table 45. Continued.

| Cruise | All stations: Number of species | All stations: Number of stations | All stations: Mean species per station | <50 m stations: Number of species | <50 m stations: Number of stations | <50 m stations: Mean species per station | >50 m stations: Number of species | >50 m stations: Number of stations | >50 m stations: Mean species per station |
|---|---|---|---|---|---|---|---|---|---|
| IS 7313 | 0- 3 | 4 | 7.48 | 0- 3 | 4 | 6.26 | 0- 3 | 0 | 10.06 |
| | 4- 7 | 24 | | 4- 7 | 20 | | 4- 7 | 4 | |
| | 8-11 | 18 | | 8-11 | 10 | | 8-11 | 8 | |
| | 12-15 | 2 | | 12-15 | 0 | | 12-15 | 2 | |
| | 16-19 | 2 | | 16-19 | 0 | | 16-19 | 2 | |
| IS 7320 | 0- 3 | 11 | 6.04 | 0- 3 | 11 | 4.33 | 0- 3 | 0 | 9.17 |
| | 4- 7 | 26 | | 4- 7 | 18 | | 4- 7 | 8 | |
| | 8-11 | 9 | | 8-11 | 4 | | 8-11 | 5 | |
| | 12-15 | 4 | | 12-15 | 0 | | 12-15 | 4 | |
| | 16-19 | 1 | | 16-19 | 0 | | 17-19 | 1 | |
| All Five Cruises Combined | 0- 3 | 40 | 7.01 | 0- 3 | 39 | 5.56 | 0- 3 | 1 | 9.96 |
| | 4- 7 | 126 | | 4- 7 | 100 | | 4- 7 | 26 | |
| | 8-11 | 54 | | 8-11 | 28 | | 8-11 | 26 | |
| | 12-15 | 25 | | 12-15 | 2 | | 12-15 | 23 | |
| | 16-19 | 5 | | 16-19 | 0 | | 16-19 | 5 | |
| | 20-23 | 2 | | 20-23 | 0 | | 20-23 | 2 | |

Table 46. Estimates of Shannon-Weaver diversity (H'), evenness (J), Simpson's index of diversity (C) and species richness (R) for fish larvae collected in 17 cruises to the eastern Gulf of Mexico, 1971-1974. The number of species (S) and the number of individuals (N) used to obtain the estimates also are given. Species richness was estimated only for those cruises where number of stations and sampling pattern were alike.

| Cruise | Month | S | N | H' | J | C | R |
|---|---|---|---|---|---|---|---|
| GE 7101 | Feb. | 48 | 3,230 | 2.5761 | .6655 | .1142 | -- |
| 8C 7113-TI 7114 | May | 66 | 6,220 | 2.7930 | .6667 | .1003 | -- |
| GE 7117 | June | 30 | 732 | 2.4114 | .7090 | .1263 | -- |
| 8C 7120-TI 7121 | Aug. | 68 | 6,618 | 3.1948 | .7572 | .0654 | -- |
| TI 7131-8B 7132 | Nov. | 58 | 1,463 | 3.0115 | .7417 | .0793 | -- |
| 8B 7201-GE 7202 | Feb. | 48 | 875 | 2.7158 | .7016 | .1139 | -- |
| GE 7208 | May | 67 | 2,773 | 3.0568 | .7270 | .0601 | -- |
| GE 7210 | June | 19 | 1,487 | 1.0459 | .3552 | .5647 | -- |
| IS 7205 | Sept. | 53 | 5,936 | 2.0538 | .5173 | .2545 | -- |
| IS 7209 | Nov. | 51 | 1,333 | 2.7932 | .7104 | .1010 | 6.9491 |
| IS 7303 | Jan. | 53 | 1,875 | 3.0313 | .7635 | .0708 | 6.7672 |
| IS 7308 | May | 63 | 6,189 | 3.1696 | .7650 | .0608 | 7.1015 |
| IS 7311 | June-July | 57 | 5,669 | 2.5430 | .6289 | .1444 | 6.4794 |
| IS 7313 | Aug. | 57 | 4,195 | 2.7253 | .6741 | .1129 | 6.5934 |
| IS 7320 | Nov. | 54 | 1,709 | 2.6717 | .6698 | .1384 | 7.1201 |
| CL 7405 | Feb.-Mar. | 21 | 747 | 1.9508 | .6408 | .2004 | -- |
| CL 7412 | May | 33 | 8,437 | 1.6187 | .4629 | .3368 | -- |

Table 47. Analysis of variance to determine if there were significant differences in the evenness coefficients (J) among years for 14 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973. Cruise GE 7210 is not included in the analysis because only 13 stations were sampled on it and all were at depths < 50 m.

EVENNESS COEFFICIENTS

| | 1971 | 1972 | 1973 |
|---|---|---|---|
| | .6655 | .7016 | .7635 |
| | .6667 | .7270 | .7650 |
| | .7090 | .5173 | .6289 |
| | .7572 | .7104 | .6741 |
| | .7417 | | .6698 |
| Mean | .7080 | .6641 | .7003 |
| $S_{\bar{x}}$ | .0188 | .0492 | .0273 |

ANALYSIS OF VARIANCE

| Source | SS | d.f. | MS | F |
|---|---|---|---|---|
| Total | .0557 | 13 | | |
| Years | .0048 | 2 | .0024 | 0.522 n.s. |
| Within Years | .0509 | 11 | .0046 | |

$F_{.05(1)2,11} = 3.98$ $P > .50$

Table 48. Analysis of variance to determine if there were significant differences in the evenness coefficients (J) among seasons for 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

EVENNESS COEFFICIENTS

| | Winter | Spring | Summer | Fall |
|---|---|---|---|---|
| | .6655 | .6667 | .7090 | .7417 |
| | .7016 | .7270 | .7572 | .7104 |
| | .7635 | .7650 | .3552 | .6698 |
| | .6408 | .4629 | .5173 | |
| | | | .6289 | |
| | | | .6741 | |
| Mean | .6929 | .6554 | .6070 | .7073 |
| $S_{\bar{x}}$ | .0267 | .0673 | .0604 | .0207 |

ANALYSIS OF VARIANCE

| Source | SS | d.f. | MS | F |
|---|---|---|---|---|
| Total | .2026 | 16 | | |
| Seasons | .0278 | 3 | .0093 | 0.694 n.s. |
| Within Seasons | .1748 | 13 | .0134 | |

$F_{.05(1)3,13} = 3.41$ P > .50

Table 49. A comparison of ichthyoplankton diversity in the northern and southern sectors of the eastern Gulf of Mexico. Northern and southern sectors were designated by latitude 27$^{\circ}$15'N. Shannon-Weaver diversities (H'), evenness (J), Simpson's index of diversity (C) and species richness (R). The number of species (S) and number of individuals (N) used to obtain estimates also are given.

| Cruise | Month | NORTH | | | | | | SOUTH | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | N | H' | J | C | R | S | N | H' | J | C | R |
| 8C 7113-TI 7114 | May | 53 | 3,353 | 2.6976 | .6795 | .1007 | -- | 65 | 2,867 | 2.7500 | .6588 | .1113 | -- |
| 8C 7120-TI 7121 | Aug. | -- | -- | -- | -- | -- | -- | 60 | 3,923 | 3.1497 | .7693 | .0645 | -- |
| TI 7131 8B 7132 | Nov. | 53 | 1,120 | 2.9847 | .7518 | .0803 | -- | -- | -- | -- | -- | -- | -- |
| 8B 7201-GE 7202 | Feb. | 28 | 352 | 2.2340 | .6704 | .1724 | -- | 44 | 523 | 2.6671 | .7048 | .1094 | -- |
| GE 7208 | May | -- | -- | -- | -- | -- | -- | 59 | 2,108 | 3.1658 | .7764 | .0600 | -- |
| IS 7205 | Sept. | 40 | 2,759 | 2.0690 | .5609 | .2031 | -- | 44 | 3,177 | 1.9145 | .5059 | .2787 | -- |
| IS 7209 | Nov. | 37 | 556 | 2.5016 | .6928 | .1412 | 5.6955 | 45 | 777 | 2.7946 | .7341 | .0966 | 6.6111 |
| IS 7303 | Jan. | 38 | 810 | 2.5174 | .6920 | .1383 | 5.5248 | 44 | 1,065 | 3.1423 | .8304 | .0597 | 6.1686 |
| IS 7308 | May | 42 | 2,638 | 3.1399 | .8380 | .0594 | 5.2045 | 50 | 3,555 | 2.6360 | .6738 | .0872 | 5.5038 |
| IS 7311 | June-July | 41 | 1,078 | 2.4170 | .6509 | .1468 | 5.7283 | 48 | 4,591 | 2.3143 | .5978 | .2508 | 5.5741 |

Table 49. Continued.

| Cruise | Month | NORTH | | | | | | SOUTH | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | N | H' | J | C | R | S | N | H' | J | C | R |
| IS 7313 | Aug. | 47 | 2,437 | 2.3365 | .6069 | .1600 | 5.8986 | 51 | 1,759 | 2.7936 | .7105 | .0997 | 6.6912 |
| IS 7320 | Nov. | 38 | 724 | 2.2221 | .6109 | .2208 | 5.6190 | 46 | 985 | 2.7005 | .7053 | .1094 | 6.5287 |
| CL 7412 | May | 27 | 4,052 | 1.4189 | .4305 | .4066 | -- | 22 | 4,385 | 1.5816 | .5117 | .3109 | -- |

Table 50. Values of the evenness coefficient (J) for 10 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Values for the northern and southern sectors of the survey area are given and results of a paired-t test to determine if there were significant differences in evenness between the two sectors are presented.

| Cruise | Evenness (J) | | Difference (d) |
|---|---|---|---|
| | North | South | |
| 8C 7113-TI 7114 | .6795 | .6588 | +.0207 |
| 8B 7201-GE 7202 | .6704 | .7048 | -.0344 |
| IS 7205 | .5609 | .5059 | +.0550 |
| IS 7209 | .6928 | .7341 | -.0413 |
| IS 7303 | .6920 | .8304 | -.1384 |
| IS 7308 | .8380 | .6738 | +.1642 |
| IS 7311 | .6509 | .5978 | +.0531 |
| IS 7313 | .6069 | .7105 | -.1036 |
| IS 7320 | .6109 | .7053 | -.0944 |
| CL 7412 | .4305 | .5117 | -.0812 |

$\Sigma d = -.2003$

$\bar{d} = -.0200$

$S_{\bar{d}} = .0293$

$t_{.05(2)9} = 2.262$ $t = \bar{d}/S_{\bar{d}} = -0.682$

$P > .50$

Table 51. A comparison of ichthyoplankton diversity in the onshore (<50 m depth zone) and offshore (>50 m depth zone) sectors of the eastern Gulf of Mexico. Shannon-Weaver diversity (H'), evenness (J), Simpson's index of diversity (C) and species richness (R). The number of species (S) and number of individuals (N) used to obtain estimates also are given.

| Cruise | Month | <50 m | | | | | | >50 m | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | N | H' | J | C | R | S | N | H' | J | C | R |
| 8C 7113- TI 7114 | May | 41 | 4,477 | 2.0992 | .5653 | .1719 | -- | 55 | 1,743 | 3.0277 | .7556 | .0704 | -- |
| GE 7117 | June | 21 | 383 | 1.9302 | .6340 | .2481 | -- | 25 | 349 | 2.2986 | .7141 | .1531 | -- |
| 8C 7120- TI 7121 | Aug. | 32 | 2,805 | 2.0481 | .5910 | .1745 | -- | 63 | 3,813 | 3.2169 | .7764 | .0698 | -- |
| TI 7131- 8B 7132 | Nov. | 30 | 495 | 2.3407 | .6882 | .1337 | -- | 45 | 968 | 2.9802 | .7829 | .0838 | -- |
| 8B 7201 GE 7202 | Feb. | 19 | 348 | 1.9399 | .6589 | .1931 | -- | 44 | 527 | 2.7938 | .7383 | .0935 | -- |
| GE 7208 | May | 28 | 1,716 | 1.8542 | .5564 | .2132 | -- | 51 | 1,057 | 3.1688 | .8060 | .0737 | -- |
| IS 7205 | Sept. | 30 | 5,118 | 1.1605 | .3412 | .5421 | -- | 35 | 816 | 2.3065 | .6487 | .1471 | -- |
| IS 7209 | Nov. | 19 | 535 | 1.9916 | .6764 | .1672 | 2.8652 | 45 | 798 | 2.7102 | .7120 | .1144 | 6.5847 |
| IS 7303 | Jan. | 28 | 1,042 | 2.4266 | .7208 | .1160 | 3.8855 | 42 | 833 | 2.9808 | .7975 | .0841 | 6.0966 |
| IS 7308 | May | 27 | 5,119 | 1.9306 | .5858 | .1829 | 3.0442 | 46 | 1,070 | 3.1976 | .8352 | .0587 | 6.4512 |

Table 51. Continued.

| Cruise | Month | <50 m | | | | | | >50 m | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | N | H' | J | C | R | S | N | H' | J | C | R |
| IS 7311 | June-July | 23 | 4,733 | 1.2280 | .3916 | .4621 | 2.5998 | 45 | 936 | 2.7597 | .7250 | .1328 | 6.4312 |
| IS 7313 | Aug. | 25 | 3,125 | 1.9598 | .6088 | .2144 | 2.9824 | 42 | 1,070 | 2.3666 | .6332 | .1830 | 5.8778 |
| IS 7320 | Nov. | 24 | 559 | 2.1829 | .6869 | .1441 | 3.6357 | 44 | 1,150 | 2.5295 | .6684 | .1494 | 6.1014 |
| CL 7412 | May | 30 | 8,232 | 1.3761 | .4046 | .3958 | -- | -- | -- | -- | -- | -- | -- |

Table 52. Values of the evenness coefficient (J) for 13 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973. Values for <50 m and >50 m depth zones of the survey area are given and results of a paired-t test to determine if there were significant differences in evenness between the two zones are presented.

| Cruise | Evenness (J) | | Difference |
| --- | --- | --- | --- |
| | <50 m | >50 m | (d) |
| 8C 7113-TI 7114 | .5653 | .7556 | -.1903 |
| GE 7117 | .6340 | .7141 | -.0801 |
| 8C 7120-TI 7121 | .5910 | .7764 | -.1854 |
| TI 7131-8B 7132 | .6882 | .7829 | -.0947 |
| 8B 7201-GE 7202 | .6589 | .7383 | -.0794 |
| GE 7208 | .5564 | .8060 | -.2496 |
| IS 7205 | .3412 | .6487 | -.3075 |
| IS 7209 | .6764 | .7120 | -.0356 |
| IS 7303 | .7208 | .7975 | -.0767 |
| IS 7308 | .5858 | .8352 | -.2494 |
| IS 7311 | .3916 | .7250 | -.3334 |
| IS 7313 | .6088 | .6332 | -.0244 |
| IS 7320 | .6869 | .6684 | +.0185 |

$\Sigma d = -1.8086$

$\bar{d} = -0.1391$

$S_{\bar{d}} = 0.0339$

$t_{.05(2)12} = 2.179 \qquad t = \bar{d}/S_{\bar{d}} = -4.107$

$.001 < P > .002$

Table 53. Mean values of the evenness coefficient (J) for stations on transects off Sanibel Island (lat. 26°30'N) and off Tampa Bay (lat. 27°30'N) from 11 ichthyoplankton survey cruises. Results of the paired-t test to determine if there were significant differences in evenness between the two transects also are given.

| Cruise | Evenness (J) Sanibel | Evenness (J) Tampa | Difference (d) |
|---|---|---|---|
| 8C 7113-TI 7114 | .6898 | .6699 | +.0199 |
| 8C 7120-TI 7121 | .7416 | .7796 | -.0380 |
| TI 7131-8B 7132 | .7474 | .6919 | +.0555 |
| GE 7208 | .6560 | .7613 | -.1053 |
| IS 7205 | .6264 | .6338 | -.0074 |
| IS 7209 | .7415 | .6974 | +.0441 |
| IS 7303 | .7321 | .6398 | +.0923 |
| IS 7308 | .5654 | .6662 | -.1008 |
| IS 7311 | .6548 | .6466 | +.0082 |
| IS 7313 | .7011 | .7719 | -.0708 |
| IS 7320 | .6462 | .7281 | -.0819 |

$\Sigma d = -.1694$

$\bar{d} = -.0154$

$S_{\bar{d}} = .0204$

$t_{.05(2)10} = 2.228 \qquad t = \bar{d}/S_{\bar{d}} = -0.754$

$P > .20$

Table 54. Within cruise comparisons, using Student's t test, to determine if there are significant differences in Shannon-Weaver diversity coefficients (H') between <50 m and >50 m areas, and between North and South sectors of the survey area. The diversity estimates are based on a taxocene of 94 possible species of fish larvae collected in the eastern Gulf of Mexico, 1971-1974.

| Cruise | Shannon-Weaver Coefficient | | t | d.f. | Probability level | Shannon-Weaver Coefficient | | t | d.f. | Probability level |
|---|---|---|---|---|---|---|---|---|---|---|
| | <50 m | >50 m | | | | North | South | | | |
| 8C 7113- TI 7114 | 2.0992 | 3.0277 | 28.24 | 3,049 | P<.001 | 2.6976 | 2.7500 | 1.72 | 4,343 | .05<P<.10 |
| GE 7117 | 1.9302 | 2.2986 | 4.60 | 625 | P<.001 | -- | -- | -- | -- | -- |
| 8C 7120- TI 7121 | 2.0481 | 3.2169 | 43.53 | 6,414 | P<.001 | -- | -- | -- | -- | -- |
| TI 7131- 8B 7132 | 2.3047 | 2.9801 | 10.55 | 1,051 | P<.001 | -- | -- | -- | -- | -- |
| 8B 7201- GE 7202 | 1.9399 | 2.7938 | 11.08 | 785 | P<.001 | 2.2340 | 2.6671 | 4.99 | 744 | P <001 |
| GE 7208 | 1.8542 | 3.1688 | 31.44 | 2,350 | P<.001 | -- | -- | -- | -- | -- |
| GE 7210 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| IS 7205 | 1.1605 | 2.3065 | 24.13 | 1,149 | P<.001 | 2.0690 | 1.9145 | 4.15 | 6,403 | P<.001 |
| IS 7209 | 1.9916 | 2.7102 | 11.97 | 1,326 | P<.001 | 2.5016 | 2.7946 | 4.24 | 1,145 | P<.001 |
| IS 7303 | 2.4266 | 2.9808 | 12.51 | 1,837 | P<.001 | 2.5174 | 3.1423 | 11.95 | 1,288 | P<.001 |
| IS 7308 | 1.9306 | 3.1976 | 36.27 | 1,493 | P<.001 | 3.1321 | 2.6360 | 15.06 | 5,773 | P<.001 |
| IS 7311 | 1.2280 | 2.7597 | 32.23 | 1,342 | P<.001 | 2.4170 | 2.3143 | 2.23 | 2,101 | .025<P<.05 |
| IS 7313 | 1.9598 | 2.3666 | 8.49 | 1,560 | P<.001 | 2.3365 | 2.7936 | 10.95 | 4,121 | P<.001 |
| IS 7320 | 2.1829 | 2.5295 | 5.98 | 1,441 | P<.001 | 2.2221 | 2.7005 | 7.01 | 1,405 | P<.001 |
| CL 7405 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CL 7412 | -- | -- | -- | -- | -- | 1.4189 | 1.5816 | 5.74 | 8,063 | P<.001 |

Table 55. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 94 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are pooled from all 17 cruises, 1971-1974 (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Etrumeus teres | -- | -- | -- | -- | -- |
| Harengula jaguana | -- | -.22* | -- | +.22* | +.23* |
| Opisthonema oglinum | +.26** | +.24** | -- | -.22** | -- |
| Sardinella anchovia | -- | +.15* | -- | -- | -- |
| Gonostoma elongatum | -- | -- | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- | -- |
| Polymetme (?) Type I | -- | -- | -- | -- | -- |
| Vinciguerria nimbaria | +.44** | -.33** | +.27* | +.36** | -- |
| Vinciguerria poweriae | -- | -- | +.32* | -- | -- |
| Vinciguerria attenuata | -- | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- | -- |
| Lampadena luminosa | +.51** | -- | +.51** | -- | -- |
| Lampanyctus alatus | -- | -- | -- | -- | -- |
| Lampanyctus cuprarius | -- | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | +.19* | -- | -- |
| Myctophum selenops | -- | -- | +.58** | -- | -- |

Table 55. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Hygophum reinhardti | -- | -- | -- | -- | +.44* |
| Ceratoscopelus warmingi | -- | -- | -- | -- | -.37* |
| Centrobranchus nigroocellatus | -- | -- | -- | -- | -- |
| Notoscopelus caudispinosus | -- | -- | -- | -- | -- |
| Notoscopelus resplendens | -- | -- | -- | -- | -- |
| Lobiancha gemellari | -- | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -- | -- |
| Symbolophorus rufinus | -- | -- | -- | -- | -- |
| Chlorophthalmus agassizi | +.88** | -- | -- | +.69* | -- |
| Gymnothorax nigromarginatus | -- | -- | -- | -- | -- |
| Hoplunnis diomedianus | -- | -- | -- | -- | -- |
| Ariosomma balearicum | -- | -- | -- | -- | -- |
| Paraconger caudilimbatus | -- | -- | -- | -- | -- |
| Hildebrandia flava | -- | -- | -- | -- | -- |
| Hildebrandia gracilior | -- | -- | -- | +.37 | -- |
| Myrophis punctatus | +.60 | -- | -- | -- | -.57 |

Table 55. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Hyporhamphus unifasciatus | -- | -- | -- | -- | -- |
| Parexocoetus brachypterus | -- | -- | -- | -- | -- |
| Prognichthys gibbifrons | +.44* | -.54** | +.46* | +.54** | -.60* |
| Bregmaceros atlanticus | -- | -- | -- | -- | -- |
| Bregmaceros Type A | -- | -- | -- | -- | -- |
| Bregmaceros Type B | +.13* | -.14* | -- | +.28** | -- |
| Bregmaceros macclellandi | -- | -- | -- | -- | -- |
| Hippocampus erectus | -- | -- | +.67** | -- | -- |
| Syngnathus elucens | +.38 | -- | +.49** | +.30* | -- |
| Syngnathus springeri | -- | -- | +.38* | +.43** | -- |
| Syngnathus louisianae | -- | -- | -- | -- | -- |
| Syngnathus scovelli | -- | -- | -- | +.61** | -- |
| Membras martinicus | +.99* | -- | -- | -- | -- |
| Sphyraena barracuda | -- | -- | -- | -- | -- |
| Sphyraena borealis | -- | -- | -- | +.58 | -- |
| Anthias Type I | -- | -- | +.50** | +.43* | -- |
| Anthias Type III | +.73* | -- | -- | +.75* | -- |
| Diplectrum formosum | -.18** | -- | -- | -- | -- |

Table 55. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Centropristis striata | -- | -- | -- | -- | -- |
| Hemanthias vivanus | -- | -- | -- | -- | -- |
| Pronotogrammus aureorubens | -- | -- | -- | +.40* | -- |
| Serraniculus pumilio | +.21* | -- | +.17* | -- | -- |
| Caranx crysos | -- | -- | -- | -- | -- |
| Chloroscombrus chrysurus | +.36** | -- | -- | -- | -- |
| Decapterus punctatus | +.09* | +.12** | -- | -- | -- |
| Oligoplites saurus | -- | -- | -- | -- | -- |
| Selene vomer | -- | -- | -- | -- | -- |
| Trachurus lathami | -- | -- | -- | +.31* | -- |
| Pristipomoides aquilonaris | -- | -- | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | +.24* | -- | -- |
| Cynoscion arenarius | -- | -- | -- | -- | -- |
| Cynoscion nebulosus | -- | -- | -- | -- | -- |
| Leiostomus xanthurus | -- | -- | -- | -- | -- |
| Menticirrhus saxatilis | -- | +.67* | -- | -- | -- |
| Micropogon undulatus | -- | -- | -- | -- | -- |

Table 55. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Diplodus holbrooki | -- | -- | -- | -- | -- |
| Lagodon rhomboides | -- | +.34* | +.48** | -- | -- |
| Archosargus probatocephalus | -- | -- | -.49* | -- | -- |
| Carapus bermudensis | -- | -- | -- | -- | -- |
| Echiodon sp. | +.20* | -- | -- | +.20* | -- |
| Auxis sp. | +.20* | -.26** | -- | +.28** | -- |
| Euthynnus alletteratus | +.22* | -.41** | +.24** | +.26** | -.29* |
| Katsuwonus pelamis | -- | -- | -- | -- | -- |
| Thunnus atlanticus | -- | -- | -- | -- | -- |
| Thunnus thynnus | -- | -- | -- | -- | -- |
| Scomberomorus maculatus | -- | -- | -- | -- | -- |
| Peprilus paru | -- | -- | -- | -- | -- |
| Cubiceps pauciradiatus | -- | -- | -- | +.41* | -- |
| Psenes pellucidus | -- | -- | -- | -- | -- |
| Citharichthys cornutus | +.22* | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- | +.22* |
| Citharichthys spilopterus | +.93** | -.94** | -- | +.94** | -- |
| Citharichthys gymnorhinus | -- | -- | +.29** | -- | -.38** |

Table 55. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Latitude | Log plankton volume |
|---|---|---|---|---|---|
| Cyclopsetta fimbriata | -- | -- | -- | -- | -- |
| Etropus rimosus | -- | +.15* | -- | -- | +.23* |
| Syacium papillosum | +.37** | -.20** | -- | -- | -- |
| Engyrophrys senta | -- | -- | -- | -- | -- |
| Monolene sessilicauda | -- | -- | +.77** | +.76** | -- |
| Bothus robinsi | +.23** | -- | -- | -- | -- |
| Achirus lineatus | -- | -- | -- | -- | -- |
| Gymnachirus melas | -- | -- | -- | -- | -- |

Table 56. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 32 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled winter (Jan-Mar) cruises, 1971-1974 (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | +.51** | -- | +.42* |
| Sardinella anchovia | +.60* | -- | -- | -- |
| Gonostoma elongatum | -- | -- | +.81** | -- |
| Vinciguerria nimbaria | -- | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Hygophum reinhardti | -.78* | -- | -- | -- |
| Ceratoscopelus warmingi | -- | +.70* | -- | -- |
| Notoscopelus caudispinosus | -- | -- | -- | -- |
| Notoscopelus resplendens | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -- |
| Myrophis punctatus | -- | -- | -- | -- |
| Bregmaceros atlanticus | -- | -- | -- | -- |
| Bregmaceros Type A | -- | +.46* | -- | -.58* |

Table 56. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
| --- | --- | --- | --- | --- |
| Bregmaceros Type B | -- | +.45** | +.48** | -- |
| Dipelctrum formosum | -- | -- | -- | -- |
| Centropristis striata | -- | -- | -- | -- |
| Hemanthias vivanus | -- | +.70* | +.86** | -- |
| Pronotogrammus aureorubens | -- | -- | +.55* | -- |
| Decapterus punctatus | -- | -- | -- | -- |
| Trachurus lathami | -- | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- | -- |
| Lagodon rhomboides | -- | +.29* | +.47** | -- |
| Echiodon sp. | -- | -- | +.80** | -- |
| Citharichthys cornutus | -.59* | +.87** | -- | -- |
| Citharichthys macrops | -- | -- | +.36 | -- |
| Citharichthys gymnorhinus | -- | +.58* | -- | -- |
| Etropus rimosus | -- | -- | -- | -- |
| Bothus robinsi | -- | +.44 | -- | -- |

Table 57. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 44 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled spring (May) cruises, 1971-1974 (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | -- | -- | -- |
| Harengula jaguana | -- | -- | -- | -- |
| Opisthonema oglinum | +.19* | +.28** | -- | -- |
| Sardinella anchovia | -- | -- | -- | -- |
| Gonostoma elongatum | -- | -- | -- | +.94* |
| Maurolicus muelleri | -- | -- | -- | -- |
| Vinciguerria nimbaria | -- | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Vinciguerria attenuata | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Lampadena luminosa | -- | -- | -- | +.85* |
| Lampanyctus alatus | -.76* | -- | -- | -- |
| Lampanyctus cuprarius | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Myctophum selenops | -- | -- | +.68* | -- |
| Hygophum reinhardti | -- | -- | -- | -- |

Table 57. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Ceratoscopelus warmingi | -- | -- | -- | -- |
| Centrobranchus nigroocellatus | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | +.51** | -- |
| Diogenichthys atlanticus | -- | -- | -- | -- |
| Bregmaceros atlanticus | -- | -- | -- | -- |
| Bregmaceros Type A | -- | -- | -- | +.63* |
| Bregmaceros Type B | -- | -.43** | -- | -- |
| Bregmaceros macclellandi | -- | -- | -- | -- |
| Sphyraena borealis | +.75** | -- | -- | -- |
| Diplectrum formosum | -.19* | -- | -- | +.26* |
| Centropristis striata | -- | -- | -- | -- |
| Hemanthias vivanus | -- | -- | -- | -- |
| Pronotogrammus aureorubens | +.59* | -.47* | -- | -- |
| Serraniculus pumilio | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- | -- |
| Orthopristis chrysoptera | -.50** | -- | -- | +.70* |
| Cynoscion nebulosus | -- | -- | -- | -- |
| Leiostomus xanthurus | -- | -- | -- | -- |

Table 57. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Echiodon sp. | -- | -- | -- | -- |
| Auxis sp. | -- | -- | -- | -- |
| Euthynnus alletteratus | -- | -- | -- | -- |
| Cubiceps pauciradiatus | -- | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | +.25* | -- |
| Citharichthys gymnorhinus | -- | +.36* | -- | -- |
| Etropus rimosus | -- | -- | -- | +.40 |
| Syacium papillosum | -- | -- | -- | -- |
| Bothus robinsi | -- | +.30** | -- | -- |

Table 58. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 25 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled early summer (June-July) cruises, 1971-1974 (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Harengula jaguana | -- | -- | -- | -- |
| Opisthonema oglinum | -- | +.41** | -- | +.39* |
| Sardinella anchovia | -- | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- |
| Vinciguerria nimbaria | -- | -- | -- | -.77* |
| Notolychnus valdiviae | -- | +.80* | -- | -- |
| Myctophum nitidulum | -- | -.83** | -- | -- |
| Hygophum reinhardti | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -- |
| Bregmaceros atlanticus | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Serraniculus pumilio | -- | -- | -- | +.63* |
| Decapterus punctatus | -- | -- | -- | -- |
| Echiodon sp. | -- | -- | -- | -- |

Table 58. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Auxis sp. | -- | -- | -- | -- |
| Euthynnus alletteratus | -- | -.52** | +.55** | -- |
| Thunnus atlanticus | -- | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -.57* | -- | -- |
| Citharichthys gymnorhinus | -- | -- | -- | -- |
| Cyclopsetta fimbriata | -- | -.64* | +.89** | -- |
| Syacium papillosum | -- | -.38** | +.42** | -- |
| Bothus robinsi | -- | -- | -- | -- |

Table 59. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 44 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled late summer (Aug-Sept) cruises, 1971-1974 (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Harengula jaguana | -- | -.59** | -- | -- |
| Opisthonema oglinum | -- | -- | -- | -- |
| Sardinella anchovia | ---- | -- | -- | -- |
| Gonostoma elongatum | -- | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- |
| Vinciguerria nimbaria | +.53* | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Vinciguerria attenuata | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Lampadena luminosa | -- | -- | +.61* | -- |
| Lampanyctus alatus | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Myctophum selenops | -- | -- | +.80** | -- |
| Ceratoscopelus warmingi | -- | -- | -- | -- |
| Centrobranchus nigroocellatus | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |

Table 59. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Diogenichthys atlanticus | -- | -- | -- | -- |
| Gymnothorax nigromarginatus | -- | -- | -- | -.71* |
| Paraconger caudilimbatus | -- | -- | -- | -- |
| Hildebrandia gracilior | -- | -- | -- | -- |
| Bregmaceros atlanticus | -- | -- | -- | -- |
| Bregmaceros Type A | -.54** | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Bregmaceros macclellandi | -- | -- | +.83* | -- |
| Sphyraena barracuda | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | +.23 | -- |
| Serraniculus pumilio | -- | -- | -- | -- |
| Chloroscombrus chrysurus | -- | -- | -- | -- |
| Decapterus punctatus | -.21** | +.16* | -- | -.25* |
| Selene vomer | -- | -- | -- | -- |
| Echiodon sp. | -- | -- | -- | -- |
| Auxis sp. | -- | -.36** | -- | -.56** |
| Euthynnus alletteratus | -- | -.39** | +.25* | -.49** |
| Thunnus atlanticus | -- | -- | -- | -- |

Table 59. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Cubiceps pauciradiatus | -- | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -.45* | -- | +.36* | -- |
| Citharichthys gymnorhinus | -- | -- | -- | -- |
| Cyclopsetta fimbriata | -- | -- | -- | -- |
| Syacium papillosum | -- | -- | -- | -- |
| Bothus robinsi | -- | -- | -- | -- |

Table 60. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 32 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled fall (Nov) cruises, 1971-1974 (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | -- | -- | -- |
| Sardinella anchovia | -- | -- | -- | -- |
| Gonostoma elongatum | +.71** | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- |
| Vinciguerria nimbaria | -- | -- | +.69** | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Lampanyctus alatus | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Myctophum selenops | -- | -- | -- | -- |
| Hygophum reinhardti | -- | -- | -- | -- |
| Ceratoscopelus warmingi | -- | -- | -- | -- |
| Centrobranchus nigroocellatus | -- | -- | -- | -- |
| Benthosema suborbitale | +.57** | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -.71* |
| Myrophis punctatus | -- | -- | -- | -- |

Table 60. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Bregmaceros atlanticus | -- | -- | -- | -- |
| Bregmaceros Type A | +.49* | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | +.49** | -- |
| Centropristis striata | -- | -- | -- | -- |
| Hemanthias vivanus | -- | -- | -- | -- |
| Serraniculus pumilio | -- | -- | -- | -- |
| Decapterus punctatus | +.31** | +.21* | -- | -- |
| Leiostomus xanthurus | -- | -- | -- | -- |
| Echiodon sp. | -- | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Citharichthys gymnorhinus | +.56** | -- | +.51* | -.59** |
| Etropus rimosus | -- | -- | -- | -- |
| Syacium papillosum | +.43** | -- | -- | -.27* |
| Bothus robinsi | +.32** | +.21* | -- | -- |

Table 61. Cruise GE 7101. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Etrumeus teres | -- | -- | -- |
| Bregmaceros Type A | +.87* | -- | -- |
| Bregmaceros Type B | -- | -- | +.80* |
| Diplectrum formosum | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- |
| Trachurus lathami | +.66* | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- |
| Lagodon rhomboides | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- |
| Etropus rimosus | -- | -- | -- |
| Bothus robinsi | -- | -- | -- |

Table 62. Cruise 8C 7113-TI 7114. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 26 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Etrumeus teres | -- | -- | -- |
| Harengula jaguana | -- | -- | -.63* |
| Opisthonema oglinum | -- | -- | -.38** |
| Sardinella anchovia | -- | -- | -- |
| Vinciguerria nimbaria | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- |
| Myctophum nitidulum | -- | -- | +.66** |
| Ceratoscopelus warmingi | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- |
| Diogenichthys altanticus | -- | -- | -- |
| Bregmaceros Type A | -- | -- | +.60** |
| Bregmaceros Type B | -- | -.57** | +.41* |
| Diplectrum formosum | -.30** | -- | -- |
| Centropristis striata | -- | -- | -- |
| Hemanthias vivanus | -- | -.50* | -- |
| Serraniculus pumilio | -- | -- | -- |

Table 62. Continued.

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Decapterus punctatus | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- |
| Echiodon sp. | -- | -- | -- |
| Citharichthys cornutus | -- | -- | +.51** |
| Citharichthys macrops | -- | -- | -- |
| Citharichthys gymnorhinus | -- | -- | -- |
| Etropus rimosus | -- | -- | -- |
| Syacium papillosum | -- | -- | -- |
| Bothus robinsi | -- | -- | -- |

Table 63. Cruise GE 7117. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 7 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Opisthonema oglinum | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- |
| Decapterus punctatus | -.61* | -- | -- |
| Euthynnus alletteratus | -- | -- | -- |
| Syacium papillosum | -- | -- | -- |
| Bothus robinsi | -- | -- | -- |

Table 64. Cruise 8C 7120-TI 7121. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 29 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Harengula jaguana | -- | -- | -- |
| Opisthonema oglinum | -- | -- | -- |
| Sardinella anchovia | -- | -- | -.38* |
| Gonostoma elongatum | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- |
| Vinciguerria nimbaria | +.56* | -- | +.55* |
| Notolychnus valdiviae | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- |
| Myctophum Selenops | -- | -- | +.81** |
| Benthosema suborbitale | -- | -- | -- |
| Gymnothorax nigromarginatus | -- | -- | -- |
| Paraconger caudilimbatus | -- | -- | -- |
| Bregmaceros Type A | -.72** | -- | -- |
| Bregmaceros Type B | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- |
| Serraniculus pumilio | -- | -- | -- |
| Chloroscombrus chrysurus | -- | -- | -.40* |

Table 64. Continued.

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Decapterus punctatus | -- | -- | -- |
| Echiodon sp. | -- | -- | -- |
| Auxis sp. | -- | -.50** | -- |
| Euthynnus alletteratus | -- | -.58** | +.31* |
| Thunnus atlanticus | -- | -- | -- |
| Cubiceps pauciradiatus | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- |
| Citharichthys gymnorhinus | -- | -- | -- |
| Cyclopsetta fimbriata | -- | -- | -- |
| Syacium papillosum | -- | -- | -- |
| Bothus robinsi | -- | -- | -- |

Table 65. Cruise TI 7131-8B 7132. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 22 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Etrumeus teres | -- | -- | -- |
| Sardinella anchovia | -- | -- | -- |
| Gonostoma elongatum | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- |
| Bregmaceros atlanticus | +.70* | -- | -- |
| Bregmaceros Type A | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- |
| Hemanthias vivanus | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- |
| Echiodon sp. | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- |

Table 65. Continued.

| Species | Surface temperature | Surface salinity | Station depth |
|---|---|---|---|
| Citharichthys macrops | -- | -- | -- |
| Citharichthys gymnorhinus | -- | -- | -- |
| Etropus rimosus | -- | -- | -- |
| Syacium papillosum | -- | -- | -- |
| Bothus robinsi | -.47* | -- | -- |

Table 66. Cruise 8B 7201-GE 7202. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 8 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | -- | -- | +.64* |
| Bregmaceros Type A | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- | -- |
| Trachurus lathami | -- | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- | -- |
| Lagodon rhomboides | -- | -- | -- | -- |

Table 67. Cruise GE 7208. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 20 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Opisthonema oglinum | -- | -- | -- | -- |
| Sardinella anchovia | -- | -- | -- | -- |
| Vinciguerria nimbaria | -- | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Ceratoscopelus warmingi | +.91** | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -- |
| Bregmaceros Type A | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | +.52* | -- | -- |
| Hemanthias vivanus | -- | -- | -- | -- |
| Serraniculus pumilio | -- | +.82* | -- | -- |
| Decapterus punctatus | -- | +.53* | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- |

Table 67. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etropus rimosus | -- | -- | -- | -- |
| Syacium papillosum | -- | +.54* | -- | -- |
| Bothus robinsi | -- | -- | -- | -- |

Table 68. Cruise GE 7210. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 4 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Opisthonema oglinum | -- | -- | +.72* | +.70* |
| Diplectrum formosum | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- | -- |
| Syacium papillosum | -- | -- | +.79 | -- |

Table 69. Cruise IS 7205. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 13 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Sardinella anchovia | -- | -- | -- | -- |
| Gymnothorax nigromarginatus | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Serraniculus pumilio | -- | +.49* | -- | -- |
| Chloroscombrus chrysurus | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | +.60** | -- |
| Auxis sp. | -- | -- | -- | -- |
| Euthynnus alletteratus | -- | -- | +.72** | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Cyclopsetta fimbriata | -- | -.63* | -- | -- |
| Syacium papillosum | +.51** | -- | +.38* | -- |
| Bothus robinsi | +.42* | -- | -- | -- |

Table 70. Cruise IS 7209. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 12 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Benthosema suborbitale | -- | -- | -- | -- |
| Bregmaceros Type A | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Hemanthias vivanus | -- | -- | +.95* | -- |
| Decapterus punctatus | +.75** | +.55** | +.47* | -- |
| Echiodon sp. | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Citharichthys gymnorhinus | +.74* | +.77** | -- | -.77** |
| Etropus rimosus | -- | -- | -- | -- |
| Syacium papillosum | +.61** | -- | -- | -.52** |
| Bothus robinsi | +.54** | -- | -- | -- |

Table 71. Cruise IS 7303. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | +.71** | -- | -- |
| Bregmaceros Type A | +.76** | -- | -- | -.84** |
| Bregmaceros Type B | +.62** | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | -- | -- |
| Trachurus lathami | -- | -- | -- | -- |
| Orthopristis chrysoptera | +.63* | +.79** | -- | -- |
| Lagodon rhomboides | +.54** | +.60** | +.56** | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Etropus rimosus | -- | +.39 | -- | -- |
| Bothus robinsi | +.67** | +.57** | -- | -- |

Table 72. Cruise IS 7308. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 18 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* $P < .05$; ** $P < .01$).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Harengula jaguana | -- | -- | -- | -- |
| Opisthonema oglinum | +.49* | -- | -- | -- |
| Sardinella anchovia | -- | -- | -- | -- |
| Notolychnus valdiviae | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Bregmaceros Type A | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Serraniculus pumilio | -- | -- | +.68* | -- |
| Decapterus punctatus | +.39* | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- | -- |
| Citharichthys cornutus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | +.59** | -- |
| Citharichthys gymnorhinus | -- | -- | -- | -- |
| Etropus rimosus | -- | +.61* | -- | -- |

Table 72. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Syacium papillosum | -- | -- | -- | -- |
| Bothus robinsi | -- | +.51** | -- | -- |

Table 73. Cruise IS 7311. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 9 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Opisthonema oglinum | -- | +.53* | +.48* | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | -- | -- |
| Serraniculus pumilio | -- | -- | -- | +.67* |
| Decapterus punctatus | -- | -- | -- | -- |
| Euthynnus alletteratus | -- | -.82** | +.71** | -- |
| Citharichthys macrops | -- | -.71 | +.79 | -- |
| Syacium papillosum | +.39* | -.51** | +.37* | -- |
| Bothus robinsi | -- | -- | -- | |

Table 74. Cruise IS 7313. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 20 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Harengula jaguana | -- | -.62* | -- | -- |
| Opisthonema oglinum | -- | -- | -- | -- |
| Sardinella anchovia | -- | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- |
| Myctophum nitidulum | -- | -- | -- | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | +.47* | -- |
| Serraniculus pumilio | -- | -- | +.63* | -- |
| Chloroscombrus chrysurus | -- | -- | -- | -- |
| Decapterus puncatatus | -- | +.40* | -- | -.54** |
| Echiodon sp. | -- | -- | -- | -- |
| Auxis sp. | -- | -- | +.61 | -.72** |
| Euthynnus alletteratus | -- | -.43* | -- | -.60** |
| Thunnus atlanticus | -- | -- | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- |

Table 74. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Citharichthys gymnorhinus | -- | -- | -- | -- |
| Cyclopsetta fimbriata | -- | -- | +.96** | -- |
| Syacium papillosum | -- | -- | -- | -- |
| Bothus robinsi | -- | -- | +.40* | +.41* |

Table 75. Cruise IS 7320. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 18 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Etrumeus teres | -- | -- | -- | -- |
| Sardinella anchovia | +.91* | -- | -- | -- |
| Gonostoma elongatum | -- | -- | -- | -- |
| Maurolicus muelleri | -- | -- | -- | -- |
| Vinciguerria poweriae | -- | -- | -- | -- |
| Notolychnus valdiviae | +.90** | +.75* | +.75** | -- |
| Benthosema suborbitale | -- | -- | -- | -- |
| Diogenichthys atlanticus | -- | -- | -- | -.80 |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | +.78** | -- |
| Decapterus punctatus | +.47** | -- | +.51** | -- |
| Echiodon sp. | -- | -- | +.58* | -- |
| Citharichthys cornutus | -- | -.89** | -- | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Citharichthys gymnorhinus | -- | -- | -- | -- |
| Etropus rimosus | -- | -- | -- | -- |

Table 75. Continued.

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
| --- | --- | --- | --- | --- |
| Syacium papillosum | +.71** | +.45* | -- | -- |
| Bothus robinsi | +.66** | +.47** | +.36* | -- |

Table 76. Cruise CL 7405. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 4 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Diplectrum formosum | -- | -- | -- | -- |
| Orthopristis chrysoptera | -- | -- | -- | -- |
| Lagodon rhomboides | -- | -- | +.90* | -- |
| Citharichthys macrops | -- | -- | -- | -- |

Table 77. Cruise CL 7412. Significant correlations between the logarithm of abundance (no. under 10 $m^2$) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

| Species | Surface temperature | Surface salinity | Station depth | Log plankton volume |
|---|---|---|---|---|
| Harengula jaguana | -- | -- | -- | -- |
| Opisthonema oglinum | +.50* | +.55** | -- | -- |
| Sardinella anchovia | -- | -- | -- | +.51* |
| Bregmaceros Type B | -- | -- | -- | -- |
| Diplectrum formosum | -- | -- | +.61** | -- |
| Serraniculus pumilio | -- | -- | -- | -- |
| Decapterus punctatus | -- | -- | +.51** | -- |
| Citharichthys macrops | -- | -- | -- | -- |
| Etropus rimosus | -- | -- | -- | -- |
| Syacium papillosum | -- | -- | +.91** | -- |
| Bothus robinsi | -- | -- | +.65* | -- |

Table 78. The percentage cumulative frequencies of station occurrences for the 20 most often sampled, identified species of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974, in relation to surface temperature, surface salinity and station depth.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies | | |
|---|---|---|---|---|
| | | Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
| Clupeidae | Sardinella anchovia | 21.0-23.9-- 18% | 27.0-28.9-- 1% | <10-- 6% |
| | | 24.0-26.9-- 46% | 29.0-30.9-- 1% | 11- 30-- 56% |
| | | 27.0-29.9-- 80% | 31.0-32.9-- 2% | 31- 50-- 90% |
| | | 30.0-32.0--100% | 33.0-34.9-- 16% | 51- 70-- 96% |
| | | | 35.0-36.9--100% | 71- 146--100% |
| Clupeidae | Opisthonema oglinum | 18.0-20.9-- 3% | 27.0-28.9-- 1% | <10-- 13% |
| | | 21.0-23.9-- 15% | 29.0-30.9-- 1% | 11- 30-- 77% |
| | | 24.0-26.9-- 60% | 31.0-32.9-- 5% | 31- 50-- 96% |
| | | 27.0-29.9-- 88% | 33.0-34.9-- 15% | 51- 101--100% |
| | | 30.0-31.9--100% | 35.0-36.9-- 95% | |
| | | | ≥37.0--100% | |
| Carangidae | Decapterus punctatus | 20.0-22.9-- 3% | 27.0-28.9-- <1% | <10-- 3% |
| | | 23.0-25.9-- 46% | 29.0-30.9-- 1% | 11- 30-- 38% |
| | | 26.0-28.9-- 66% | 31.0-32.9-- 4% | 31- 50-- 68% |
| | | 29.0-31.9-->99% | 33.0-34.9-- 15% | 51- 70-- 87% |
| | | ≥32.0--100% | 35.0-36.9-- 99% | 71- 90-- 90% |
| | | | ≥37.0--100% | 91-3,292--100% |
| Serranidae | Diplectrum formosum | 17.0-19.9-- 1% | 31.0-32.9-- 1% | <10-- 2% |
| | | 20.0-22.9-- 9% | 33.0-34.9-- 13% | 11- 30-- 50% |
| | | 23.0-25.9-- 54% | 35.0-36.9-- 99% | 31- 50-- 84% |
| | | 26.0-28.9-- 72% | ≥37.0--100% | 51- 70-- 97% |
| | | 29.0-31.9-->99% | | 71- 155--100% |
| | | ≥32.0--100% | | |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies: Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
|---|---|---|---|---|
| Clupeidae | Harengula jaguana | 18.0-20.9-- 6% | 27.0-28.9-- 1% | <10-- 29% |
| | | 21.0-23.9-- 19% | 29.0-30.9-- 2% | 11- 30-- 92% |
| | | 24.0-26.9-- 62% | 31.0-32.9-- 9% | 31- 50-- 97% |
| | | 27.0-29.9-- 82% | 33.0-34.9-- 31% | 51- 155--100% |
| | | 30.0-30.9--100% | 35.0-36.0-- 96% | |
| | | | ≥37.0--100% | |
| Bothidae | Syacium papillosum | 19.0-21.9-- 1% | 25.0-26.9-- <1% | <10-- <1% |
| | | 22.0-24.9-- 17% | 27.0-28.9-- 1% | 11- 30-- 18% |
| | | 25.0-27.9-- 47% | 29.0-30.9-- 1% | 31- 50-- 51% |
| | | 28.0-30.9-- 99% | 31.0-32.9-- 6% | 51- 70-- 75% |
| | | 31.0-32.0--100% | 33.0-34.9-- 15% | 71- 90-- 79% |
| | | | 35.0-36.9-- 99% | 91- 110-- 83% |
| | | | ≥37.0--100% | 111- 130-- 86% |
| | | | | 131- 170-- 93% |
| | | | | 171-1,000-- 99% |
| | | | | ≥1,001--100% |
| Bregmacerotidae | Bregmaceros Type B | 19.0-21.9-- 6% | 25.0-26.9-- 1% | 11- 30-- 4% |
| | | 22.0-24.9-- 29% | 27.0-28.9-- 1% | 31- 50-- 36% |
| | | 25.0-27.9-- 63% | 29.0-30.9-- 1% | 51- 70-- 74% |
| | | 28.0-30.9--100% | 31.0-32.9-- 8% | 71- 90-- 80% |
| | | | 33.0-34.9-- 14% | 91- 110-- 85% |
| | | | 35.0-36.9-->99% | 111- 150-- 89% |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies: Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
|---|---|---|---|---|
| | | | ≥37.0--100% | 151- 200-- 96% |
| | | | | 201-1,000-- 99% |
| | | | | ≥1,001--100% |
| Bothidae | Bothus robinsi | 17.0-19.9-- 2% | 25.0-26.9-- <1% | <10-- 1% |
| | | 20.0-22.9-- 7% | 27.0-28.9-- 1% | 11- 30-- 18% |
| | | 23.0-25.9-- 37% | 29.0-30.9-- 1% | 31- 50-- 49% |
| | | 26.0-28.9-- 60% | 31.0-32.9-- 5% | 51- 70-- 74% |
| | | 29.0-31.9-->99% | 33.0-34.9-- 13% | 71- 90-- 78% |
| | | ≥32.0--100% | 35.0-36.9-- 99% | 91- 110-- 82% |
| | | | ≥37.0--100% | 111- 130-- 84% |
| | | | | 131- 170-- 93% |
| | | | | 171-1,000-- 99% |
| | | | | ≥1,0001--100% |
| Bothidae | Etropus rimosus | 16.0-18.9-- 6% | 31.0-32.9-- 1% | <10-- 2% |
| | | 19.0-21.9-- 14% | 33.0-34.9-- 12% | 11- 30-- 25% |
| | | 22.0-24.9-- 55% | 35.0-36.9-->99% | 31- 50-- 64% |
| | | 25.0-27.9-- 90% | ≥37.0--100% | 51- 70-- 89% |
| | | 28.0-30.9--100% | | 71- 90-- 92% |
| | | | | 91- 110-- 96% |
| | | | | 111- 329--100% |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies | | |
|---|---|---|---|---|
| | | Surface temperature ($^{o}C$) | Surface salinity ($^{o}/oo$) | Station depth (m) |
| Gonostomatidae | Maurolicus muelleri | 21.0-23.9-- 6% | 23.0-24.9-- 1% | 31- 50-- 2% |
| | | 24.0-26.9-- 38% | 25.0-26.9-- 2% | 51- 70-- 5% |
| | | 27.0-29.9-- 85% | 27.0-28.9-- 5% | 71- 90-- 10% |
| | | 30.0-30.9--100% | 29.0-30.9-- 5% | 91- 110-- 15% |
| | | | 31.0-32.9-- 20% | 111- 130-- 20% |
| | | | 33.0-34.9-- 27% | 131- 170-- 63% |
| | | | 35.0-36.9--100% | 171- 500-- 84% |
| | | | | 501-1,000-- 93% |
| | | | | ≥1,001--100% |
| Clupeidae | Etrumeus teres | 17.0-19.9-- 6% | 34.0-35.9-- 19% | 11- 30-- 8% |
| | | 20.0-22.9-- 28% | 36.0-36.9--100% | 31- 50-- 39% |
| | | 23.0-25.9-- 87% | | 51- 70-- 70% |
| | | 26.0-27.9--100% | | 71- 90-- 77% |
| | | | | 91- 110-- 86% |
| | | | | 111- 130-- 87% |
| | | | | 131- 170-- 98% |
| | | | | 171- 823--100% |
| Bregmacerotidae | Bregmaceros Type A | 21.0-23.9-- 15% | 32.0-33.9-- 4% | 11- 30-- 2% |
| | | 24.0-26.9-- 61% | 34.0-35.9-- 27% | 31- 50-- 6% |
| | | 27.0-29.9-- 99% | 36.0-36.9--100% | 51- 70-- 27% |
| | | 30.0-30.9--100% | | 71- 90-- 40% |
| | | | | 91- 110-- 58% |
| | | | | 111- 150-- 78% |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies: Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
|---|---|---|---|---|
| | | | | 151- 200-- 89% |
| | | | | 201-1,000-- 97% |
| | | | | ≥1,001--100% |
| Carangidae | Chloroscombrus chrysurus | 24.0-26.9-- 11% | 27.0-28.9-- 1% | <10-- 14% |
| | | 27.0-29.9-- 64% | 29.0-30.9-- 1% | 11- 30-- 93% |
| | | 30.0-31.9--100% | 31.0-32.9-- 6% | 31- 40--100% |
| | | | 33.0-34.9-- 11% | |
| | | | 35.0-36.9-- 94% | |
| | | | 37.0-37.9--100% | |
| Pomadasyidae | Orthopristis chrysoptera | 15.0-17.9-- 16% | 30.0-31.9-- 4% | <10-- 16% |
| | | 18.0-20.9-- 48% | 32.0-33.9-- 22% | 11- 30-- 96% |
| | | 21.0-23.9-- 75% | 34.0-35.9-- 71% | 31--100% |
| | | 24.0-25.9--100% | 36.0-36.9--100% | |
| Bothidae | Citharichthys cornutus | 21.0-23.9-- 13% | 25.0-26.9-- 1% | 11- 30-- 3% |
| | | 24.0-26.9-- 58% | 27.0-28.9-- 1% | 31- 50-- 8% |
| | | 27.0-29.9-- 92% | 29.0-30.9-- 1% | 51- 70-- 19% |
| | | 30.0-30.9--100% | 31.0-32.9-- 7% | 71- 90-- 30% |
| | | | 33.0-34.9-- 13% | 91- 110-- 45% |
| | | | 35.0-36.9--100% | 111- 150-- 66% |
| | | | | 151- 200-- 86% |
| | | | | 201-1,000-- 99% |
| | | | | ≥1,001--100% |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies: Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
|---|---|---|---|---|
| Bothidae | Citharichthys macrops | 17.0-19.9-- 4% | 27.0-28.9-- 1% | <10-- 4% |
| | | 20.0-22.9-- 18% | 29.0-30.9-- 1% | 11- 30-- 76% |
| | | 23.0-25.9-- 64% | 31.0-32.9-- 4% | 31- 50-- 96% |
| | | 26.0-28.9-- 81% | 33.0-34.9-- 18% | 51- 70-- 98% |
| | | 29.0-30.9--100% | 35.0-36.9-- 97% | 71-3,384--100% |
| | | | 37.0-37.9--100% | |
| Myctophidae | Myctophum nitidulum | 18.0-20.9-- 1% | 23.0-24.9-- 1% | 11- 30-- 1% |
| | | 21.0-23.9-- 10% | 25.0-26.9-- 2% | 31- 50-- 3% |
| | | 24.0-26.9-- 47% | 27.0-28.9-- 3% | 51- 70-- 16% |
| | | 27.0-29.9-- 84% | 29.0-30.9-- 3% | 71- 90-- 21% |
| | | 30.0-30.9--100% | 31.0-32.9-- 16% | 91- 110-- 30% |
| | | | 33.0-34.9-- 29% | 111- 150-- 49% |
| | | | 35.0-36.9--100% | 151- 200-- 68% |
| | | | | 201-1,000-- 89% |
| | | | | ≥1,001--100% |
| Serranidae | Hemanthias vivanus | 22.0-24.9-- 25% | 31.0-32.9-- 1% | 11- 30-- 4% |
| | | 25.0-27.9-- 84% | 33.0-34.9-- 4% | 31- 50-- 6% |
| | | 28.0-30.9--100% | 35.0-36.9--100% | 51- 70-- 27% |
| | | | | 71- 90-- 37% |
| | | | | 91- 110-- 48% |
| | | | | 111- 150-- 73% |
| | | | | 151- 200-- 87% |
| | | | | 201- 677--100% |

Table 78. Continued.

| Family | Species | Station Occurrences--Percentage Cumulative Frequencies | | |
|---|---|---|---|---|
| | | Surface temperature (°C) | Surface salinity (°/oo) | Station depth (m) |
| Serranidae | Serraniculus pumilio | 22.0-24.9-- 24% | 33.0-34.9-- 13% | <10-- 4% |
| | | 25.0-27.9-- 46% | 35.0-36.9-- 98% | 11- 30-- 74% |
| | | 28.0-30.9-- 99% | 37.0-37.9--100% | 31- 50-- 97% |
| | | ≥31.0--100% | | 51- 70-- 99% |
| | | | | 71- 155--100% |
| Scombridae | Euthynnus alletteratus | 24.0-26.9-- 8% | 23.0-24.9-- 1% | 11- 30-- 10% |
| | | 27.0-29.9-- 74% | 25.0-26.9-- 2% | 31- 50-- 33% |
| | | 30.0-30.9--100% | 27.0-28.9-- 4% | 51- 70-- 60% |
| | | | 29.0-30.9-- 5% | 71- 90-- 67% |
| | | | 31.0-32.9-- 20% | 91- 110-- 71% |
| | | | 33.0-34.9-- 35% | 111- 150-- 77% |
| | | | 35.0-36.9--100% | 151- 200-- 87% |
| | | | | 201-1,000-- 97% |
| | | | | ≥1,001--100% |

Table 79. Observed and expected frequencies of occurrence for 14 species of larval fishes from the eastern Gulf of Mexico in the <50 and 50-100 m depth zones for areas where $\geq$ 36.5°/oo salinity water was present. Data are part of a contingency chi-square analysis in which adjusted observed frequencies (adjusted to 1,000 stations sampled) in three depth zones (< 50 m, 50-100 m, and > 100 m) were tested for independence of occurrence between two salinity conditions (< 36.5°/oo and $\geq$ 36.5°/oo--Loop Current).

| Species | Occurrences at $\geq$ 36.5°/oo for <50 and 50-100 m depths | | Total Chi-square[a] | Chi-square component for <50 and 50-100 m depths |
|---|---|---|---|---|
| | Adjusted observed frequencies | Expected frequencies | | |
| Hemanthias vivanus | 125 | 122.62 | 3.12 n.s. | 3.08 |
| Bregmaceros atlanticus | 188 | 144.40 | 44.51 ** | 36.45 |
| Bregmaceros macclellandi | 0 | 9.21 | 59.74 ** | 56.60 |
| Bregmaceros Type A | 375 | 370.67 | 16.42 ** | 16.31 |
| Bregmaceros Type B | 655 | 735.97 | 81.13 ** | 41.07 |
| Diogenichthys atlanticus | 31 | 19.95 | 10.37 ** | 9.81 |
| Benthosema suborbitale | 63 | 59.94 | 0.32 n.s. | 0.29 |
| Notolychnus valdiviae | 31 | 54.37 | 25.69 ** | 23.33 |
| Myctophum nitidulum | 281 | 214.45 | 64.61 ** | 51.15 |

Table 79. Continued.

| Species | Occurrences at ≥ 36.5°/oo for <50-100 m depths | | Total Chi-square[a] | Chi-square component for <50 and 50-100 m depths |
| --- | --- | --- | --- | --- |
| | Adjusted observed frequencies | Expected frequencies | | |
| Diaphus spp. | 530 | 510.98 | 2.48 n.s. | 1.72 |
| Maurolicus muelleri | 63 | 60.82 | 0.18 n.s. | 0.16 |
| Gonostoma elongatum | 31 | 21.15 | 9.74 ** | 9.24 |
| Vinciguerria nimbaria | 125 | 121.09 | 6.24 * | 6.17 |
| Auxis sp. | 250 | 262.02 | 35.53 ** | 34.80 |

[a] n.s. = not significant; * = P < .05; ** = P < .01.

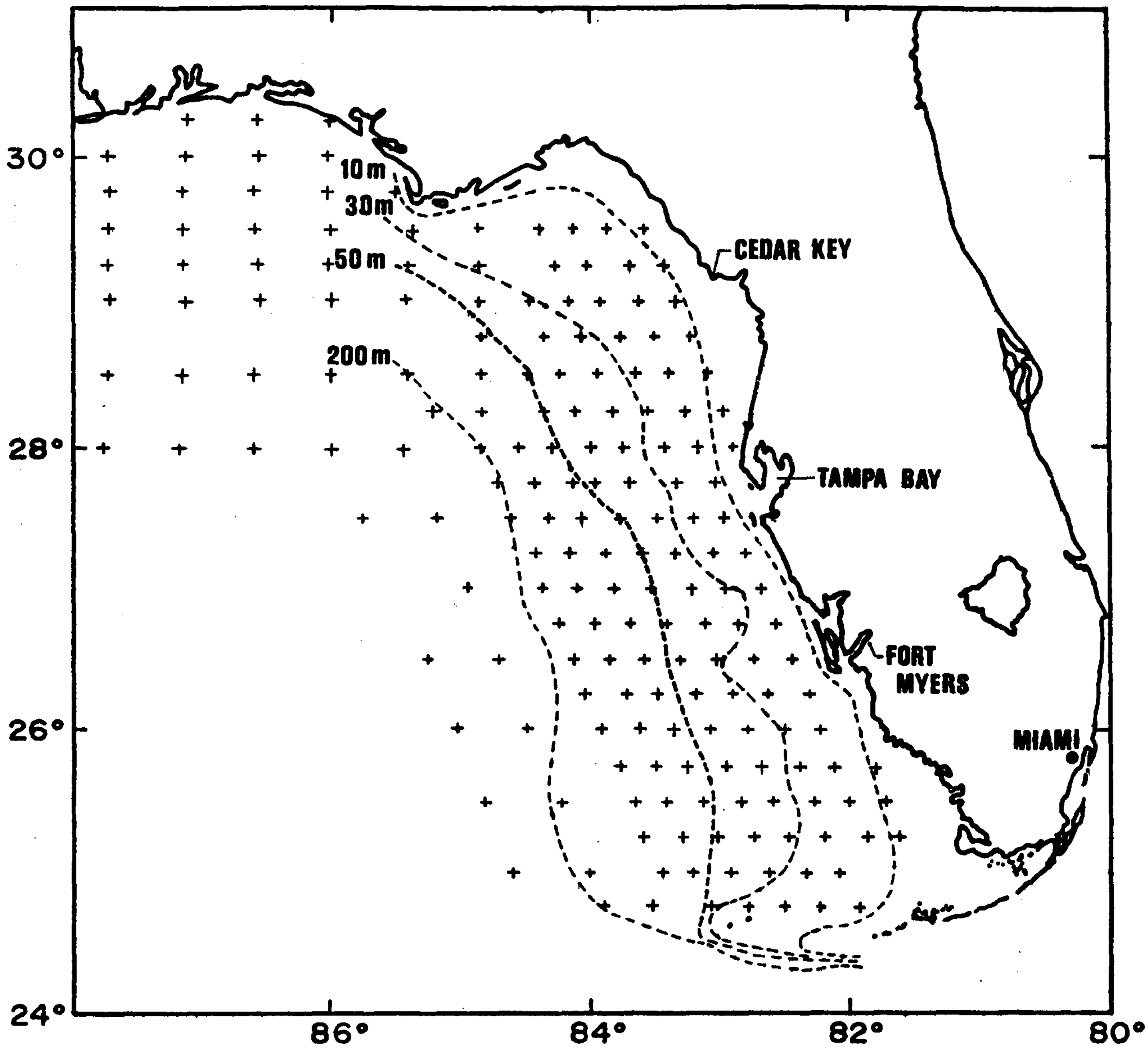



Fig. 1 Chart of eastern Gulf of Mexico ichthyoplankton survey area, with potential sampling stations and depth contours indicated.

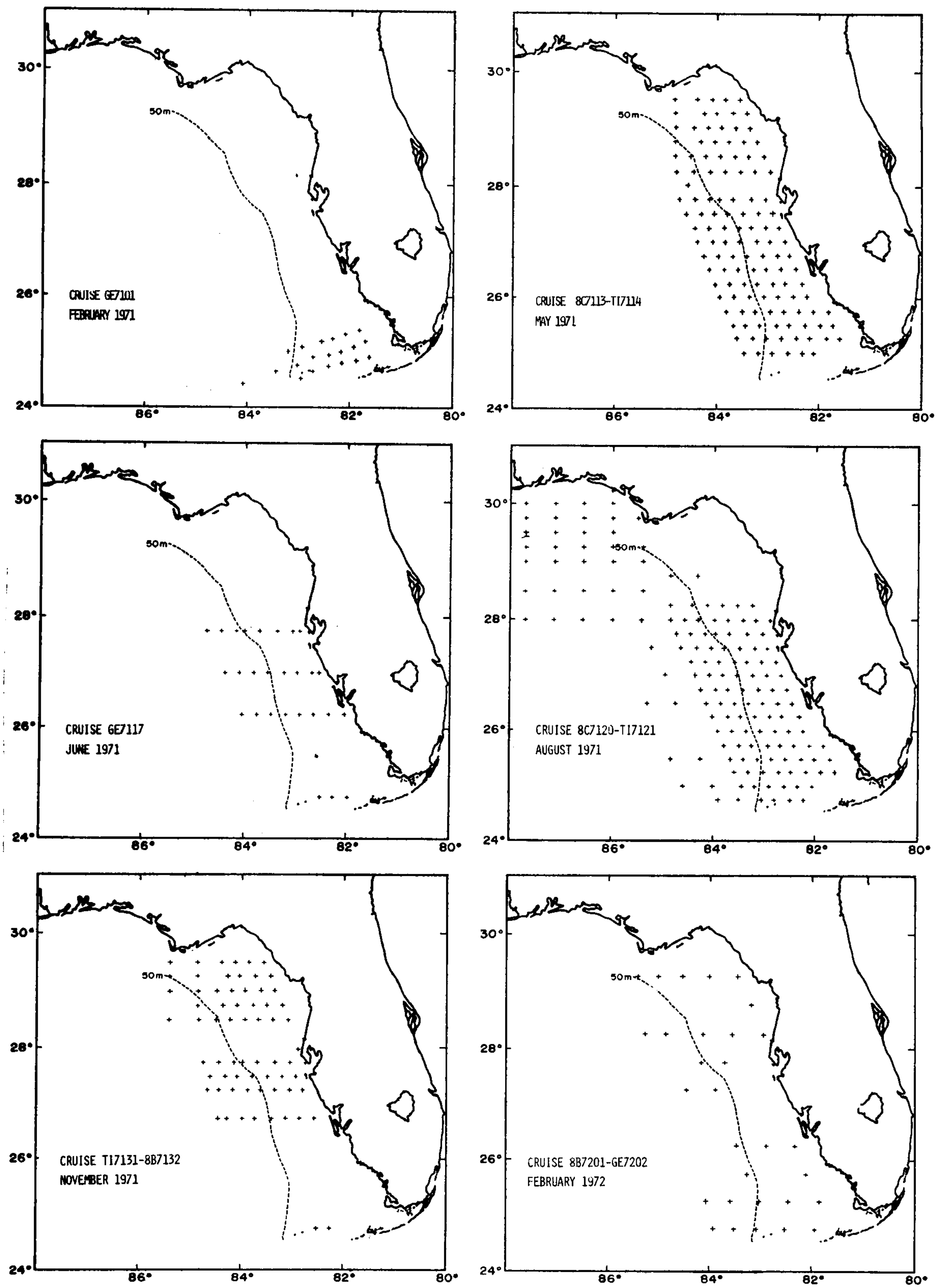



Fig. 2 Ichthyoplankton sampling stations, eastern Gulf of Mexico, 1971-1974.

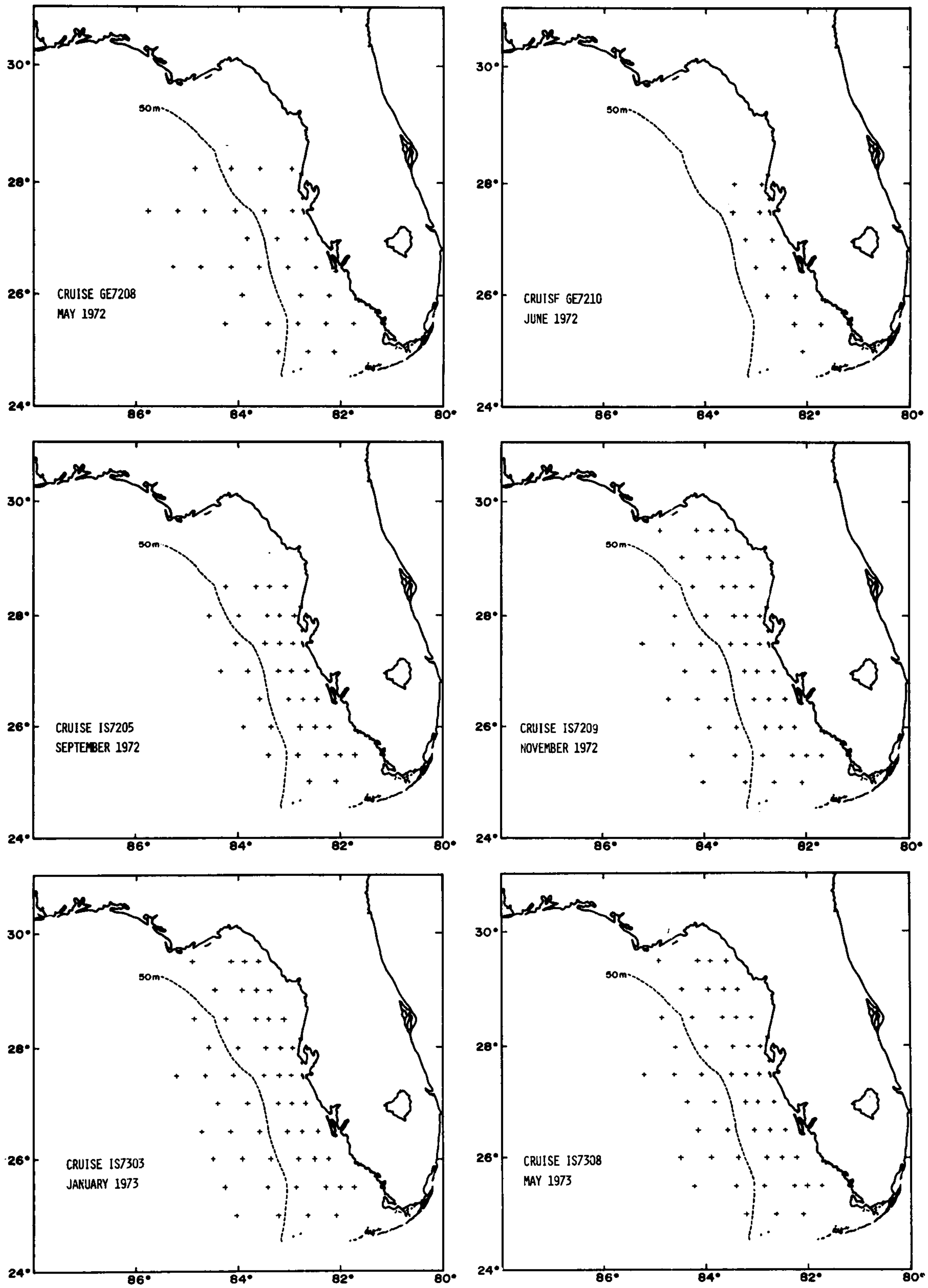

30°
28°
26°
24°
86°
84°
82°
80°
50m
CRUISE GE7208
MAY 1972
CRUISF GE7210
JUNE 1972
CRUISE IS7205
SEPTEMBER 1972
CRUISE IS7209
NOVEMBER 1972
CRUISE IS7303
JANUARY 1973
CRUISE IS7308
MAY 1973

Fig. 2 Cont.

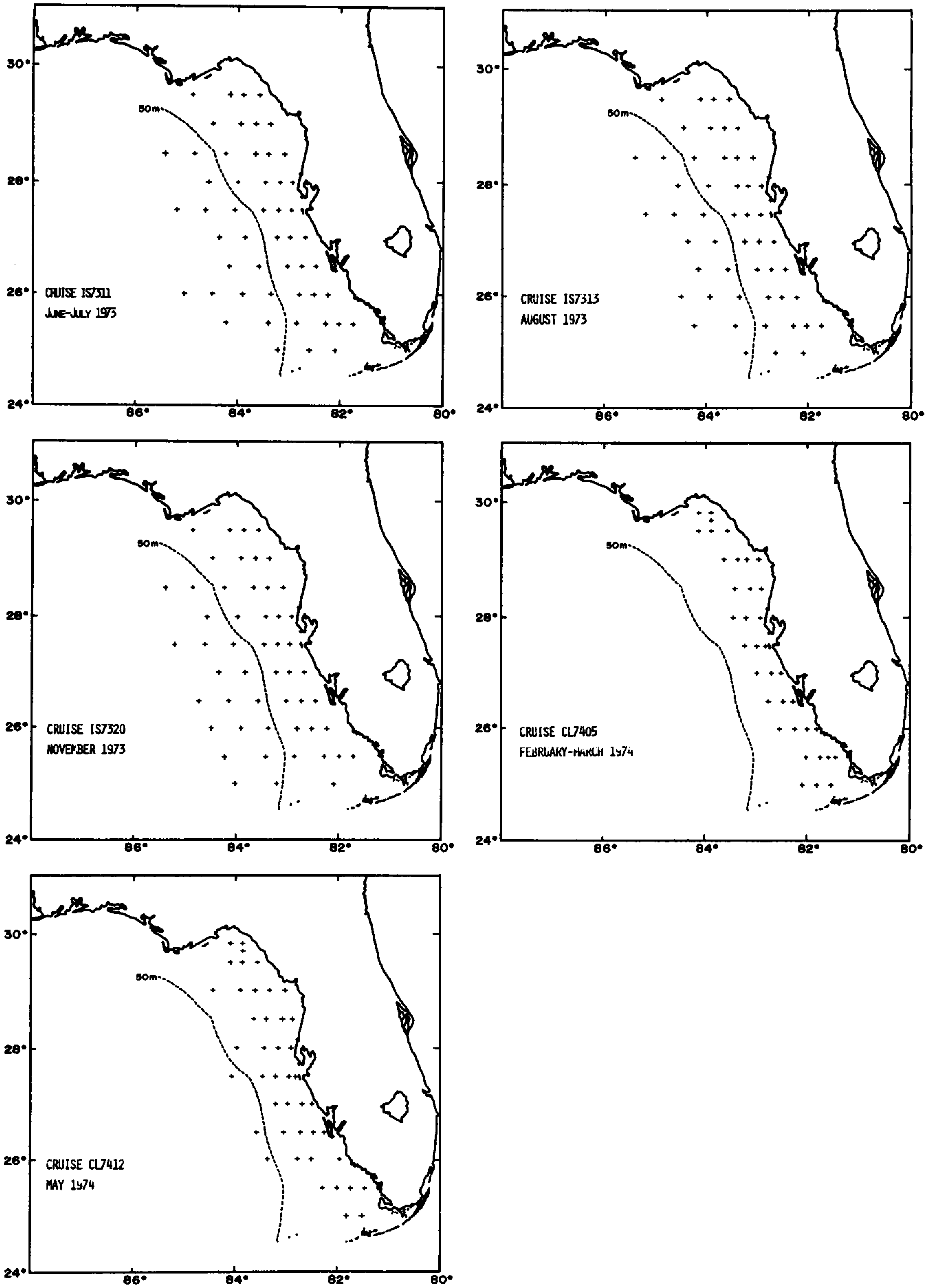

30°
28°
26°
24°
86°
84°
82°
80°
50m
CRUISE IS7311
JUNE-JULY 1973
CRUISE IS7313
AUGUST 1973
CRUISE IS7320
NOVEMBER 1973
CRUISE CL7405
FEBRUARY-MARCH 1974
CRUISE CL7412
MAY 1974

Fig. 2 Cont.

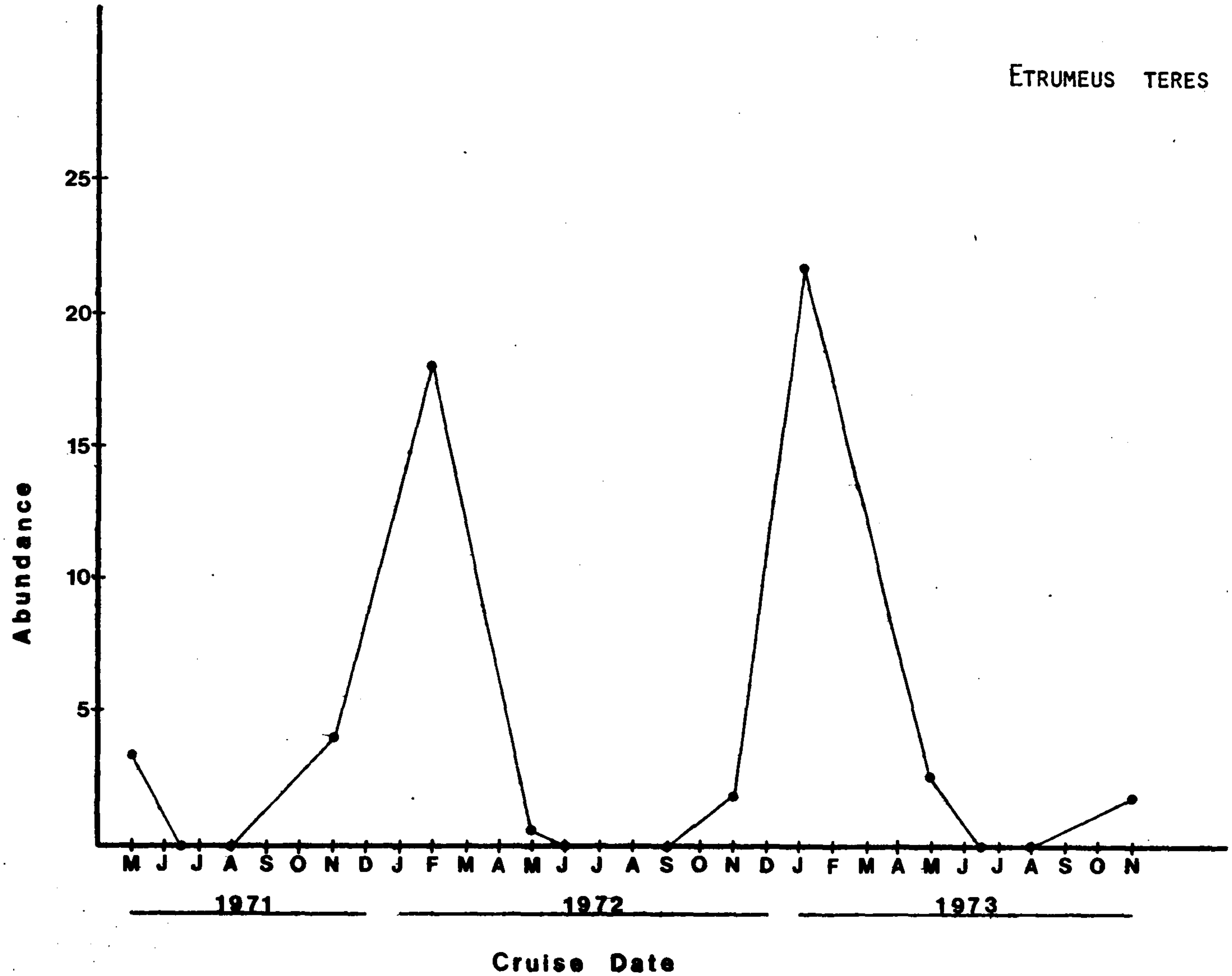



Fig. 3 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Etrumeus teres larvae in the eastern Gulf of Mexico, 1971-1974.

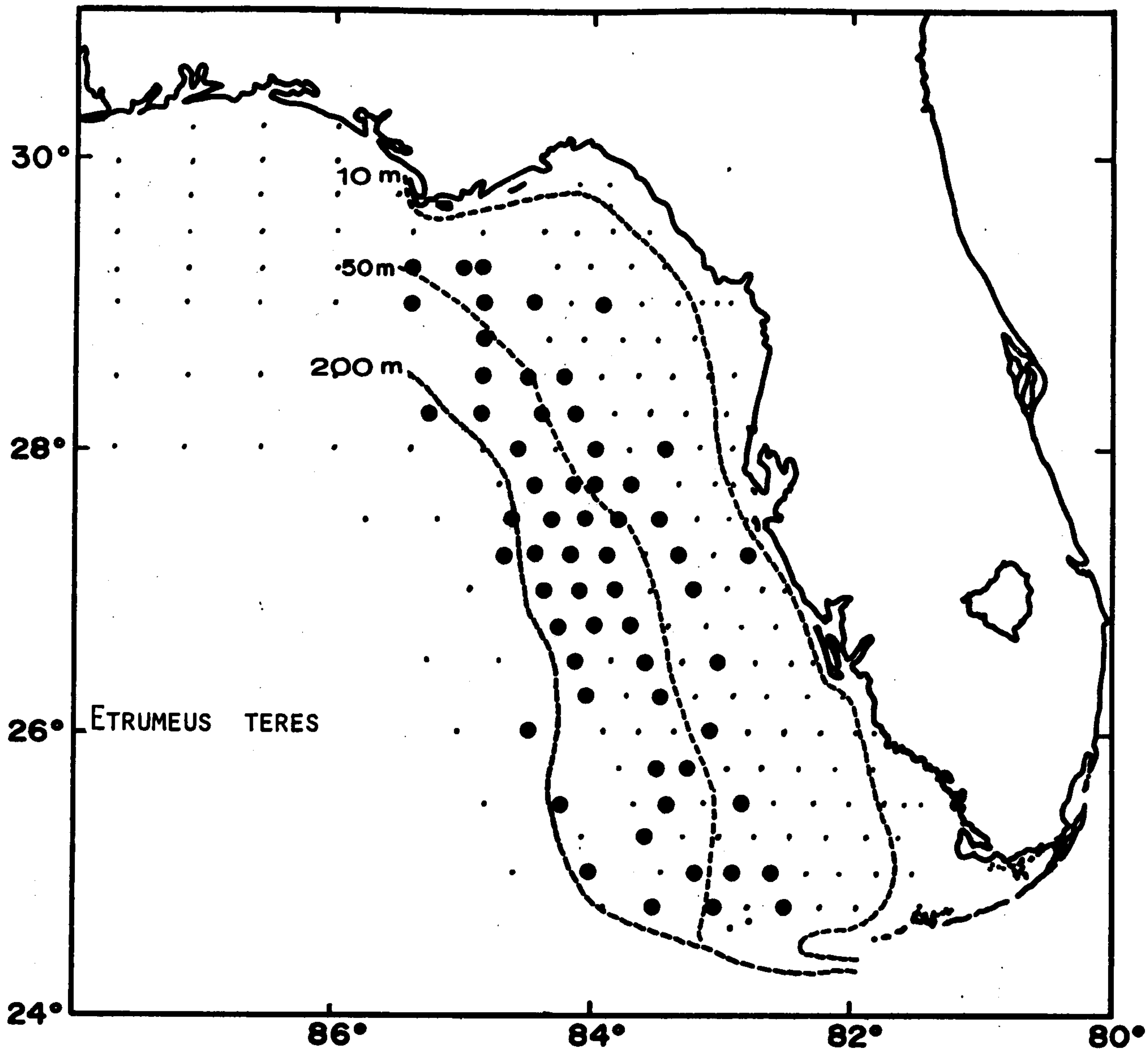



Fig. 4 Stations at which Etrumeus teres larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

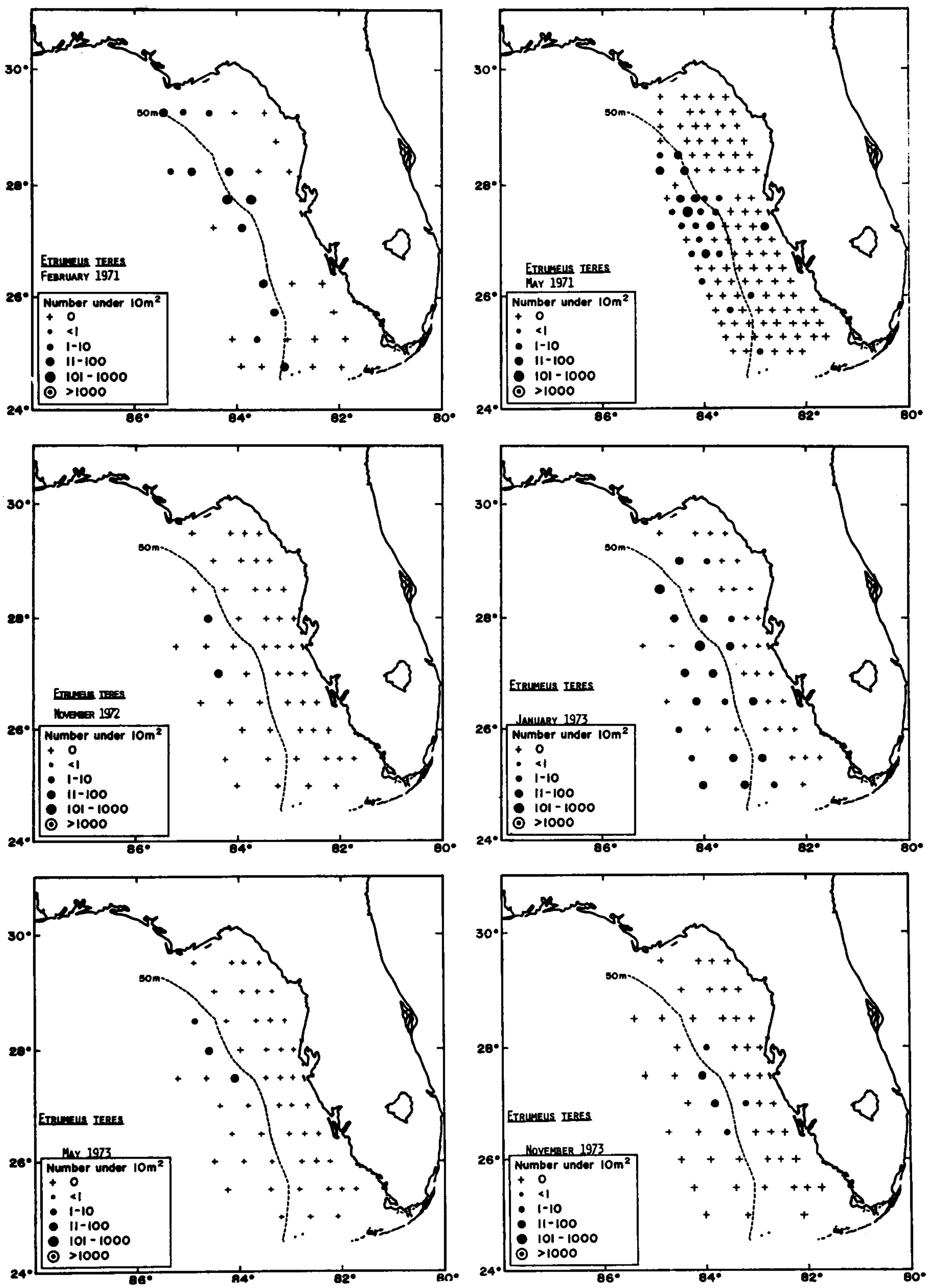



Fig. 5 Distribution and abundance of Etrumeus teres larvae in the eastern Gulf of Mexico, 1971-1974.

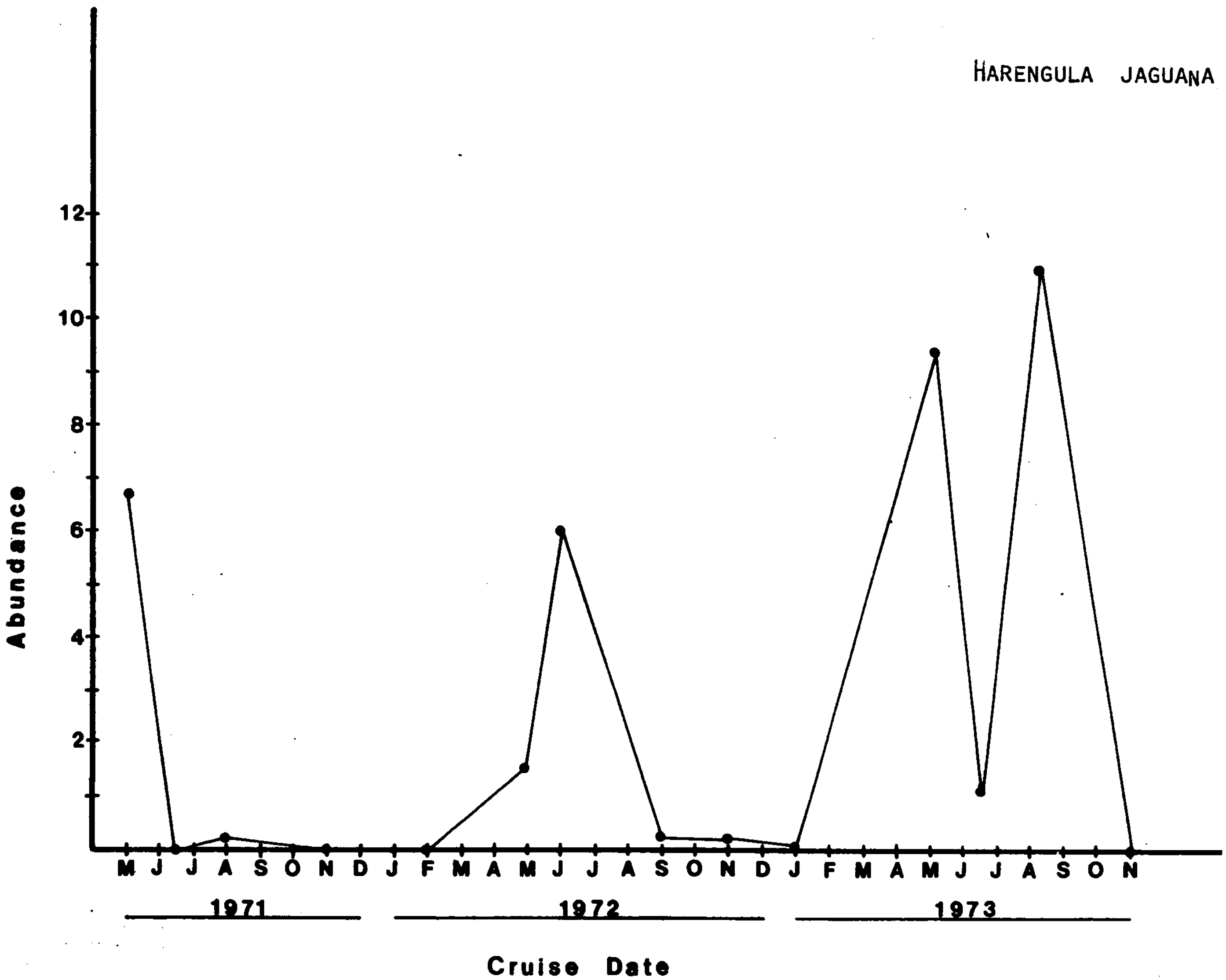



Fig. 6 Estimated mean abundances (number under 10 $m^2$ of sea surface) of *Harengula jaguana* larvae in the eastern Gulf of Mexico, 1971-1974.

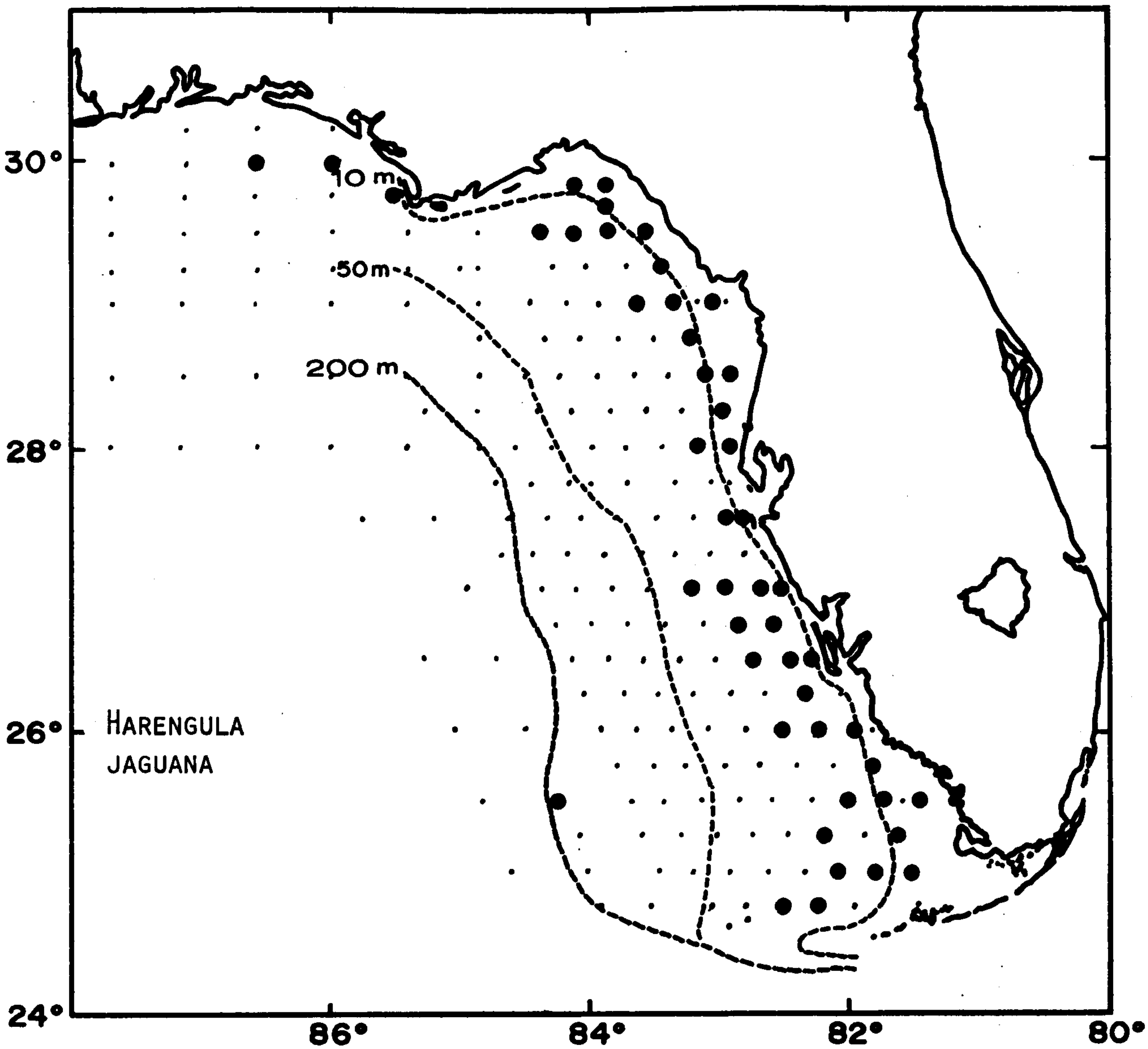



Fig. 7 Stations at which Harengula jaguana larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

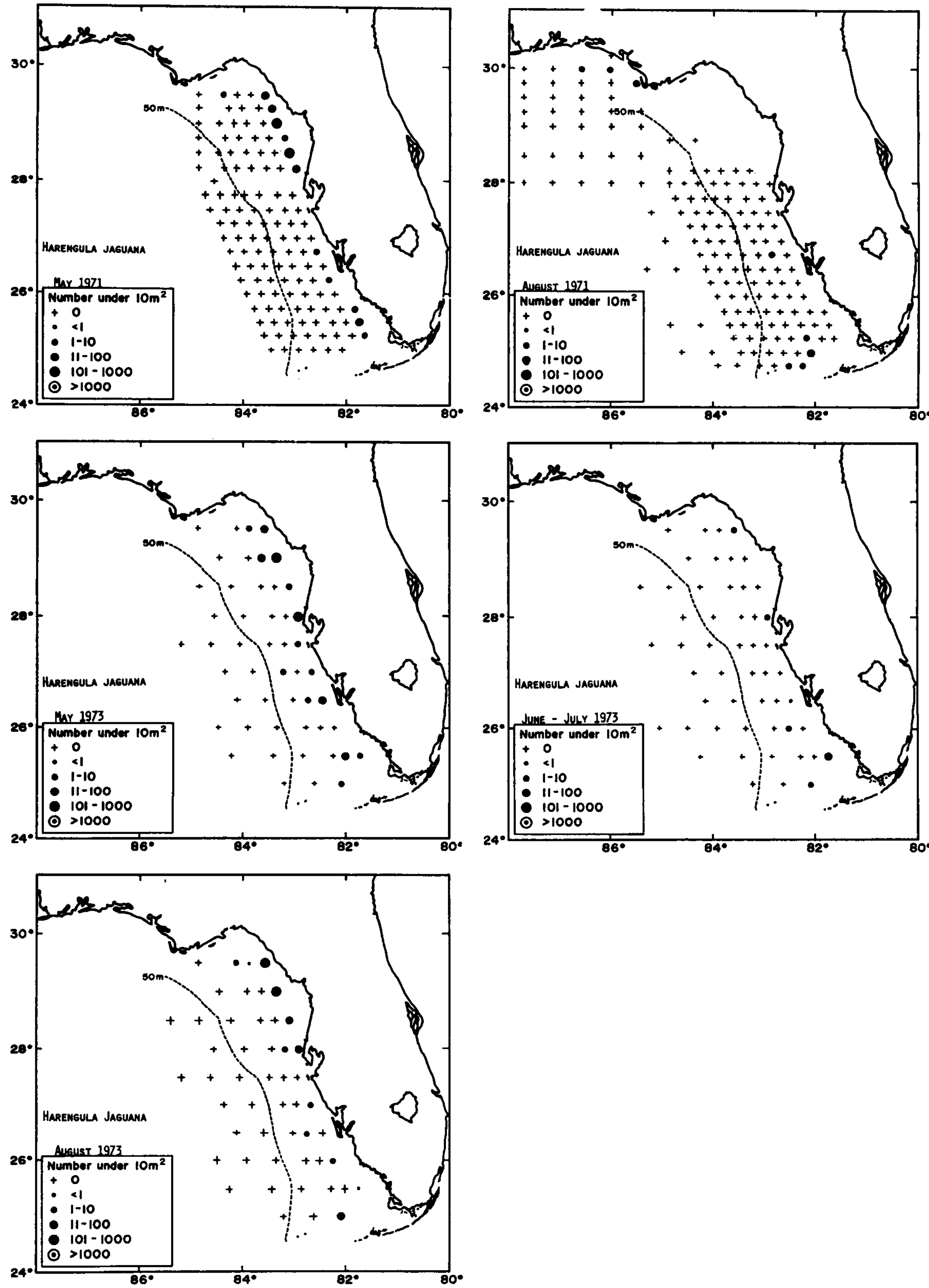



Fig. 8 Distribution and abundance of *Harengula jaguana* larvae in the eastern Gulf of Mexico, 1971-1974.

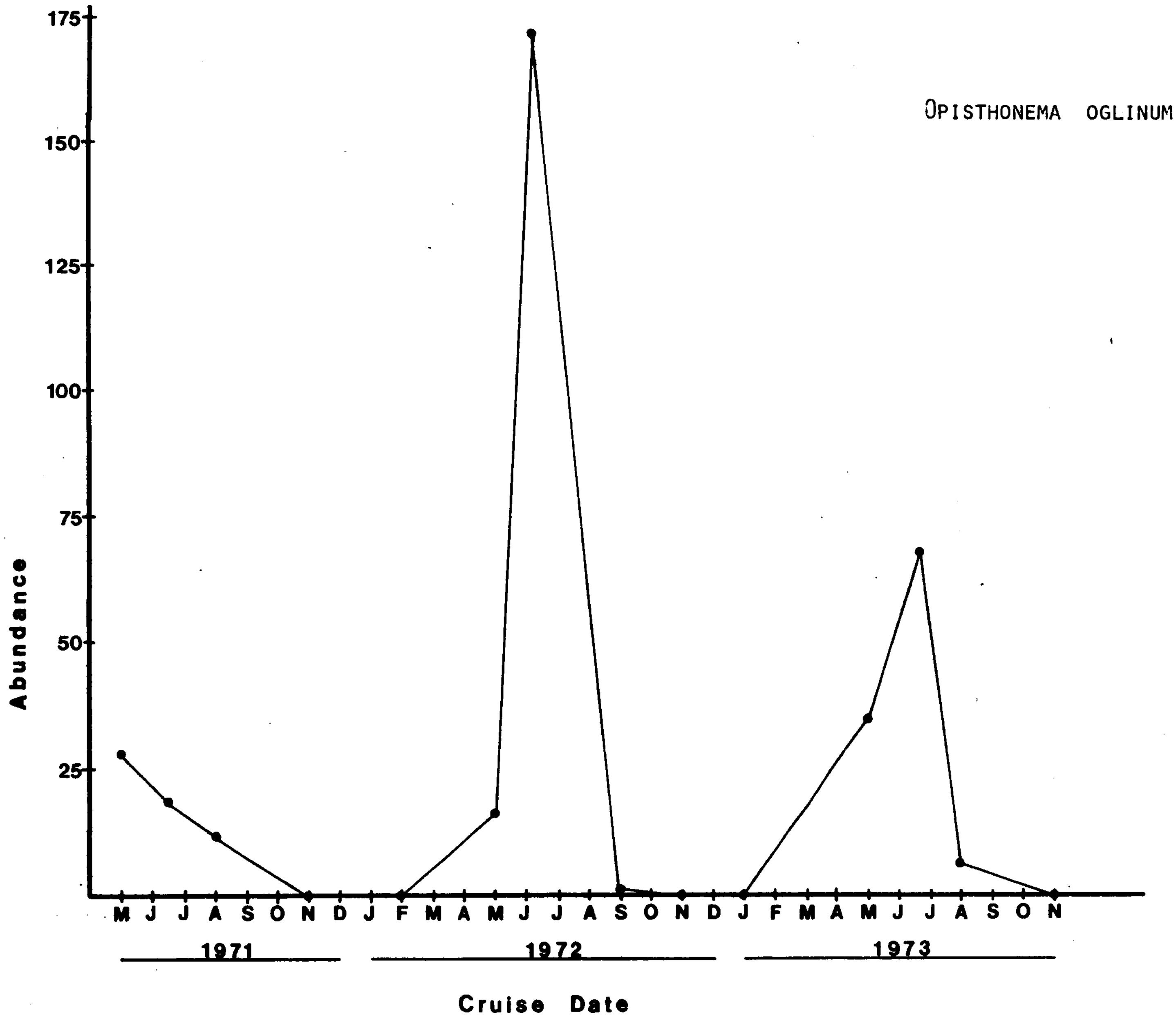



Fig. 9 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Opisthonema oglinum larvae in the eastern Gulf of Mexico, 1971-1974.

