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VERTICAL DISTRIBUTION OF RECENTLY-HATCHED HERRING LARVAE AND ASSOCIATED ZOOPLANKTON ON JEFFREYS LEDGE AND GEORGES BANK, OCTOBER 1974*

by

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ABSTRACT

In mid-October 1974, a time series of vertical bongo hauls was made in the vicinity of historic Atlantic herring (*Clupea harengus* L.) spawning sites on Jeffreys Ledge (coastal western Gulf of Maine, 40-m bottom depth), and on the northeast part of Georges Bank (80-m bottom depth). On both study sites recently-hatched larvae (7-mm SL mode) were found to be broadly distributed throughout the well-mixed water column with a higher mean abundance at middepth. On the Georges Bank site, the size range of larvae was greater (5-12 mm) than on Jeffreys Ledge (5-8 mm); the mean size of larvae generally increased with depth. At night larger larvae (>7 mm) were caught near the surface (1-10 m) frequently, indicating the development of a diel pattern of vertical migration. Virtually none of the larvae examined from the Jeffreys Ledge site had prey items in their guts, however, 53% of the larvae examined from Georges Bank contained gut items identified as copepod nauplii (50%), copepodite stages and small copepods (31%) and copepod eggs (15%). Potentially available prey items determined from fine mesh samples also were distributed throughout the water column and had a mean density of 5 prey per liter on both sites.

The copepods, *Centropages typicus* and *Pseudocalanus* sp., were the two dominant members of the zooplankton community on both study sites; however, species diversity was greater on Georges Bank than Jeffreys Ledge. A dense breeding population of the chaetognath, *Sagitta elegans*, was present on Georges Bank and the

mature adults were observed to undergo extensive vertical migration, residing near bottom during the day and dispersing toward the surface by night. On both sites, a crustacean biomass, mostly copepods, was distributed throughout the water column with a higher mean abundance at middepth. Some evidence of vertical migration was noted for adult females of *Metridia lucens*, *Pseudocalanus* sp., and *Centropages typicus*, and for both sexes of adult *Calanus finmarchicus*.

INTRODUCTION

Atlantic herring larvae, Clupea harengus L., are known to be capable of extensive vertical movements in the water column, migrating into the surface layers at night and seeking deeper water by day, similar to many other planktonic organisms (Banse, 1964). However, field studies have documented considerable variability in their vertical distribution, thus obscuring a clear picture of their behavioral interactions with biological and physical environmental factors. Their pattern of vertical migration has been inferred from a comparison of night to day catches based on integrated hauls, or single depth-level samples. Those few studies where discrete vertical sampling was employed have been conducted mostly by investigators in the North Sea (Bridger, 1956, 1958; Woods, 1971; Rudakov, 1971; Schnack, 1972, 1974; Seliverstov, 1974; Dubravin et al., 1976; Bjørke, 1971, 1978; Sjöblom and Parmanne, 1978; Grainger, 1978). In the Georges Bank-Gulf of Maine region, Colton et al. (1961) inferred that the depth of maximum abundance of herring larvae on Georges Bank was below 10 m and that they moved up towards the surface at night. Also, it appeared that the extent of these diel movements increased with the size of the larvae. Potter and Lough (1982) reported on a study of the vertical distribution of herring larvae on Nantucket Shoals using electronically-controlled opening-closing nets. In the first series of hauls, larvae ranging in length from 5-32 mm were most abundant in the surface layers both day and night, but during a second series 10 days later, larvae were distributed more uniformly throughout the water column

(64-74 m bottom depth) during both day and night. No recurring pattern of diel vertical migration was observed between the two series of hauls. Graham and Sampson (1982) conducted a 3 factorial experiment (incident light, tidal phase, depth of sampling) on factors affecting the depth distribution of larval herring at the mouth of the Sheepscot River estuary, Sheepscot Bay, Maine, during the spring of 1967. Despite the wide range of values of some of the environmental factors measured, the results of their study were inconclusive.