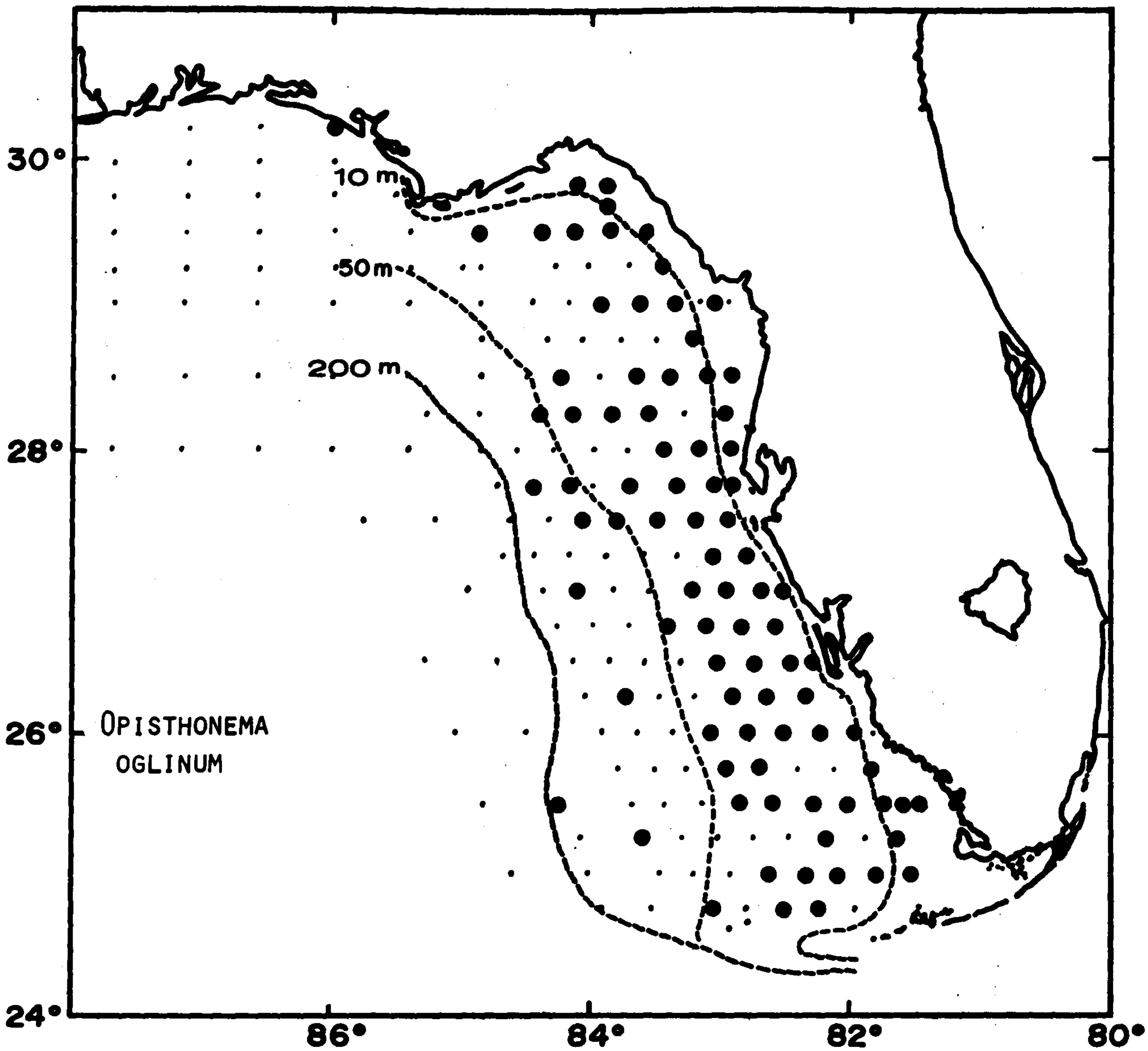



Fig. 10 Stations at which Opisthonema oglinum larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

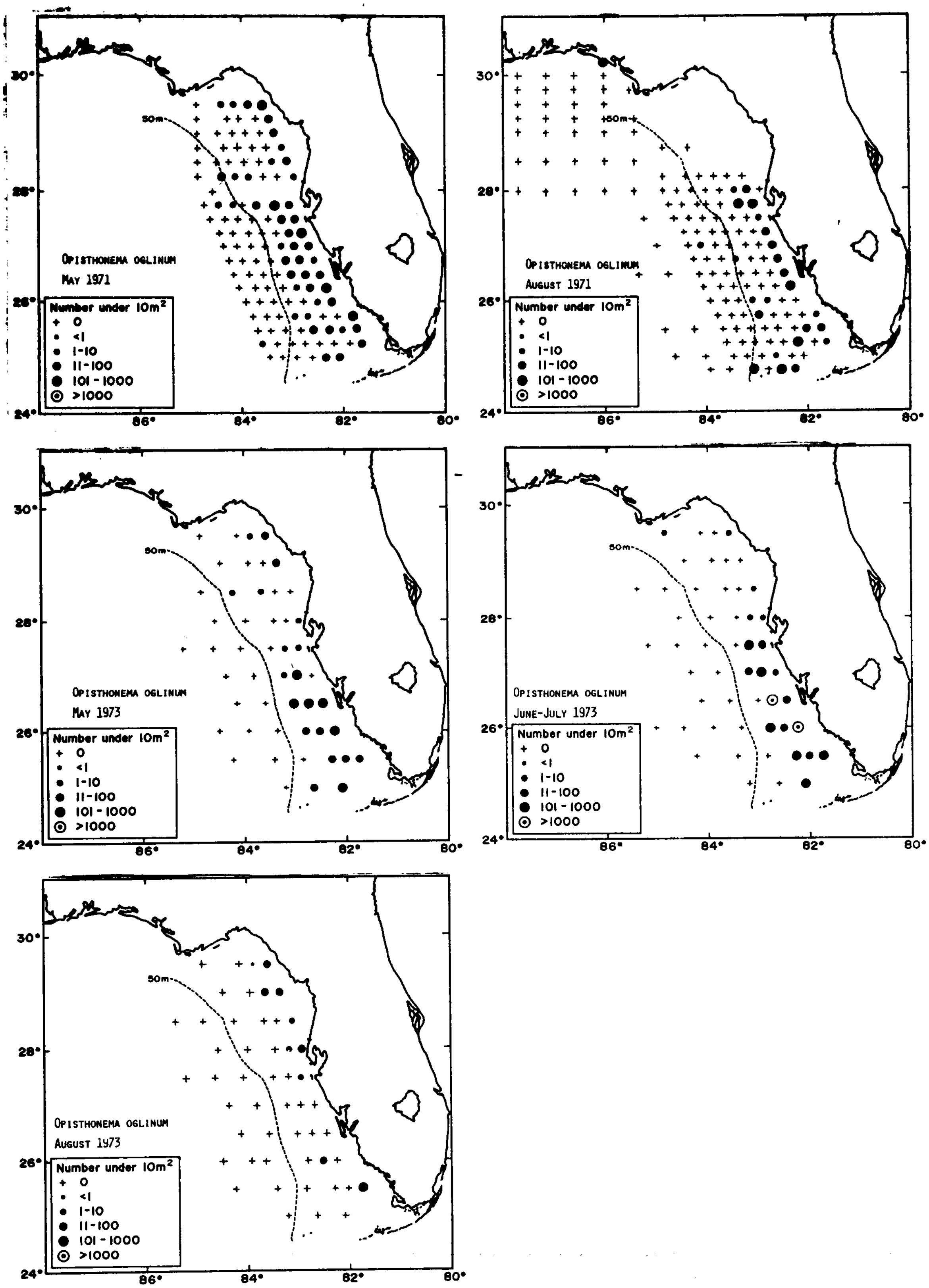



Fig. 11 Distribution and abundance of *Opisthonema oglinum* larvae in the eastern Gulf of Mexico, 1971-1974.

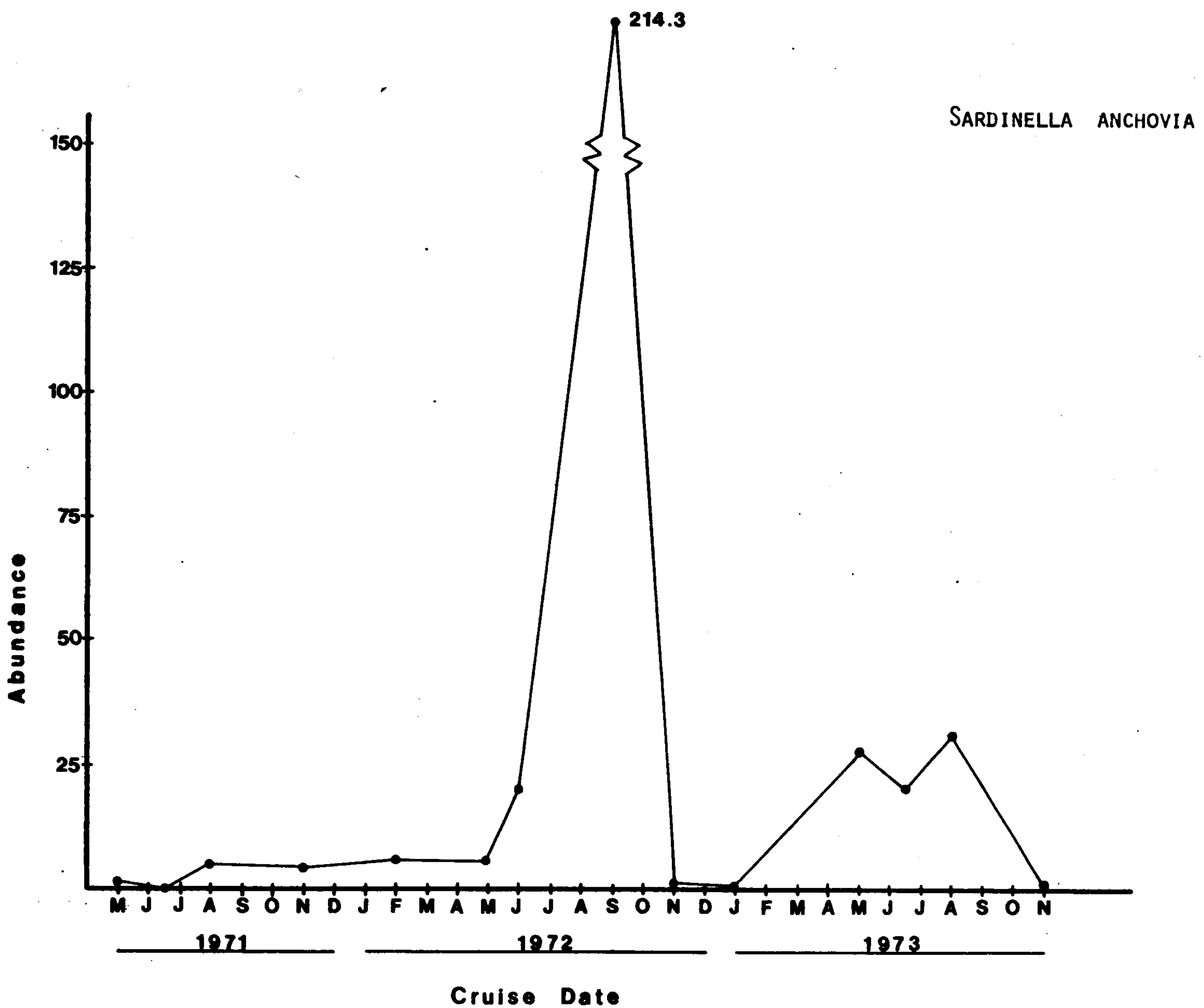



Fig. 12 Estimated mean abundances (number under 10 $m^2$ of sea surface) of *Sardinella anchovia* larvae in the eastern Gulf of Mexico, 1971-1974.

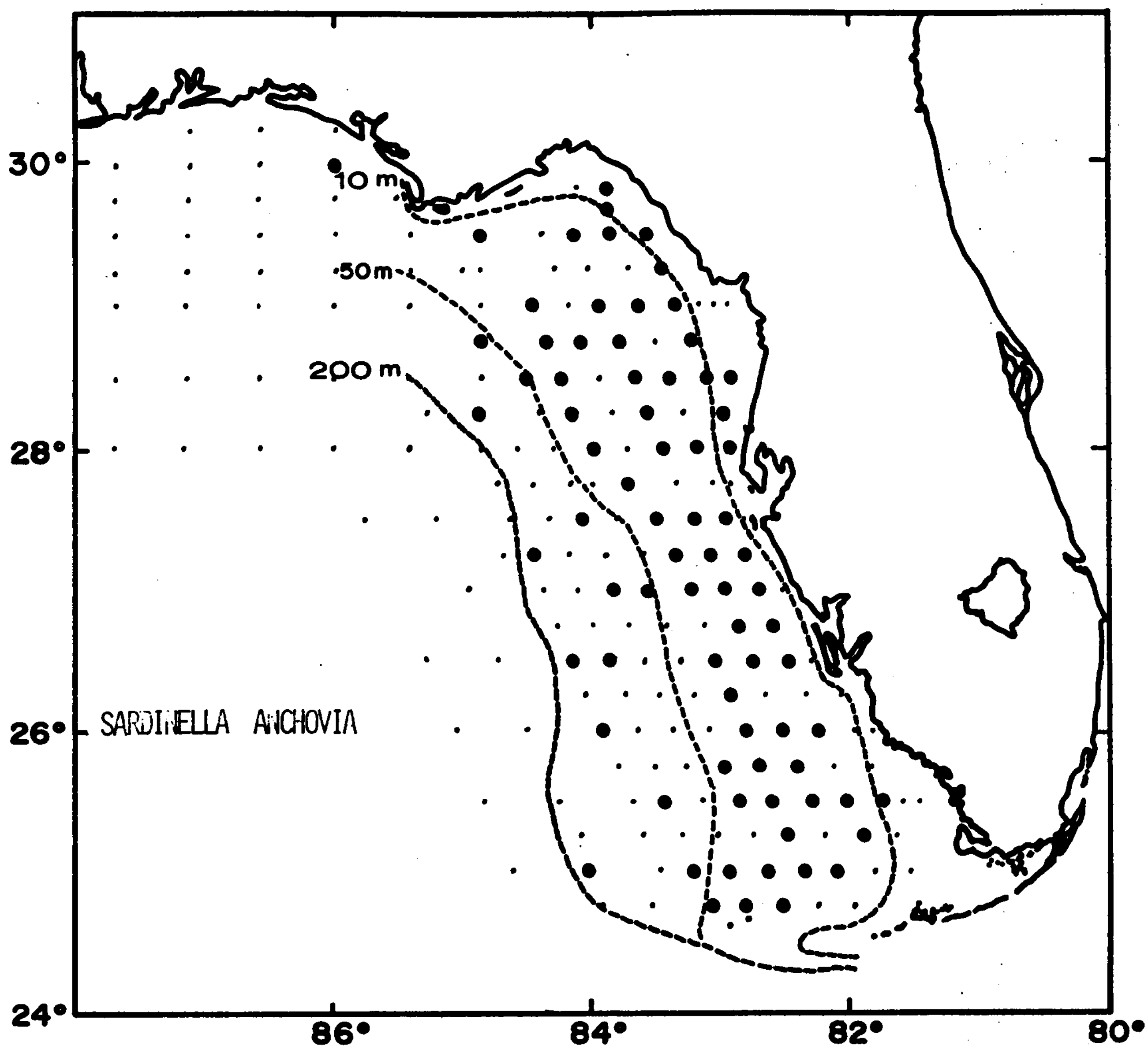



Fig. 13 Stations at which *Sardinella anchovia* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

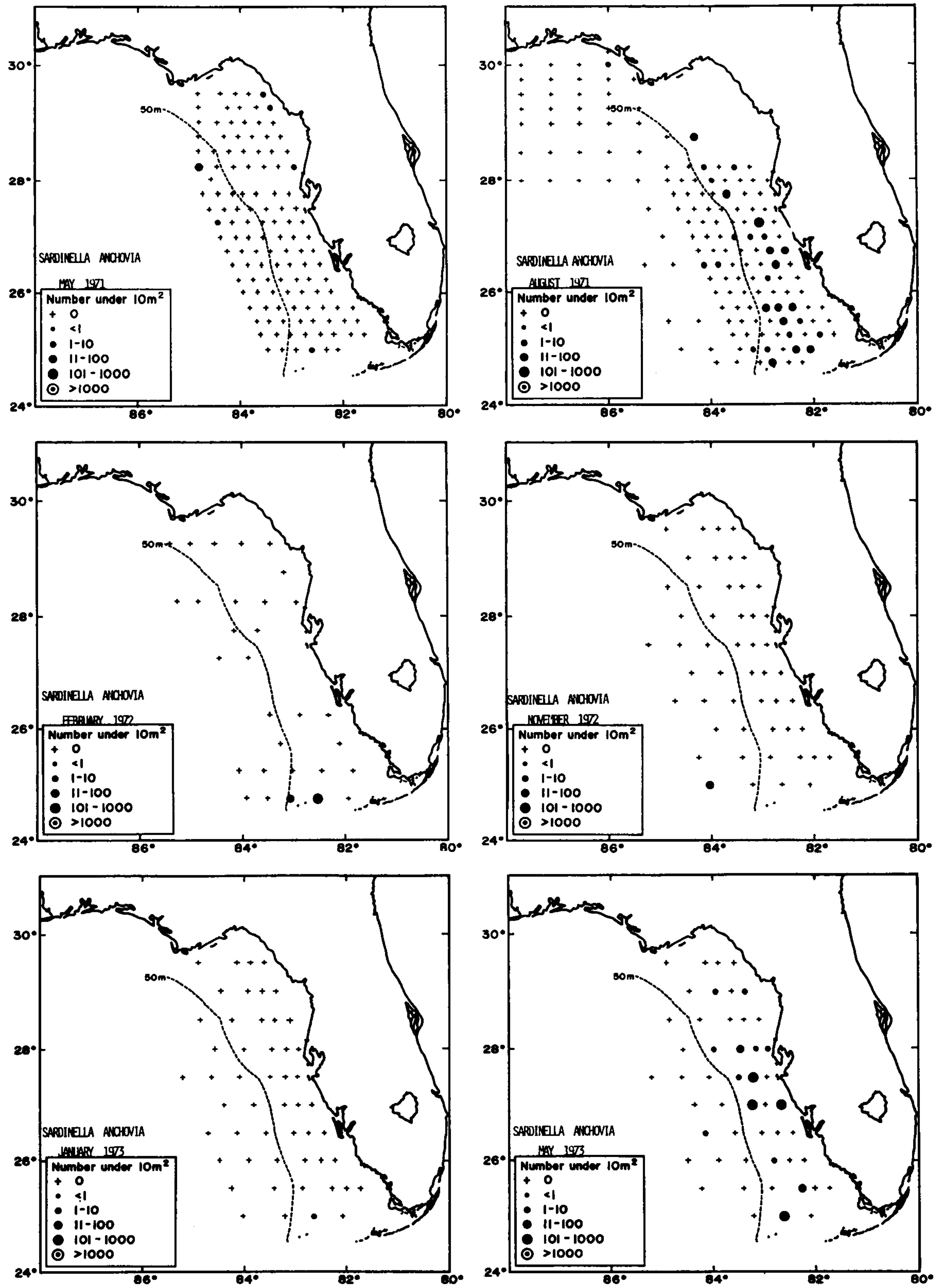



Fig. 14 Distribution and abundance of *Sardinella anchovia* larvae in the eastern Gulf of Mexico, 1971-1974.

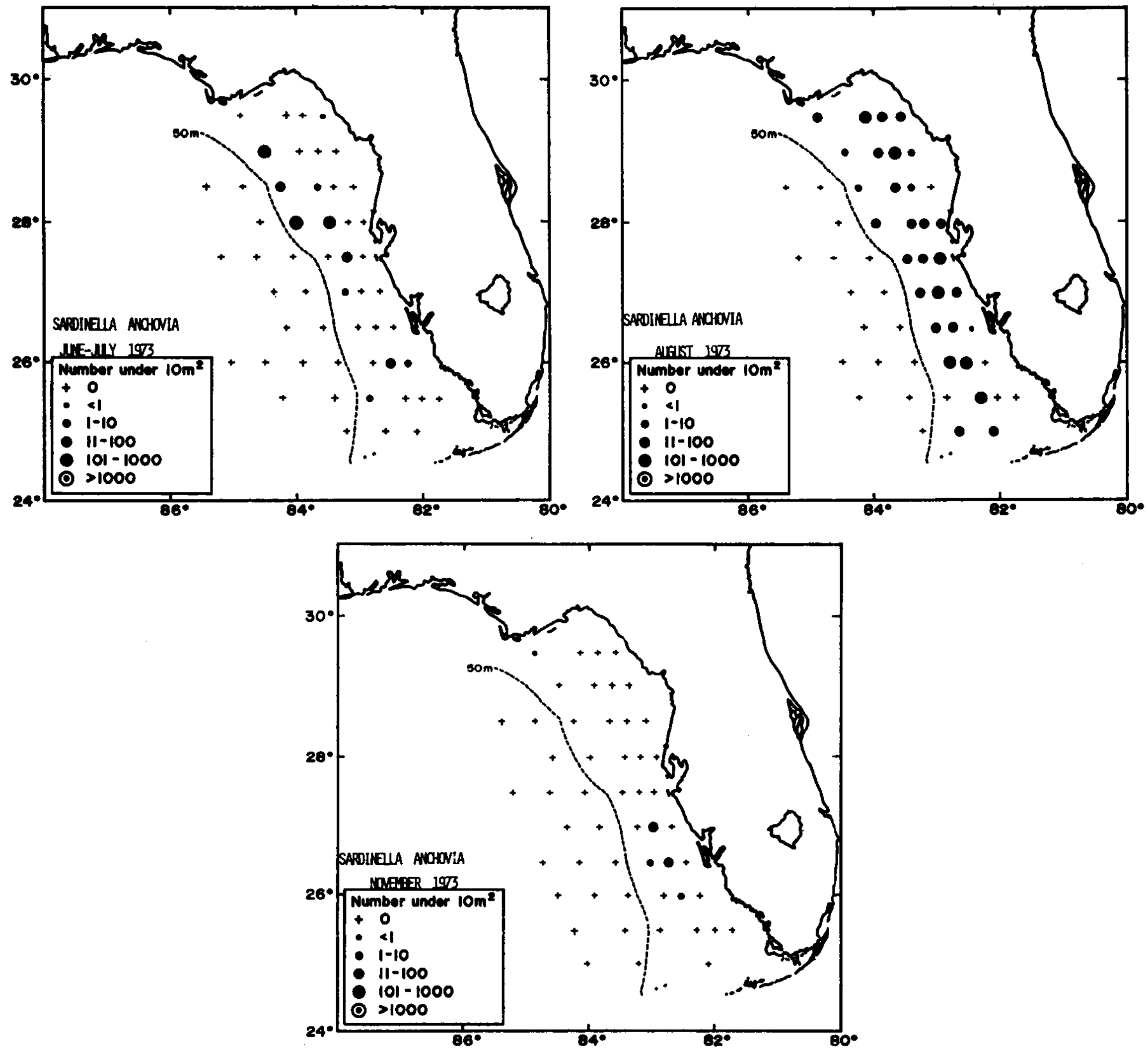

SARDINELLA ANCHOVIA
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
SARDINELLA ANCHOVIA
AUGUST 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
SARDINELLA ANCHOVIA
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 14 Cont.

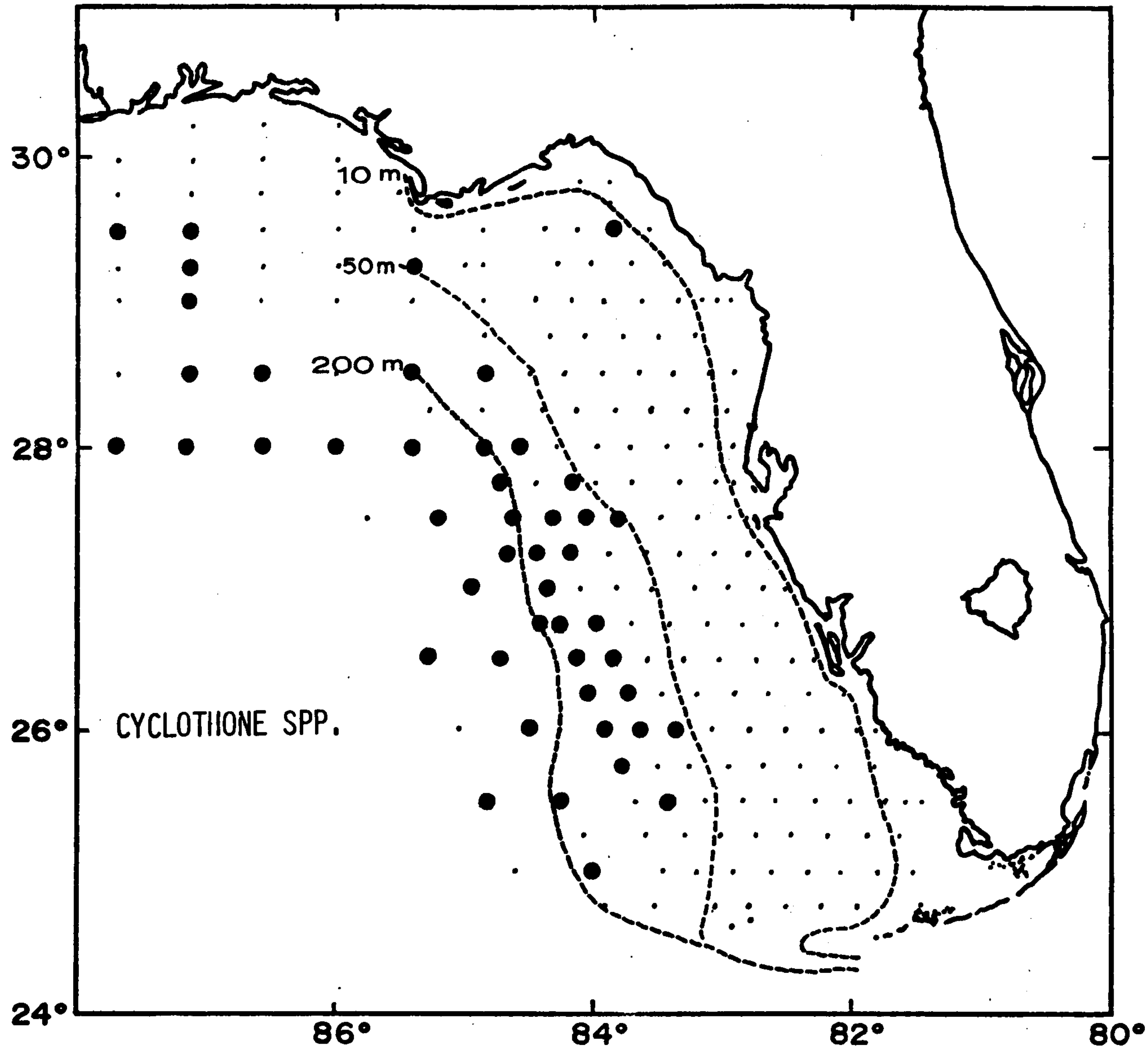



Fig. 15 Stations at which Cyclothone spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

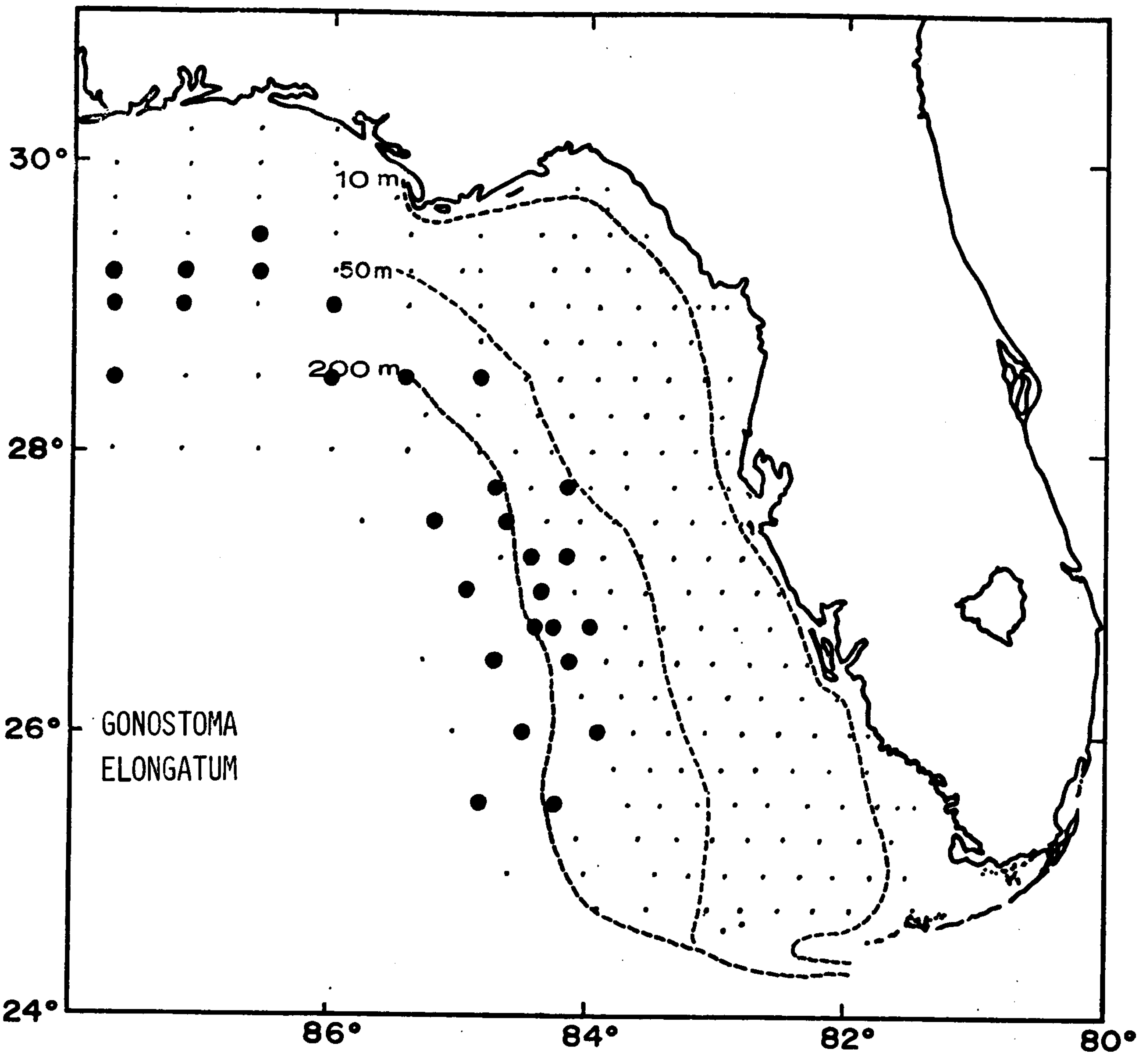



Fig. 16 Stations at which Gonostoma elongatum larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

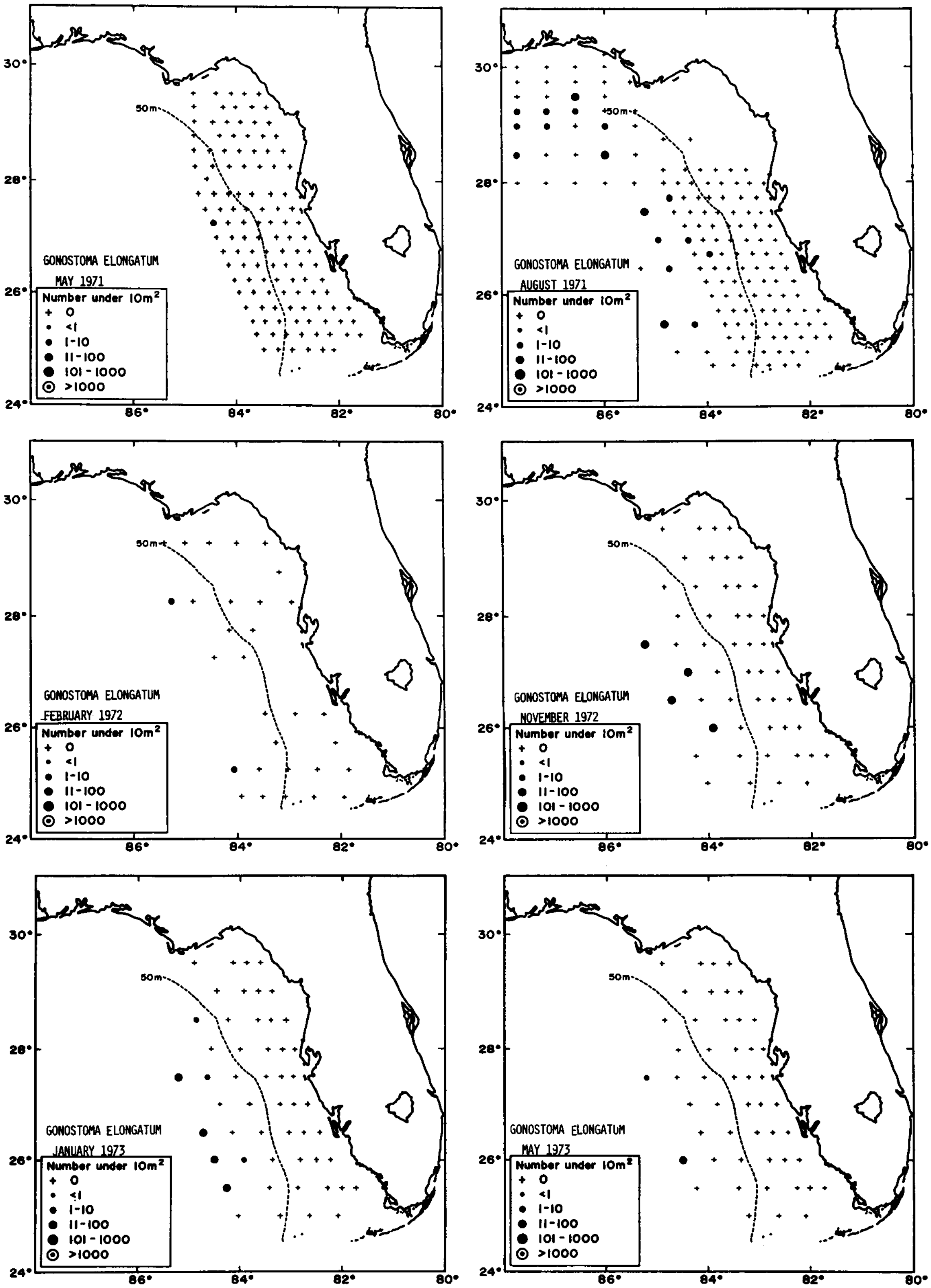
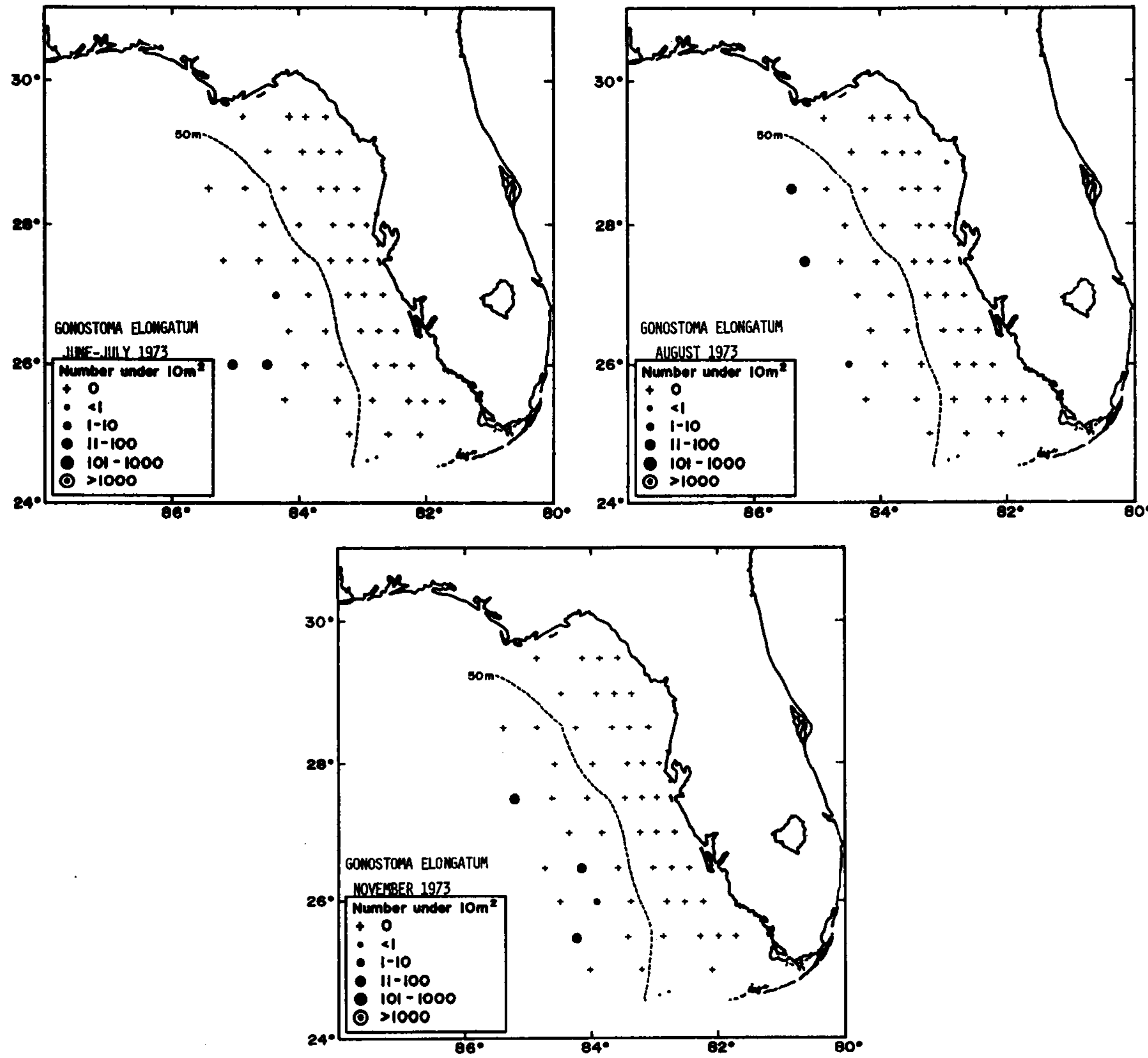



Fig. 17 Distribution and abundance of _Gonostoma elongatum_ larvae in the eastern Gulf of Mexico, 1971-1974.



GONOSTOMA ELONGATUM
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
GONOSTOMA ELONGATUM
AUGUST 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
GONOSTOMA ELONGATUM
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°


Fig. 17 Cont.

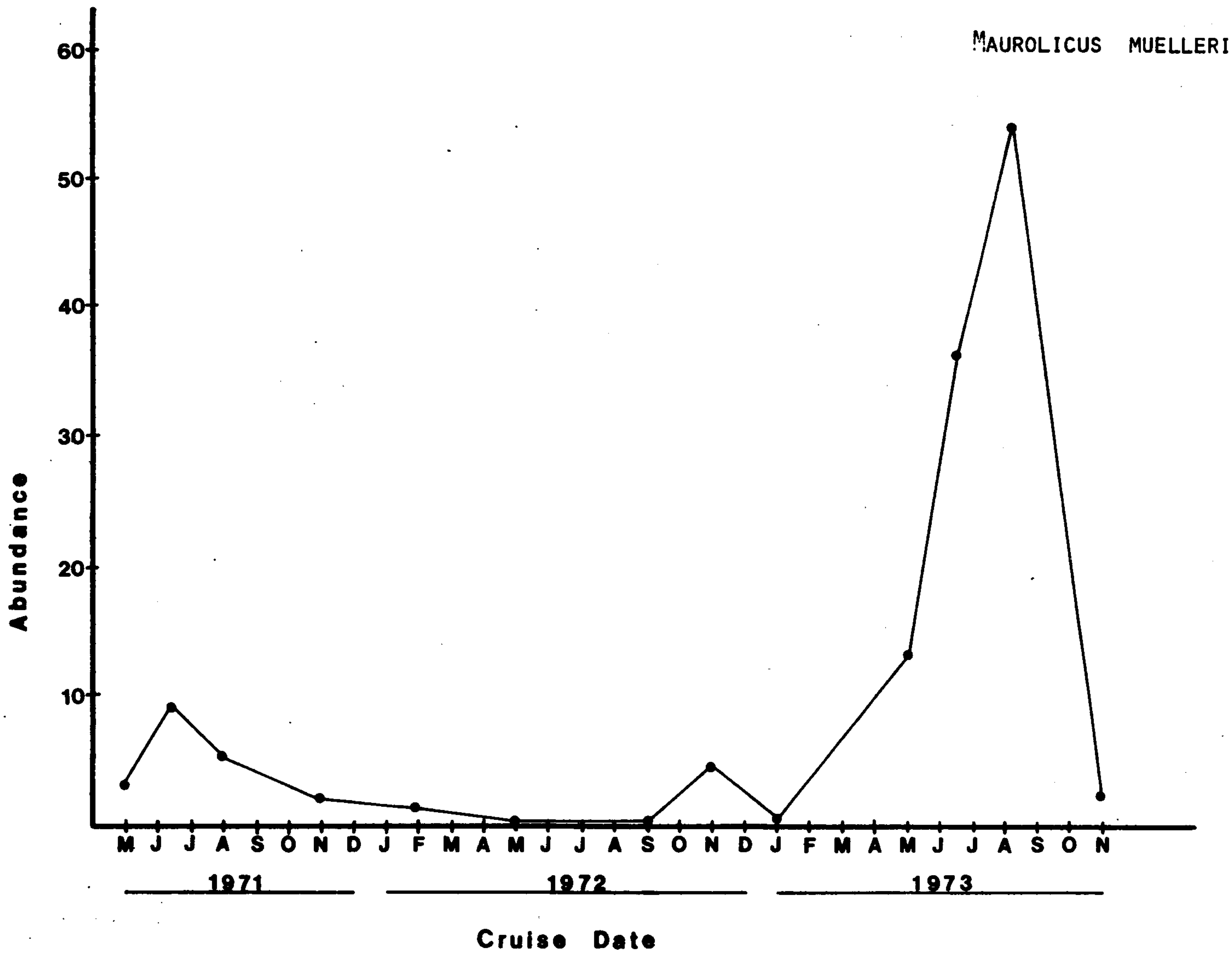



Fig. 18 Estimated mean abundances (number under $10 m^2$ of sea surface) of Maurolicus muelleri larvae in the eastern Gulf of Mexico, 1971-1974.

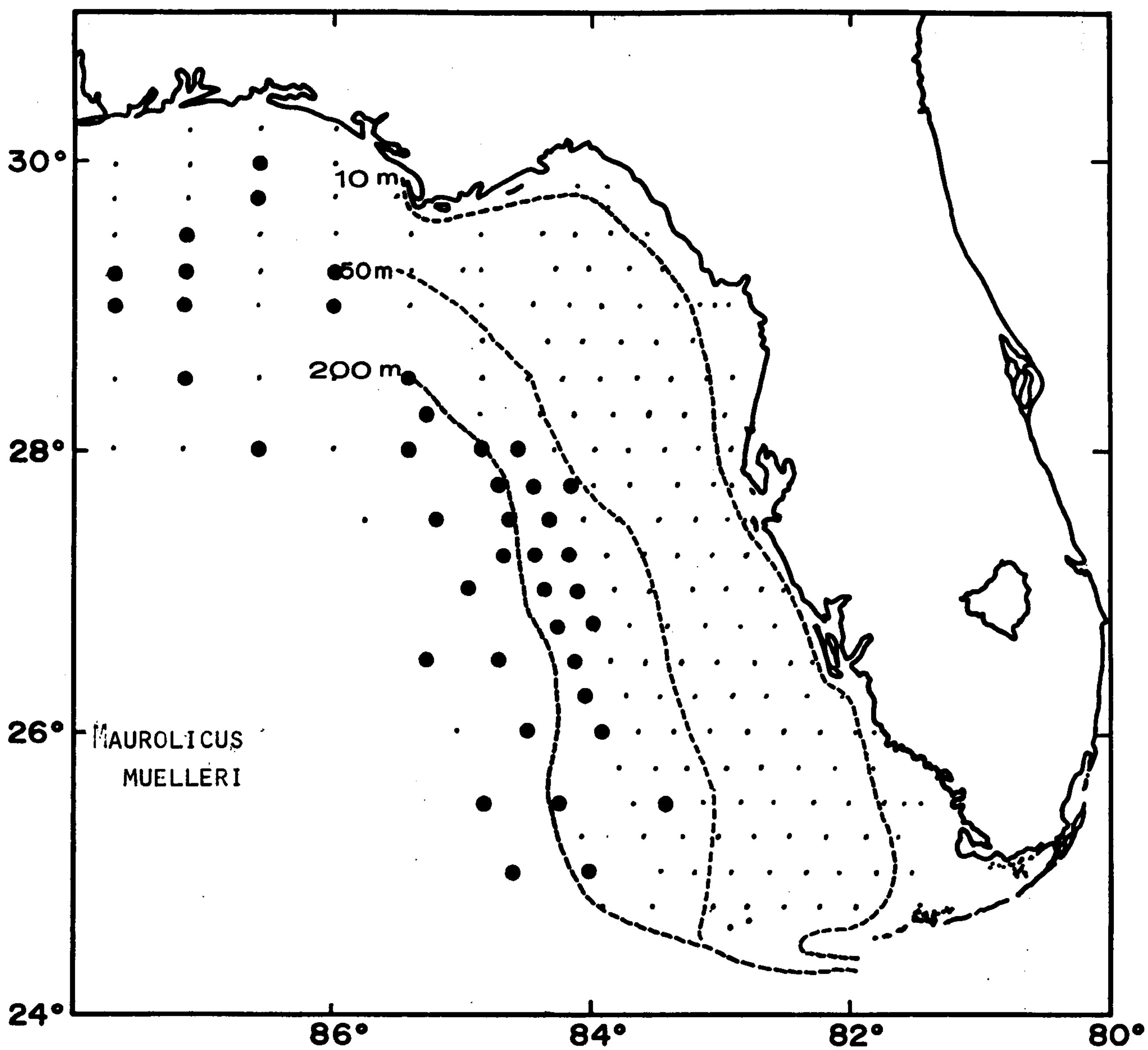



Fig. 19 Stations at which Maurolicus muelleri larvae occurred at least once during 17 cruises in the eastern Gulf of Mexico, 1971-1974.

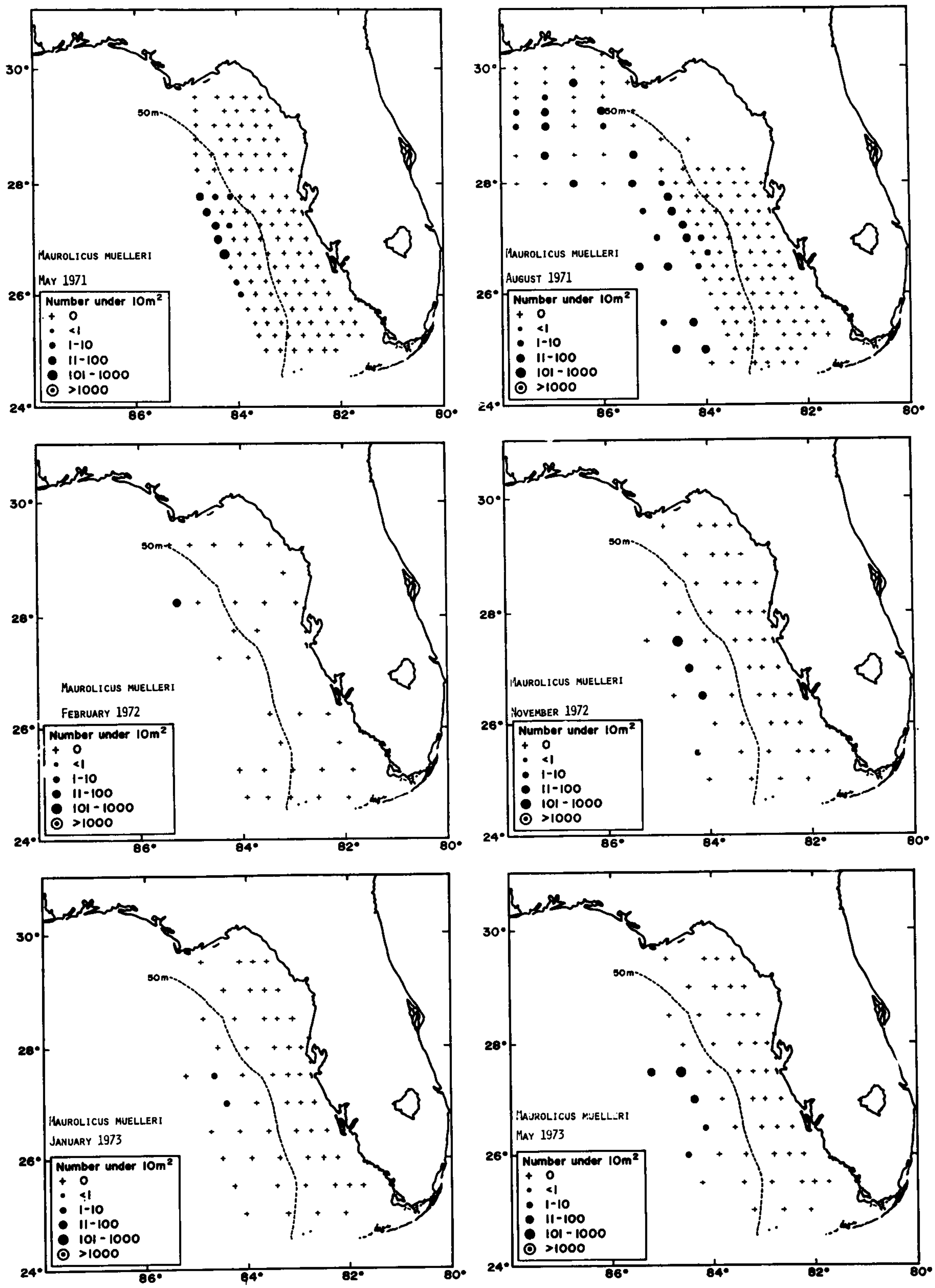



Fig. 20 Distribution and abundance of Maurolicus muelleri larvae in the eastern Gulf of Mexico, 1971-1974.

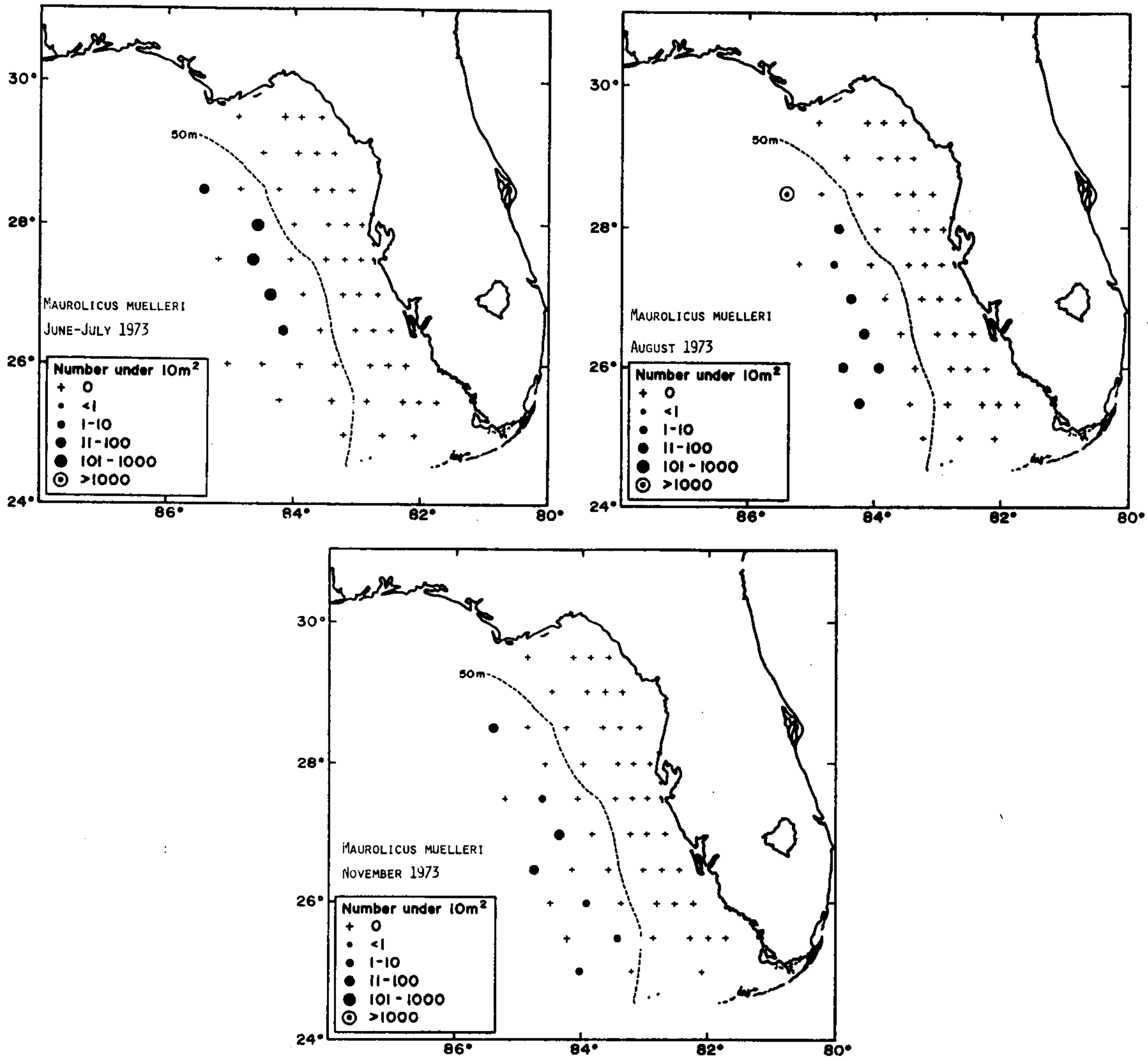

MAUROLICUS MUELLERI
JUNE-JULY 1973
Number under 10m²
+ 0
<1
1-10
11-100
101 - 1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
MAUROLICUS MUELLERI
AUGUST 1973
Number under 10m²
+ 0
<1
1-10
11-100
101 - 1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
MAUROLICUS MUELLERI
NOVEMBER 1973
Number under 10m²
+ 0
<1
1-10
11-100
101 - 1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 20 Cont.

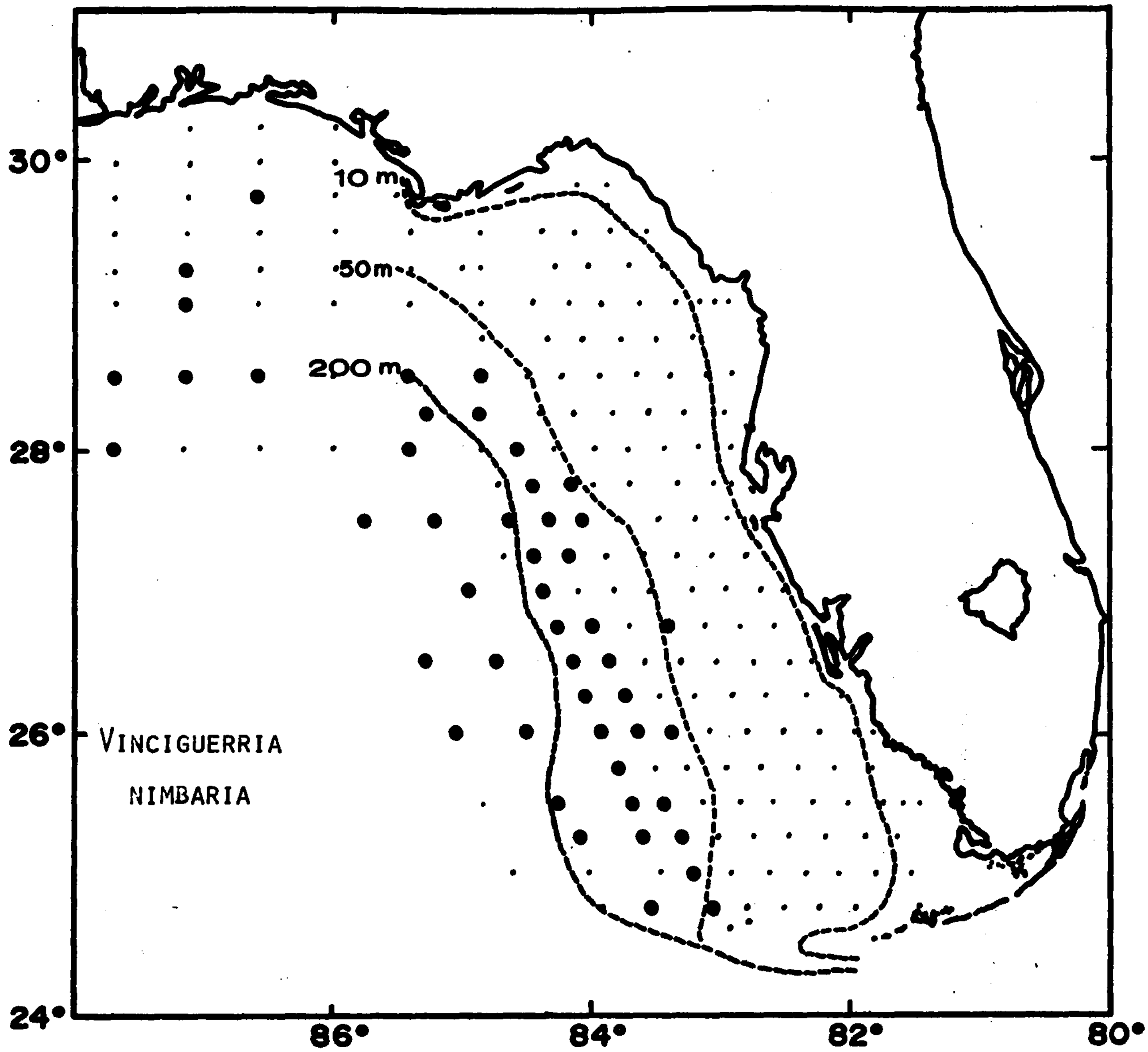



Fig. 21 Stations at which Vinciguerria nimbaria larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

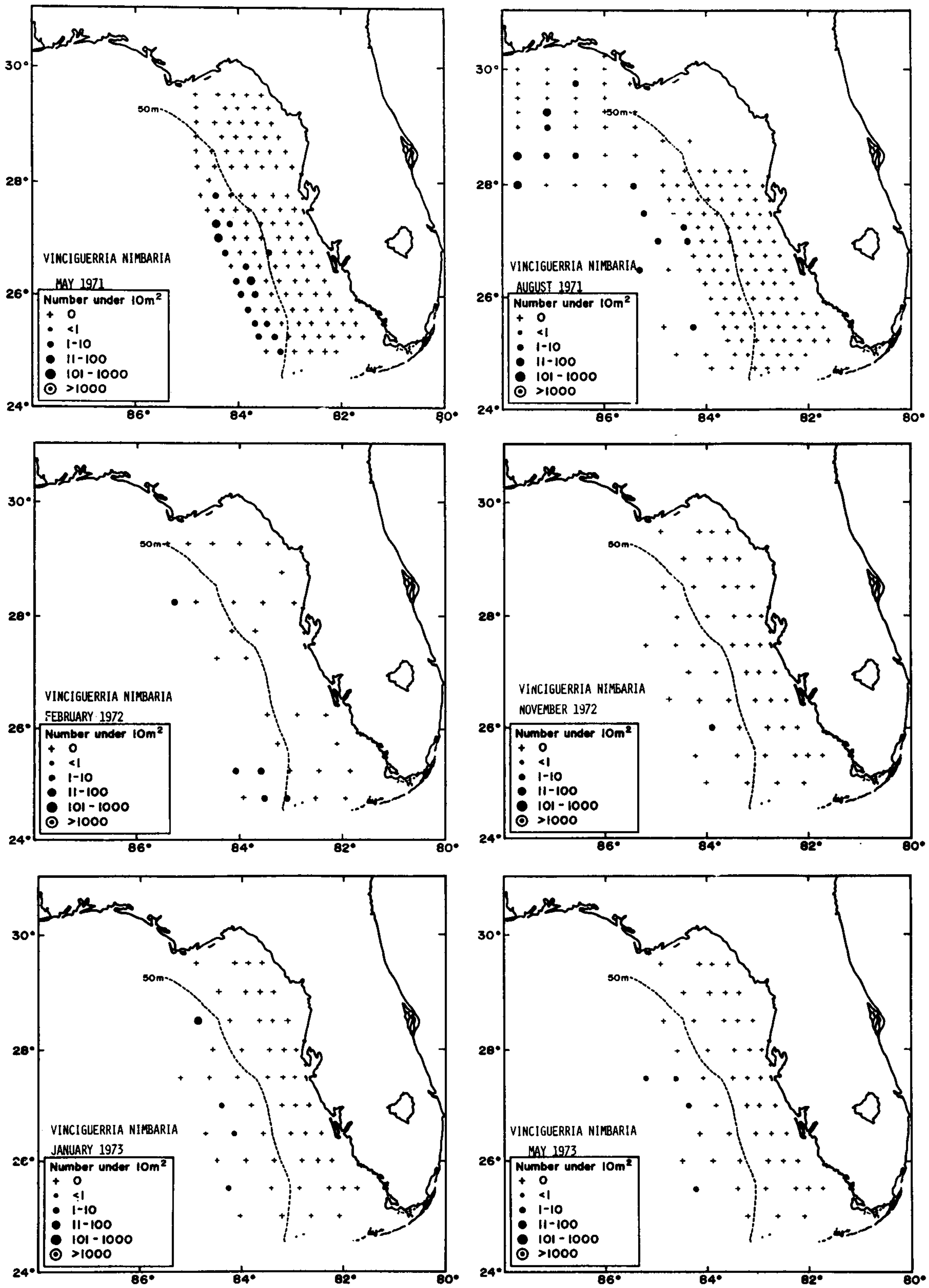



Fig. 22 Distribution and abundance of <u>Vinciguerria nimbaria</u> larvae in the eastern Gulf of Mexico, 1971-1974.

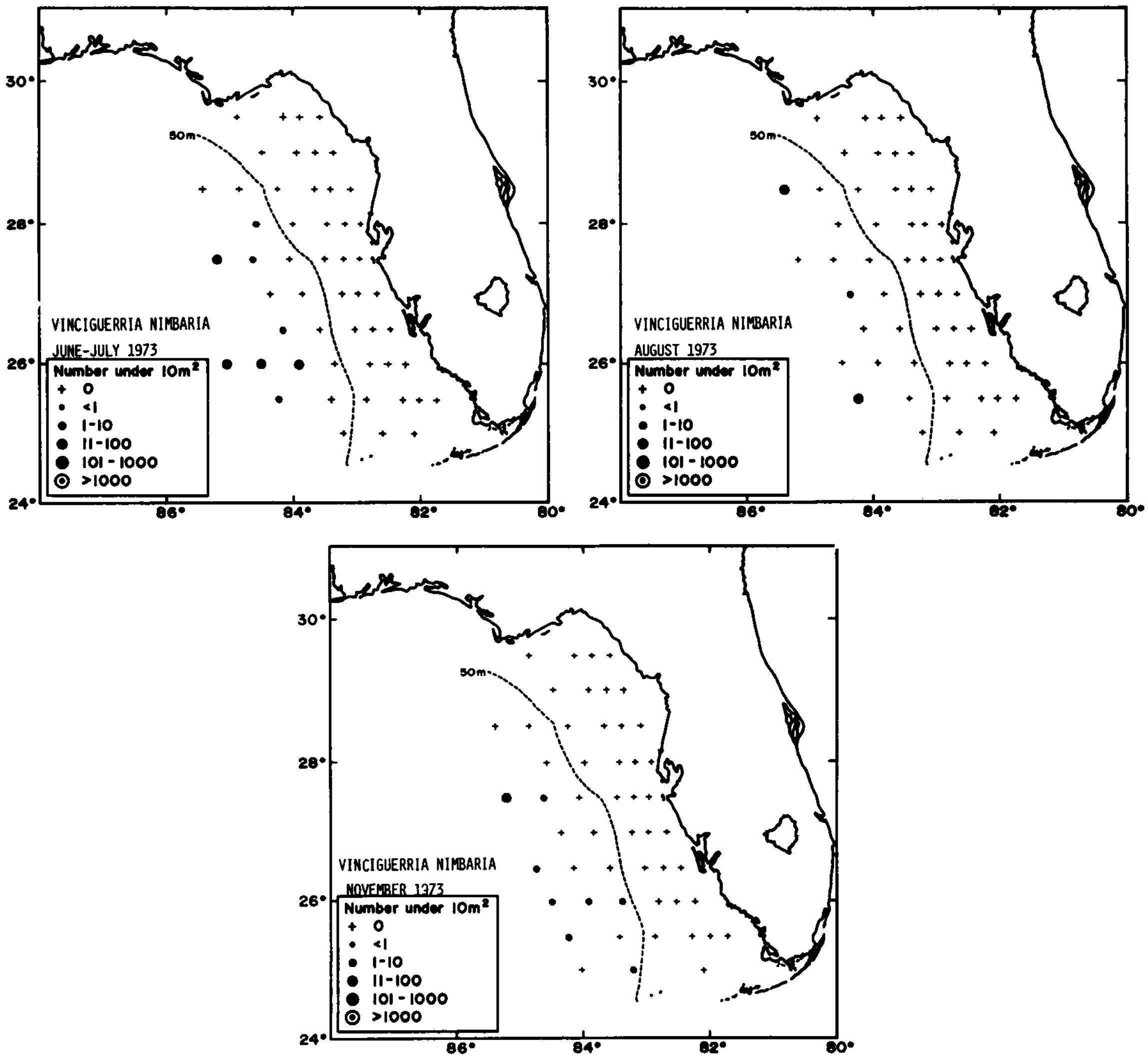

30°
28°
26°
24°
86°
84°
82°
80°
50m
VINCIGUERRIA NIMBARIA
JUNE-JULY 1973
Number under 10m²
+ 0
<1
1-10
11-100
101-1000
>1000
VINCIGUERRIA NIMBARIA
AUGUST 1973
VINCIGUERRIA NIMBARIA
NOVEMBER 1973

Fig. 22 Cont.

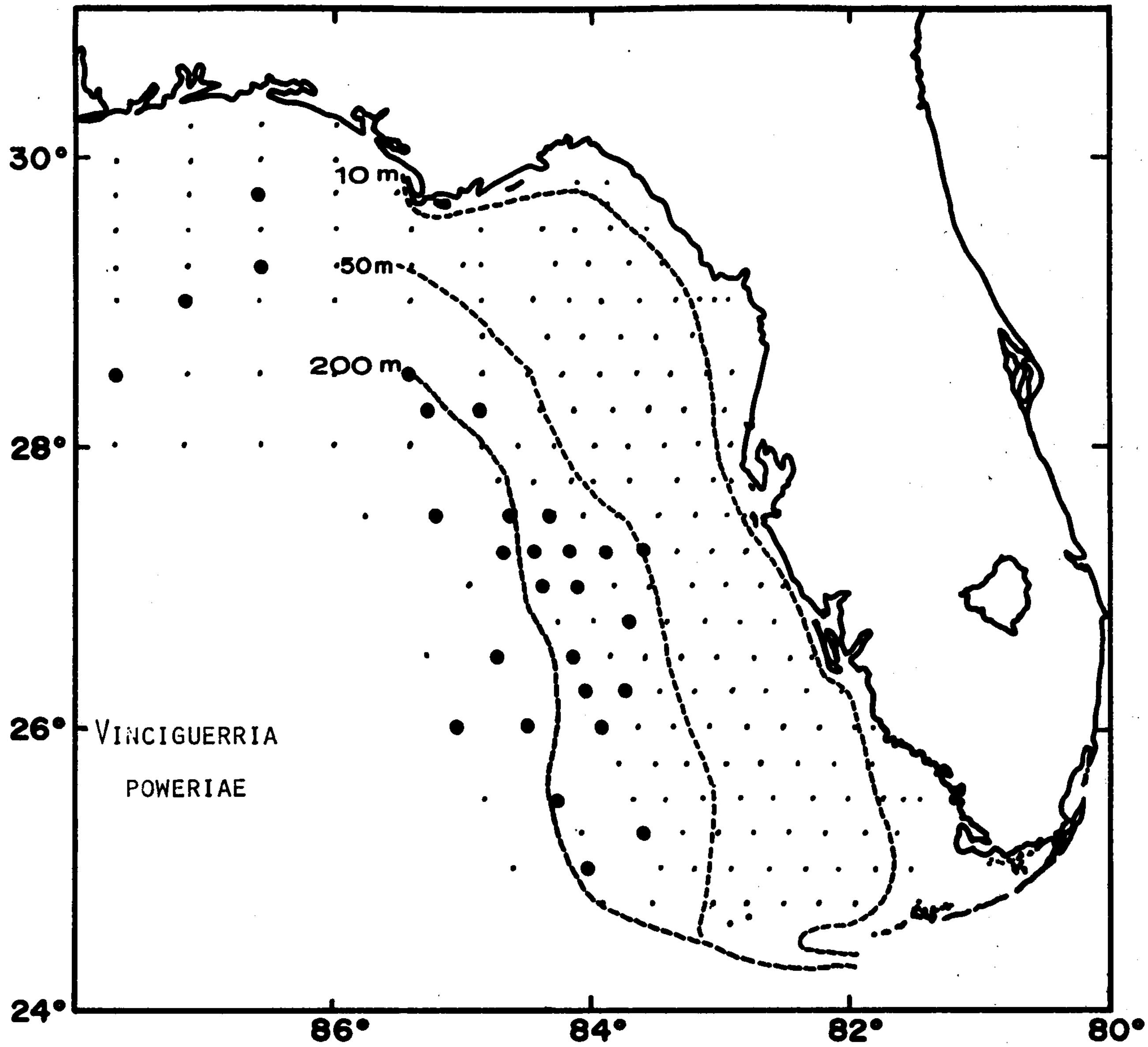



Fig. 23 Stations at which Vinciguerria poweriae larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

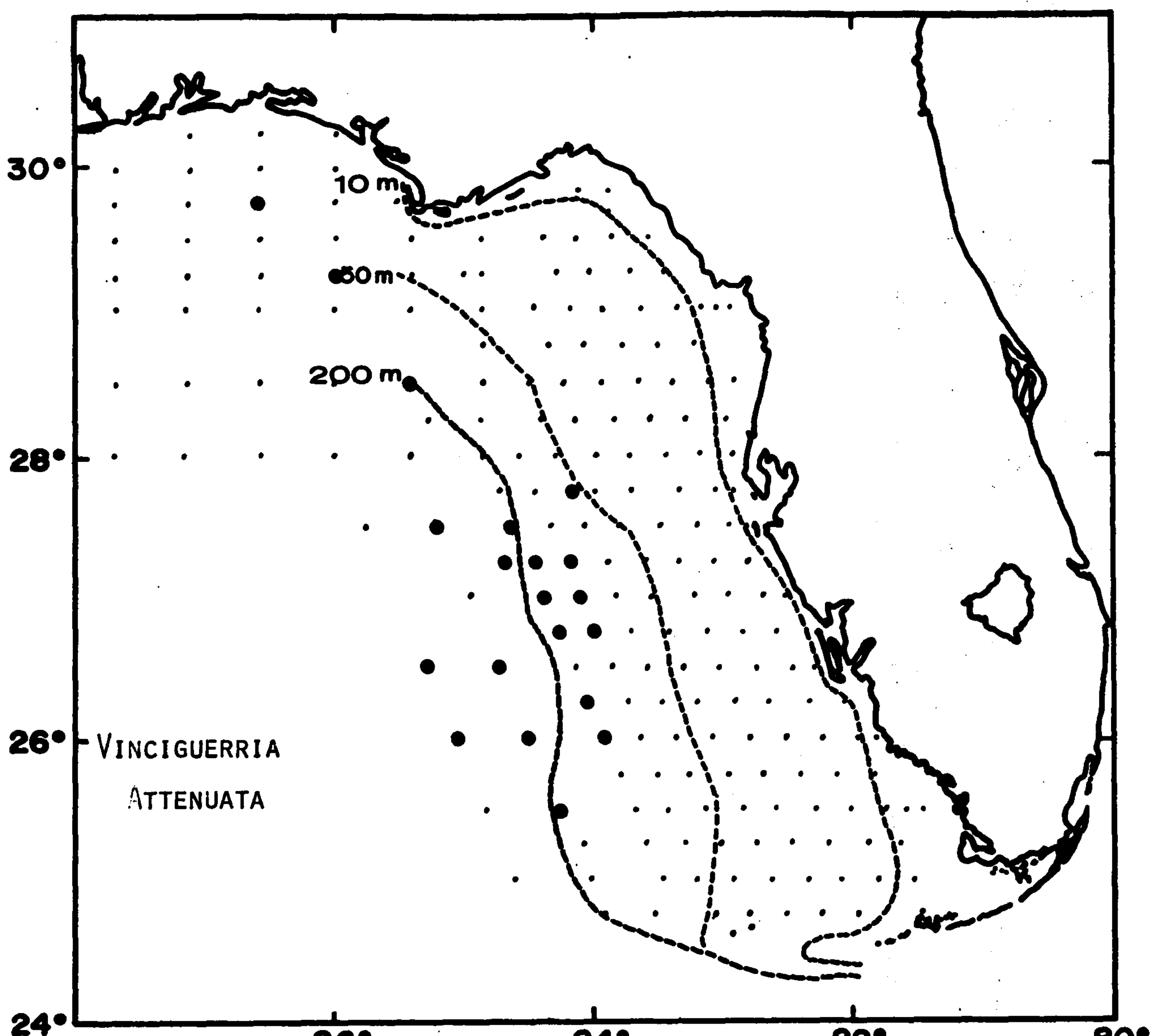



Fig. 24 Stations at which Vinciguerria attenuata larvae occurred at least once during 17 crusies to the eastern Gulf of Mexico, 1971-1974.

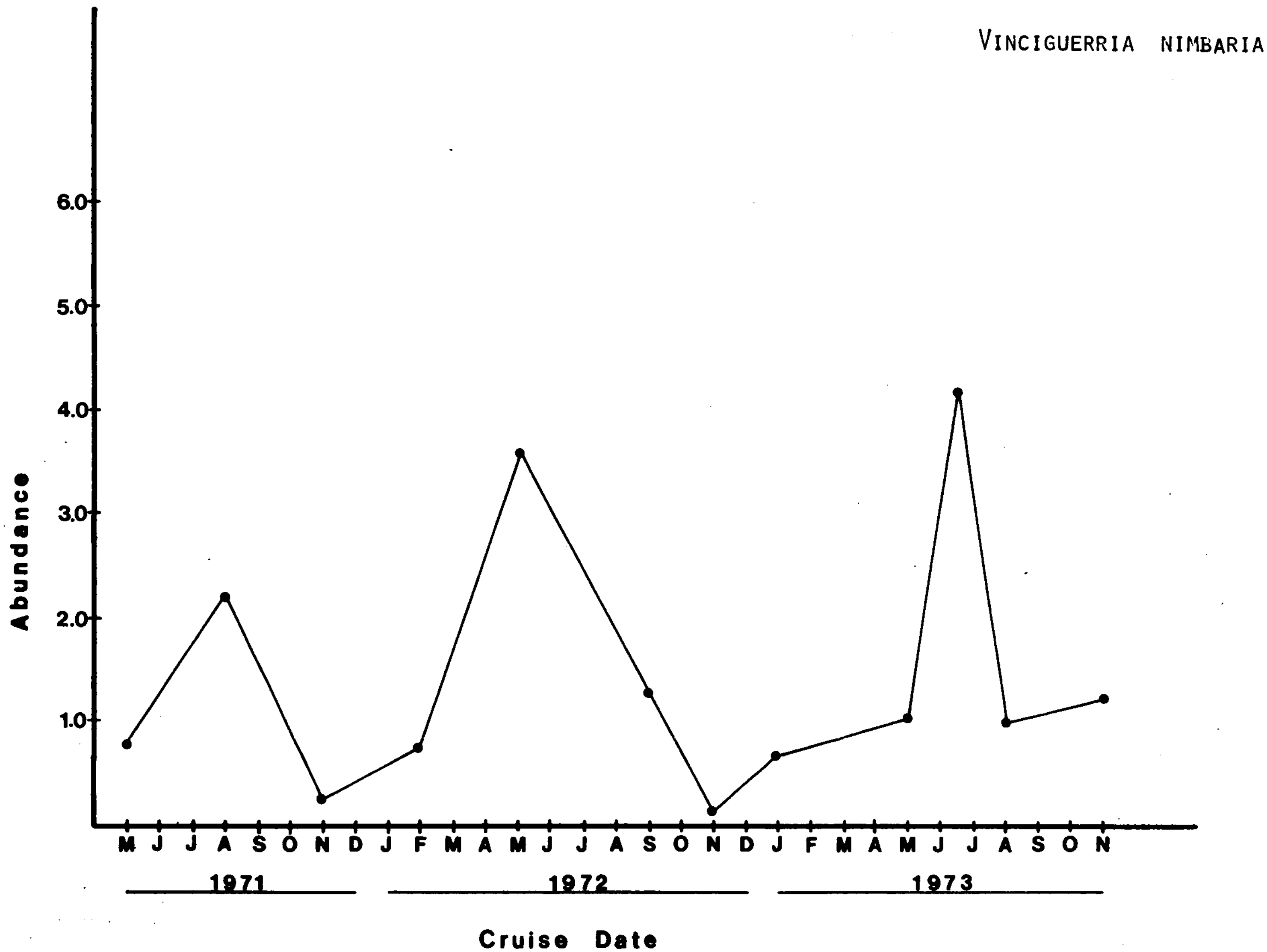



Fig. 25 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Vinciguerria nimbaria larvae in the eastern Gulf of Mexico, 1971-1974.

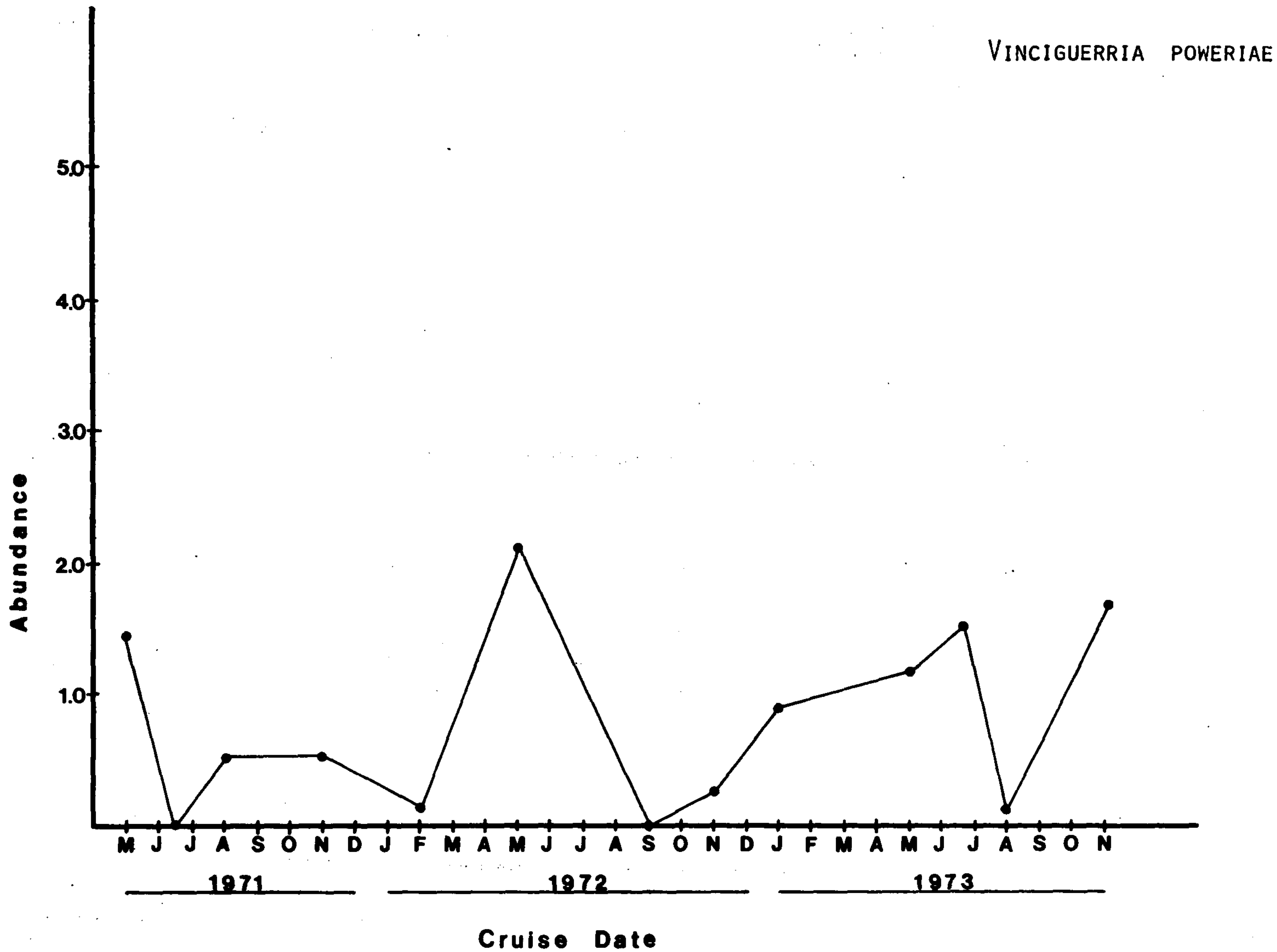



Fig. 26 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Vinciguerria poweriae larvae in the eastern Gulf of Mexico, 1971-1974.

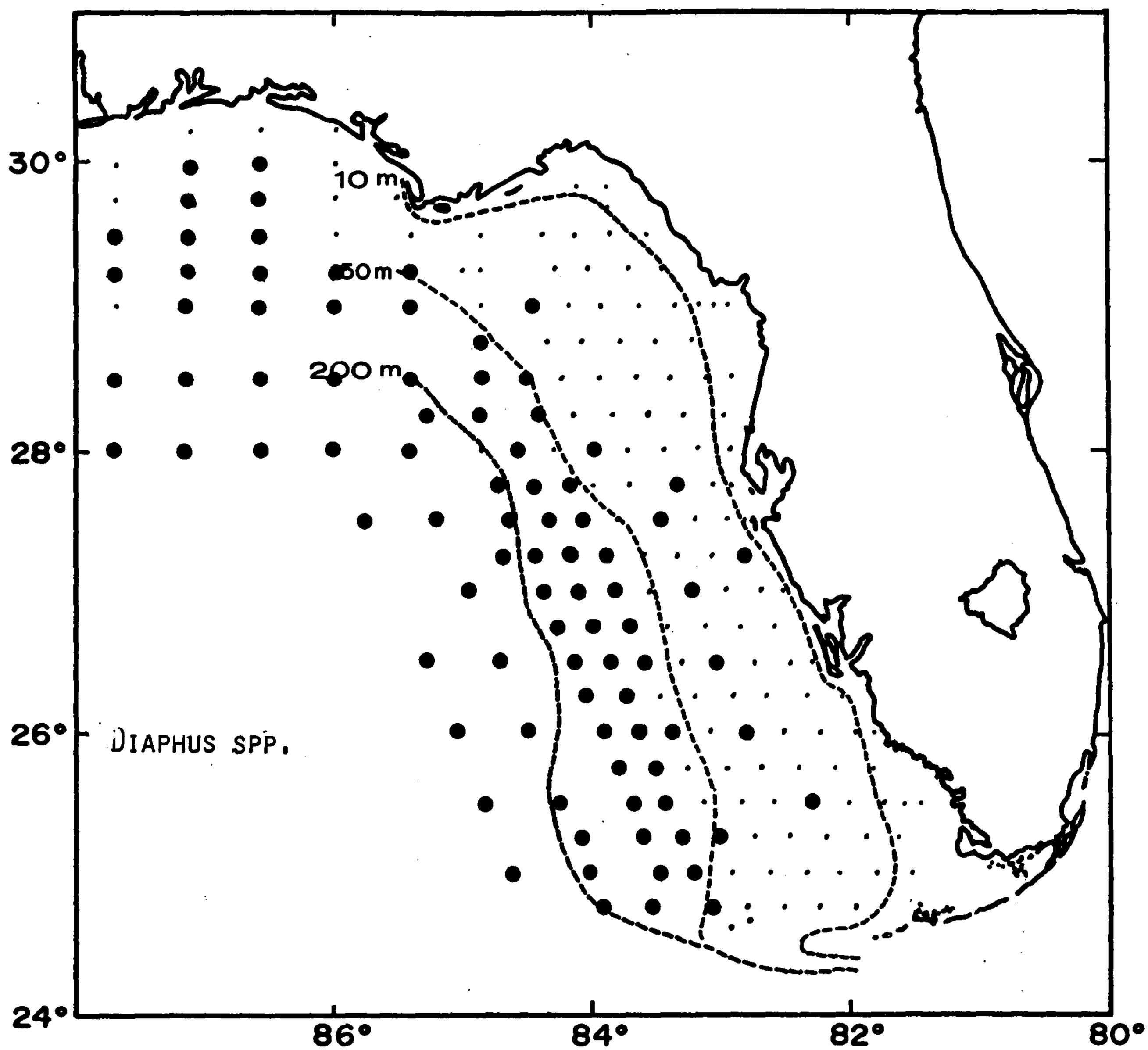



Fig. 27 Stations at which Diaphus spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

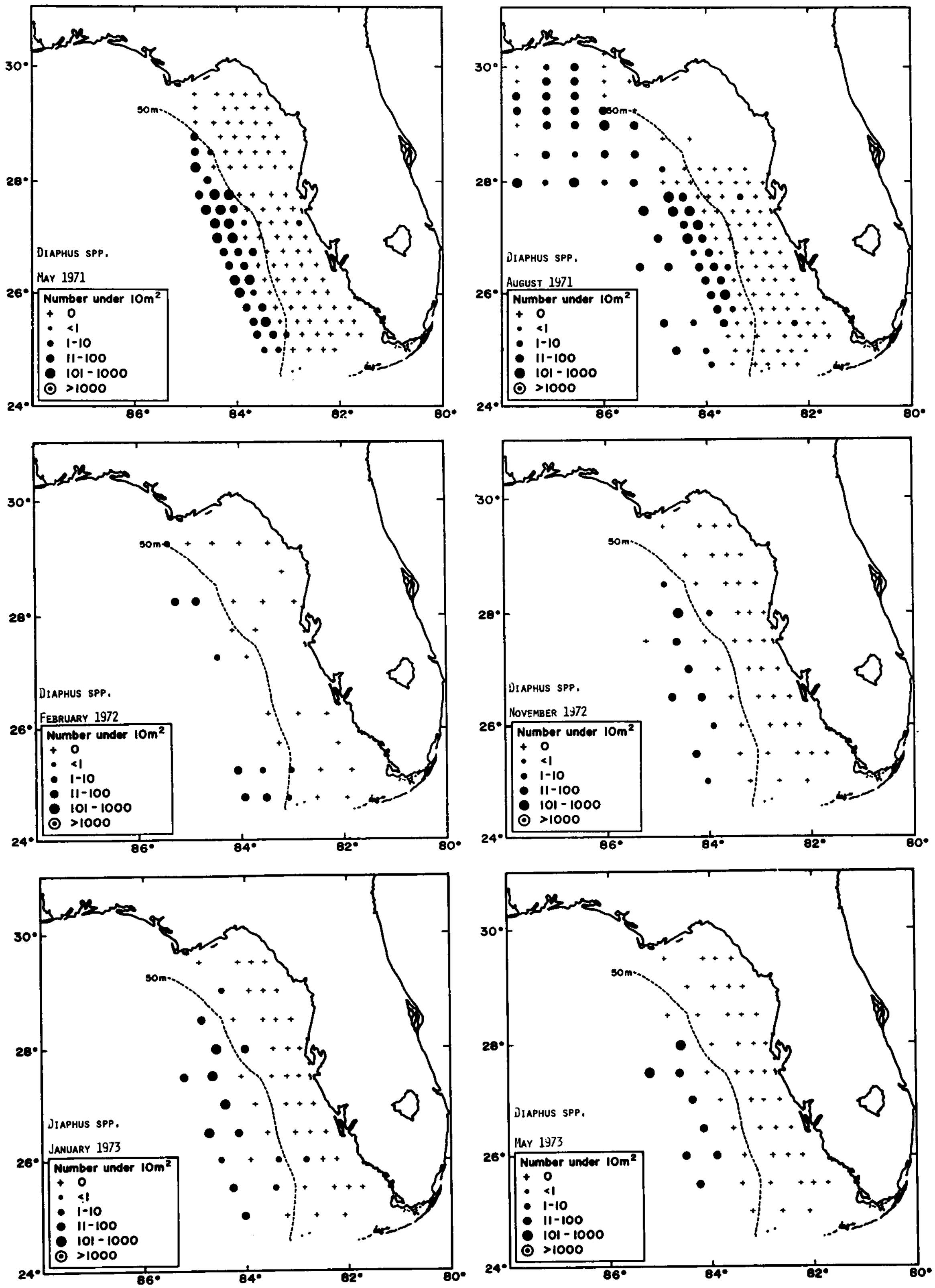



Fig. 28 Distribution and abundance of Diaphus spp. larvae in the eastern Gulf of Mexico, 1971-1974.

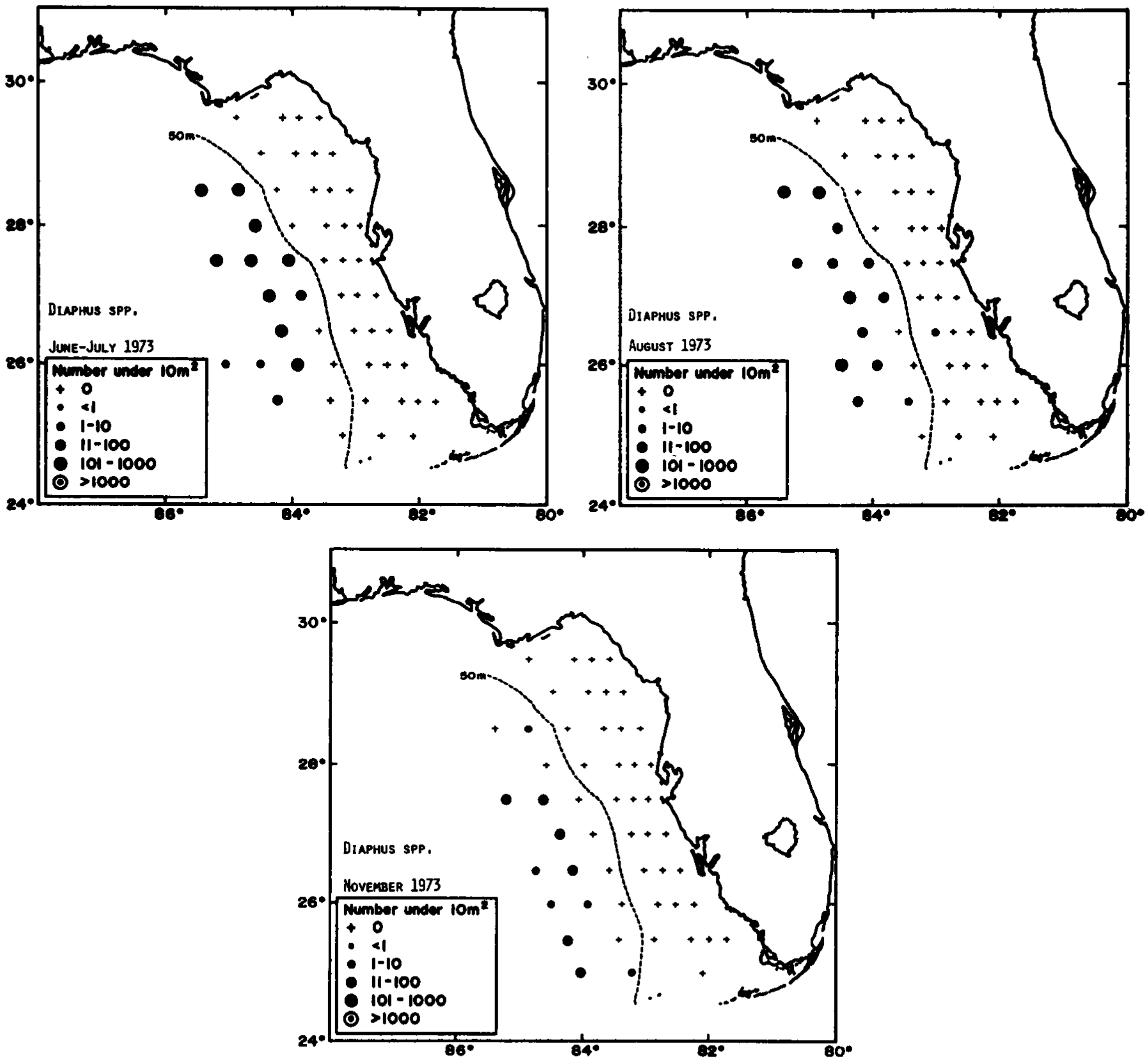

30°
28°
26°
24°
86°
84°
82°
80°
50m
Diaphus spp.
June-July 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
Diaphus spp.
August 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
Diaphus spp.
November 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000

Fig. 28 Cont.

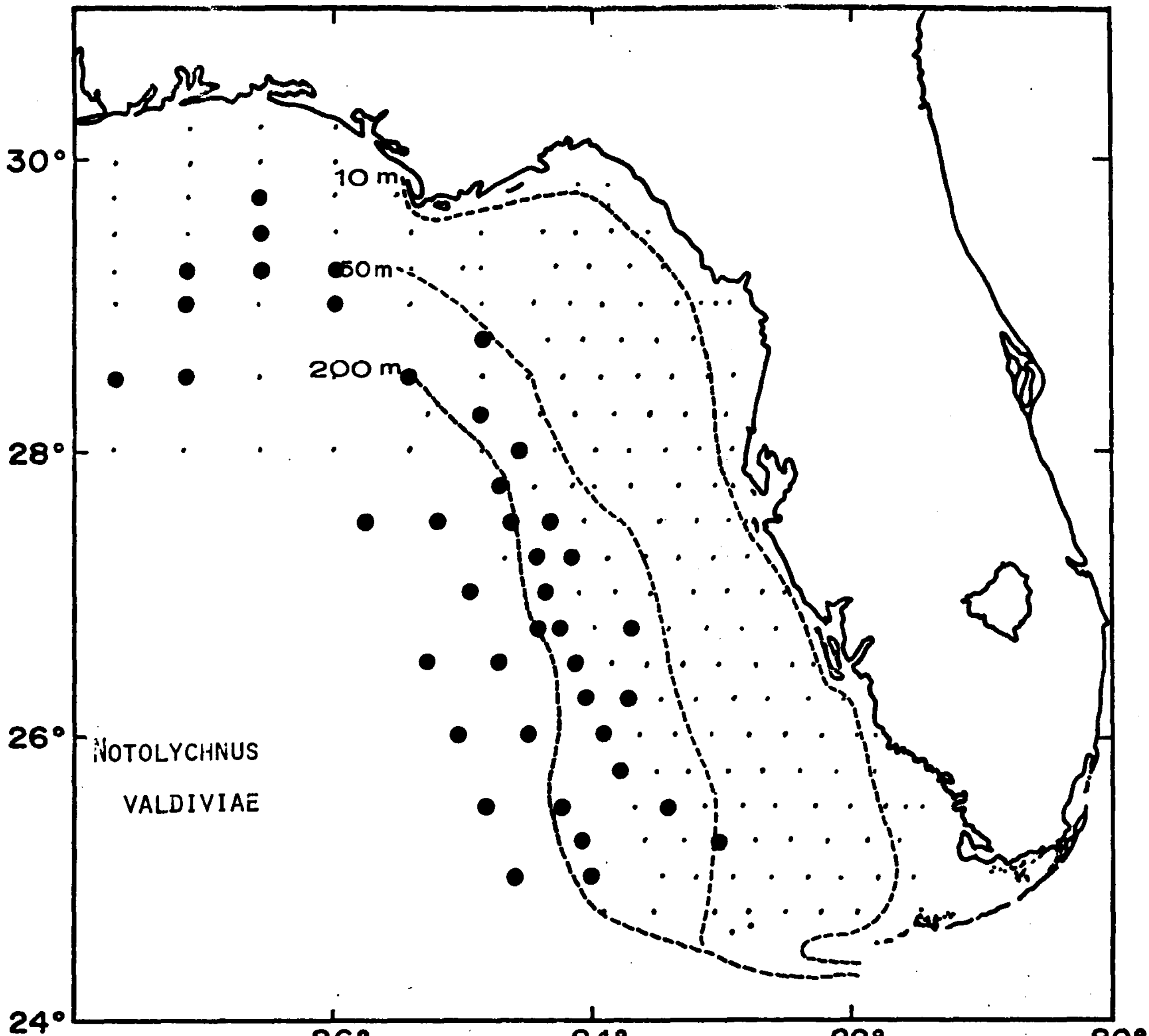



Fig. 29 Stations at which Notolychnus valdiviae larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

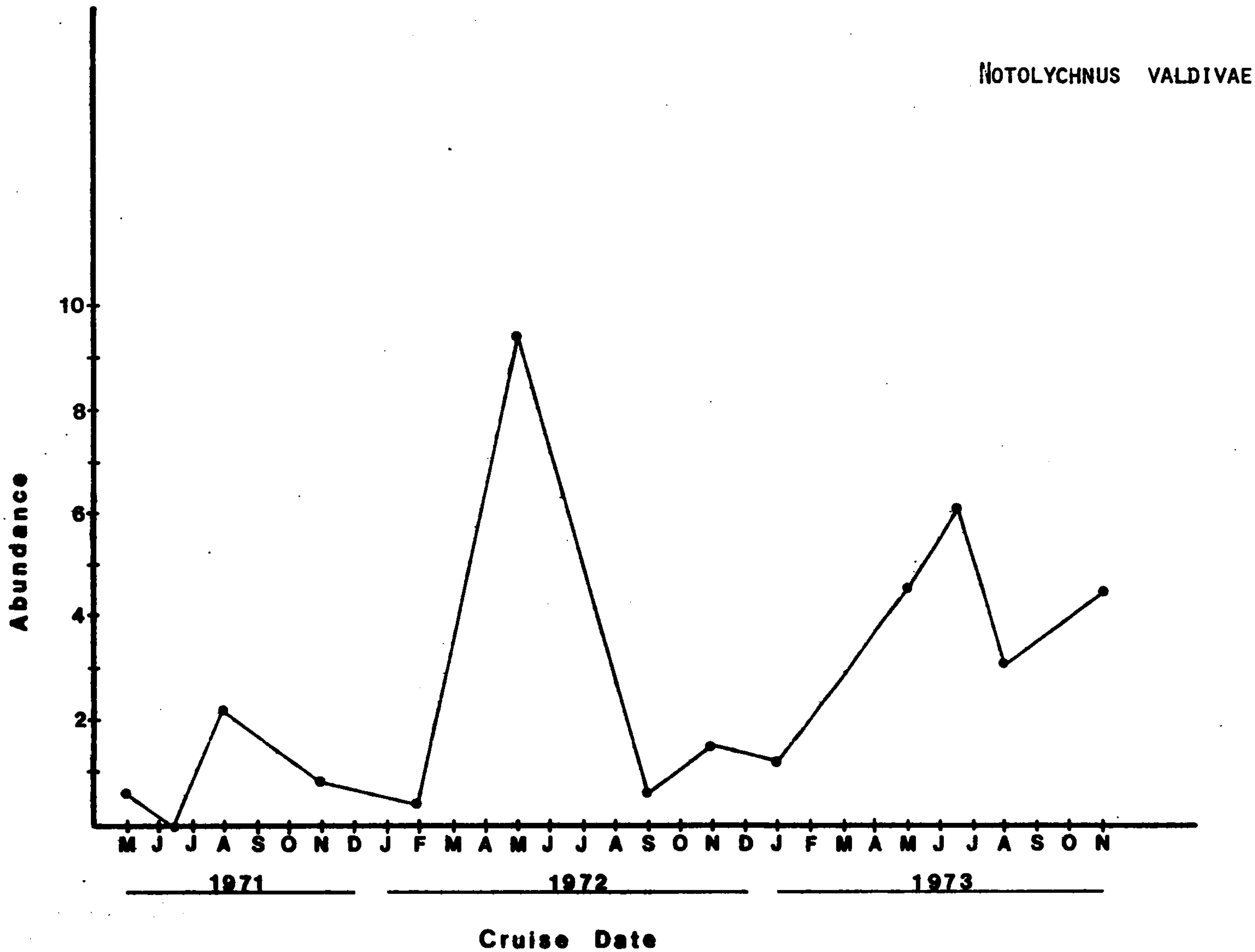



Fig. 30 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Notolychnus valdiviae larvae in the eastern Gulf of Mexico, 1971-1974.

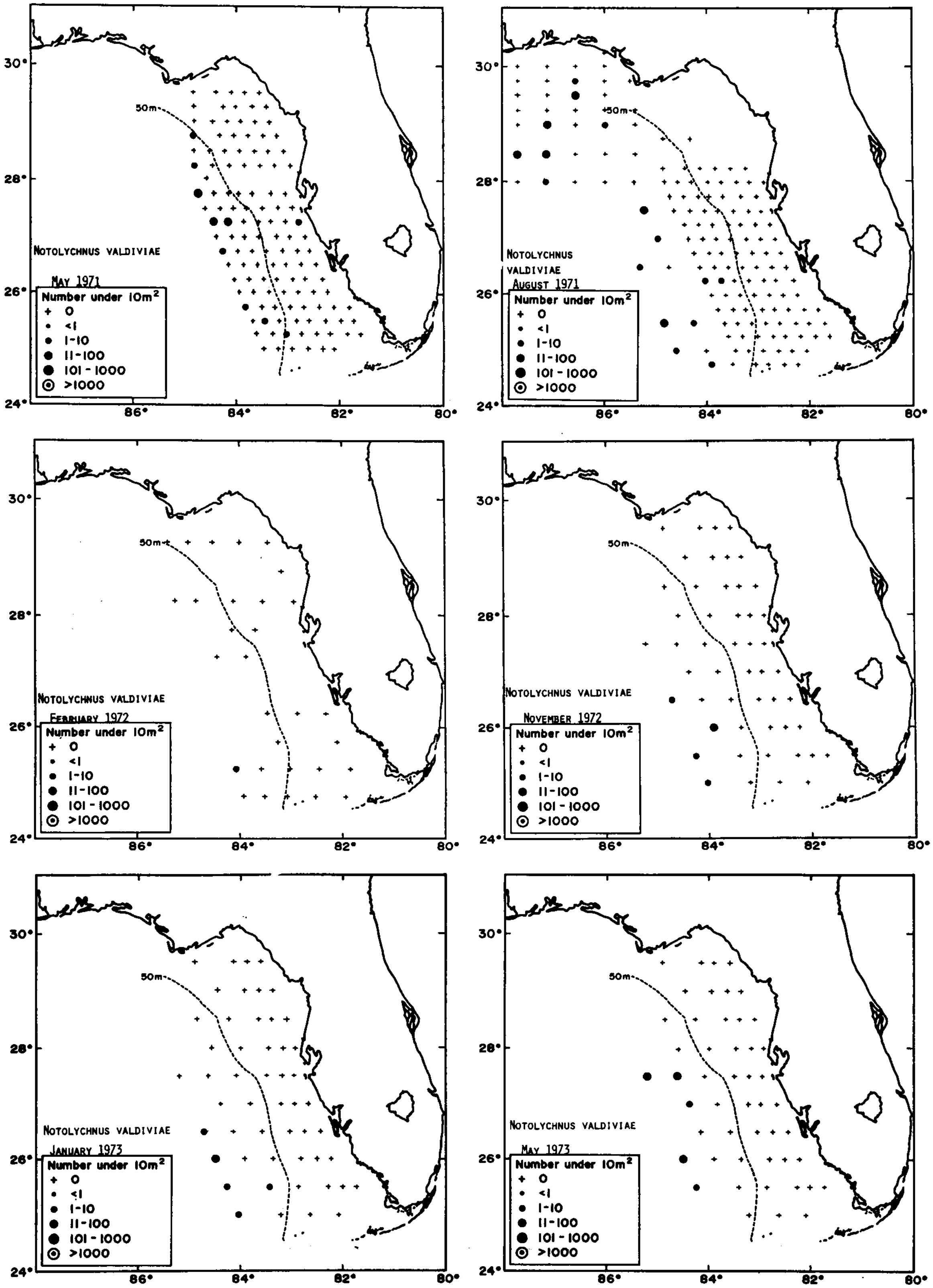



Fig. 31 Distribution and abundance of Notolychnus valdiviae larvae in the eastern Gulf of Mexico, 1971-1974.