In October 1974, a vertical distribution study of recently-hatched herring larvae was conducted in the vicinity of their historic spawning grounds located on Jeffreys Ledge and Georges Bank. The objectives were to compare and contrast the vertical distribution of herring larvae between the two spawning areas, and to charactertize their associated plankton communities with particular reference to food prey organisms. Preliminary results of the Georges Bank station were reported previously by Lough (1975). This study was made in conjunction with the ICNAF[1] larval herring surveys as part of a major international cooperative research program on the early life history of herring stocks in the Georges Bank-Gulf of Maine region (Lough et al., 1981).

[1] International Commission for the Northwest Atlantic Fisheries - superseded since 1979 by Northwest Atlantic Fisheries Organization (NAFO).

The U.S. participation was conducted concurrently as part of the MARMAP[2] program of the Northeast Fisheries Center, which measures long-term changes in the variability of fish stock abundance off the northeast coast of the United States (Sherman, 1980).

METHODS

Areas of recently-hatched herring larvae were located along the western Gulf of Maine and on Georges Bank by standard double-oblique bongo-net hauls made from aboard R/V DELAWARE II 74-12, 8-16 October 1974 (Lough et al., 1975). The first station of the vertical distribution study was located off Cape Ann near the base of Jeffreys Ledge (42°41'N, 70°25'W, 40-m bottom depth) and was occupied for a 24-hour period (12 hauls) (Figure 1). The second station was located on the northeast part of Georges Bank (42°00'N, 66°40'W, 80-m bottom depth) and was occupied for a 44-hour period (21 hauls). A vertical haul series was made on station every 2 hours employing 20-cm bongo-net samplers with 0.333- and 0.053-mm mesh nets (Posgay and Marak, 1980) set at 1-, 20-, 30-, and 40-m depth on the Jeffreys Ledge station, and at 1-, 10-, 20-, 30-, 50-, and 80-m depth on the Georges Bank station. The vertical array of samplers, once set on the wire, was towed at 2 knots so that each net filtered water at the fixed depth for 30 minutes. Ten to 12 minutes normally were required to set and retrieve the entire array, and the total haul distance was about 1.3 nm.

[2] Marine Resources Monitoring, Assessment and Prediction.

Time-depth recorders (TDR) were attached to the towing wire near the bottom sampler and at several other net levels. A 100-lb. lead ball was attached to the end of the towing wire and, according to the TDR traces, dragged on the bottom during most hauls. The bottom sampler was located within 1 m of the lead ball and frequently skipped along the bottom collecting some benthic organisms. No opening-closing device was used with the samplers; however, a control haul was made on each station to estimate contamination by setting the sampling array at depth and then immediately retrieving it to the surface. The percentage contamination estimated for hauls less than 40-m depth is less than 17%, decreasing at shoaler depth levels, and is in the vicinity of 20-26% at the 50- and 80-m depth levels sampled on Georges Bank (Table 1). Even at deeper depths the higher percentage contamination does not appear to be large enough to obscure major differences in the vertical distribution of organisms based on the inherently coarse resolution of the sampling scheme and gear used. Clogging of the 0.333-mm mesh nets did not appear to be a problem based on flowmeter readings and discoloration of the nets, but it was evident for the 0.053-mm nets. All samples were preserved in 5% buffered Formalin.

The vertical series of hauls were made at fixed stations since, with the sampling gear used, it was simpler logistically than to follow a free-drifting drogue. It was believed that little significant difference would be observed in the results obtained by occupying a fixed station and attempting to stay with the same water parcel over the 1-2 days of sampling because the

currents in the shoal regions are dominated by strong semidiurnal rotary tidal currents with speeds greater than 2 knots (104 cm/sec) (Bumpus, 1976). The clockwise rotation of the tidal elipses range 4 to 8 miles in length. Thus, the assumption was made that the same population of organisms was sampled over the course of the 2 vertical series. It also was assumed that the abundances of organisms at the sampled depths composed a continuous distribution during a haul.

Weather and hydrological observations were recorded prior to each haul. Temperature and salinity profiles were made by XBT drop and Nansen bottle cast.

In the laboratory, all ichthyoplankton and chaetognaths were sorted from the 0.333-mm mesh samples and up to 100 herring larvae per sample were measured to the nearest 0.1-mm standard length (SL). Displacement volumes of the total plankton sample and the crustacean component (total volume minus large and gelatinous organisms, chaetognaths, and fish larvae) were recorded separately. Wet weights also were recorded for the crustacean component (mostly copepods), larval fish, and chaetognath groups. The crustacean component was further aliquoted with a Folsom plankton splitter (Longhurst and Seiburt, 1967) to approximately 500 organisms, identified, and enumerated to the lowest taxon possible. Relative abundance and dominance indices were calculated for the total zooplankton following the method of Fager and McGowan (1963).

The gut contents of 40 herring larvae from the Georges Bank

station and 30 larvae from Jeffreys Ledge were processed and identified by the methods of Cohen and Lough (1979) from 0.333-mm net samples collected at middepth during daylight hours. In order to estimate the potential size range of food organisms consumed by larvae, mouth gape estimates were made based on the head breadth and maxillary length of a random sample of larvae. Two mouth gape estimates, which are a trigonometric function of maxillary length assuming a 60^{0} and 90^{0} articulation of the larval jaw were used (Shirota, 1970).

In addition, 2 vertical series of fine mesh (0.053-mm) samples were analyzed from each location to examine the prey field available to the recently-hatched larvae. The 1000h and 2200h (DST) vertical series collected on 14 and 15 October 1974, respectively, were processed for the Georges Bank site, and the 1000h and 2200h vertical series collected 11 October 1974 were processed for Jeffreys Ledge. Each sample was strained through a 0.595-mm U.S. Standard Series sieve to remove large organisms and debris. The finer fraction was diluted by 25X its original settled plankton volume, and a 1-ml aliquot was taken with a Stempel pipette according to subsampling procedures outlined by Frolander (1968). Approximately 100 organisms (1/2 of a gridded 5-cm petri dish) were counted, identified to the lowest taxon possible, and measured. An ocular grid (0.25-mm squares) was used to rapidly group the organisms into size classes: 0-0.25 mm, 0.26-0.50 mm, 0.51-0.75 mm, and 0.76-1.00 mm. Lengths of copepodites and adults were measured from the anterior tip of the cephalothorax to the tip of the fifth metasomal segment including spines. Lengths of

nauplii were measured from the anterior tip of the body to the base on the caudal armature. Maximum body width was measured excluding appendages. Volume of organisms was calculated as a prolate spheriod.

RESULTS

Hydrological and Meterological Conditions

Neither the Jeffreys Ledge or Georges Bank study site had a pronounced thermocline or halocline during the sampling period (Tables 2 and 3), indicating a well-mixed water column. However, on Jeffreys Ledge the water column was more thermally stratified than on Georges Bank. Surface temperatures on Jeffreys Ledge averaged 12.7^{o}C and decreased to 8.5^{o}C beyond 20 m depth near bottom (40 m). Average temperatures on the Georges Bank site ranged from 12.8^{o}C near surface to 11.7^{o}C at bottom (80 m). Salinity values on Jeffreys Ledge averaged from about 31.9 to 32.5^{o}/oo but were somewhat higher on Georges Bank, consistently around 32.8^{o}/oo. No periodicity was evident at either site in the temperature and salinity profiles over the time series. The tidal currents on the Jeffreys Ledge site are considered too weak and variable to be predicted (Anon., 1974), but direct measurements reported by McCarthy et al. (1979) at middepth (20 m) and just above the bottom (2 m) at a depth of 38 m in September-October 1975 indicated current reversals (NW to SW) every 6 hours with an average velocity of 31 cm/sec, ranging from 0 to 57 cm/sec. The strong semidiurnal tidal currents (range ca. 47-95 cm/sec) near the Georges Bank site are plotted in Figure 2 (Anon., 1974) to

show the fluctuations during the sampling period 13-15 October 1974. Residual currents in the vicinity of the Georges Bank station are generally to the east or southeast in the range of 1-4 miles per day (Bumpus, 1976). On the base of Jeffreys Ledge the long-term drift is south along the coast at about 2 miles per day (Graham, 1970).

Weather conditions during the Jeffreys Ledge sampling, 11-12 October, were clear, sunny, and calm until the final 6 hours when the wind blew up to 20 knots from the southwest causing the wave height to rise to 1 m. The weather during the Georges Bank study, 13-15 October, was consistently clear and sunny with about a 10 knot breeze and a sea state of less than 1-m wave height.