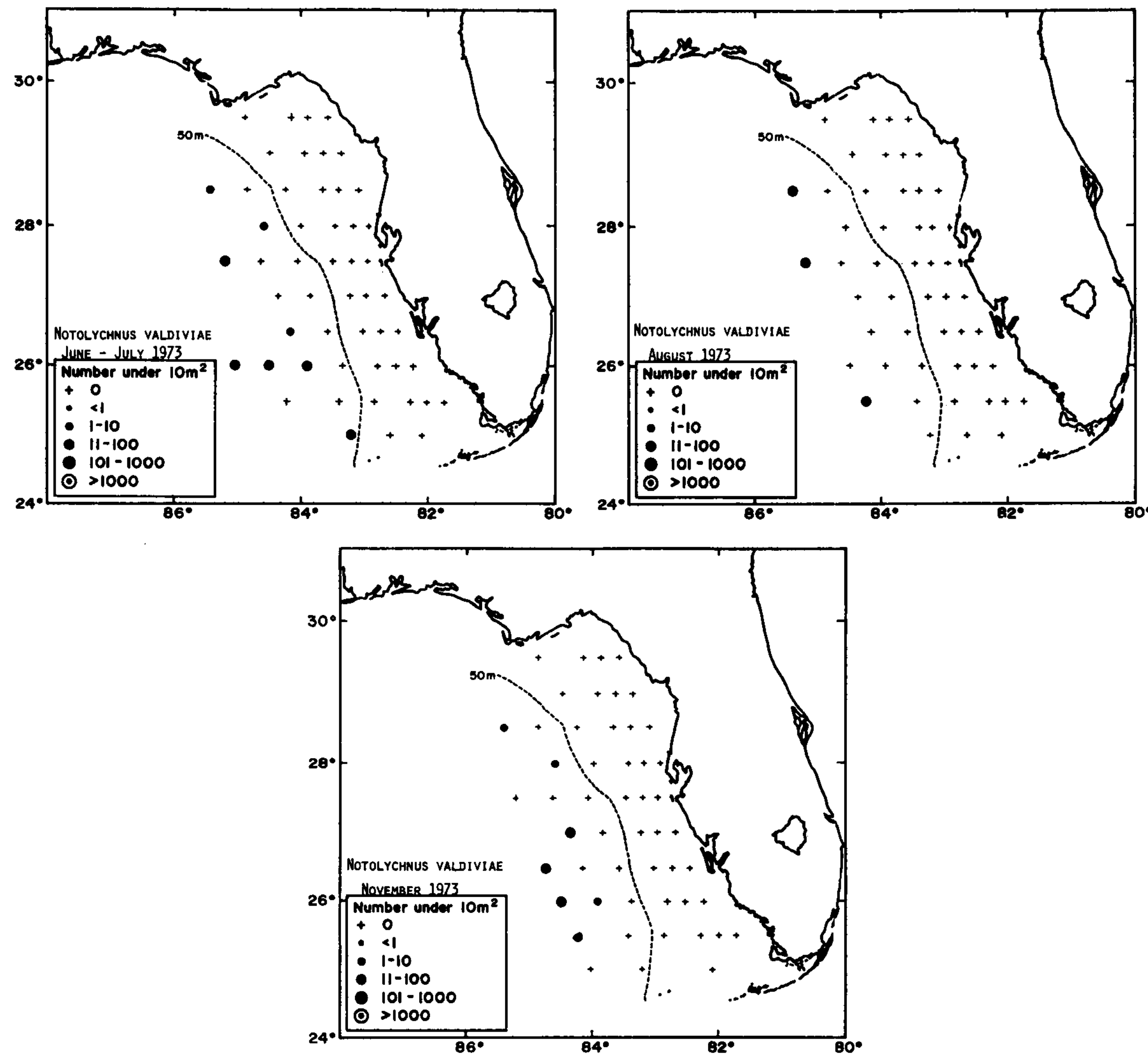

30°
28°
26°
24°
86°
84°
82°
80°
50m
NOTOLYCHNUS VALDIVIAE
JUNE - JULY 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
NOTOLYCHNUS VALDIVIAE
AUGUST 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
NOTOLYCHNUS VALDIVIAE
NOVEMBER 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000

Fig. 31 Cont.

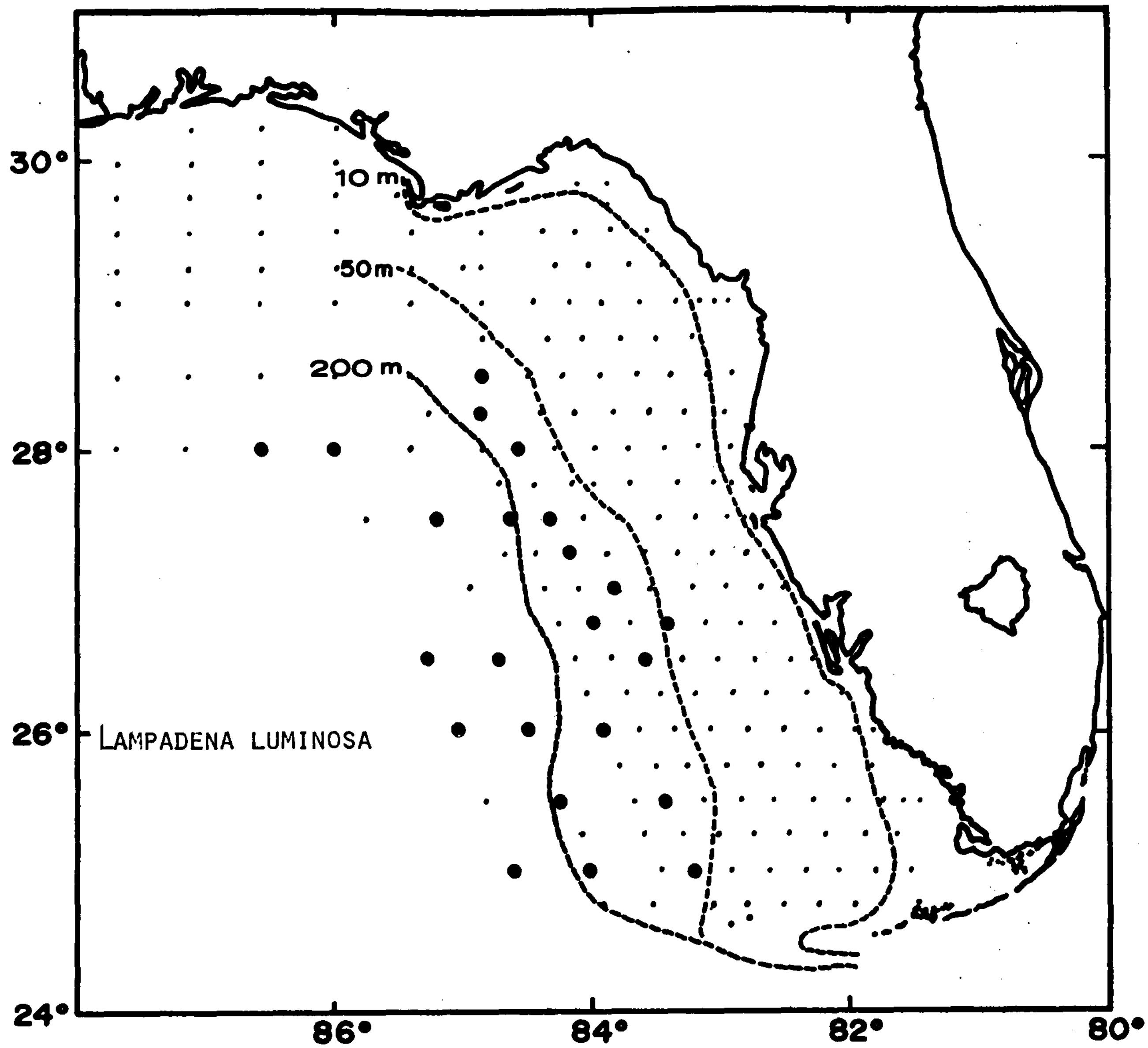



Fig. 32 Stations at which Lampadena luminosa larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

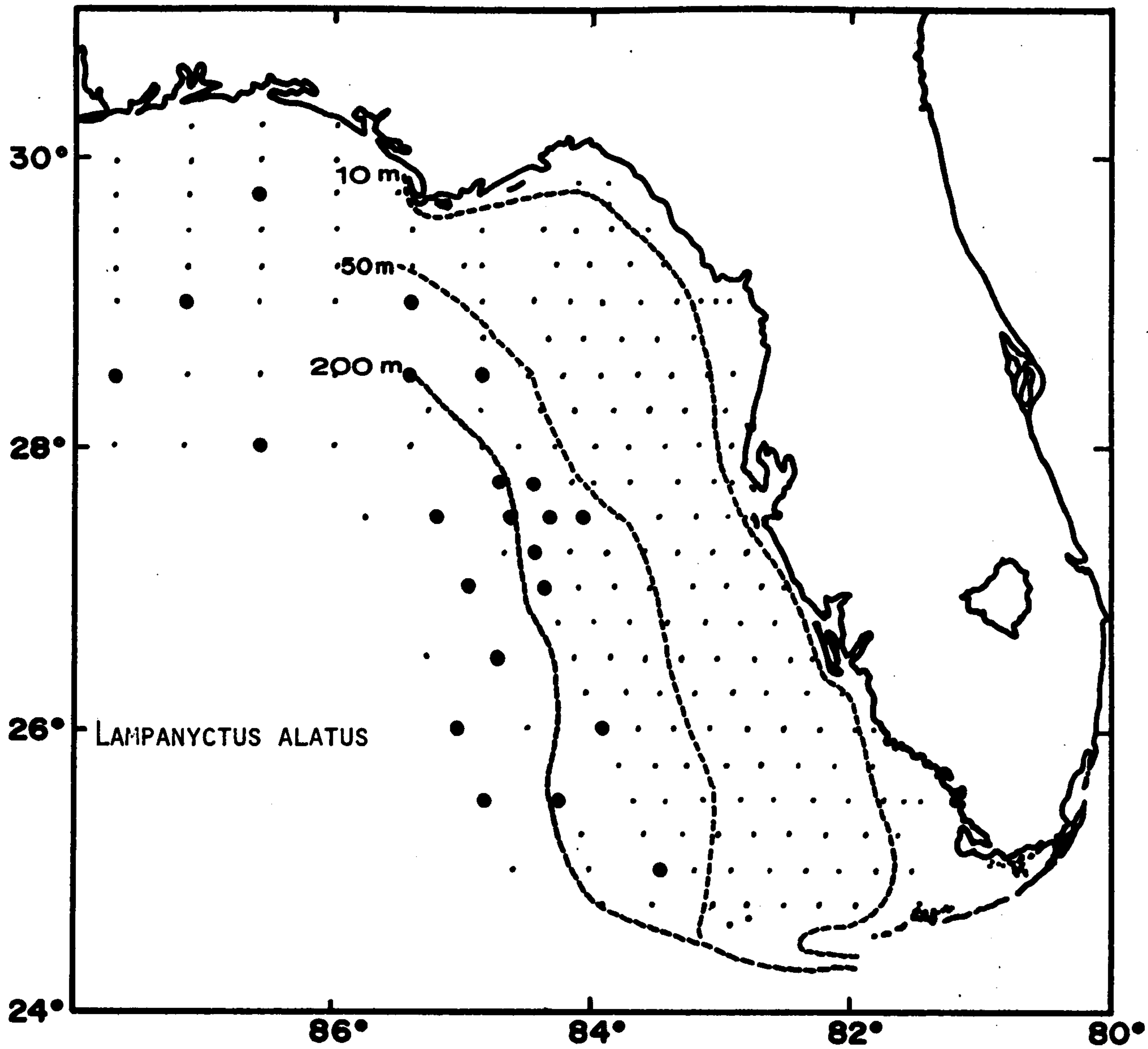



Fig. 33 Stations at which Lampanyctus alatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

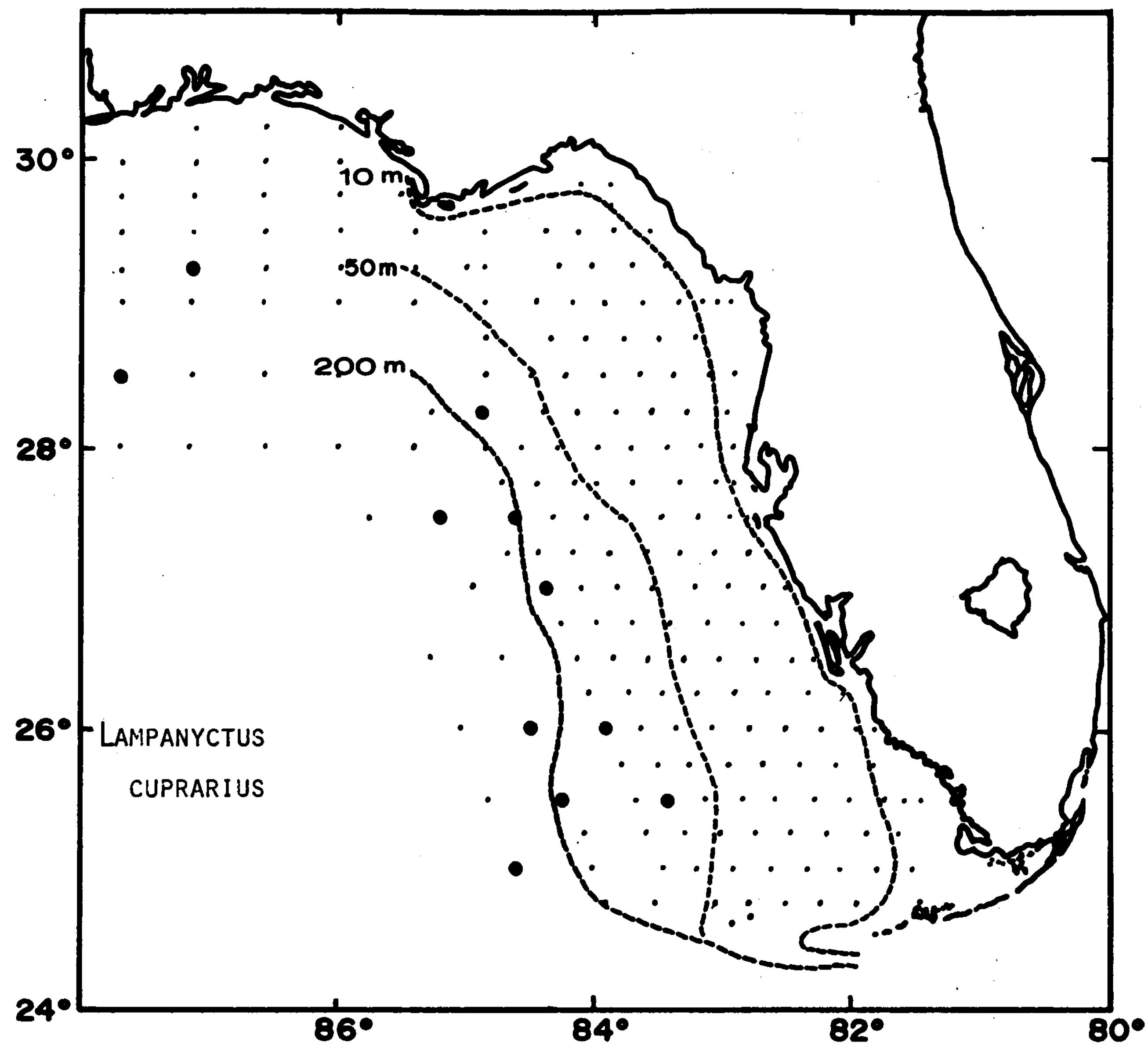



Fig. 34 Stations at which Lampanyctus cuprarius larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

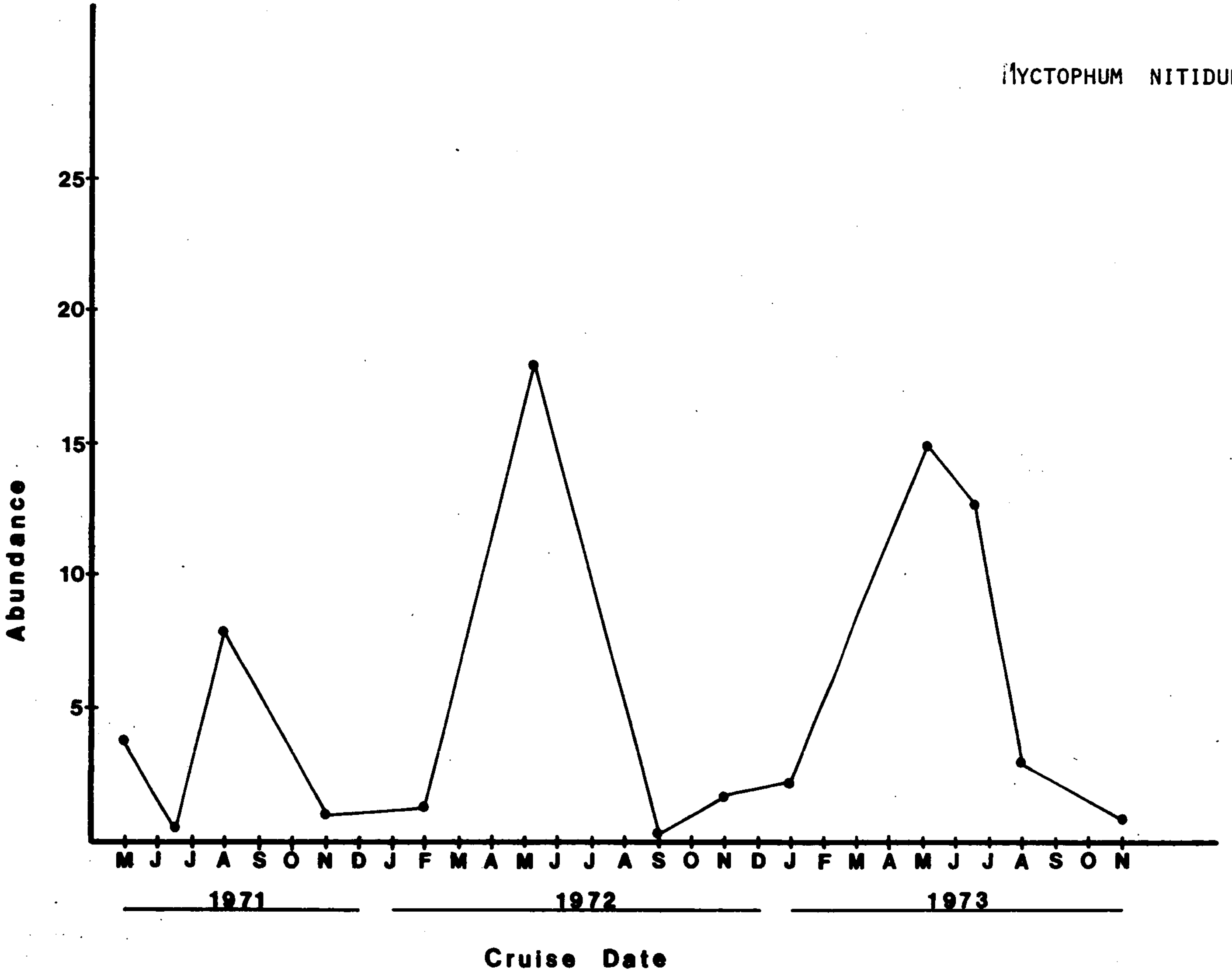



Fig. 35 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Myctophum nitidulum larvae in the eastern Gulf of Mexico, 1971-1974.

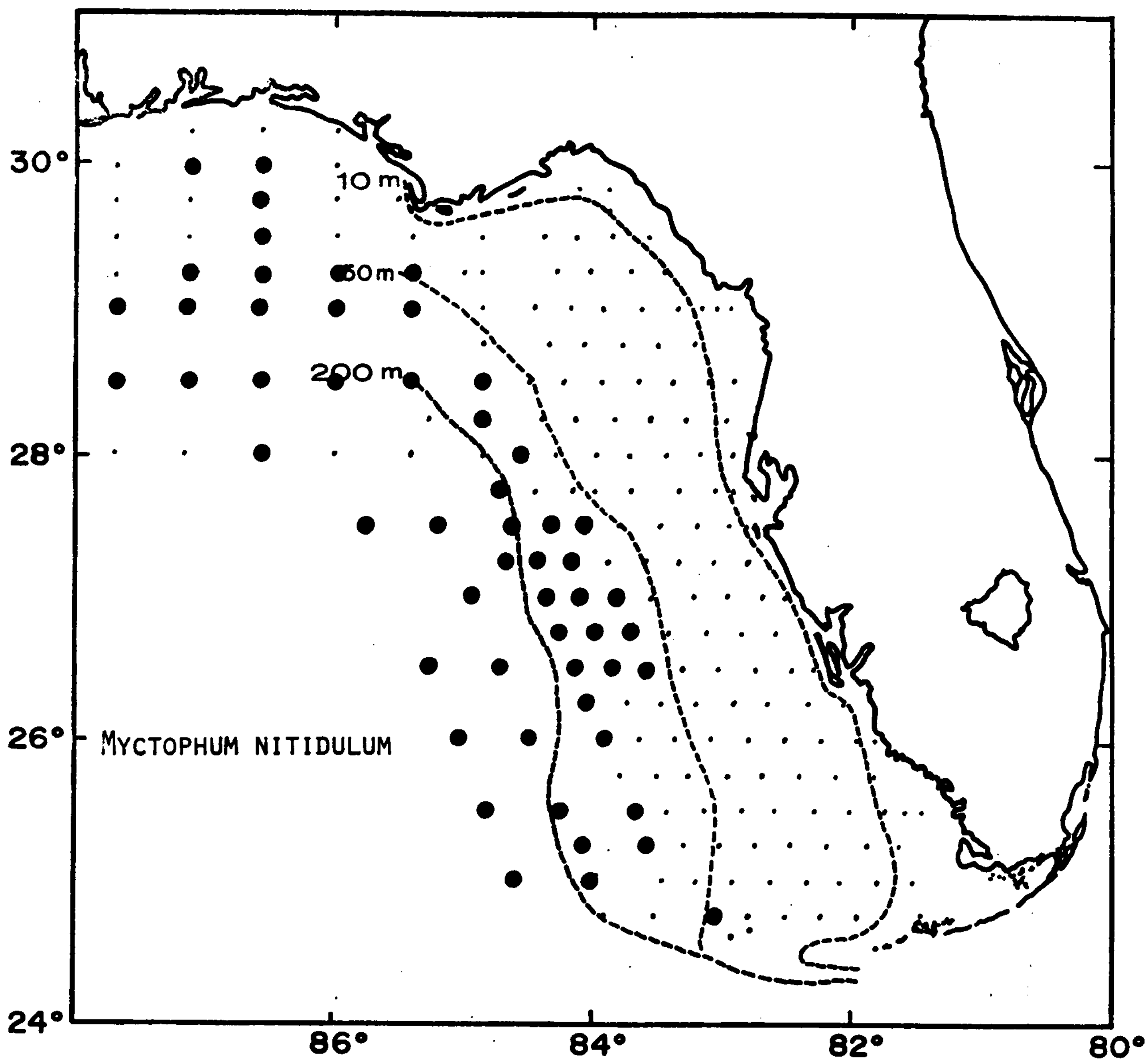



Fig. 36 Stations at which Myctophum nitidulum larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

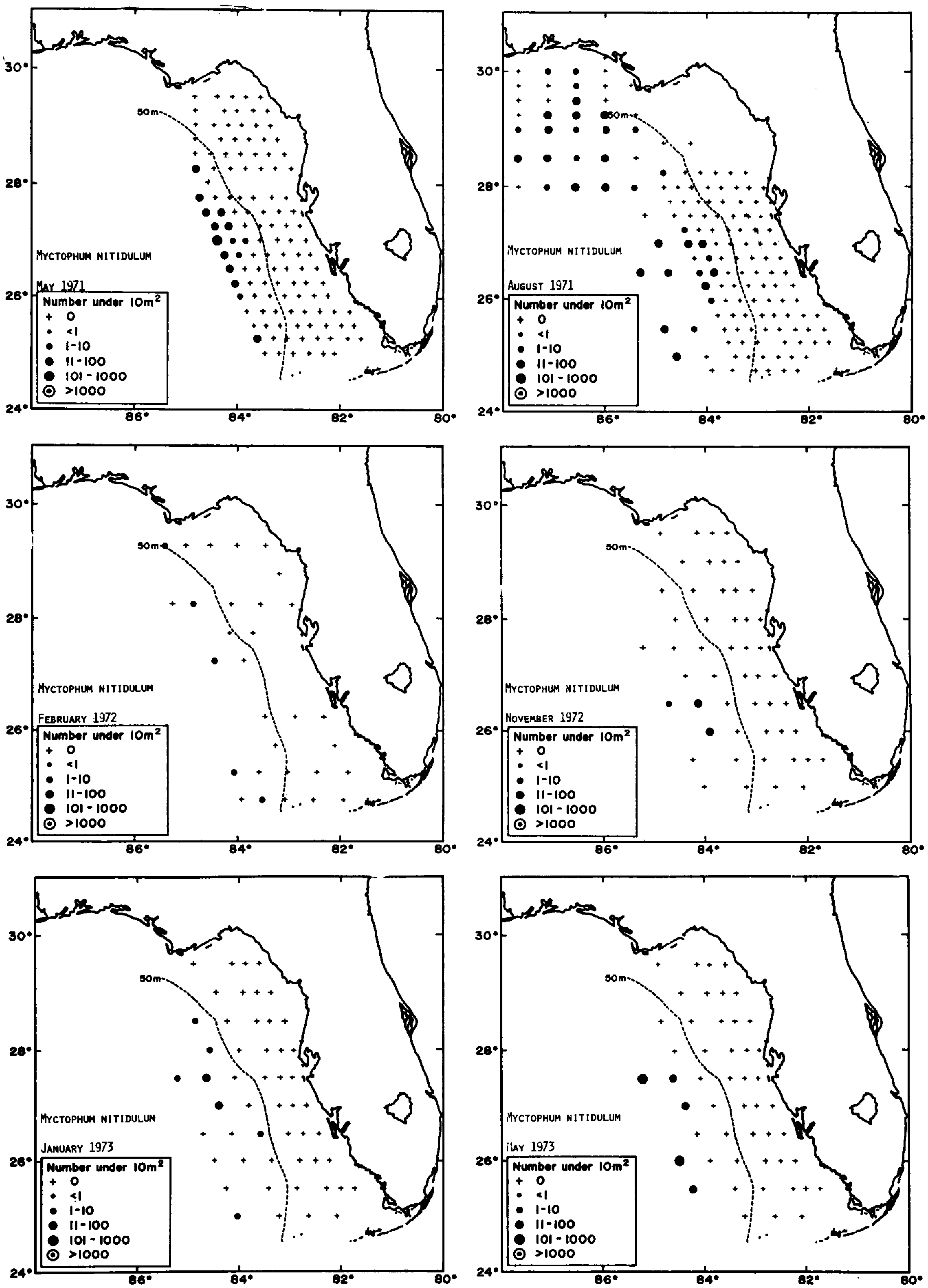



Fig. 37 Distribution and abundance of <u>Myctophum nitidulum</u> larvae in the eastern Gulf of Mexico, 1971-1974.

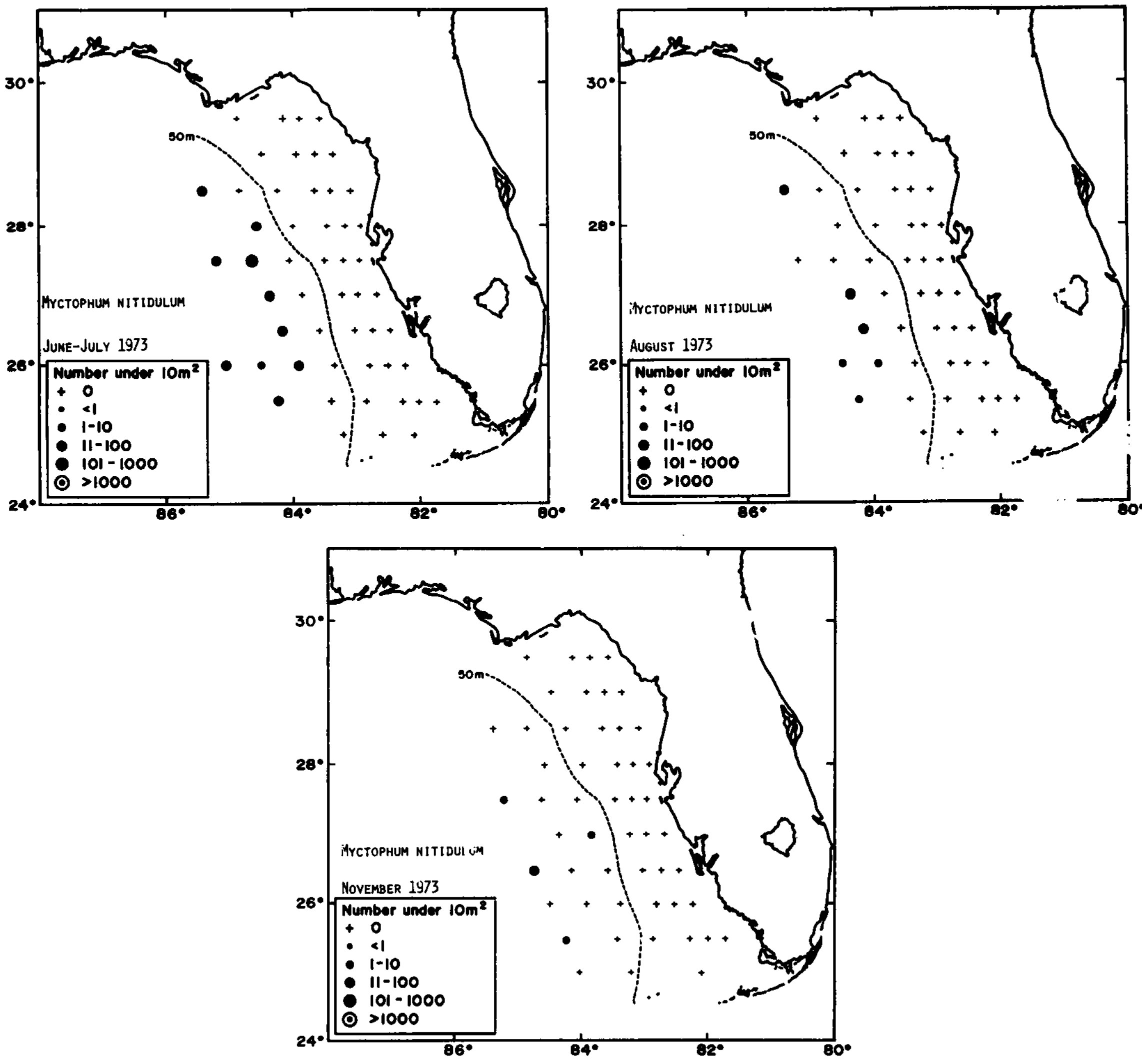

30°
28°
26°
24°
86°
84°
82°
80°
50m
MYCTOPHUM NITIDULUM
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000
MYCTOPHUM NITIDULUM
AUGUST 1973
MYCTOPHUM NITIDULUM
NOVEMBER 1973

Fig. 37 Cont.

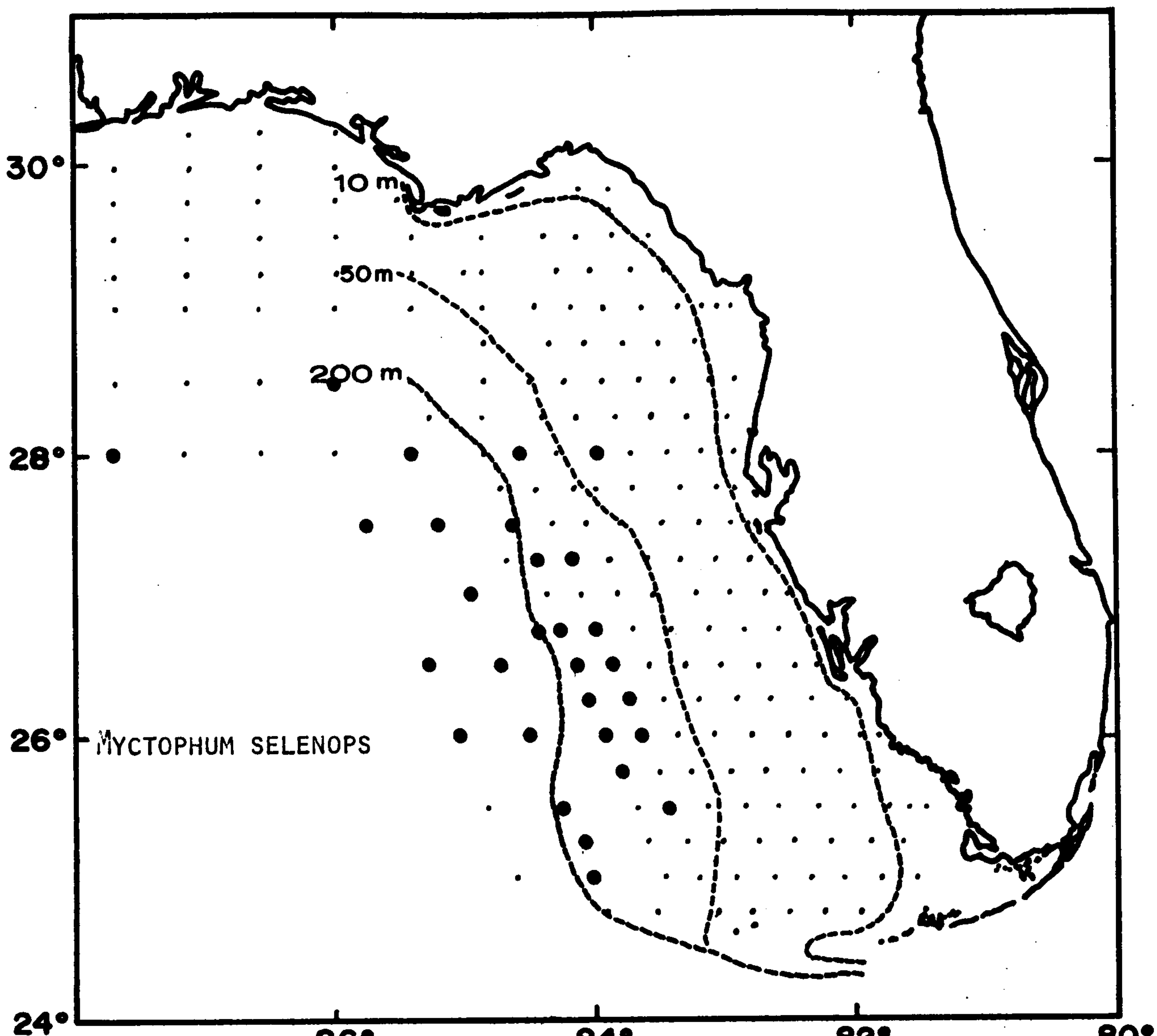



Fig. 38 Stations at which _Myctophum selenops_ larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

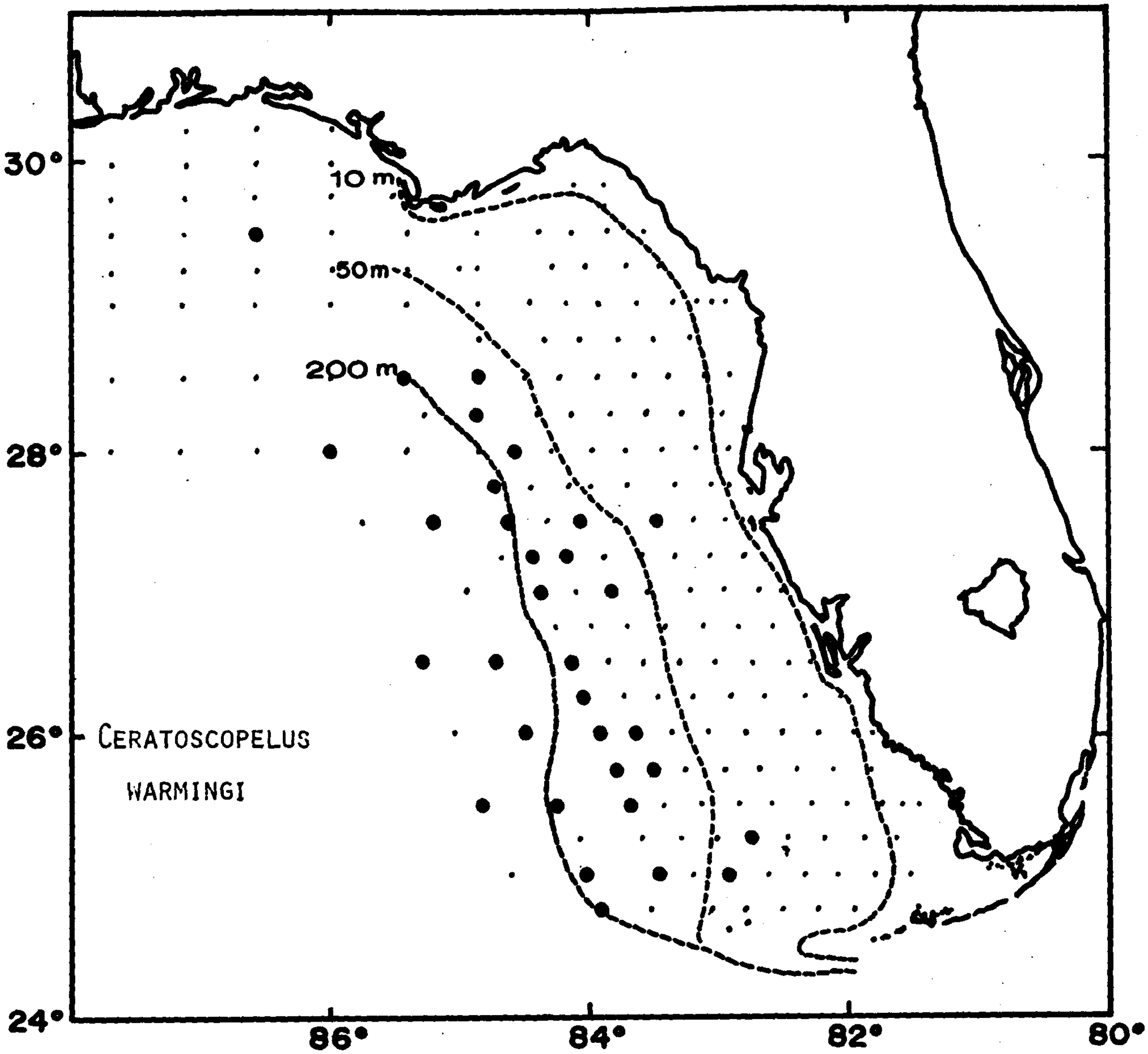



Fig. 39 Stations at which Cetatoscopelus warmingi larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

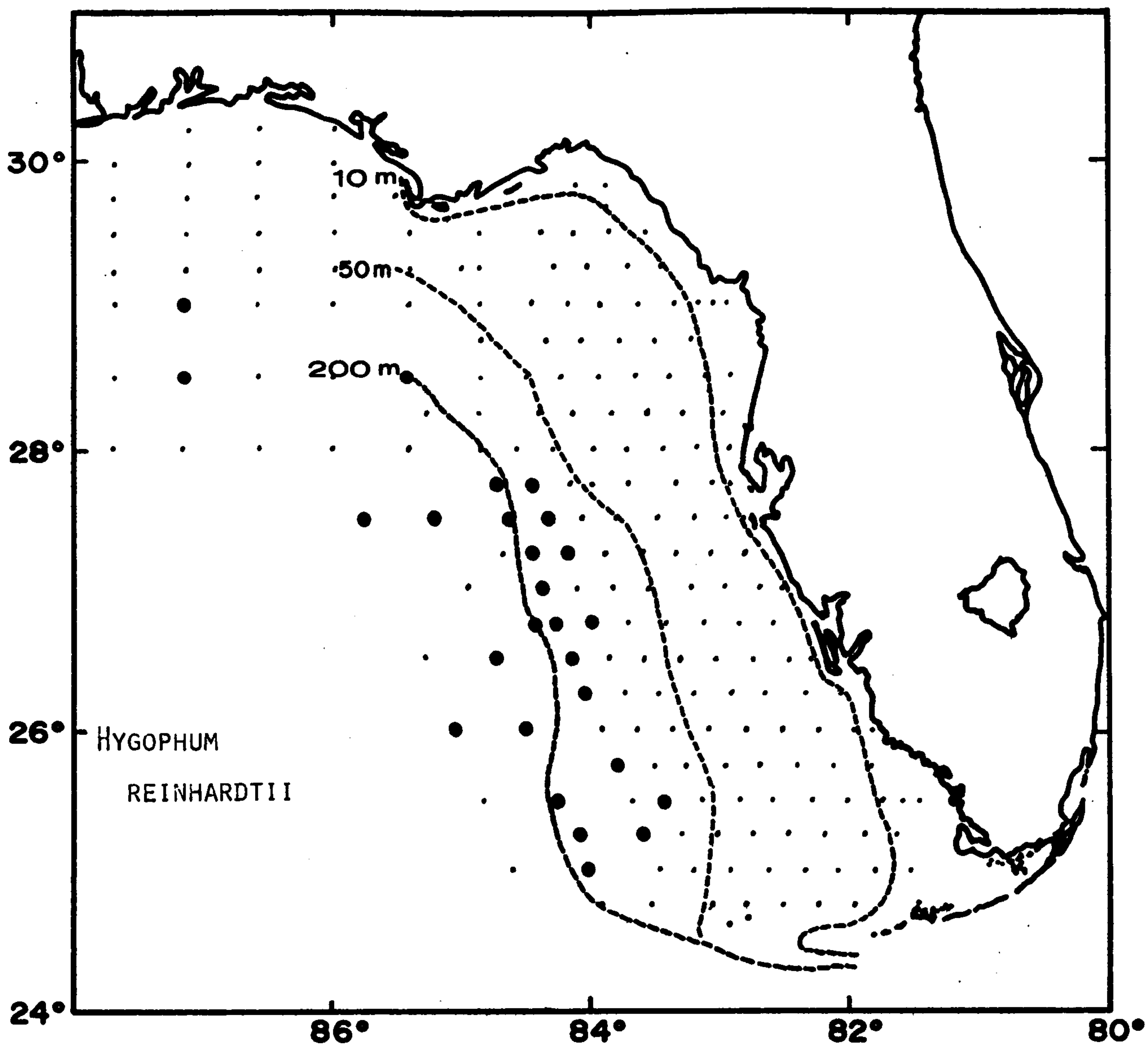



Fig. 40 Stations at which Hygophum reinhardti larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

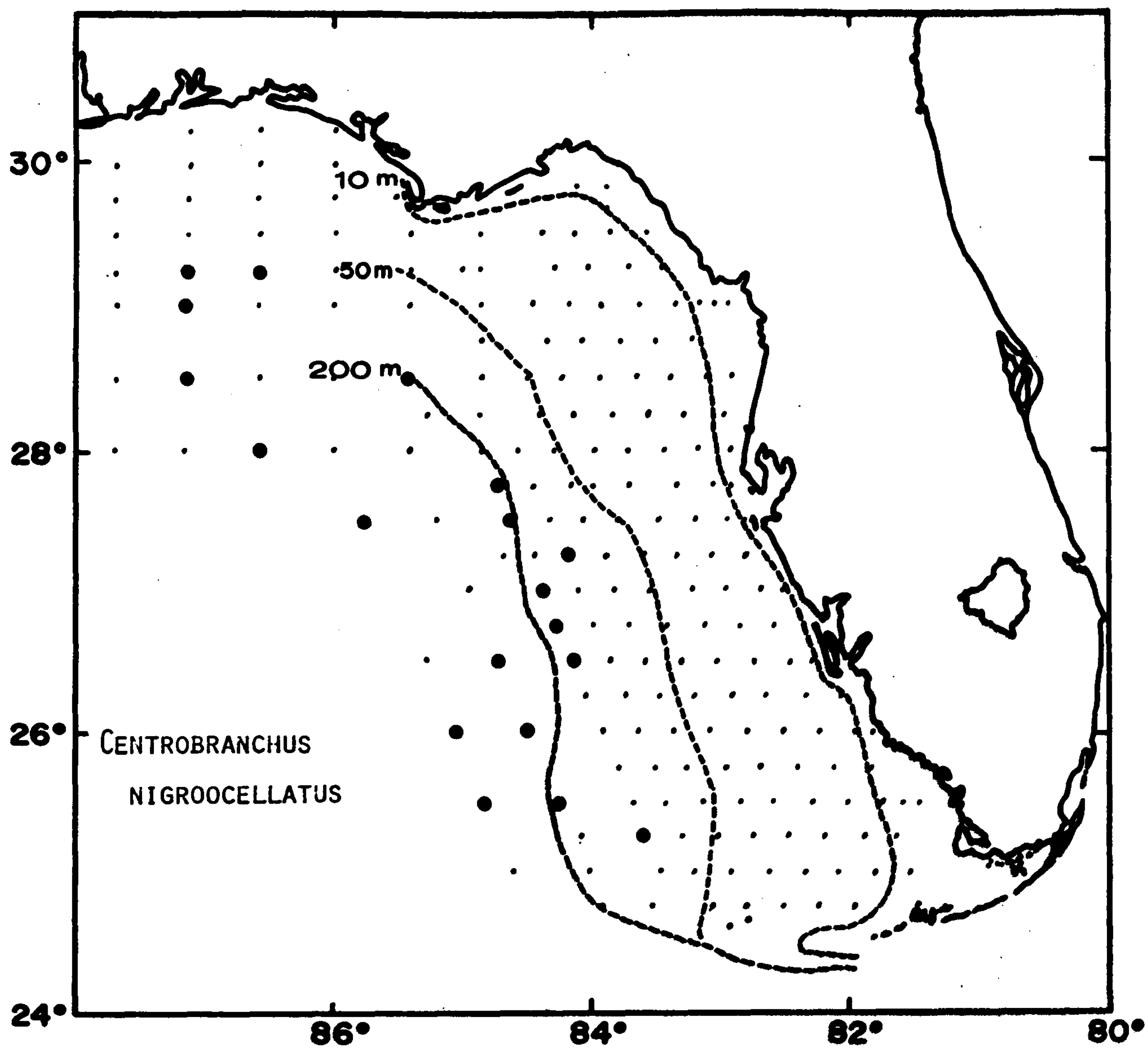



Fig. 41 Stations at which <u>Centrobranchus nigroocellatus</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

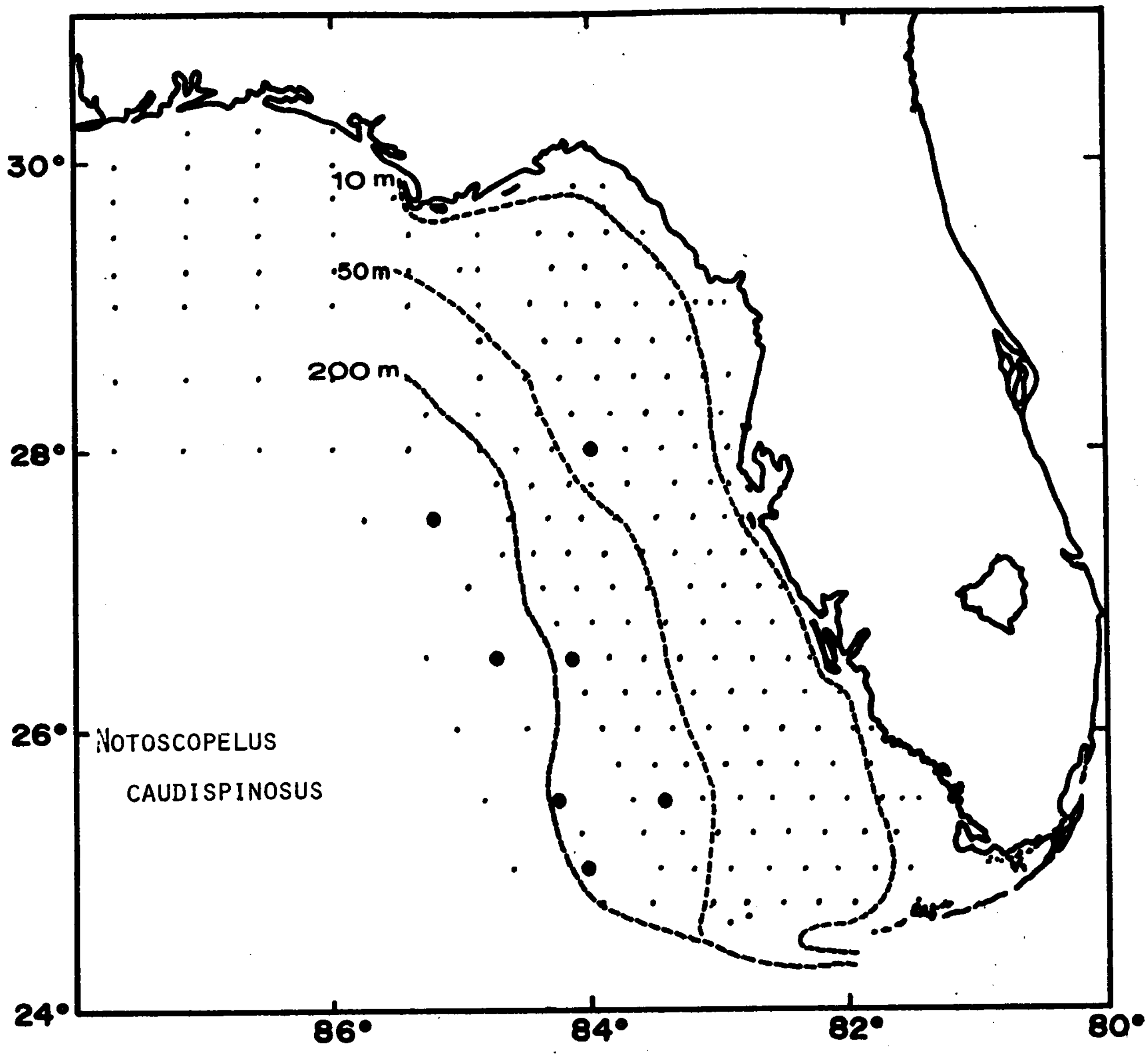



Fig. 42 Stations at which Notoscopelus caudispinosus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

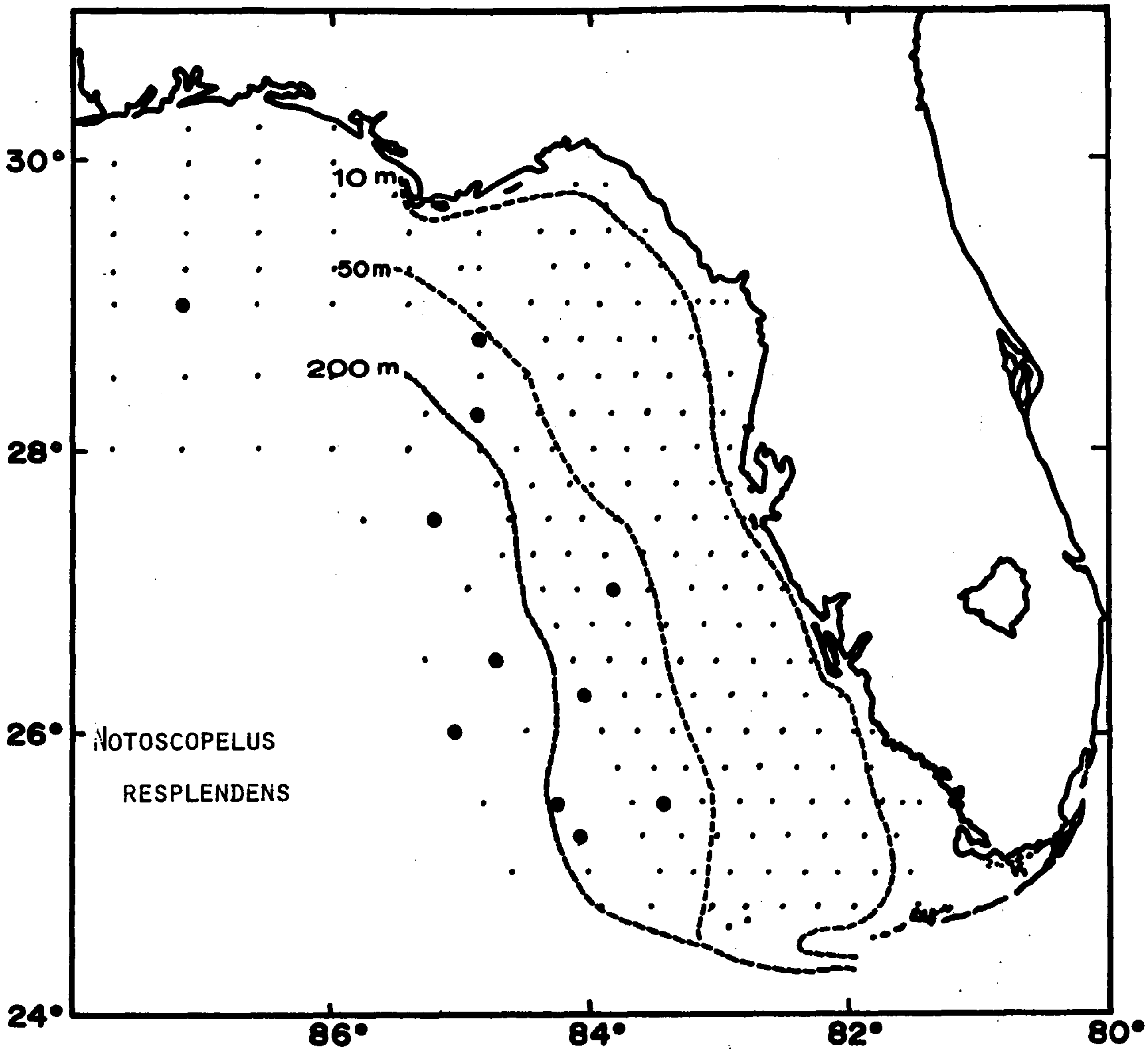



Fig. 43 Stations at which Notoscopelus resplendens larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

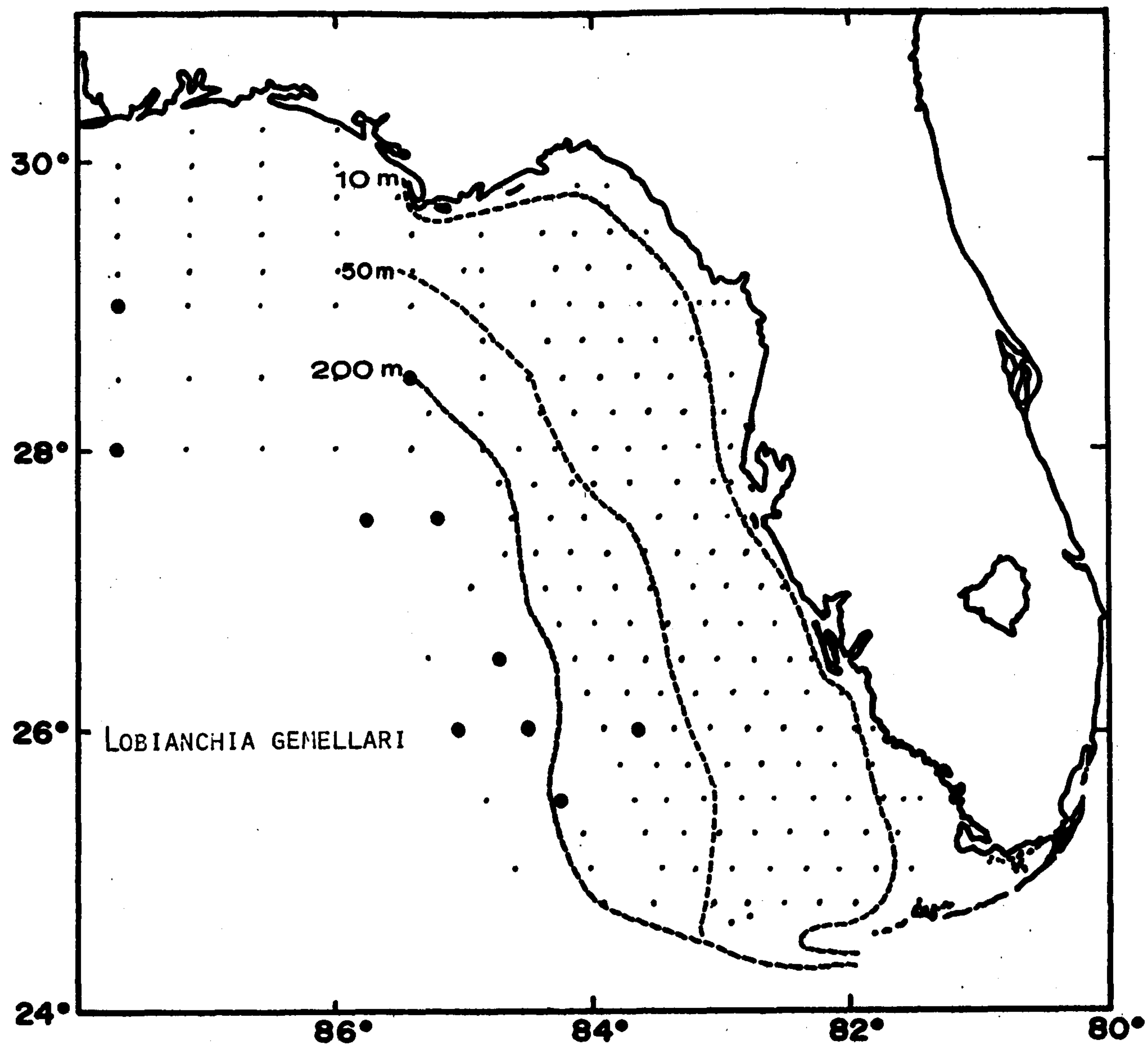



Fig. 44 Stations at which Lobiancha gemellari larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

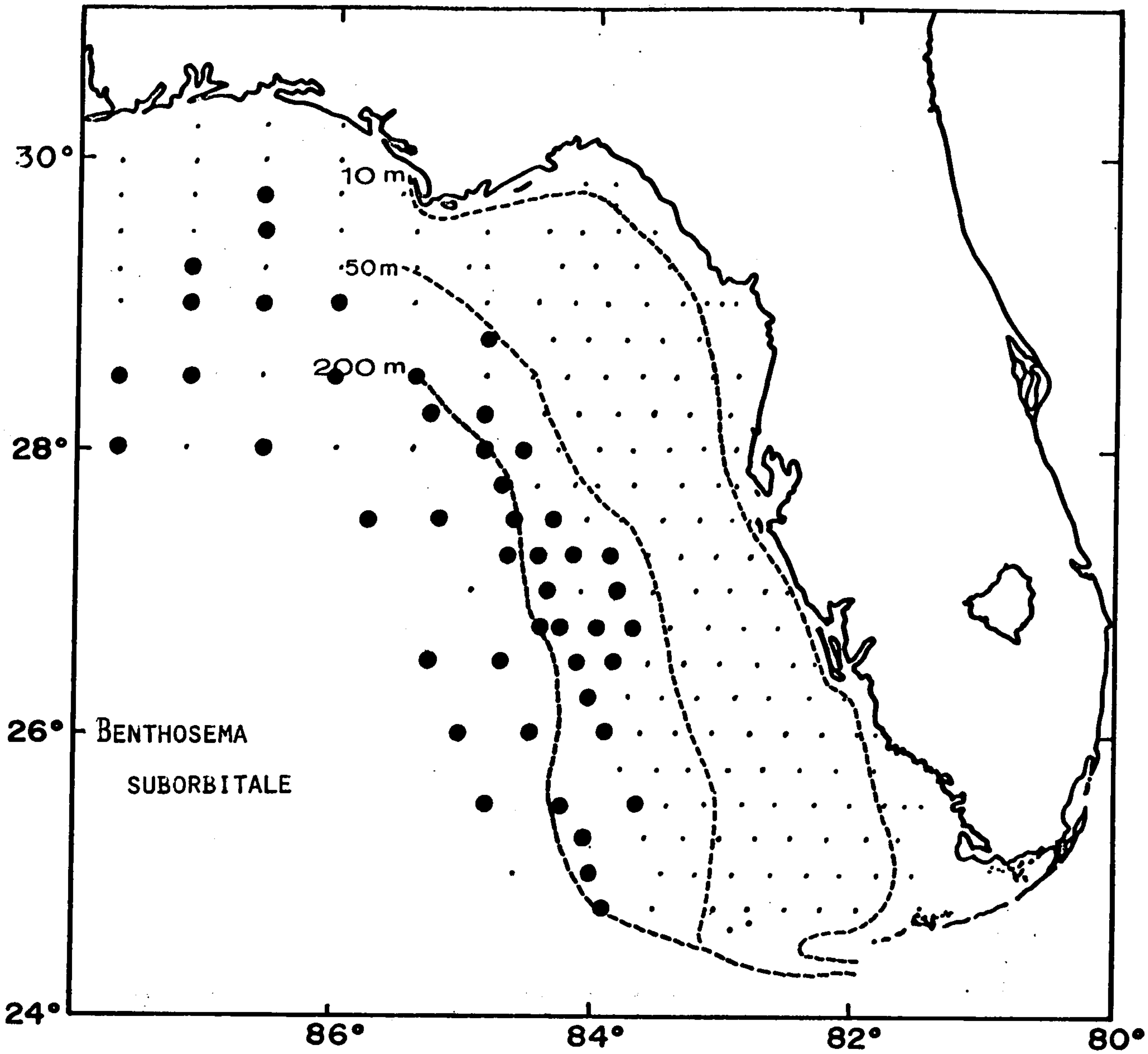



Fig. 45 Stations at wich Benthosema suborbitale larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

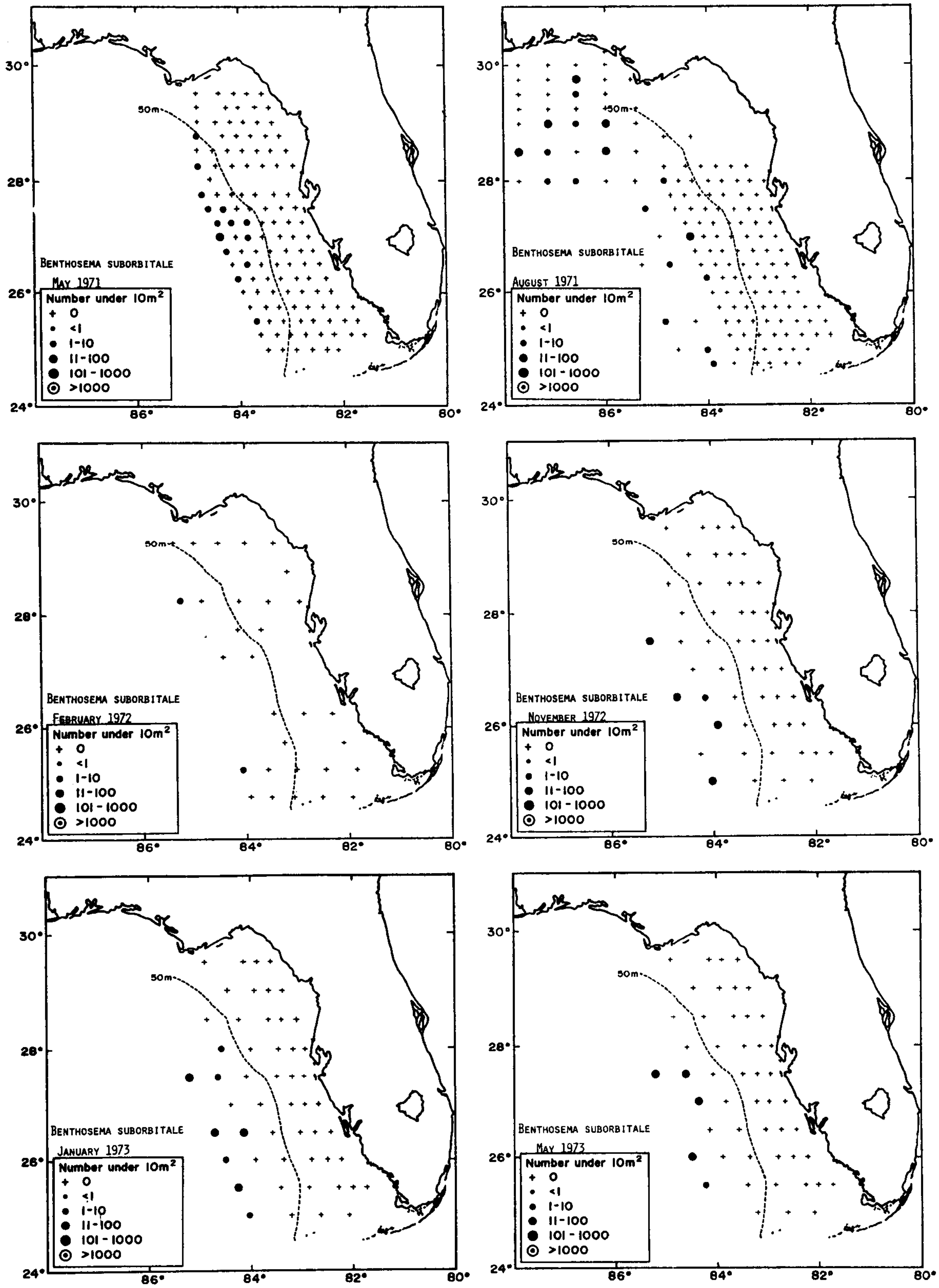



Fig. 46 Distribution and abundance of Benthosema suborbitale larvae in the eastern Gulf of Mexico, 1971-1974.

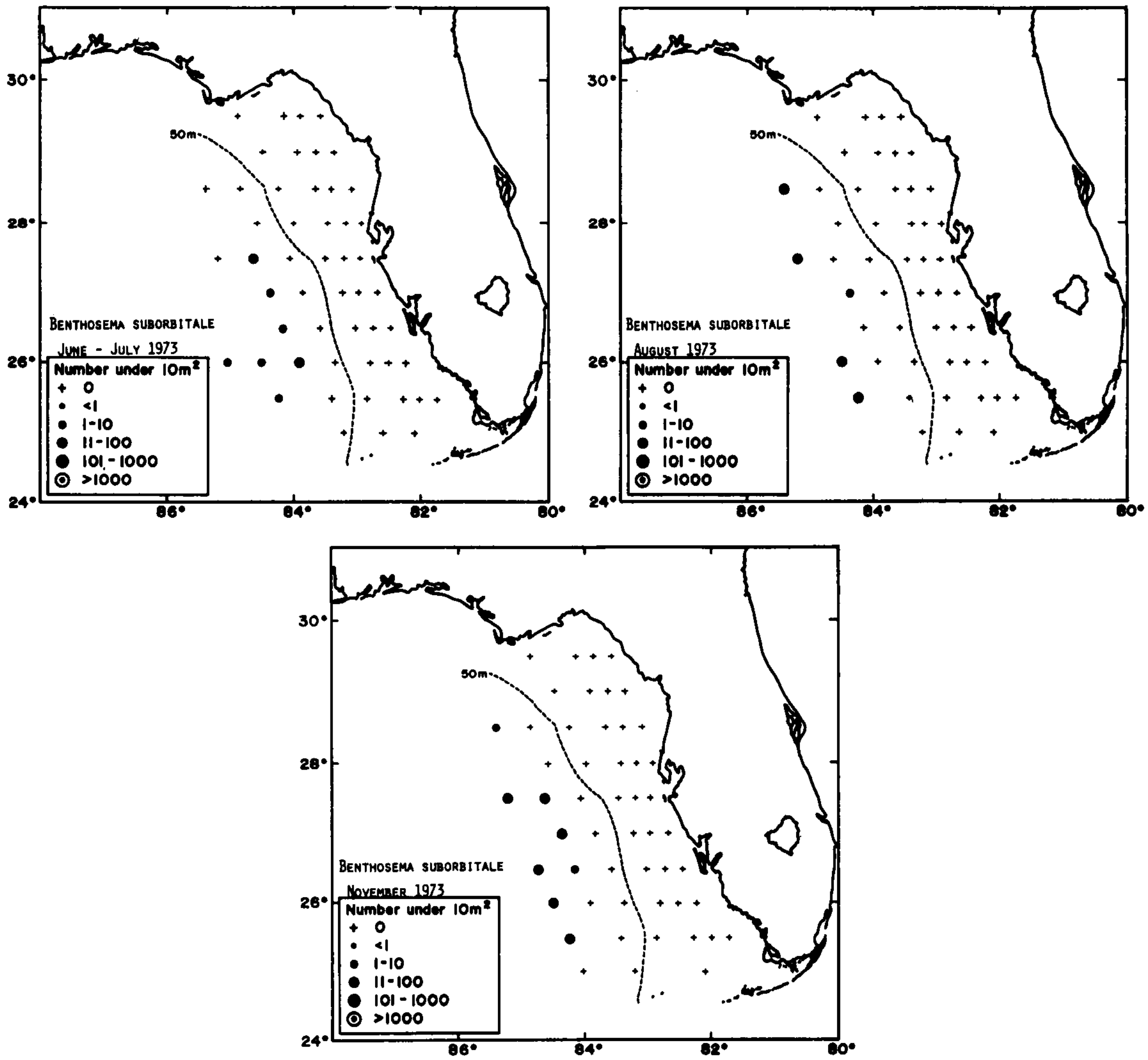

30°
28°
26°
24°
86°
84°
82°
80°
50m
BENTHOSEMA SUBORBITALE
JUNE - JULY 1973
AUGUST 1973
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000

Fig. 46 Cont.

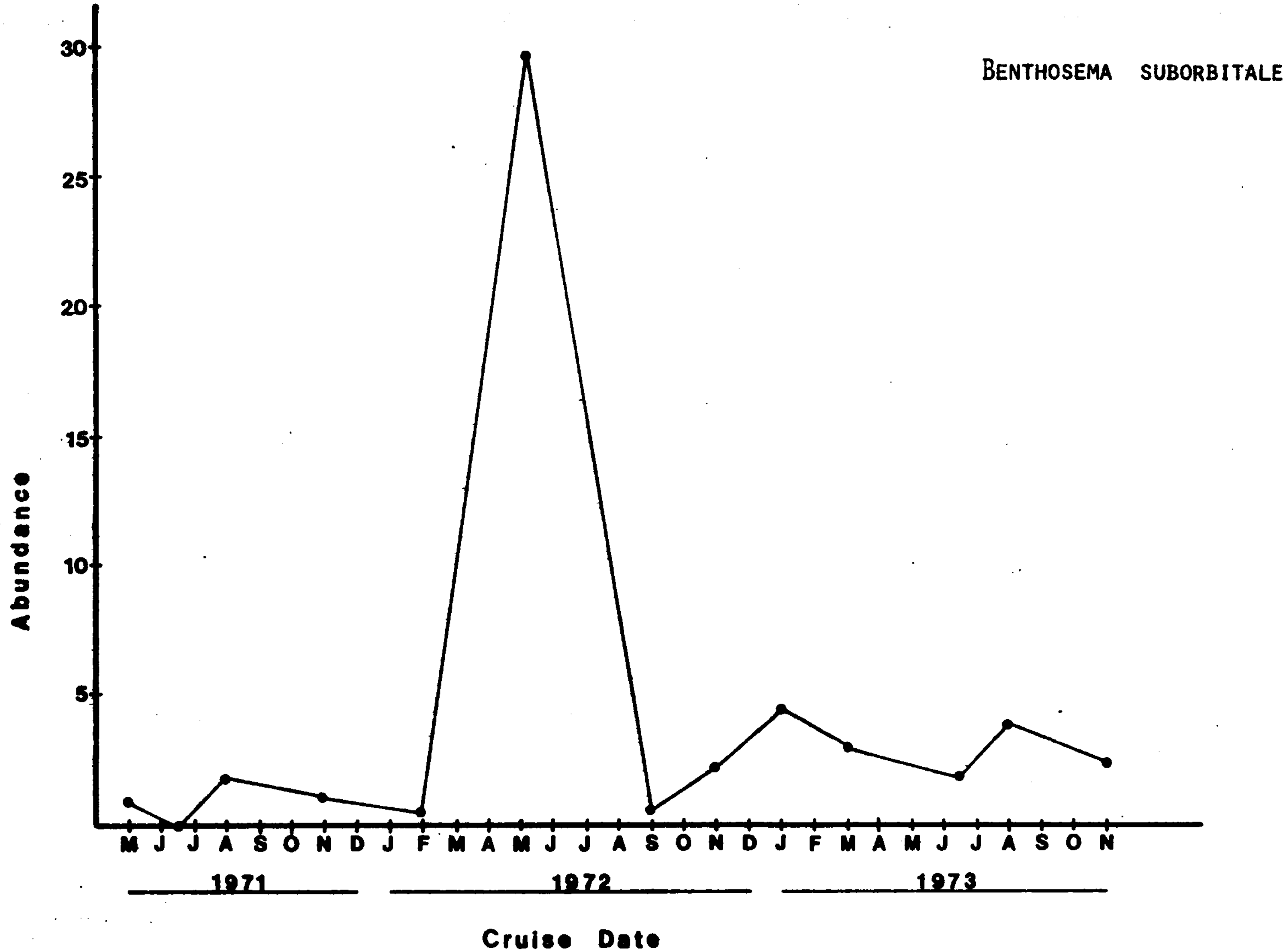



Fig. 47 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Benthosema suborbitale larvae in the eastern Gulf of Mexico, 1971-1974.

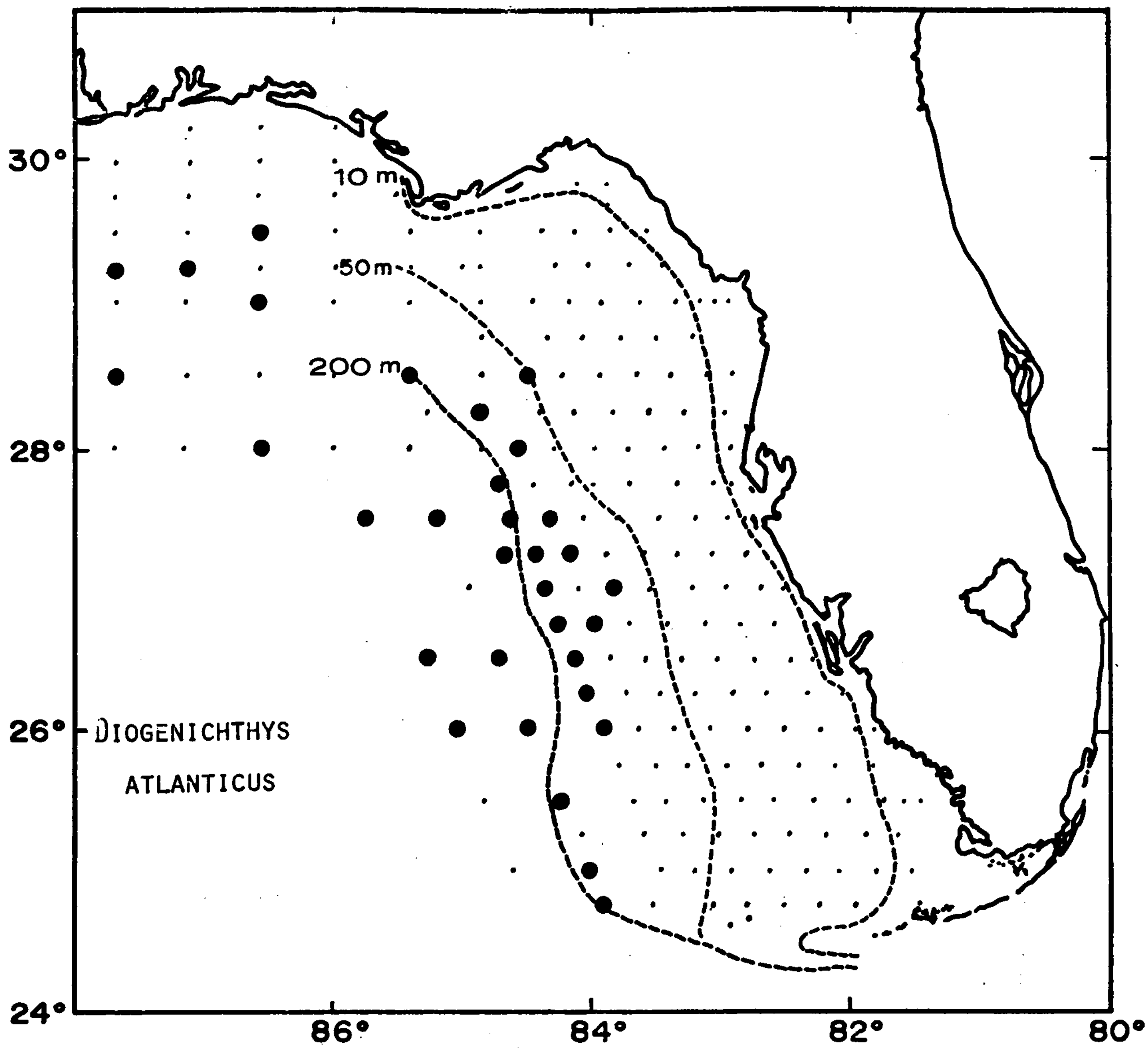



Fig. 48 Stations at which Diogenichthys atlanticus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

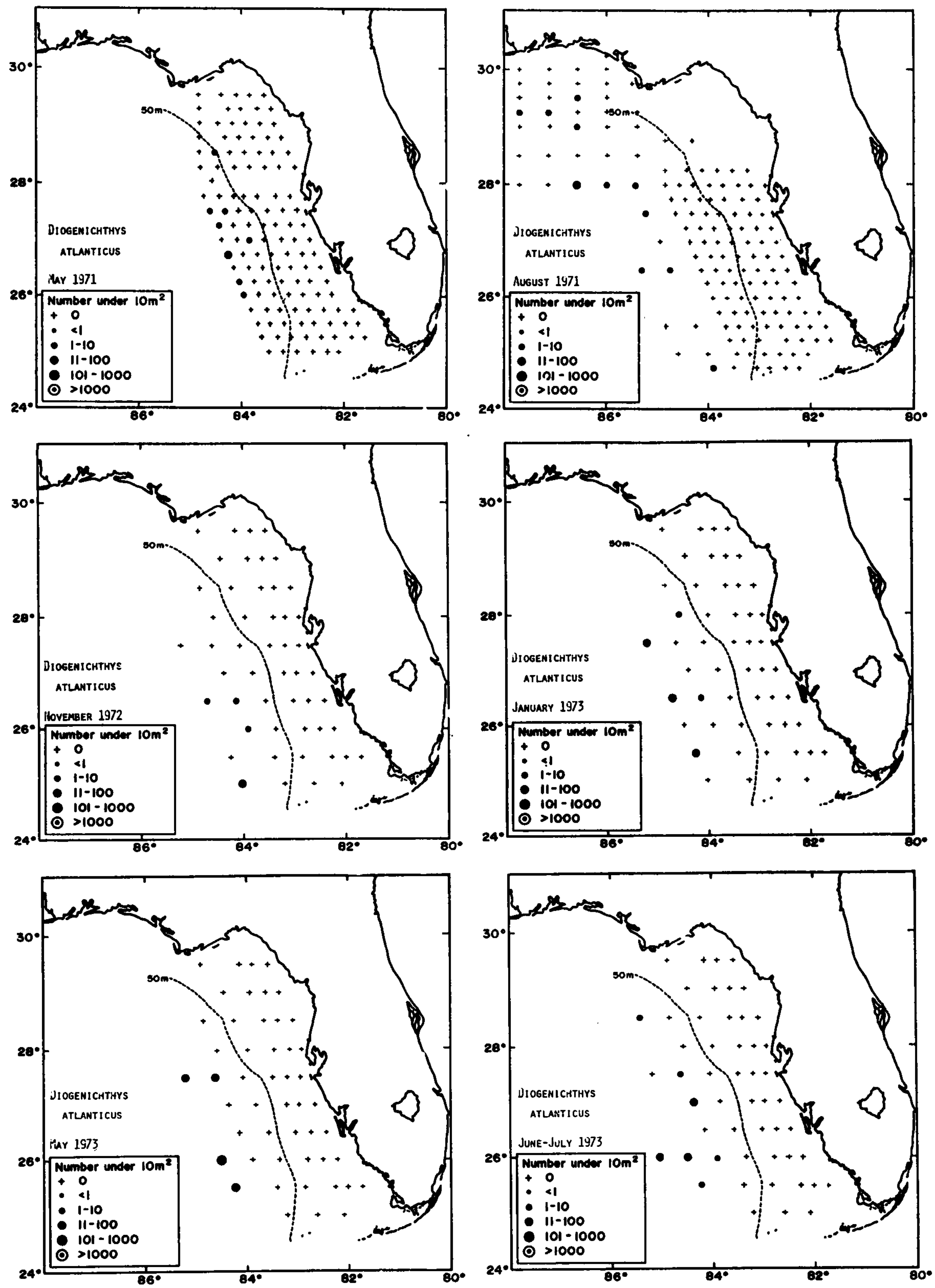
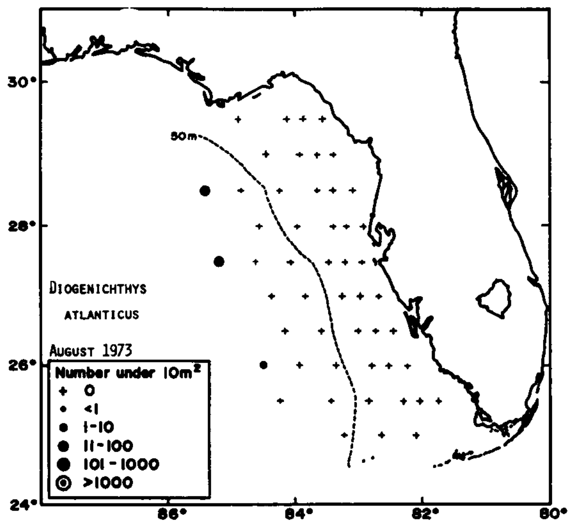



Fig. 49 Distribution and abundance of *Diogenichthys atlanticus* larvae in the eastern Gulf of Mexico, 1971-1974.


30°
28°
26°
24°
86°
84°
82°
80°
50m
Diogenichthys
atlanticus
August 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000

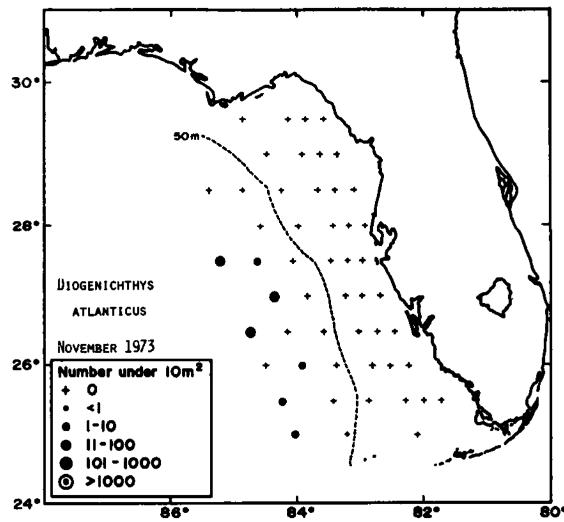

30°
28°
26°
24°
86°
84°
82°
80°
50m
Diogenichthys
atlanticus
November 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000

Fig. 49 Cont.

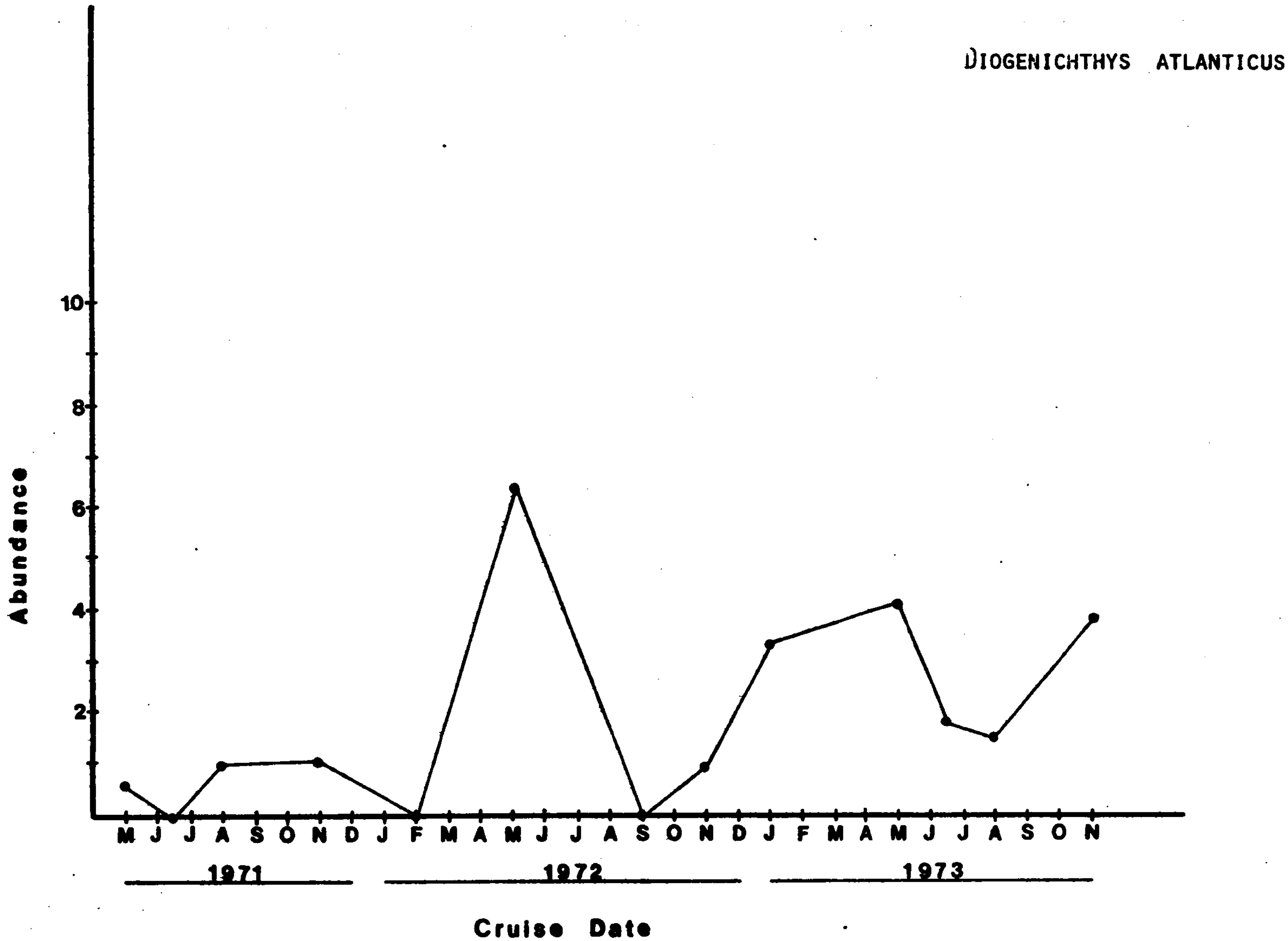



Fig. 50 Estimated mean abundances (number under 10 $m^2$ of sea surface) of <u>Diogenichthys atlanticus</u> larvae in the eastern Gulf of Mexico, 1971-1974.

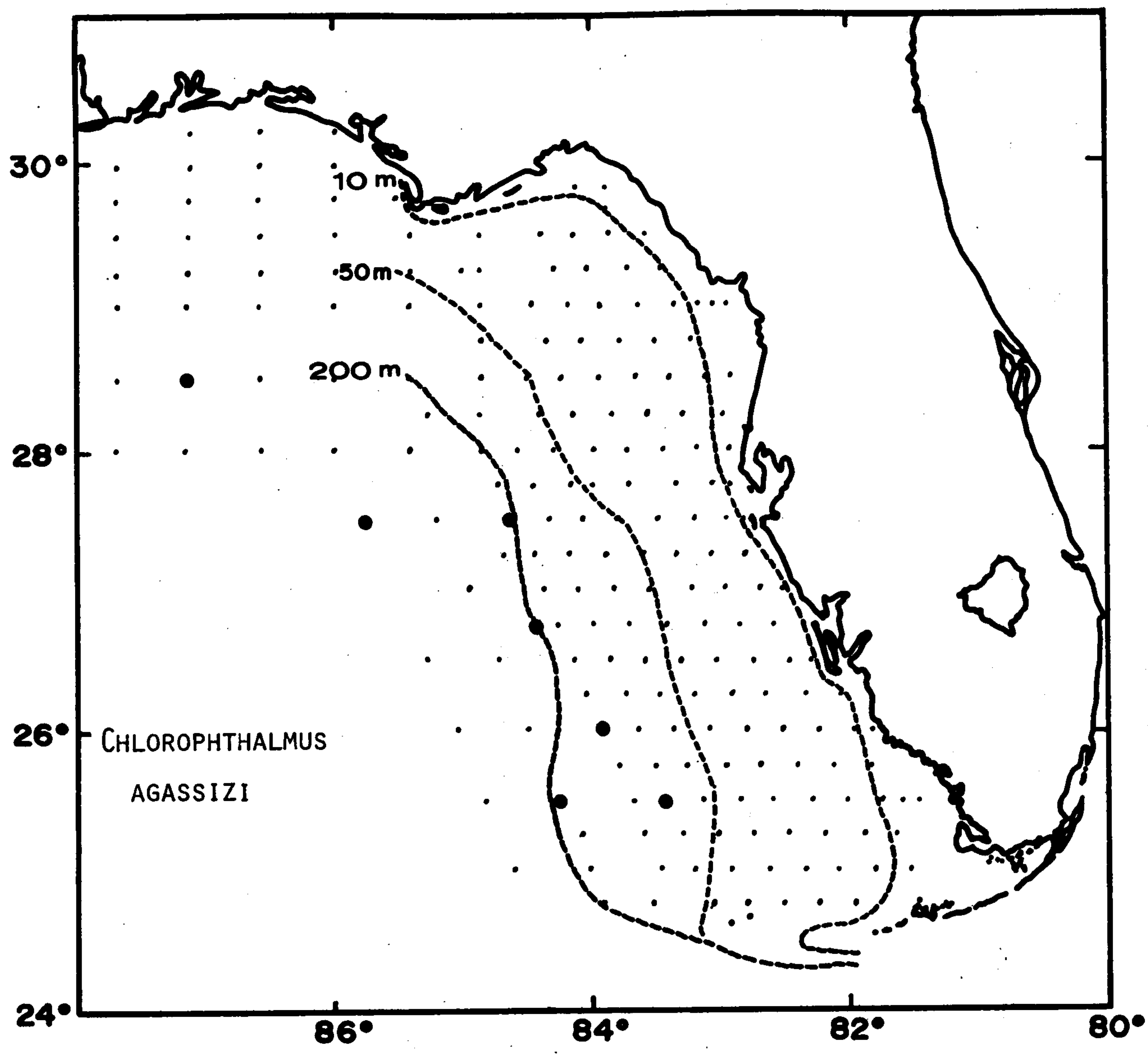



Fig. 51 Stations at which *Chlorophthalmus agassizi* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

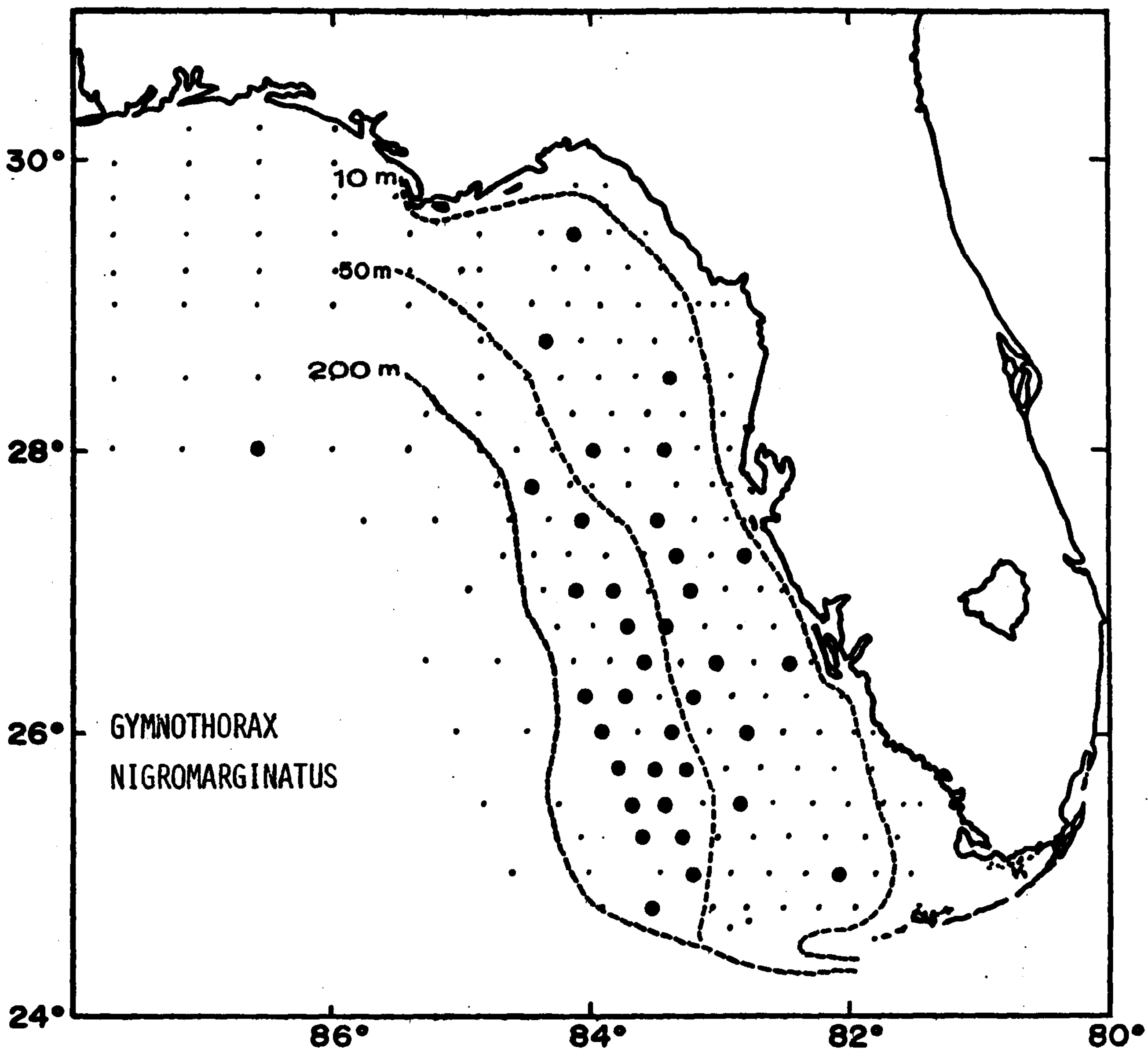



Fig. 52 Stations at which *Gymnothorax nigromarginatus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

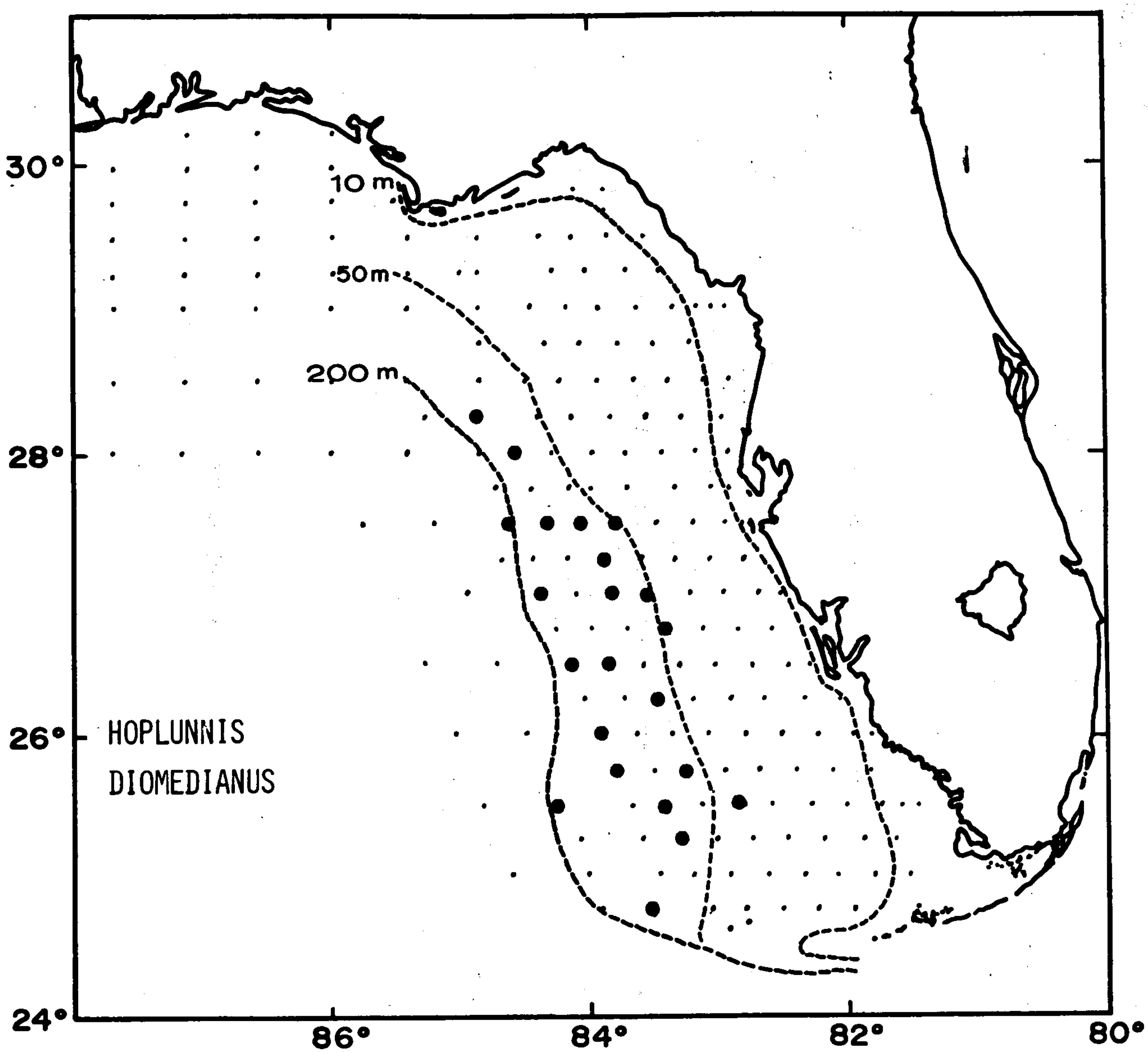



Fig. 53 Stations at which Hoplunnis diomedianus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

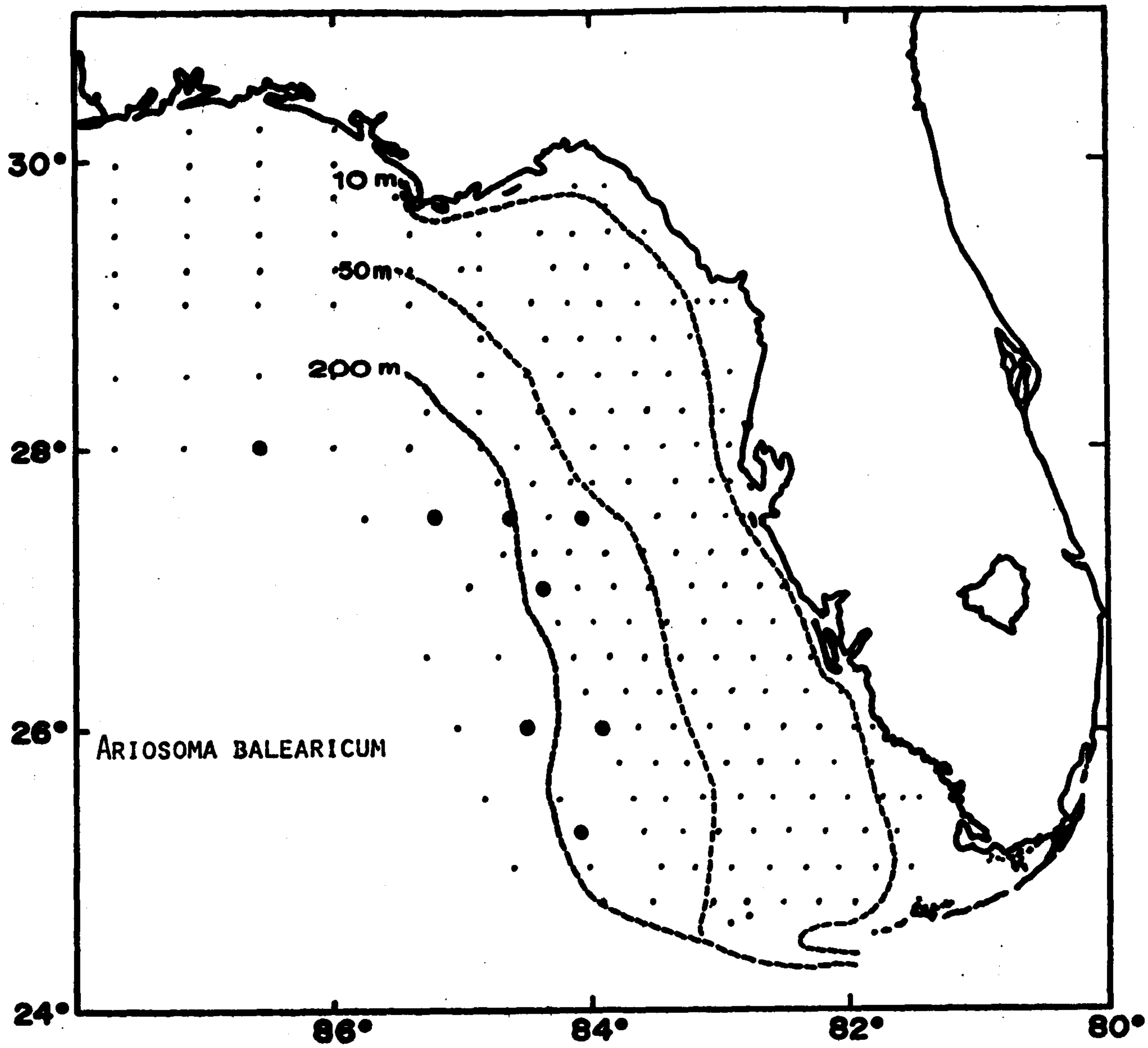



Fig. 54 Stations at which *Ariosoma balearicum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

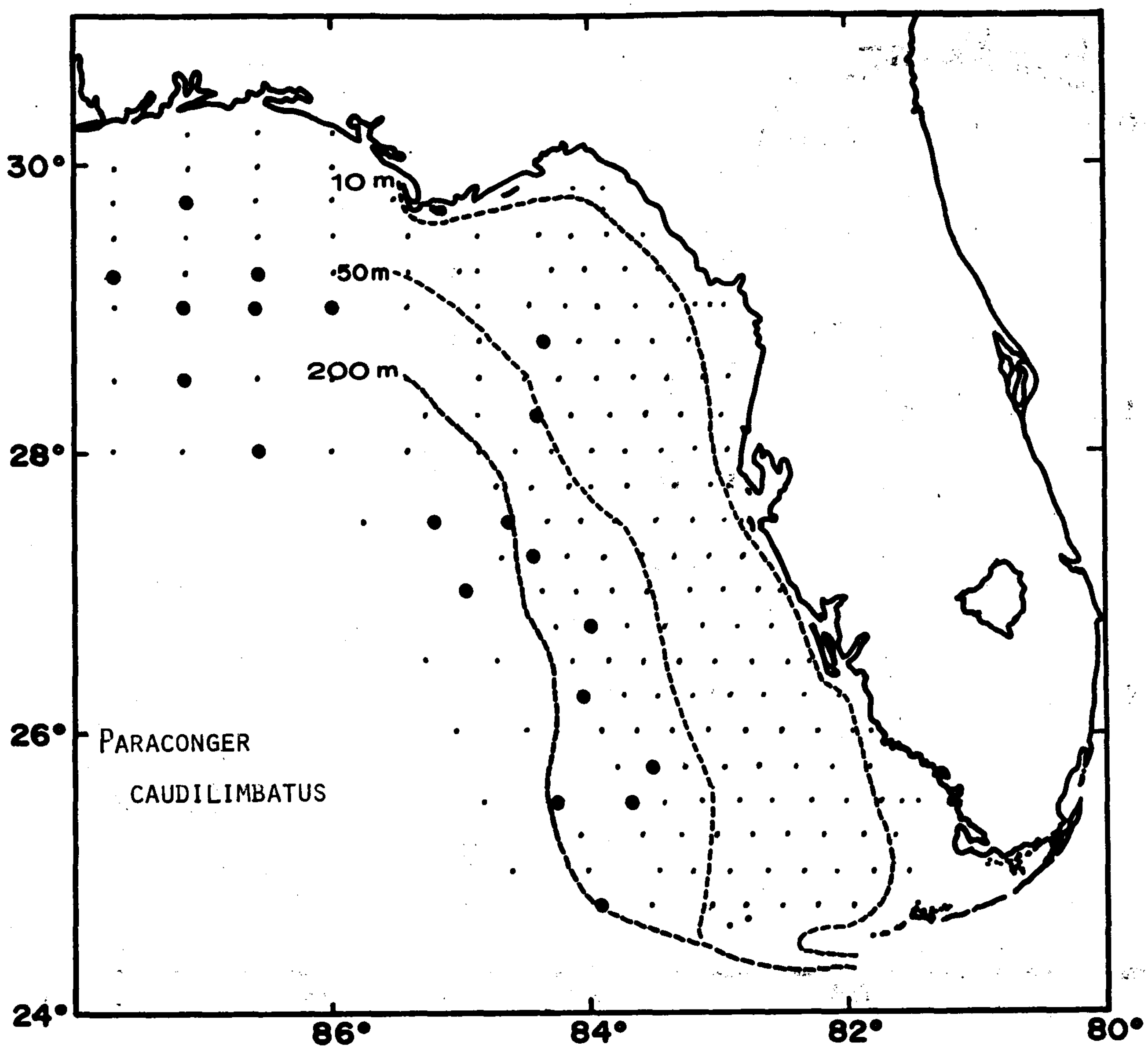



Fig. 55 Stations at which Paraconger caudilimbatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