Zooplankton, Community and Abundance

The relative abundance of zooplankton collected on Jeffreys Ledge is summarized for all night and day samples in Tables 4 and 5, and on Georges Bank, in Tables 6 and 7. The taxa are listed sequentially on the basis of their average ranks with the highest density sample assigned to the highest rank. The more abundant species compose a typical zooplankton community of this region in the autumn (Bigelow, 1926; Sherman et al., 1979; Sherman and Jones, 1980; Cohen and Lough, 1982a). One must bear in mind the effect of extrusion of the smaller zooplankton through the 0.333-mm mesh. Studies by Colton et al. (1980), Davis (1980), and Judkins et al. (1980) show that a mesh size of 0.333 mm fully retains copepods with a cephalothorax length >0.9-1.0 mm, which includes the copepod stages 3 through adults of Calanus finmar-

chicus, adults of Centropages typicus and C. hamatus, and larger adult females of Pseudocalanus sp. Smaller stages and species such as Paracalanus parvus and Oithona spp. would be undersampled.

On Jeffreys Ledge some 46 taxa were collected by day compared to 64 by night (N:D ratio = 1.4), which is most likely related to light-aided avoidance of the sampling gear. The two dominant species were the copepods Centropages typicus and Pseudocalanus sp., followed by herring (Clupea harengus) larvae, and the copepods Calanus finmarchicus, and Parcalanus parvus. Although the chaetognath, Sagitta elegans, occurred in more than 50% of the samples, its mean density was very low (<5/10 m^3). Higher densities (40-350/m^3) of S. elegans have been reported by Sherman and Schaner (1968) to occur in the nearshore area in autumn. Mean abundance of these species was not significantly different between night and day hauls; but in many cases mean abundance was greater for day hauls. Copepodite stages of Centropages typicus and Calanus finmarchicus, even though they were not fully retained by the 0.333-mm mesh net, were as abundant as the adults, indicating actively growing populations.

On the Georges Bank site the dominant species found in greater than 50% of the hauls were Centropages typicus, Pseudocalanus sp., Clupea harengus larvae, and Calanus finmarchicus, as on Jeffreys Ledge, but with the addition of Sagitta elegans, euphausiid calyptopsis larvae, Centropages hamatus, and Oithona spp. Mean abundance of Centropages typicus was about half that found on Jeffreys Ledge, but Pseudocalanus sp. numbers were

greater by about a factor of three. Larval herring mean abundance was slightly greater on Georges Bank, and Sagitta elegans, Oithona spp., and Centropages hamatus were at least an order of magnitude greater on Georges Bank than Jeffreys Ledge. Calanus finmarchicus adults were of similar abundance at the two study sites, but the immatures were 3.5 times more abundant on Jeffreys Ledge. About twice the number of taxa were identified on Georges Bank as on Jeffreys Ledge: 93 for day and 111 for night hauls (N:D ratio = 1.2). Mean night and day abundances for the dominant species were similar, except for adults of Calanus finmarchicus, Oithona spp., and Sagitta elegans, where greater numbers (a factor of 2-12x) were caught in night hauls. On the basis of the Dispersion Index provided in the tables (variance/mean), all of the individuals of these populations have a highly contagious or patchy distribution (variance>mean). Coefficients of variation (CV = standard deviation/mean) for species that occurred in more than 50% of the samples typically ranged from 100-400% with a range of 63-717%. These values (CV) were similar for both study sites during day and night sampling.

The occurrence of species or taxa on the Jeffreys Ledge and Georges Bank study sites is listed in Table 8. The dominant species, or those that occurred in more than half of the samples, were common to both sites. A small number of minor species were caught on the Jeffreys Ledge site only, but are reported to be widespread throughout the Gulf of Maine region and therefore could be expected to occur in the Georges Bank area as well. Thirty-seven of the species unique to the Georges Bank site were

relatively unimportant, occurring infrequently and in relatively low numbers, and many of them were oceanic surface species found in the Slope Water south of Georges Bank. Those immigrant zooplankters that may be indicative of intrusions of oceanic water were the copepods: Candacia armata, Nannocalanus (=Calanus) minor, Pontellina plumata, Euchaeta norwegica, Metridia lucens, Oithona spinirostris, Anomalocera pattersoni, Undinula vulgaris, Corycaeus speciosus, the chaetognaths Sagitta maxima and Sagitta serratodentata, and the chordates Salpa fusiformis and Oikopleura dioica (Bigelow and Sears, 1939; Colton et al., 1962; Grice and Hart, 1962; Gosner, 1971).

The numerically abundant zooplankton were classified as either herbivores, omnivores, or carnivores in order to describe the trophic structure at the two study sites. In general, small copepods are herbivores and large ones carnivores, but omnivorous species range widely in size (Jeffries and Johnson, 1973). Centropages typicus and C. hamatus are omnivorous but prefer animal food (Anraku and Omori, 1963). Calanus finmarchicus, Pseudocalanus sp., Paracalanus parvus, and Oithona sp. are all herbivorous. The two principal carnivores were Clupea harengus and Sagitta elegans which prey mostly upon the smaller copepods (Cohen and Lough, 1981; Pearre, 1973). The percentage of herbivores: omnivores: carnivores for the Jeffreys Ledge site was 32.4: 67.4: 0.3%, and for the Georges Bank site, 33.9: 64.2: 1.8%. These relative abundances are quite similar, with the exception of the higher percentage of carnivores on Georges Bank, which can be attributed to the high densities of chaetognaths.

Sagitta elegans is the only endemic species of chaetognath found on Georges Bank, largely confined to the well-mixed waters (Clarke et al., 1943).

Vertical Distribution of Selected Taxa

Clupea harengus

When the entire vertical range of an organism is sampled, and the assumption is made that the replicate haul catches are within the expected limits of sampling variability due to patchiness, then the total integrated night catches would have to vary by at least a factor of 3.3 from day catches to be significantly different (Wiebe and Holland, 1968). Significant diel differences can then be attributed to light-aided avoidance of the net.

The vertical distribution of herring larvae by depth and time is presented for Jeffreys Ledge and Georges Bank in Tables 9 and 10 and Figures 3 and 4. Larvae were collected at all depths from surface to bottom on both study sites with a weighted mean depth distribution of 24 m on Jeffreys Ledge and 36 m on Georges Bank. More larvae were caught in night than day hauls at nearly all depths. However, the larvae tended to be broadly distributed throughout most of the water column and did not show a clear pattern of migratory behavior except near surface and bottom where night to day ratios of catches exceeded 3.3. On both study sites the integrated water column totals (no./10 m^2) for night and day catches were not significantly different from each other (N/D

ratios = 1.8 and 1.2) based on the above criterion. Therefore, the higher N/D ratio at the surface suggests some migratory activity at this level but perhaps not as pronounced near bottom.

Composite larval length frequency distributions by depth level are shown in Figures 5 and 6 for Jeffreys Ledge and Georges Bank. On both sites the modal length group was 7-mm SL, indicating that the bulk of the larvae hatched within the previous week since they hatch at a modal size of 6 mm (Lough et al., 1982). Georges Bank larvae were slightly larger on average ($x = 6.89$ mm, range: 5-12-mm size classes) than Jeffreys Ledge larvae ($x = 6.65$ mm, range: 5-8-mm size classes) and correspondingly the percentage of larvae with yolk-sacs was less (2.5%) compared with the smaller larvae (8.5%). On Jeffreys Ledge, larvae of all sizes appeared to be uniformly distributed throughout the water column. On Georges Bank, the mean length of larvae in each haul is plotted in Figure 7 by depth level. An inspection of the size distribution of larvae by depth generally shows that smaller larvae occur nearer to the surface and larger larvae nearer to bottom. A Kolmogorov-Smirnov test of cumulative length-frequency percentages of catches (Tate and Clelland, 1959) indicated some difference in the size of larvae caught by night vs. day tows. That is, the larger larvae (>7 mm) were caught more frequently nearer the surface at night than by day, indicating that this size group may perform diel migrations through the water column.