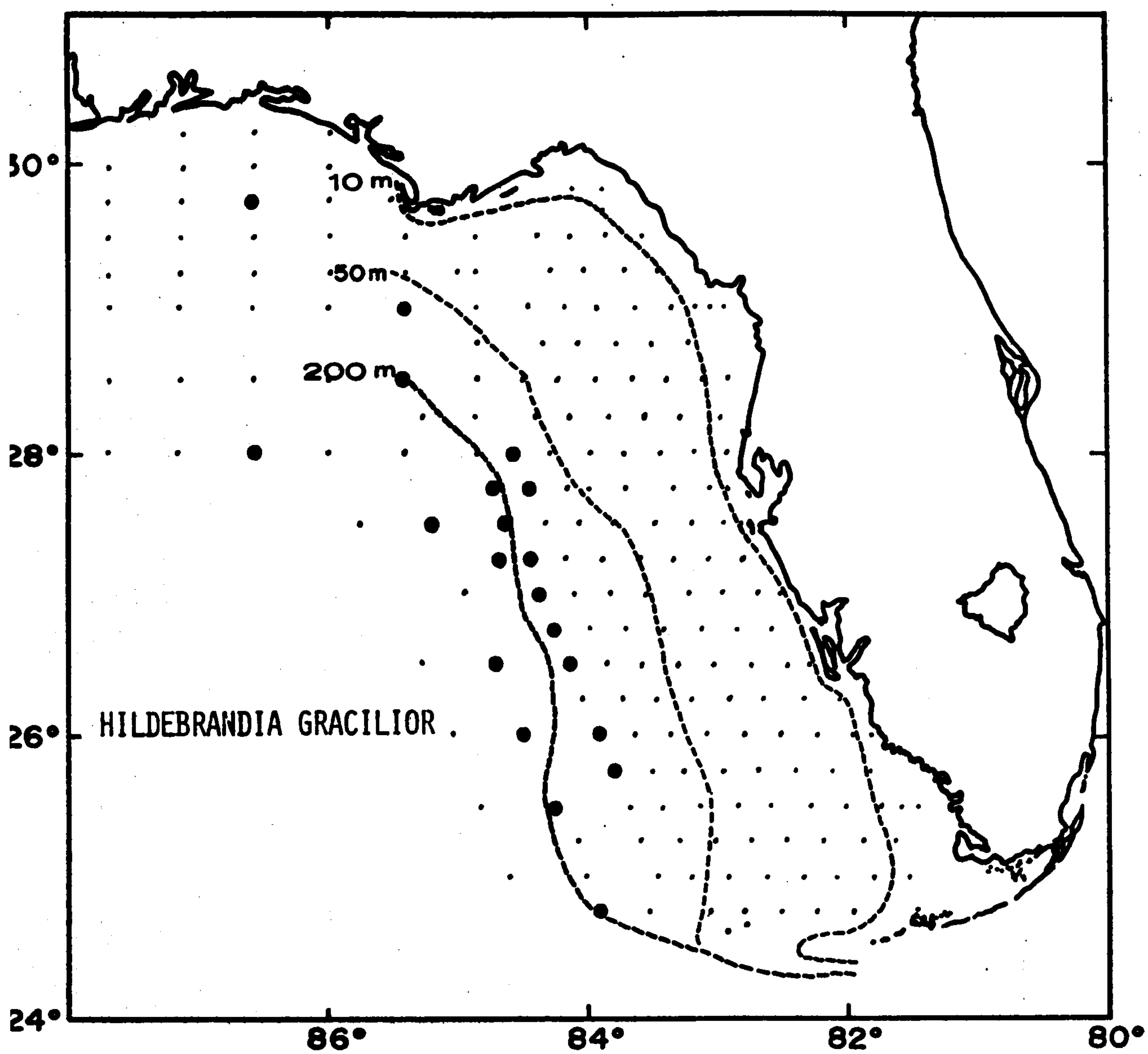



Fig. 56 Stations at which Hildebrandia gracilor larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

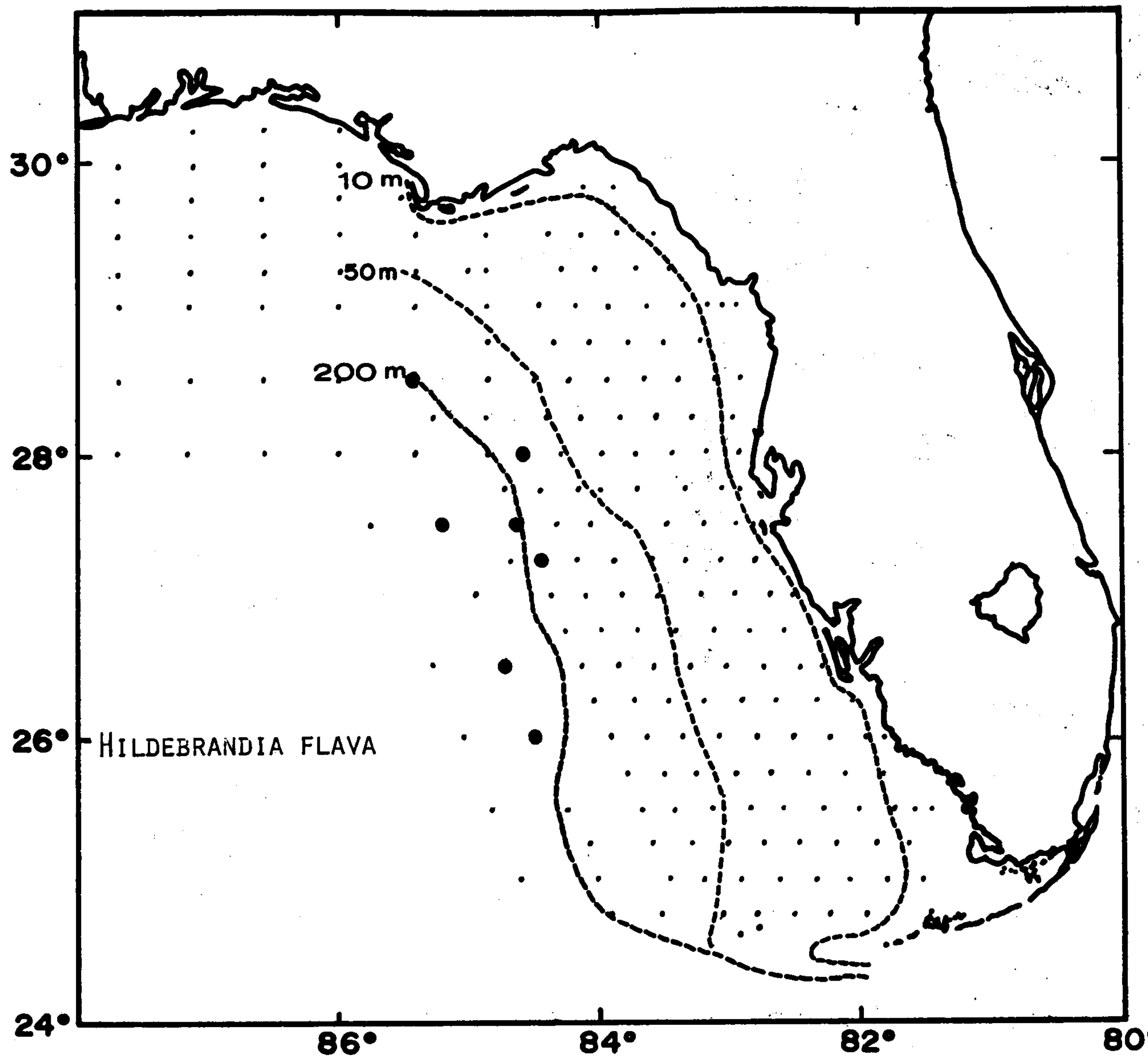



Fig. 57 Stations at which Hildebrandia flava larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

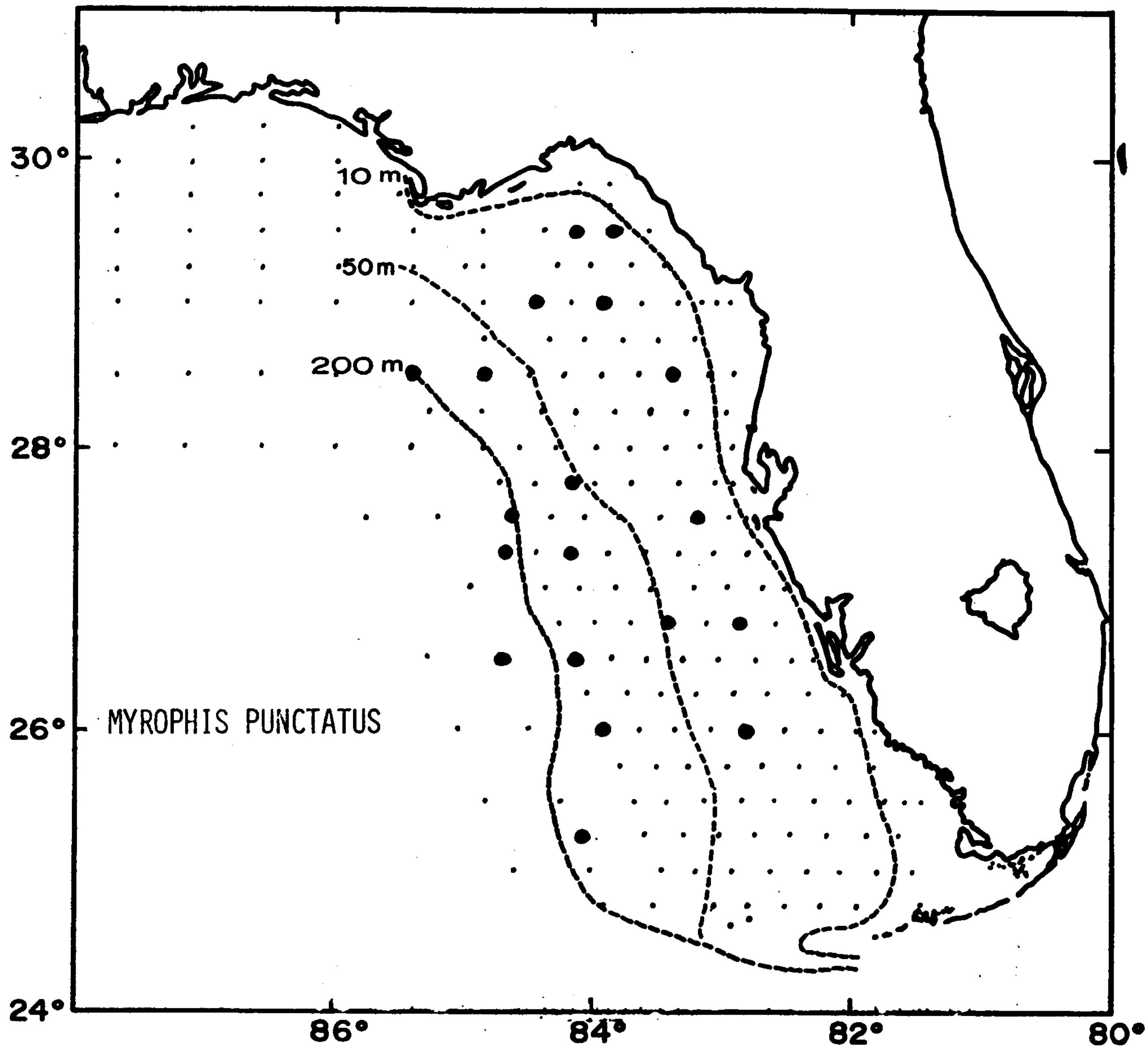



Fig. 58 Stations at which Myrophis punctatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

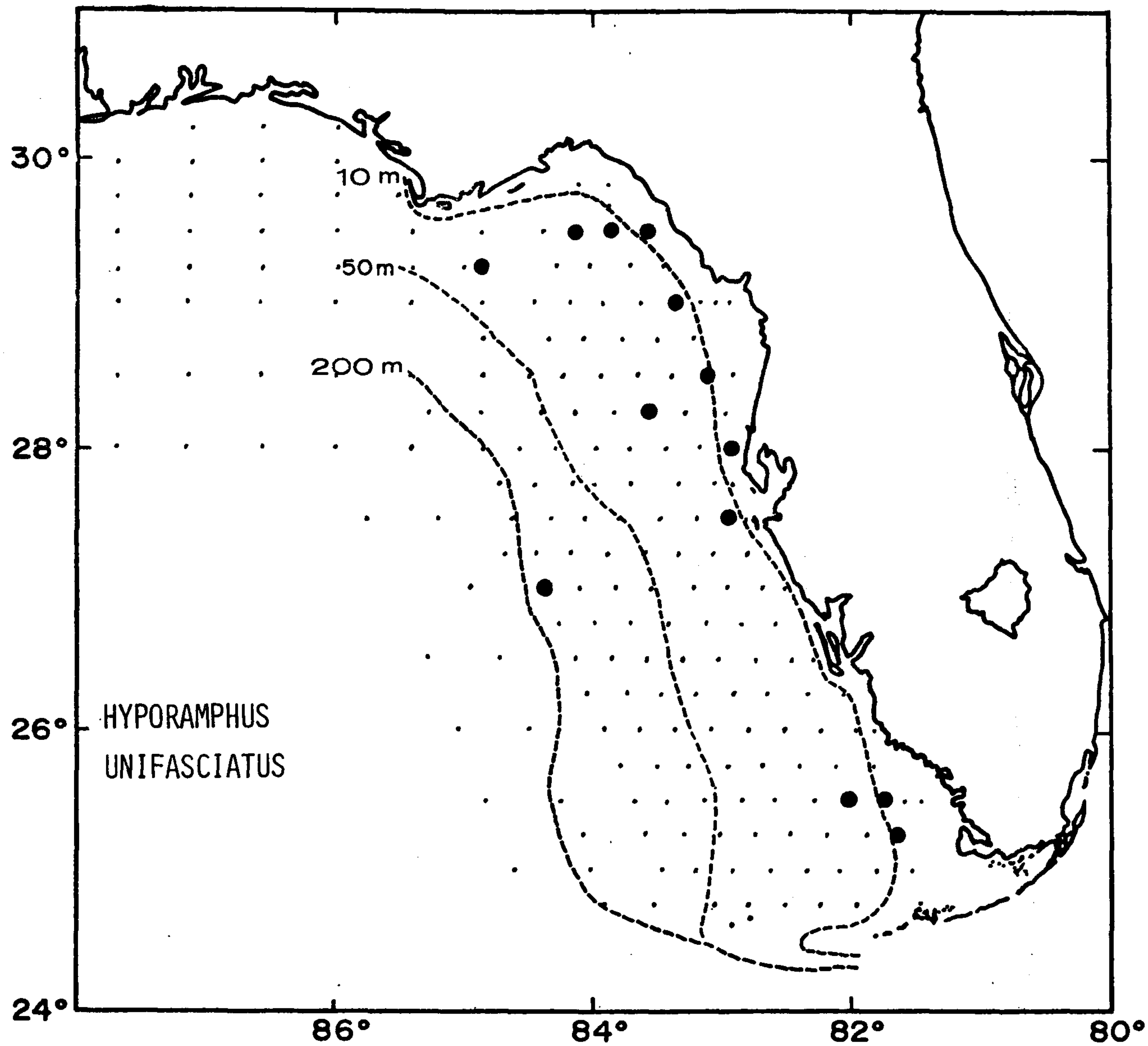



Fig. 59 Stations at which Hyporhamphus unifasciatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

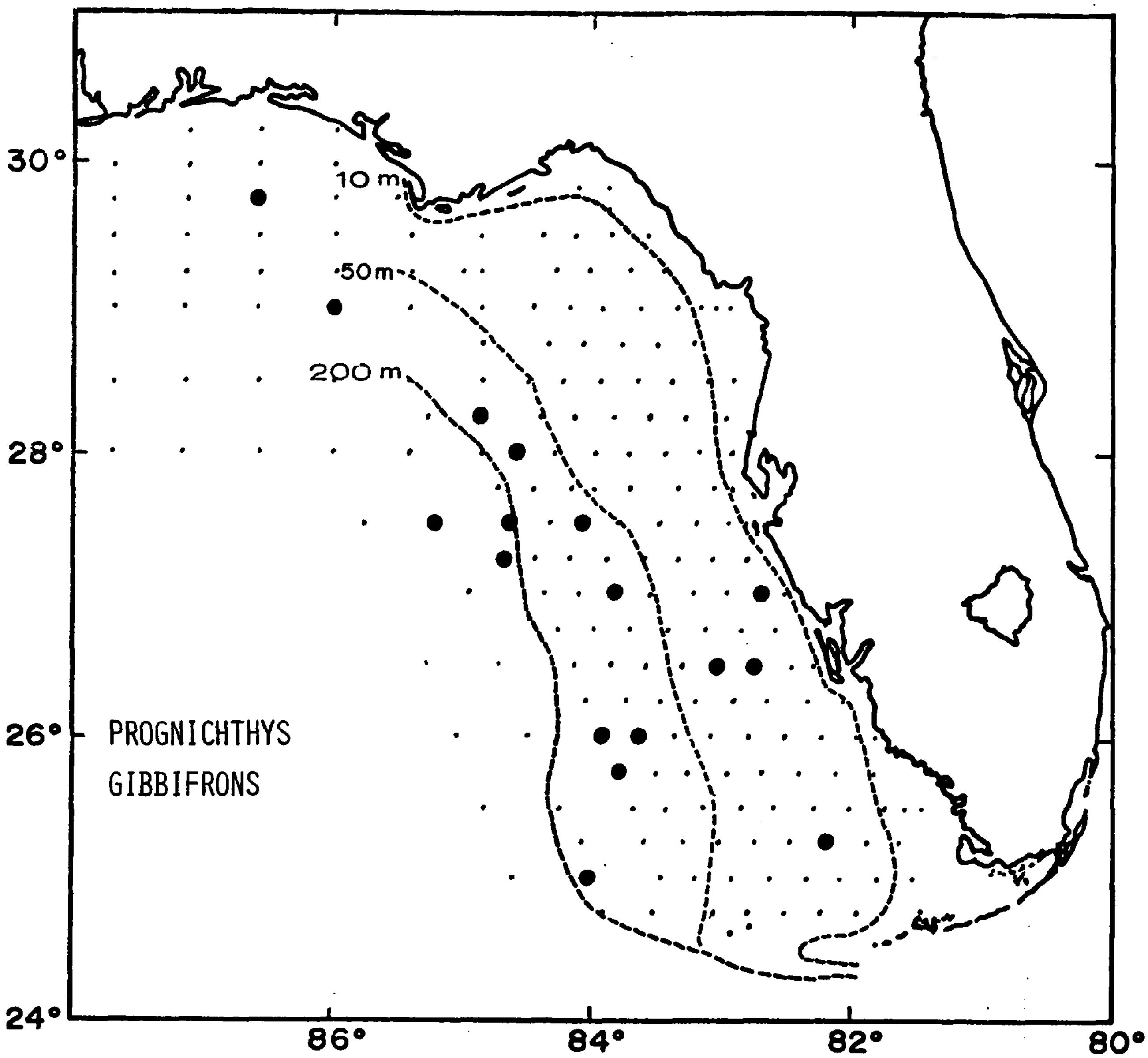



Fig. 60 Stations at which *Prognichthys gibbifrons* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

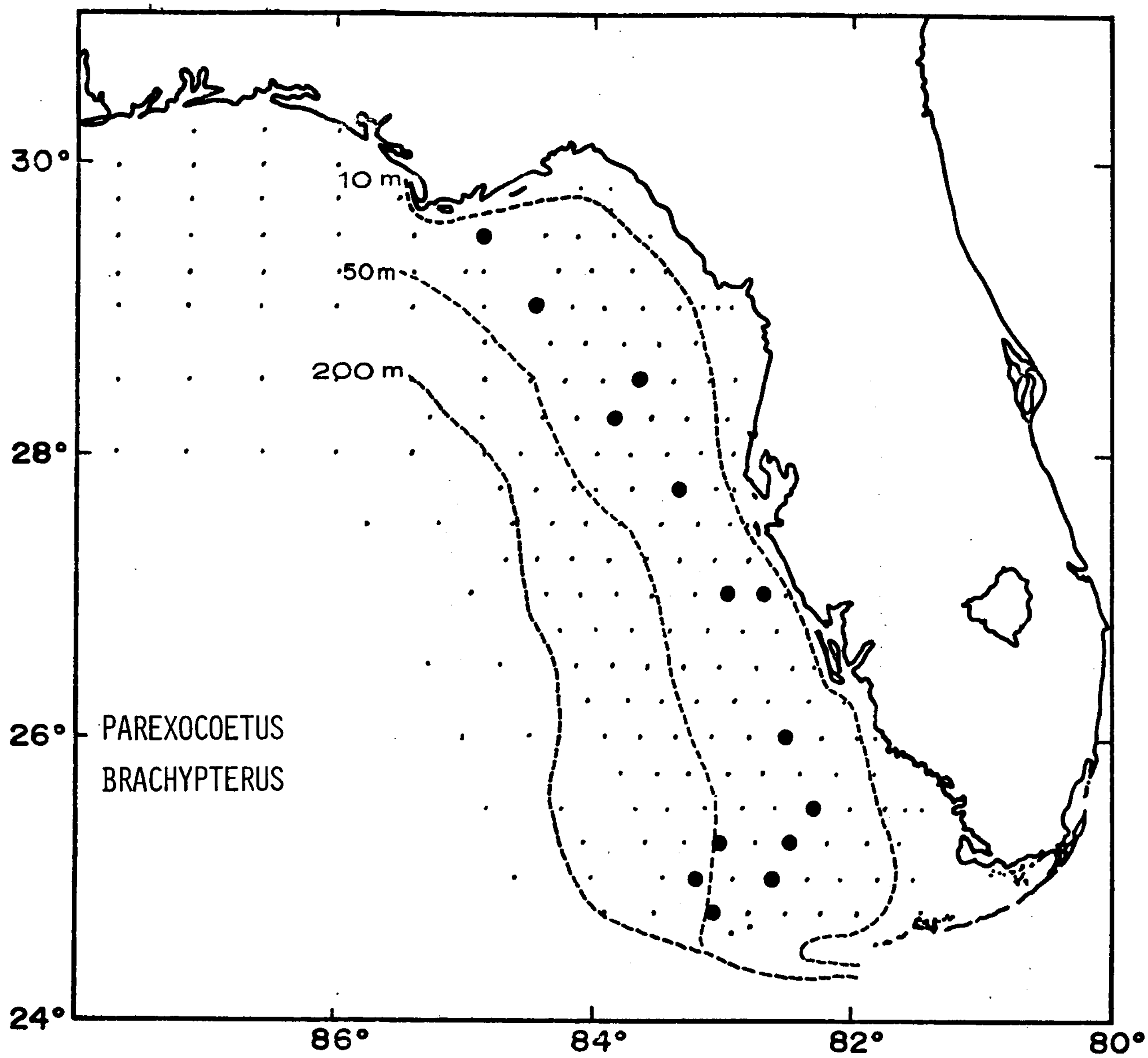



Fig. 61 Stations at which Parexocoetus brachypterus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

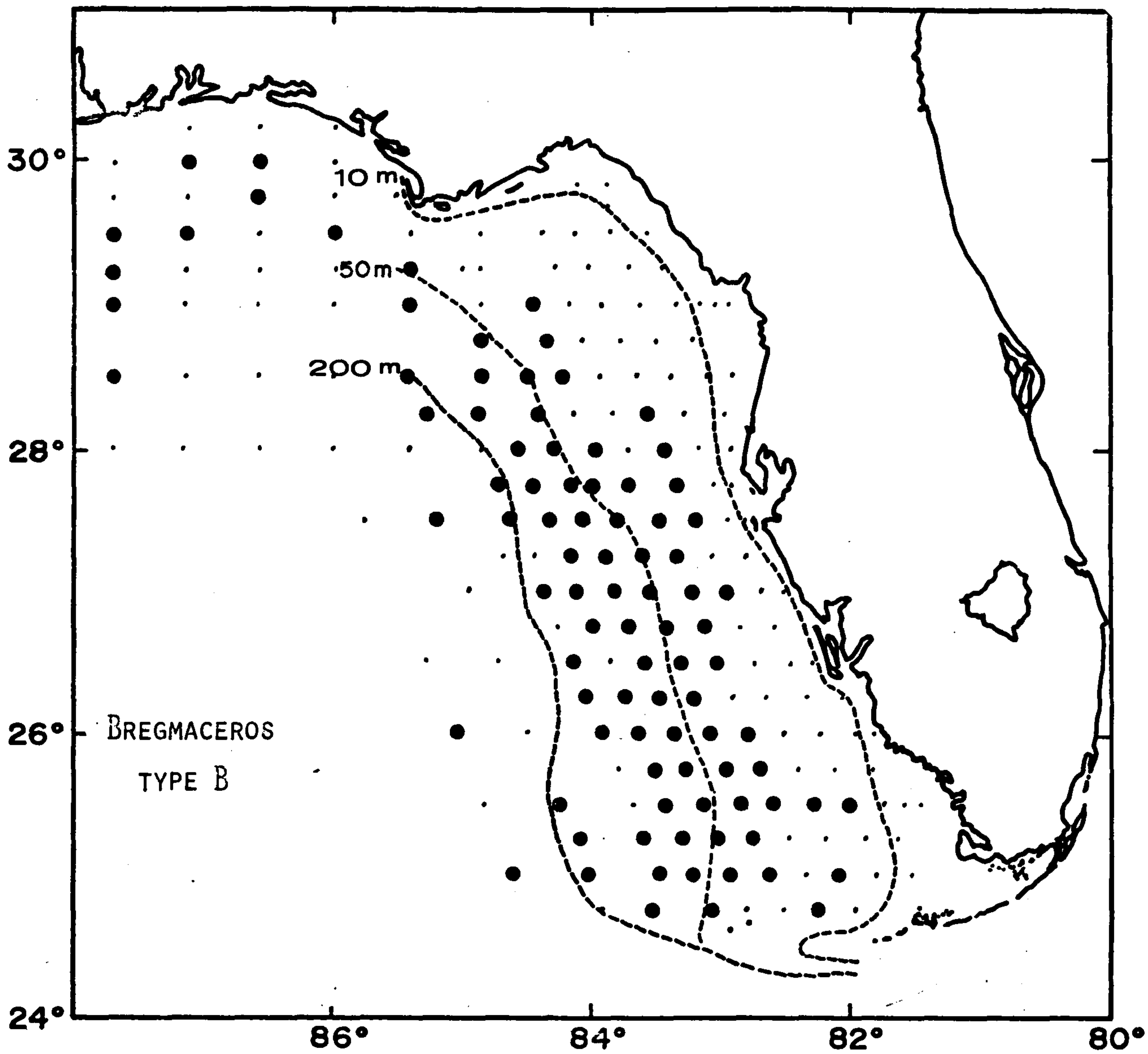



Fig. 62 Stations at which Bregmaceros Type B larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

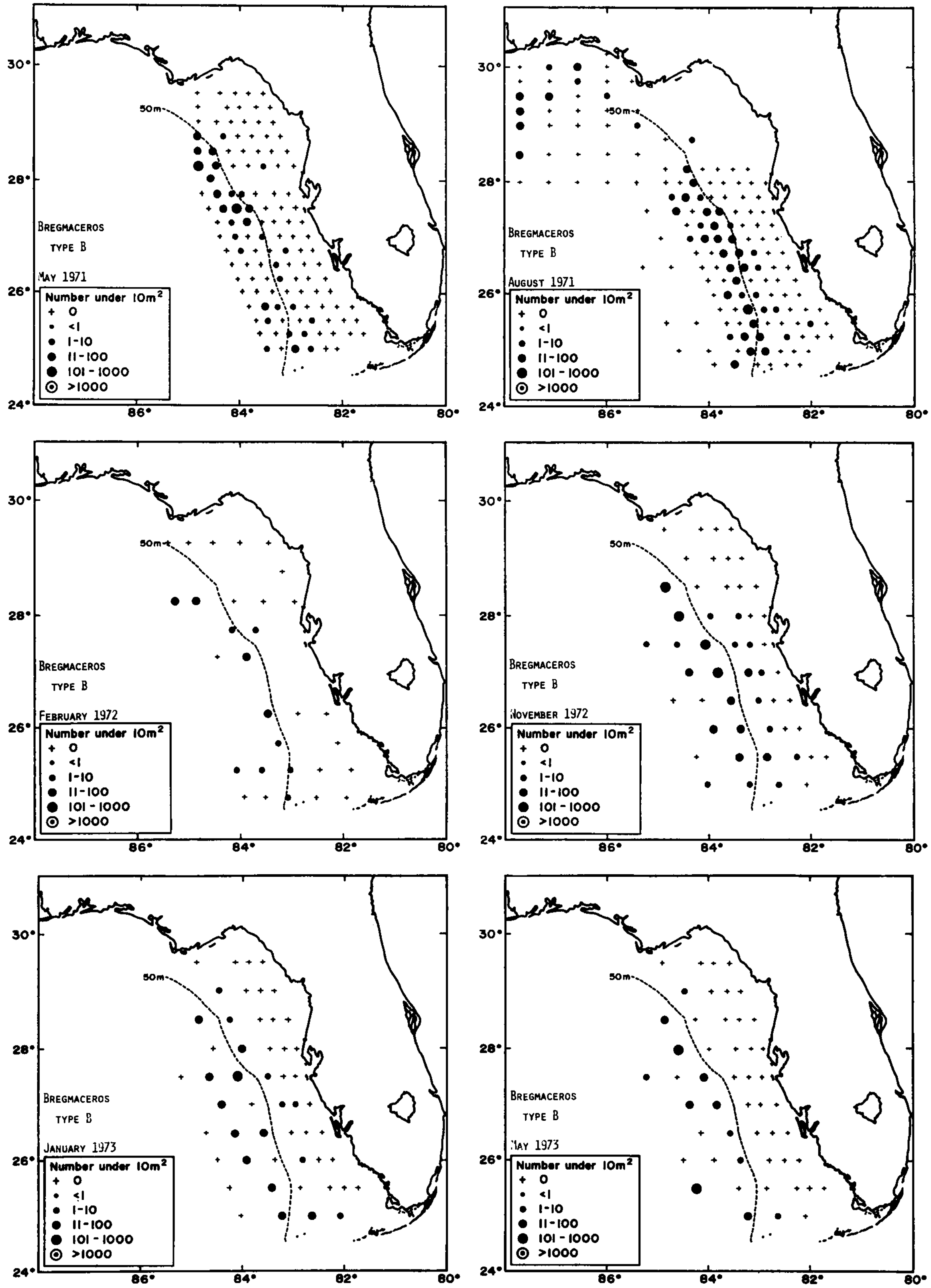



Fig. 63 Distribution and abundance of Bregmaceros Type B larvae in the eastern Gulf of Mexico, 1971-1974.

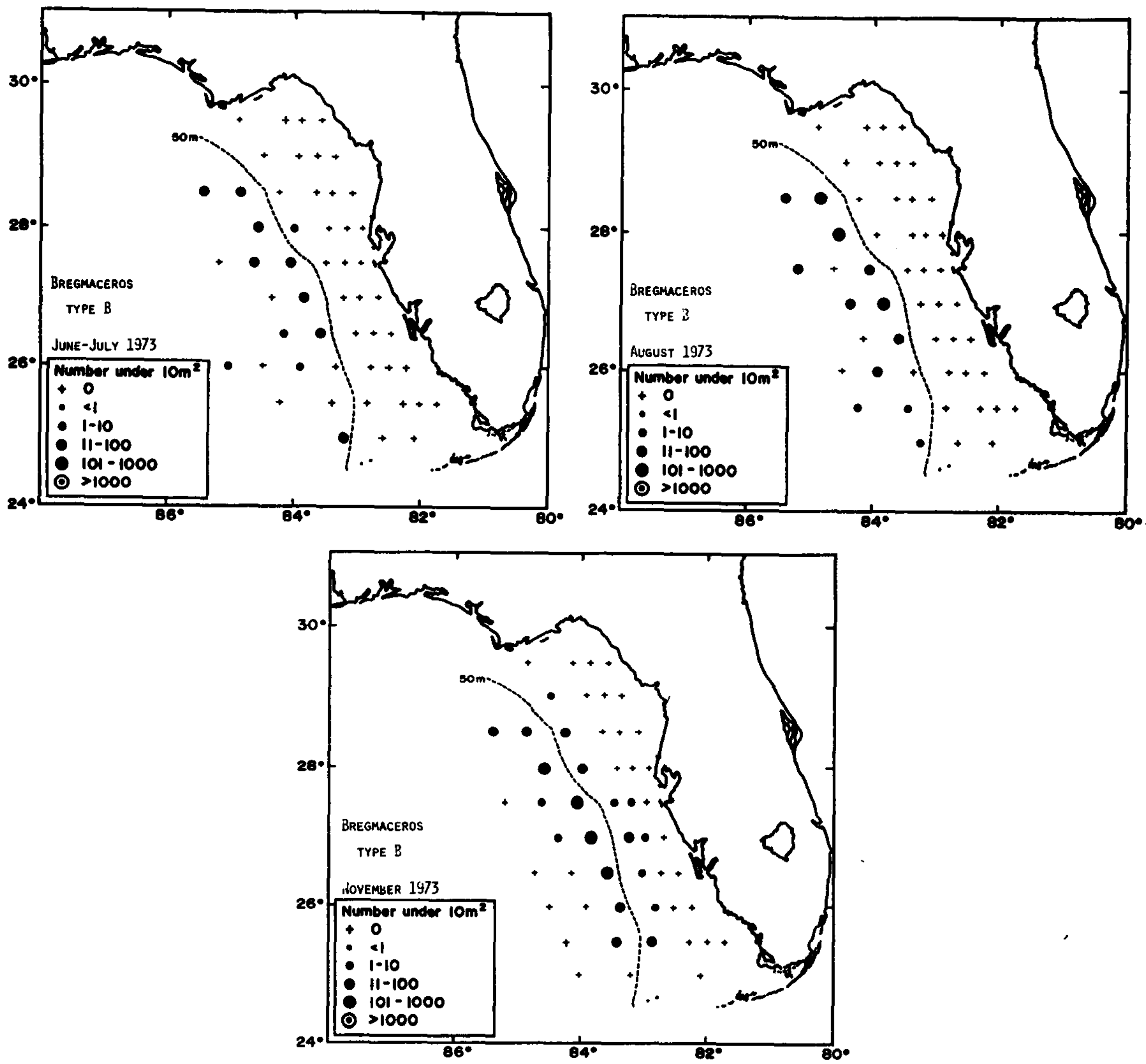

Bregmaceros
type B
June-July 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
Bregmaceros
type B
August 1973
Bregmaceros
type B
November 1973

Fig. 63 Cont.

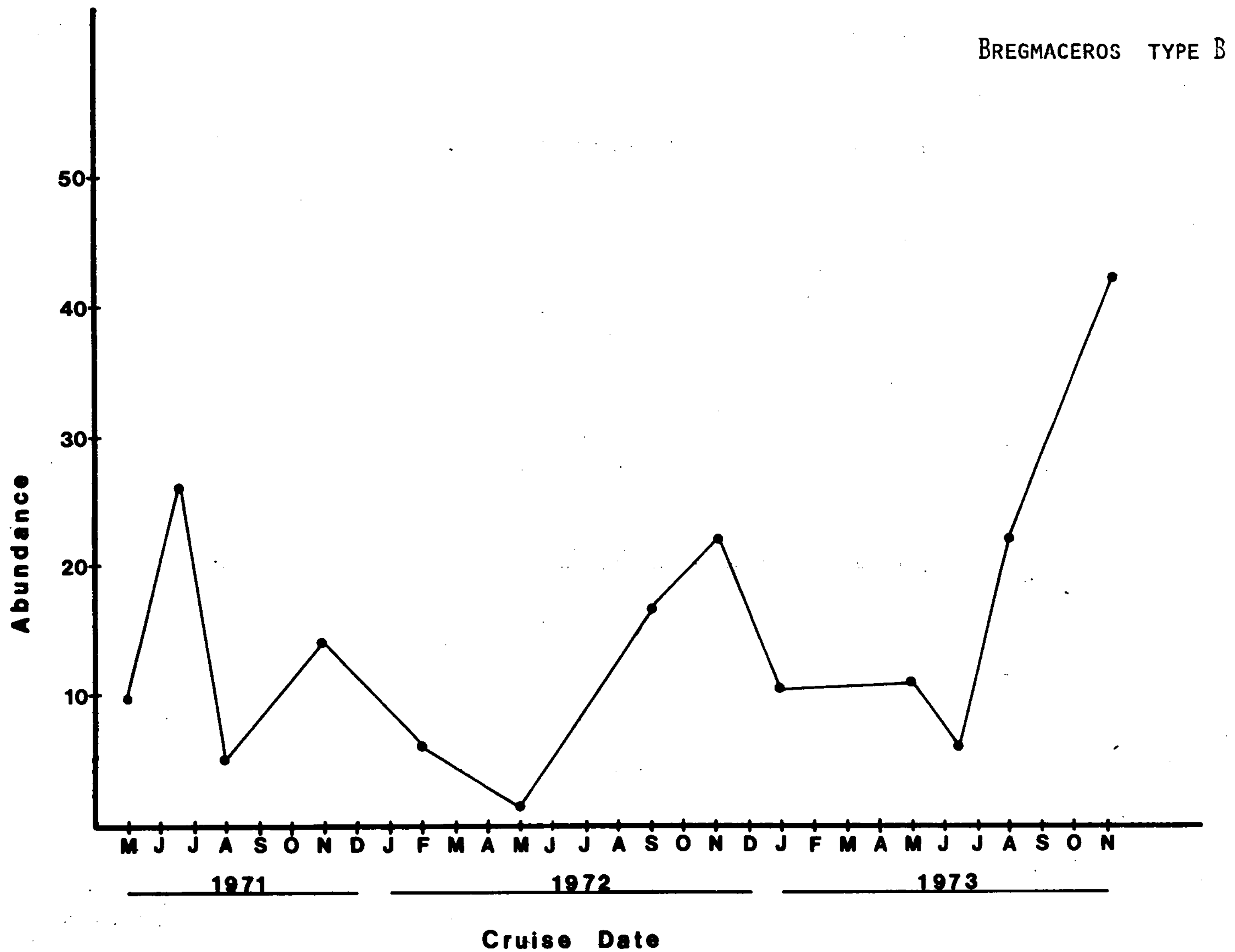



Fig. 64 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Bregmaceros Type B larvae in the eastern Gulf of Mexico, 1971-1974.

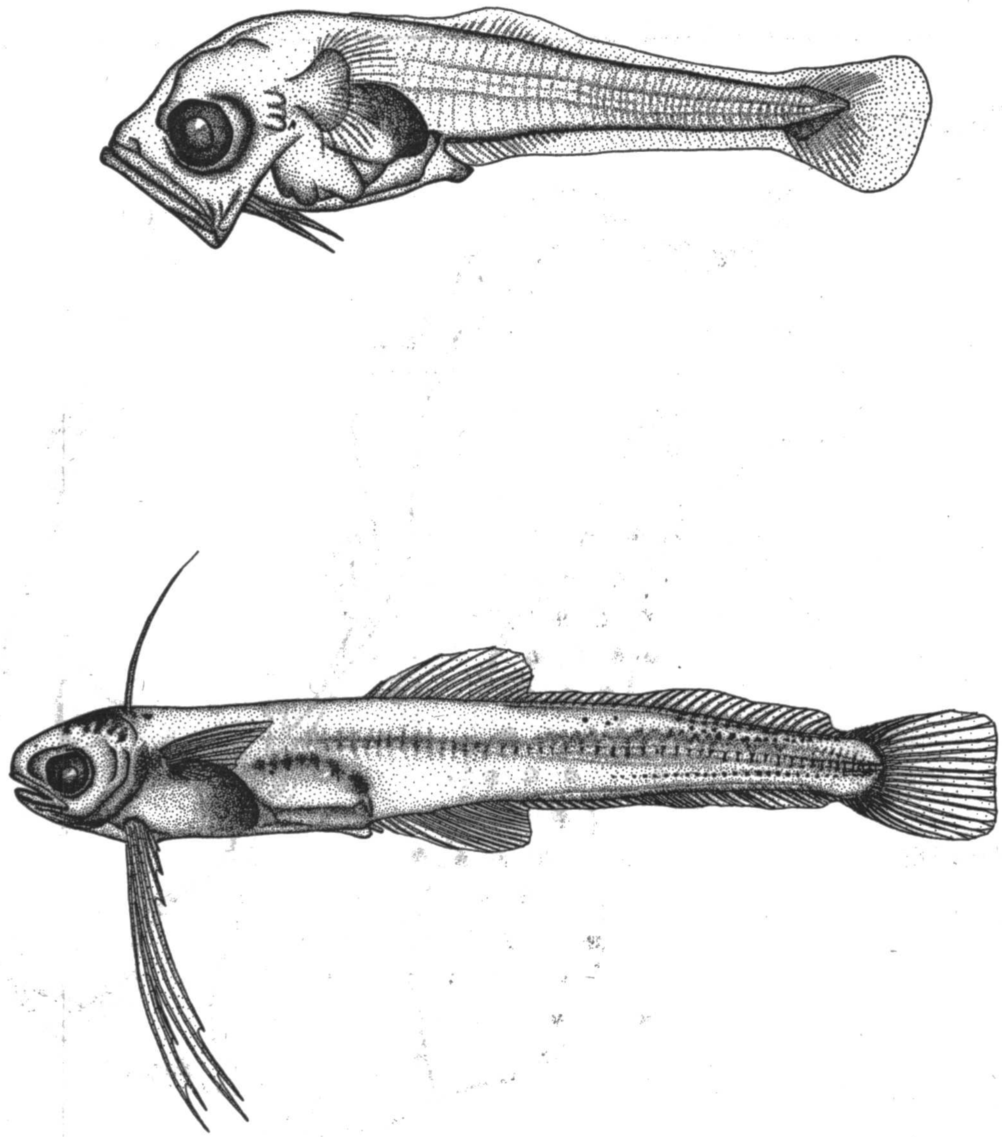


Fig. 65 Larvae of <u>Bregmaceros</u> Type B. The top specimen is a 4.0 mm SL larva. The bottom specimen is a 13.5 mm SL larva.

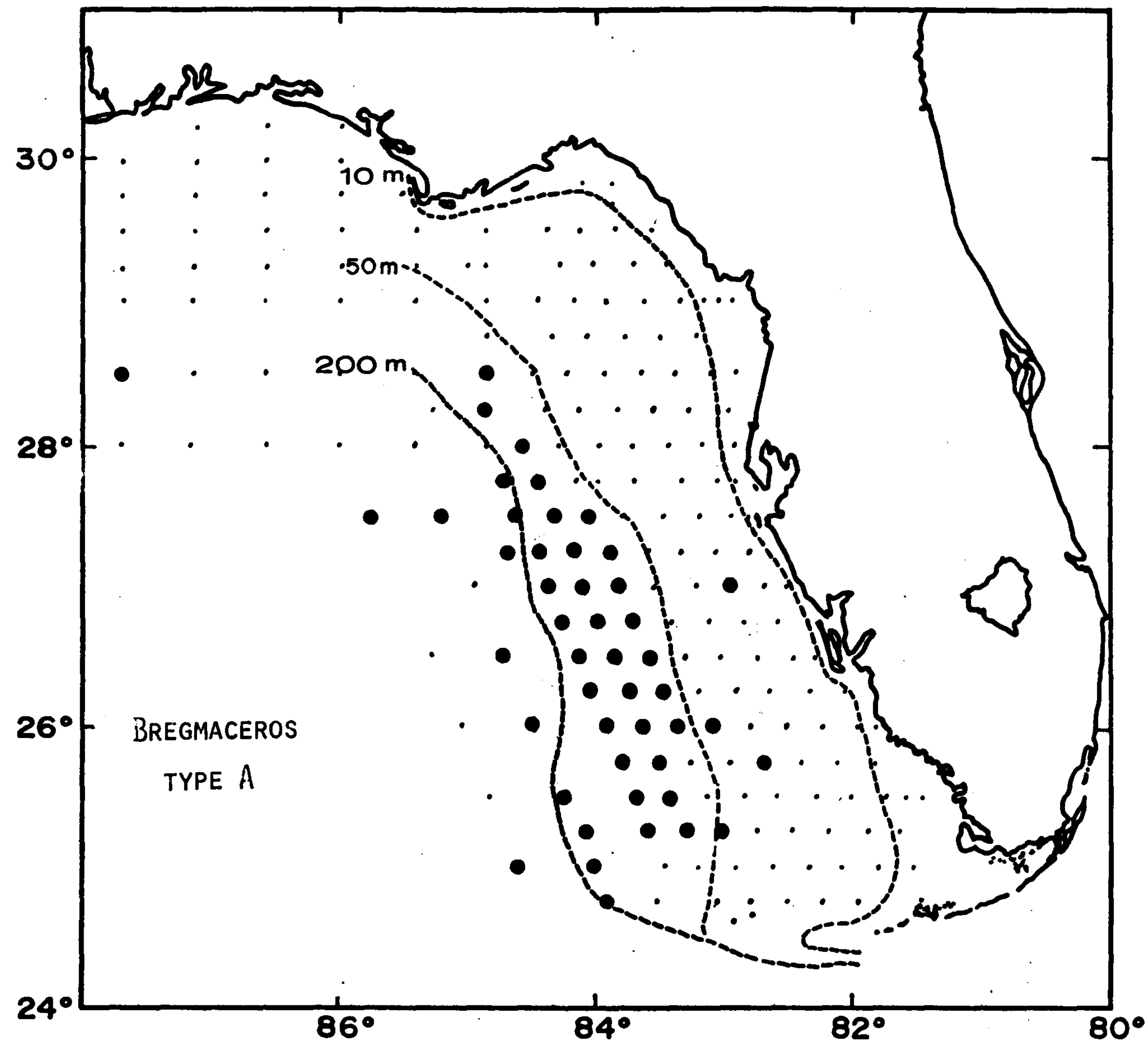



Fig. 66 Stations at which Bregmaceros Type A larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

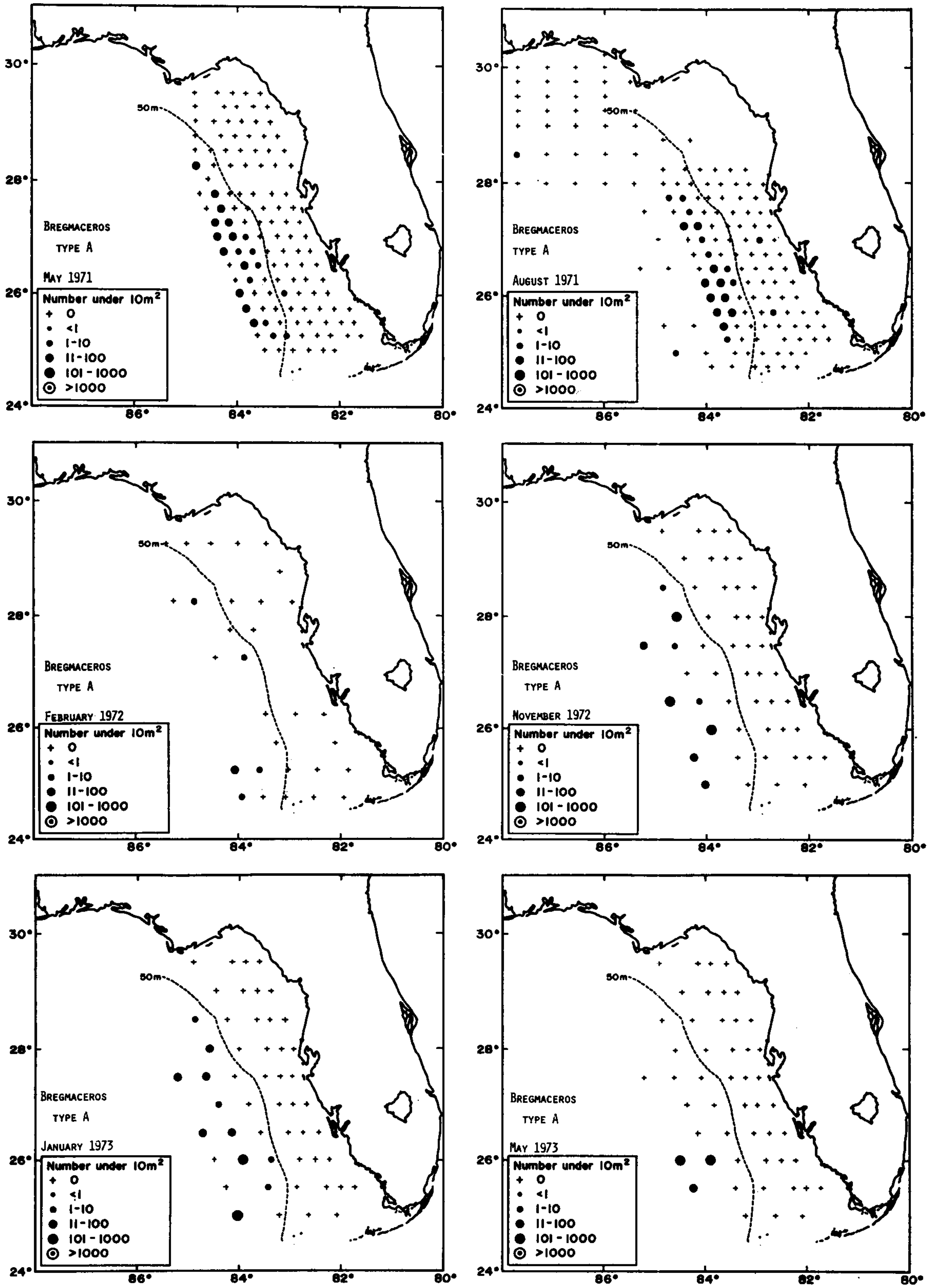
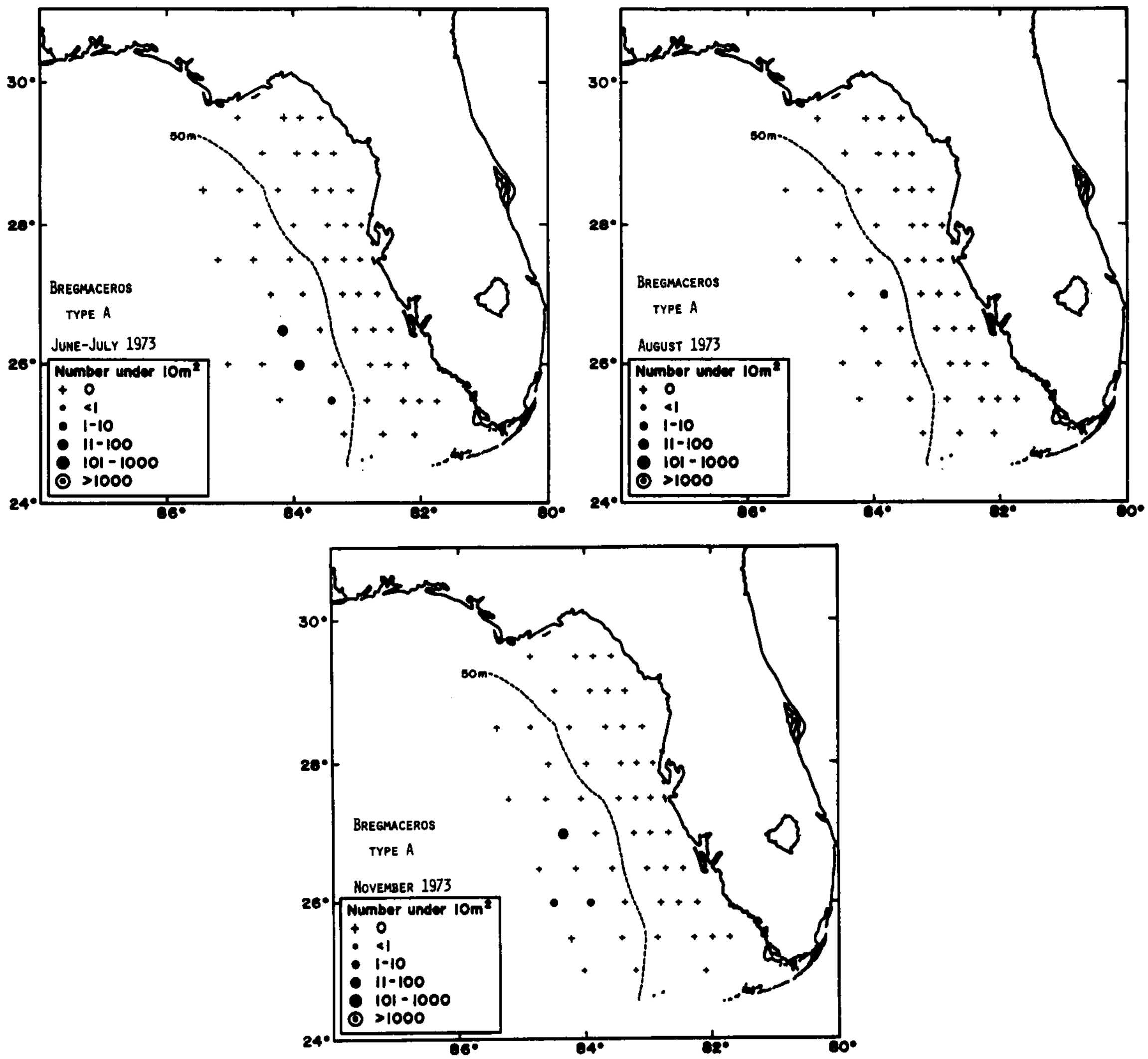



Fig. 67 Distribution and abundance of Bregmaceros Type A larvae in the eastern Gulf of Mexico, 1971-1974.



30°
28°
26°
24°
86°
84°
82°
80°
50m
BREGMACEROS
TYPE A
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000
BREGMACEROS
TYPE A
AUGUST 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000
BREGMACEROS
TYPE A
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000


Fig. 67 Cont.

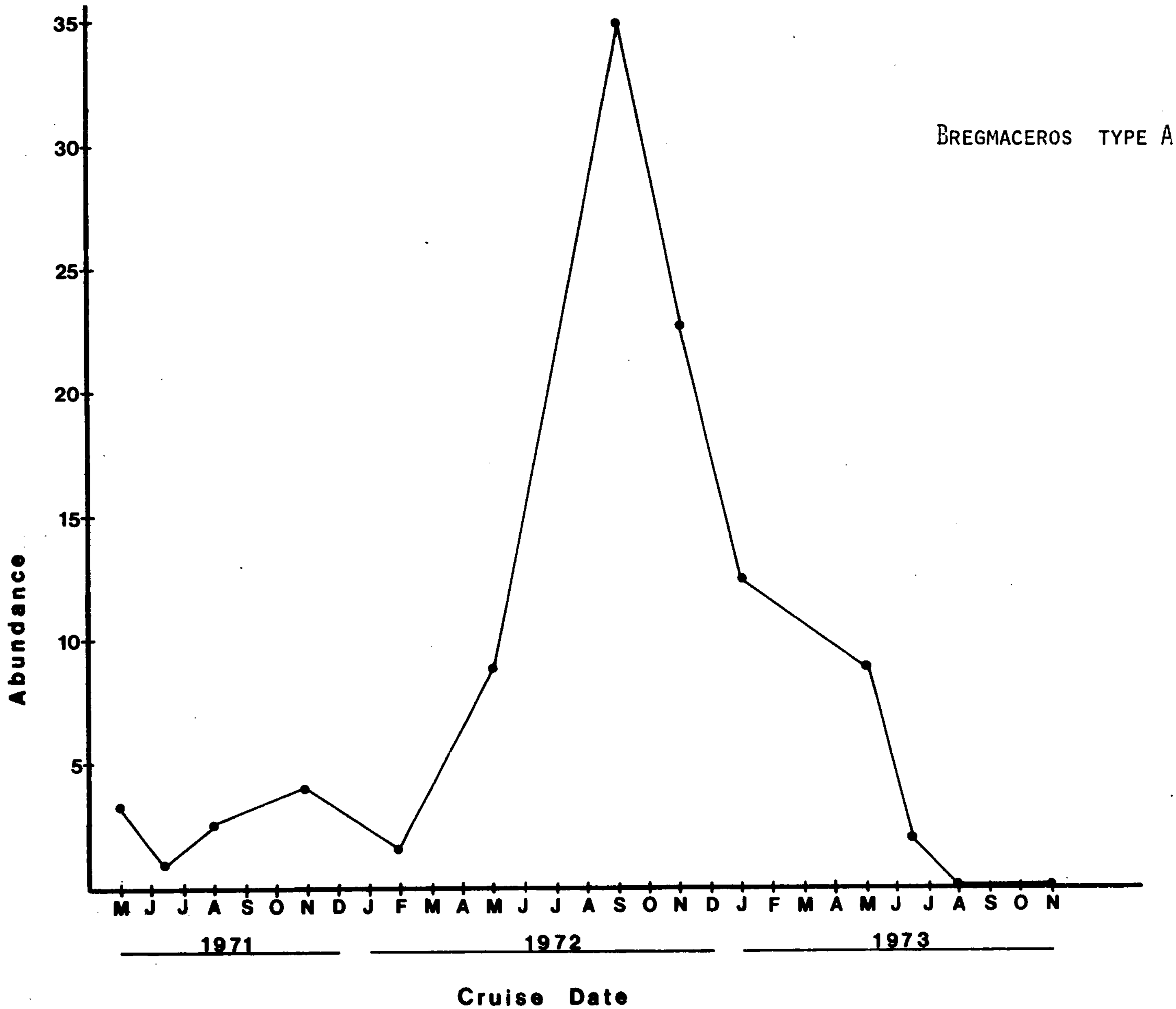



Fig. 68 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Bregmaceros Type A larvae in the eastern Gulf of Mexico, 1971-1974.

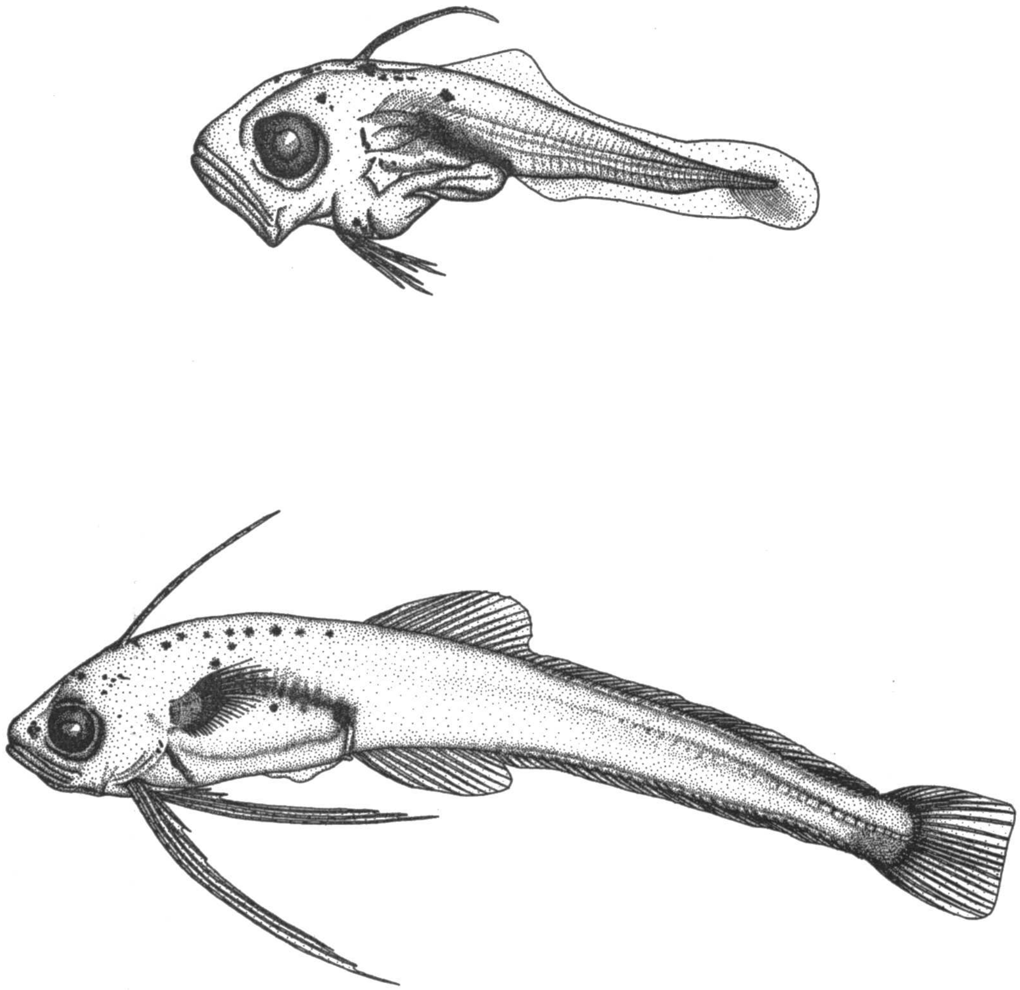


Fig. 69 Larvae of Bregmaceros Type A. The top specimen is a 3.0 mm SL larva. The bottom specimen is a 12.5 mm SL larva.

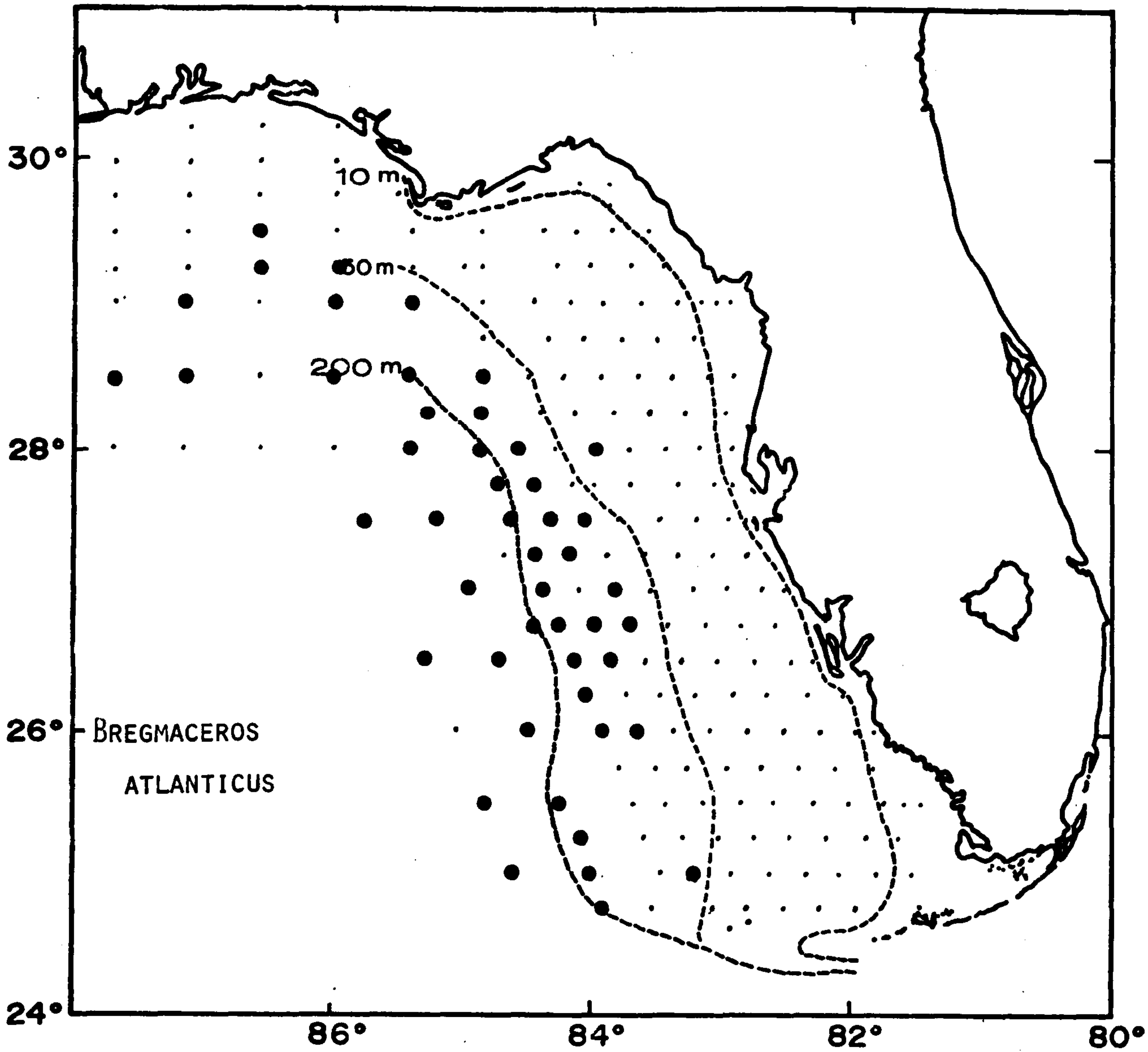



Fig. 70 Stations at which Bregmaceros atlanticus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

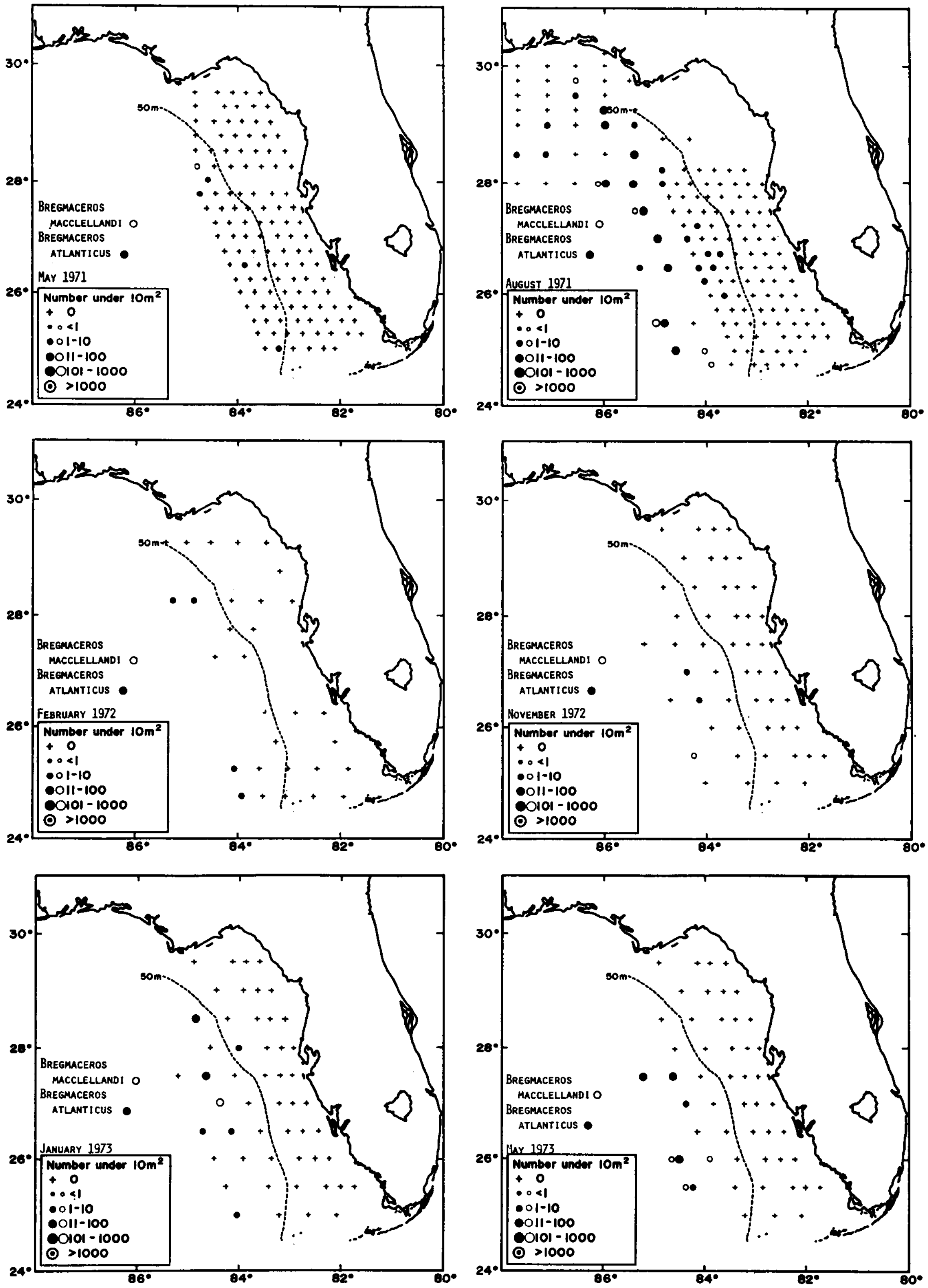
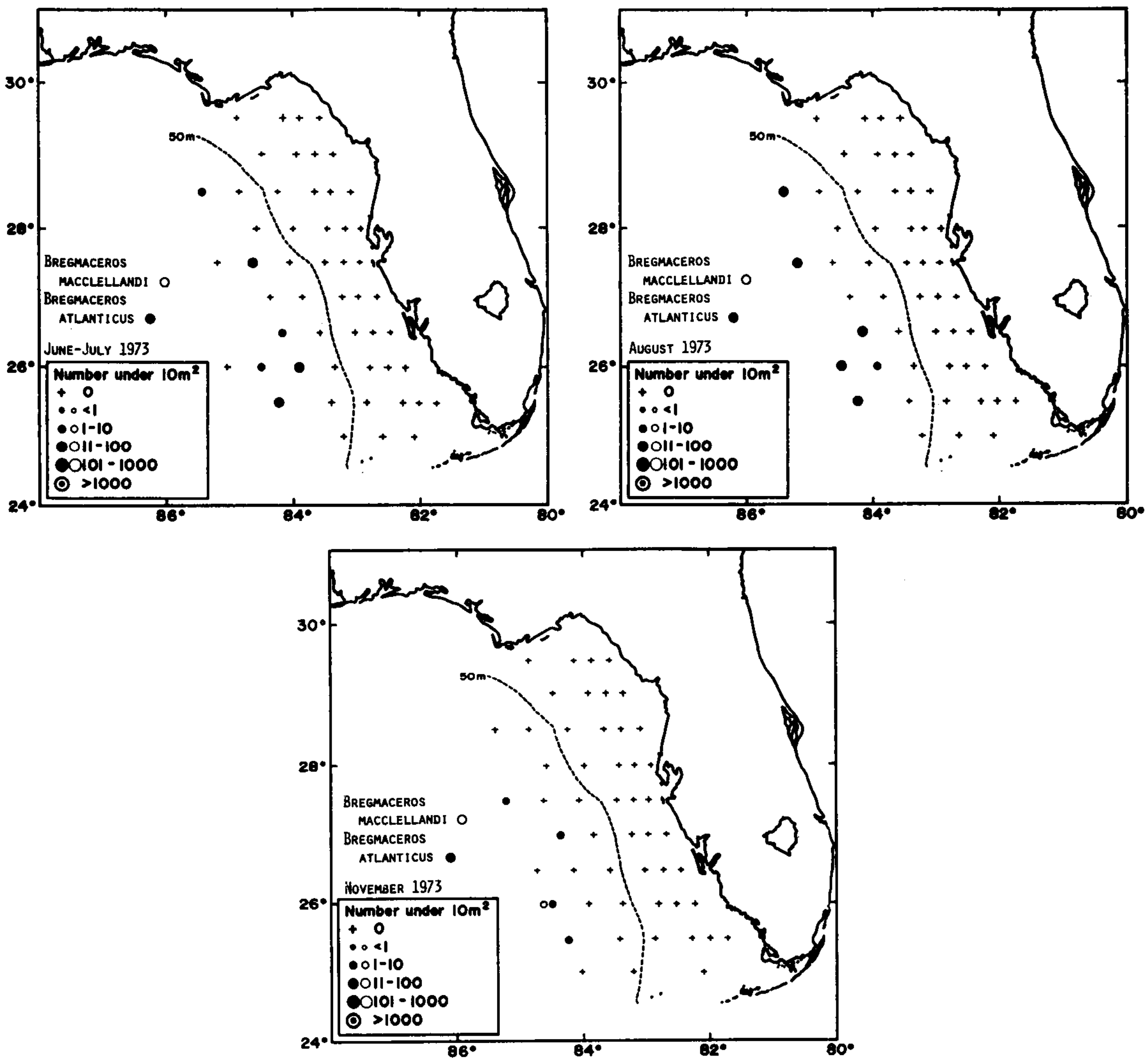



Fig. 71 Distribution and abundance of Bregmaceros atlanticus and Bregmaceros macclellandi larvae in the eastern Gulf of Mexico, 1971-1974.



30°
28°
26°
24°
86°
84°
82°
80°
50m
BREGMACEROS MACCLELLANDI
BREGMACEROS ATLANTICUS
JUNE-JULY 1973
AUGUST 1973
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000


Fig. 71 Cont.

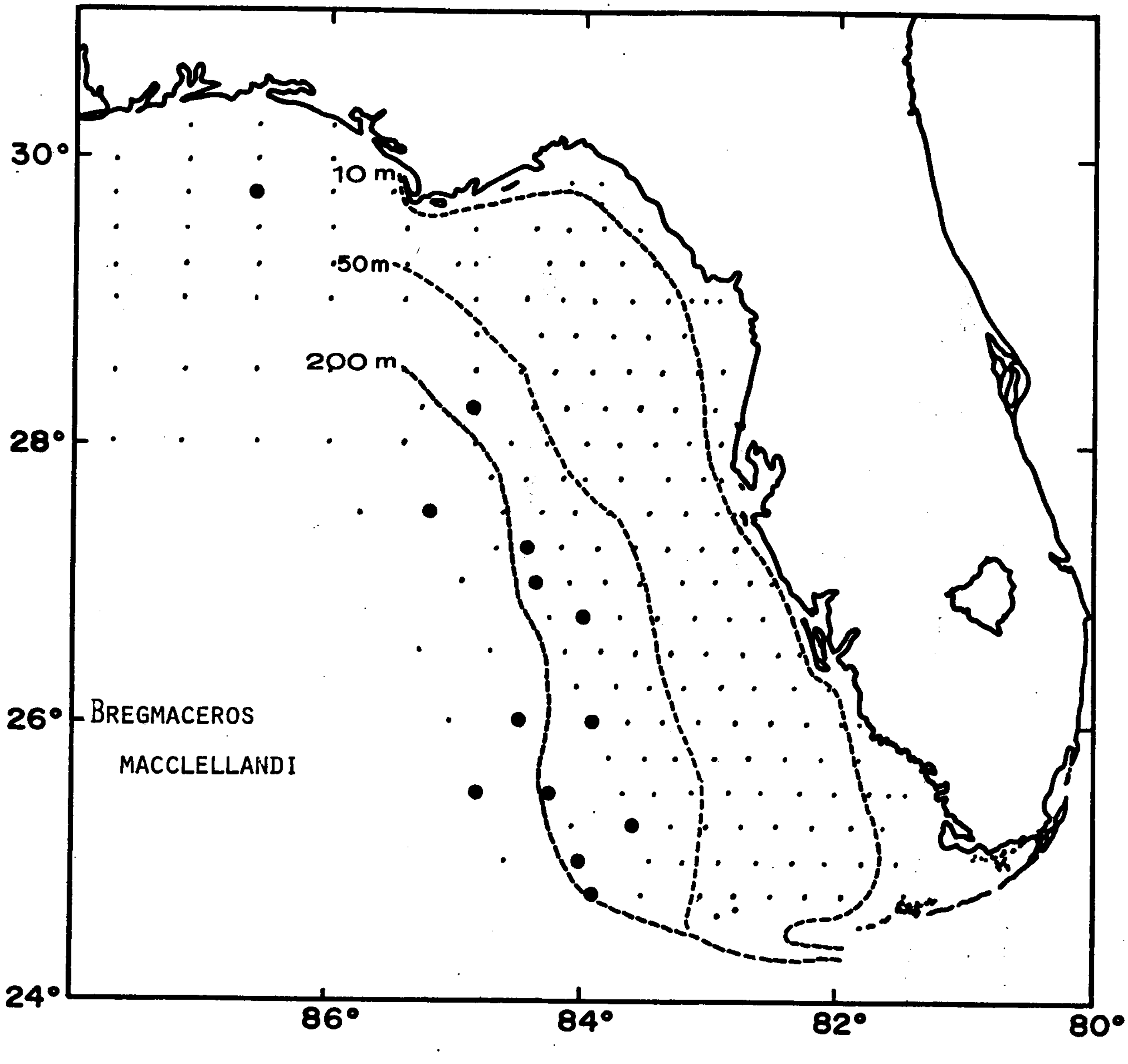



Fig. 72 Stations at which Bregmaceros macclellandi larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

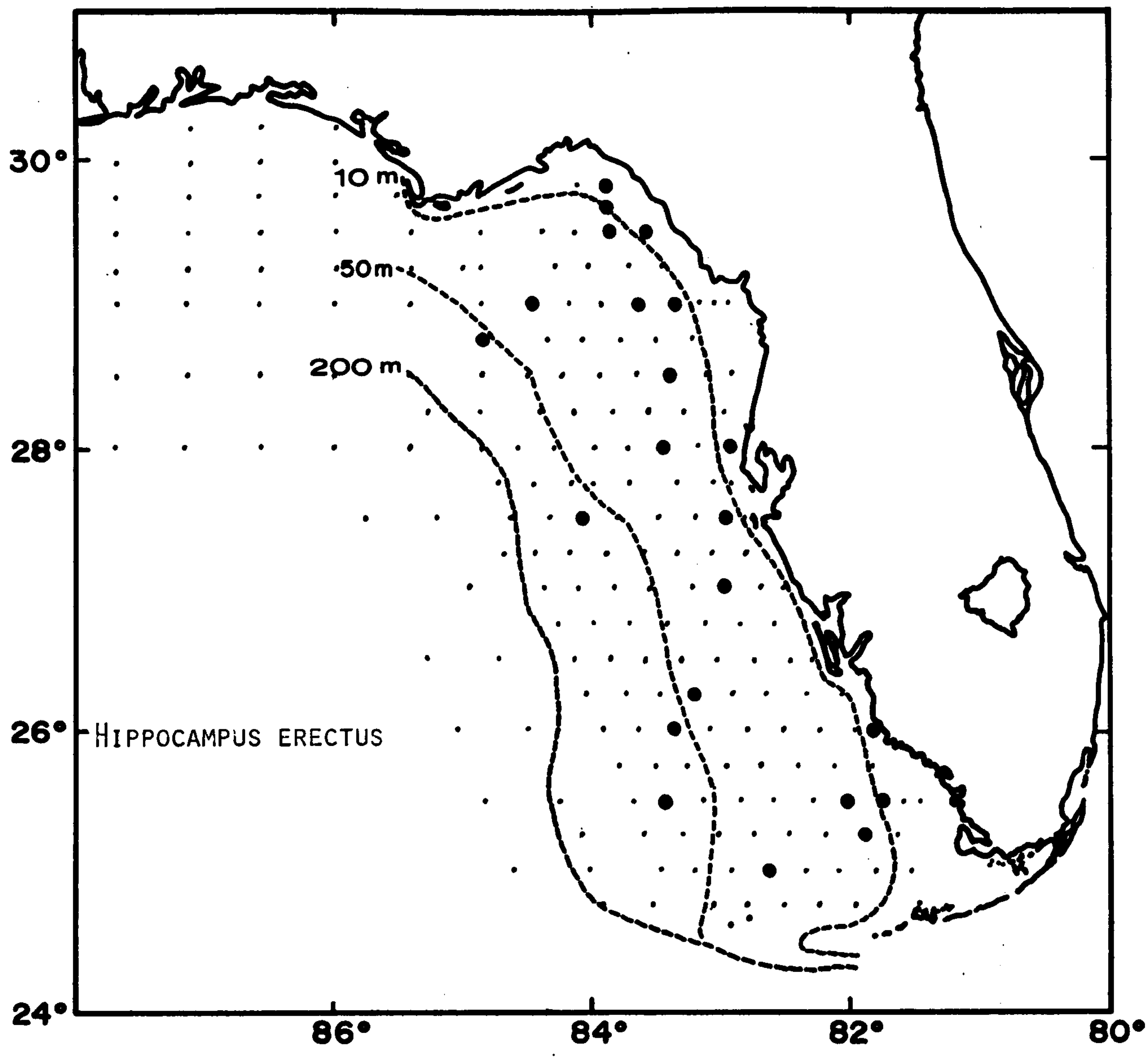



Fig. 73 Stations at which <u>Hippocampus erectus</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

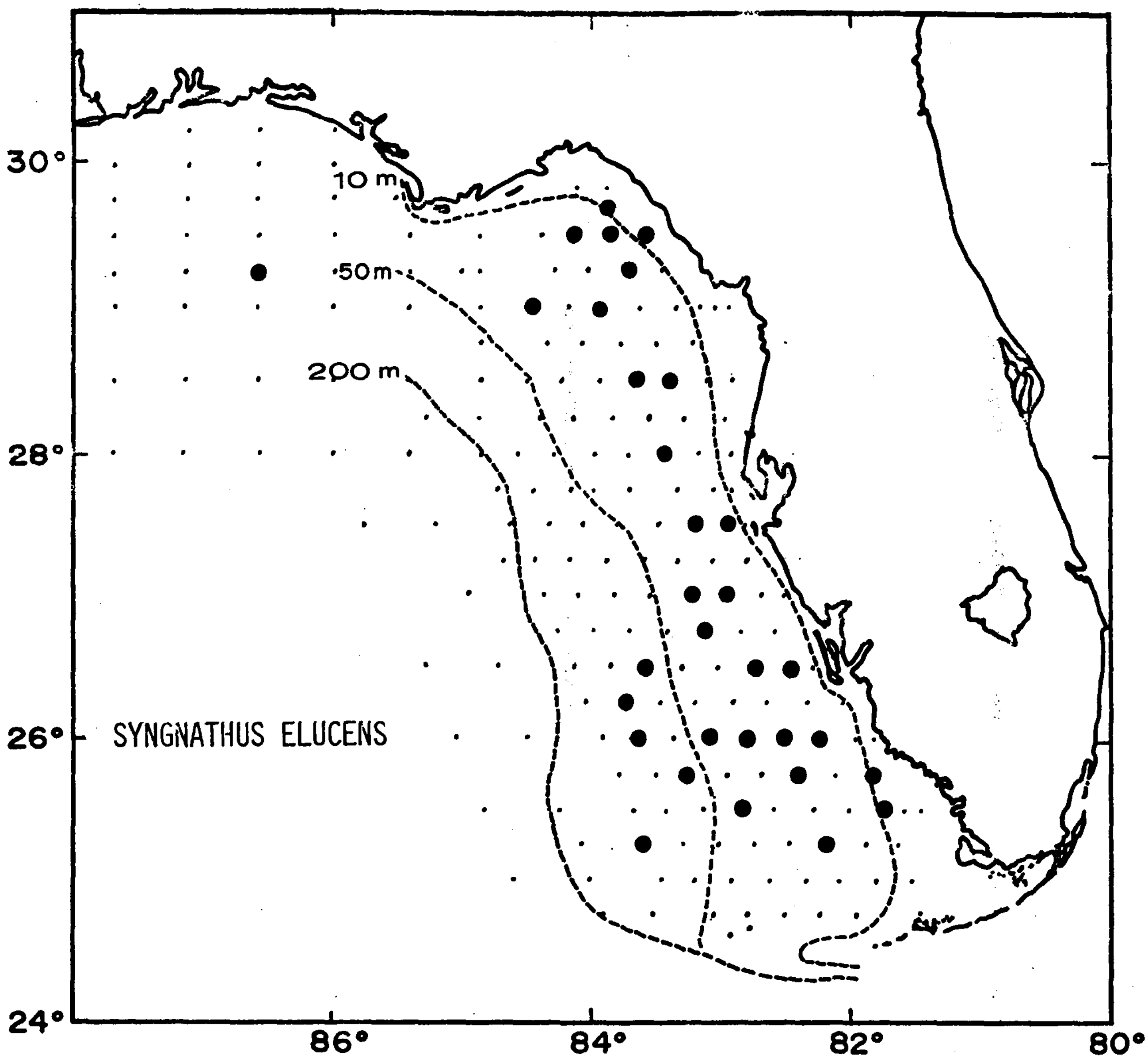



Fig. 74 Stations at which *Syngnathus elucens* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

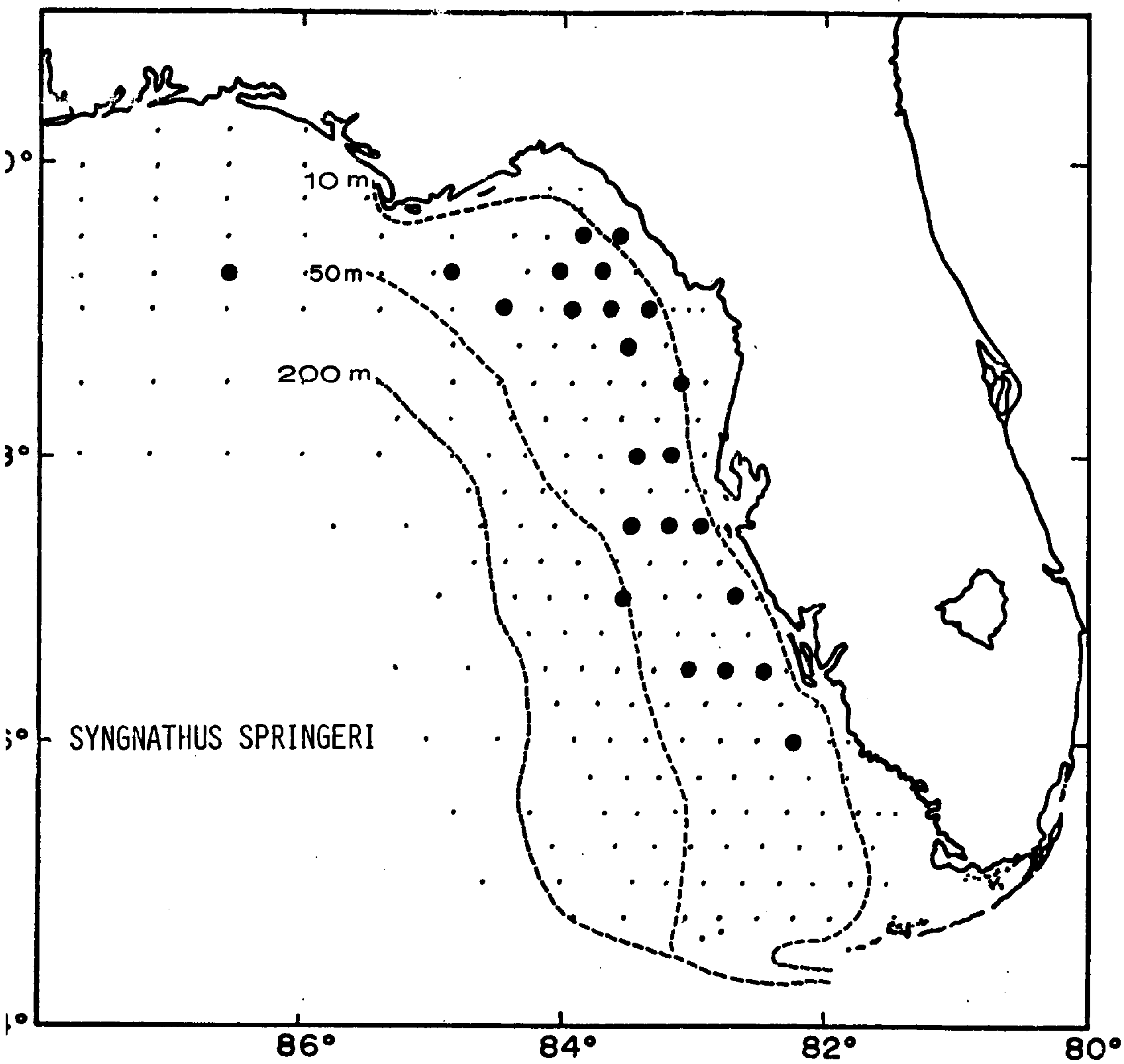



Fig. 75 Stations at which Syngnathus springeri larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

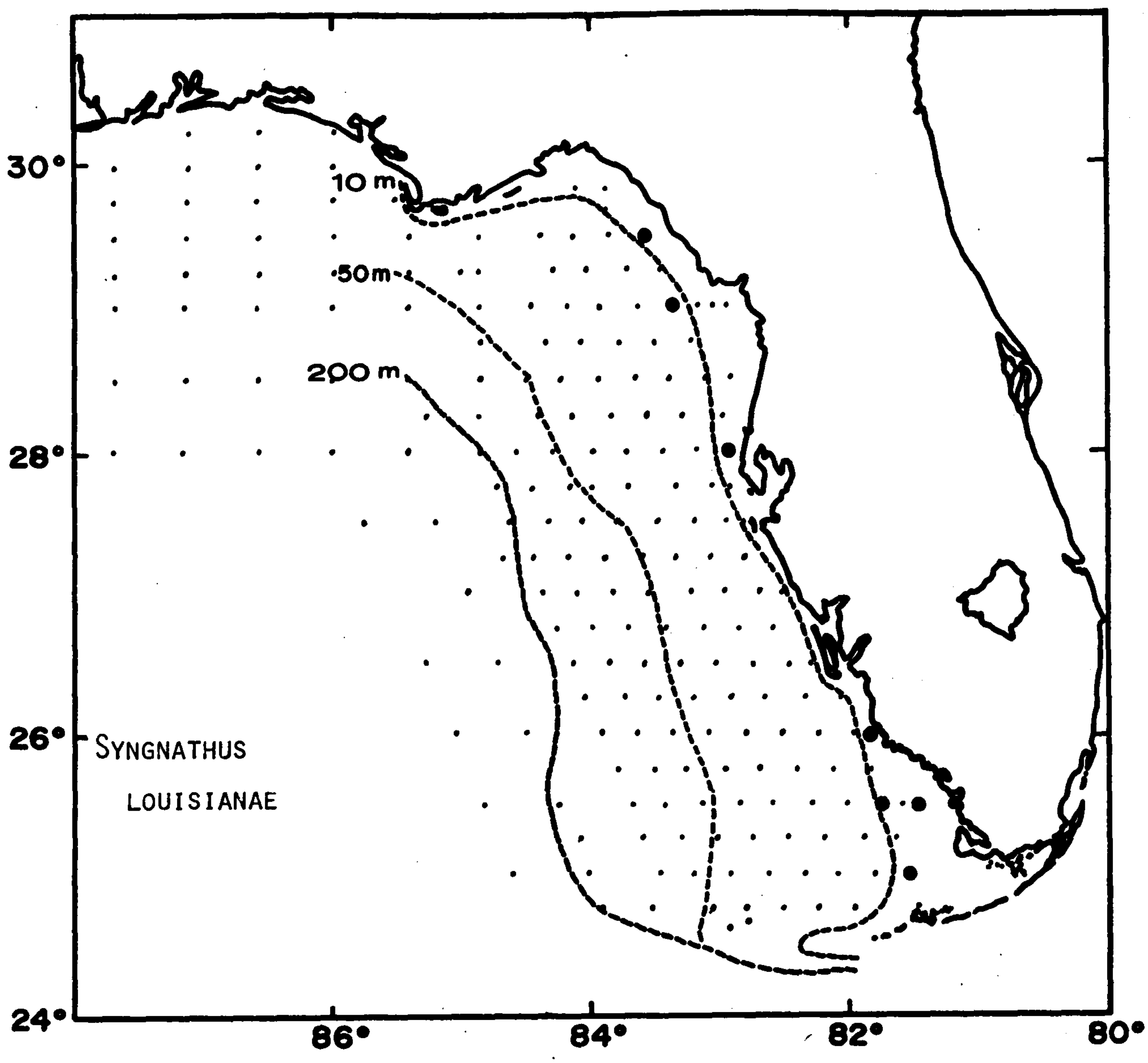



Fig. 76 Stations at which Syngnathus louisianae larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

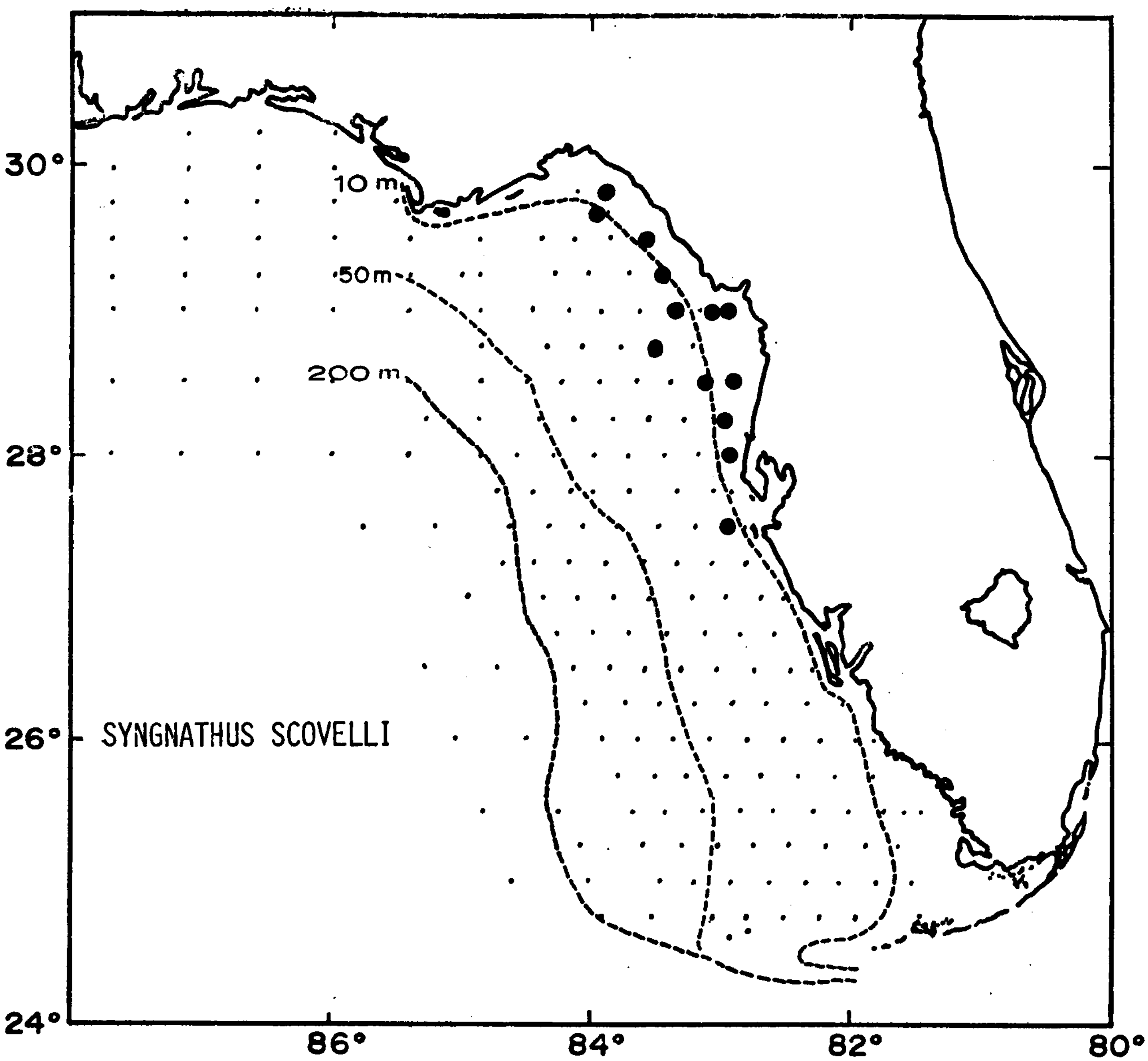



Fig. 77 Stations at which Syngnathus scovelli larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

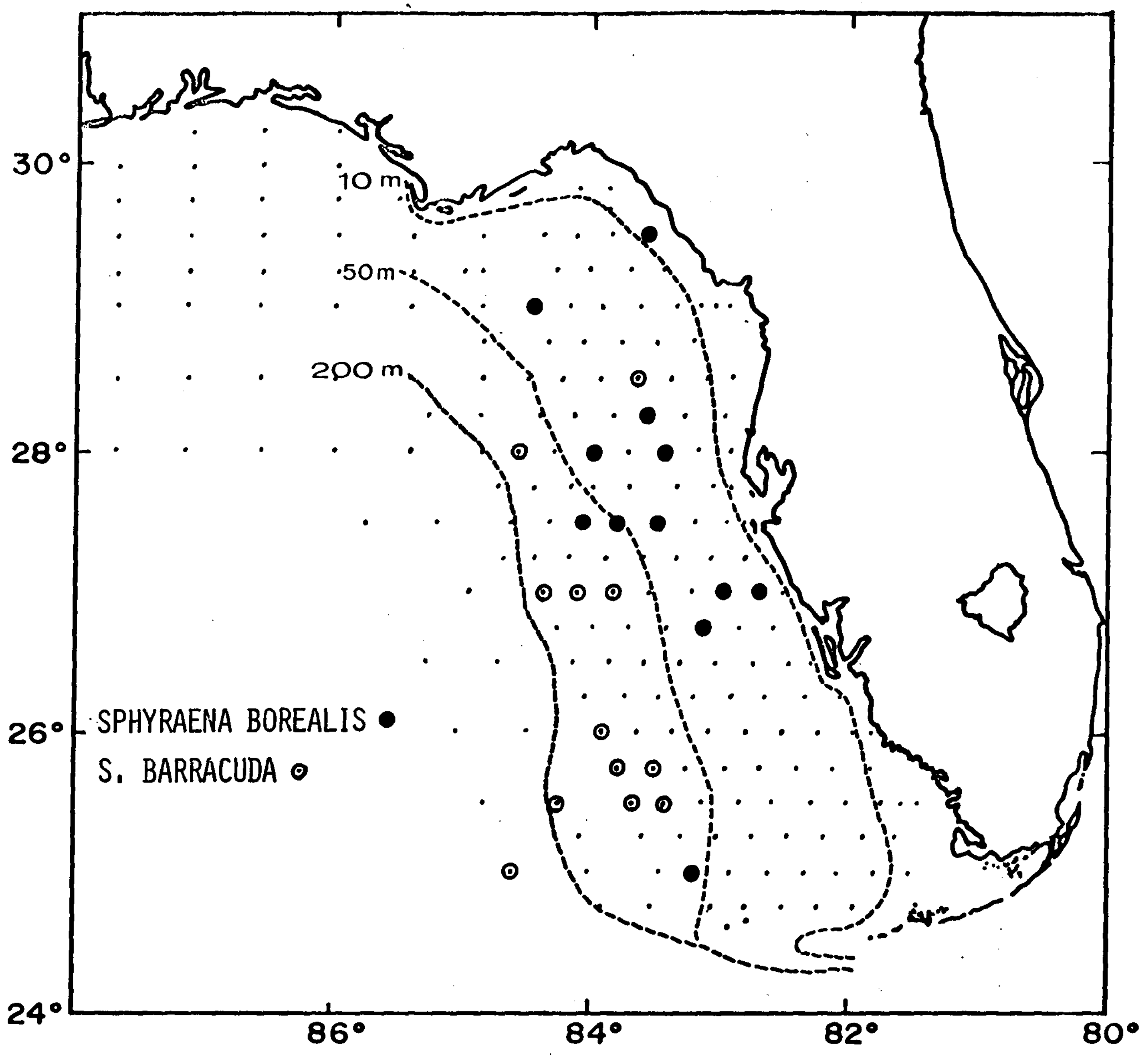



Fig. 78 Stations at which *Sphyraena borealis* and *Sphyraena barracuda* occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

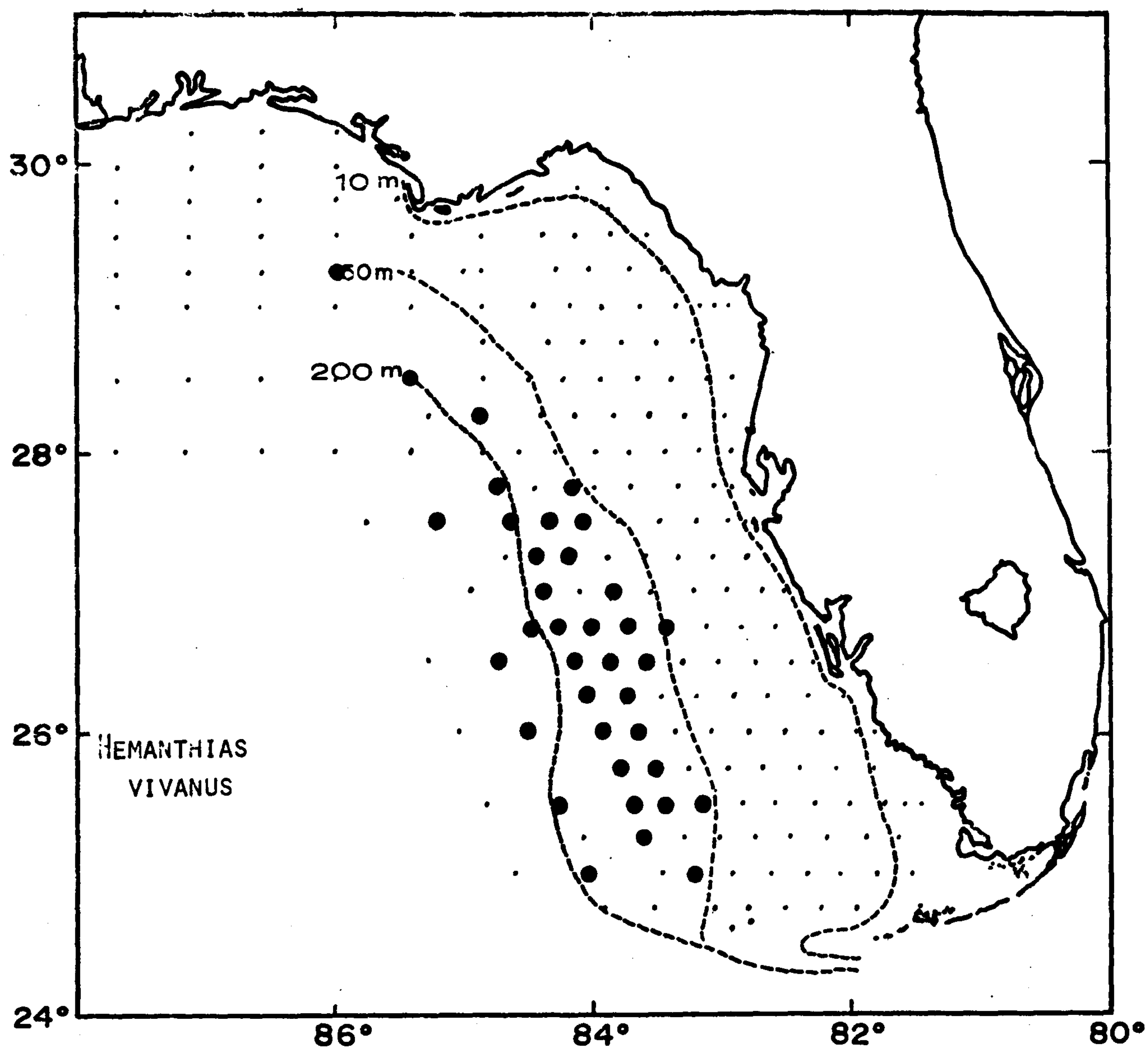



Fig. 79 Stations at which Hemanthias vivanus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

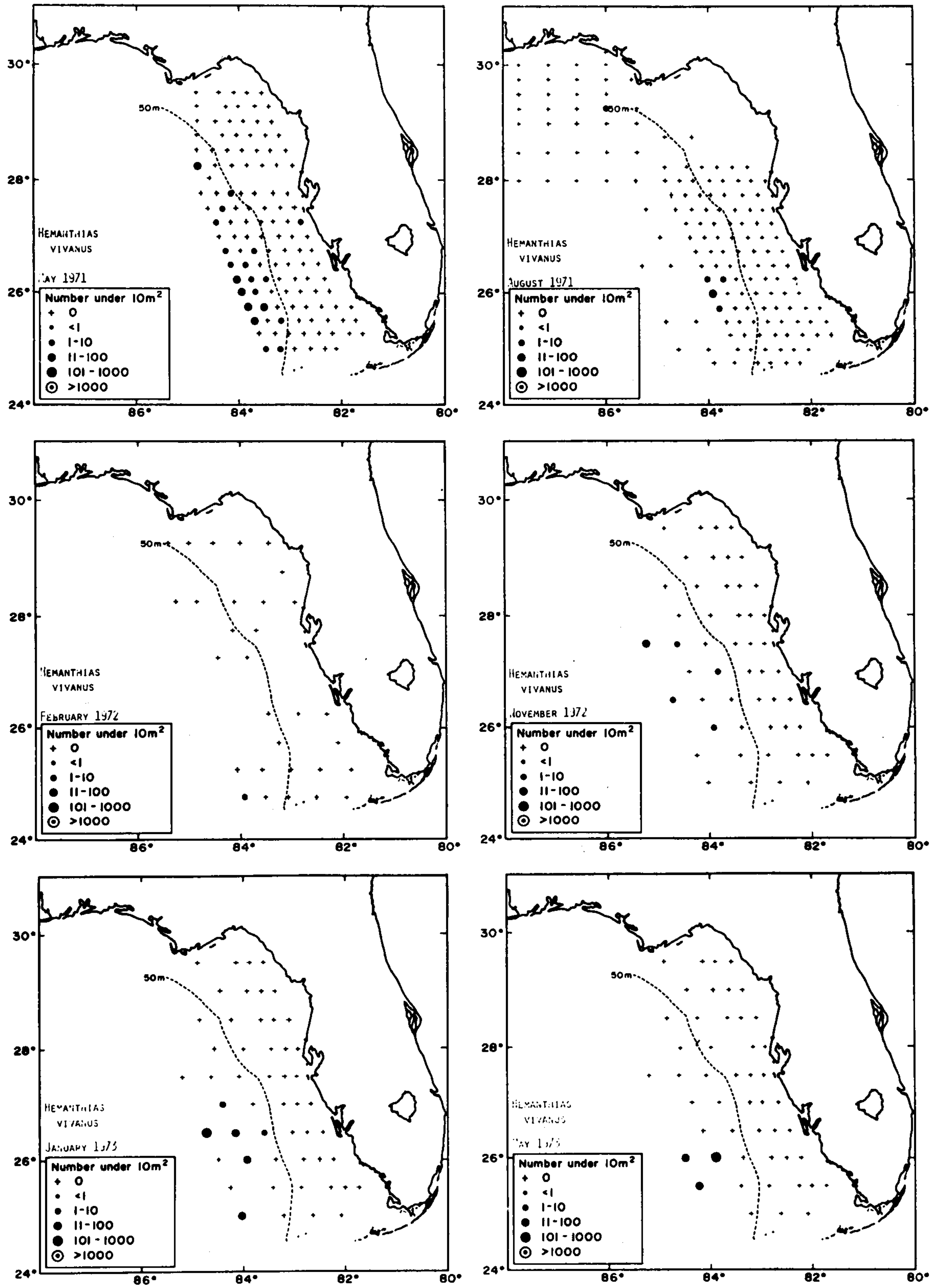



Fig. 80 Distribution and abundance of Hemanthias vivanus larvae in the eastern Gulf of Mexico, 1971-1974.

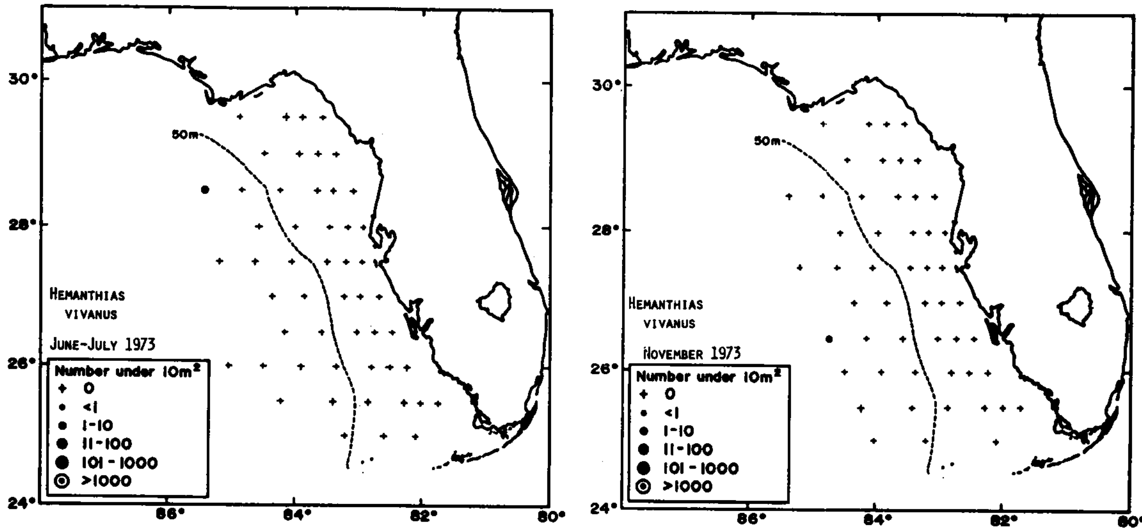

Hemanthias
vivanus
June-July 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
Hemanthias
vivanus
November 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
50m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 80 Cont.

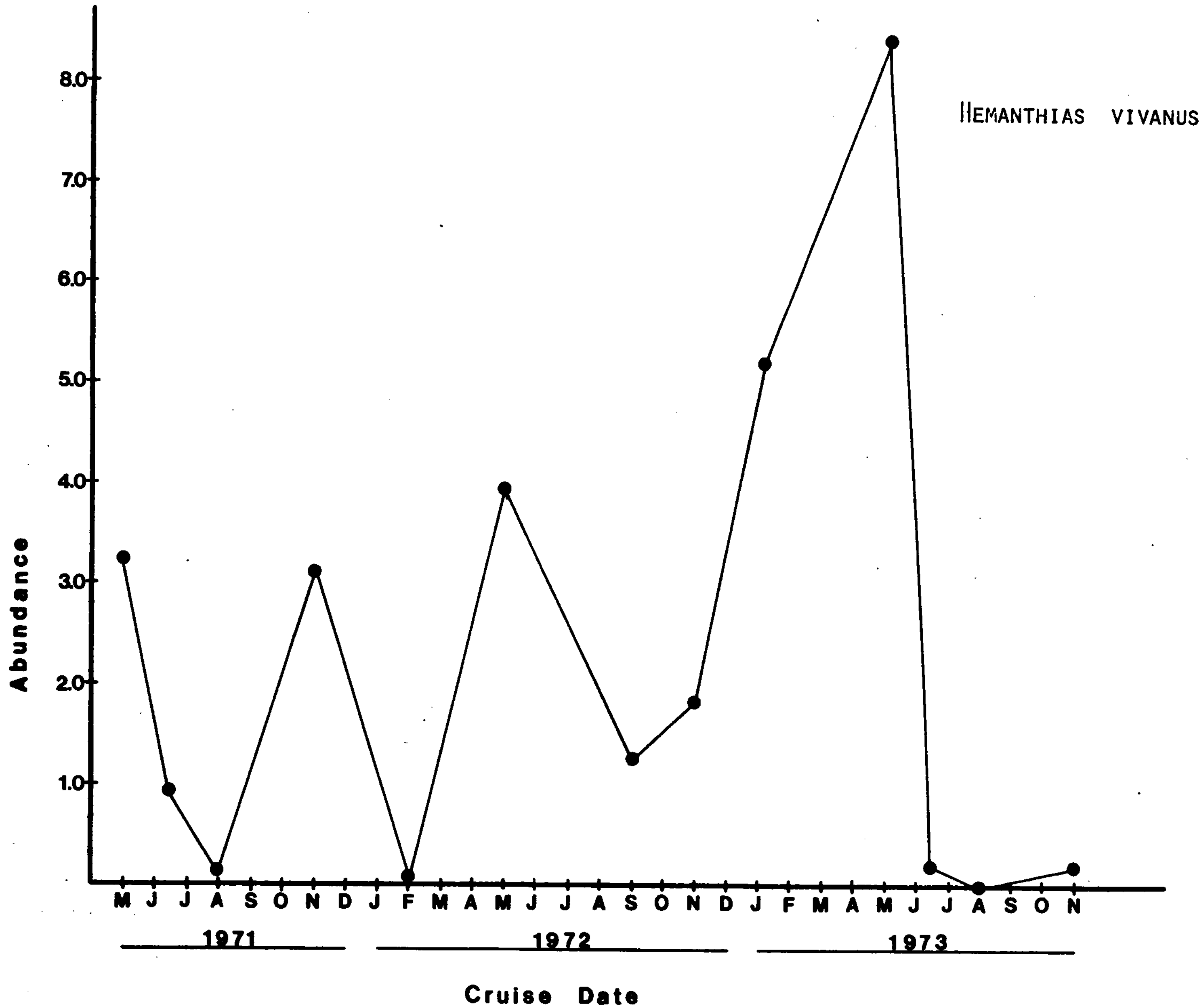



Fig. 81 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Hemanthias vivanus larvae in the eastern Gulf of Mexico, 1971-1974.

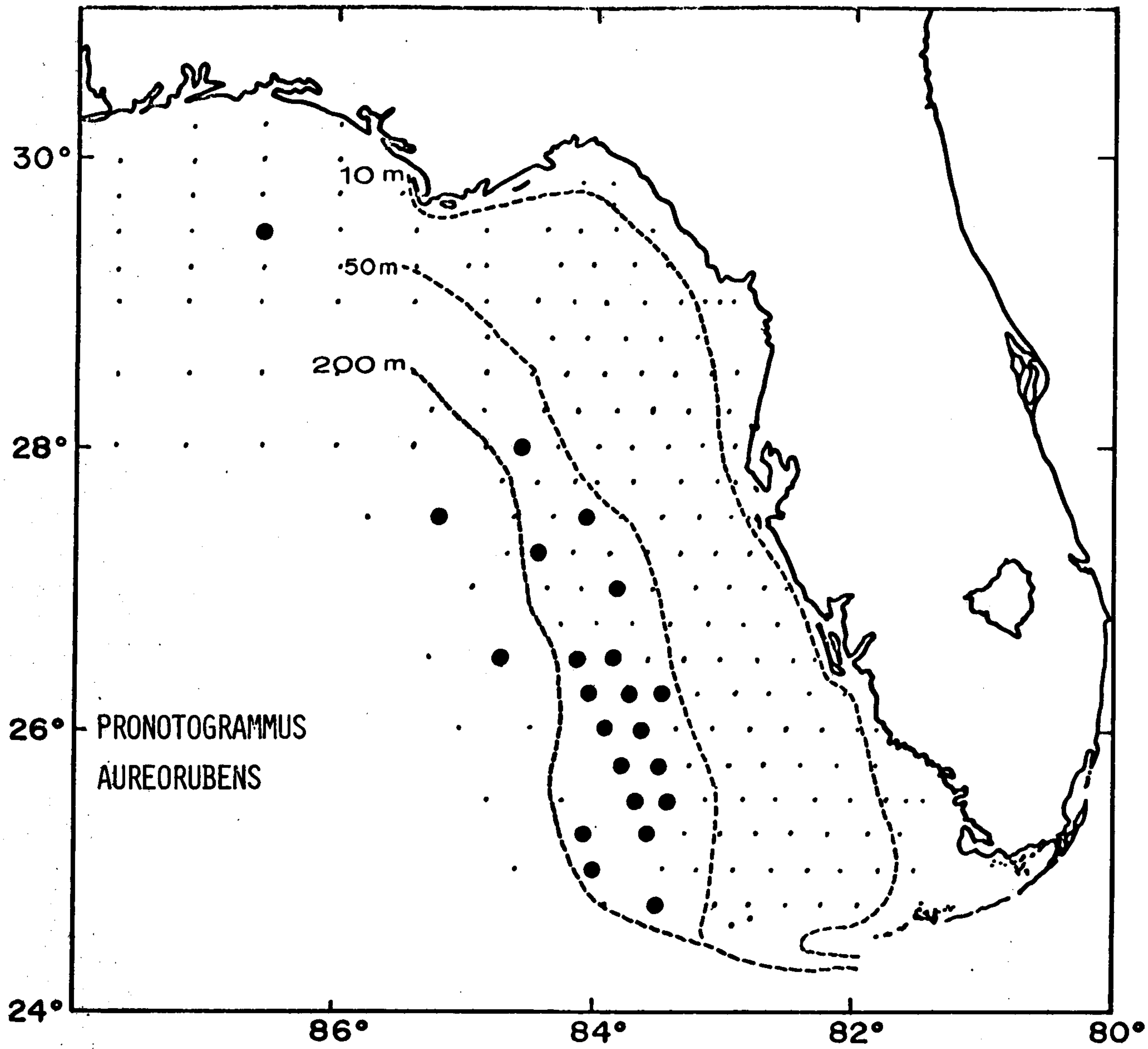



Fig. 82 Stations at which Pronotogrammus aureorubens larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974,

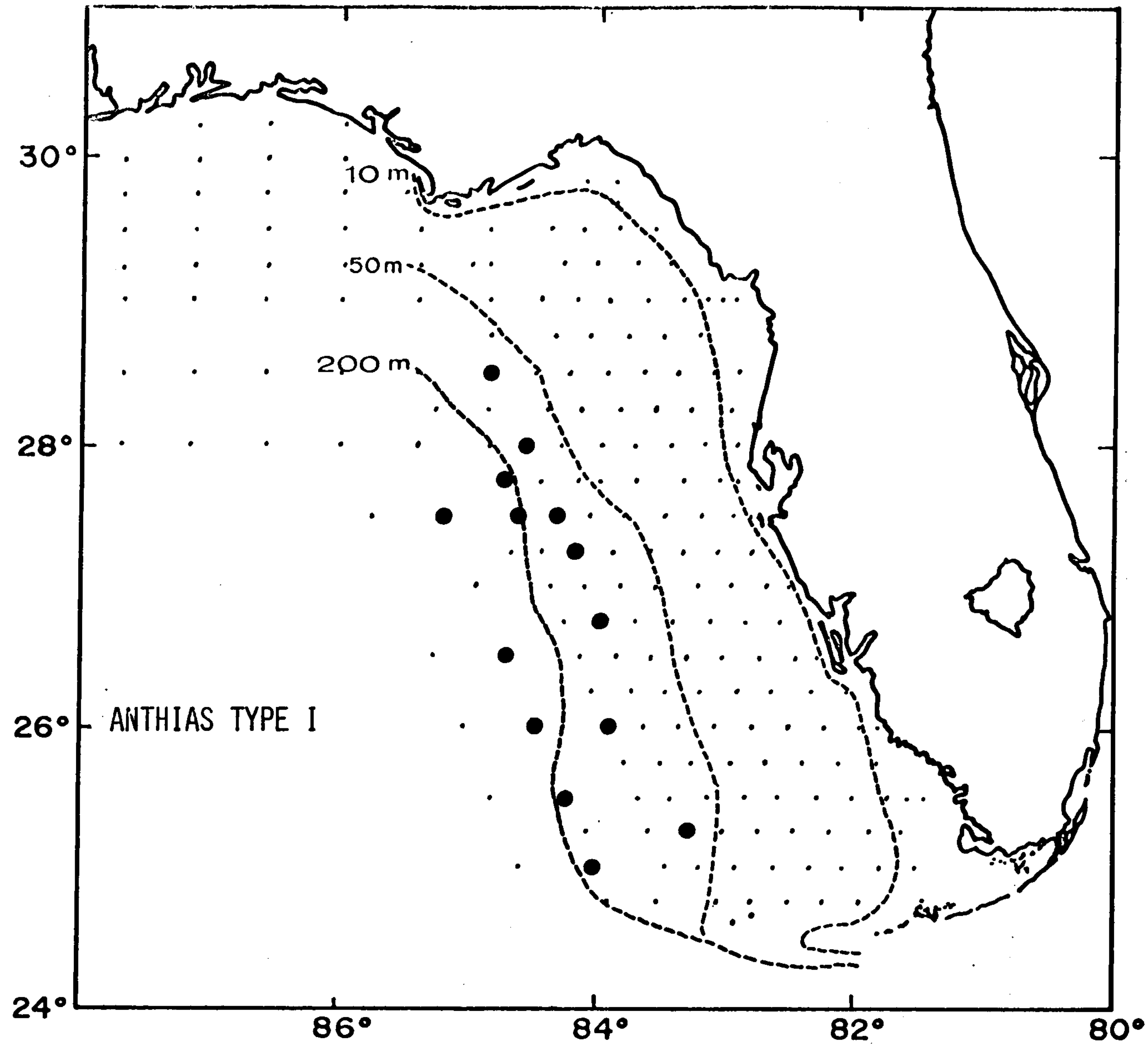



Fig. 83 Stations at which *Anthias* Type I larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

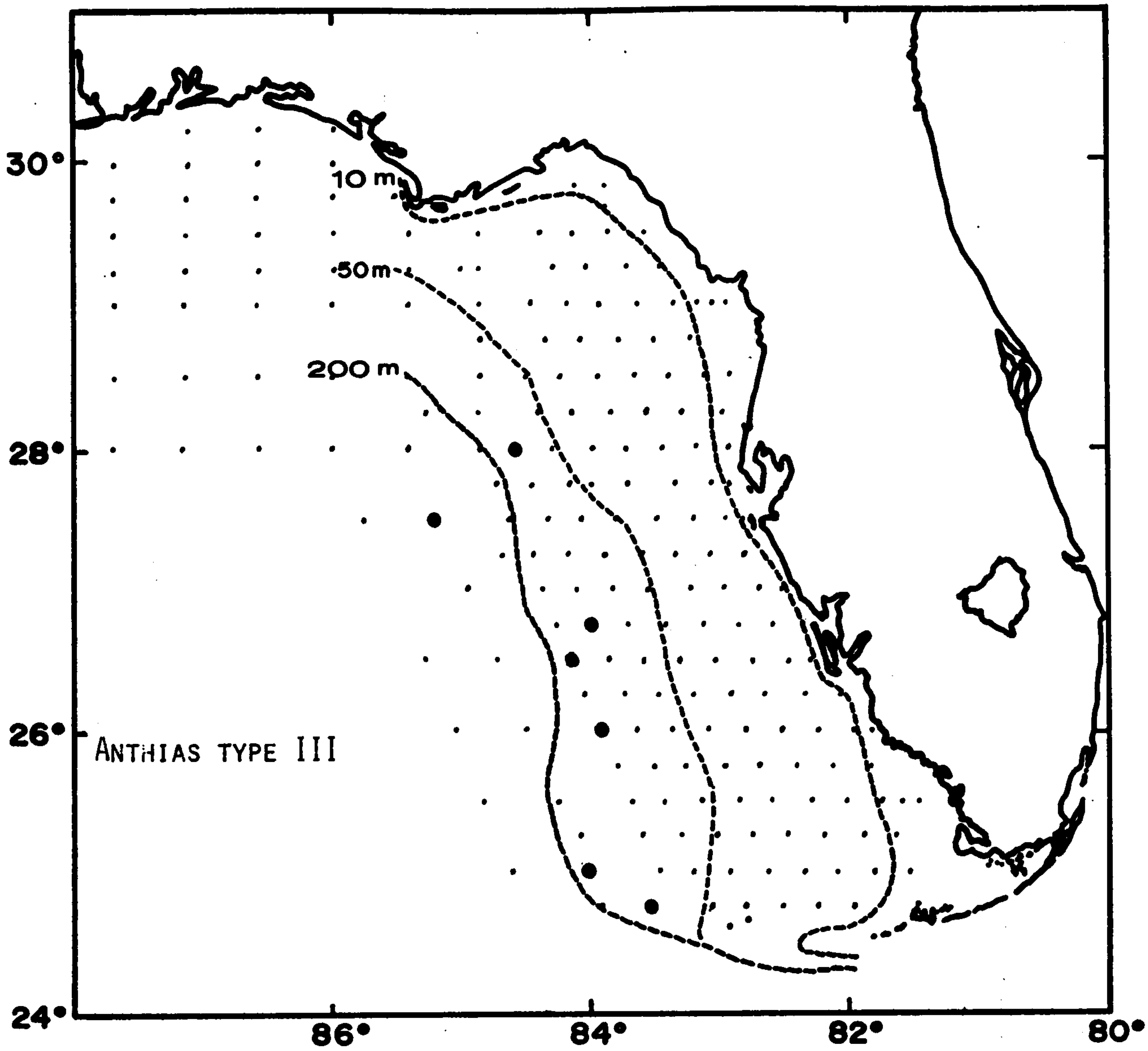



Fig. 84 Stations at which <u>Anthias</u> Type III larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

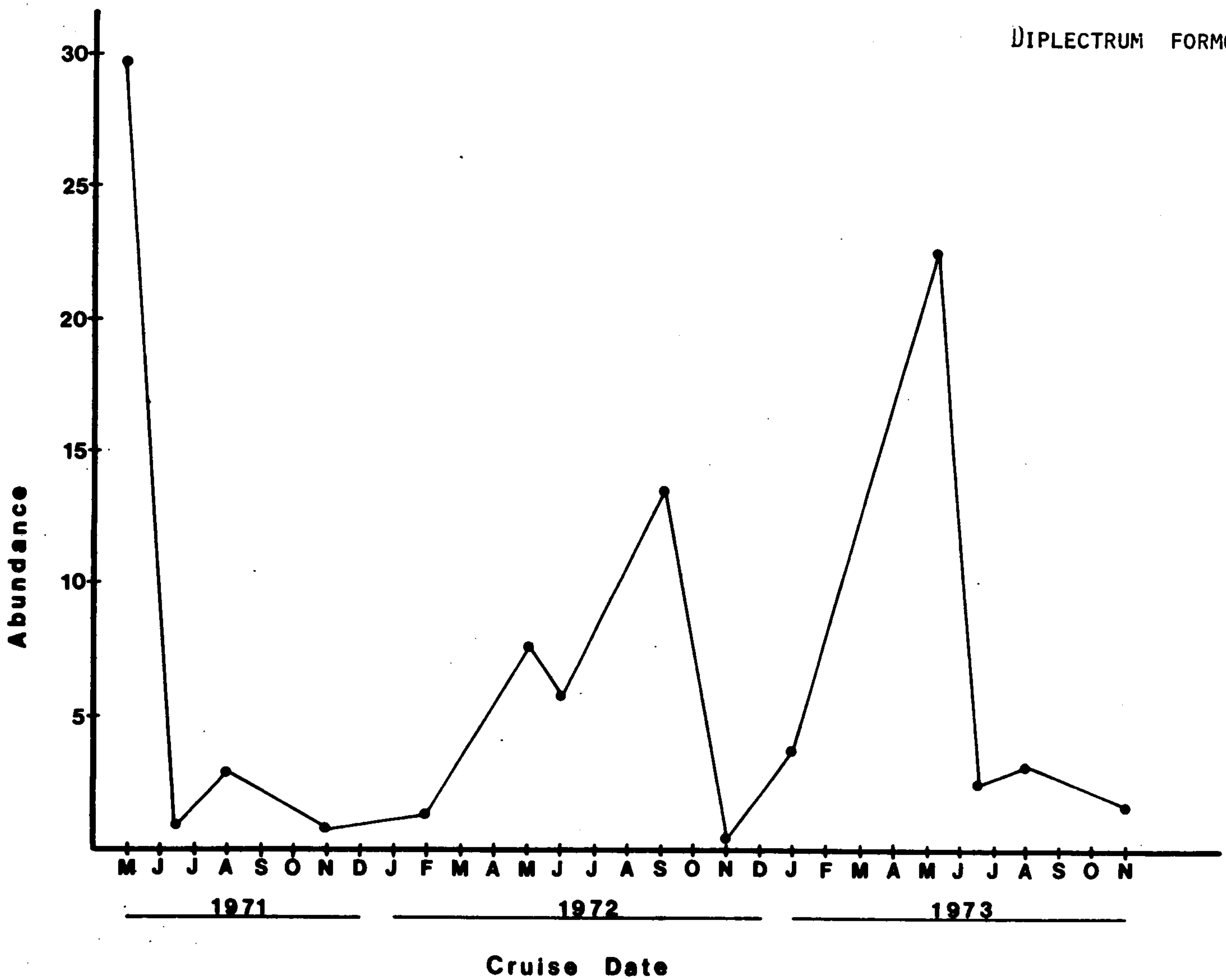



Fig. 85 Estimated mean abundances (number under 10 $m^2$ of sea surface) of <u>Diplectrum formosum</u> larvae in the eastern Gulf of Mexico, 1971-1974.

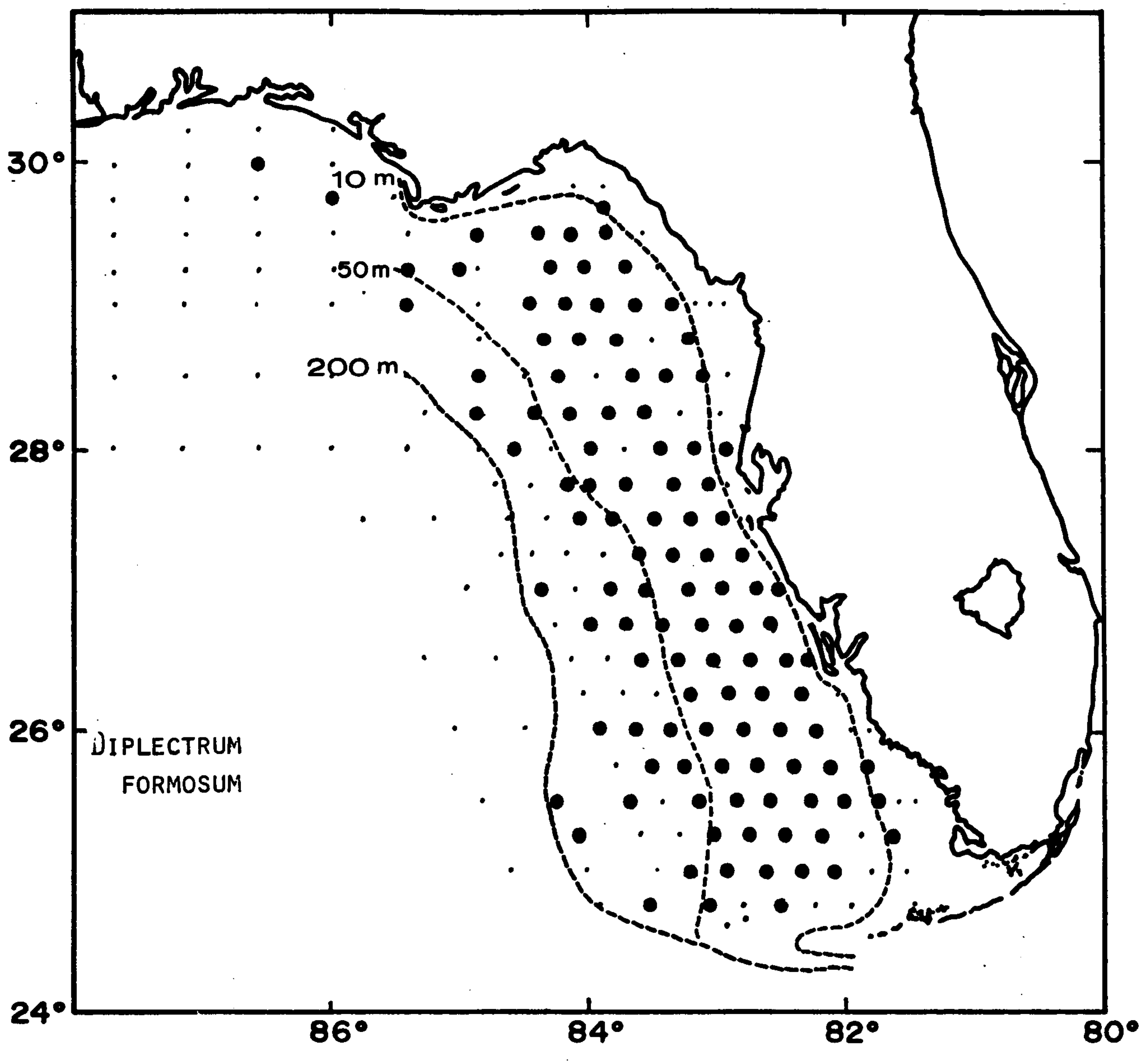



Fig. 86 Stations at which <u>Diplectrum formosum</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

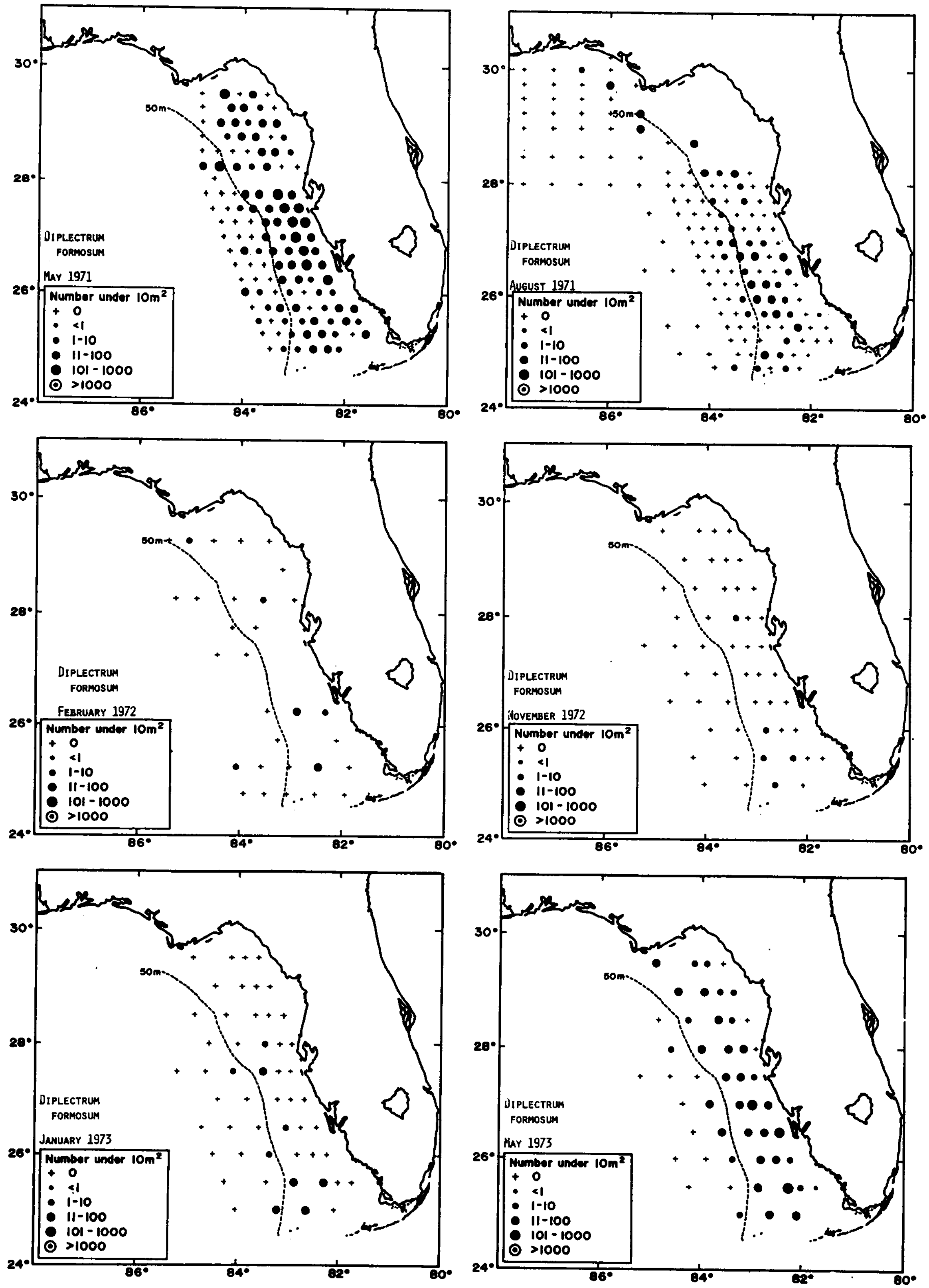



Fig. 87 Distribution and abundance of <u>Diplectrum formosum</u> larvae in the eastern Gulf of Mexico, 1971-1974.

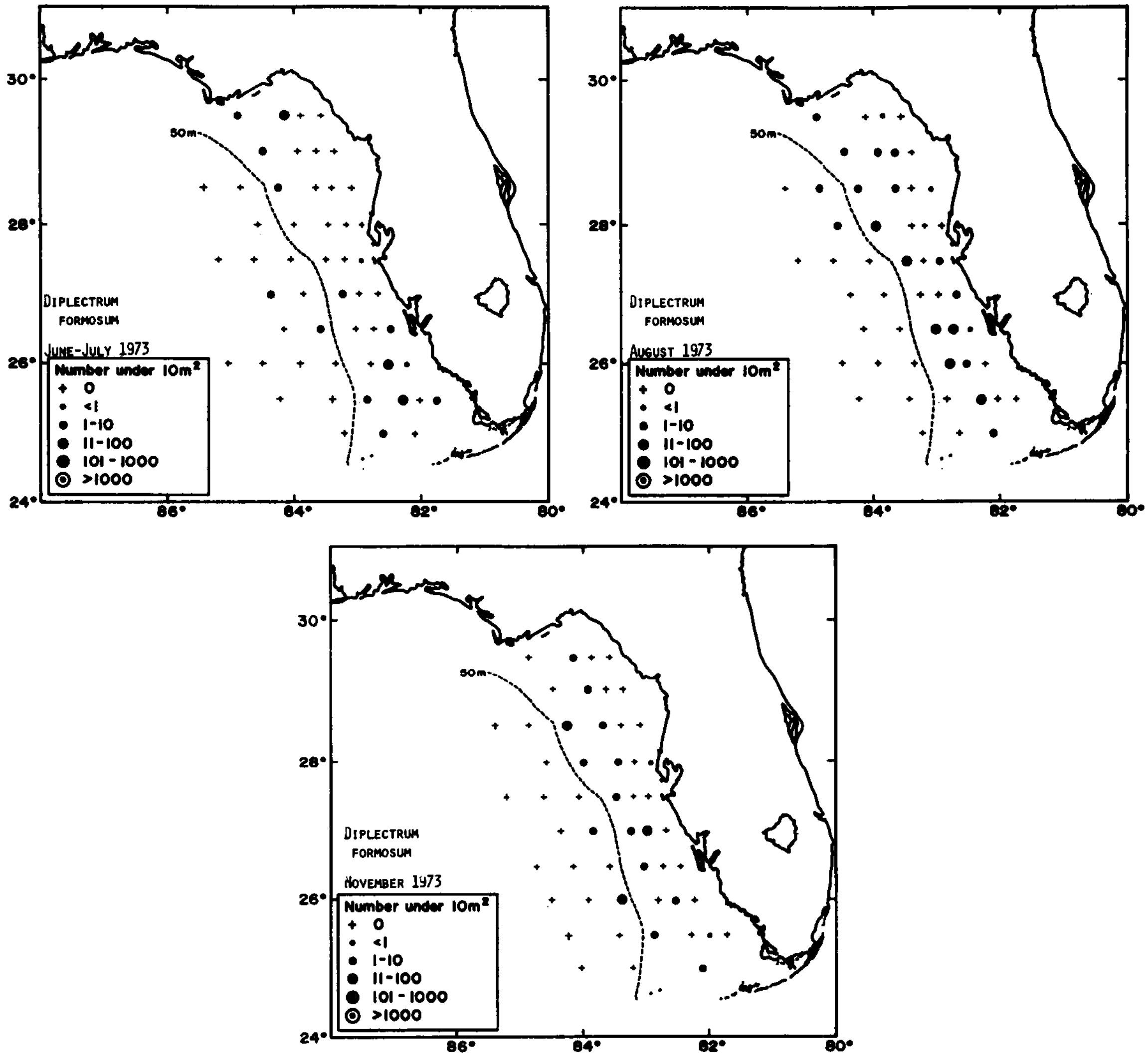

30°
28°
26°
24°
86°
84°
82°
80°
50m
DIPLECTRUM
FORMOSUM
JUNE-JULY 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
30°
28°
26°
24°
86°
84°
82°
80°
50m
DIPLECTRUM
FORMOSUM
AUGUST 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
30°
28°
26°
24°
86°
84°
82°
80°
50m
DIPLECTRUM
FORMOSUM
NOVEMBER 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000

Fig. 87 Cont.

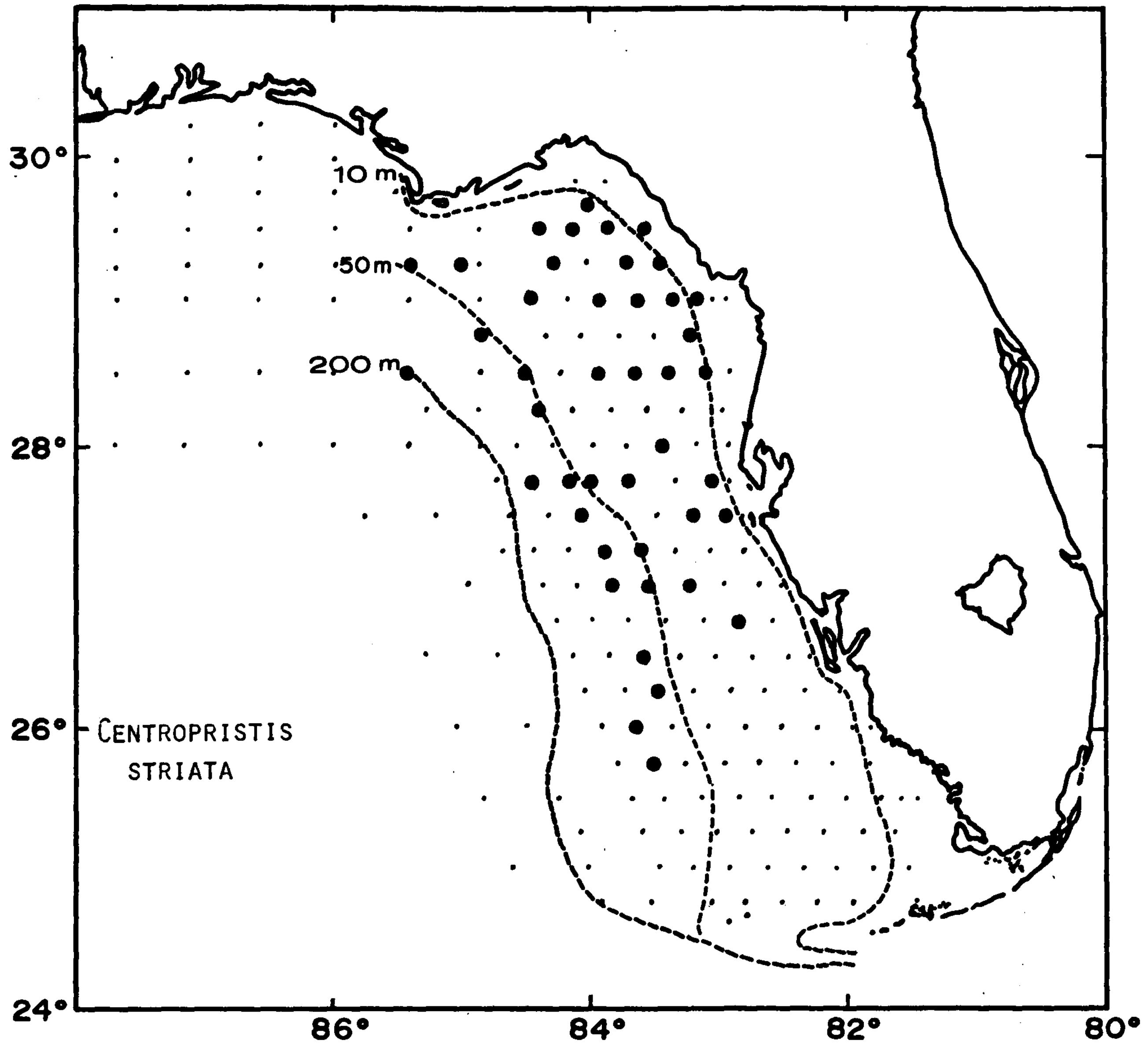



Fig. 88 Stations at which *Centropristis striata* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

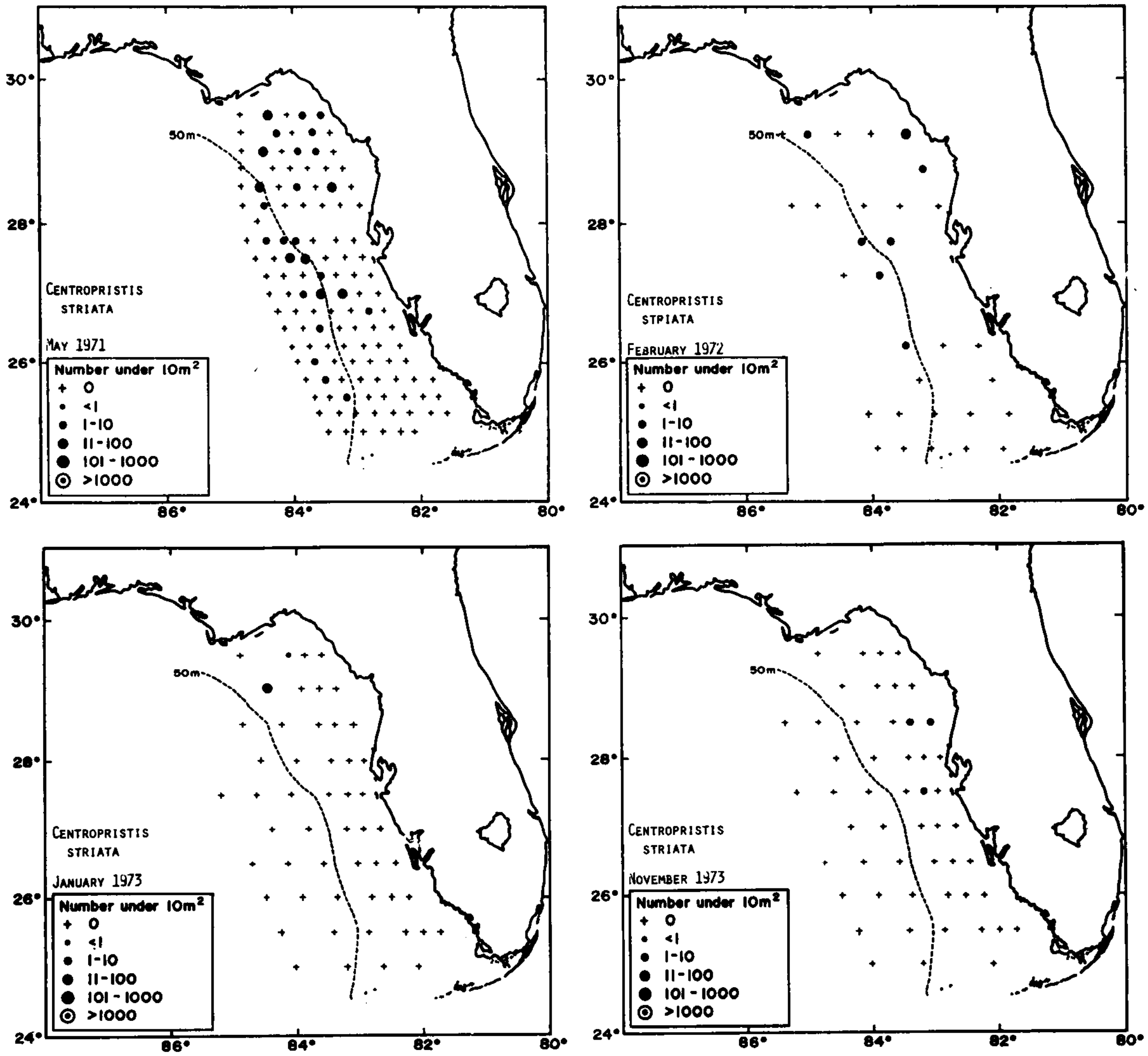



Fig. 89 Distribution and abundance of <u>Centropristis striata</u> larvae in the eastern Gulf of Mexico, 1971-1974.

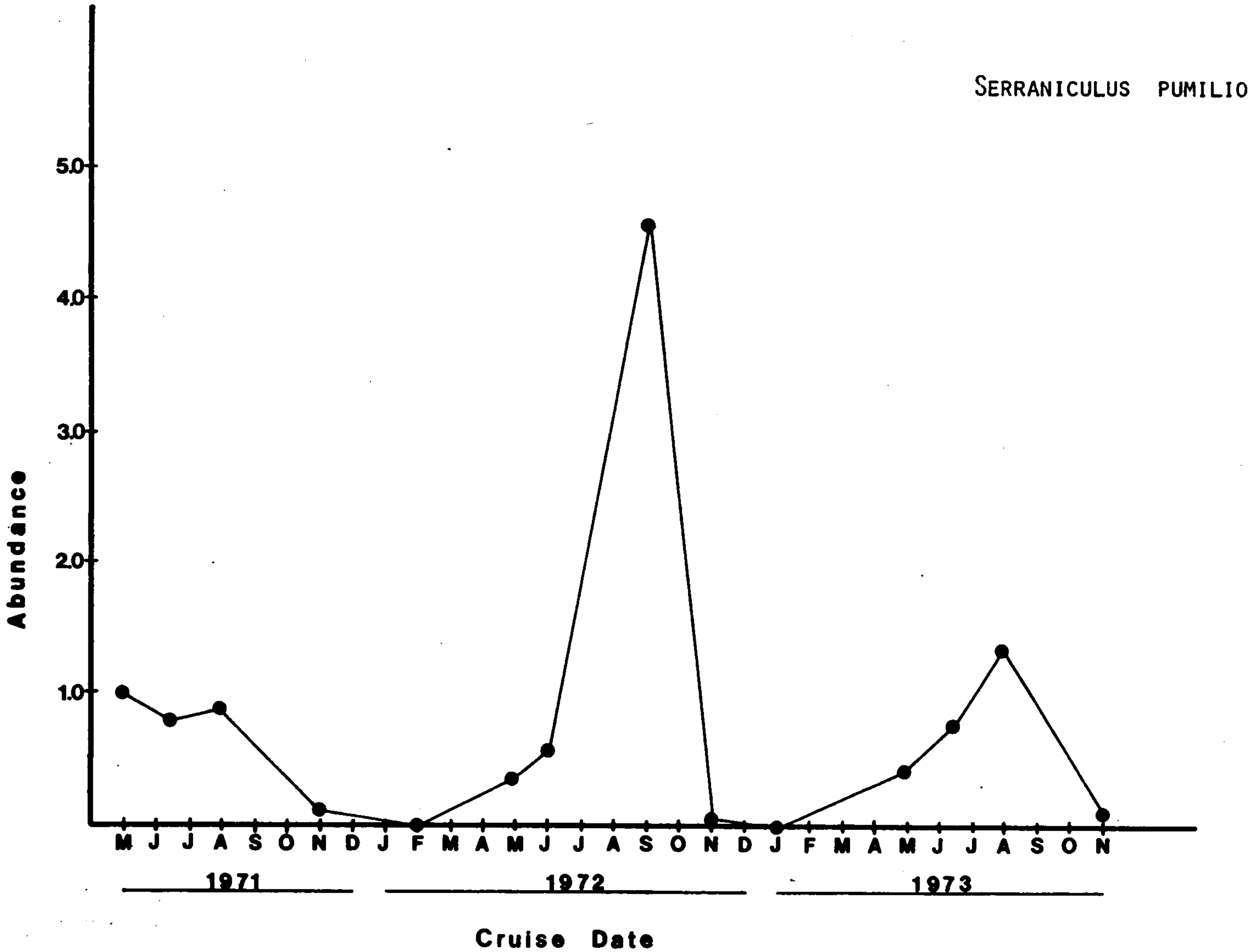



Fig. 90 Estimated mean abundances (number under 10 $m^2$ of sea surface) of <u>Serraniculus pumilio</u> larvae in the eastern Gulf of Mexico, 1971-1974.

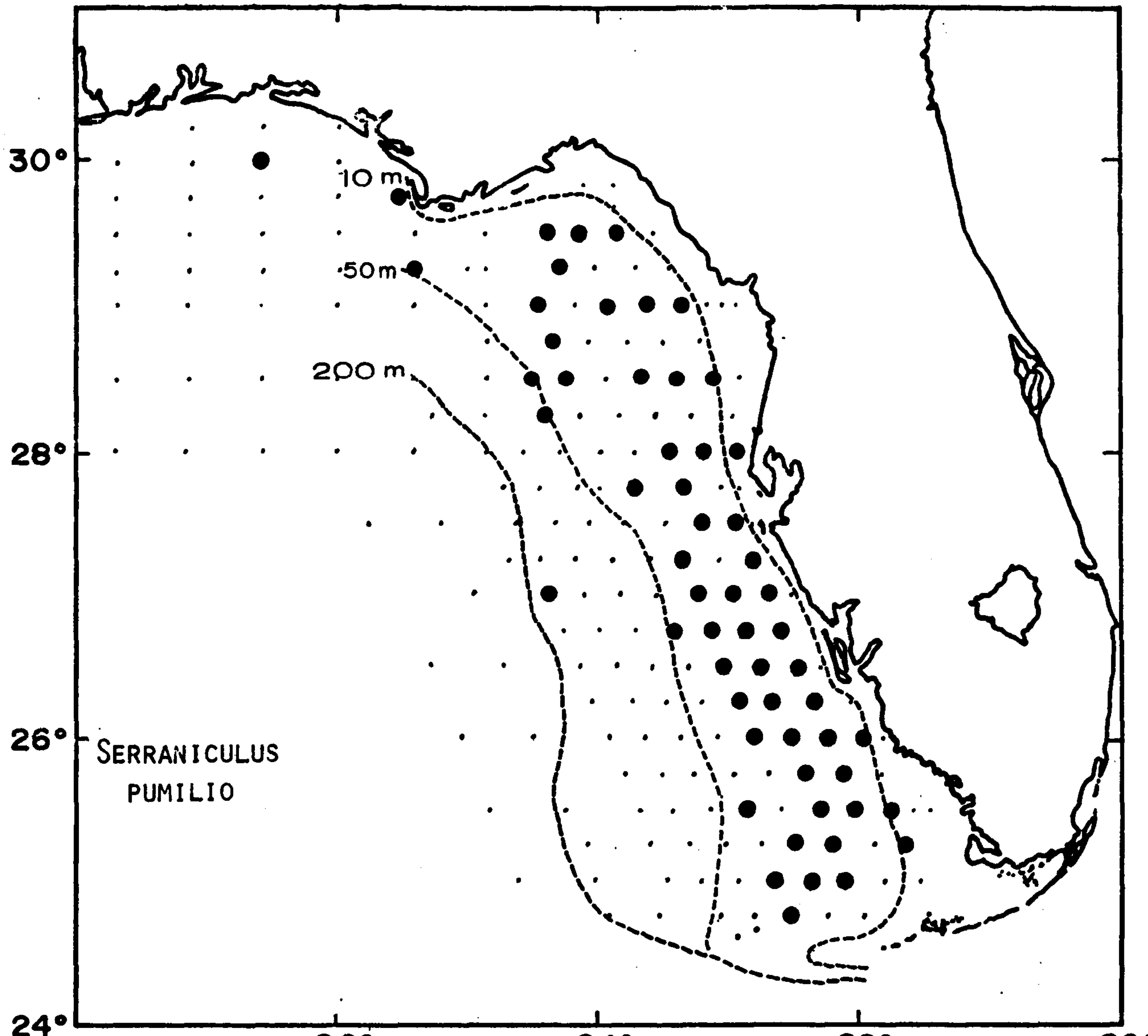



Fig. 91 Stations at which <u>Serraniculus pumilio</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

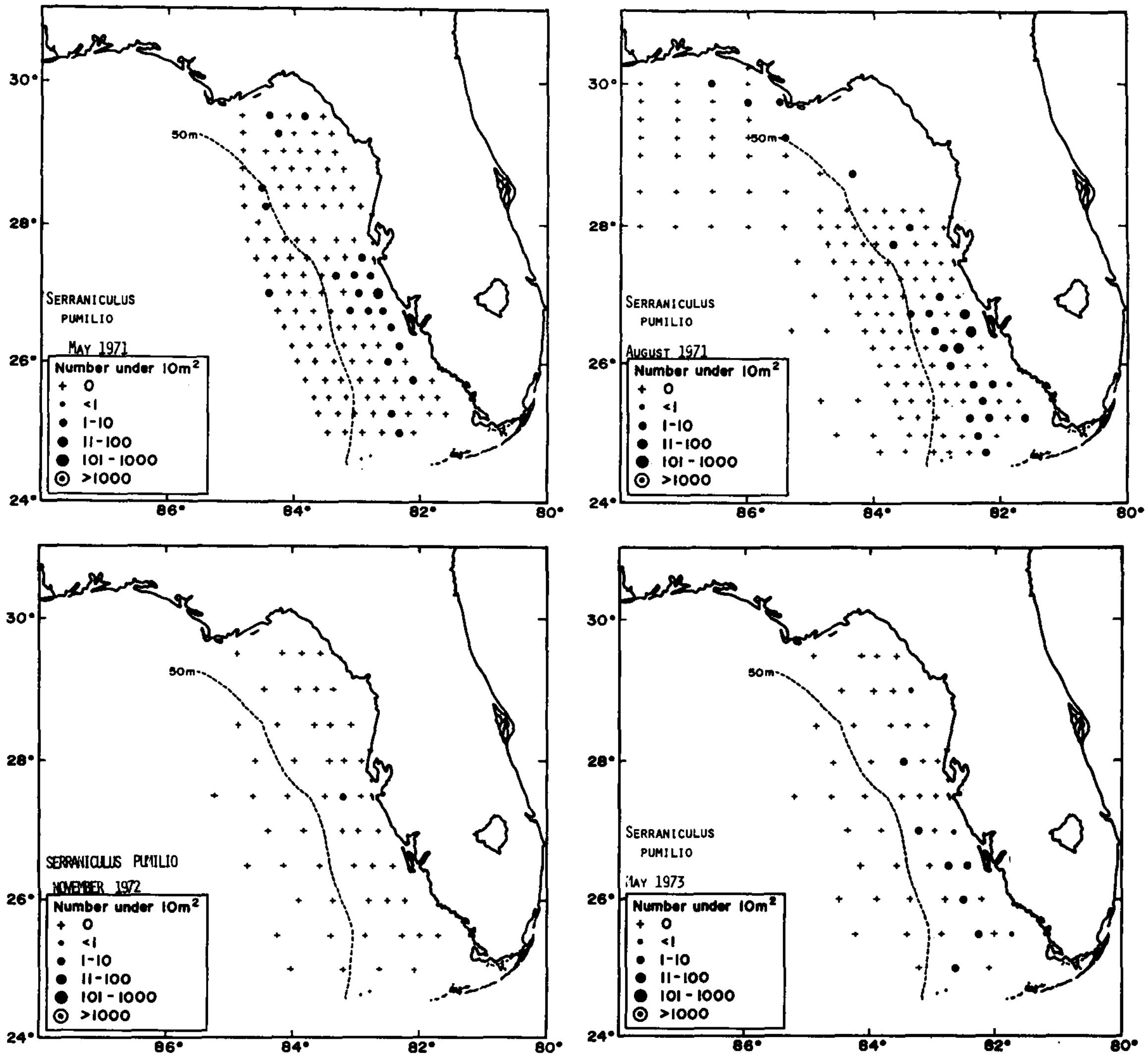



Fig. 92 Distribution and abundance of Serraniculus pumilio larvae in the eastern Gulf of Mexico, 1971-1974.

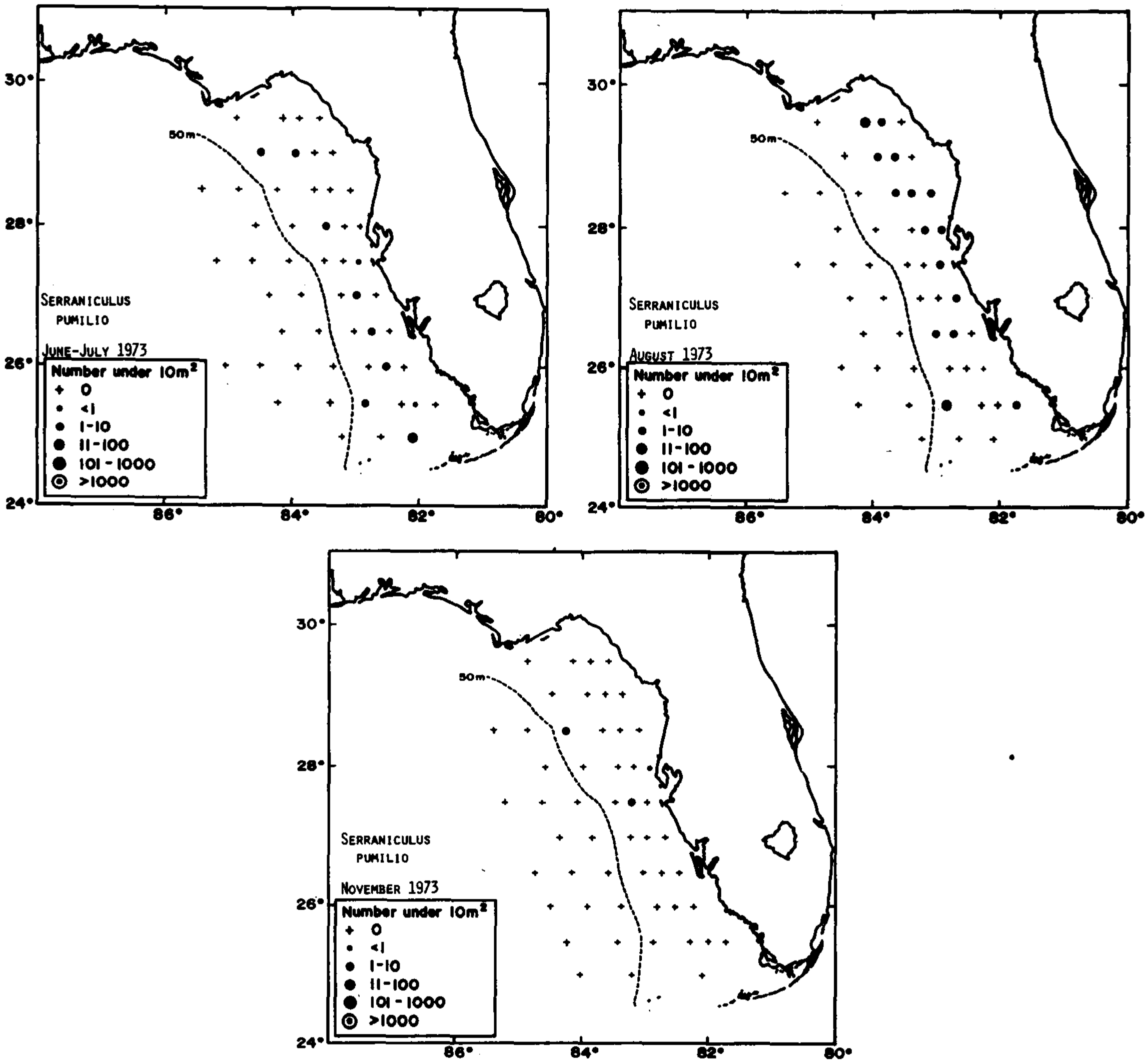

SERRANICULUS
PUMILIO
JUNE-JULY 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
50m
30°
28°
26°
24°
86°
84°
82°
80°
SERRANICULUS
PUMILIO
AUGUST 1973
NOVEMBER 1973

Fig. 92 Cont.

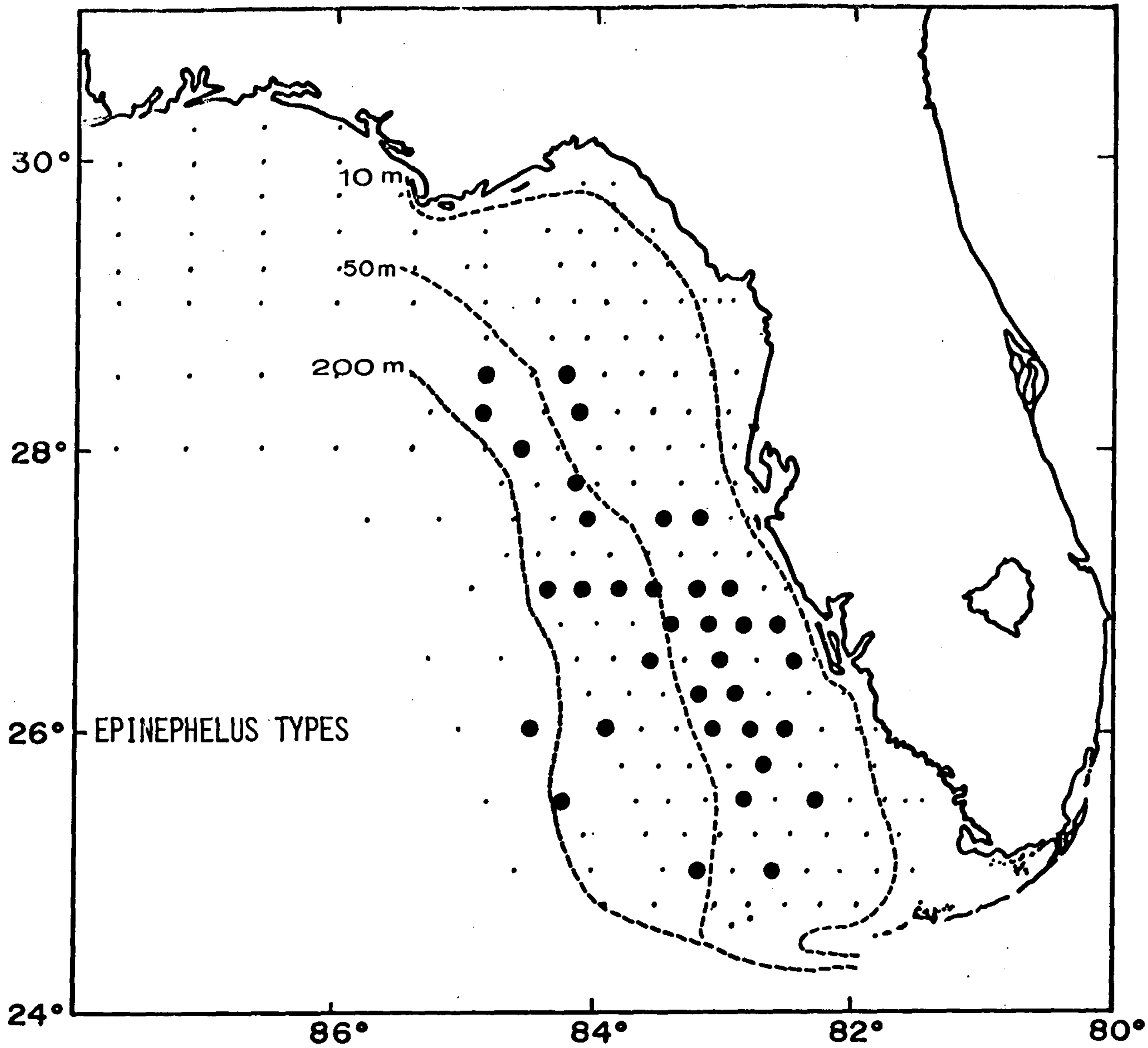



Fig. 93 Stations at which Epinephelus types of larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

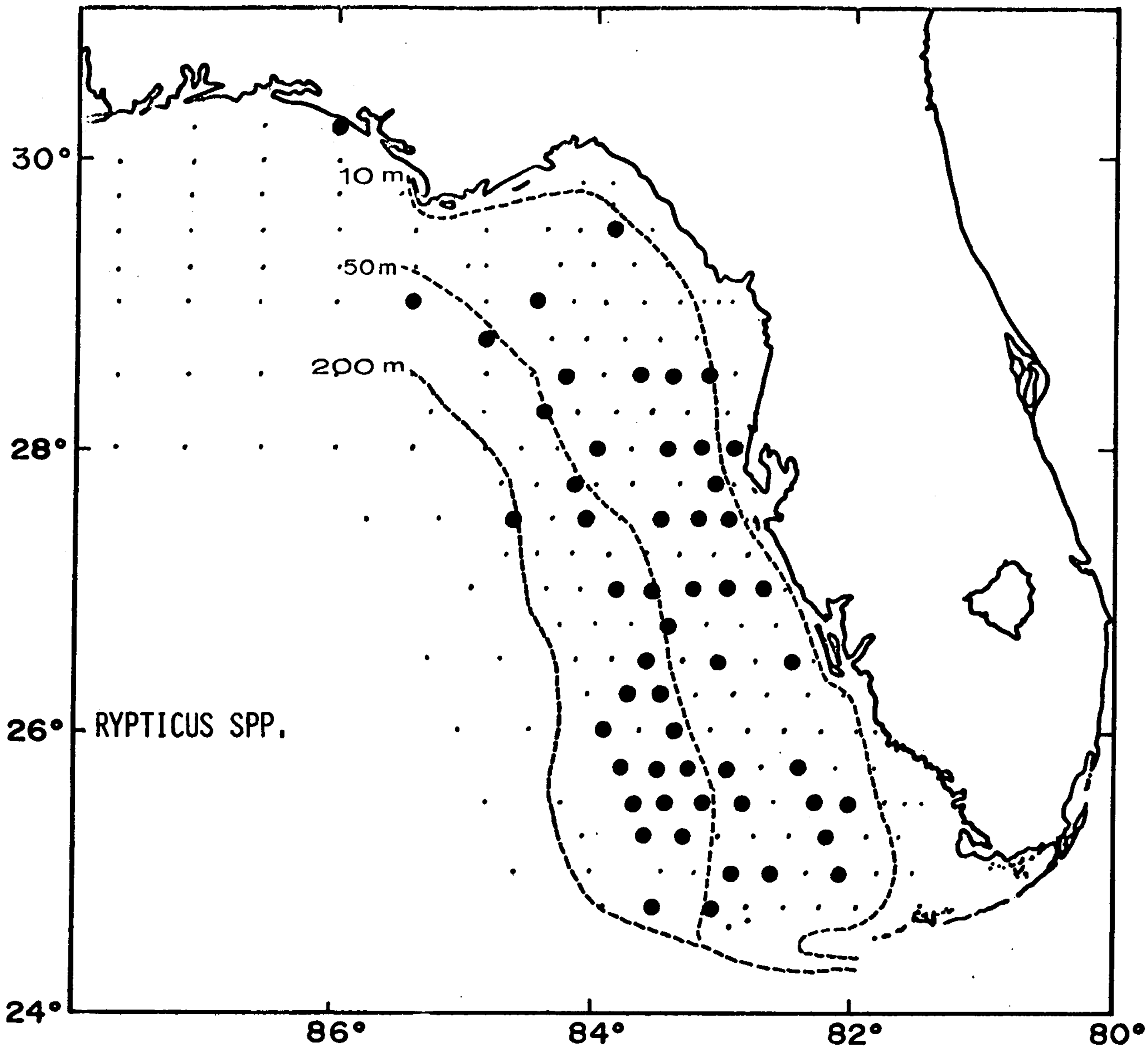



Fig. 94 Stations at which Rypticus spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

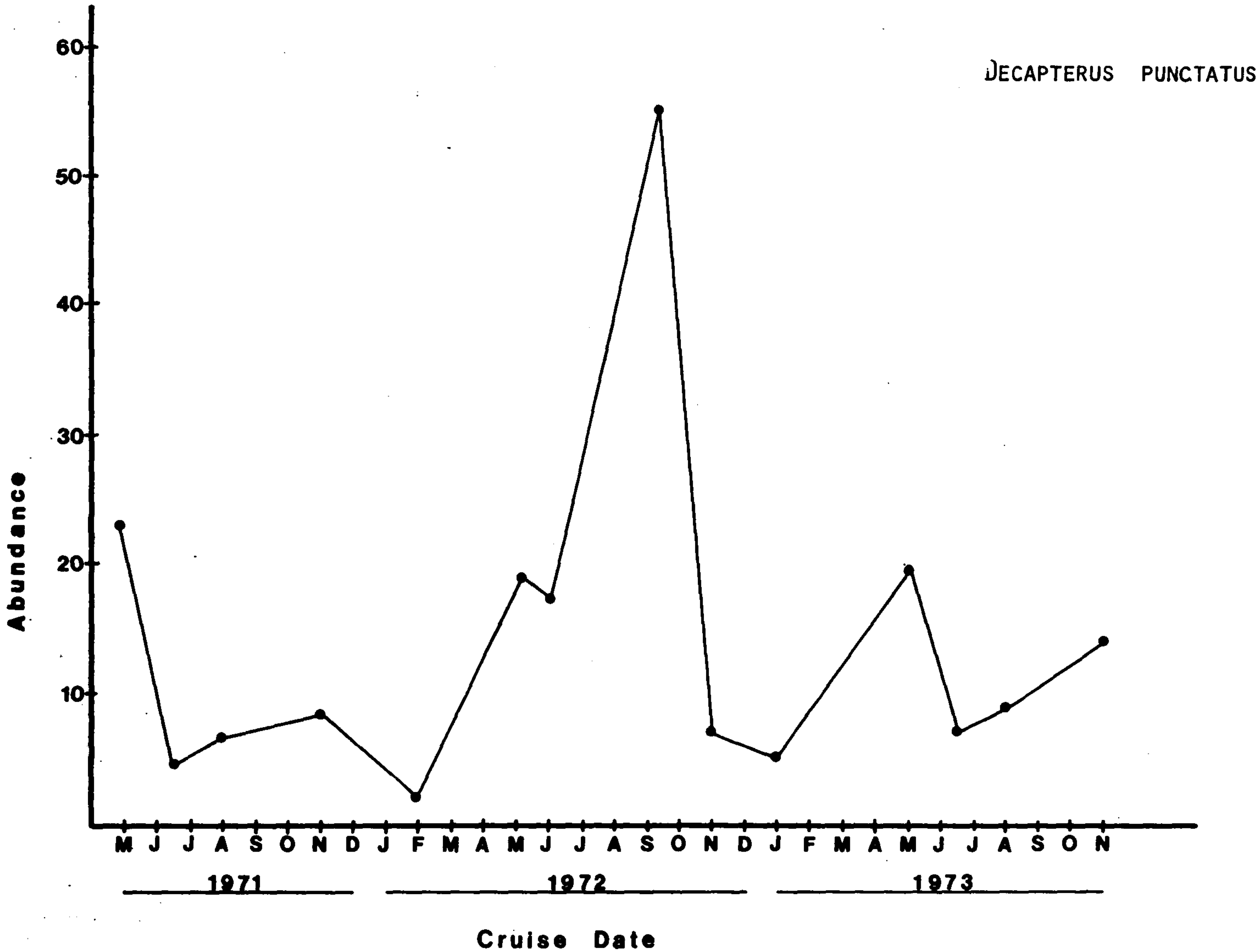



Fig. 95 Estimated mean abundances (number under 10 m$^2$ of sea surface) of Decapterus punctatus larvae in the eastern Gulf of Mexico, 1971-1974.

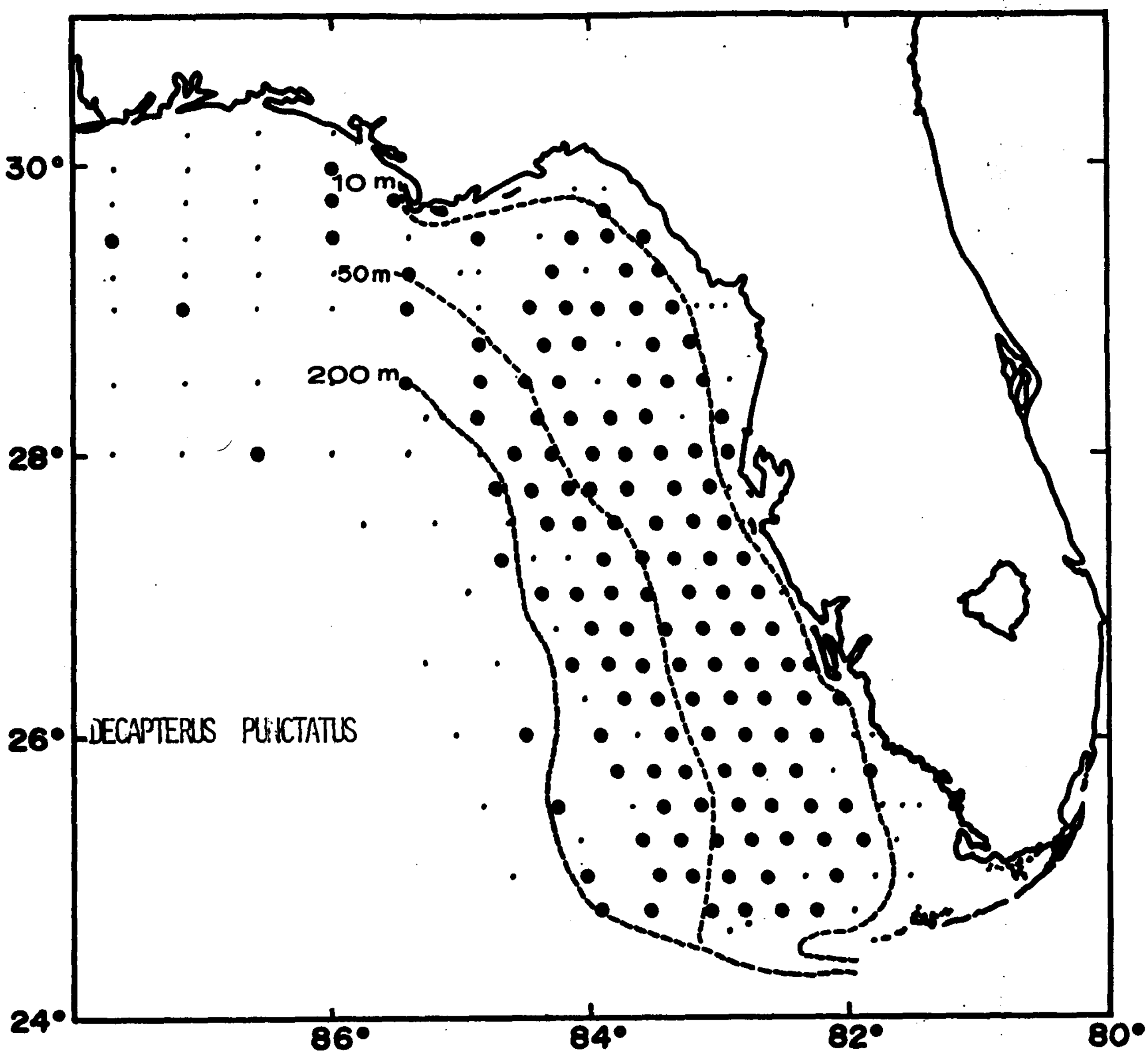



Fig. 96 Stations at which Decapterus punctatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

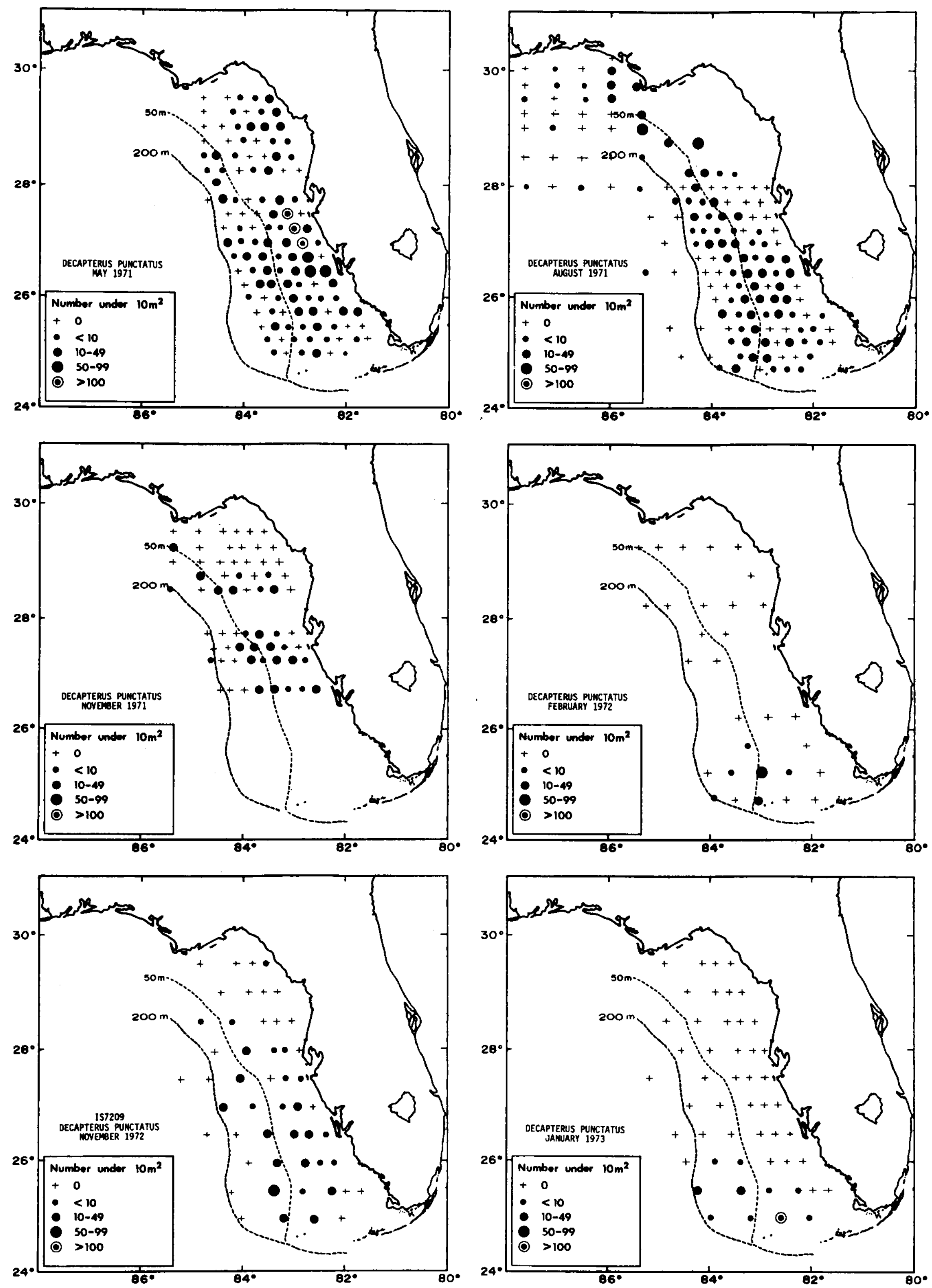



Fig. 97 Distribution and abundance of *Decapterus punctatus* larvae in the eastern Gulf of Mexico, 1971-1974.

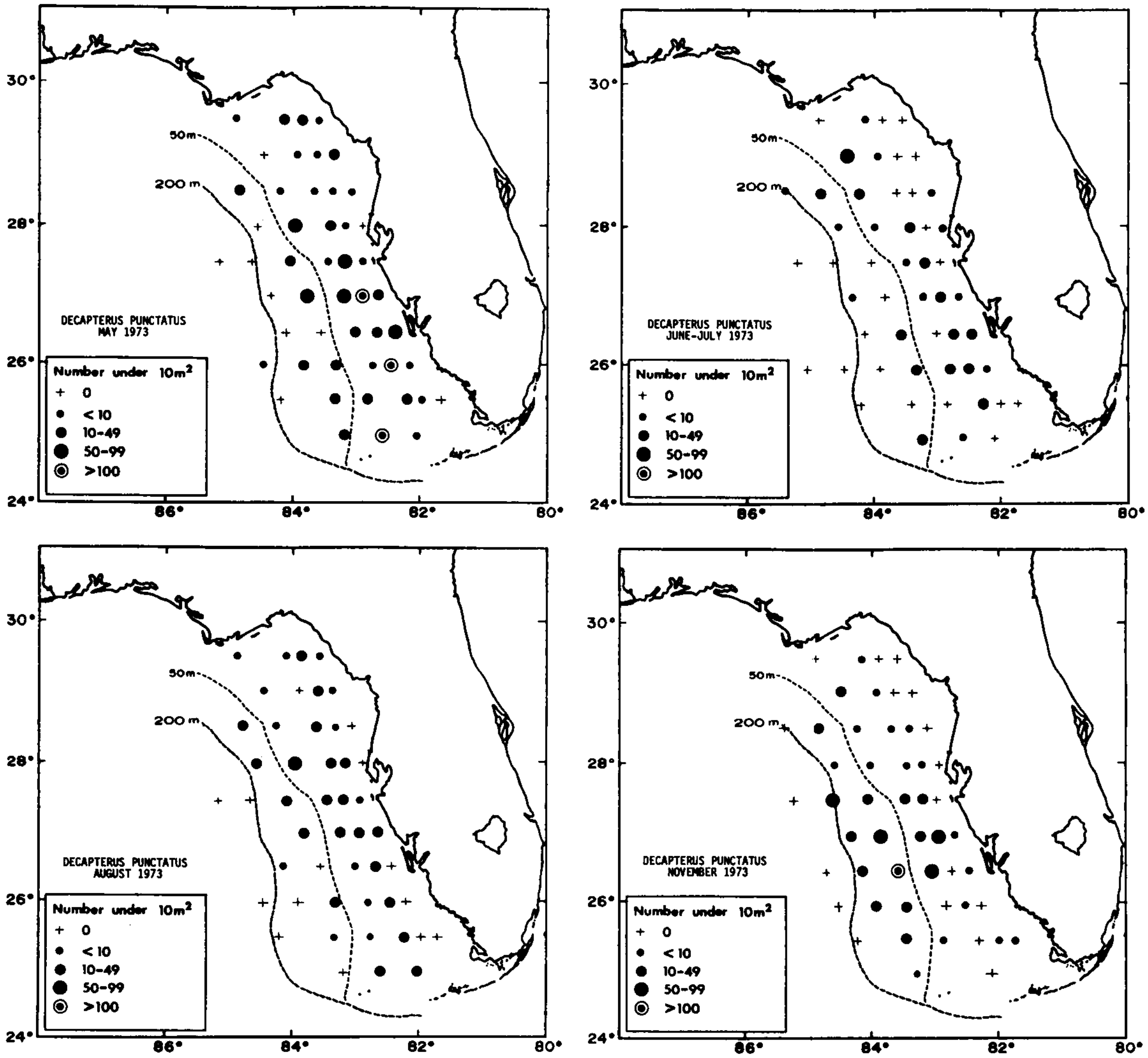

DECAPTERUS PUNCTATUS
MAY 1973
DECAPTERUS PUNCTATUS
JUNE-JULY 1973
DECAPTERUS PUNCTATUS
AUGUST 1973
DECAPTERUS PUNCTATUS
NOVEMBER 1973
Number under 10m²
0
< 10
10-49
50-99
>100
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 97 Cont.

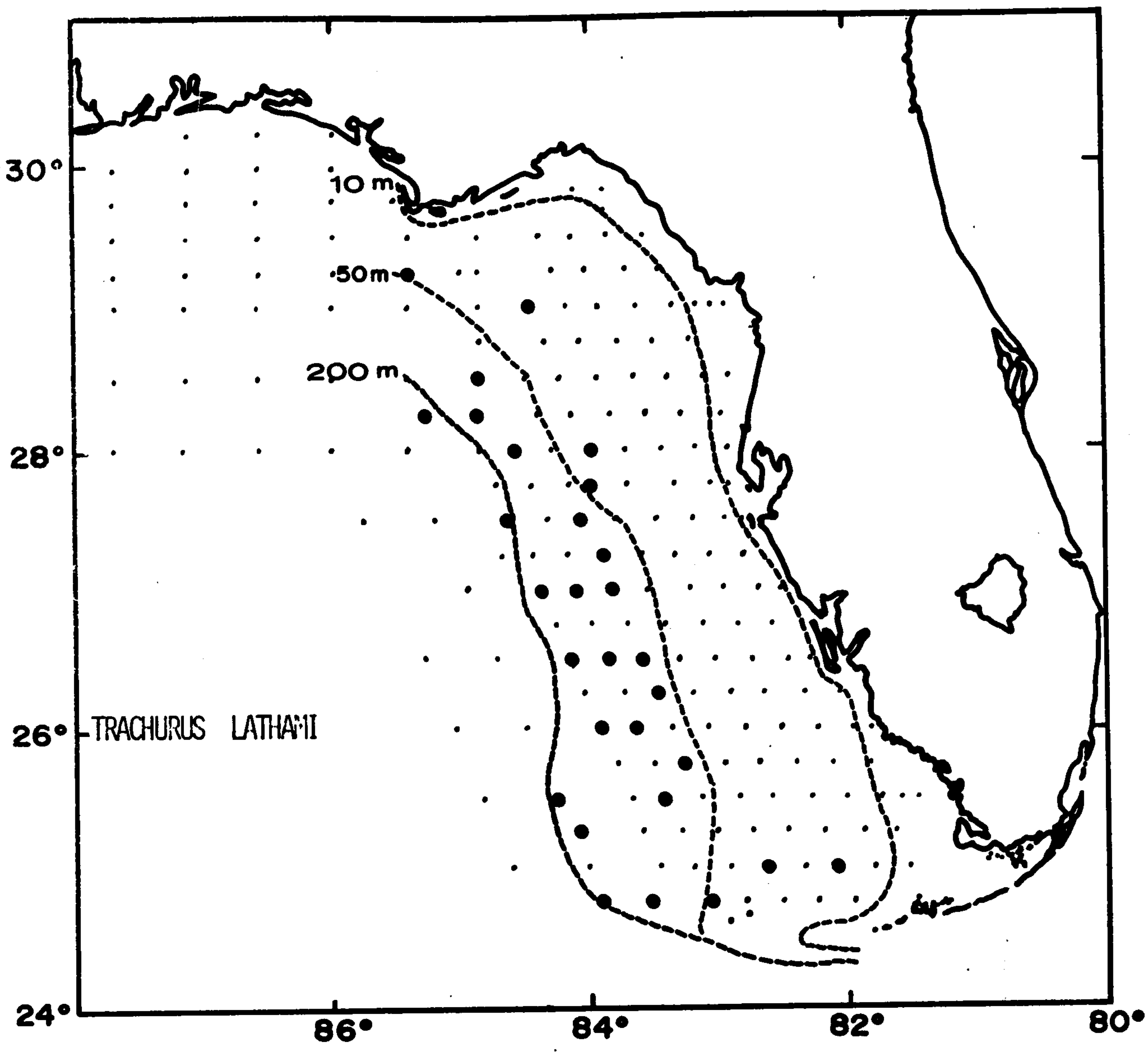



Fig. 98 Stations at which Trachurus lathami larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

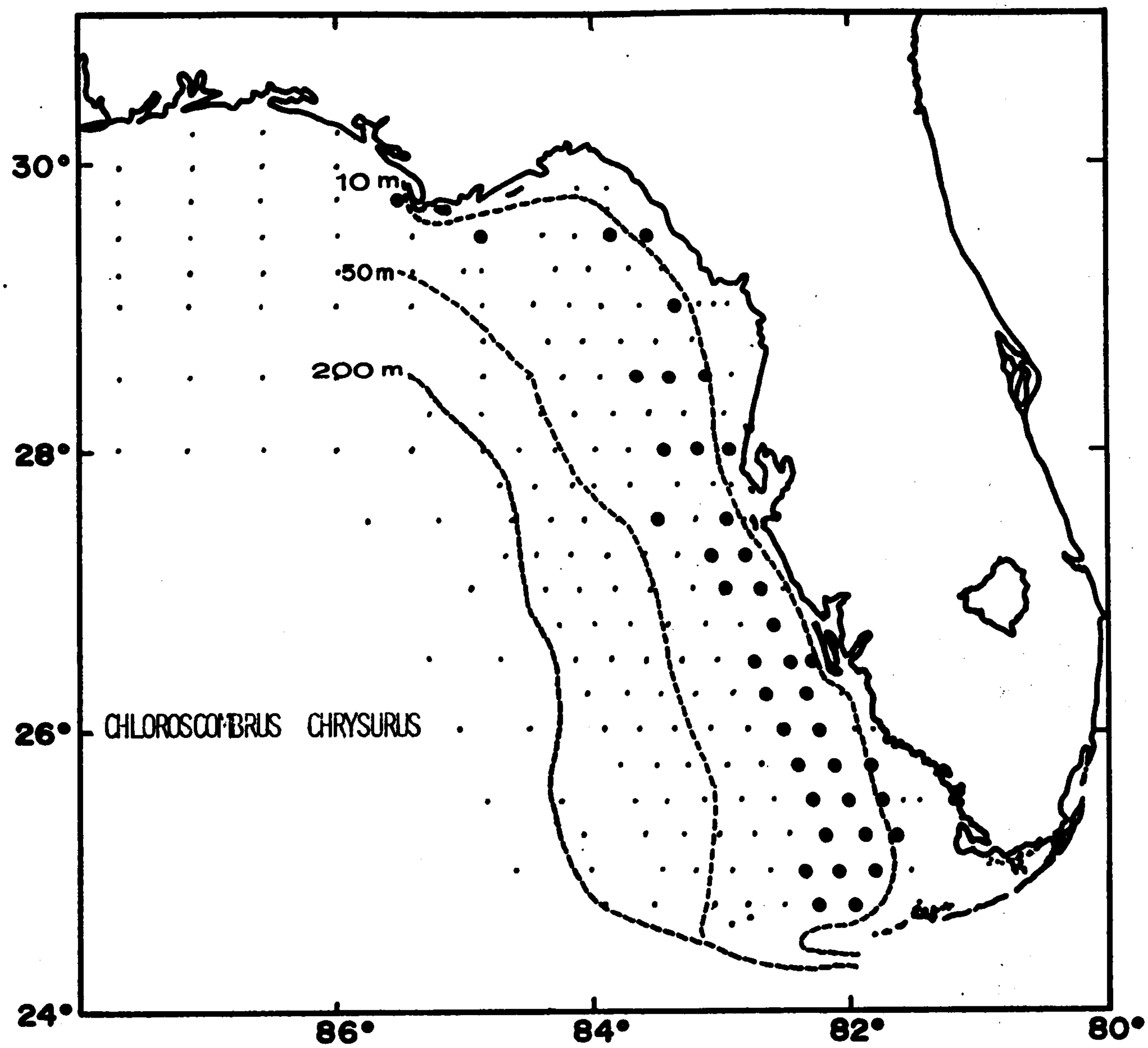



Fig. 99 Stations at which Chloroscombrus chrysurus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

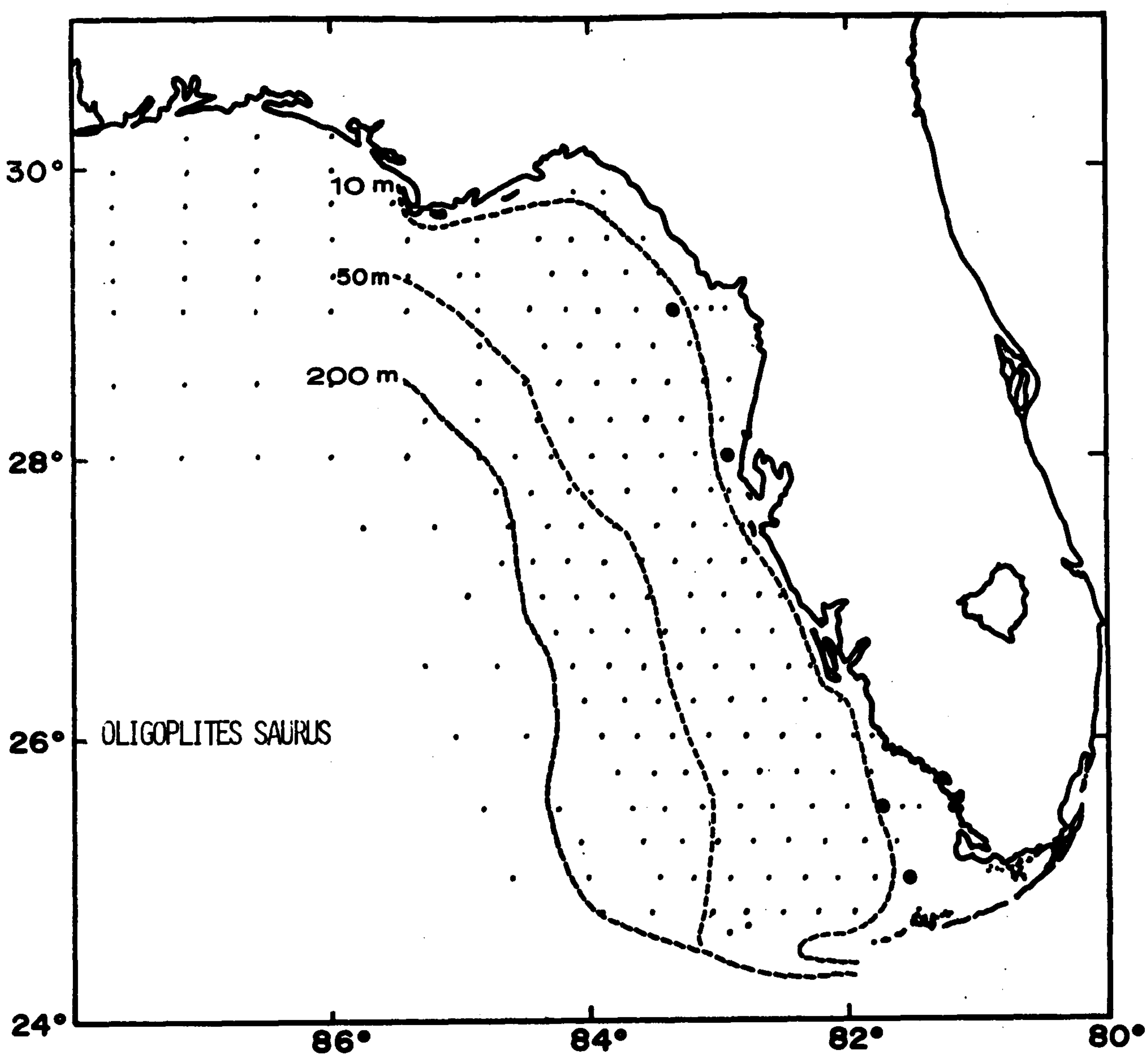



Fig. 100    Stations at which *Oligoplites saurus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

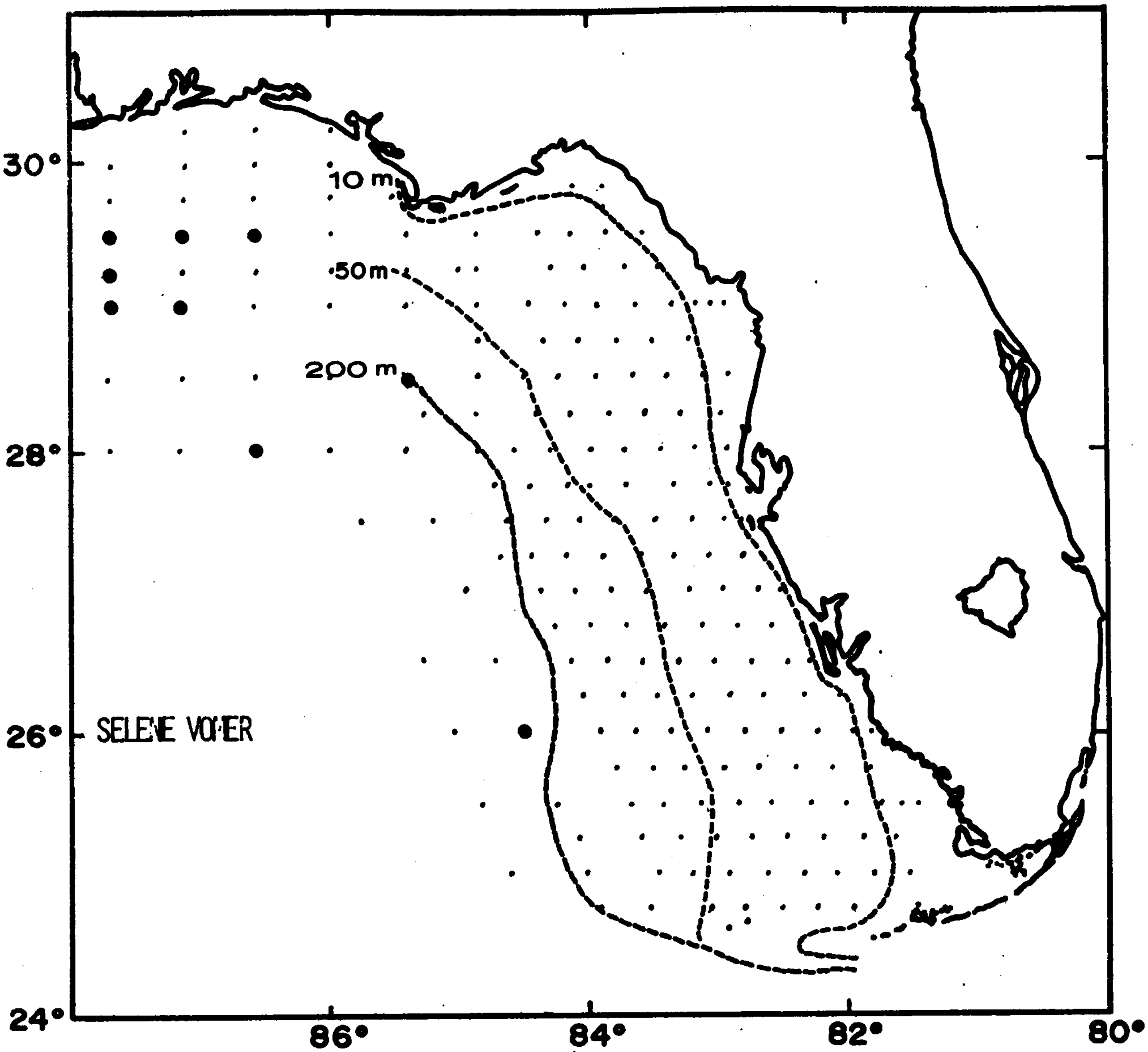



Fig. 101 Stations at which Selene vomer larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

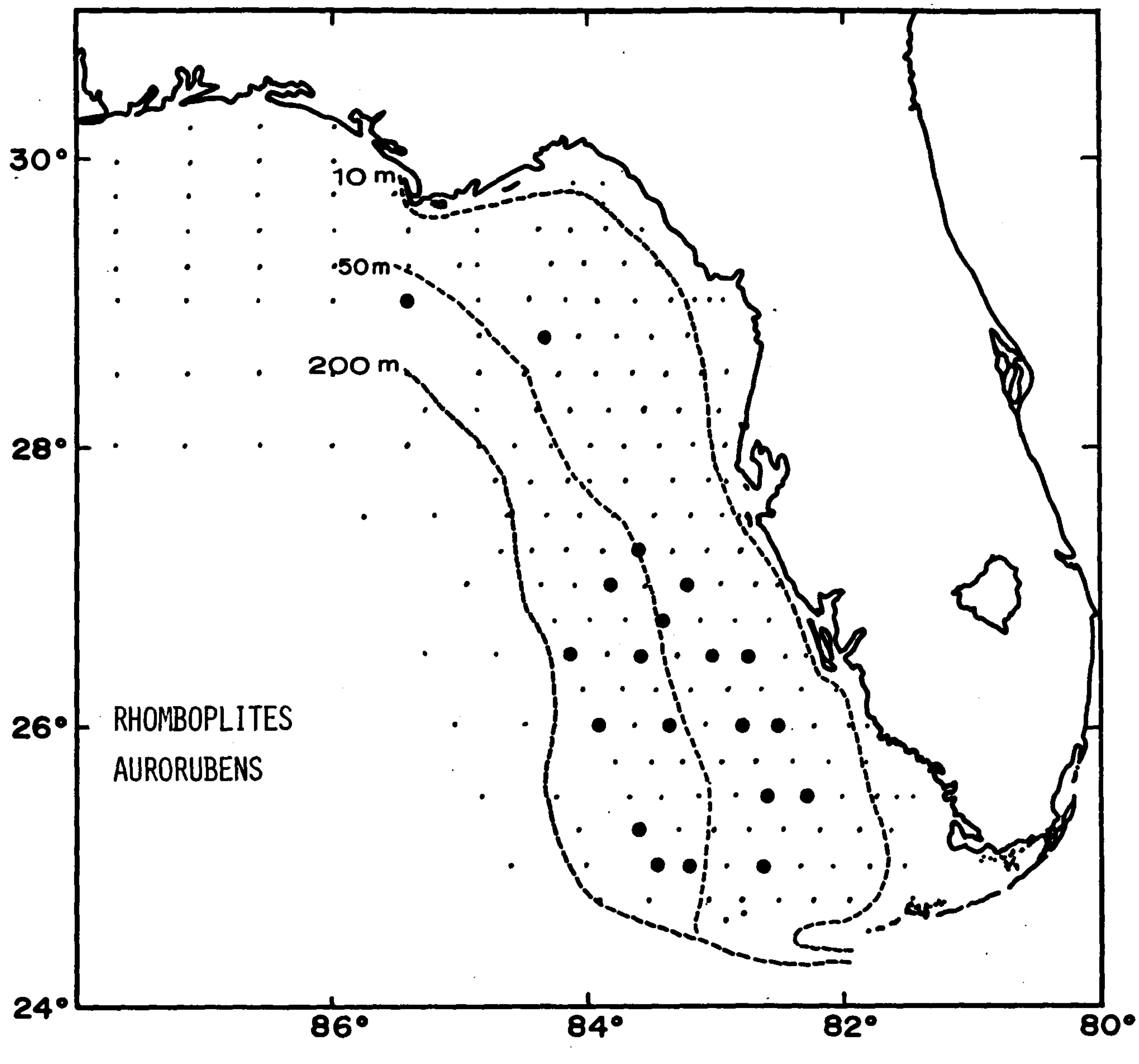



Fig. 102 Stations at which Rhomboplites aureorubens larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

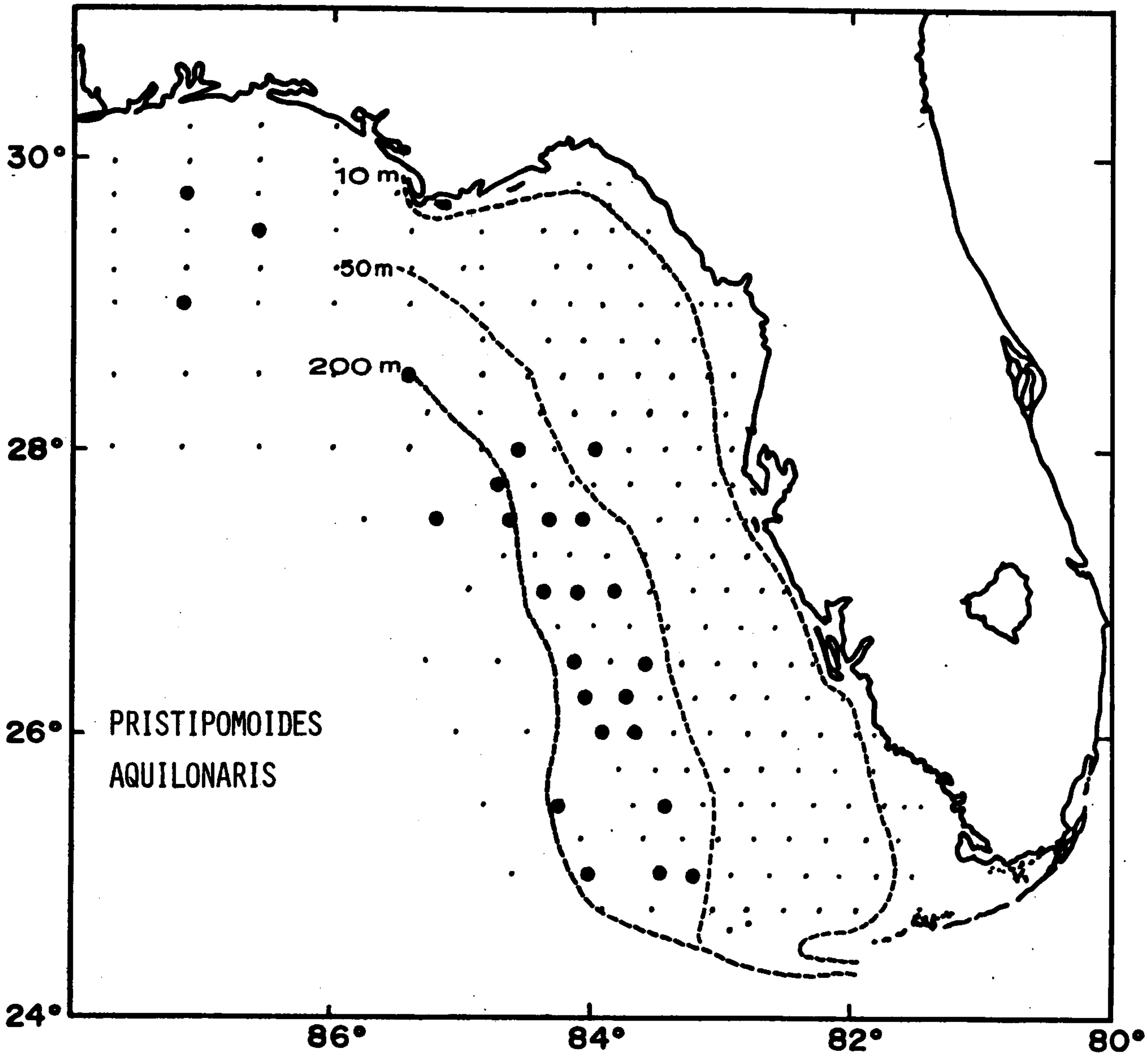



Fig. 103 Stations at which Pristipomoides aquilonaris larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

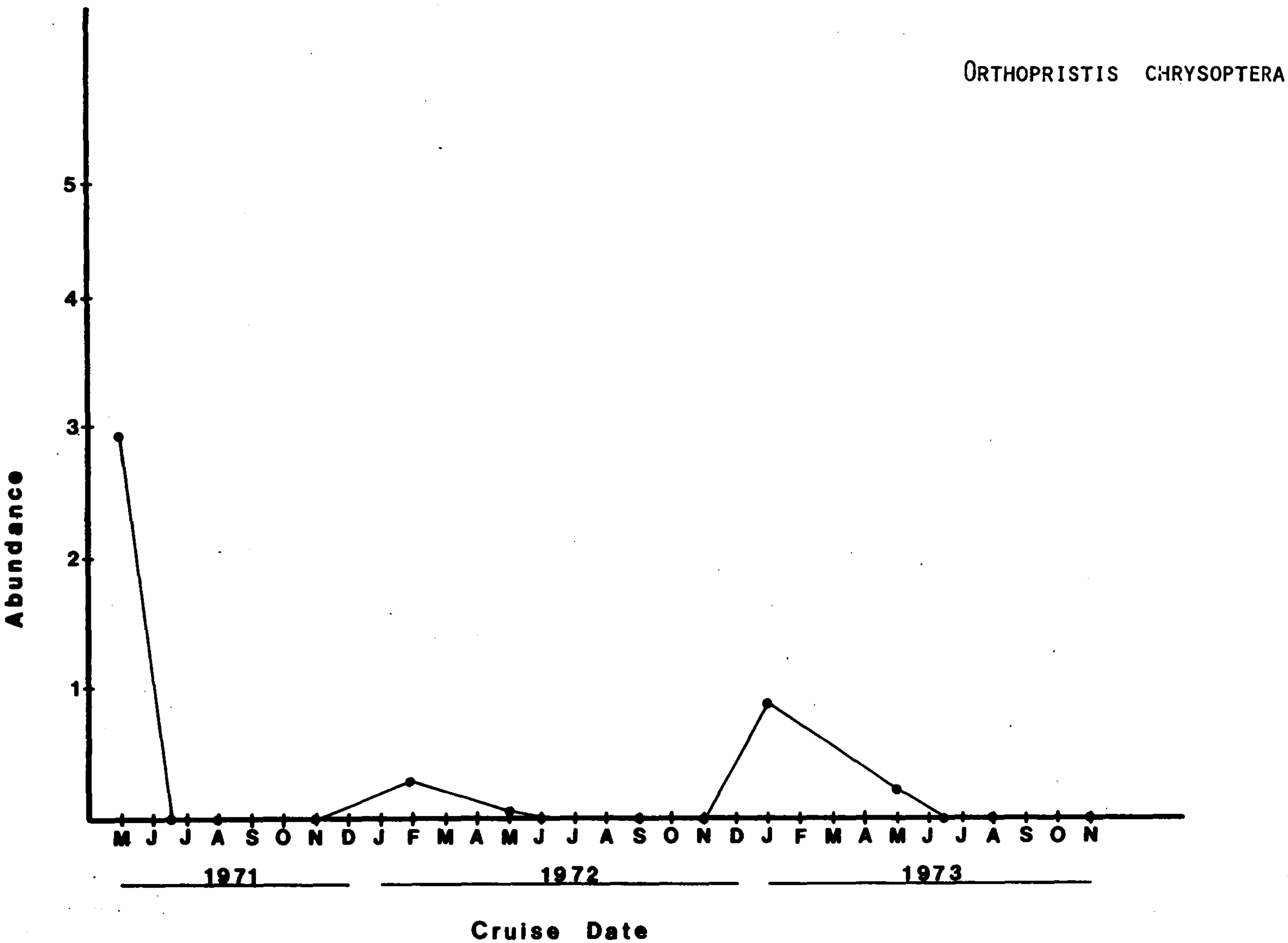



Fig. 104 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Orthopristis chrysoptera larvae in the eastern Gulf of Mexico, 1971-1974.