Figure 8 shows the weighted mean depths of larval herring calculated for each vertical haul made on Jeffreys Ledge and Georges Bank. No clear pattern is evident in the population

centers on Jeffreys Ledge, but on Georges Bank there is a systematic trend for the centers to be deeper (from about 30 to 50 m) between sunset (1722 D.S.T.) and sunrise (0610) and then to ascend at 0800 to ca. 30 m. This trend of population mean depth distribution appears to be related more to a light-dark cycle than the semidiurnal periodicity of the tidal velocity depicted in Figure 2.

An estimate of sampling variability is given in Table 11 for recently-hatched larvae collected at the Jeffreys Ledge and Georges Bank sites by the repeated series of vertical hauls. The arithmetic mean (no./100 m^3), standard deviation, and coefficient of variation (SD/mean) were calculated for each depth level sampled as well as the integrated water-column total (no./10 m^2). The mean total larval density of 12,869/10 m^2 on Georges Bank was about 4x as large as that of 2,906/10 m^2 estimated on Jeffreys Ledge, and both estimates were of similar magnitude to the larval densities reported by Lough and Bolz (1979) collected in the same area and time with 61-cm bongo nets. On Georges Bank the CV's for the 6 depths ranged from 0.6 to 1.6 with a total integrated mean (no./10 m^2) of 0.6. On Jeffreys Ledge the CV's were smaller, ranging from 0.2 to 1.1 with a total integrated mean of 0.4, which is indicative of a more homogeneously distributed population than on Georges Bank. The 95% confidence limits for a single observation in the series was calculated by multiplying and dividing the arithmetic mean by the log (10) standard deviation (x2) and representing these values as percentages of the mean. The 95% CL's in Table 11 represent the range of actual observa-

tions fairly well and were wider for the Georges Bank samples than Jeffreys Ledge. The average 95% CL's for a single depth observation on Georges Bank were 9% to 2,150%, and 17% to 1,029% for Jeffreys Ledge, but are considerably narrower for the total integrated hauls (no./10 m^2). The limits for herring larvae are similar although somewhat larger than those estimated for copepods by Wiebe and Holland (1968), Wiebe et al. (1973), and Sameoto (1978). Sameoto also found that sample variability at a fixed station over a 26-hour period (2 tidal cycles) was similar to variability over a broad area of the Scotian Shelf. In terms of evaluating significant differences between single observations at depth in this study, one can feel reasonably sure that 2 depth-level observations are significantly different if they vary by an order of magnitude, and for the integrated totals, by about a factor of 4.

Sagitta elegans

High densities (1,000-5,000/100 m^3) of the chaetognath *Sagitta elegans* were present on the Georges Bank site. Their vertical distribution by depth and time is presented in Table 12 and Figures 9 and 10. *S. elegans* in these samples clearly exhibit the classical diel migratory pattern reported in other studies (Russel, 1931, 1933; Farran, 1947; McLaren, 1969; Pearre, 1973; King, 1979). High densities were observed near the bottom by day, dispersing towards the surface at sunset, descending in the water column at midnight, and exhibiting a less pronounced predawn (0400h) rise before returning to the bottom during daylight hours. A number of investigators have reported *S. elegans* to be

concentrated within 2 m of the bottom during the day (Russel, 1928; Sameoto, 1975; Hesthagen and Gjermundsen, 1978/79). Population centers (weighted mean depths) reached about 20 m at night and 70 m by day. The extremely large night/day ratios of mean abundance at the depths sampled substantiate their dramatic diel migrations. The fact that the integrated water column totals (no./10 m^2) only differed by a factor of 1.2 (N/D ratio) indicates that there was little light-aided avoidance of the samplers. A representative length-frequency distribution (Figure 11) shows that S. elegans ranged from 7 to 17 mm with a mean of 12.7 mm (1 SD = 2.1 mm). Seventy-four percent of the individuals had both sexually mature ovaries and testes (Stage IV, $\bar{x}$ = 13.7 mm), and 23% had only mature testes (Stage III, $\bar{x}$ = 11.7 mm). Less than 3% of the individuals were small immatures (Stage II, $\bar{x}$ = 7.7 mm). There does not appear to be any relationship between S. elegans' vertical migration and the tidal cycle. The fact that the sampling methods used in this study were able to show changes in the vertical distribution of S. elegans, a species known to undergo extensive diel migrations, lends support to the validity of these samples to discern migratory activity, or lack of it, in other species in the series.