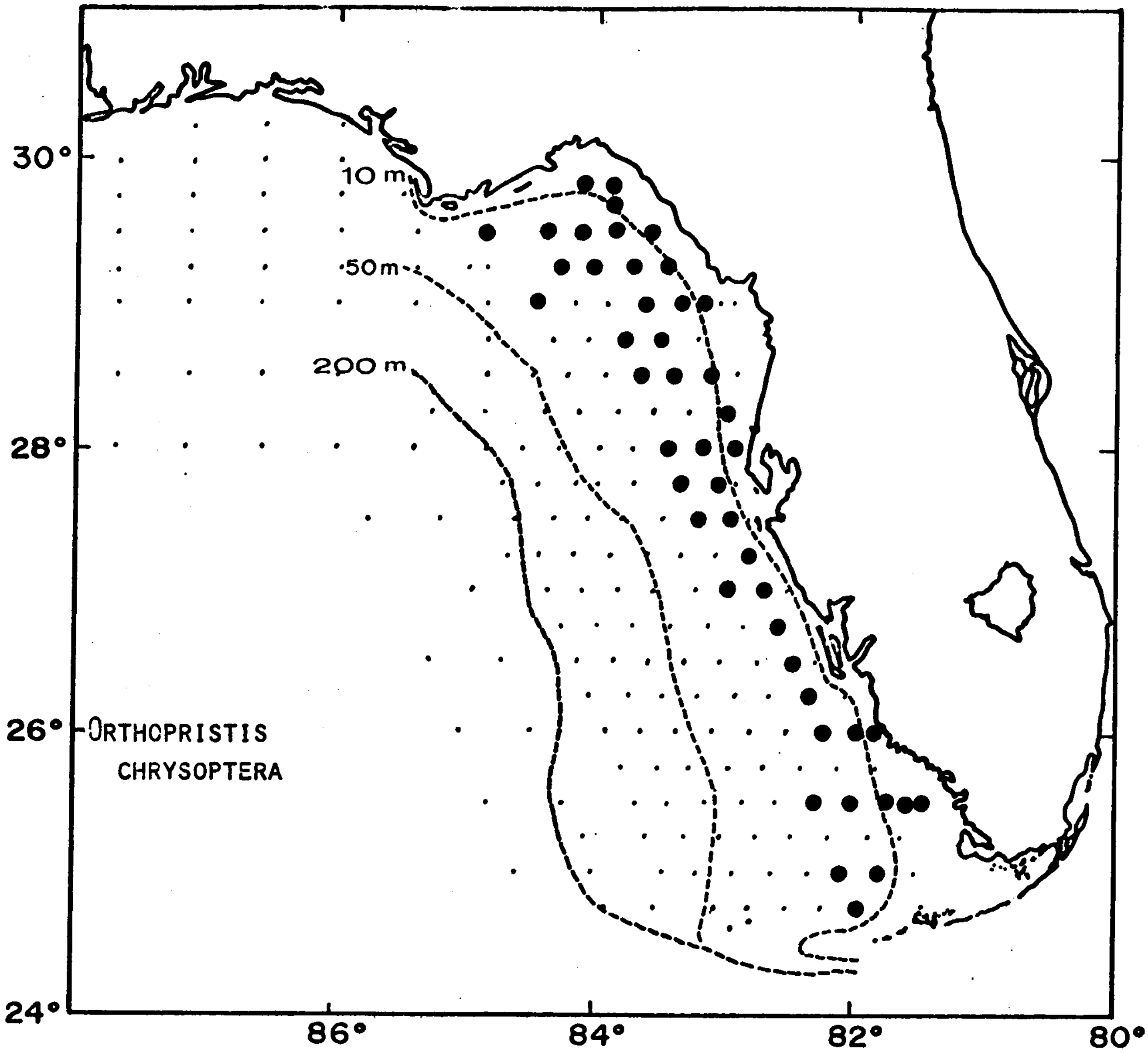



Fig. 105 Stations at which Orthopristis chrysoptera larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

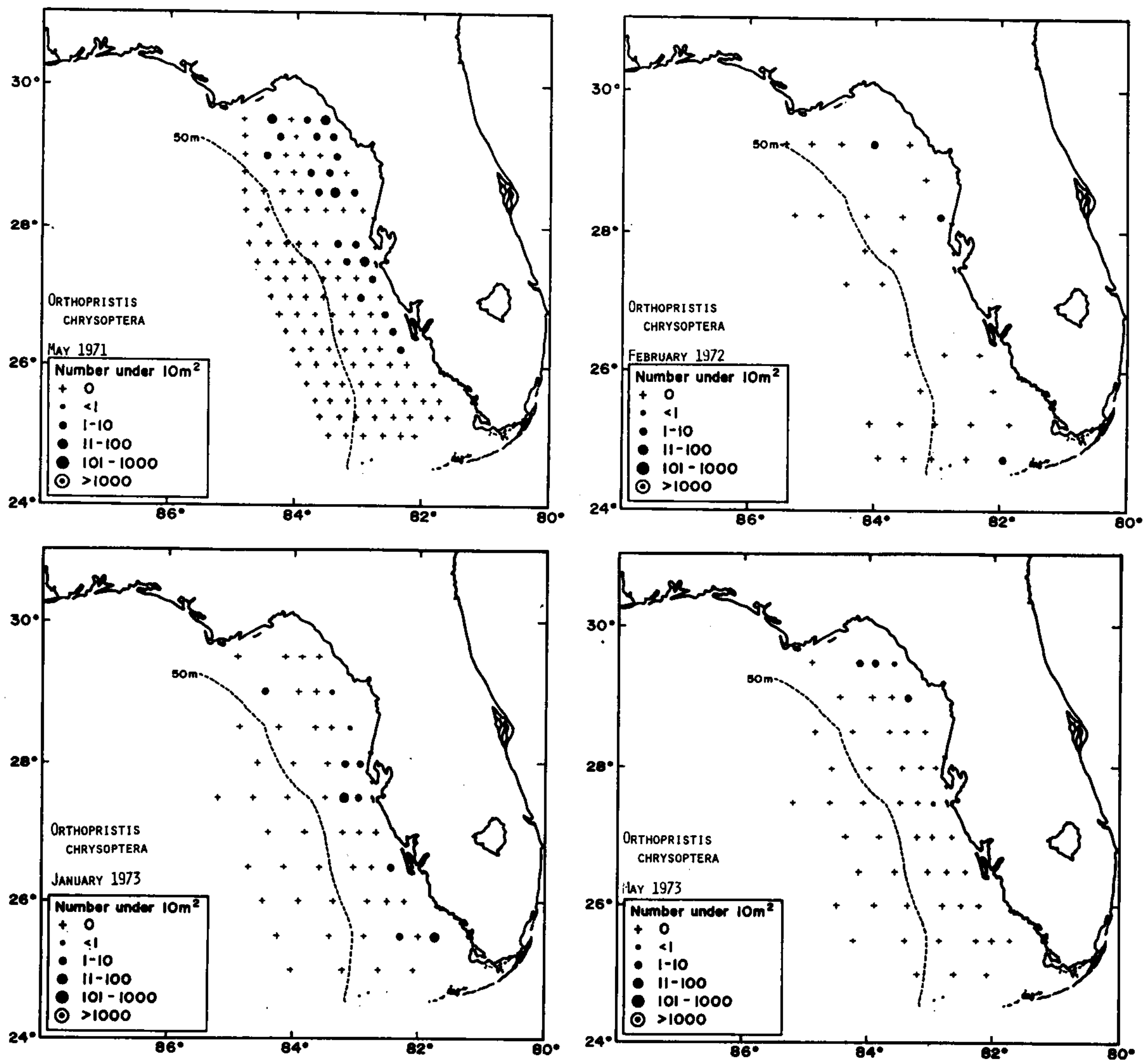



Fig. 106 Distribution and abundance of *Orthopristis chrysoptera* larvae in the eastern Gulf of Mexico, 1971-1974.

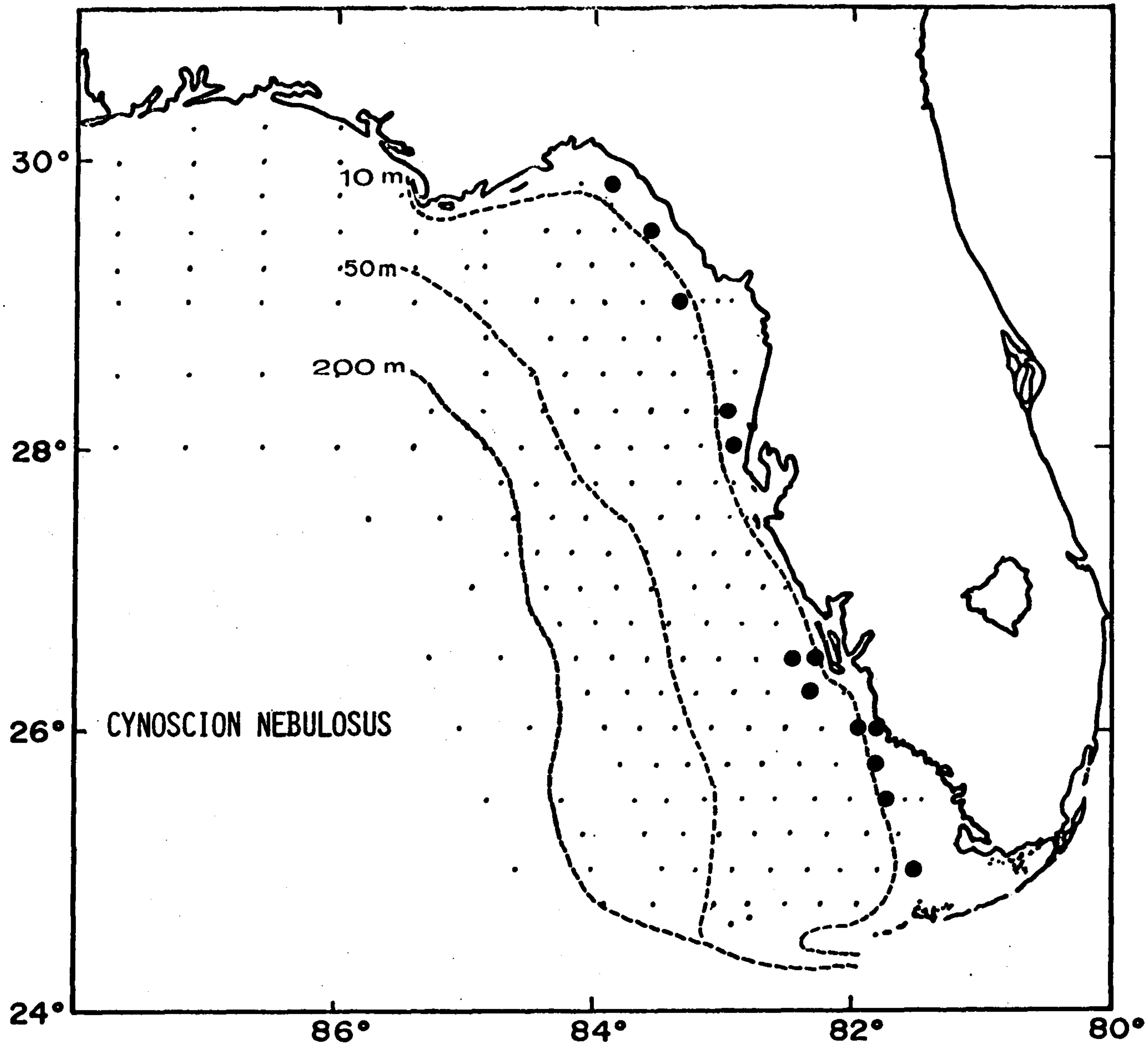



Fig. 107 Stations at which Cynoscion nebulosus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

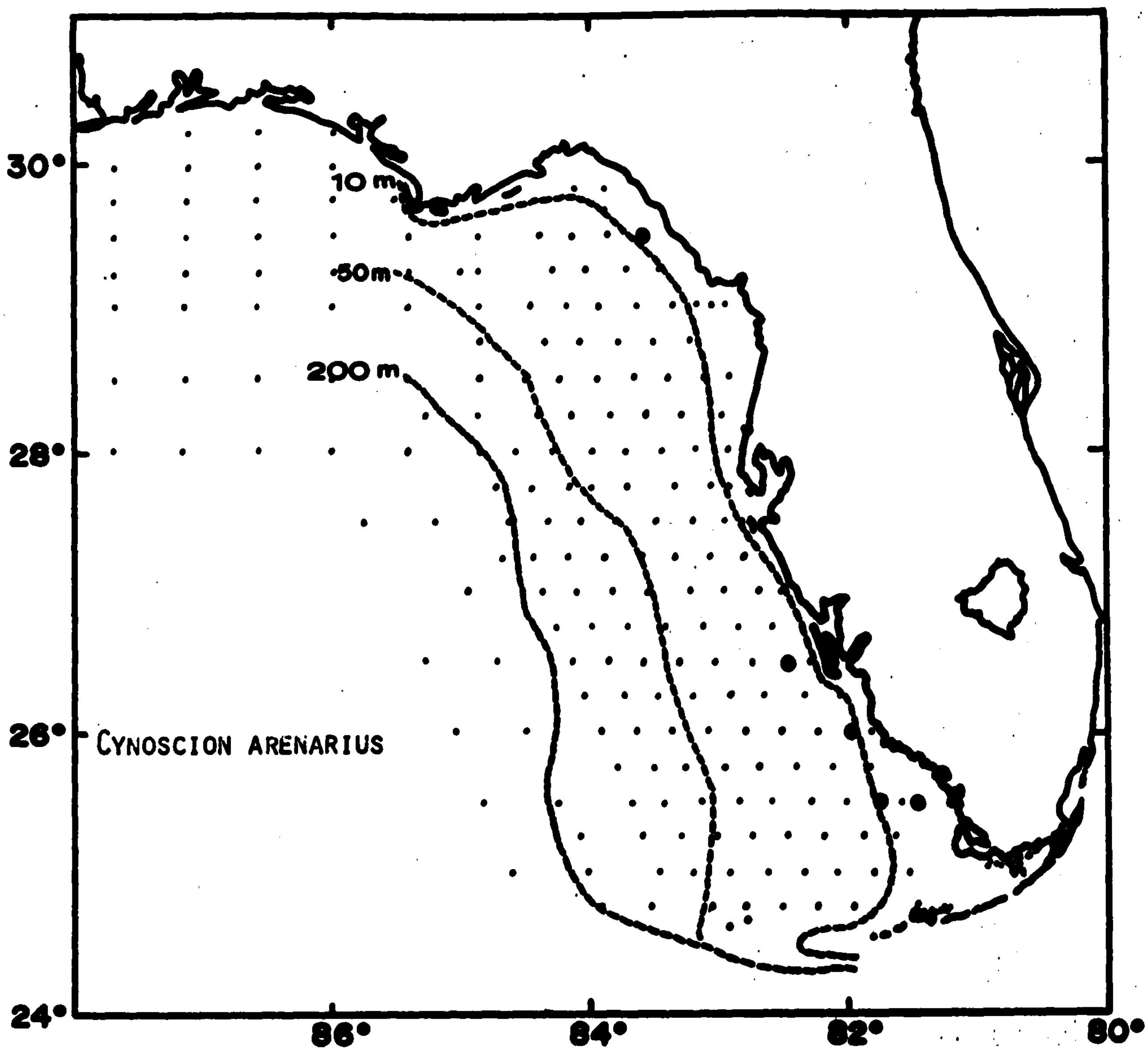



Fig. 108 Stations at which Cynoscion arenarius larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

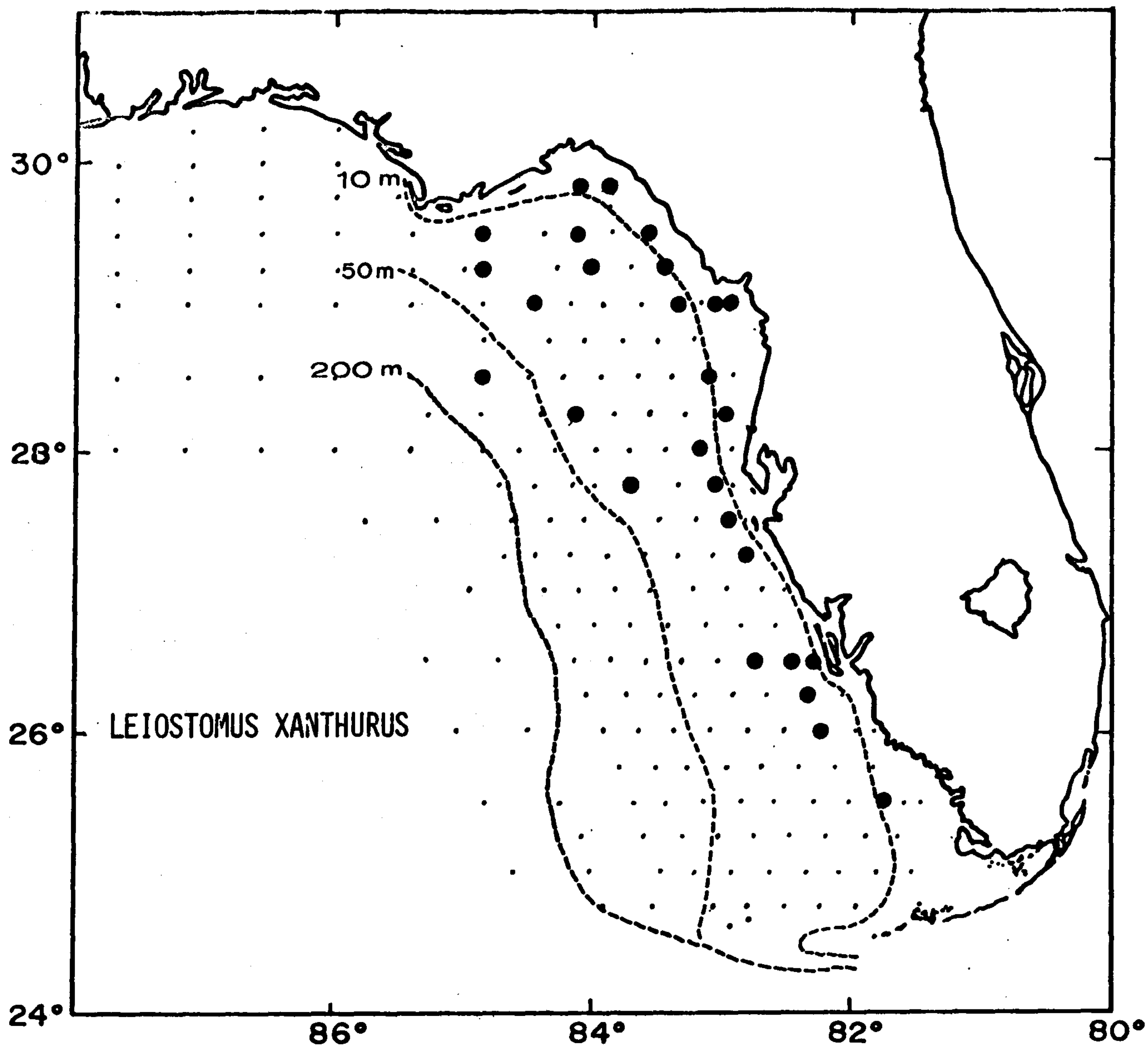



Fig. 109 Stations at which Leiostomus xanthurus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

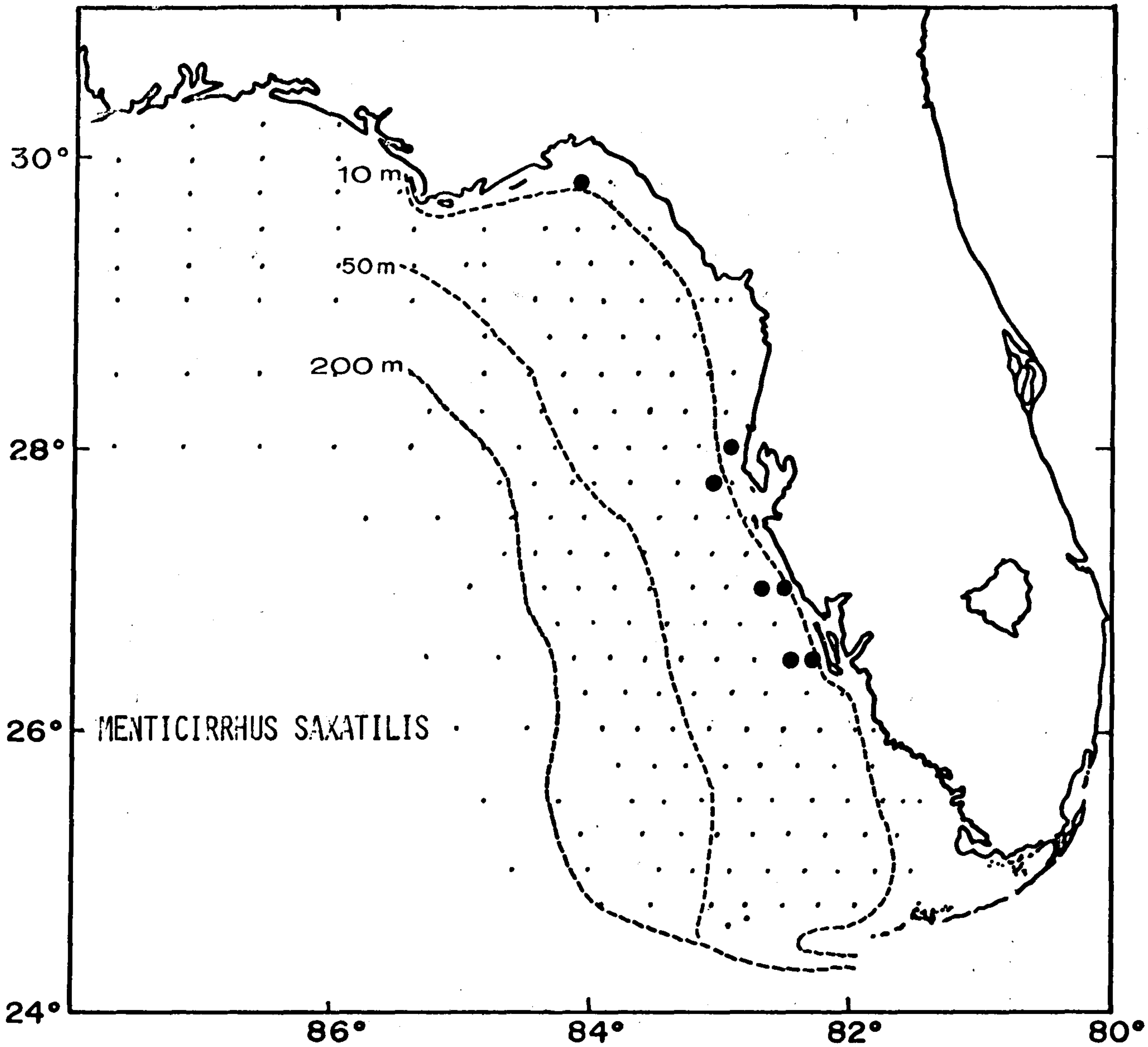



Fig. 110 Stations at which Menticirrhus saxatilis larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

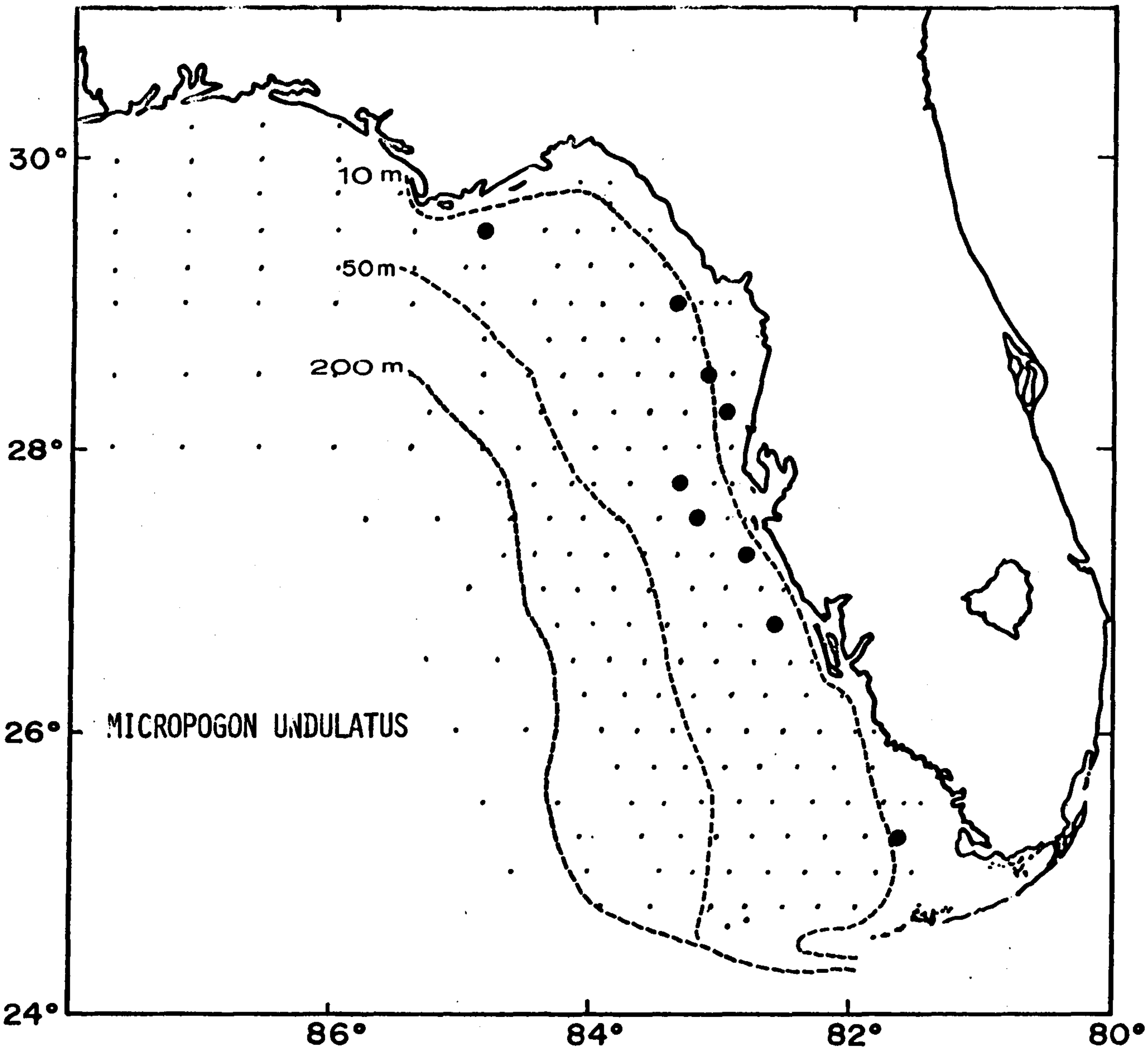



Fig. 111 Stations at which Micropogon undulatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

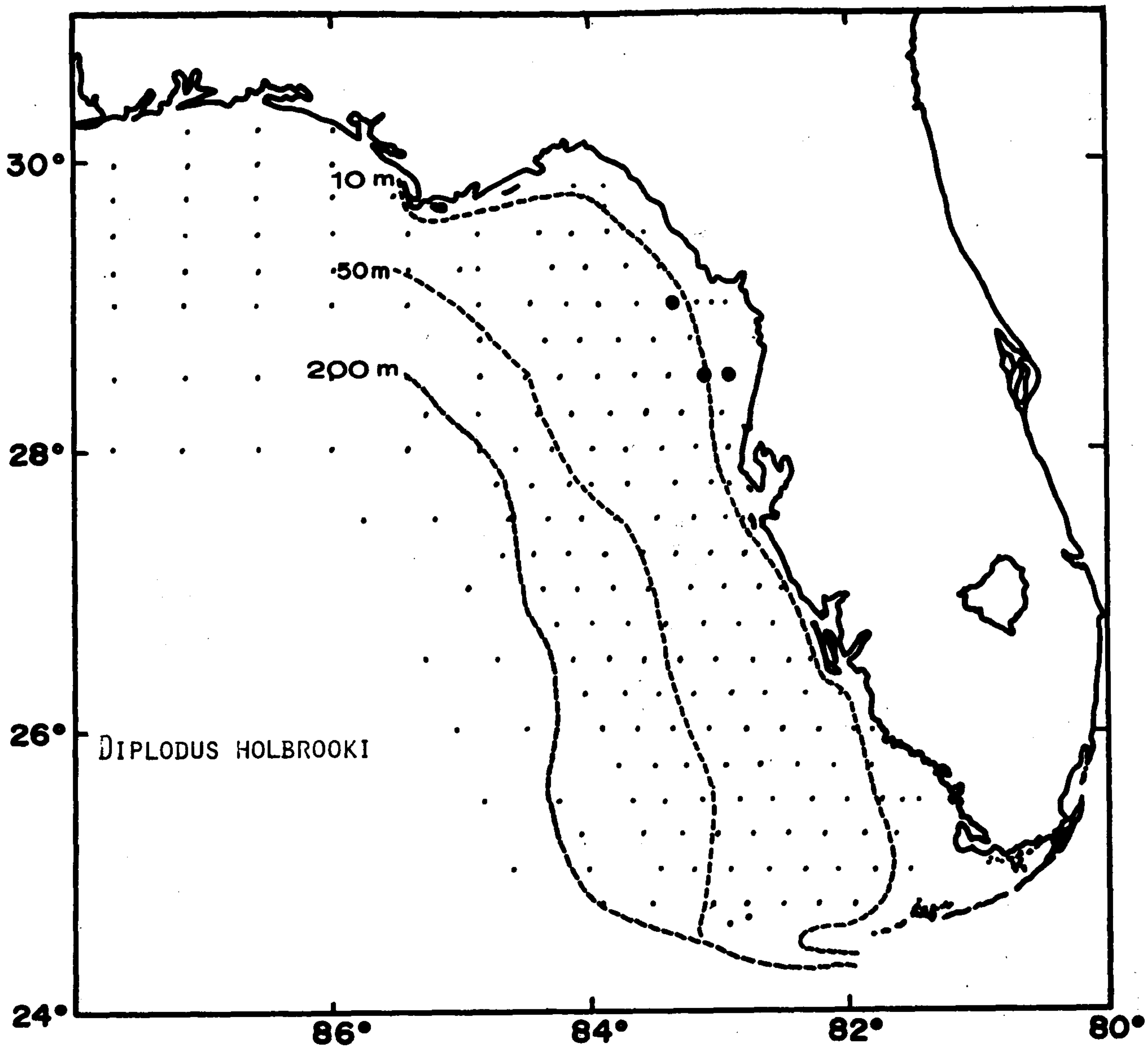



Fig. 112 Stations at which *Diplodus holbrooki* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

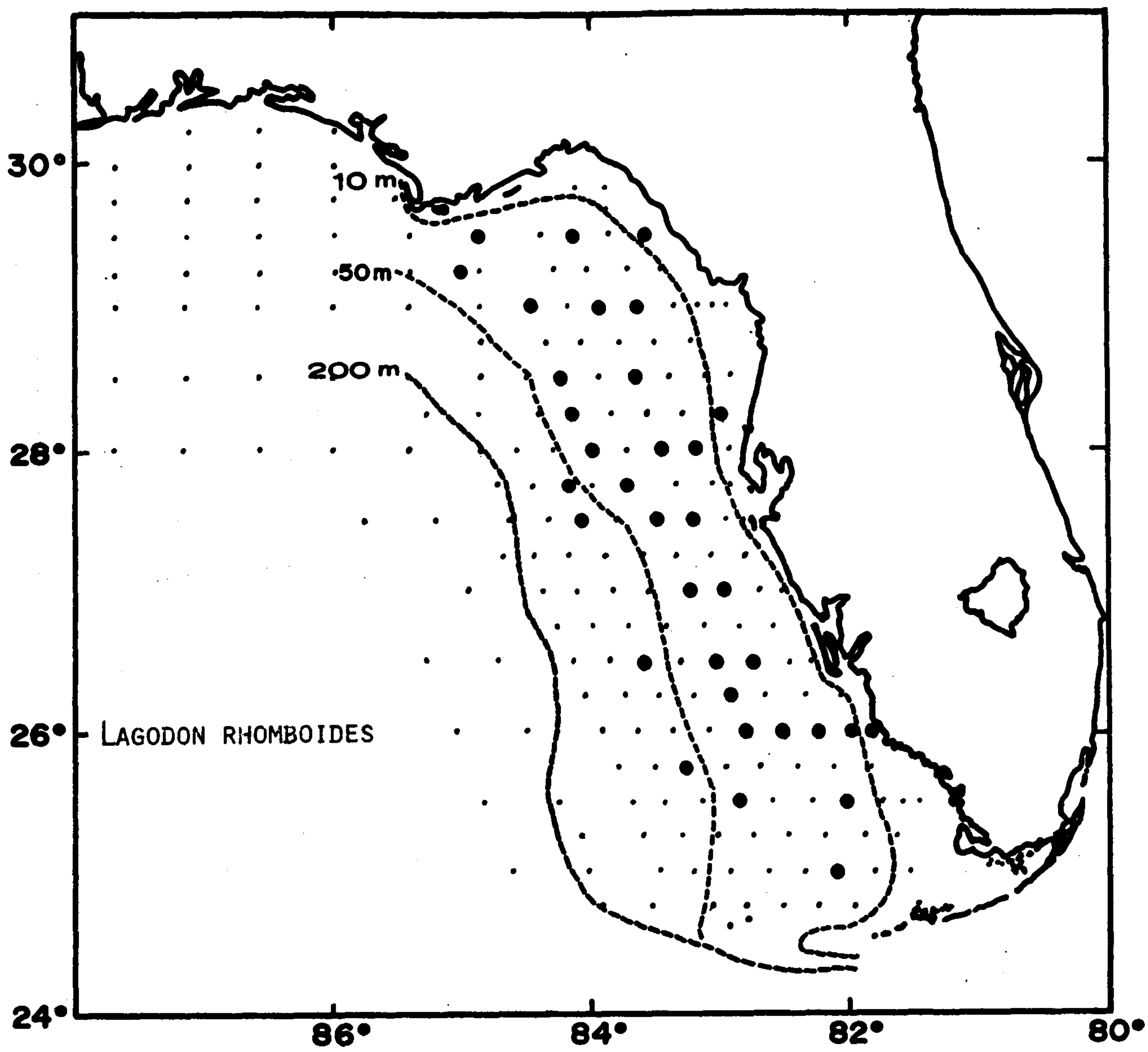



Fig. 113 Stations at which Lagodon rhomboides larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

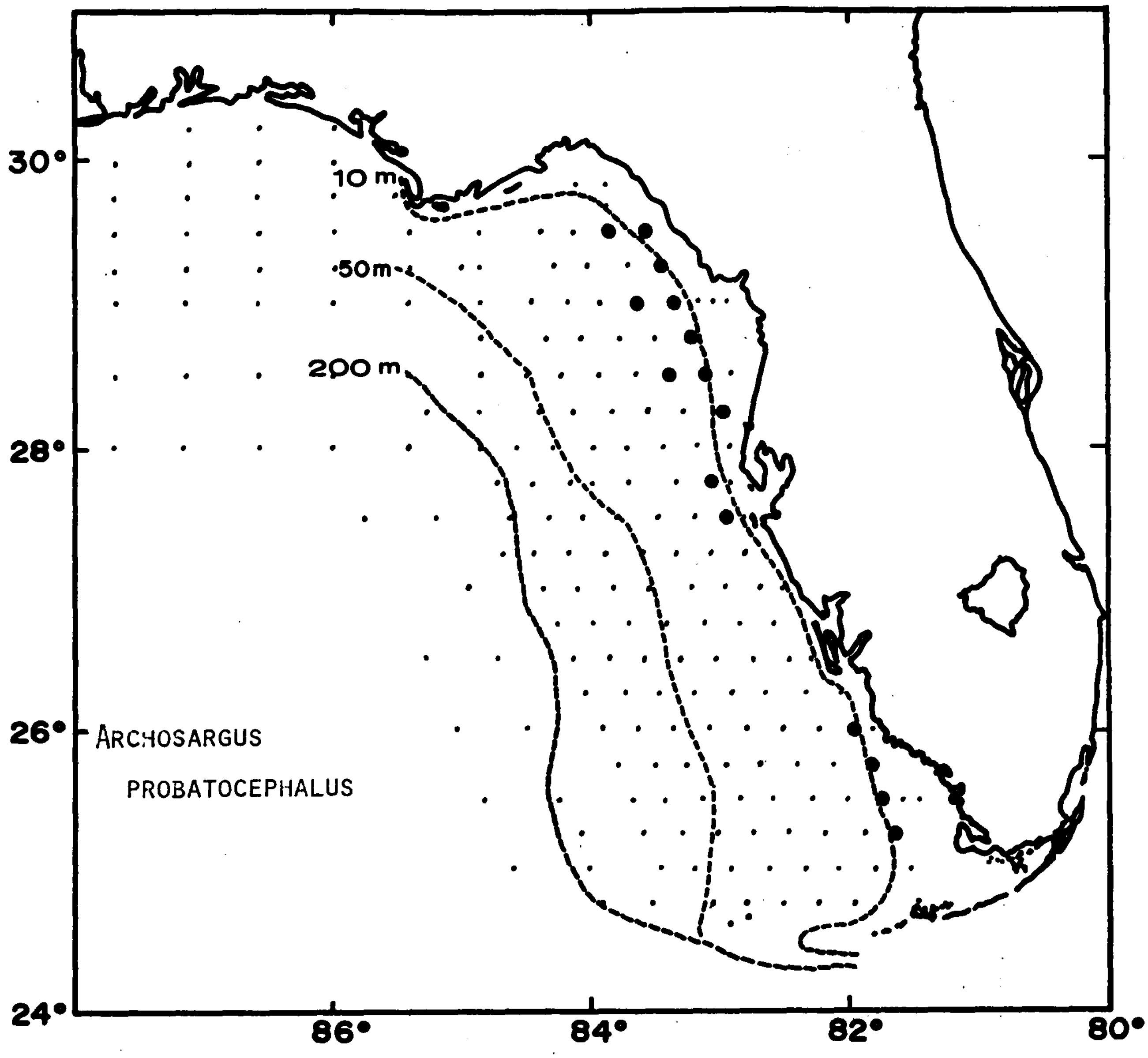



Fig. 114 Stations at which Archosargus probatocephalus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

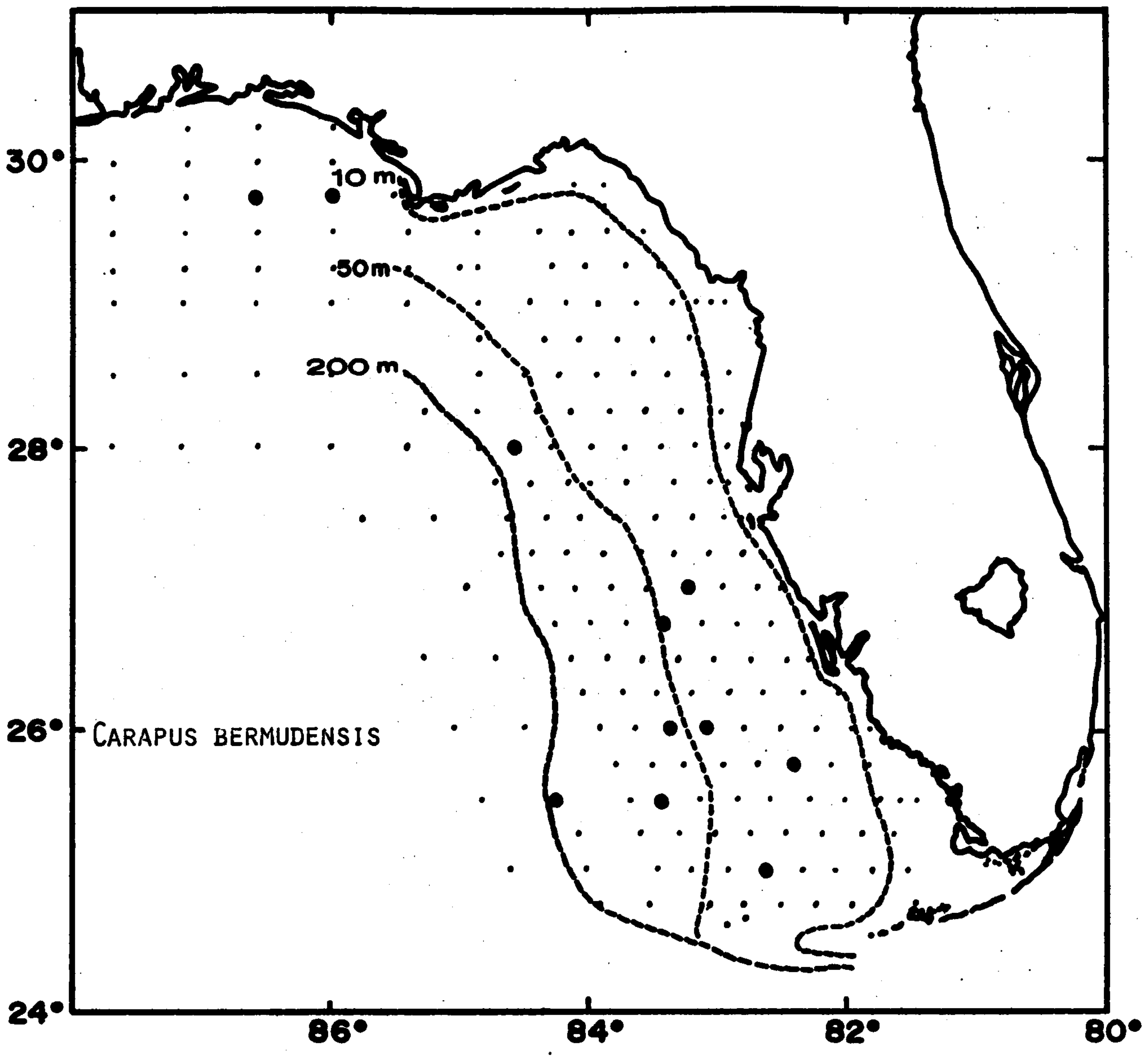



Fig. 115 Stations at which *Carapus bermudensis* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

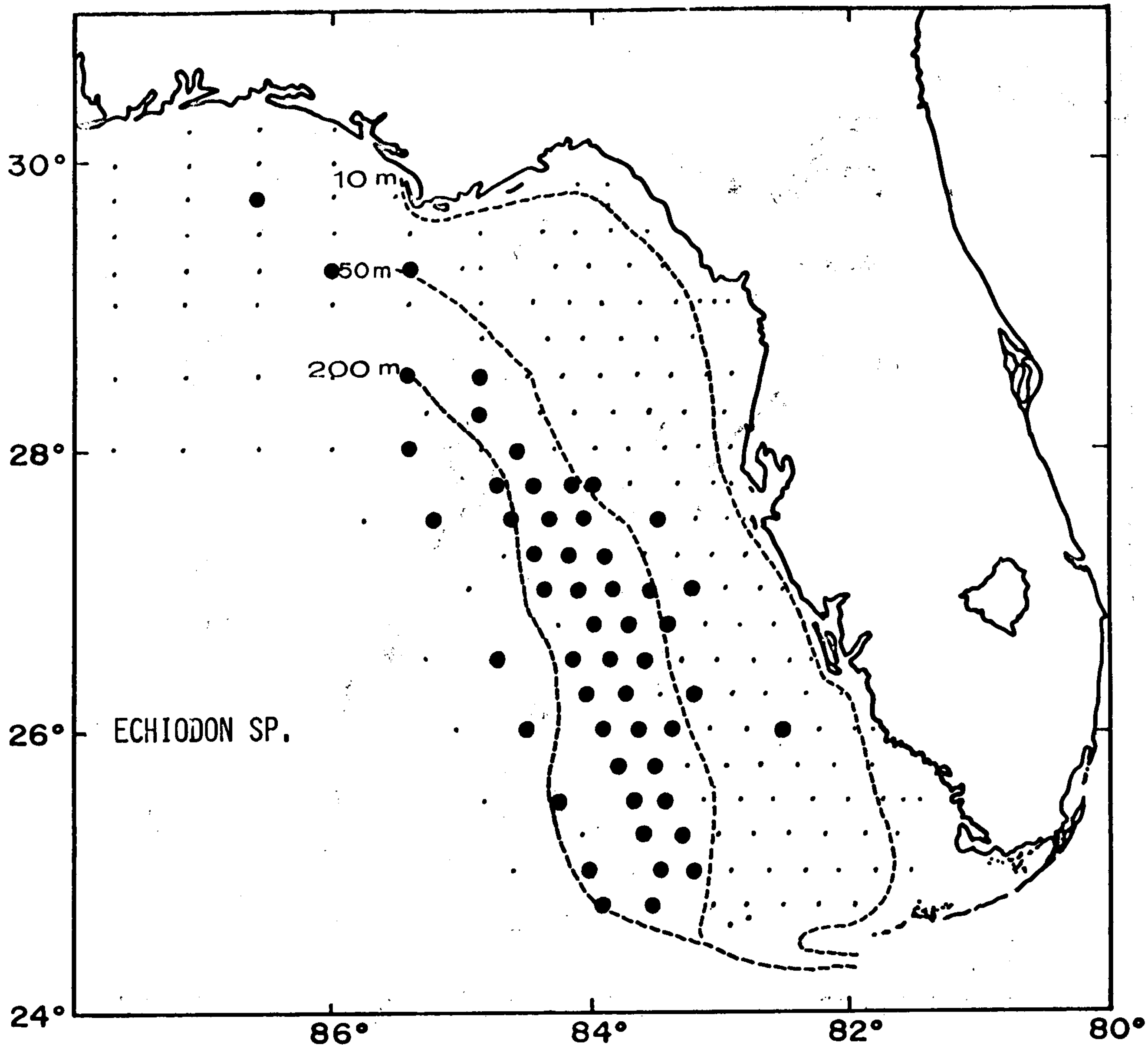



Fig. 116 Stations at which Echiodon sp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

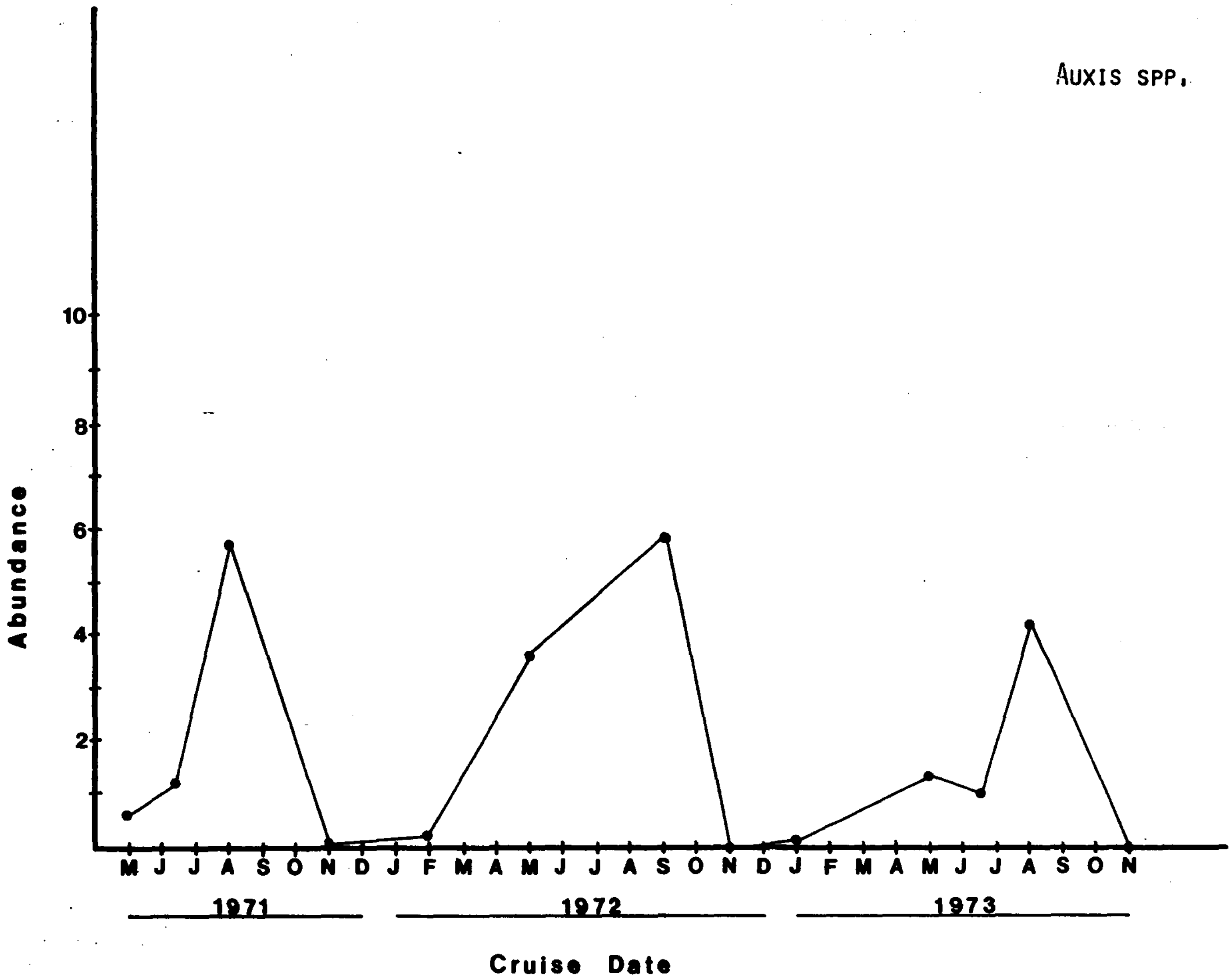



Fig. 117 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Auxis sp. larvae in the eastern Gulf of Mexico, 1971-1974.

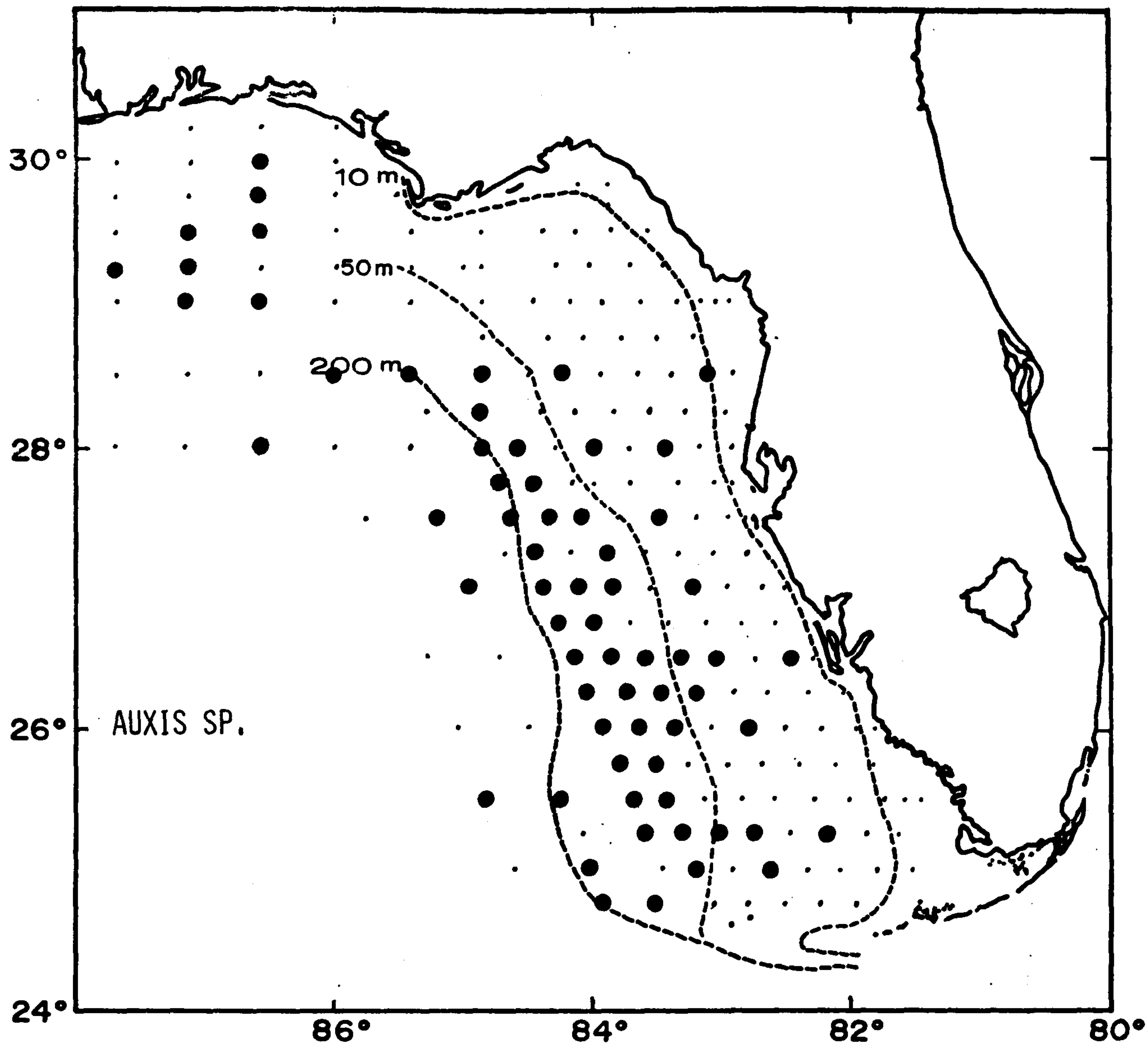



Fig. 118 Stations at which Auxis sp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

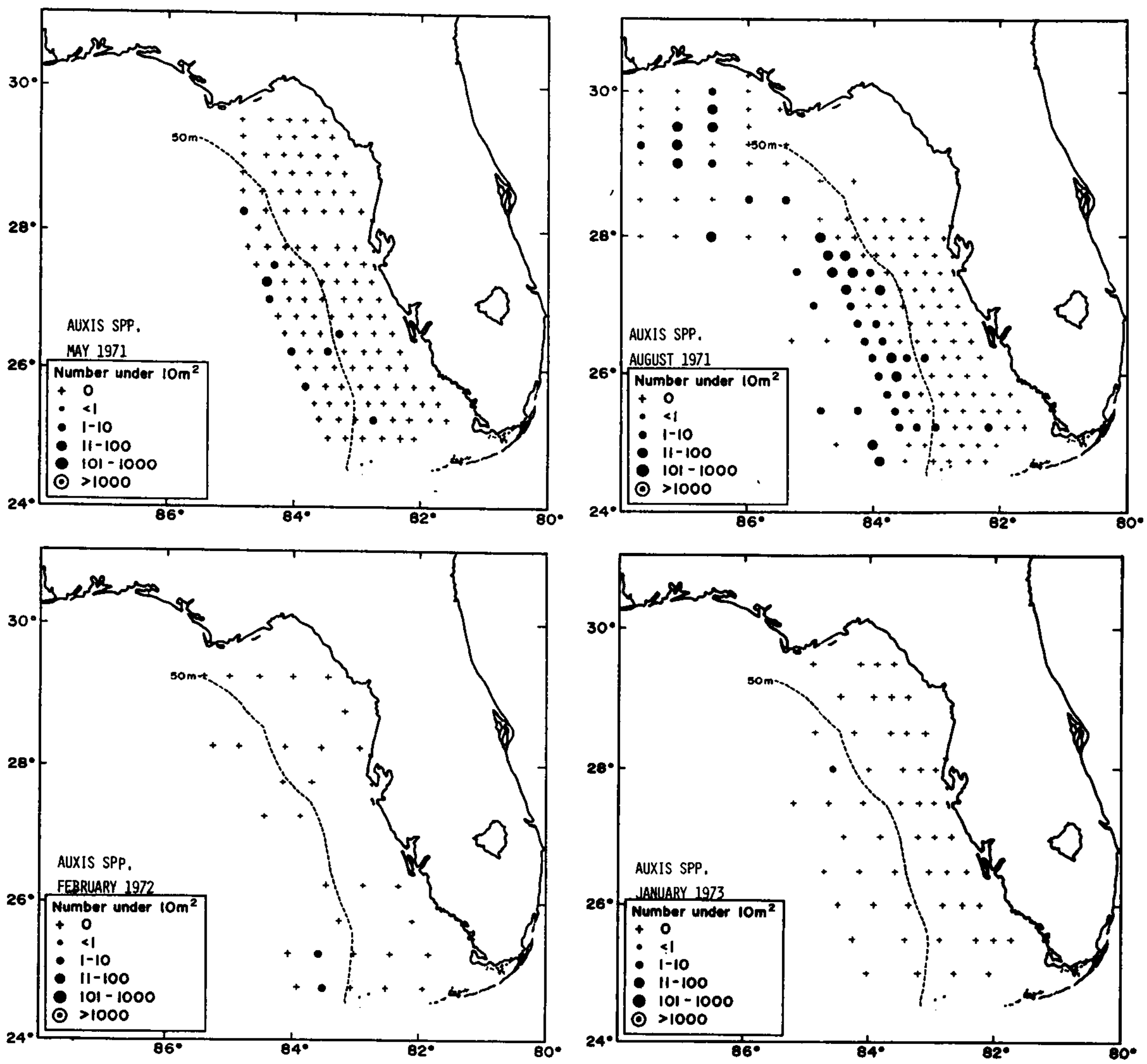



Fig. 119 Distribution and abundance of Auxis sp. larvae in the eastern Gulf of Mexico, 1971-1974.

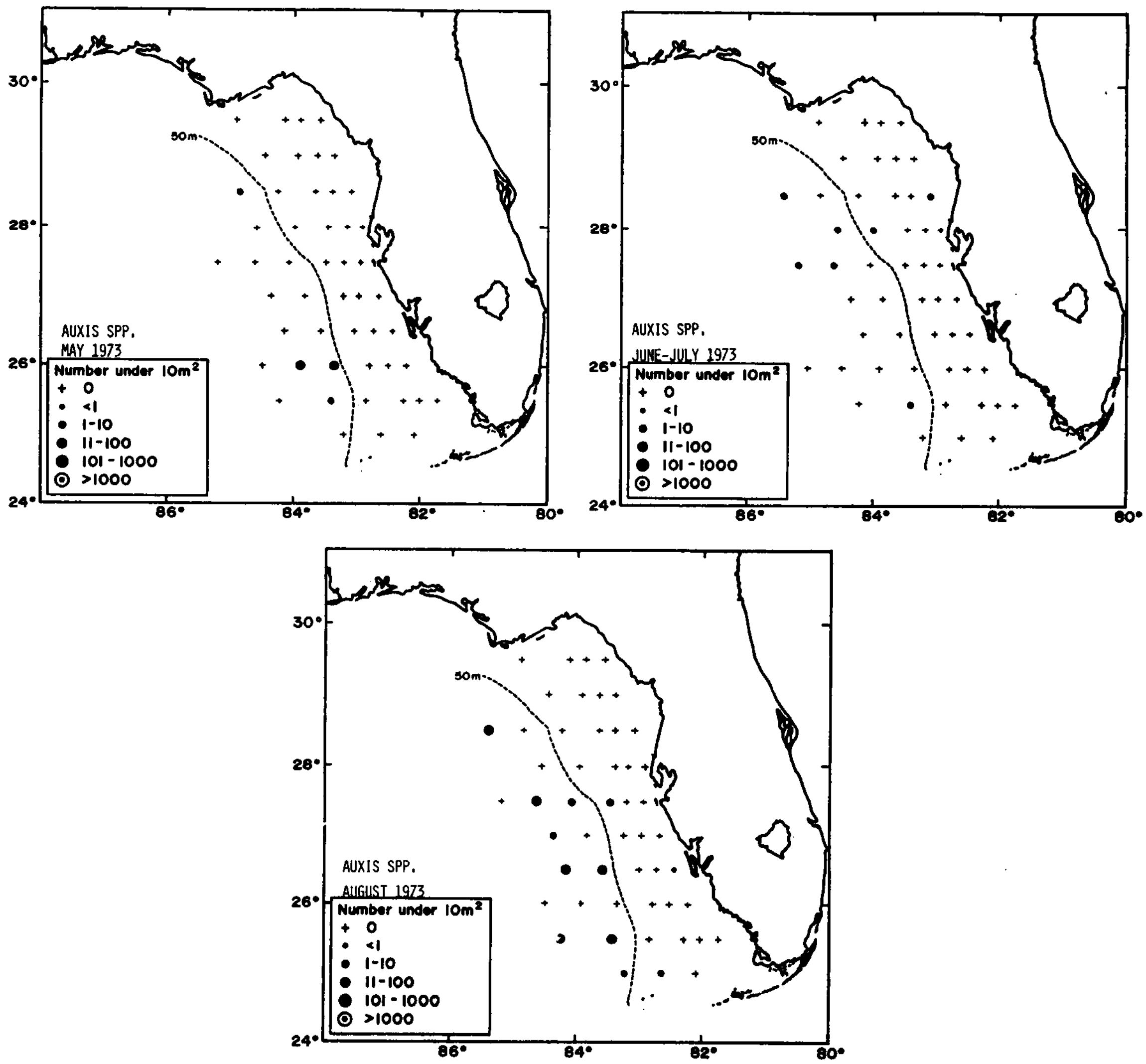

30°
28°
26°
24°
86°
84°
82°
80°
50m
AUXIS SPP.
MAY 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000
30°
28°
26°
24°
86°
84°
82°
80°
50m
AUXIS SPP.
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000
30°
28°
26°
24°
86°
84°
82°
80°
50m
AUXIS SPP.
AUGUST 1973
Number under 10m²
0
<1
1-10
11-100
101 - 1000
>1000

Fig. 119 Cont.

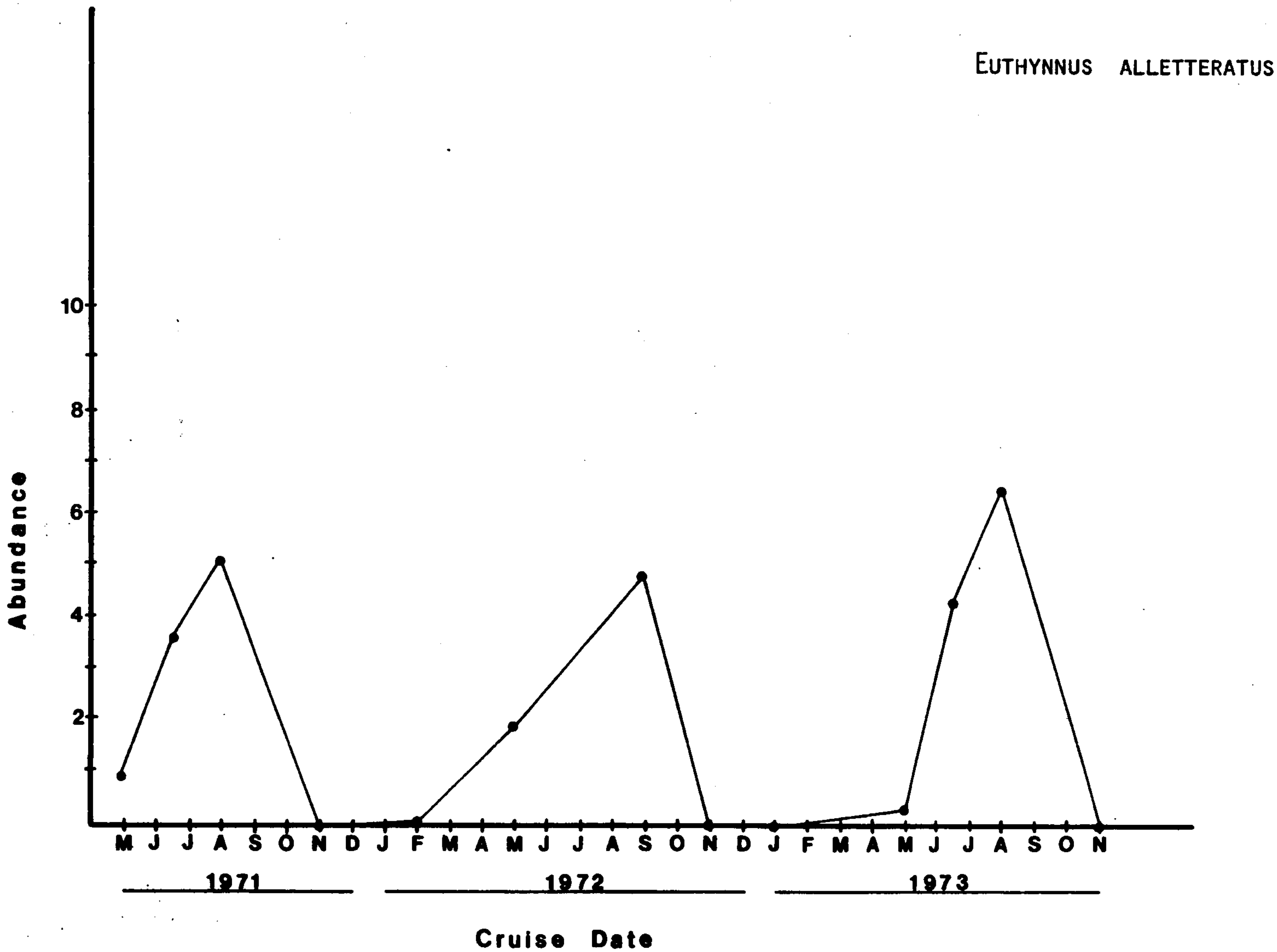



Fig. 120 Estimated mean abundances (number under 10 m$^2$ of sea surface) of Euthynnus alletteratus larvae in the eastern Gulf of Mexico, 1971-1974.

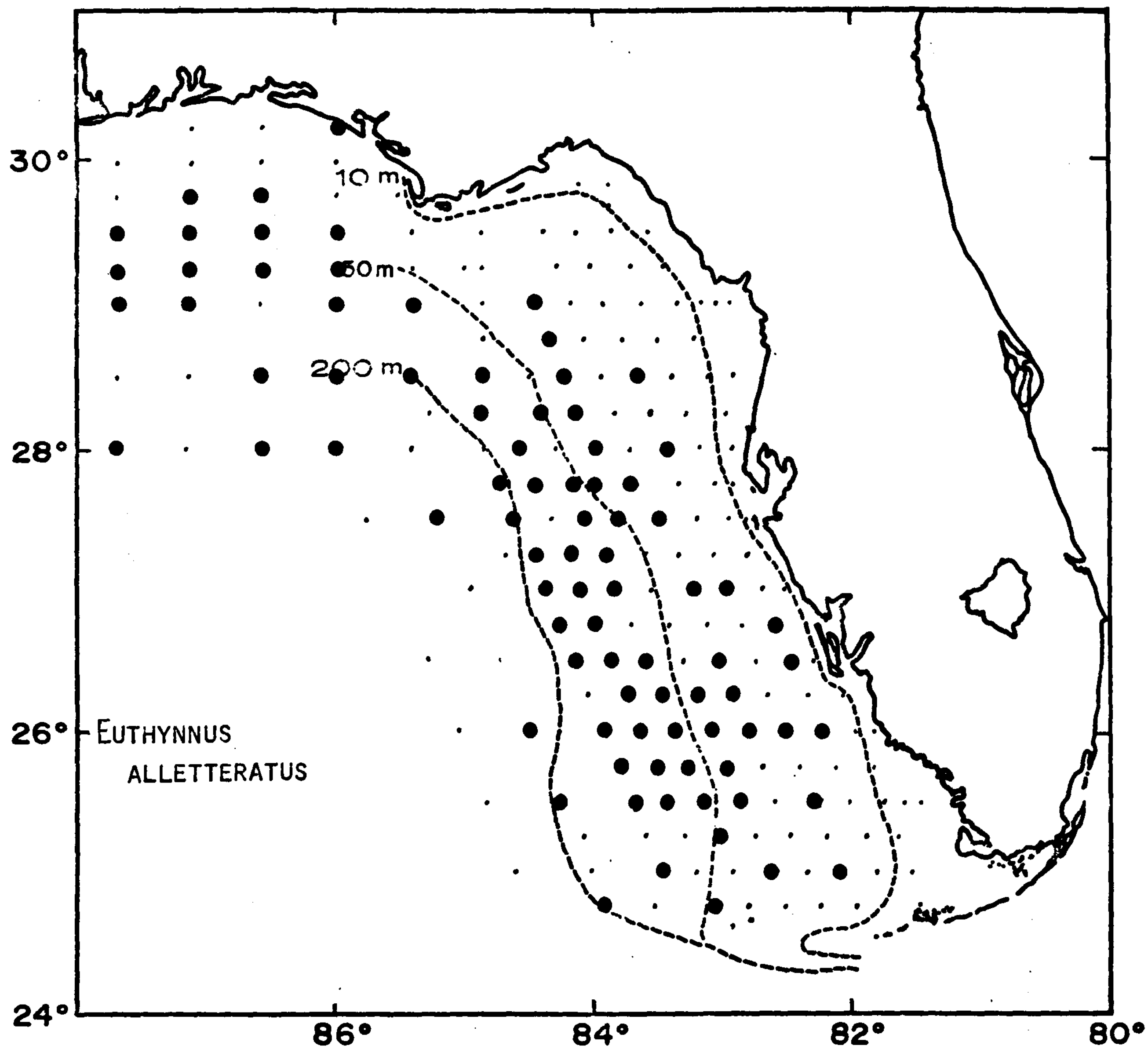



Fig. 121 Stations at which <u>Euthynnus alletteratus</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

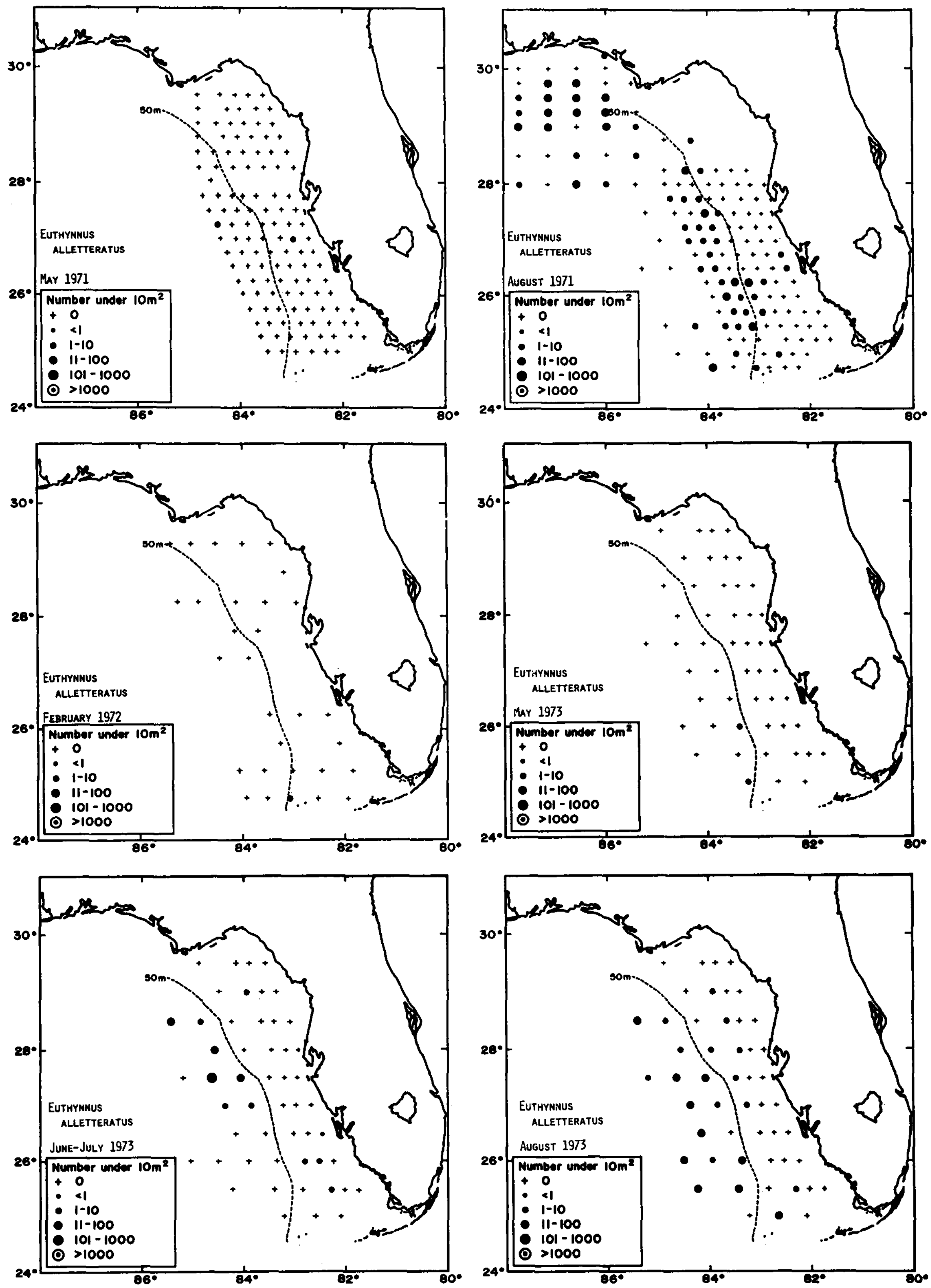



Fig. 122 Distribution and abundance of *Euthynnus alletteratus* larvae in the eastern Gulf of Mexico, 1971-1974.

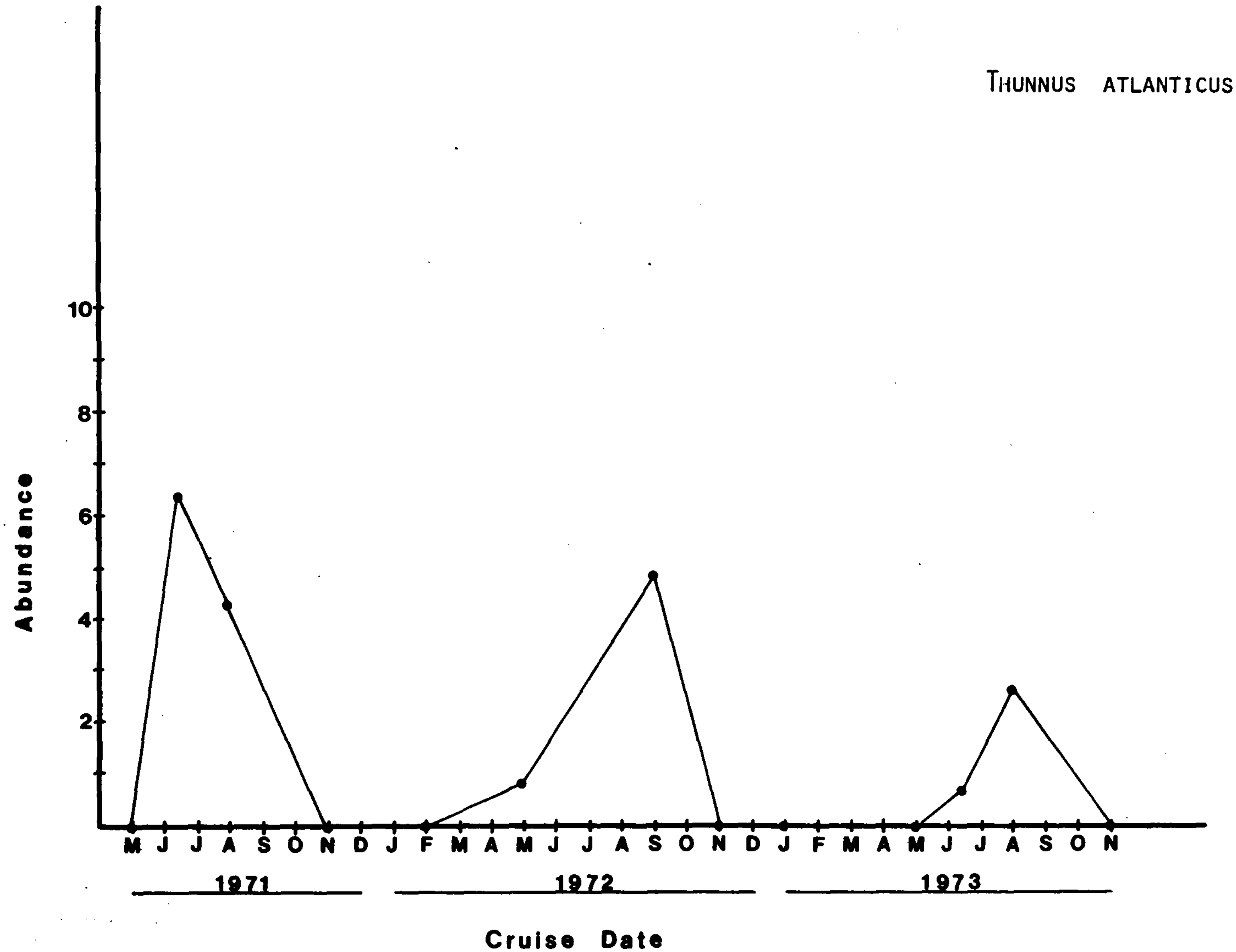



Fig. 123 Estimated mean abundances (number under $10 \cdot m^2$ of sea surface) of *Thunnus atlanticus* larvae in the eastern Gulf of Mexico, 1971-1974.

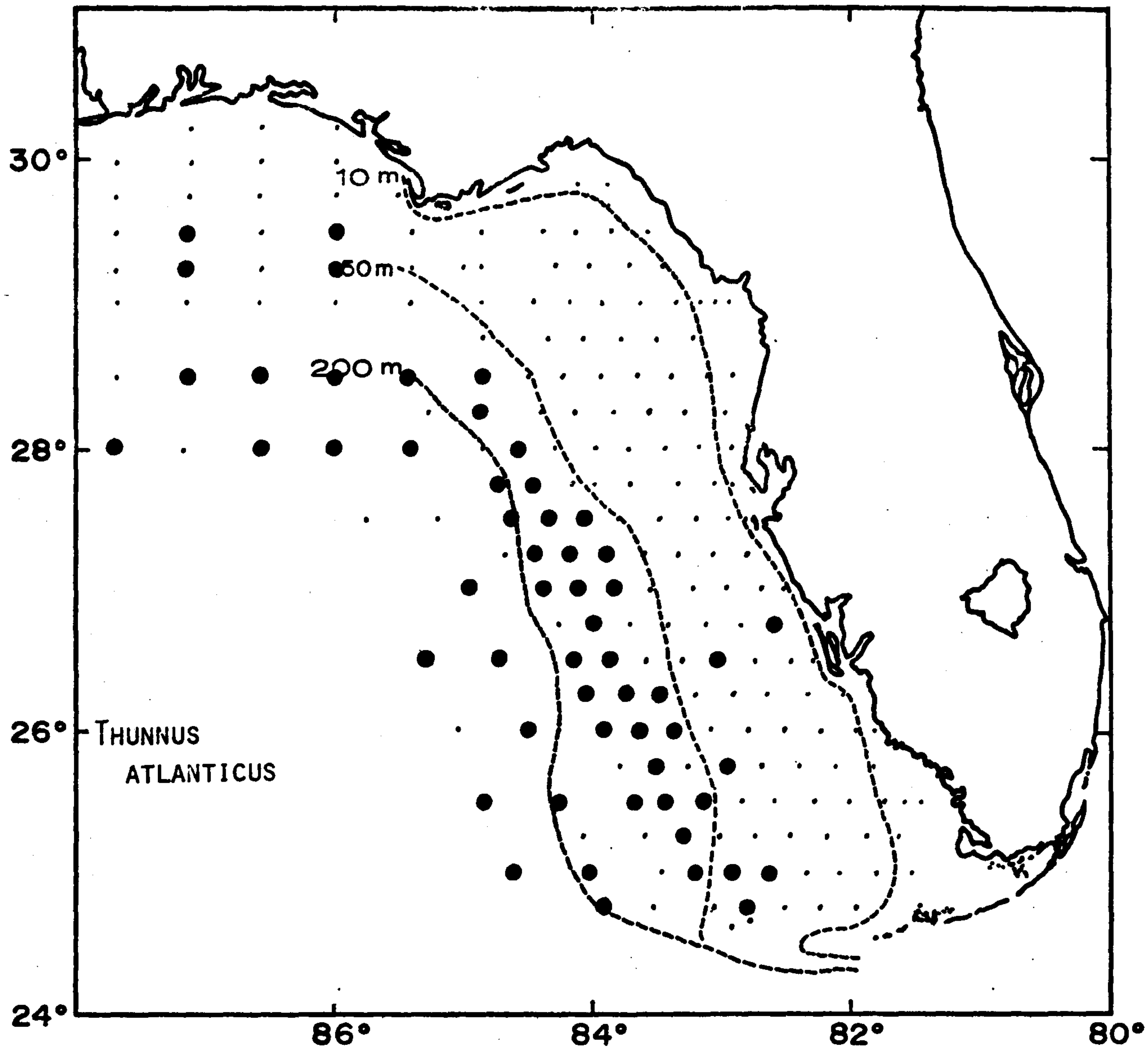



Fig. 124 Stations at which Thunnus atlanticus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

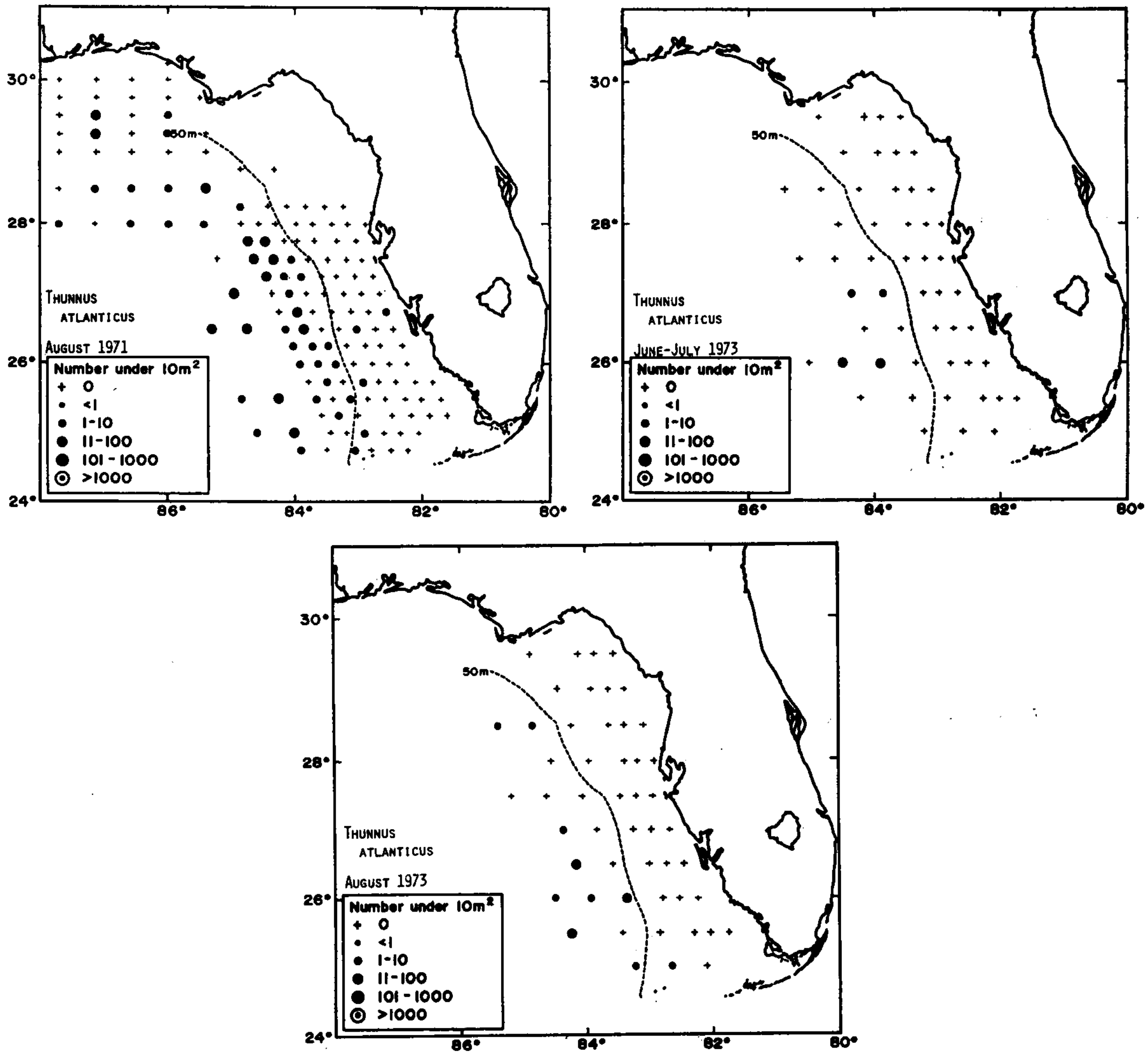



Fig. 125 Distribution and abundance of Thunnus atlanticus larvae in the eastern Gulf of Mexico, 1971-1974.

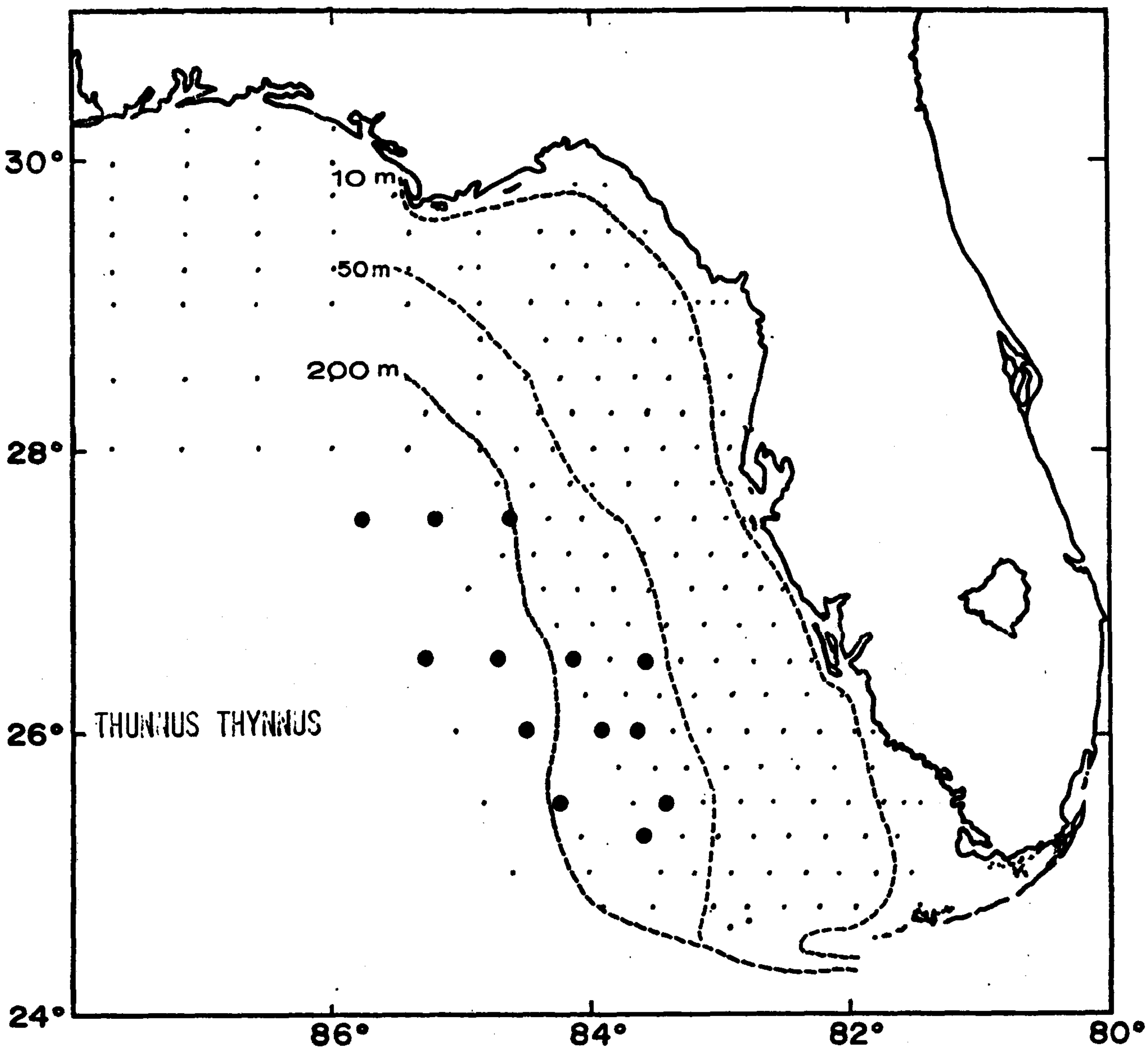



Fig. 126 Stations at which Thunnus thynnus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

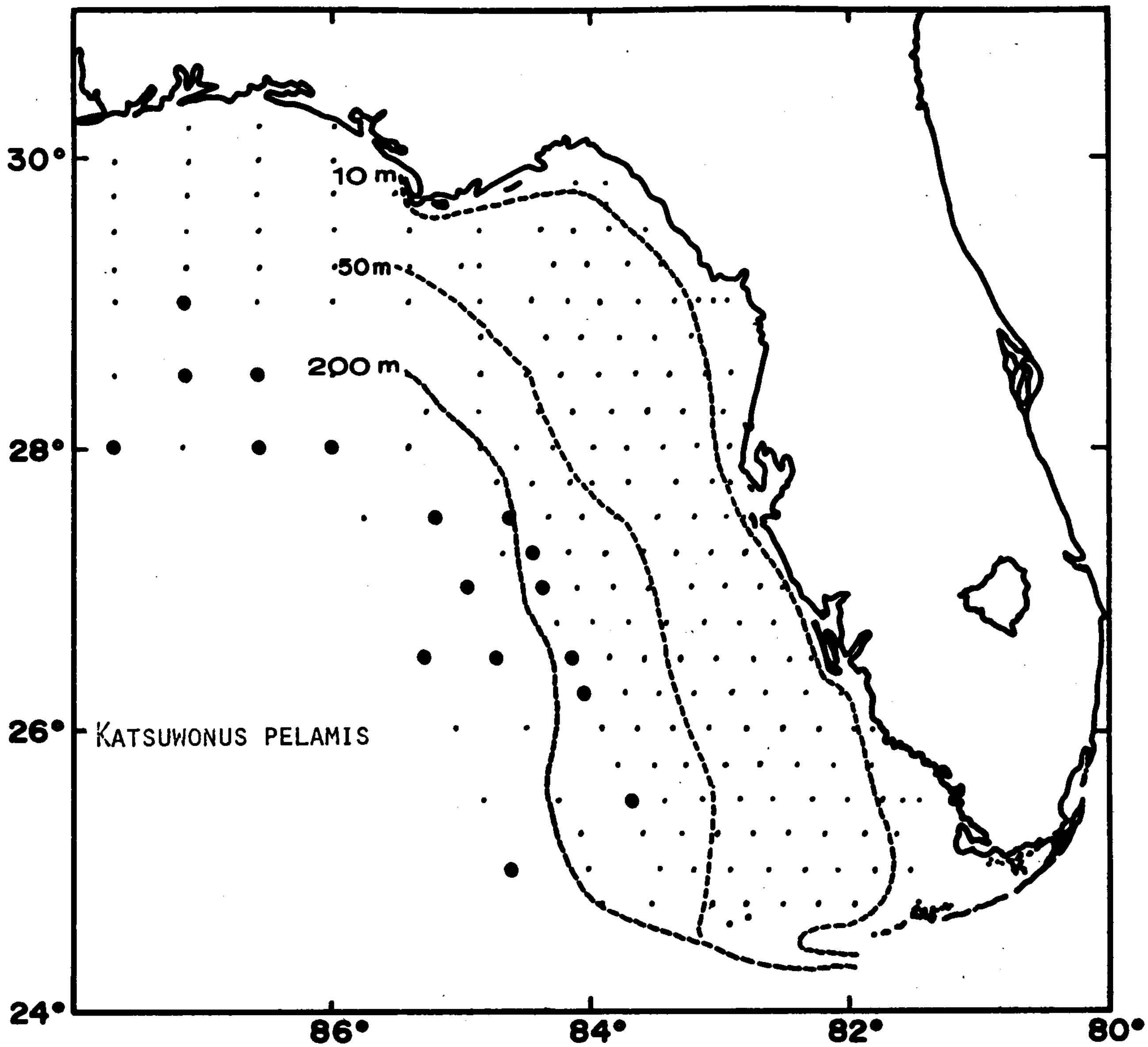



Fig. 127 Stations at which Katsuwonus pelamis larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

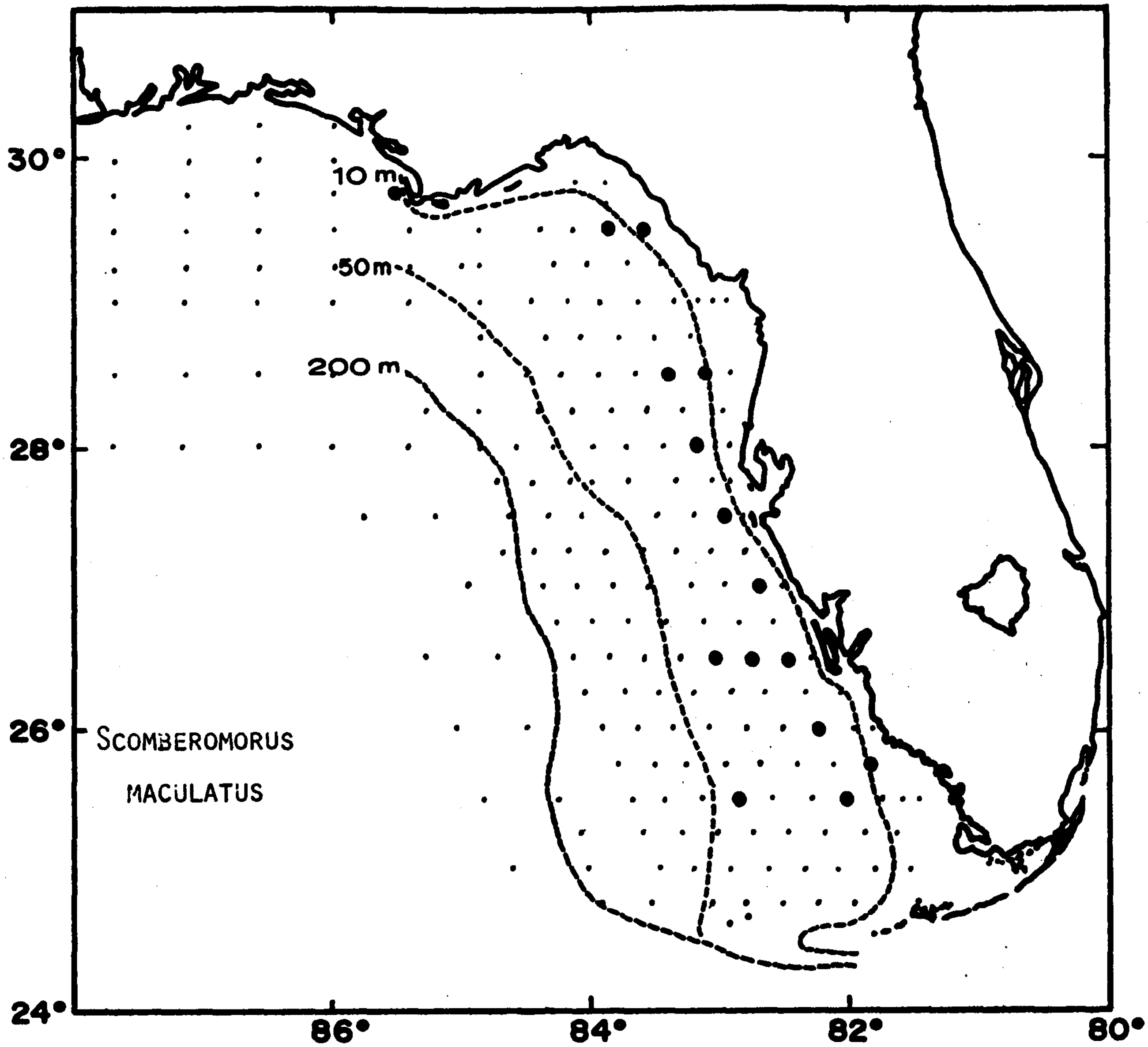



Fig. 128 Stations at which Scomberomorus maculatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

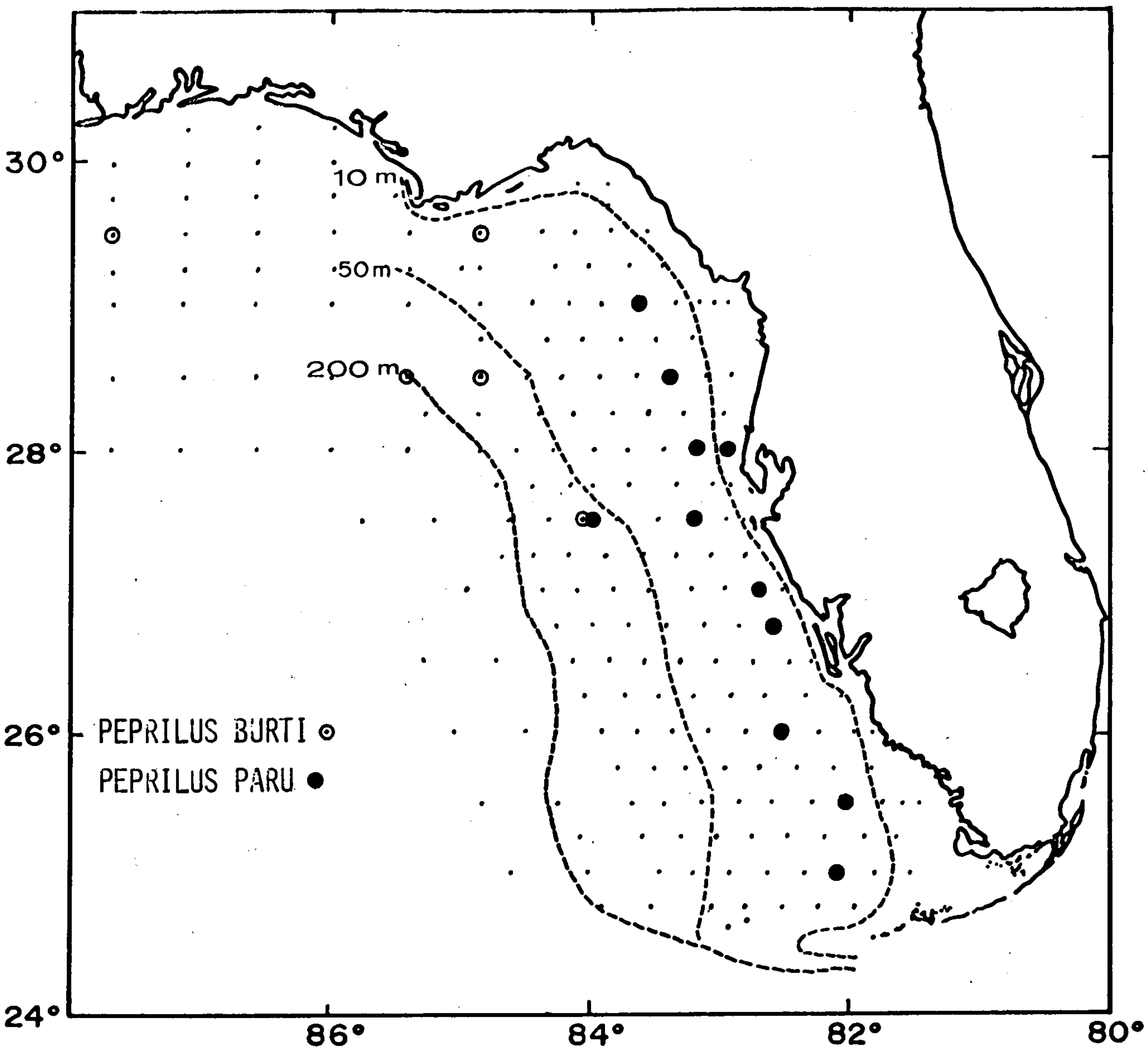



Fig. 129 Stations at which Peprilus paru and Peprilus burti larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

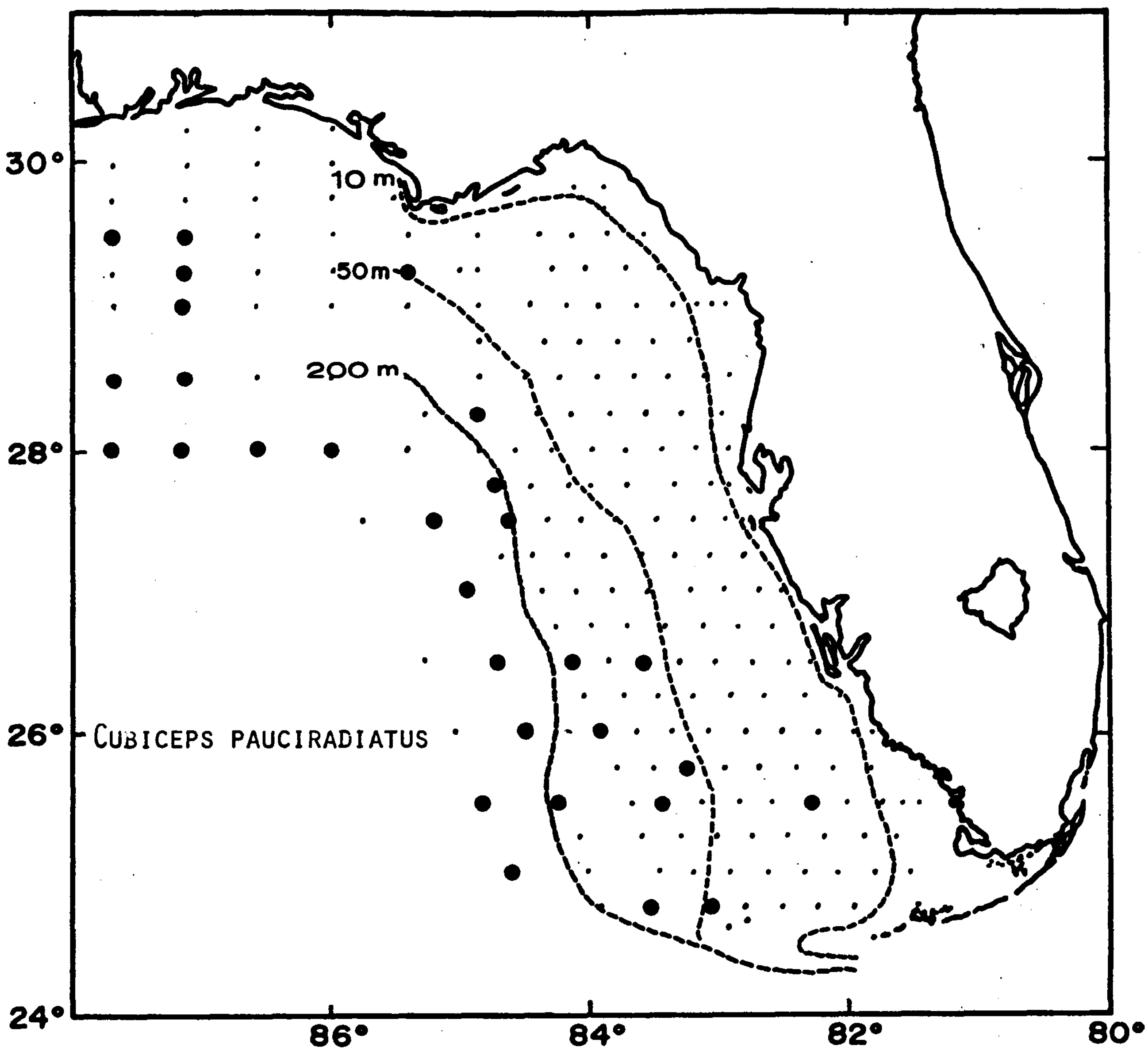



Fig. 130 Stations at which Cubiceps pauciradiatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

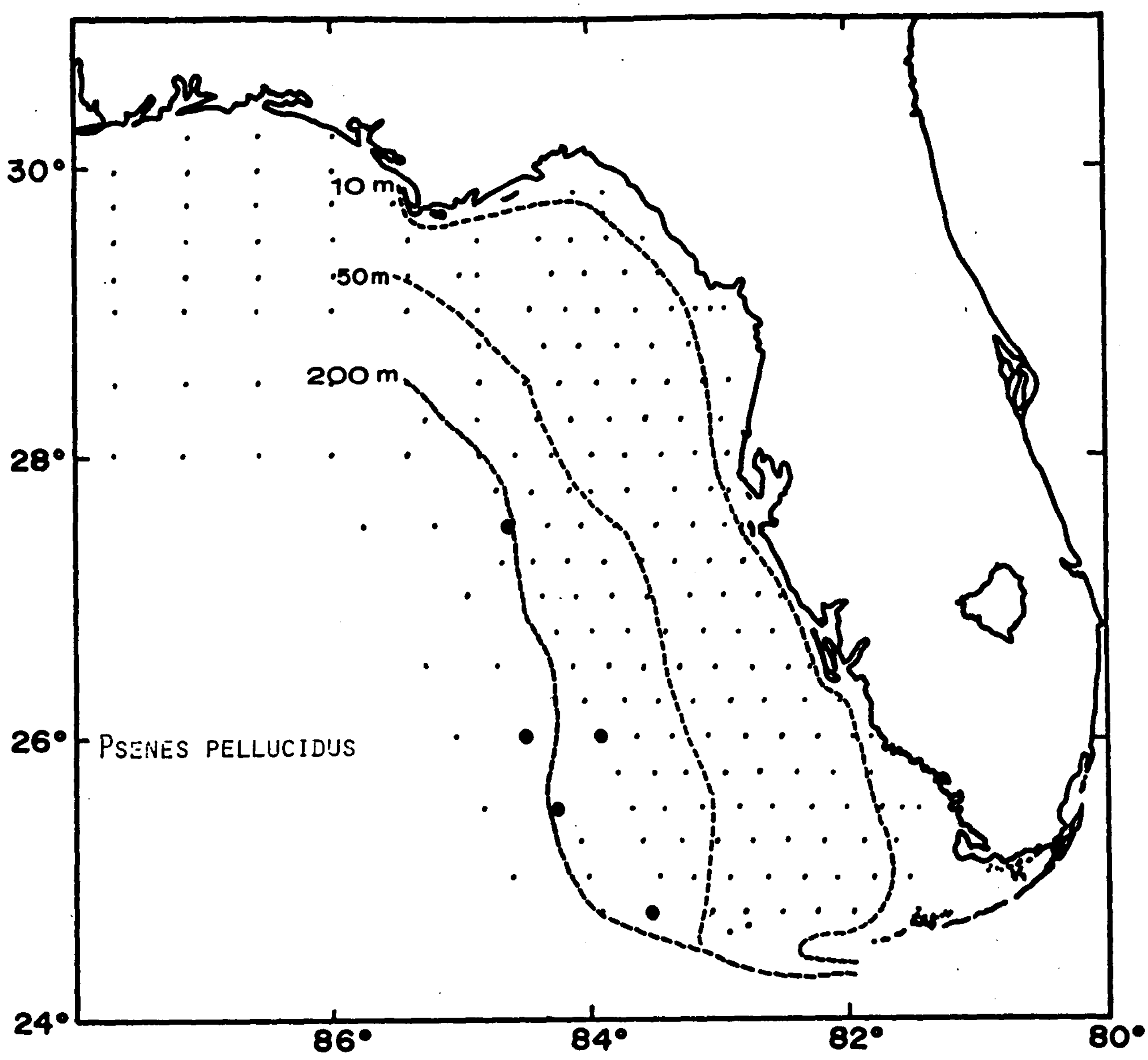



Fig. 131 Stations at which *Psenes pellucidus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

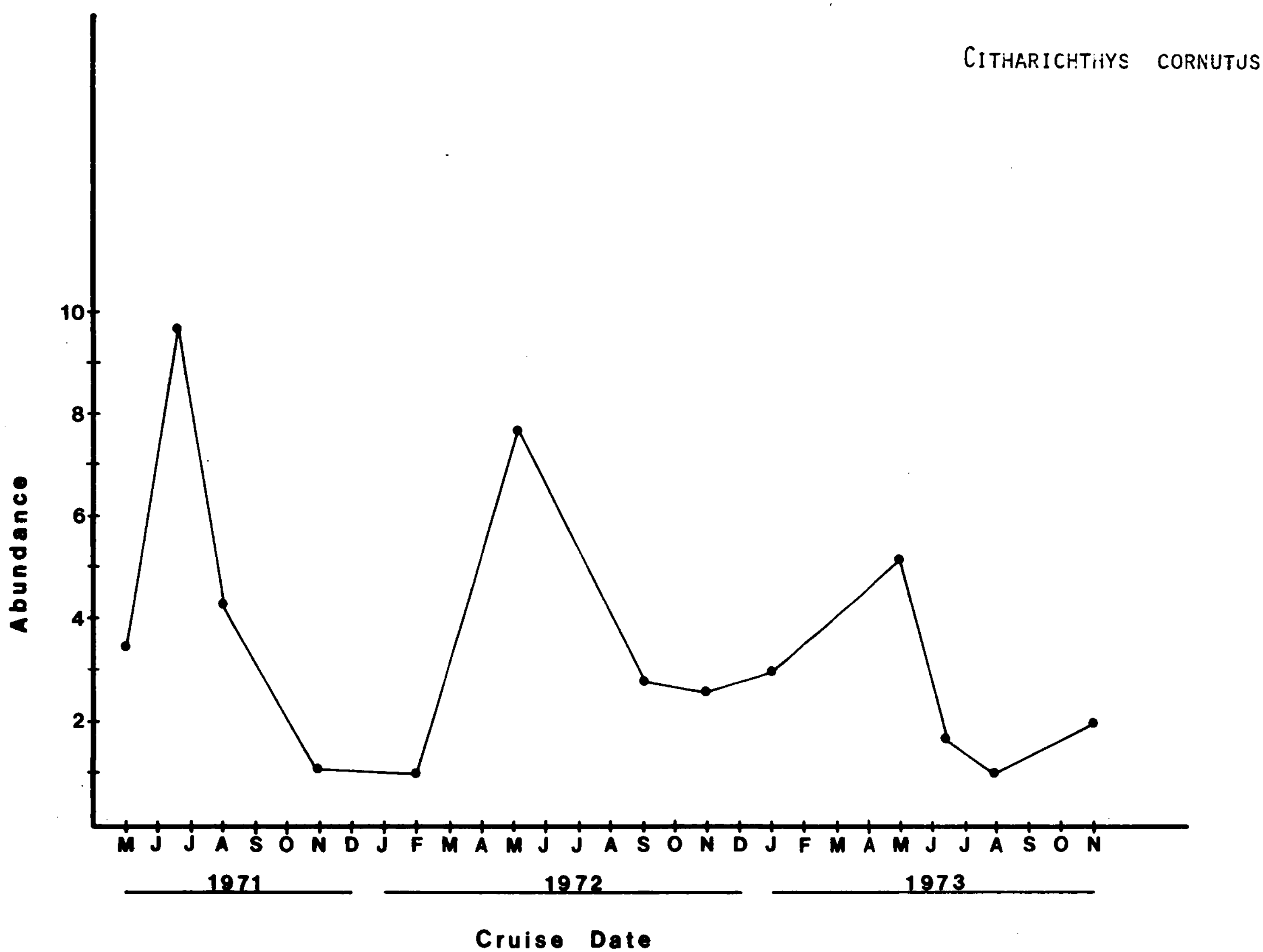



Fig. 132 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Citharichthys cornutus larvae in the eastern Gulf of Mexico, 1971-1974.

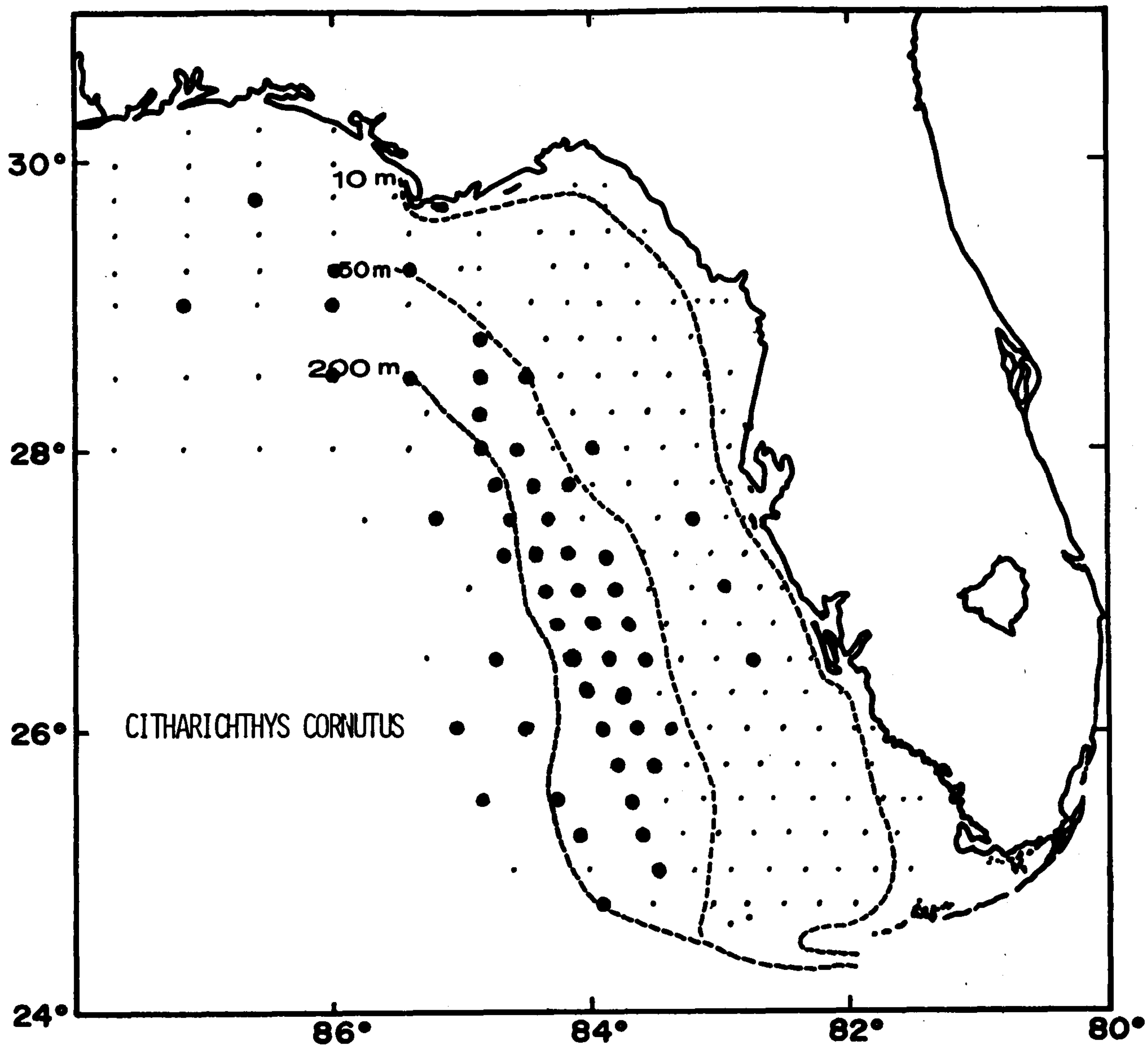



Fig. 133 Stations at which <u>Citharichthys cornutus</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

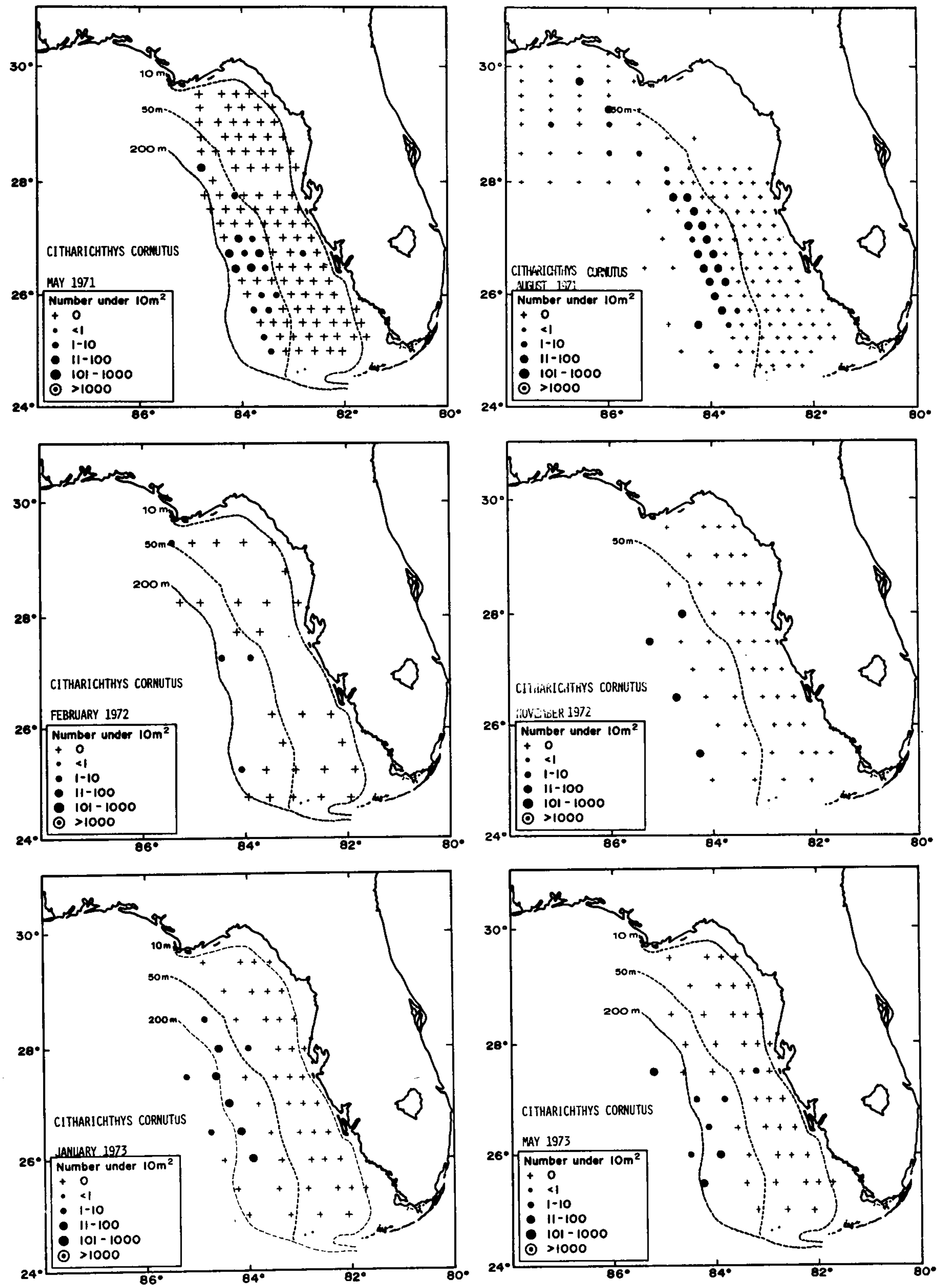



Fig. 134 Distribution and abundance of *Citharichthys cornutus* larvae in the eastern Gulf of Mexico, 1971-1974.

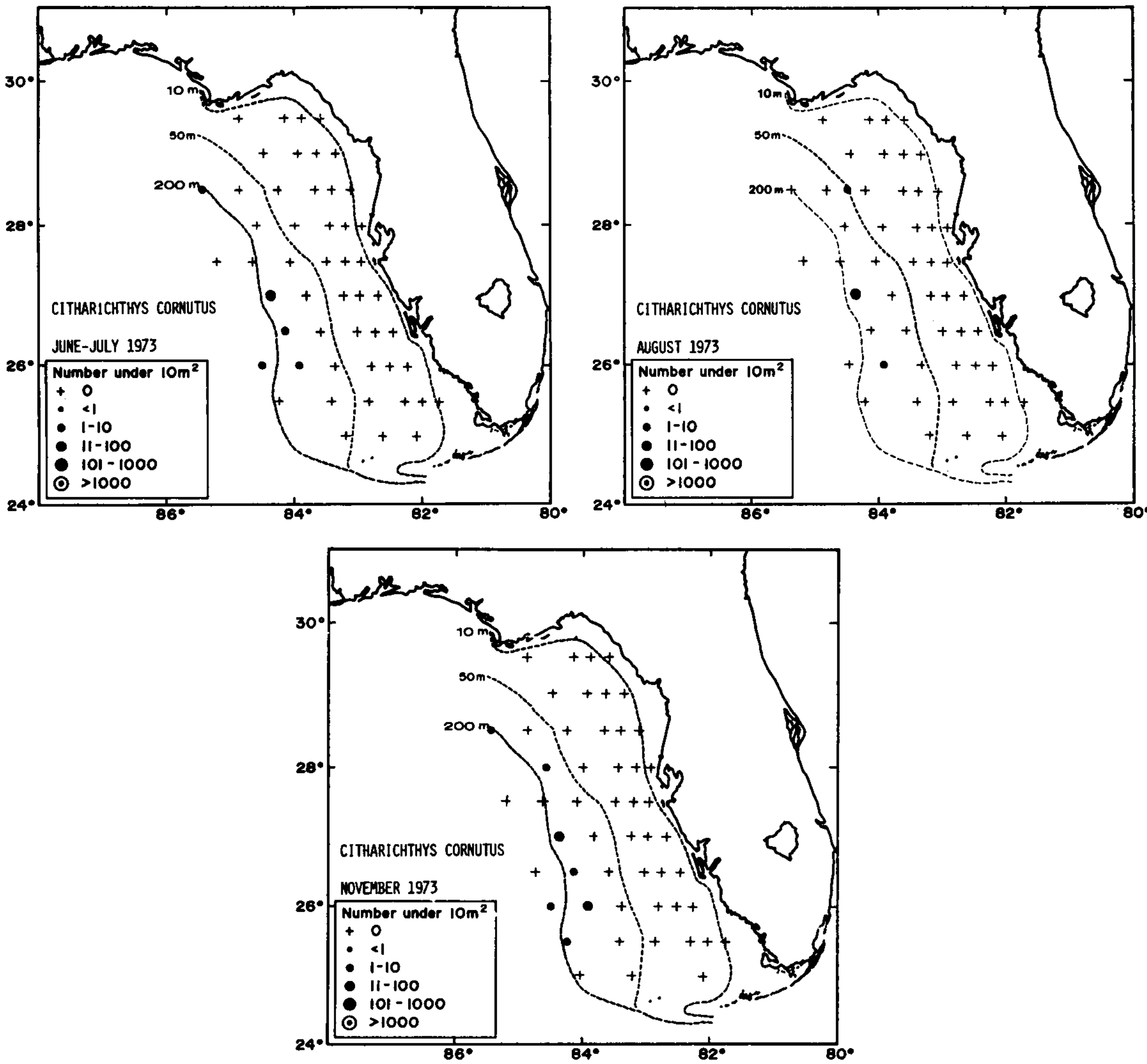

CITHARICHTHYS CORNUTUS
JUNE-JULY 1973
AUGUST 1973
NOVEMBER 1973
Number under 10m²
+ 0
<1
1-10
11-100
101-1000
>1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 134 Cont.

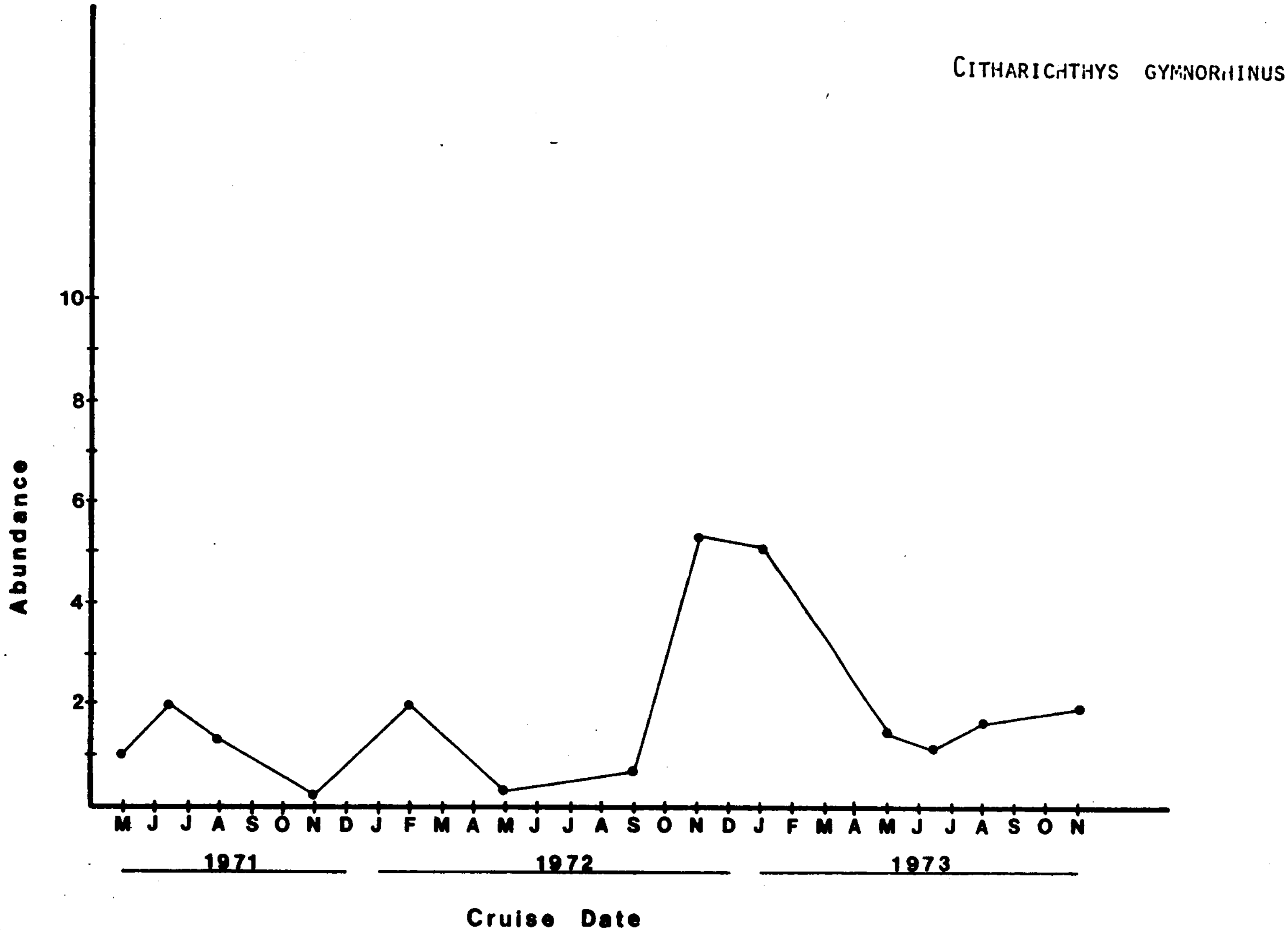



Fig. 135 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Citharichthys gymnorhinus larvae in the eastern Gulf of Mexico, 1971-1974.

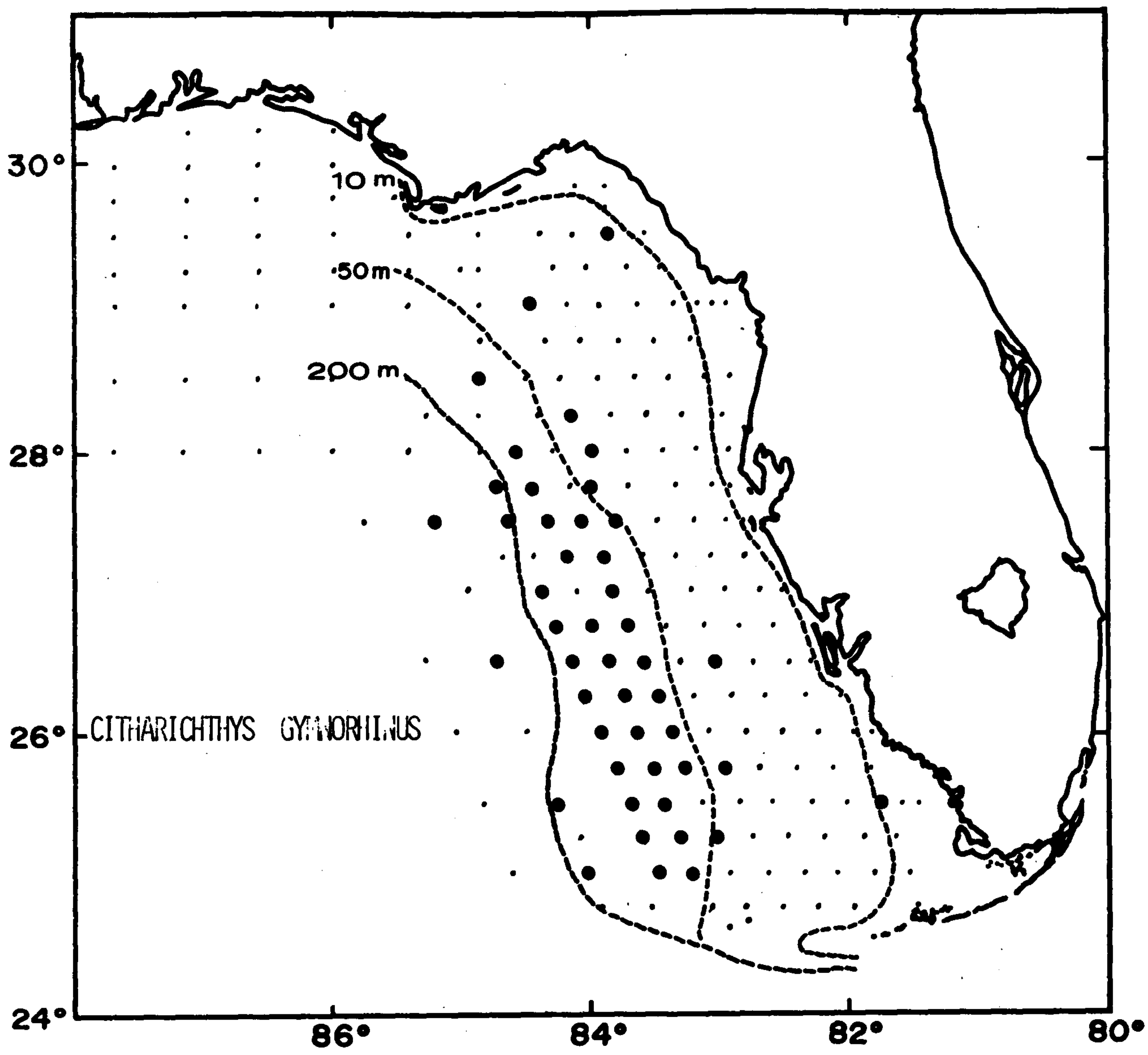



Fig. 136 Stations at which Citharichthys gymnorhinus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

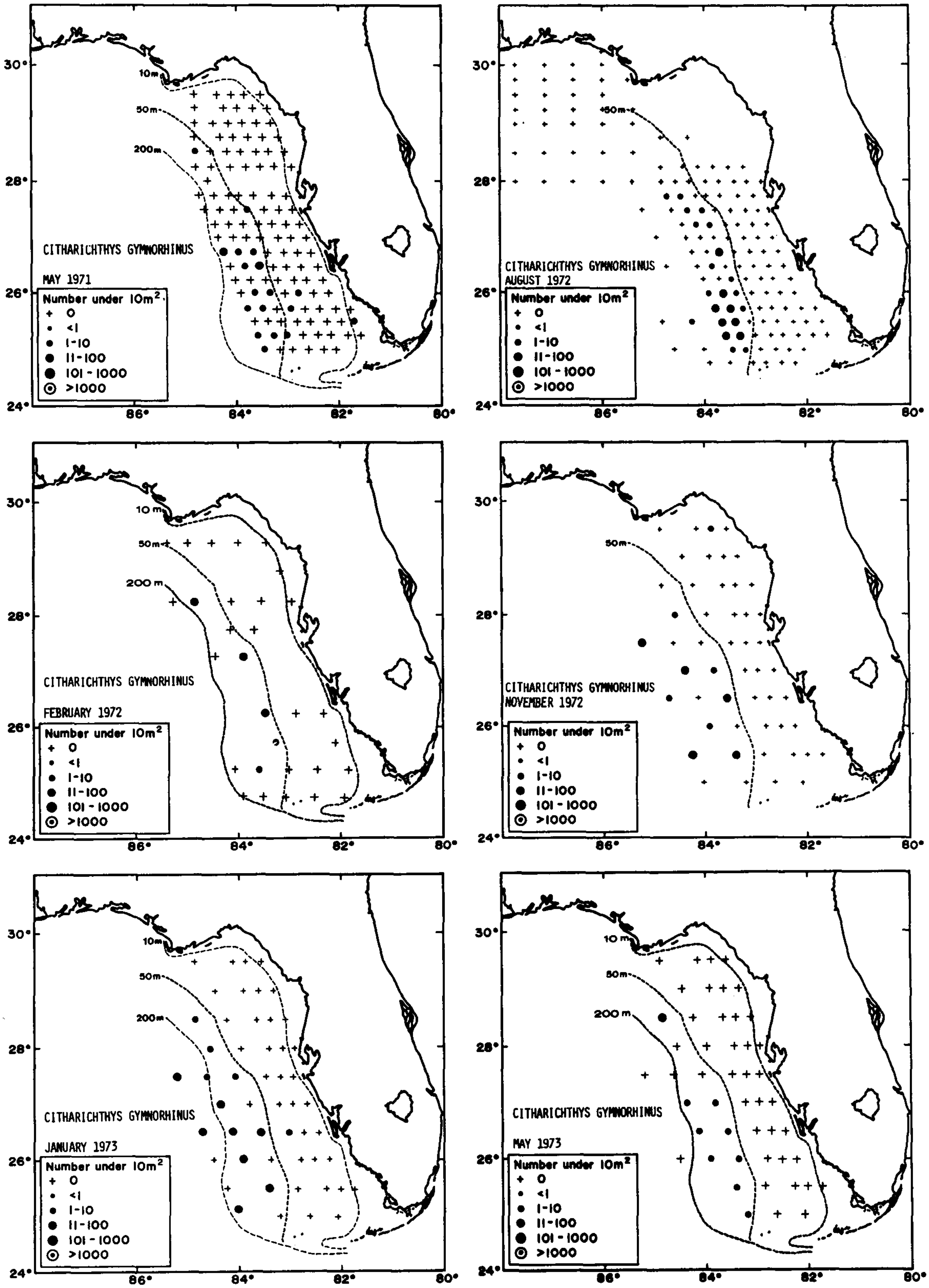



Fig. 137 Distribution and abundance of Citharichthys gymnorhinus larvae in the eastern Gulf of Mexico, 1971-1974.

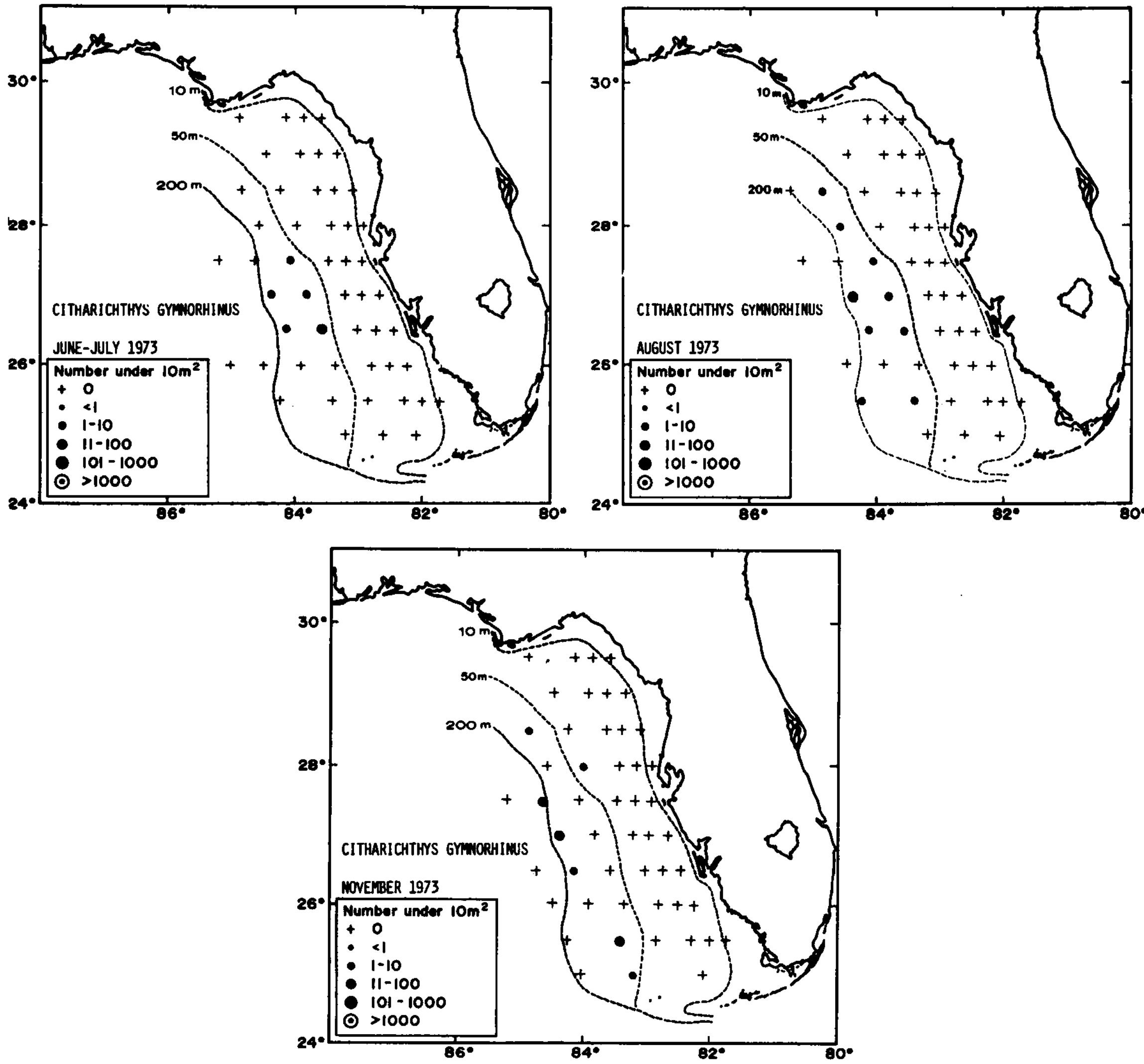

CITHARICHTHYS GYMNORHINUS
JUNE-JULY 1973
Number under 10m²
+ 0
• <1
● 1-10
● 11-100
● 101 - 1000
⊙ >1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°
CITHARICHTHYS GYMNORHINUS
AUGUST 1973
Number under 10m²
+ 0
• <1
● 1-10
● 11-100
● 101 - 1000
⊙ >1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°
CITHARICHTHYS GYMNORHINUS
NOVEMBER 1973
Number under 10m²
+ 0
• <1
● 1-10
● 11-100
● 101 - 1000
⊙ >1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 137 Cont.

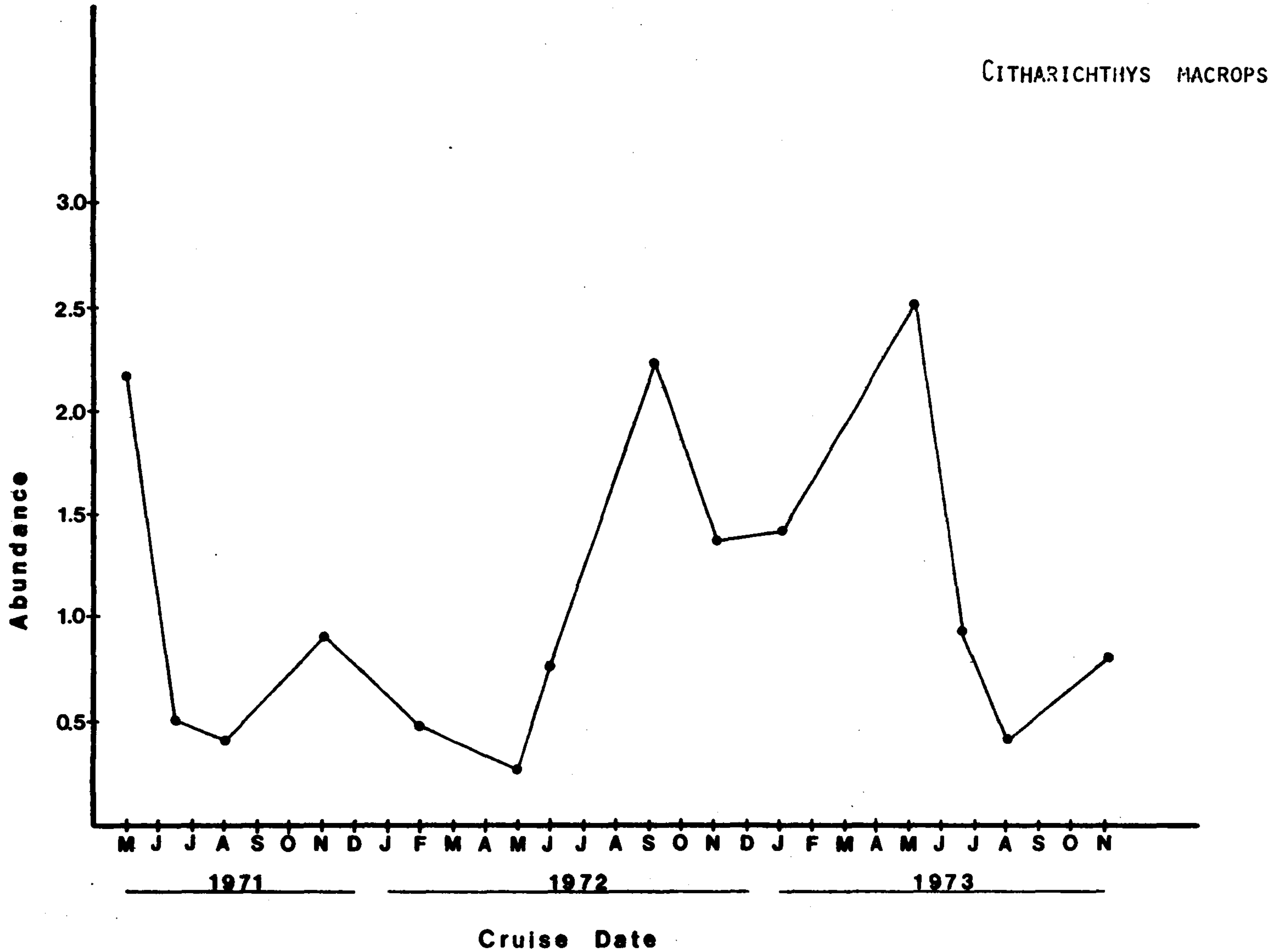



Fig. 138 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Citharichthys macrops larvae in the eastern Gulf of Mexico, 1971-1974.

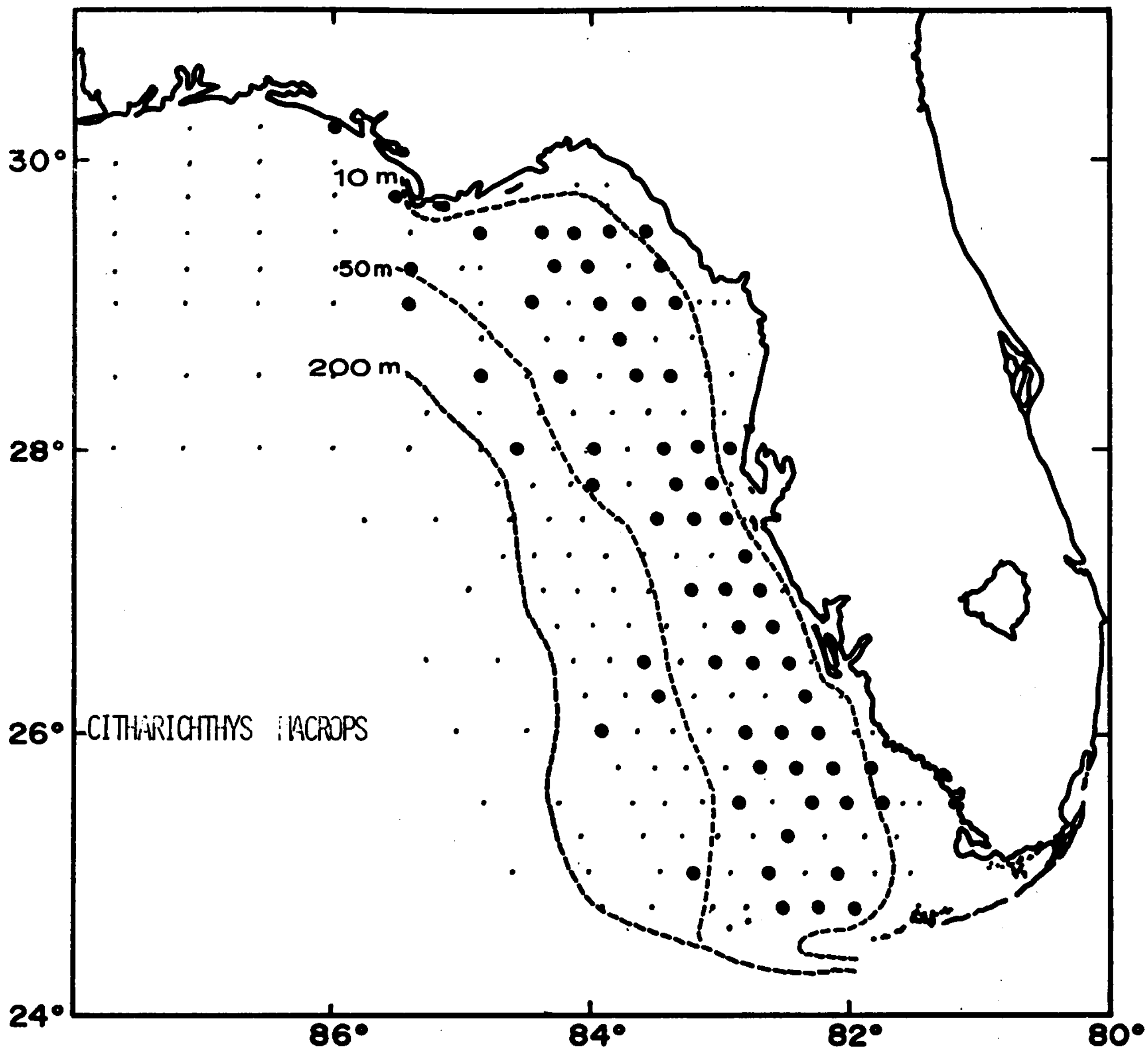



Fig. 139 Stations at which Citharichthys macrops larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

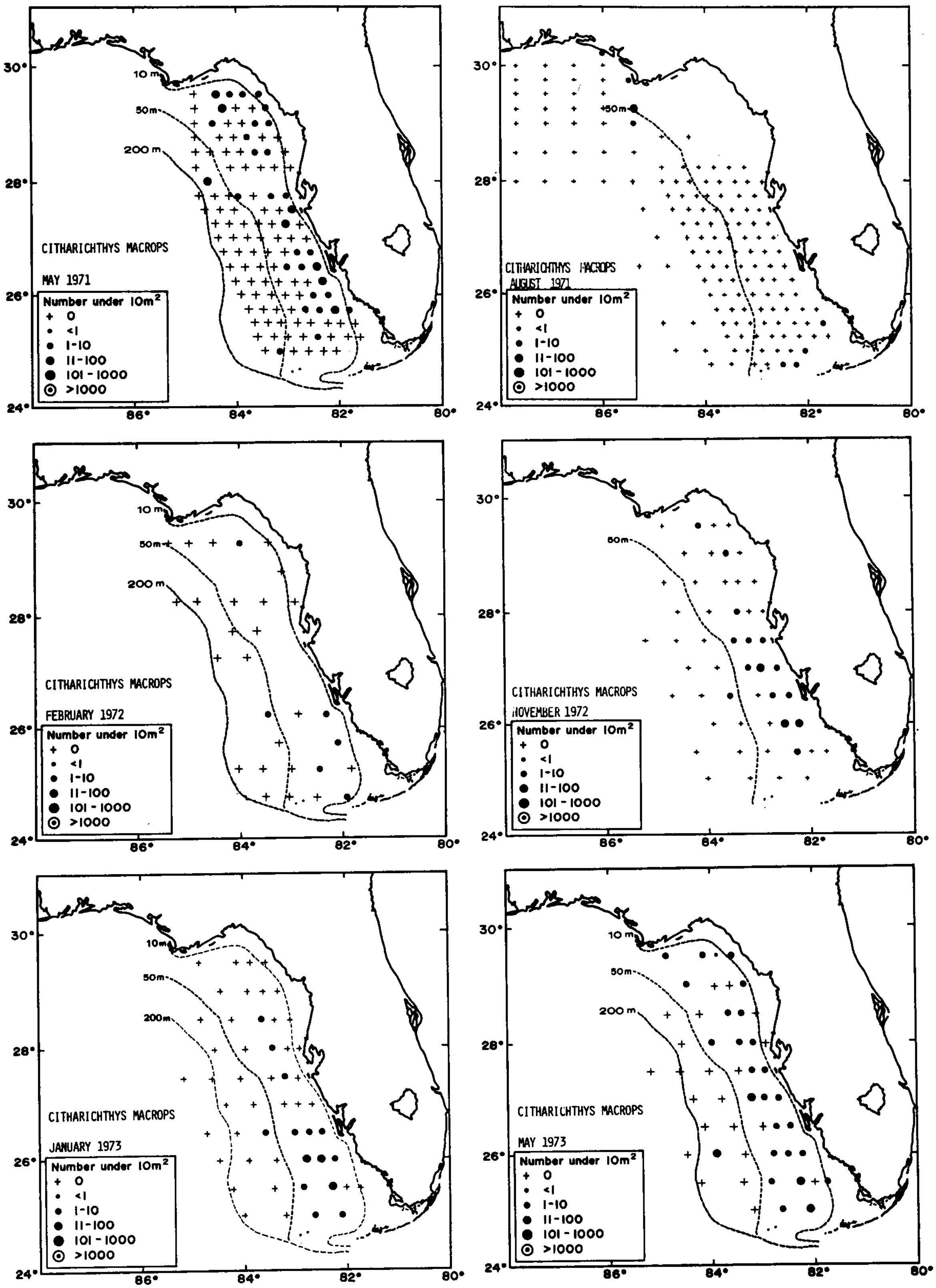



Fig. 140 Distribution and abundance of *Citharichthys macrops* larvae in the eastern Gulf of Mexico, 1971-1974.

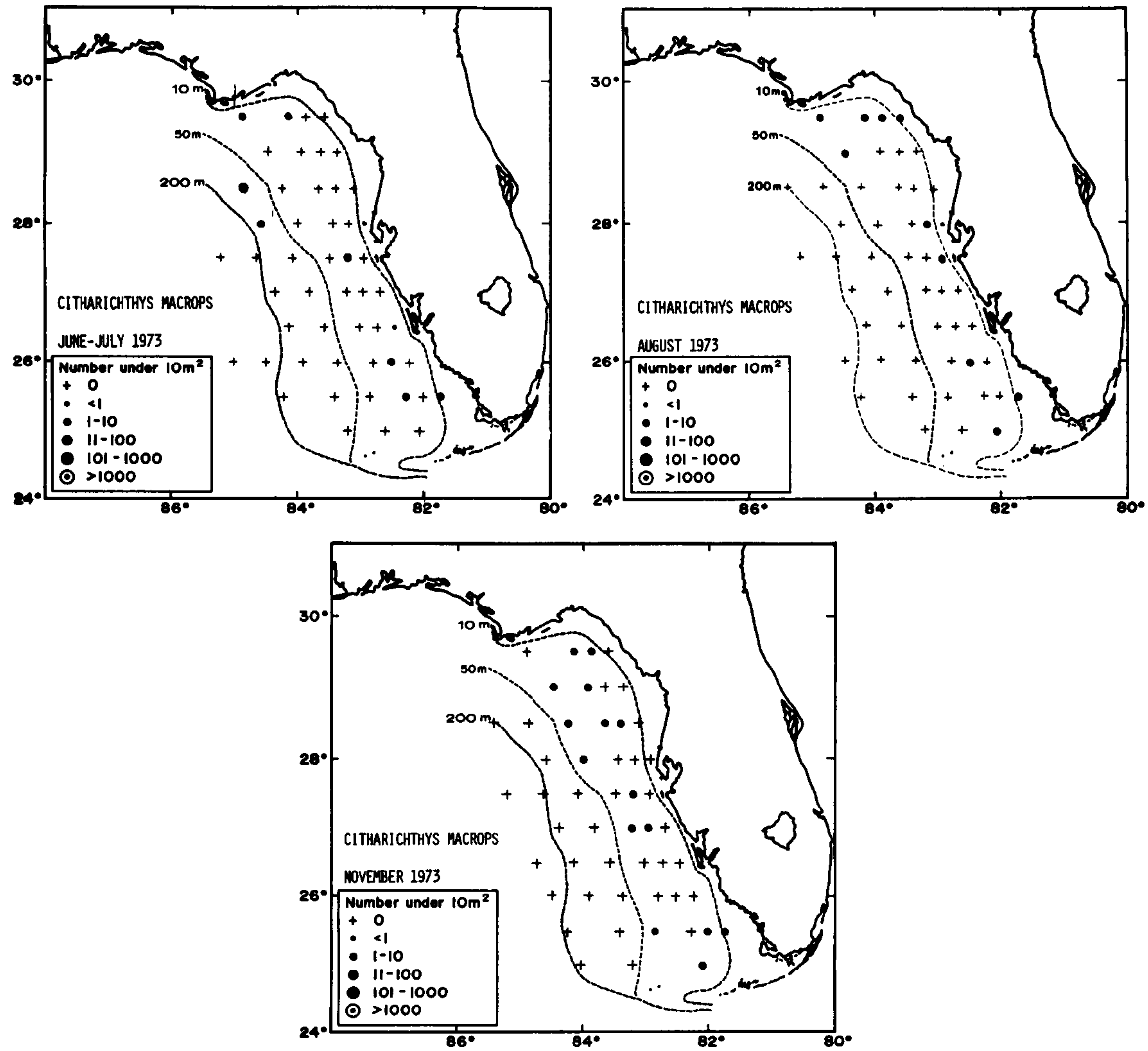

CITHARICHTHYS MACROPS
JUNE-JULY 1973
CITHARICHTHYS MACROPS
AUGUST 1973
CITHARICHTHYS MACROPS
NOVEMBER 1973
Number under 10m²
+ 0
<1
1-10
11-100
101-1000
>1000
10 m
50 m
200 m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 140 Cont.

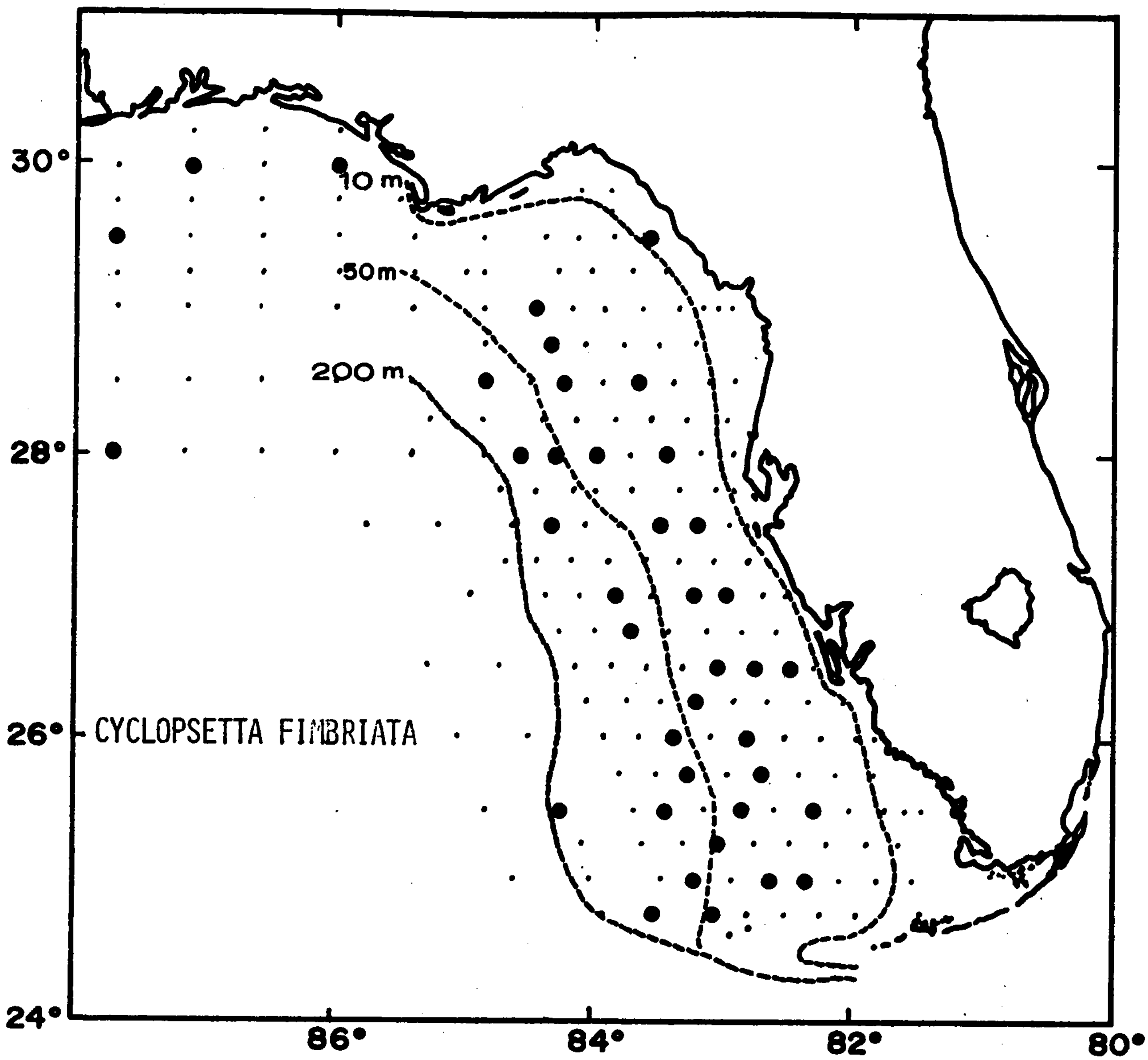



Fig. 141 Stations at which Cyclopsetta fimbriata larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

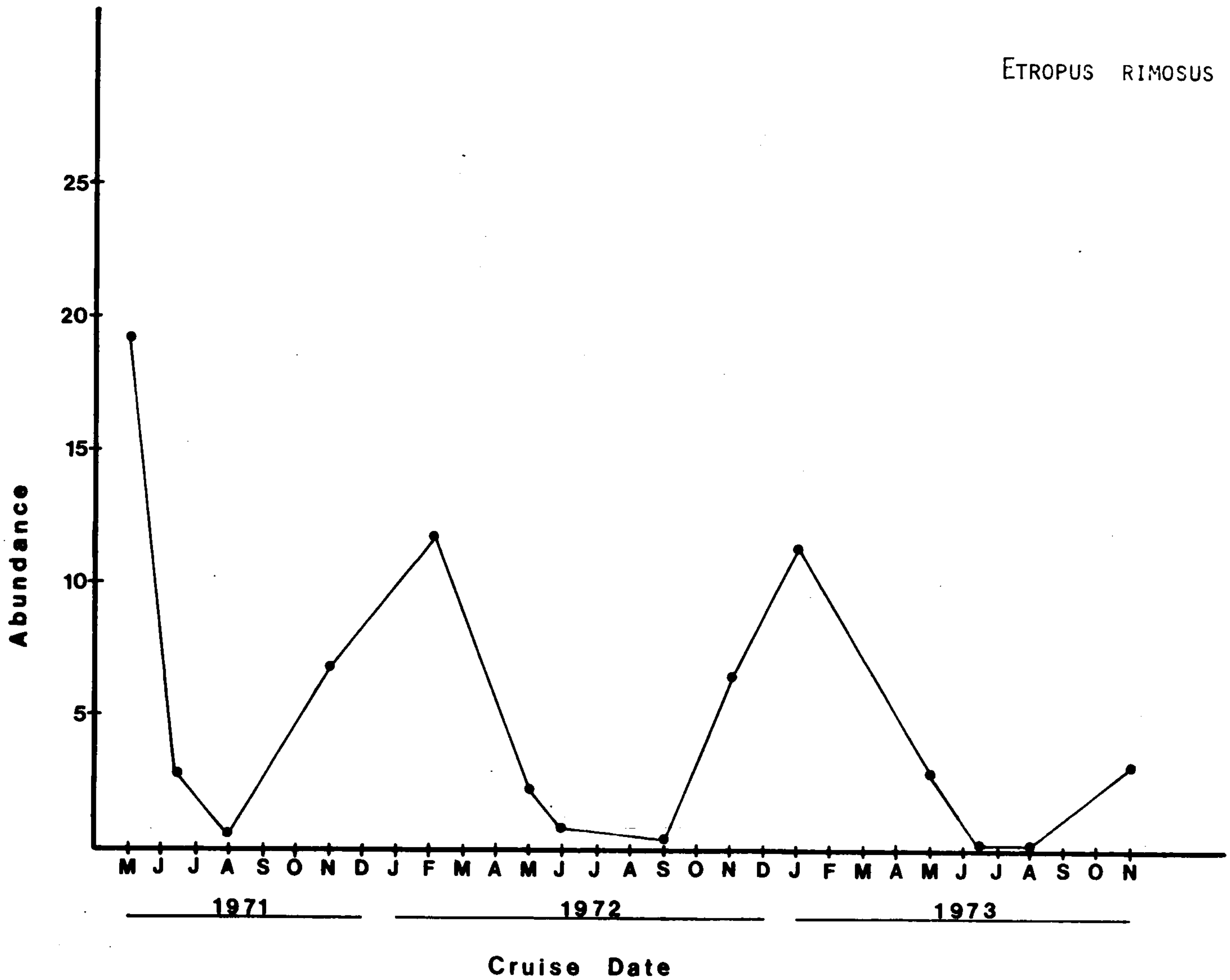



Fig. 142 Estimated mean abundances (number under 10 $m^2$ of sea surface) of <u>Etropus rimosus</u> larvae in the eastern Gulf of Mexico, 1971-1974.

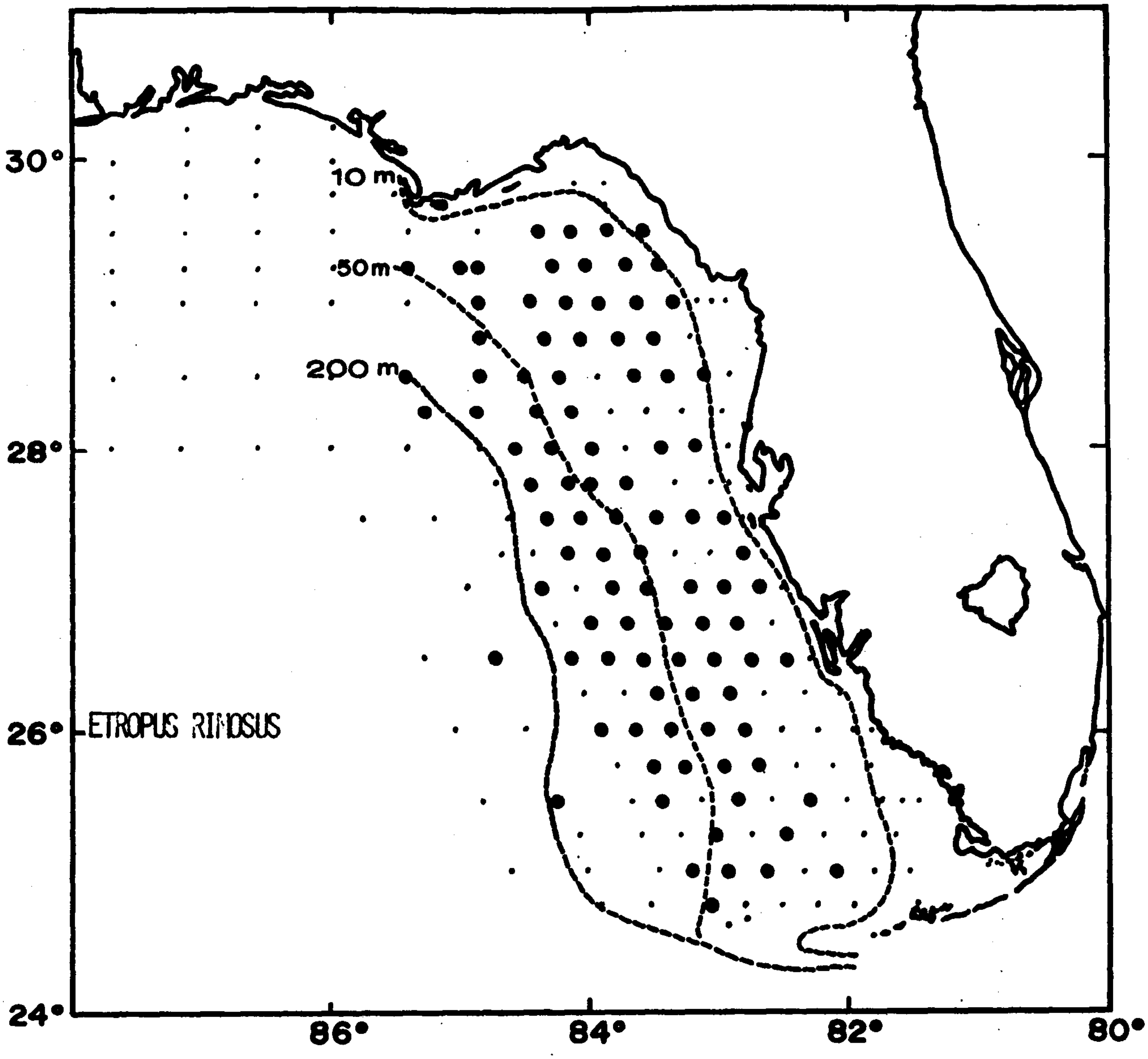



Fig. 143 Stations at which <u>Etropus</u> <u>rimosus</u> larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

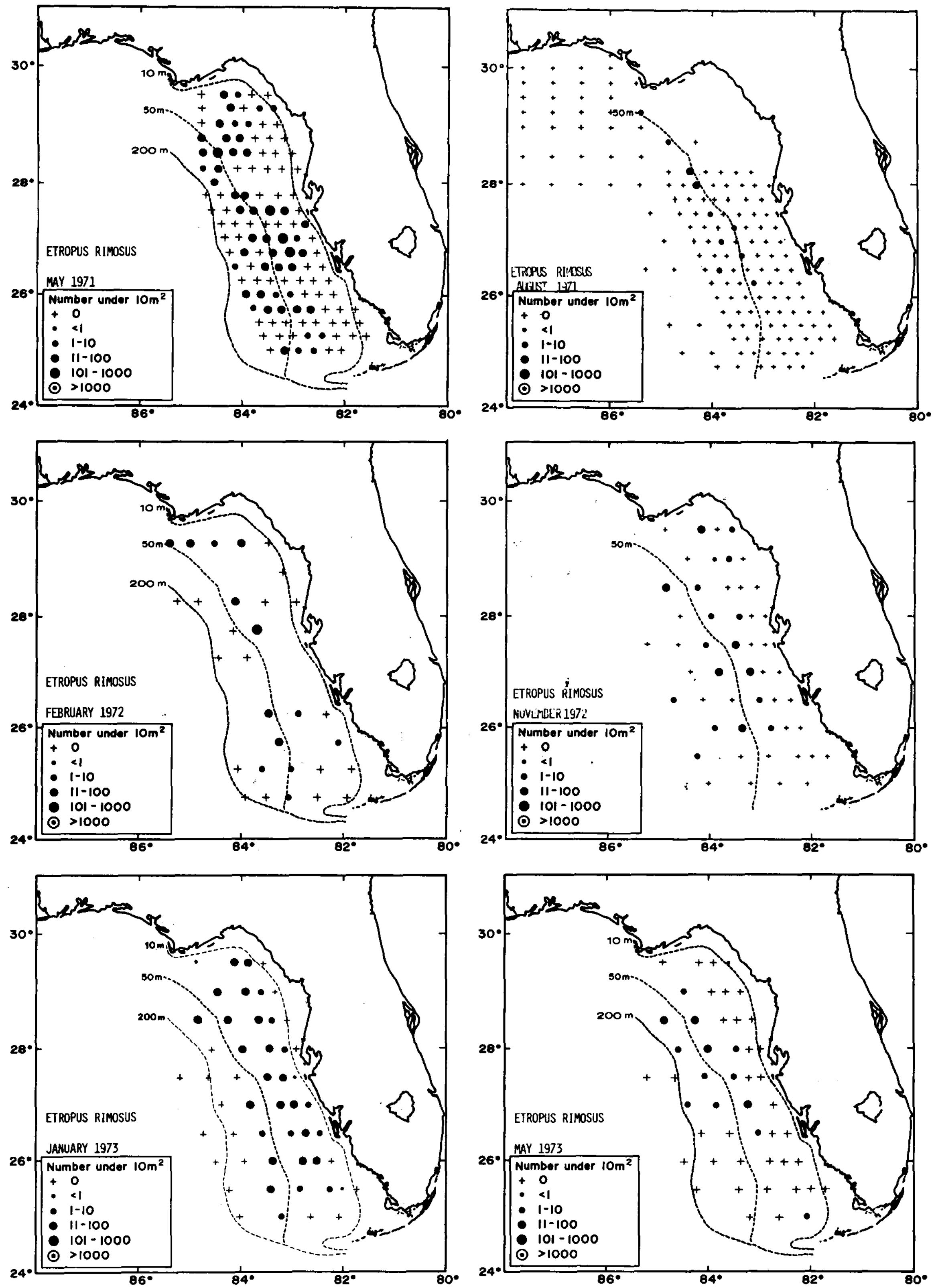



Fig. 144 Distribution and abundance of Etropus rimosus larvae in the eastern Gulf of Mexico, 1971-1974.

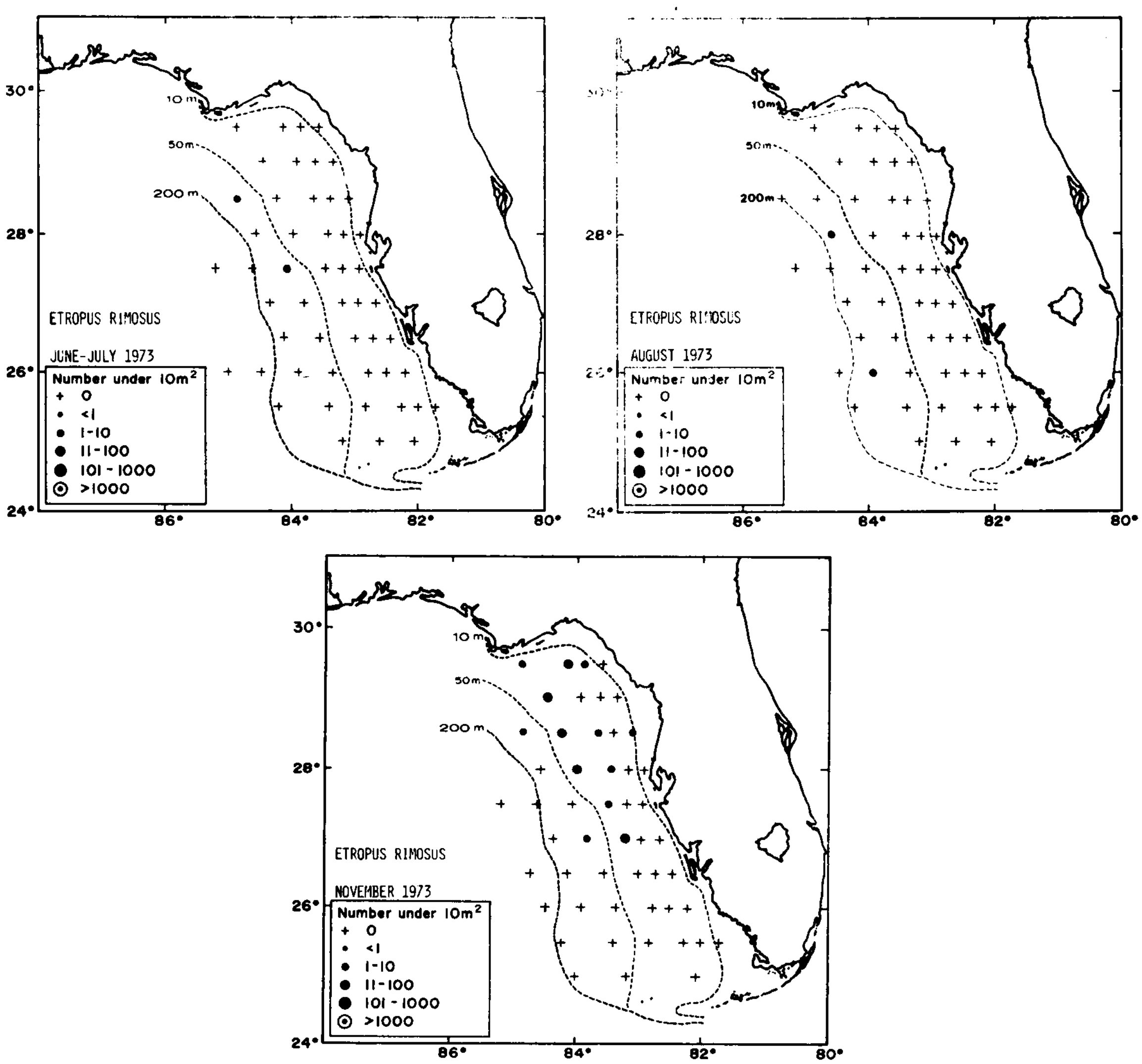

ETROPUS RIMOSUS
JUNE-JULY 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°
ETROPUS RIMOSUS
AUGUST 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000
ETROPUS RIMOSUS
NOVEMBER 1973
Number under 10m²
0
<1
1-10
11-100
101-1000
>1000

Fig. 144 Cont.

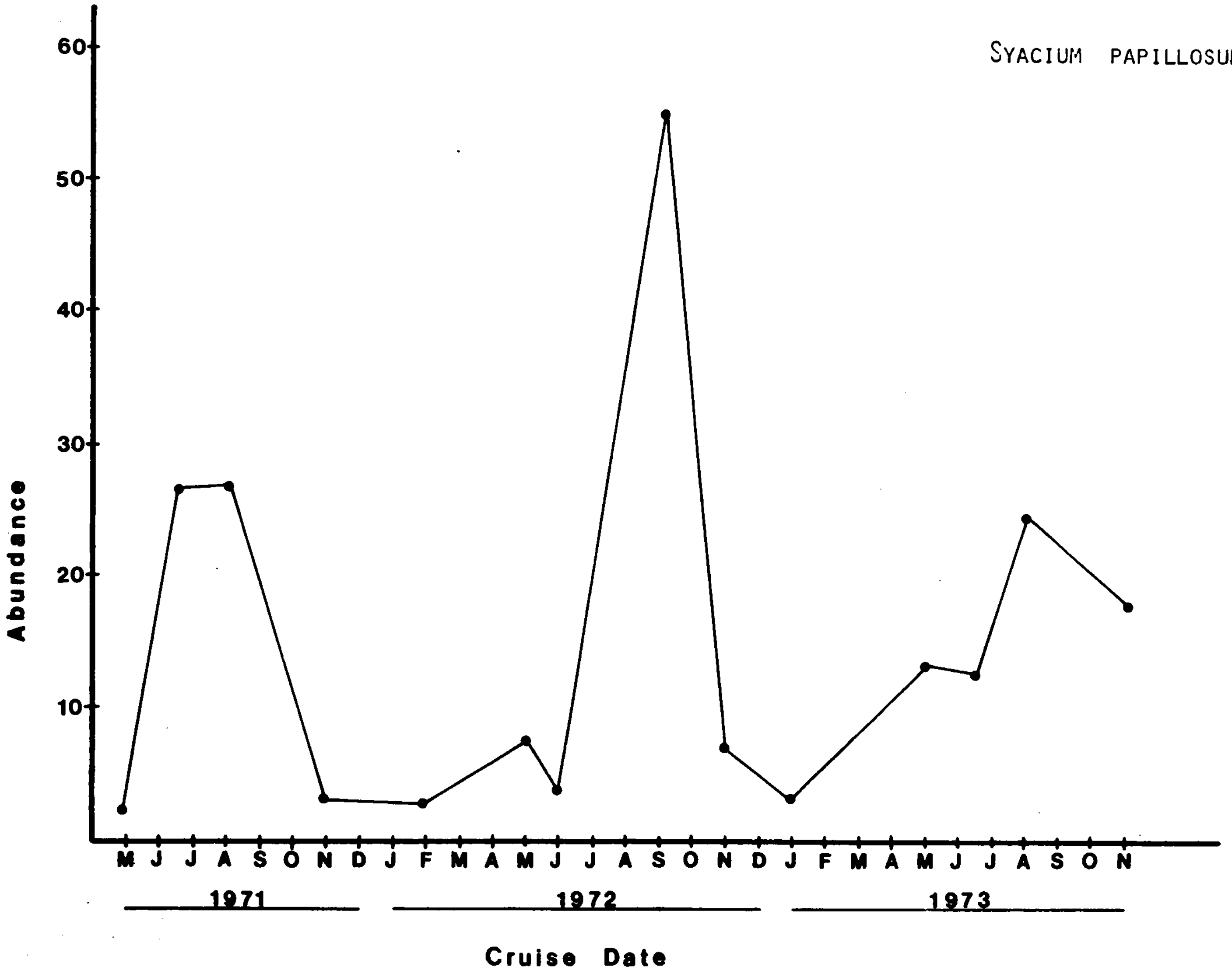



Fig. 145 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Syacium papillosum larvae in the eastern Gulf of Mexico, 1971-1974.

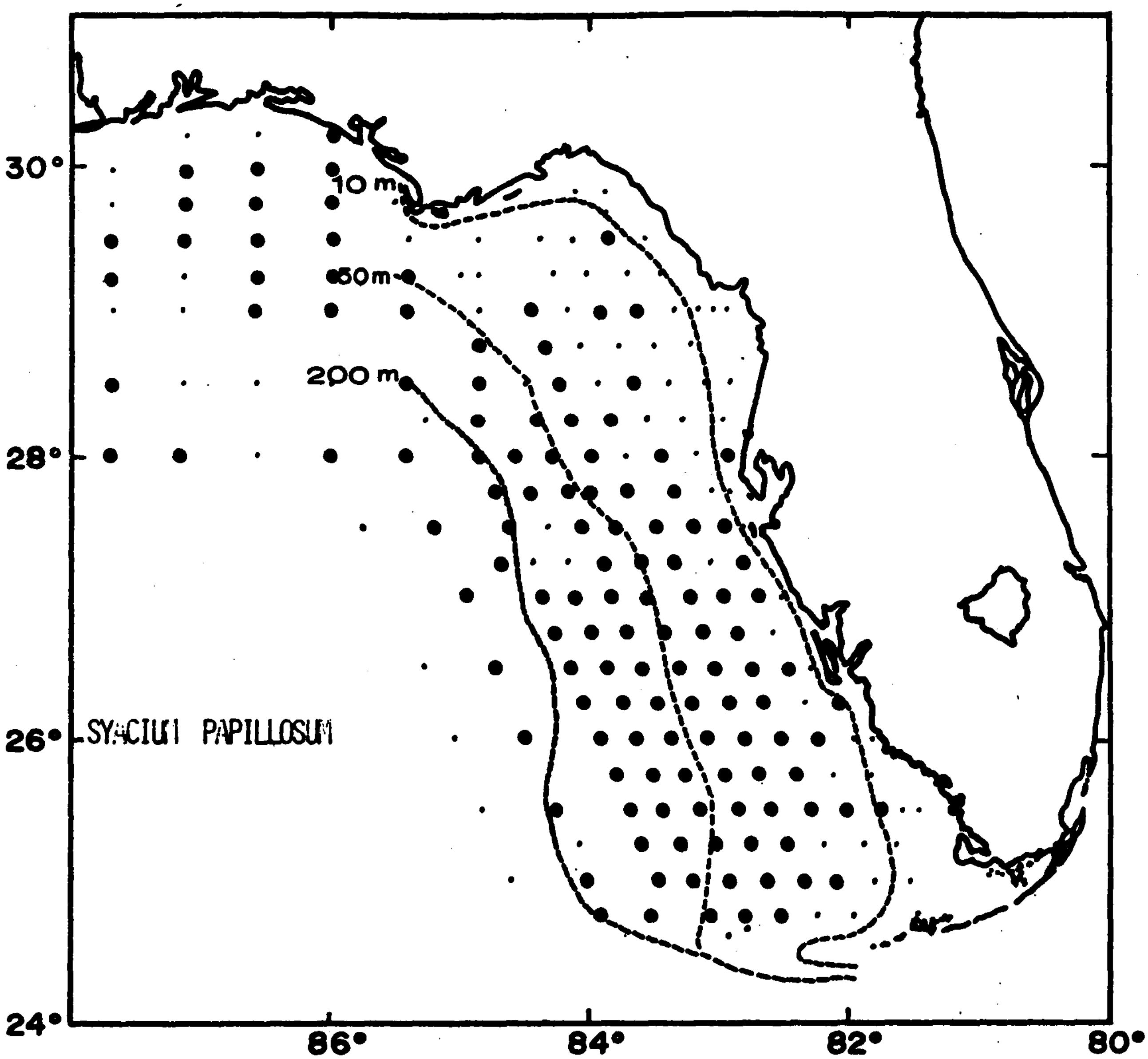



Fig. 146 Stations at which Syacium papillosum larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

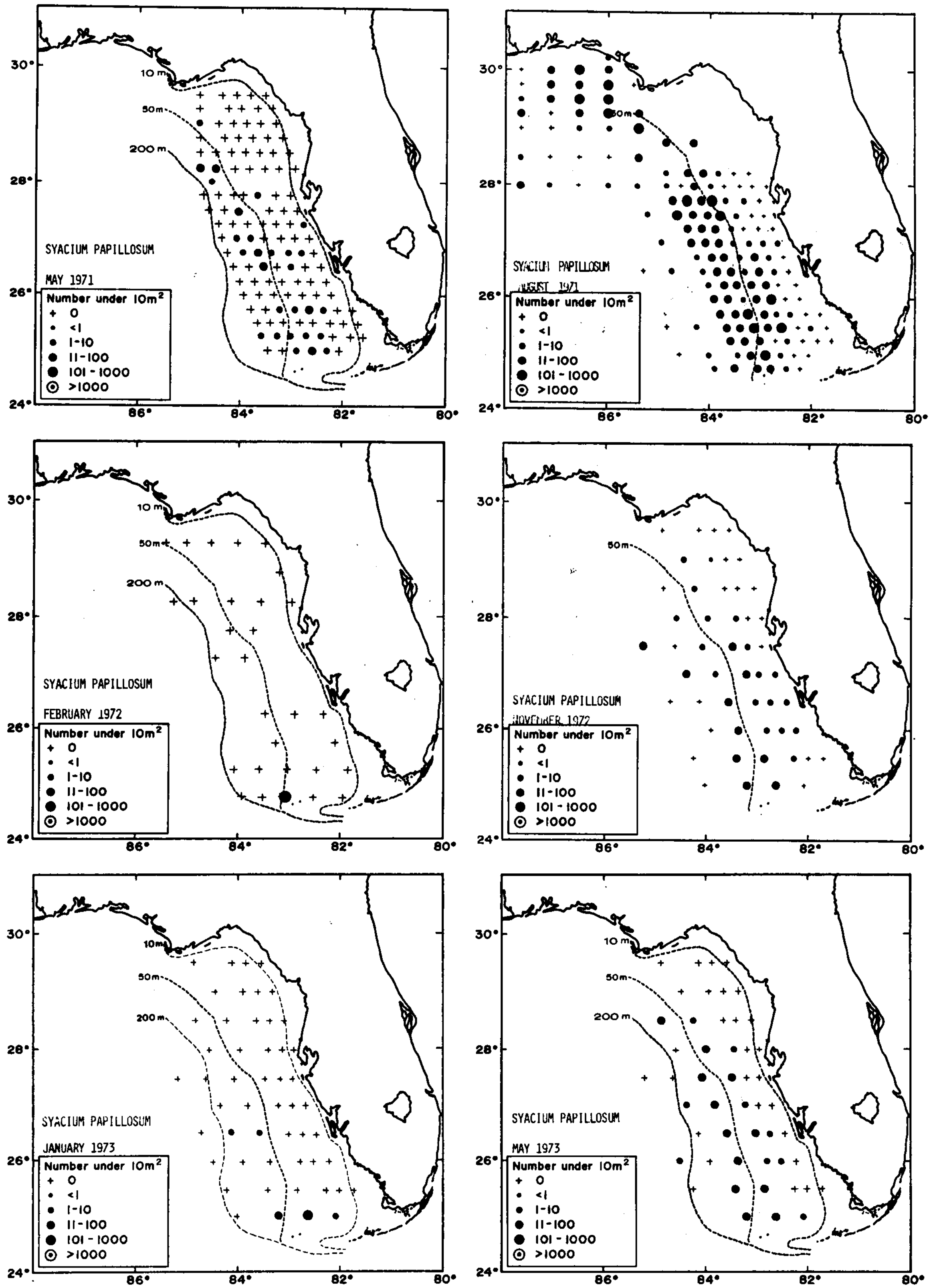



Fig. 147 Distribution and abundance of *Syacium papillosum* larvae in the eastern Gulf of Mexico, 1971-1974.

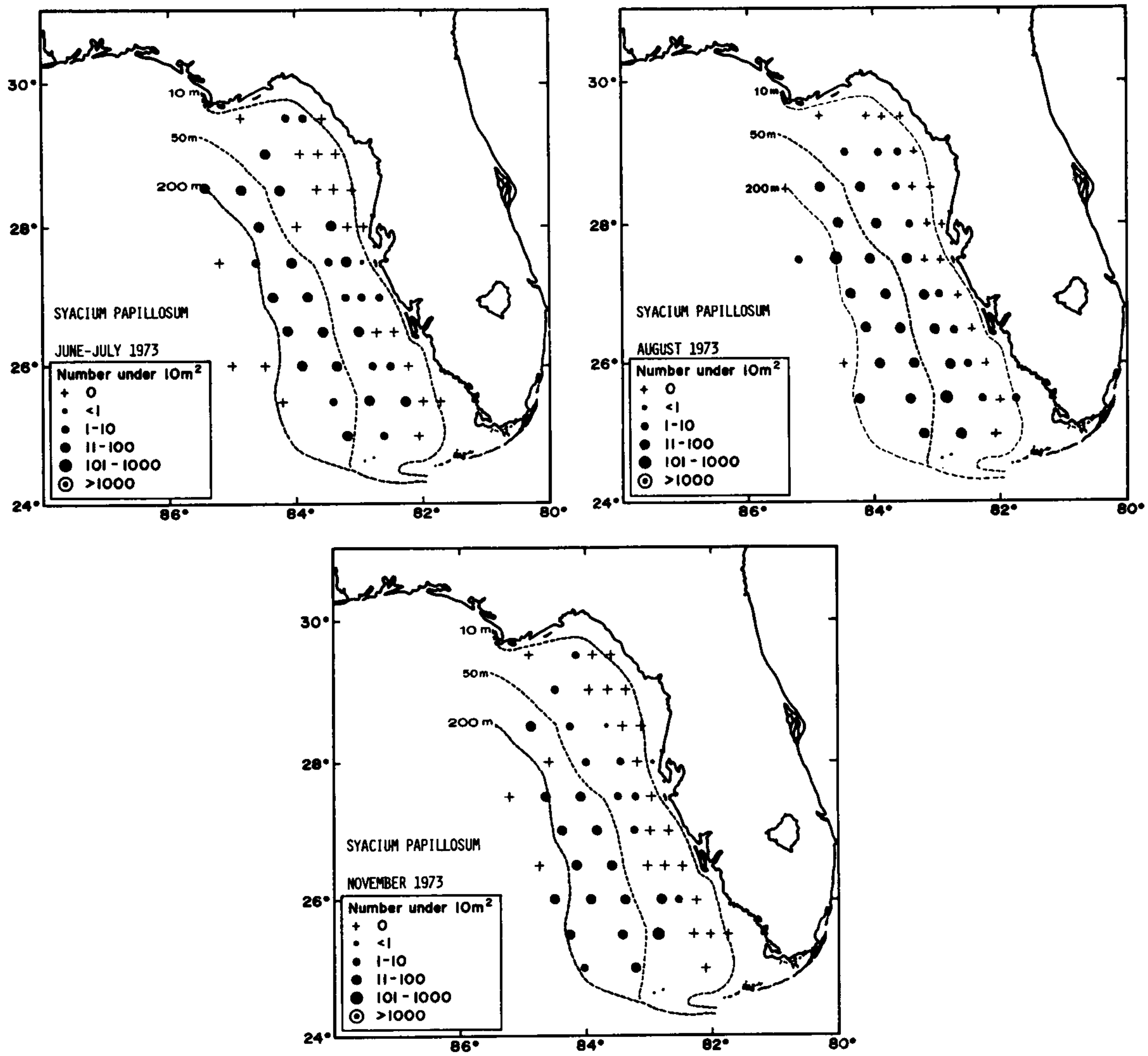

SYACIUM PAPILLOSUM
JUNE-JULY 1973
AUGUST 1973
NOVEMBER 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
◎ >1000
10 m
50 m
200 m
30°
28°
26°
24°
86°
84°
82°
80°

Fig. 147 Cont.

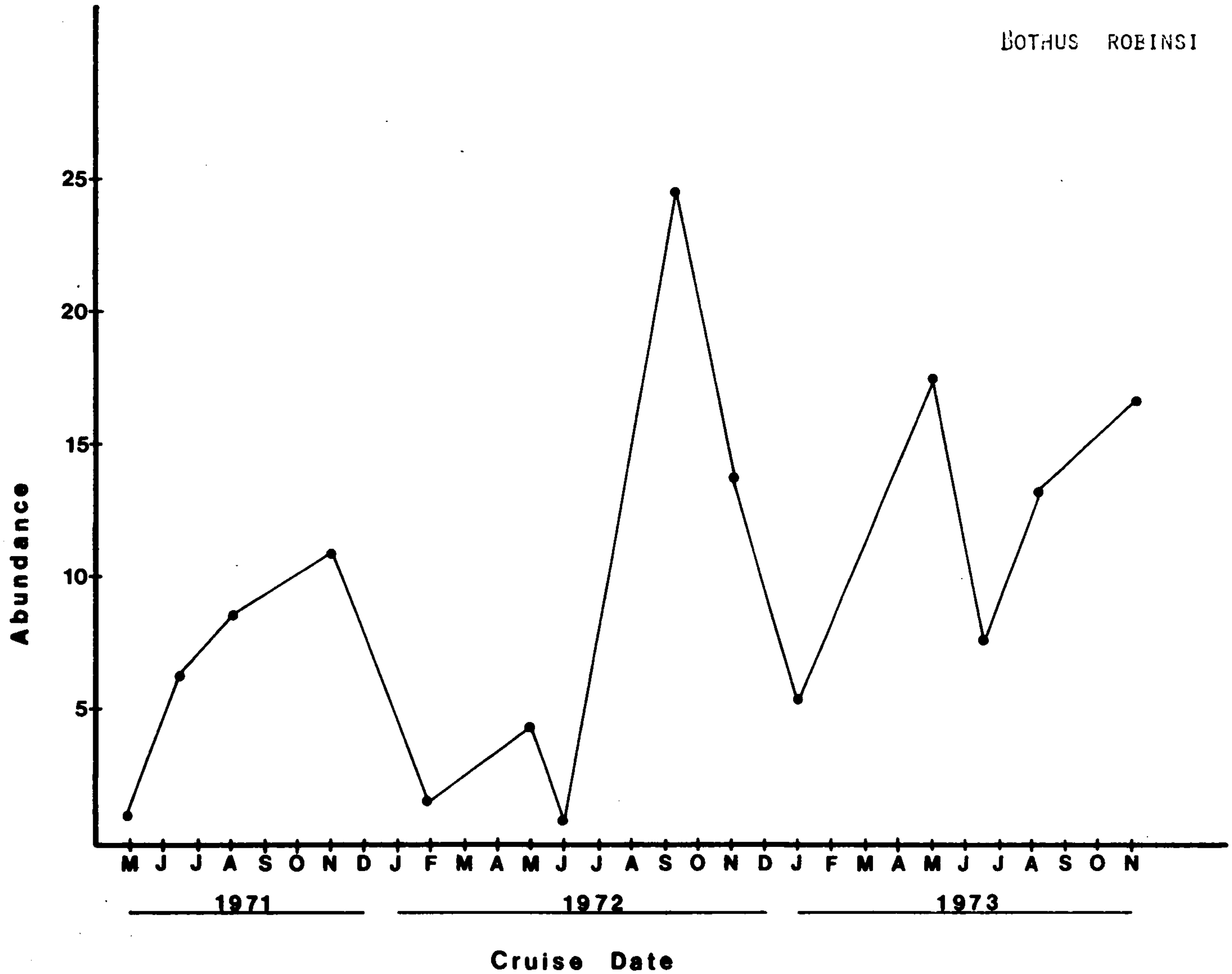



Fig. 148 Estimated mean abundances (number under 10 $m^2$ of sea surface) of Bothus robinsi larvae in the eastern Gulf of Mexico, 1971-1974.

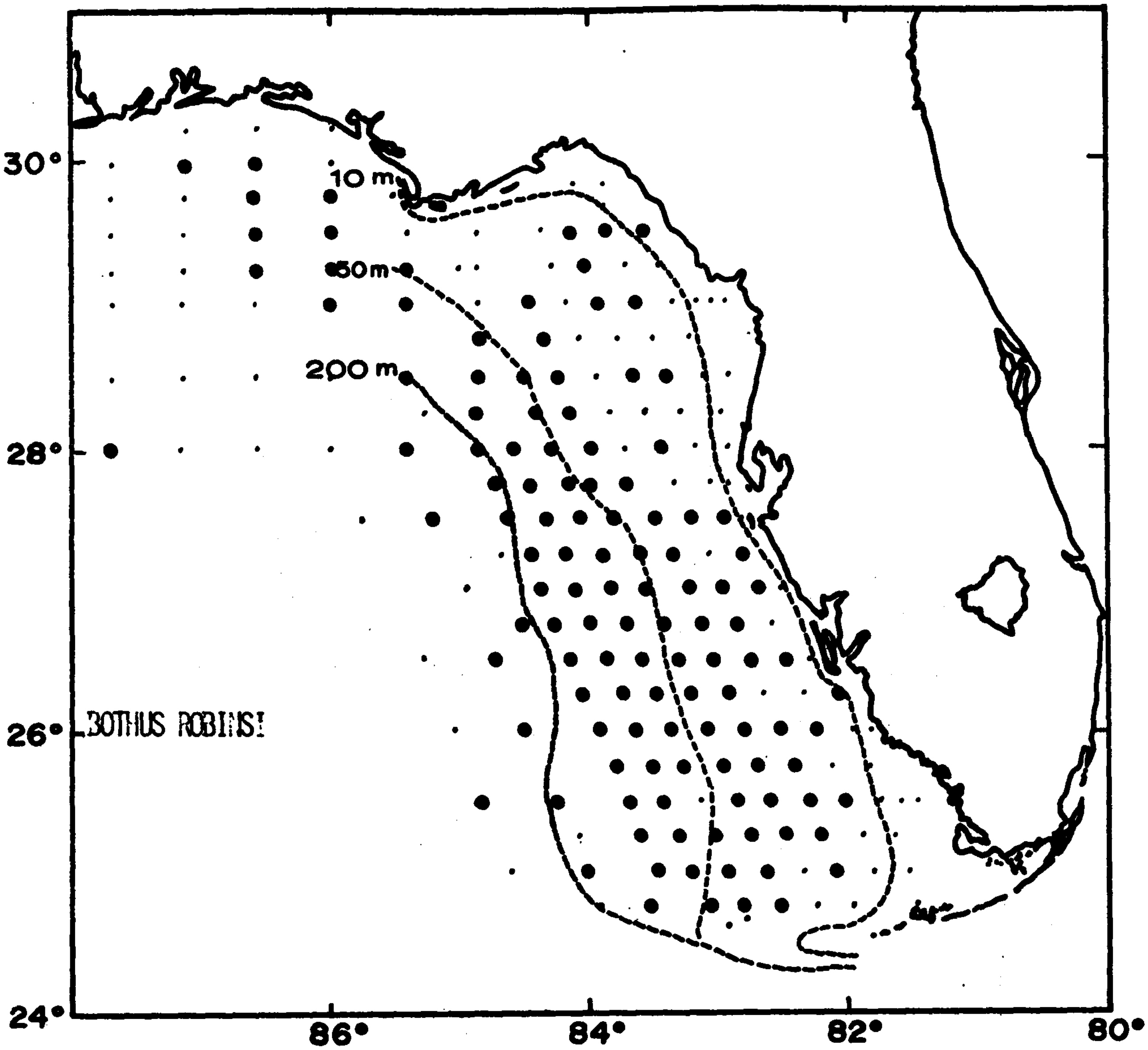



Fig. 149 Stations at which Bothus robinsi larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

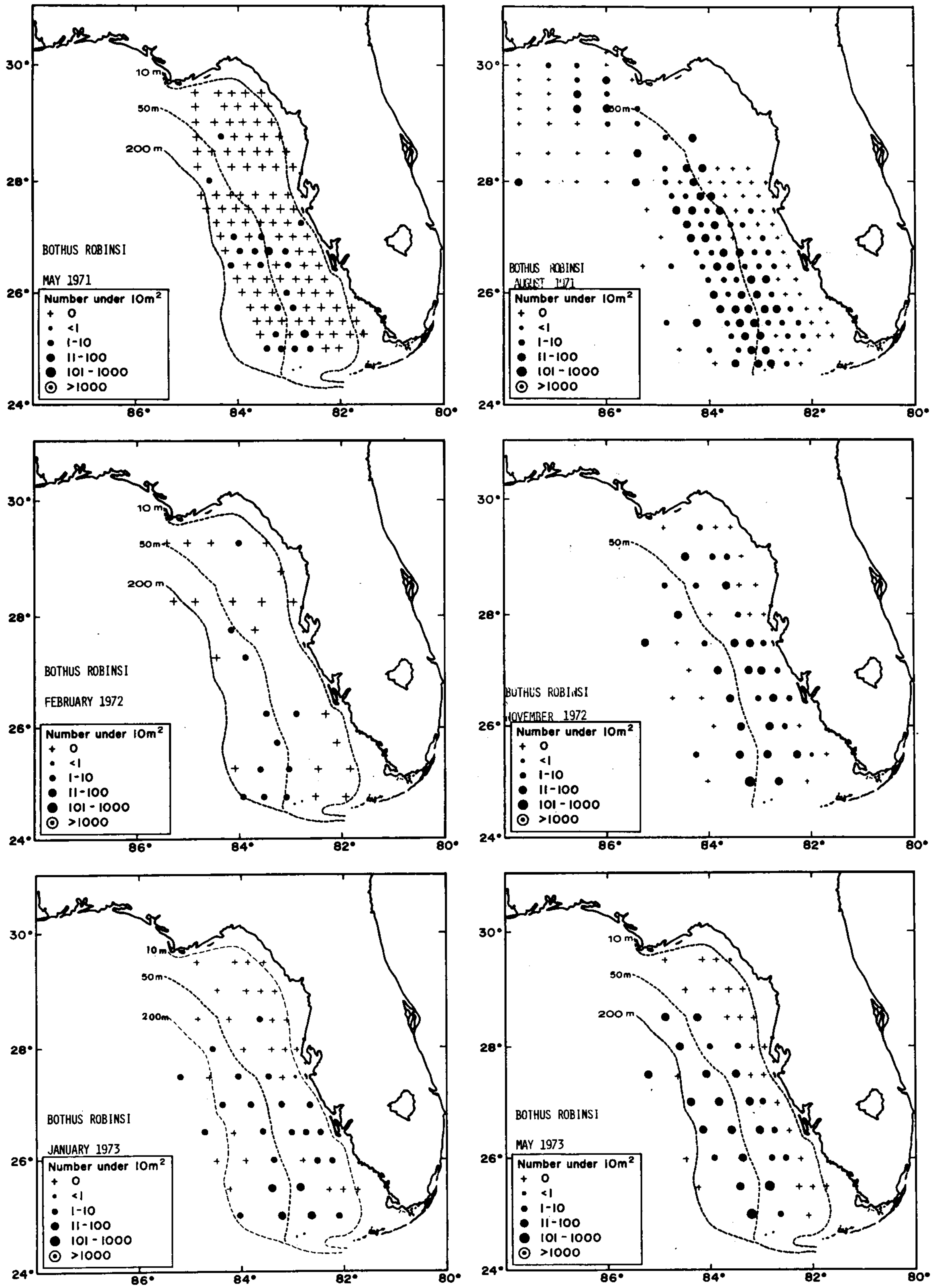



Fig. 150 Distribution and abundance of Bothus robinsi larvae in the eastern Gulf of Mexico, 1971-1974.