Crustacean Biomass

Total water column crustacean biomass was somewhat lower on Jeffreys Ledge (215 gm/10 m^2) than on Georges Bank (300 gm/10 m^2), but average density was higher: 54 gm/100 m3 vs. 37 gm/100 m^3 (Tables 13 and 14). Mean night-day densities on Jeffreys Ledge ranged from 31.8 to 82.4 gm/100 m^3 at the depths sampled, and on

Georges Bank, from 25.8 to 52.2 gm/100 m^3. Night/day ratios of mean biomass were not significantly different from unity at either site, although some larger deviations occurred on Jeffreys at the 10- and 30-m levels. Population weighted mean depths plotted over the time series in Figures 8 and 9 showed a fairly stable population center residing at about 20 m on Jeffreys Ledge and 28 m on Georges Bank. On Jeffreys Ledge, the shoalest weighted mean depth, 8 m, occurred shortly after sunset at 1800h and descended thereafter through the night to the deepest point of 26 m soon after sunrise at 0800h. On the Georges Bank site there appeared to be some periodic variation in crustacean biomass with the population center varying between 20- and 40-m depth, but it does not appear to be diel in nature or in phase with the tidal cycle. However, this pattern may be confounded by the combined species representing the crustacean biomass. Sameoto (1975, 1978) showed that fluctuations in the number of many non-migrating zooplankton species were correlated to periodic fluctuations of the tidal cycle in a series of fixed zooplankton sampling experiments in a marine embayment and on the Scotian Shelf.

Centropages typicus

The vertical distribution of *Centropages typcius* males, females, and immatures on Jeffreys Ledge is summarized in Tables 15-17. Densities of all three categories averaged 400-600/m^3. *C. typicus* were abundant at all depths from bottom (40 m) to surface with some tendency towards higher densities at middepth. Weighted mean depths averaged about 14-23 m, and were shoaler by night than day. Adult males showed the greatest difference, about 7 m,

between night and day weighted mean depths. Integrated water column totals (no./m^2) were greater in night than day hauls, but the means could not be considered significantly different. At the individual depth levels more adults were collected in night hauls above 20 m (especially females, N/D ratio = 5.0) than below, where somewhat more were collected in day hauls, indicating diel vertical migration.

On Georges Bank (Tables 18-20), C. typicus also were distributed throughout the water column from surface to 50 m, but with lower densities at the bottom (80 m). Average densities (200-400/m^3) were smaller here than on Jeffreys Ledge, however, the integrated water column totals were similar for the adults, ca. 21,100/m^2. Immatures were nearly twice as abundant on Georges Bank (ca. 31,000/m^2) as on Jeffreys Ledge (ca. 18,000/m^2). More individuals were caught by day hauls than night, athough not in significant numbers except for samples at the 20-m depth level. The depth center of the population was between 21- and 26 m; adult females resided somewhat deeper than the adult males and immatures. The plotted weighted mean depths for adults males and females (Figure 12) shows the same periodicity as the crustacean biomass since they constitute the greatest portion by weight. This pattern suggests two shoal peaks (10-20 m) in time at roughly 2000h and 0400-0600h, and two deep points (35 m) at 2400h and 1000h. It is not clear whether the periodic variation in population depth centers is more related to tidal excursion or daylight intensity. Centropages sp. had generally been considered a near surface, non-migratory species (Clarke, 1933; Bigelow and

Sears, 1939; Bainbridge, 1961), but some evidence for upward migration at dusk and downward migration at dawn in the Chesapeake Bay was presented by White et al. (1979).

Pseudocalanus sp.