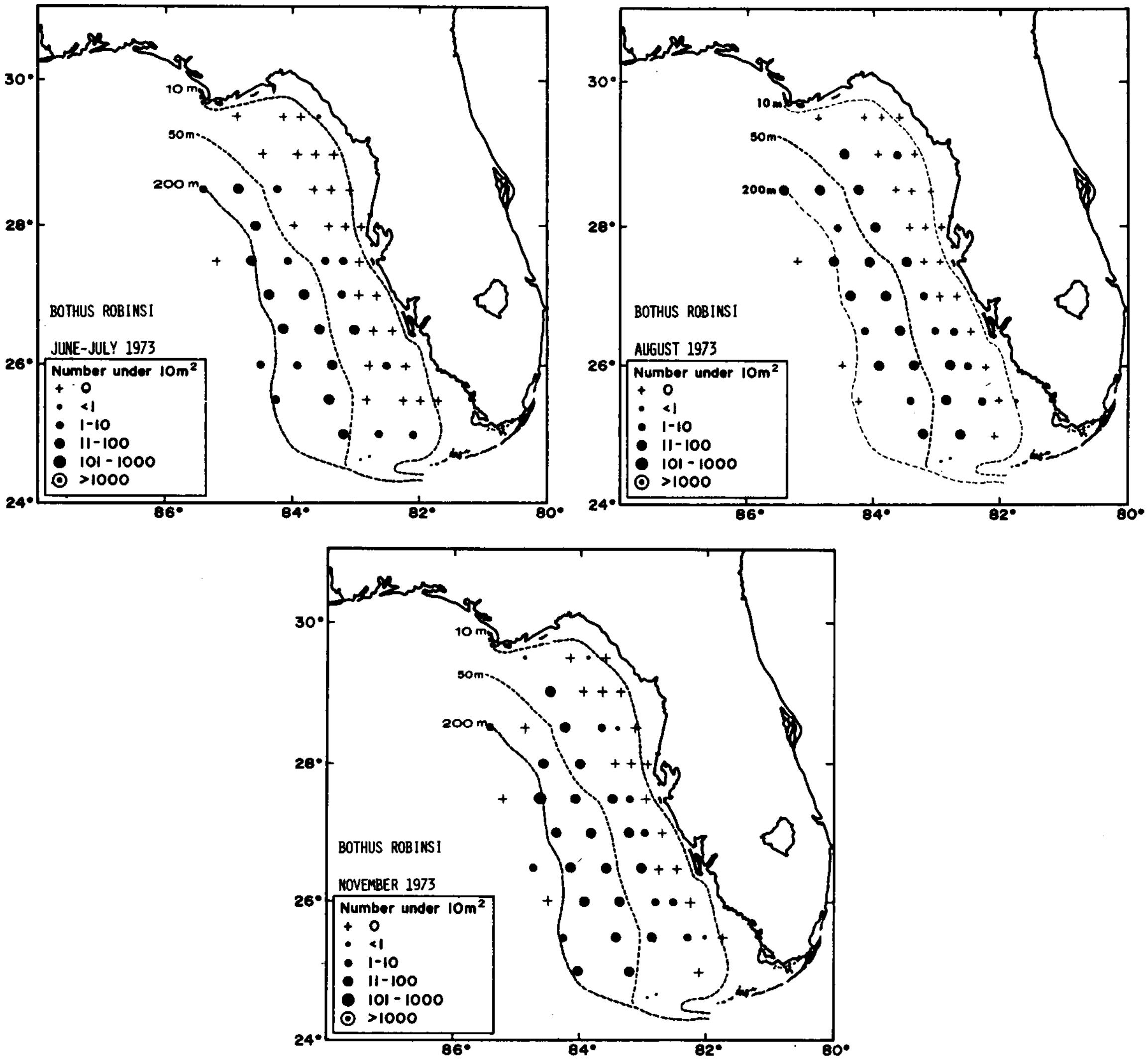

BOTHUS ROBINSI
JUNE-JULY 1973
Number under 10m²
+ 0
• <1
• 1-10
● 11-100
● 101-1000
⊙ >1000
10 m
50m
200 m
30°
28°
26°
24°
86°
84°
82°
80°
BOTHUS ROBINSI
AUGUST 1973
BOTHUS ROBINSI
NOVEMBER 1973

Fig. 150 Cont.

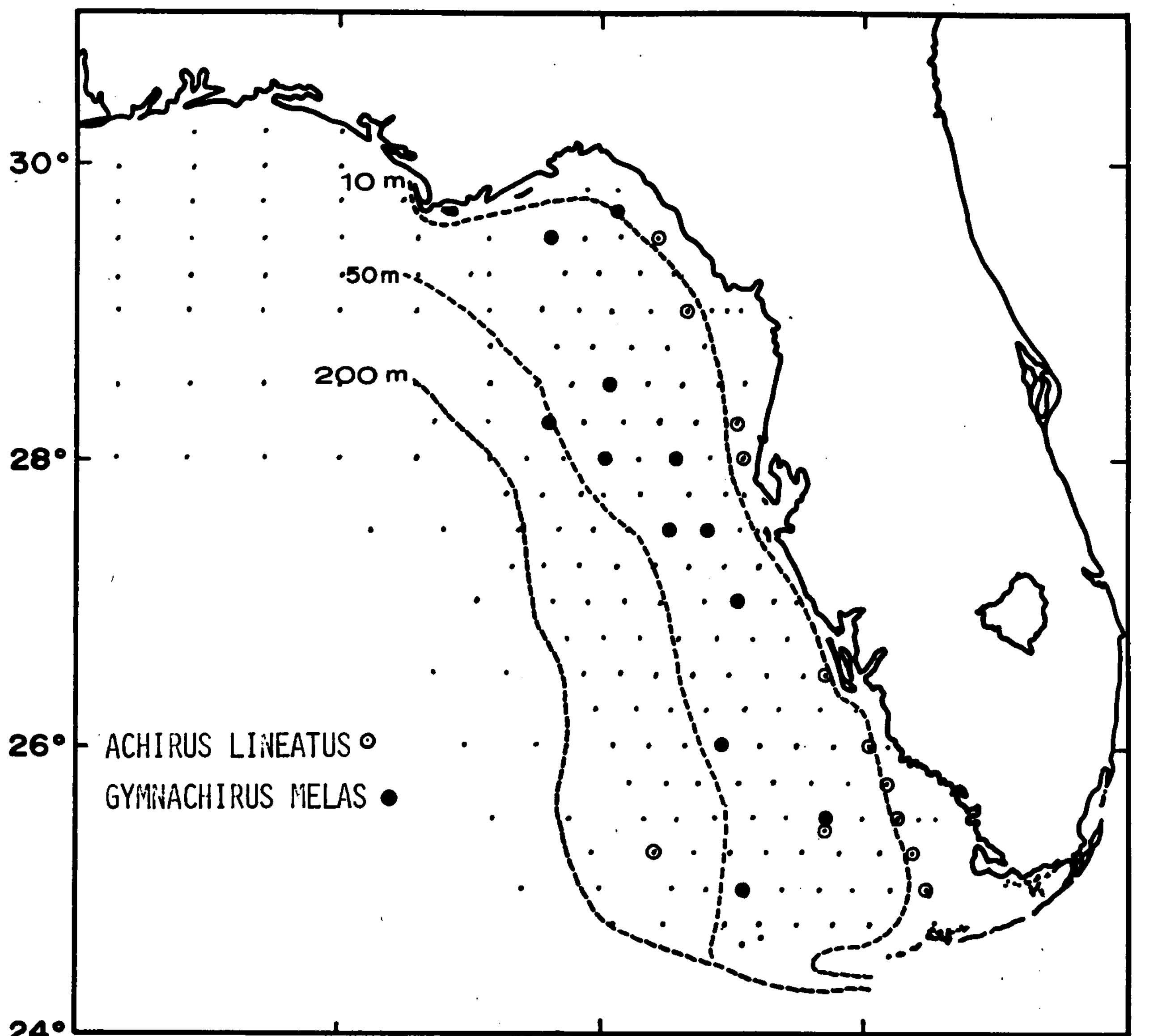



Fig 151 Stations at which Achirus lineatus and Gymnachirus melas larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

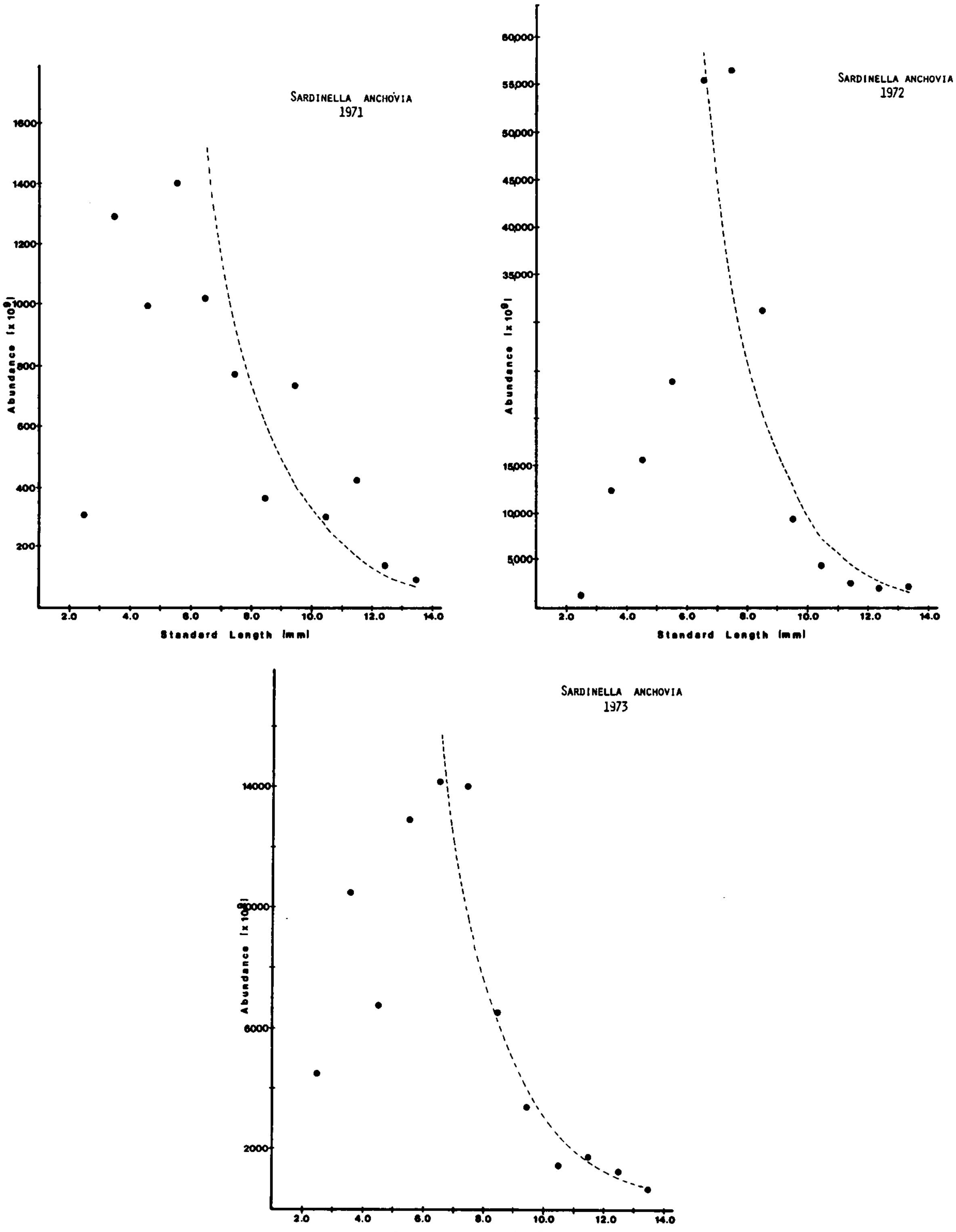



Fig. 152 Apparent mortality rates of *Sardinella anchovia* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

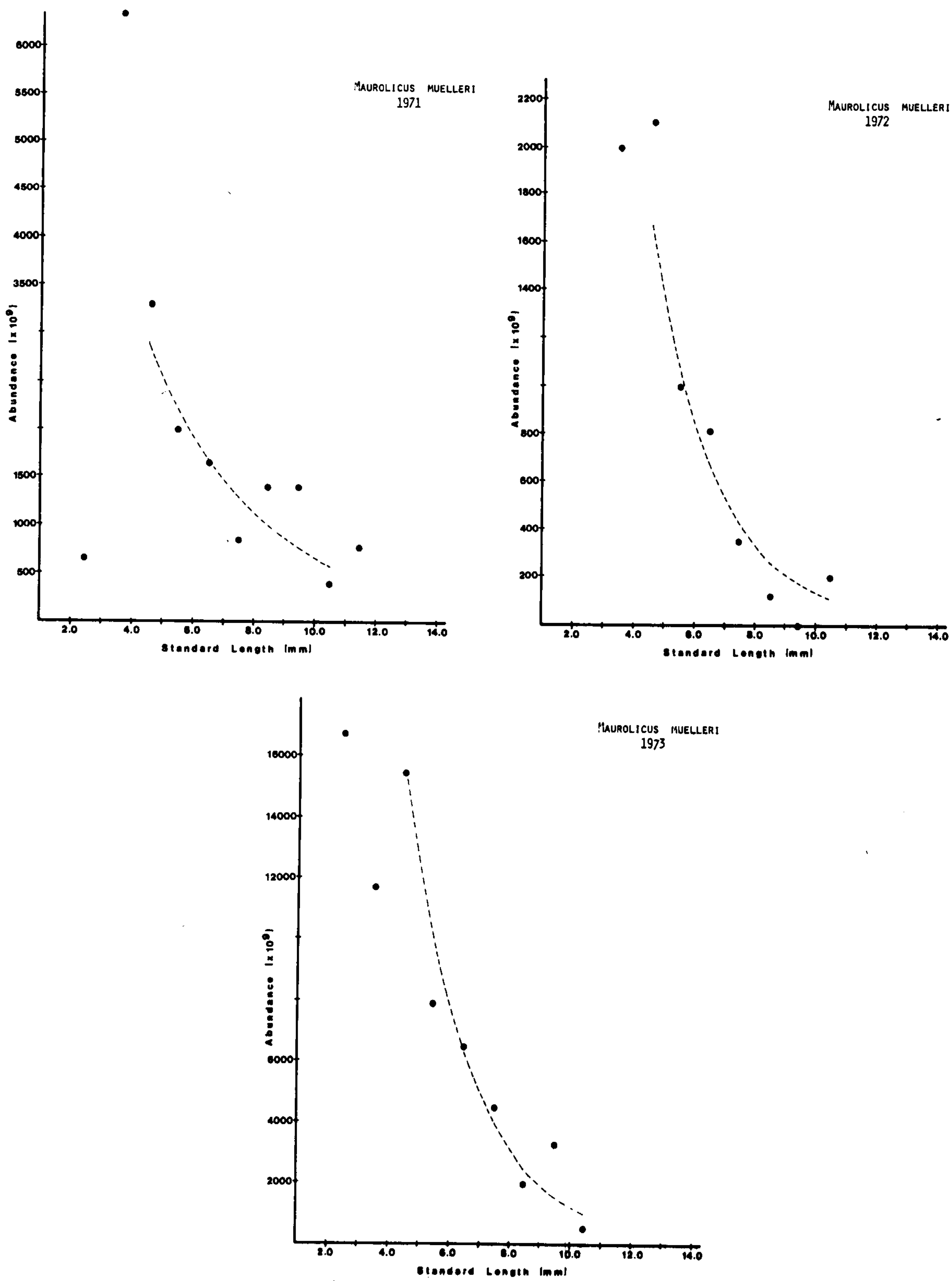



Fig. 153 Apparent mortality rates of Maurolicus muelleri larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

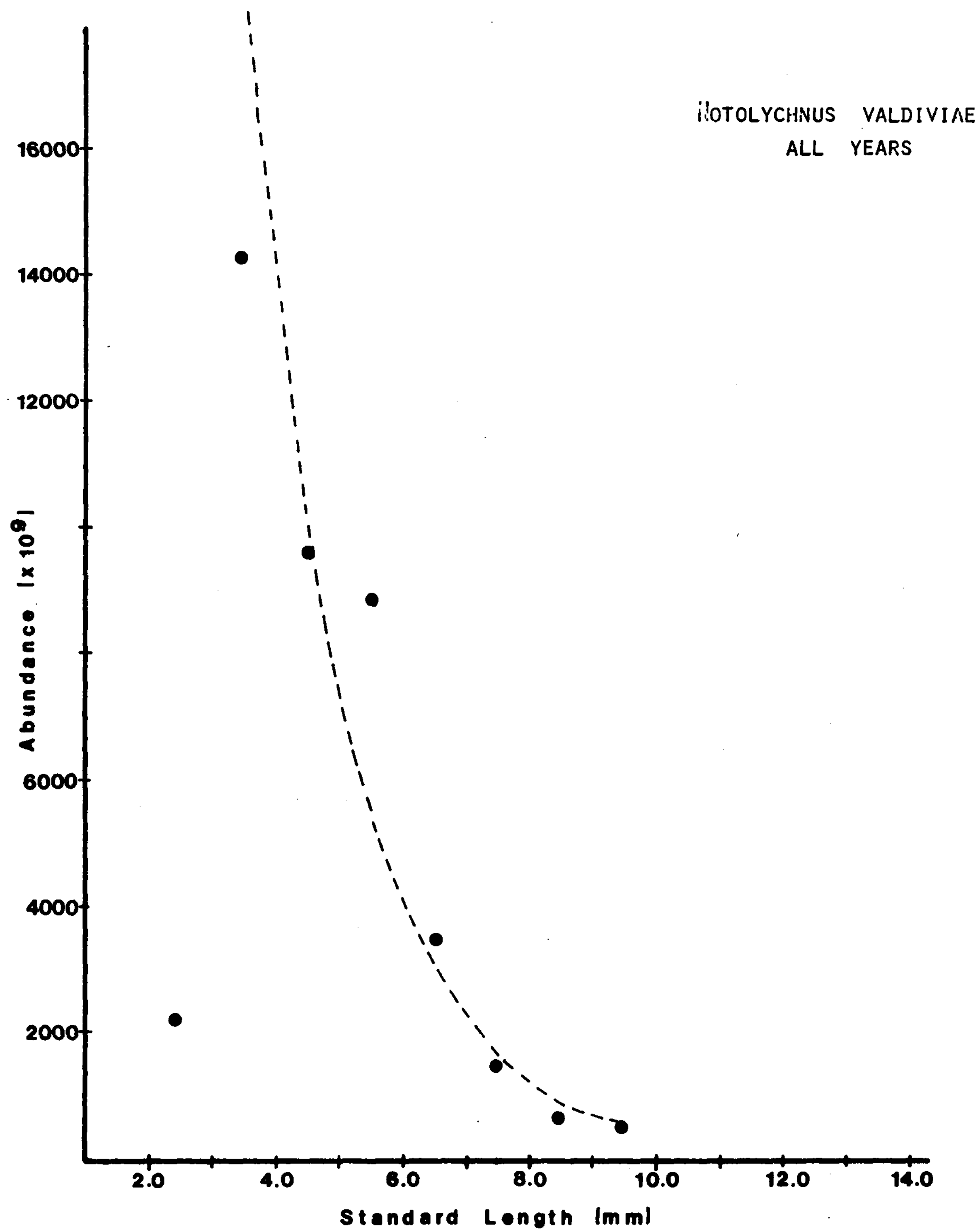



Fig. 154 Apparent mortality rate of Notolychnus valdiviae larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

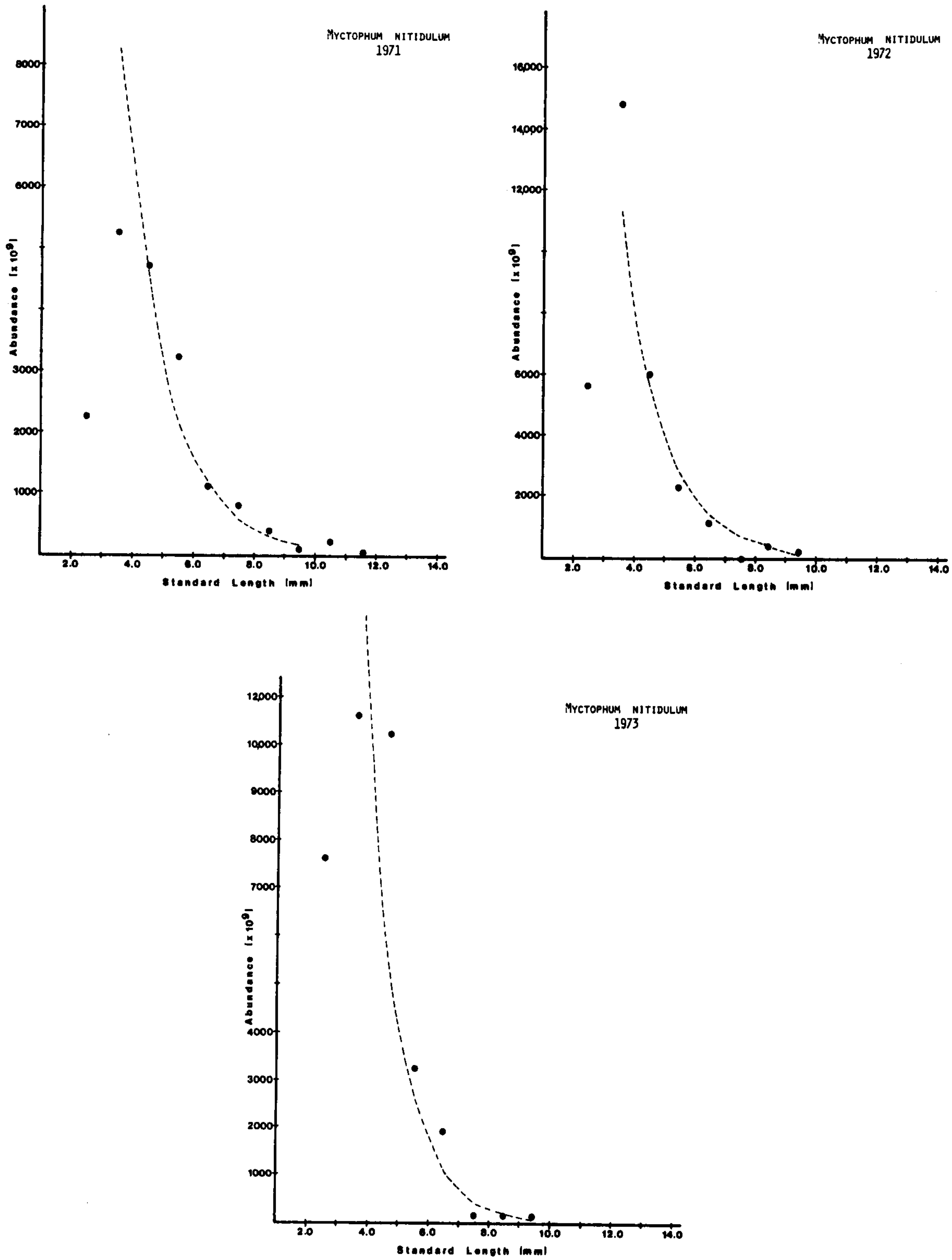



Fig. 155 Apparent mortality rates of Myctophum nitidulum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

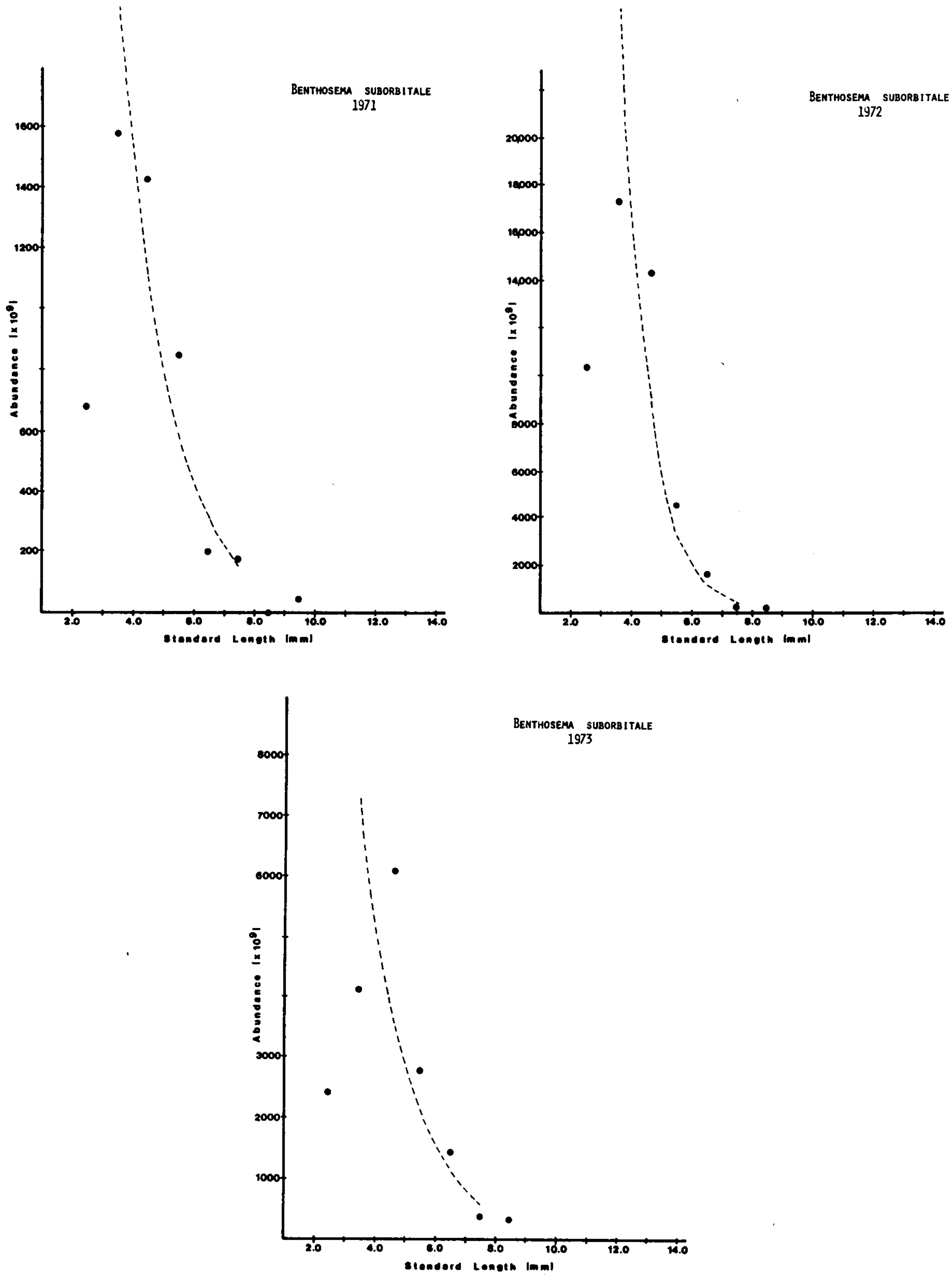



Fig. 156 Apparent mortality rates of Benthosema suborbitale larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

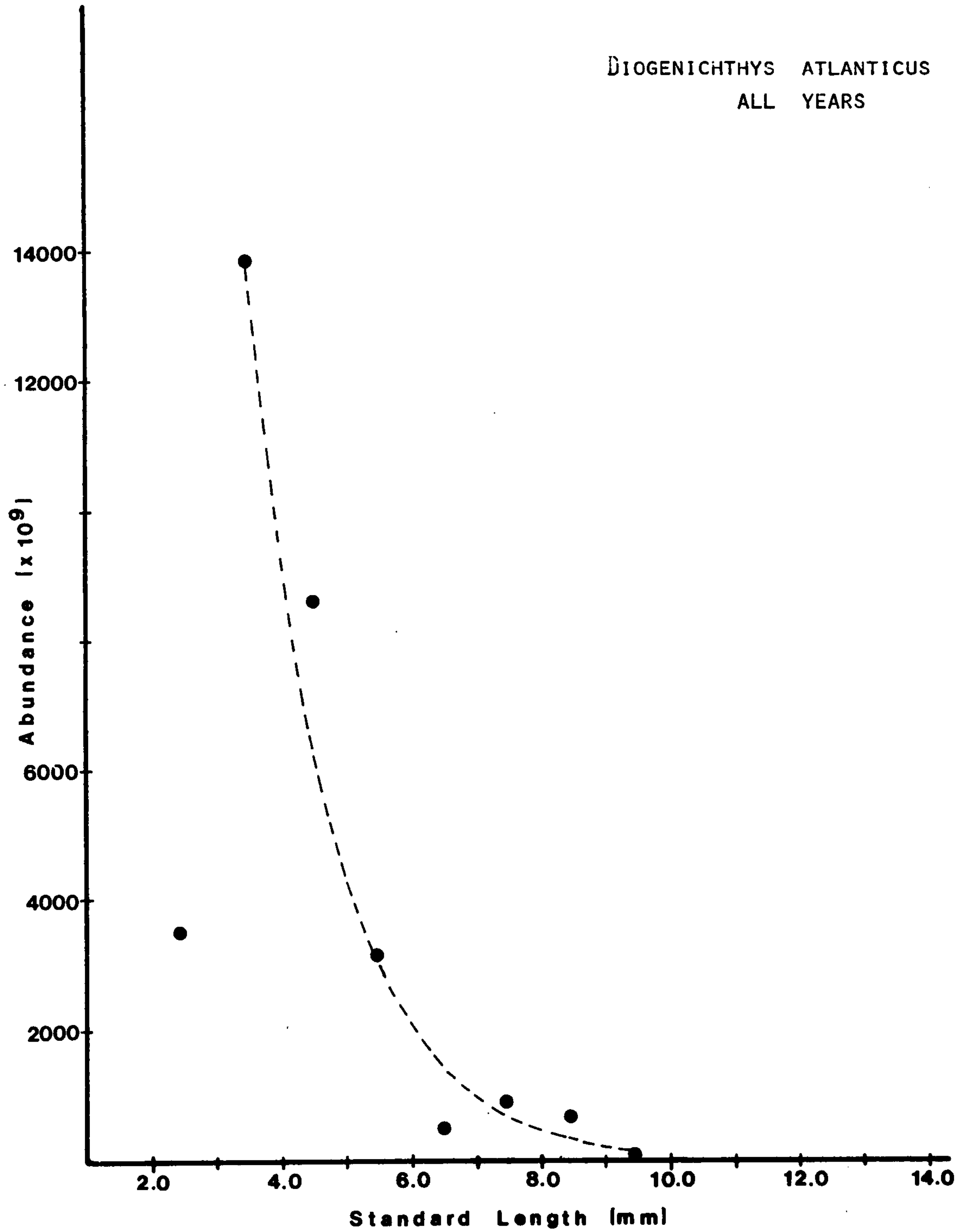



Fig. 157 Apparent mortality rate of <u>Diogenichthys atlanticus</u> larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

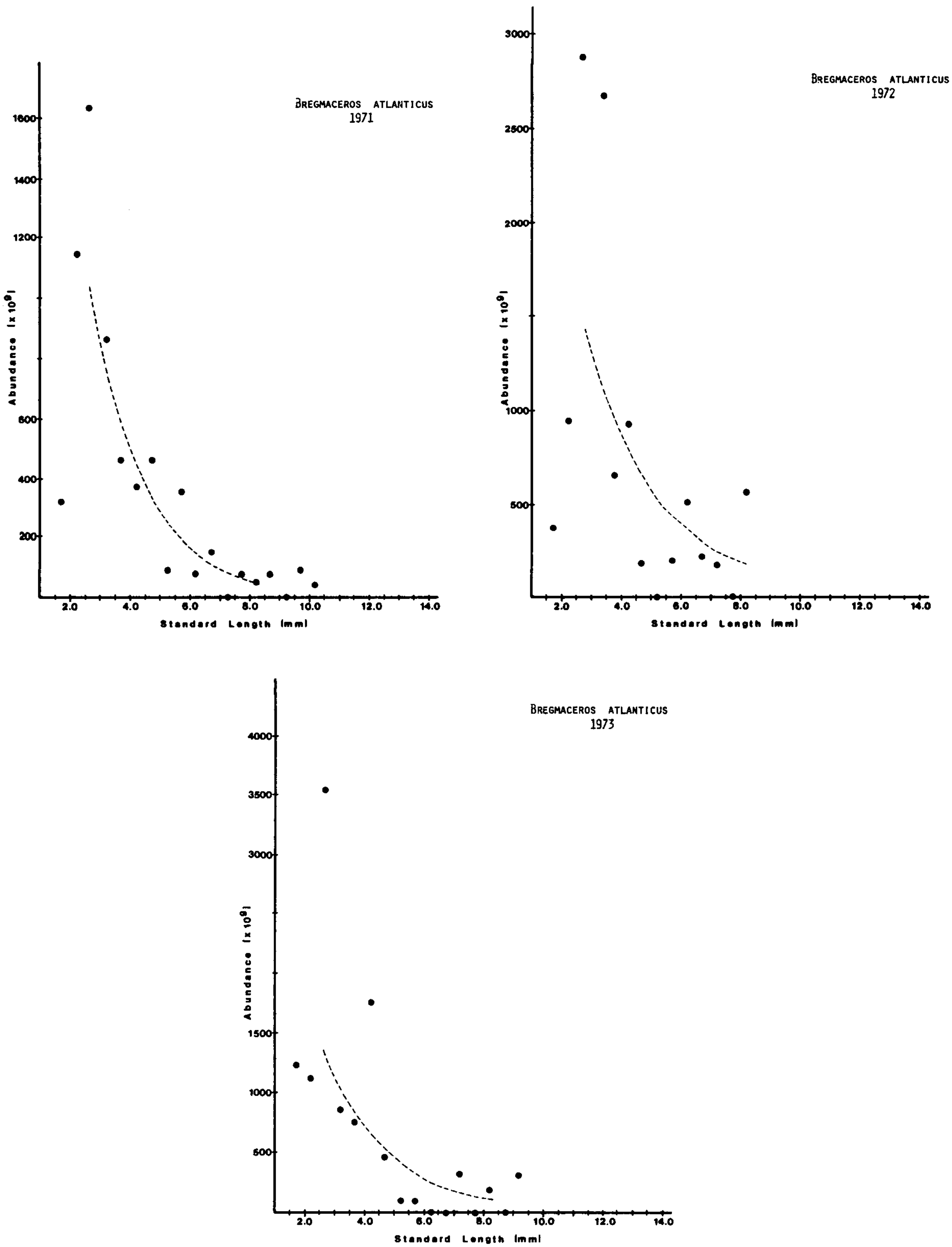



Fig. 158 Apparent mortality rates of Bregmaceros atlanticus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

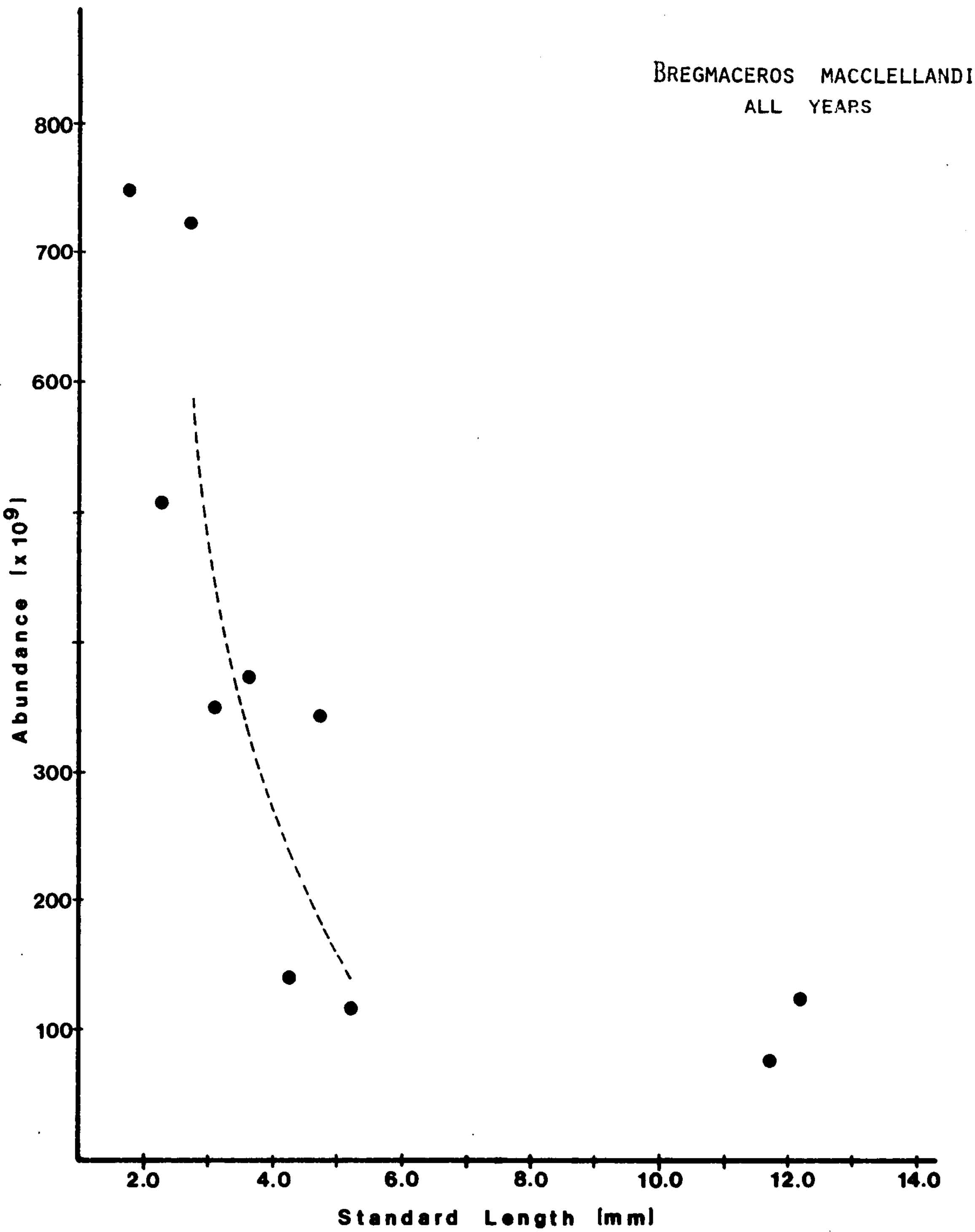



Fig. 159 Apparent mortality rate of Bregmaceros macclellandi larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

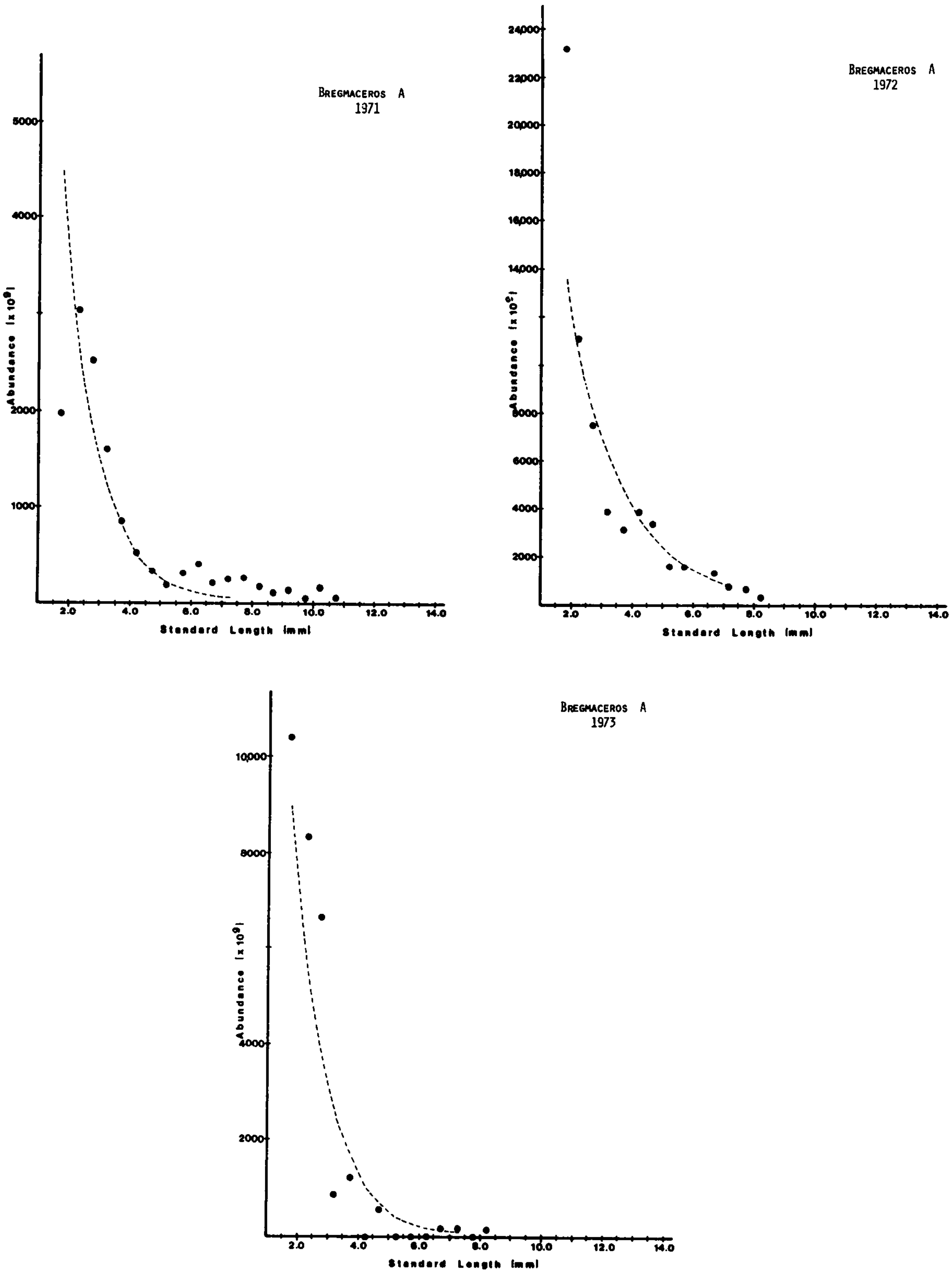



Fig. 160 Apparent morality rates of Bregmaceros Type A larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973

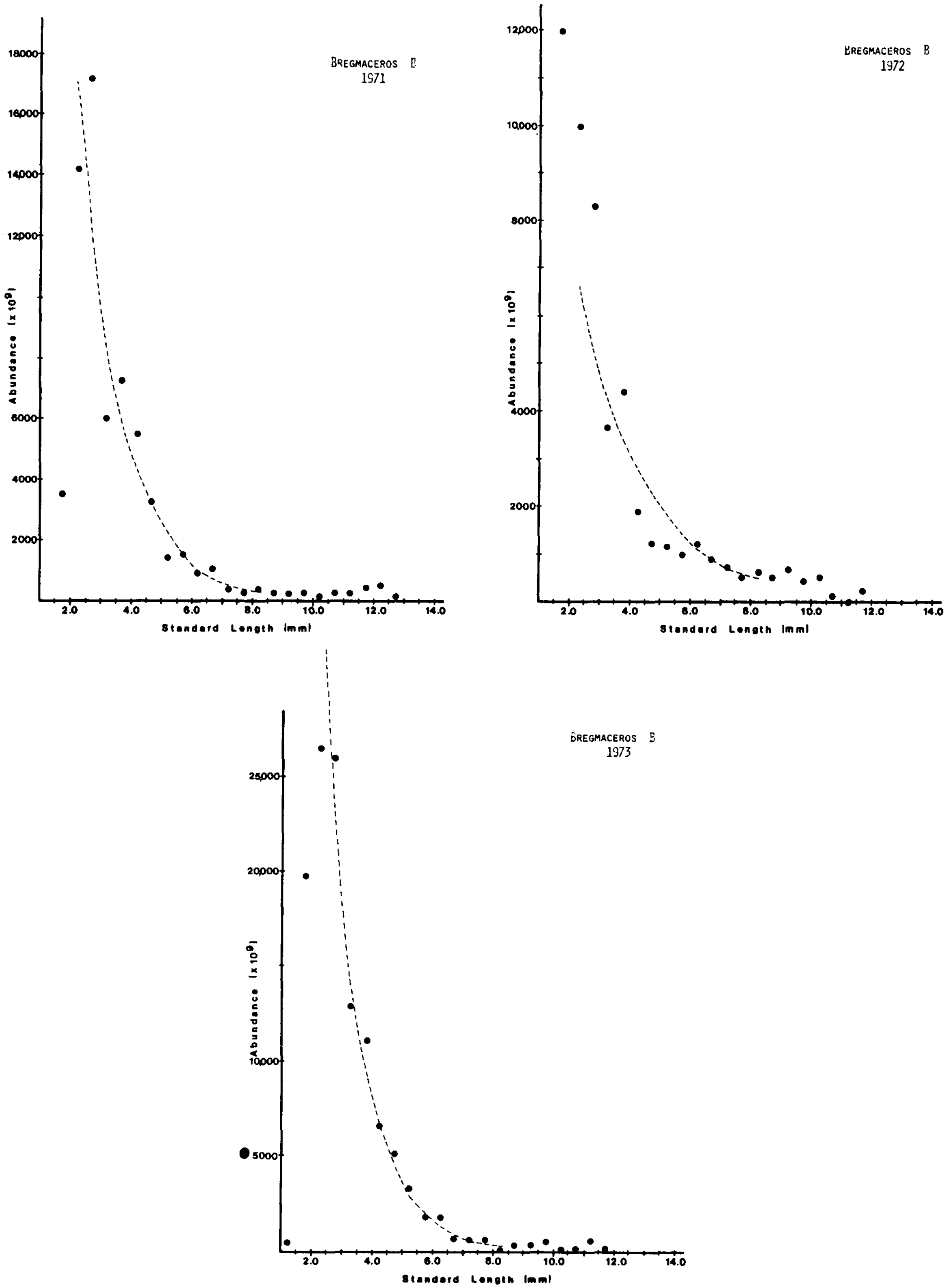



Fig. 161 Apparent mortality rates of Bregmaceros Type B larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

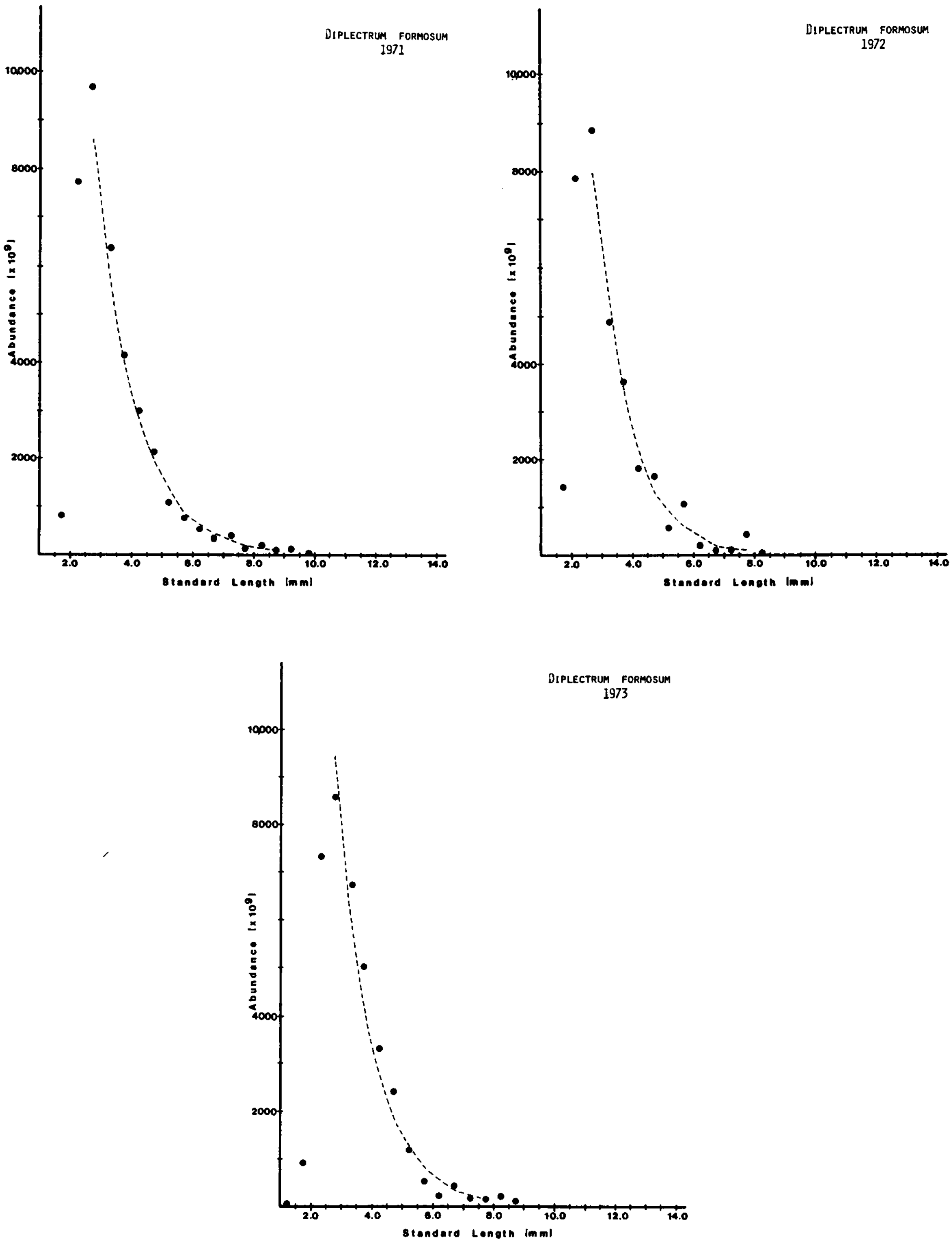



Fig. 162 Apparent mortality rates of Diplectrum formosum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

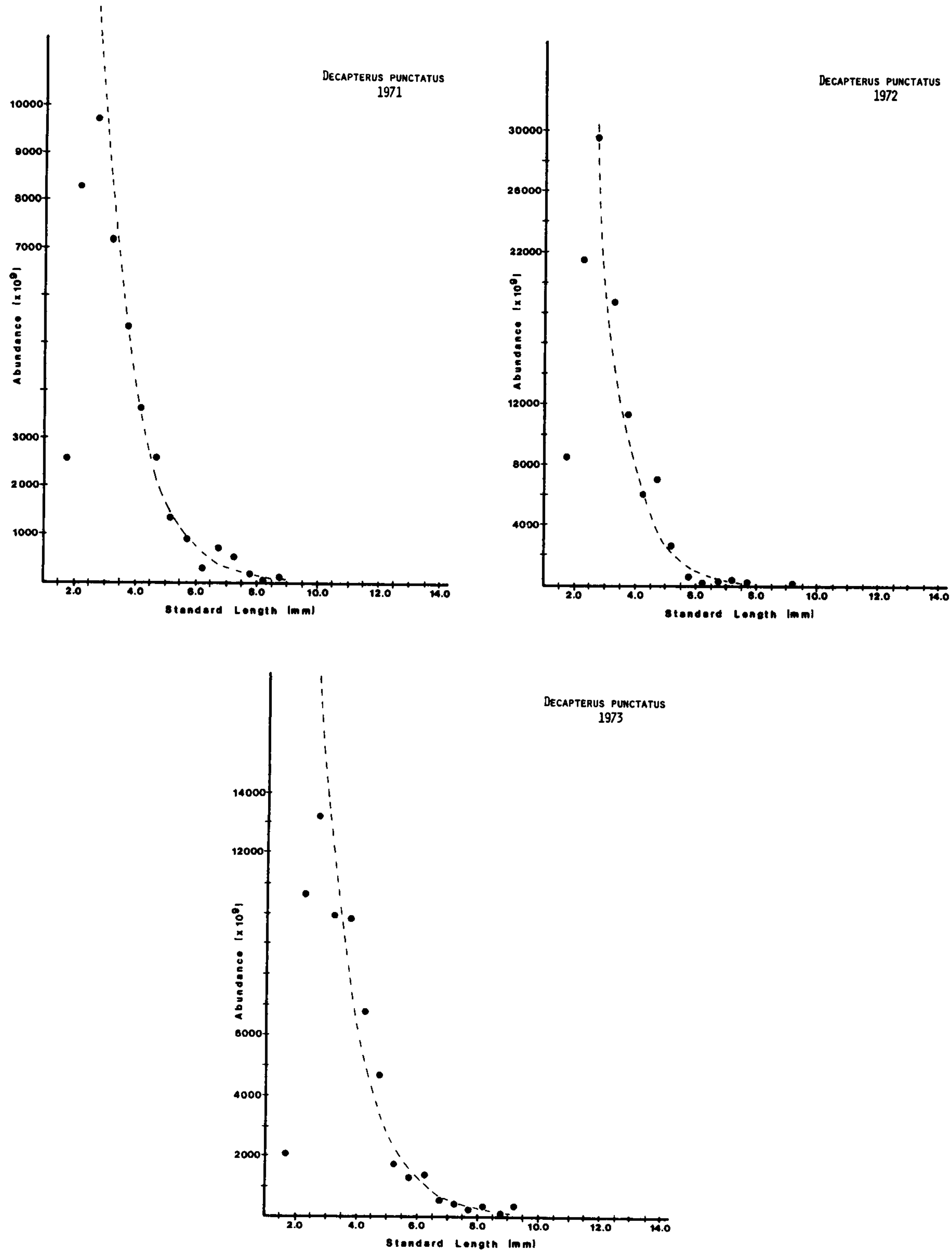



Fig. 163 Apparent mortality rates of *Decapterus punctatus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

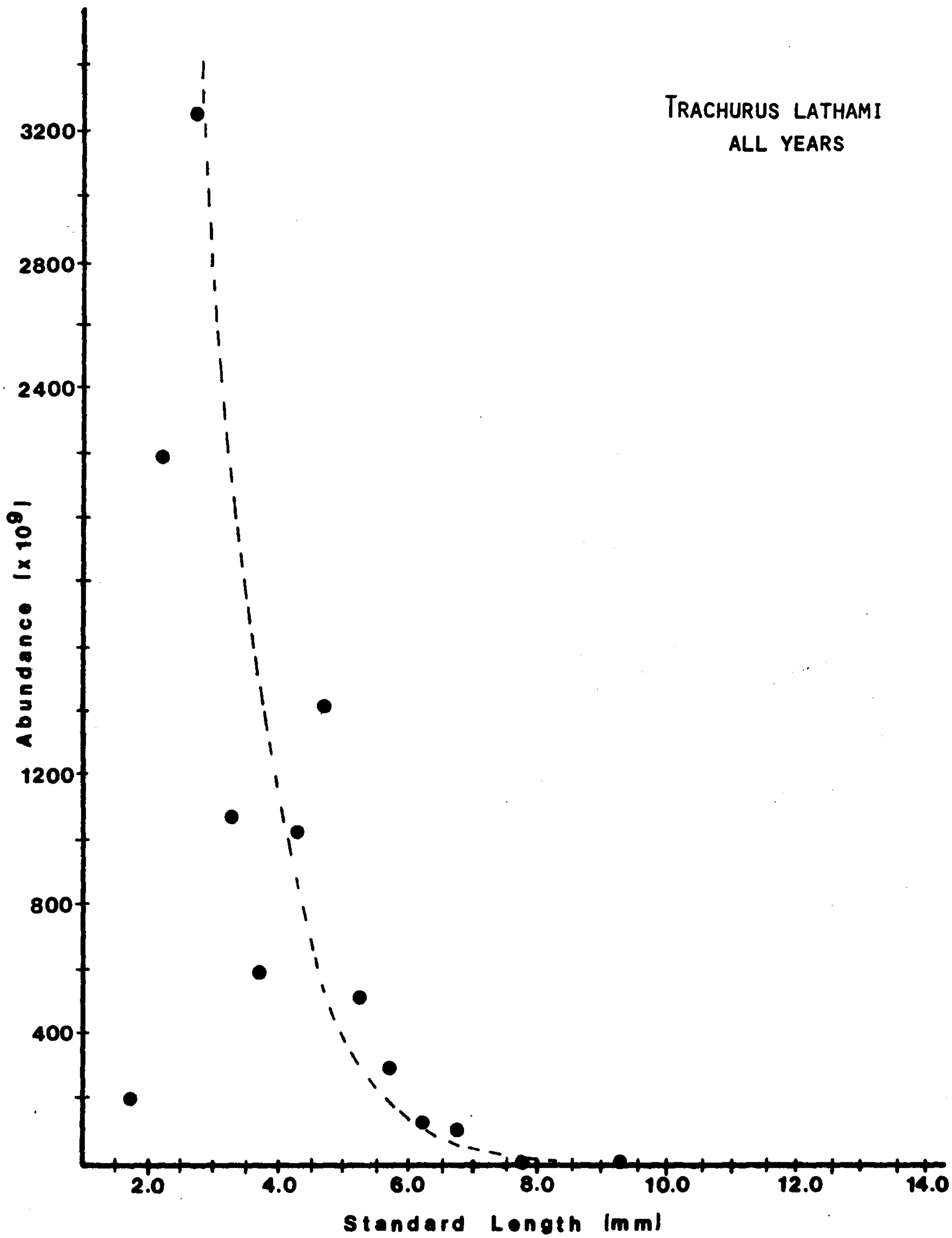



Fig. 164 Apparent mortality rate of Trachurus lathami larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

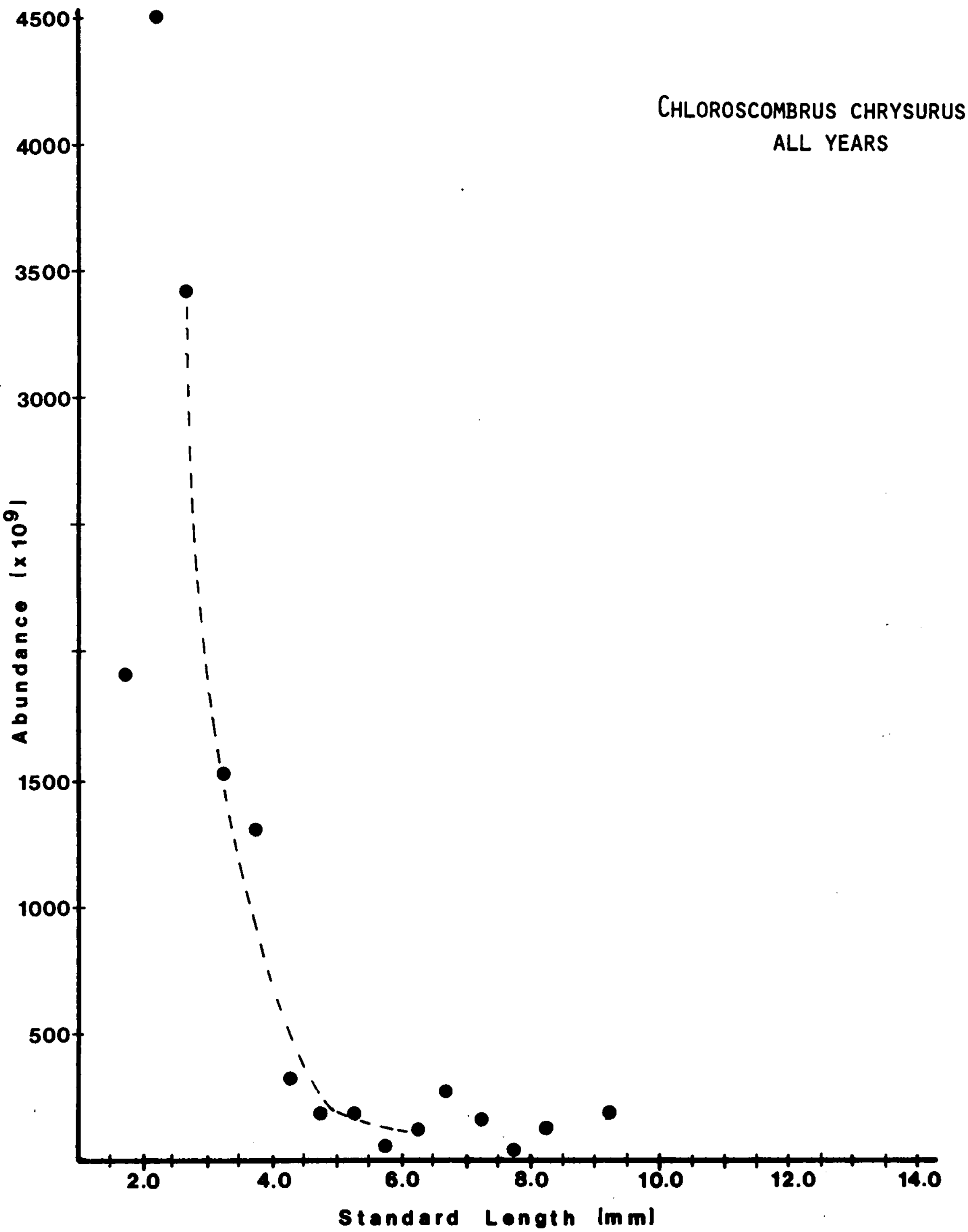



Fig. 165 Apparent mortality rate of *Chloroscombrus chrysurus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

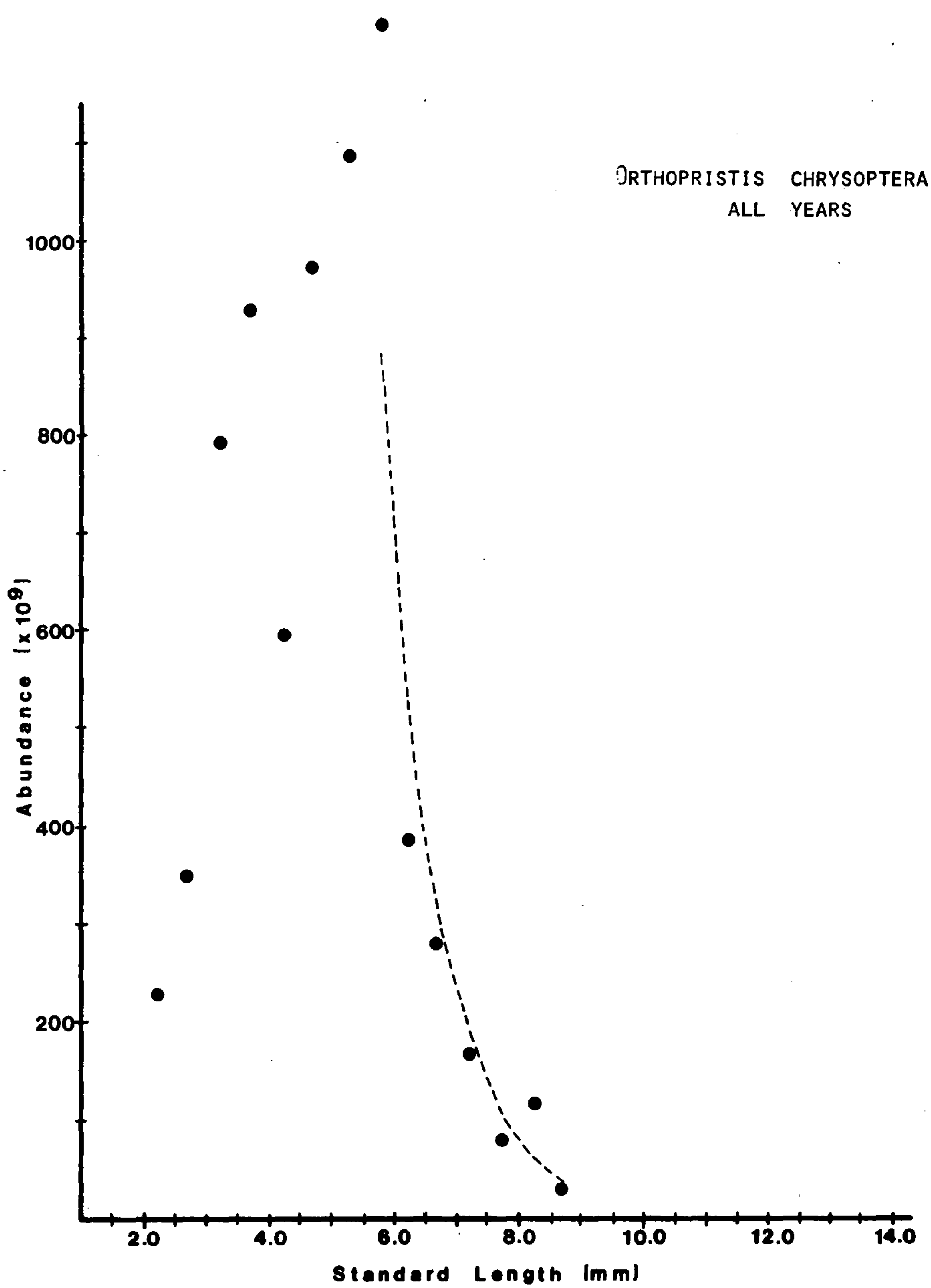



Fig. 166 Apparent mortality rate of *Orthopristis chrysoptera* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

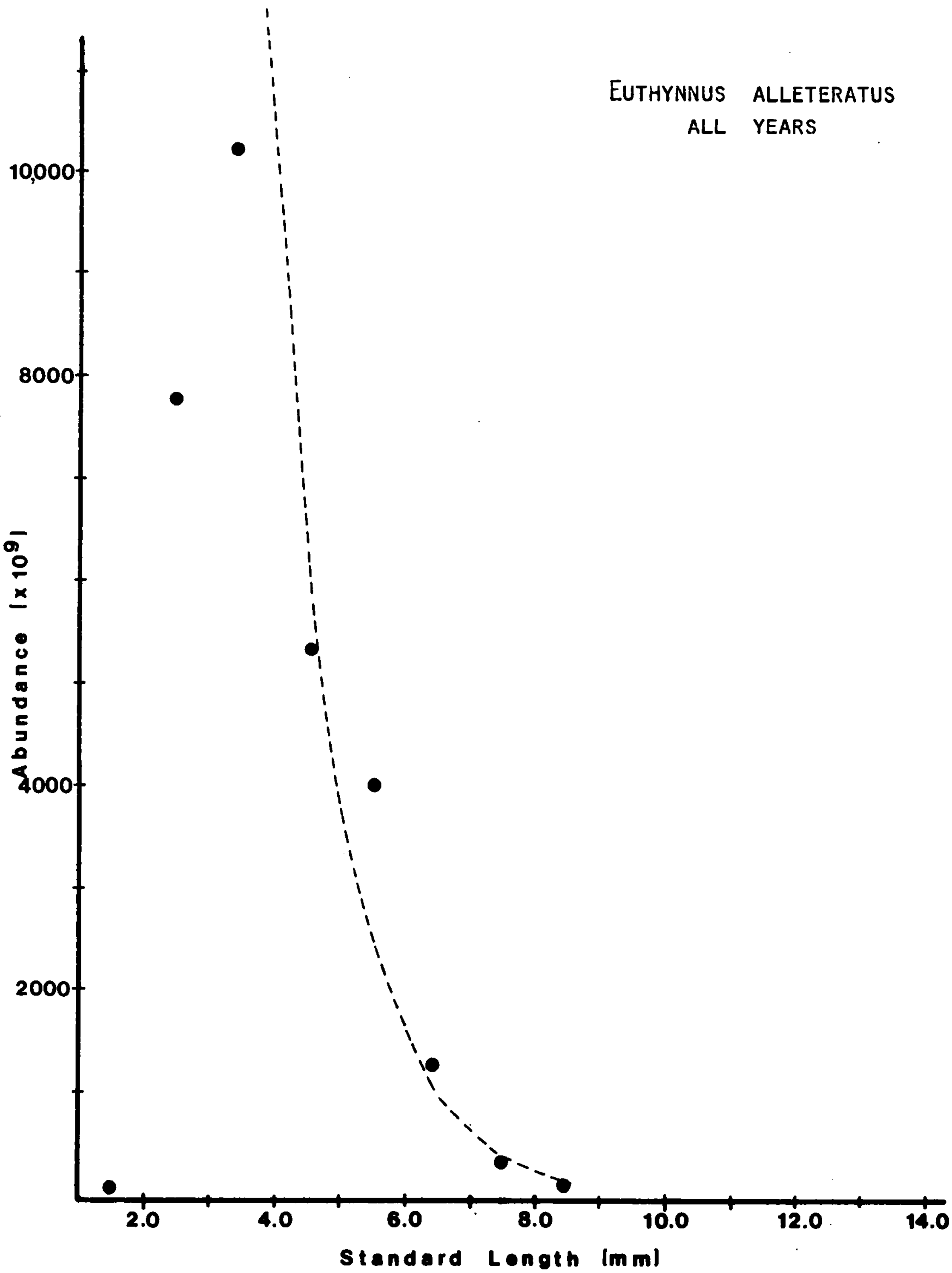



Fig. 167 Apparent mortality rate of Euthynnus alletteratus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

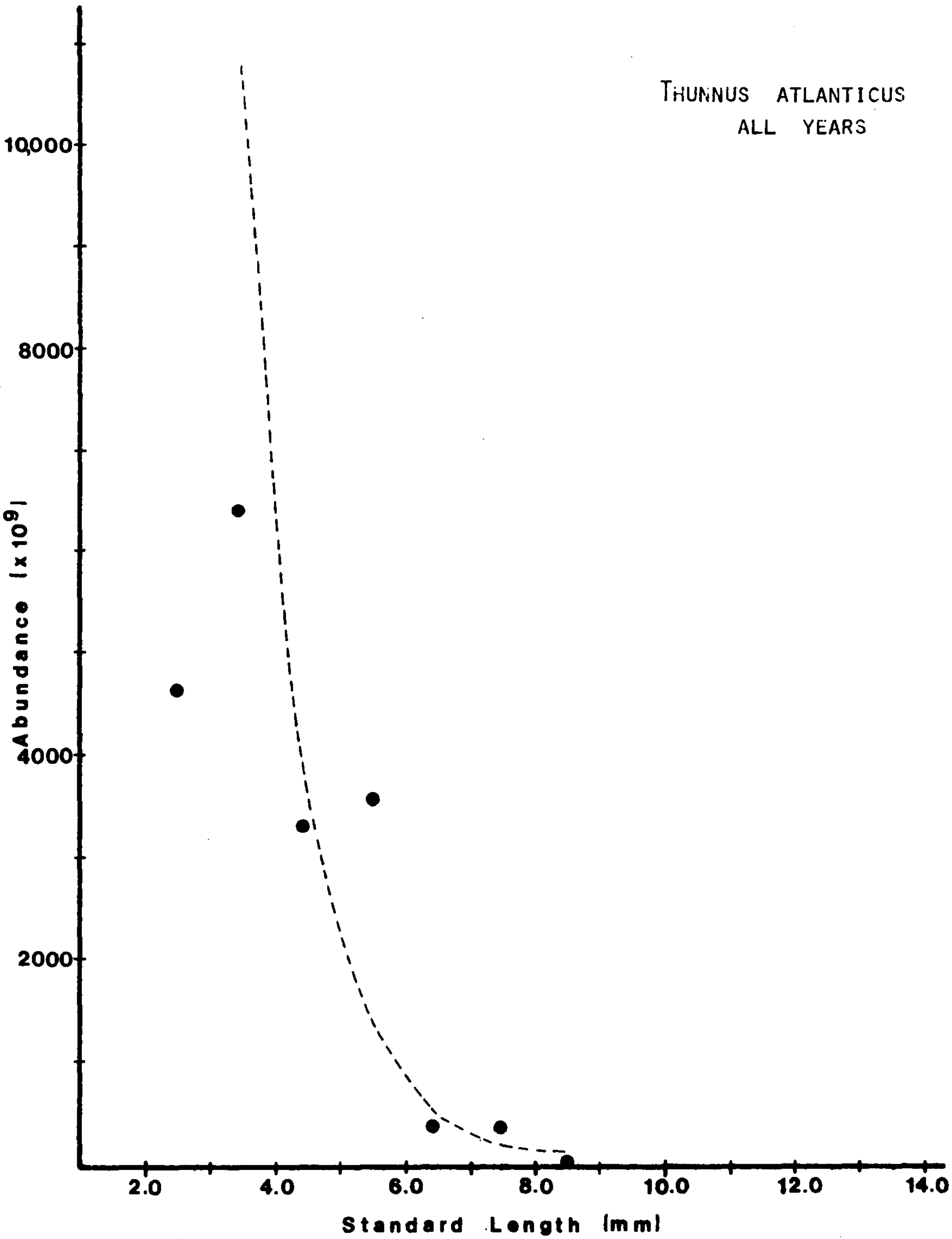



Fig. 168 Apparent mortality rate of *Thunnus atlanticus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

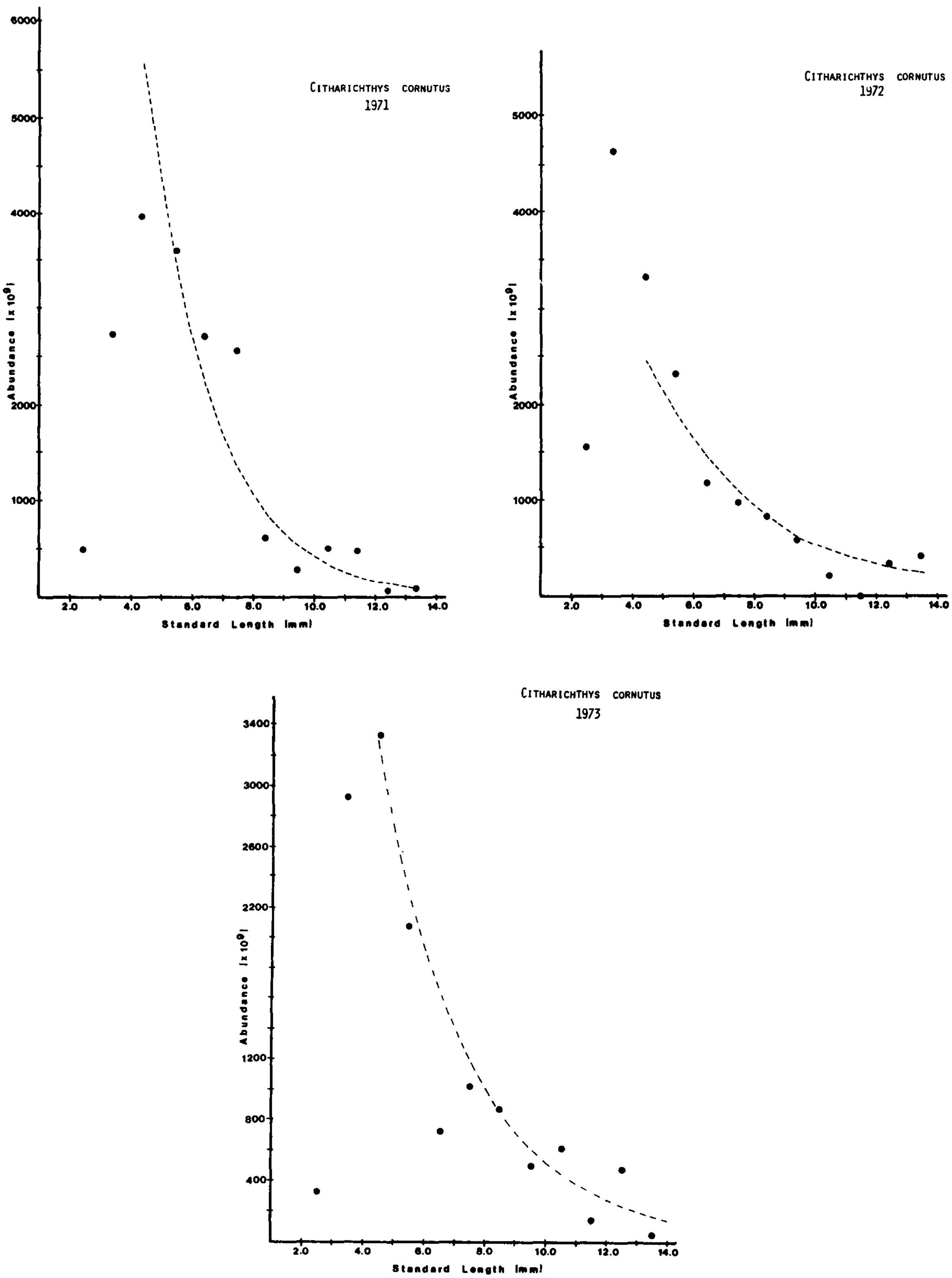



Fig. 169 Apparent mortality rates of Citharichthys cornutus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

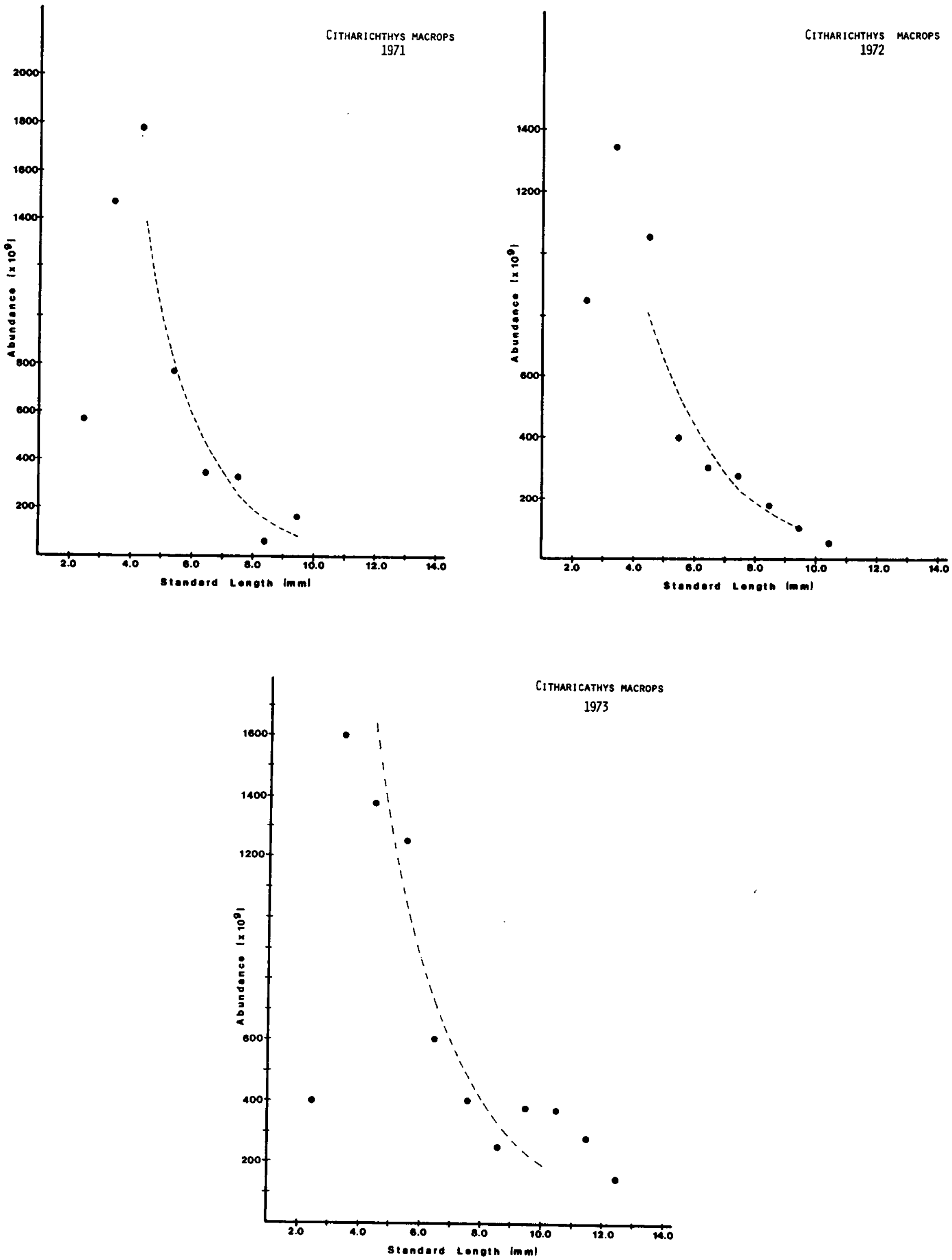



Fig. 170 Apparent mortality rates of Citharichthys macrops larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

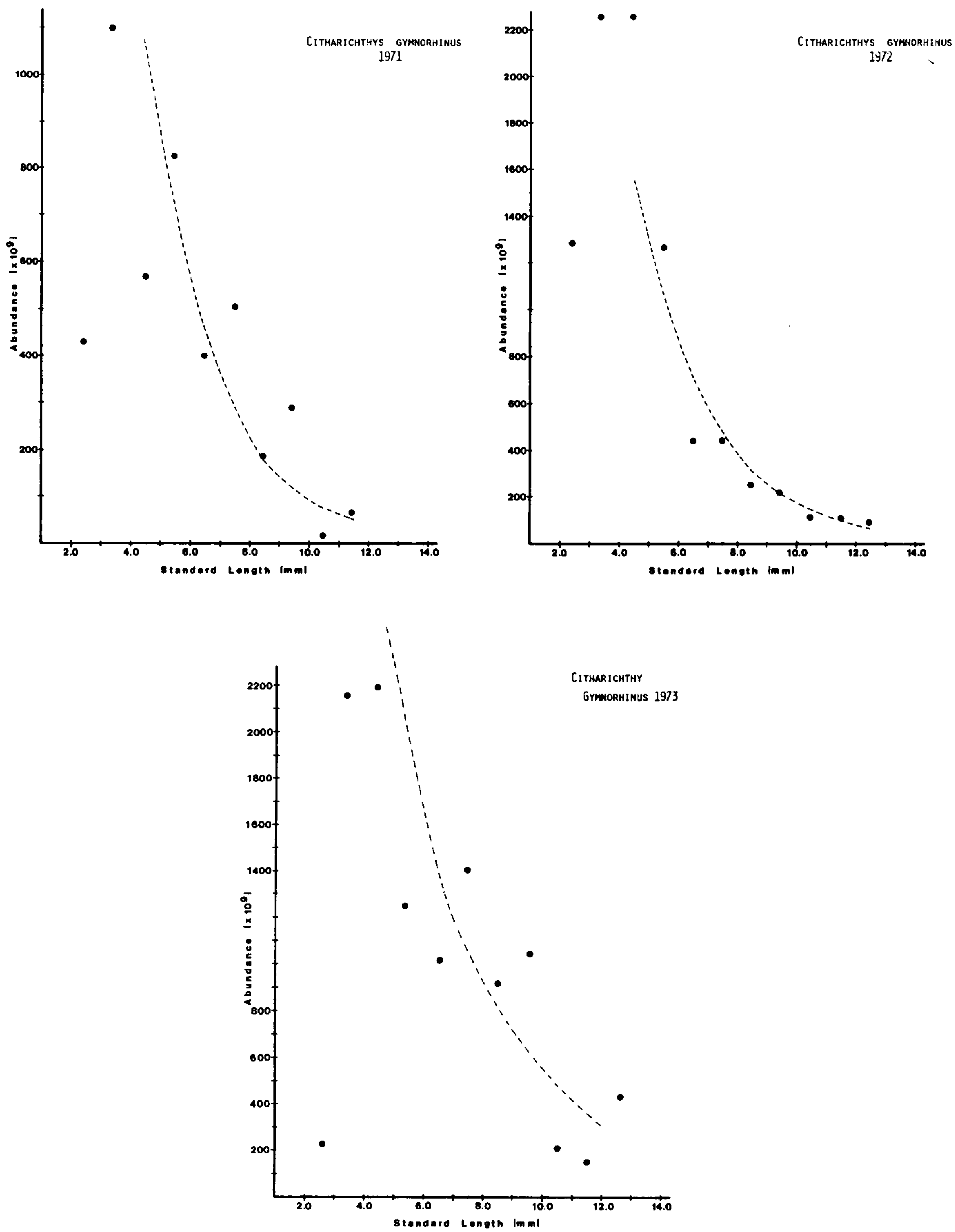



Fig. 171 Apparent mortality rates of Citharichthys gymnorhinus larvae, collected on ichthyoplankton suivey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

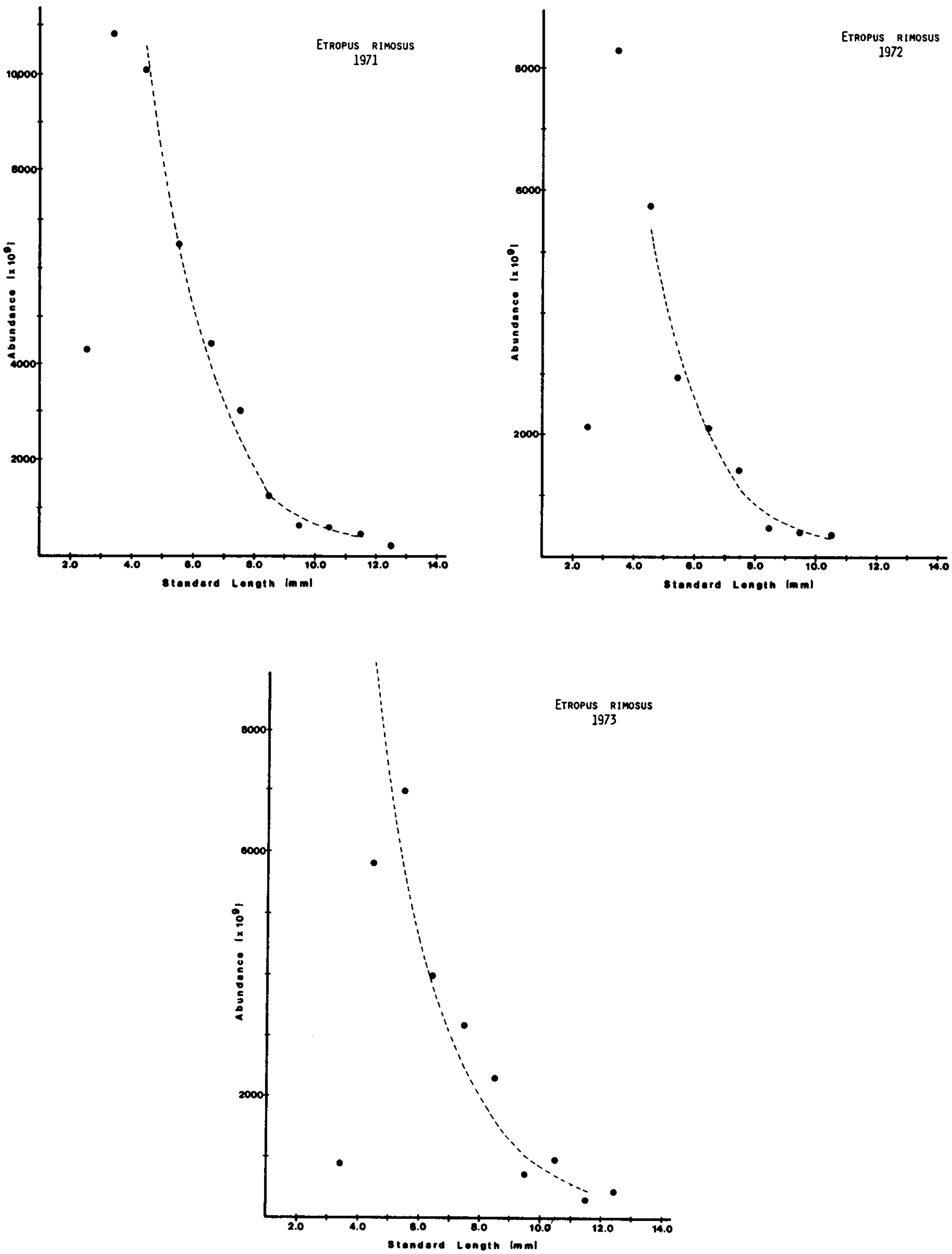



Fig. 172 Apparent mortality rates of Etropus rimosus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

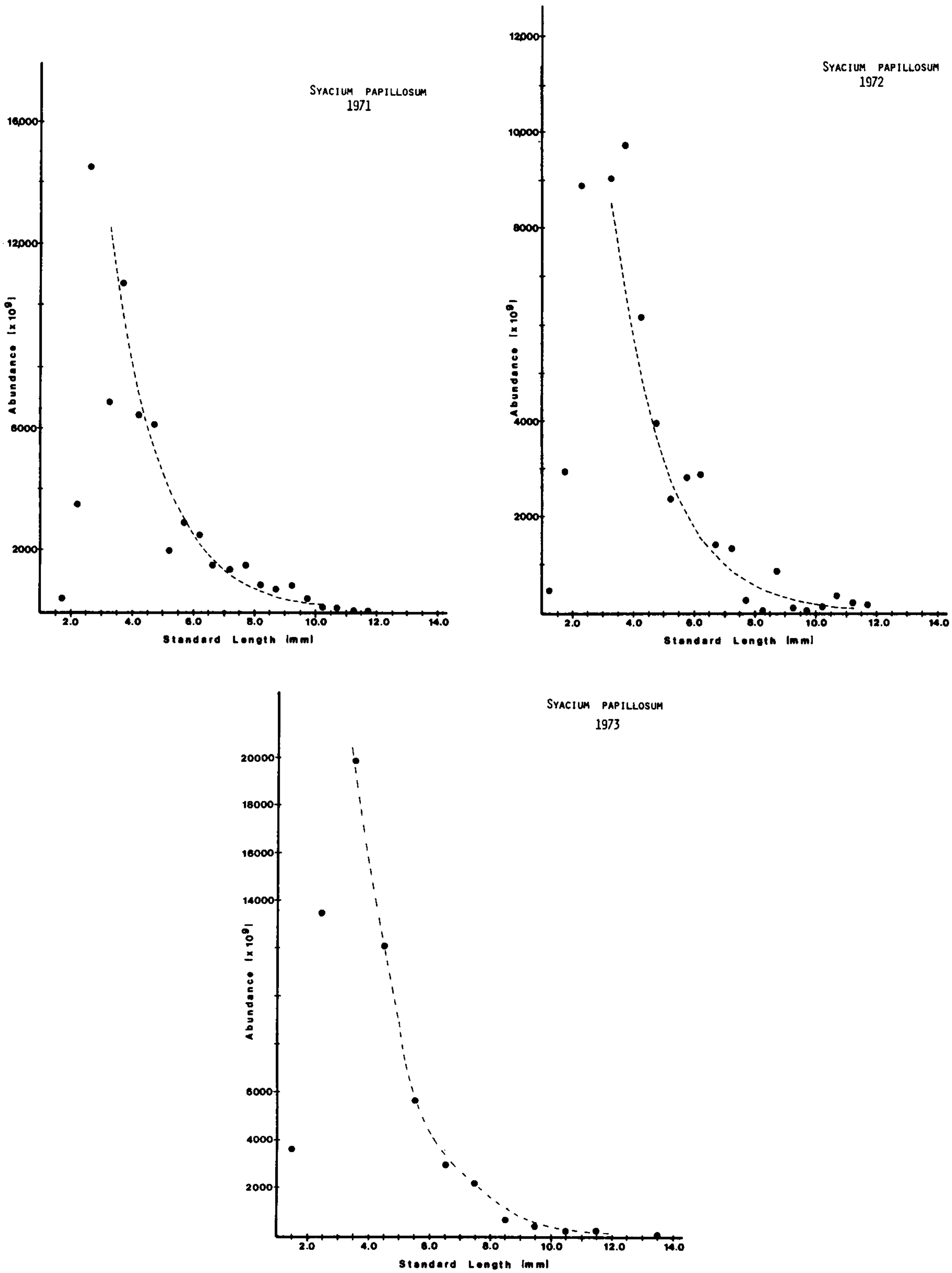



Fig. 173 Apparent mortality rates of Syacium papillosum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

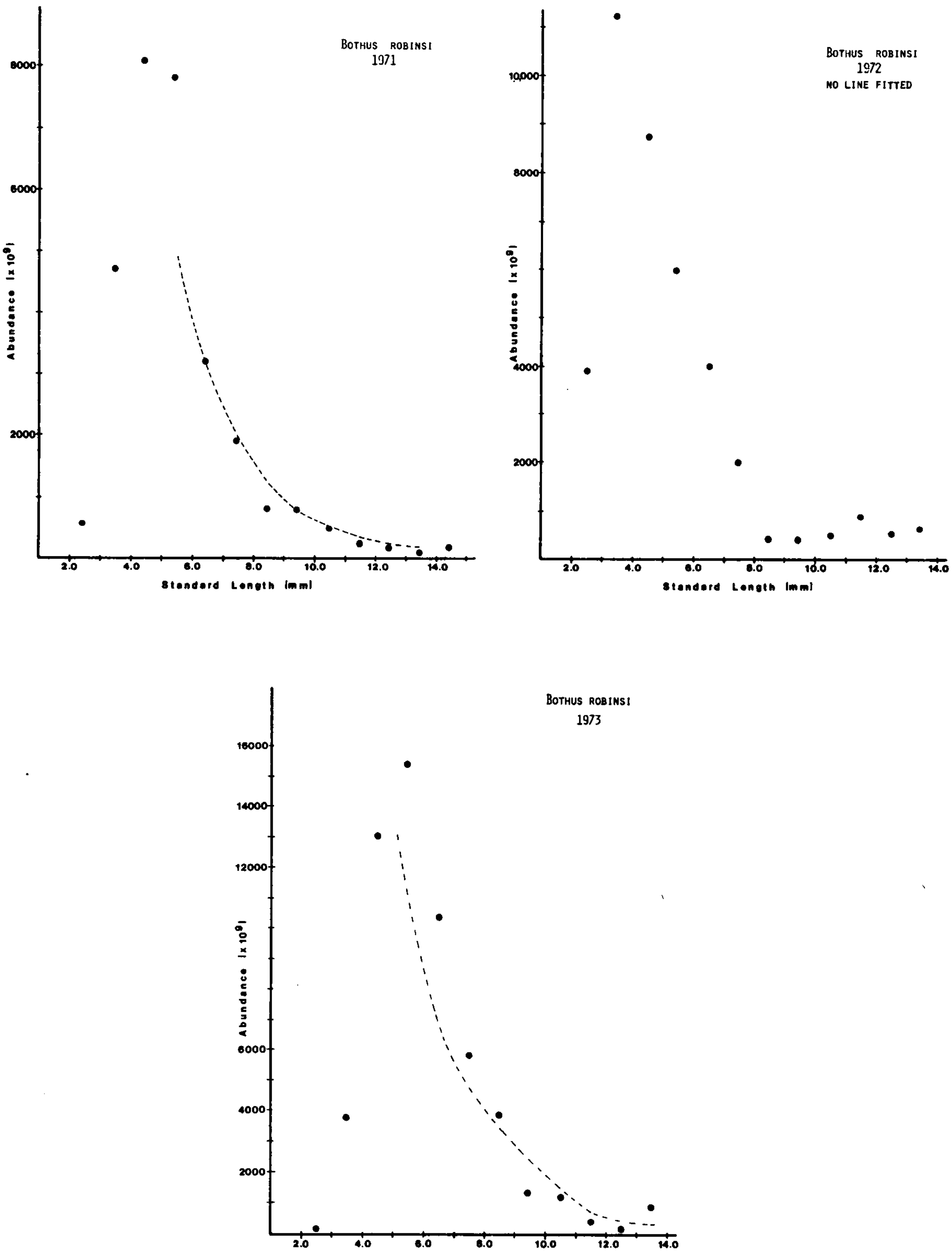



Fig. 174 Apparent mortality rates of Bothus robinsi larvae, collected on ichthyoplankton cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

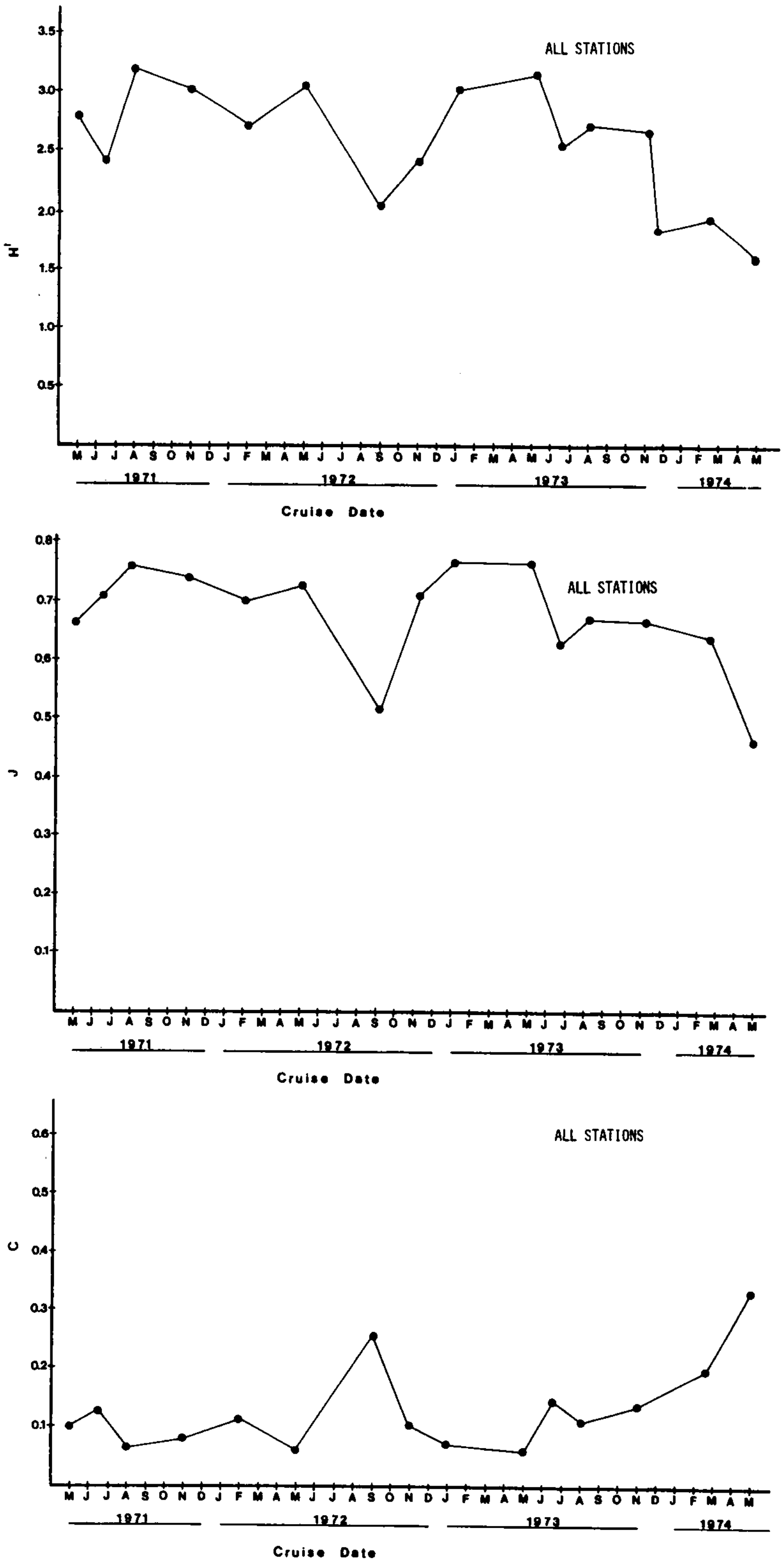



Fig. 175 Values of Shannon-Weaver (H'), eveness (J) and Simpson (C) indices of diversity for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Cruise GE7210 was omitted because only 13 stations were sampled.

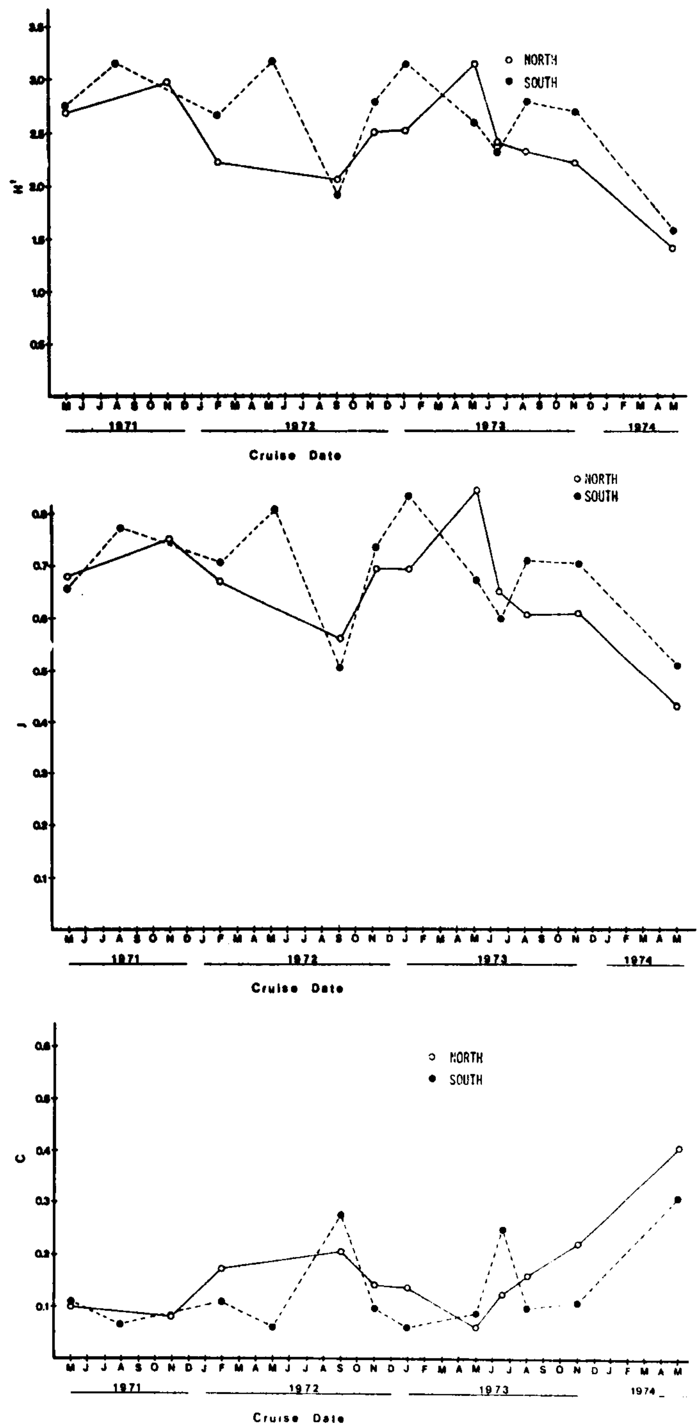



Fig. 176 Values of the Shannon-Weaver (H') eveness (J) and Simpson (C) indices of diversity in North and South sectors for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. The North sector includes stations on and north of latitude 27°15'N. The South sector includes stations south of that latitude.

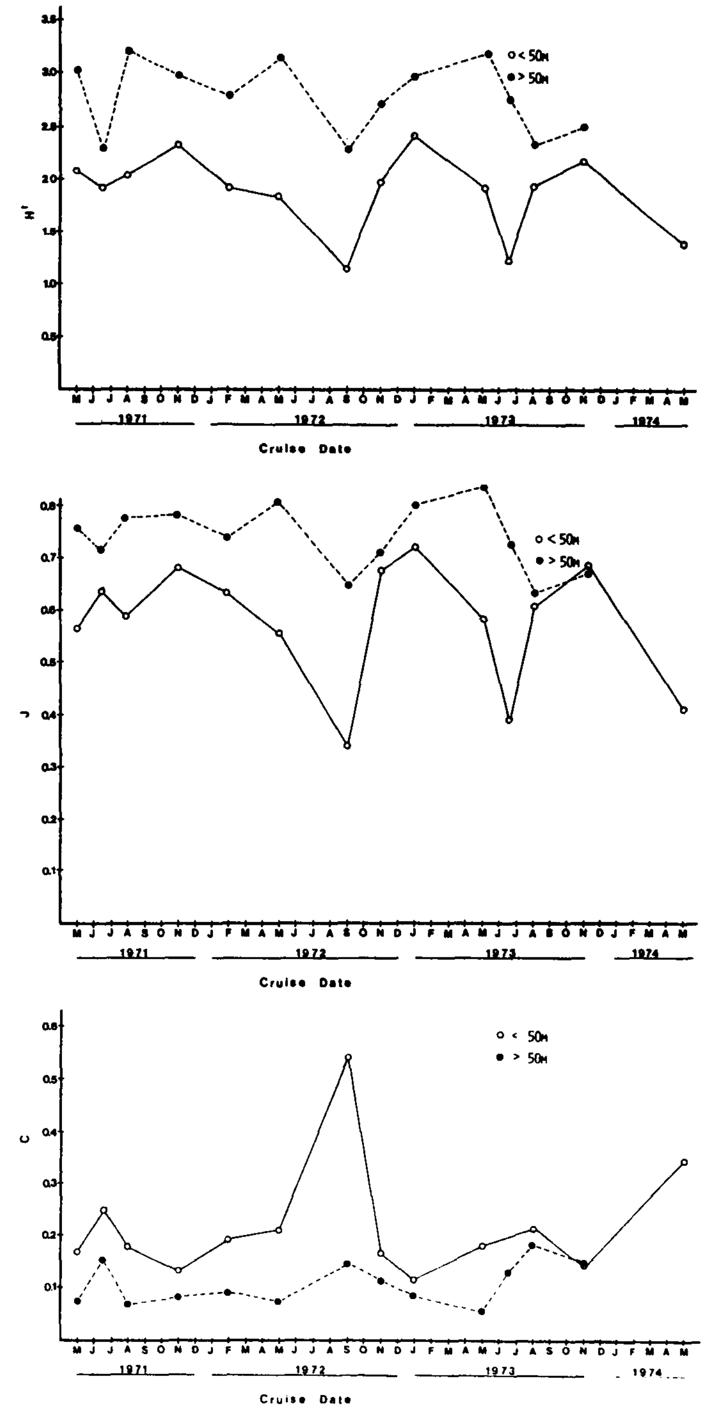



Fig. 177 Values of the Shannon-Weaver (H') eveness (J) and Simpson (C) indices of diversity in < 50 m and > 50 m deep zones for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

## The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

## The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.