The vertical distribution of adult males and females of Pseudocalanus sp. on Jeffreys Ledge and Georges Bank is presented in Tables 21-24. Only the larger adult females were adequately sampled by the 0.333-mm mesh. Their average density (509/m^3) on Jeffreys Ledge was twice that of the males (221/m^3), whereas on Georges Bank their densities were more nearly equal (226 males/m^3, 157 females/^{3}). Pseudocalanus sp. were distributed throughout the water column on both sites with a reduced abundance near the surface and a population center at middepth. On Jeffreys Ledge, males and females had a weighted mean depth of 24-27 m during night and day hauls. Night to day ratios of abundance were not significantly different except for the surface and bottom levels where more individuals were caught at night. On the Georges Bank site, however, there was a marked difference in the weighted-mean depths between adult males and females (Figure 13). Adult females were located deeper in the water column (ca. 48 m) than adult males (ca. 29 m). The males displayed little variation in their mean depths throughout the time series, but the females did show some periodic variation by descending to deeper depths at night. A similarly confused picture of their vertical migration was described in an extensive review of the literature by Corkett and McLaren (1978). The young stages of Pseudocalanus are considered non-migratory and tend to live near

the surface but the CII and CIII stages through adults exhibit pronounced diel migration, especially adult females.

Calanus finmarchicus

The vertical distribution of Calanus finmarchicus on Jeffreys Ledge (Table 25) and Georges Bank (Table 26) is denoted only by presence or absence because of their low density and the high number of zero catches. On Jeffreys Ledge, the adults and copepodites were distributed throughout the water column but were somewhat less abundant at bottom (40 m depth). Copepodites were the most frequently caught group (39%) and adult females, the least (27%). Adult males were caught more often in the upper part of the water column at night; equal numbers of females were captured in night and day hauls; and greater numbers of immatures were caught in day hauls at all depths.

At the Georges Bank site, C. finmarchicus were distributed fairly evenly from surface to 50 m depth, but were less abundant at the bottom (80 m). The frequency of adult males, females, and copepodites in the hauls was nearly equal, about 33% for each group. About twice as many positive hauls for adult males and females were made at night, and even more frequently in the upper 30 m of the water column, indicating an upward migration at night. Clarke (1934) found that Calanus (CIII through adults) in the Gulf of Maine migrated to a depth of 120 m or more during the day and moved upward to the surface at night. However, on Georges Bank (17 July 1933), Calanus were limited, for the most part, to the surface waters (<30 m) above the thermocline.

Euphausiid Larvae

Three developmental stages of euphausiids occurred in the Georges Bank samples: furcilia, calyptopsis, and nauplius, in relative frequencies of 9, 56, and 35%, respectively (Table 27). All three stages were collected throughout the water column, more by night than day; the more developed furcilias were seldom found near bottom and surface. These larvae probably belong to the dominant species that occurs on the bank: *Thysanoessa inermis* (Bigelow, 1926). Most euphausiid larvae in the Gulf of Maine have been reported to occur in the surface waters above 45 m (Kulka et al., 1982).

Centropages hamatus

Adult males and females of *C. hamatus* were collected on Georges Bank with nearly equal frequency in day and night samples (43 and 57%, respectively). *C. hamatus* were distributed throughout the water column except for fewer occurrences of adult males near the surface (Table 28).

Oithona spp.

The occurrence of *Oithona* (*similis*) is probably underestimated because of its small size, but adult males and females were frequently caught in samples throughout the water column on Georges Bank (Table 29). An equal number of males and females were collected and more than half of these samples were taken at night.

Metridia lucens

Adult male, female, and copepodite stages of *Metridia lucens* were found throughout the water column on both Jeffreys Ledge and Georges Bank (Table 30 and 31). On Georges Bank, adult females occurred more frequently (41%) than males (31%) or copepodites (27%). Adults were found often near the surface at night (above 20 m) and deeper (below 30 m) during the day. Clarke (1933, 1934) found that *Metridia* adult females carried out extensive vertical migrations on Georges Bank closely following a specific isolume, rising in the afternoon and night and returning to depth in the morning. This species generally resides deeper in the water column below the thermocline.

Larval Herring Prey Selection and Availability

On Jeffreys Ledge only one larva in the 7-mm size class had a prey item in its gut, whereas on Georges Bank, 53% of the larvae examined contained at least one prey (Table 32). The larvae collected on both study sites had well-pigmented eyes and only a small percentage had yolksacs, so that active feeding would be expected. Few larvae were physically damaged and all guts were intact. Based on the Georges Bank gut analyses, recently-hatched larvae from 6- to 9-mm were all actively feeding. Their prey items consisted primarily of copepod nauplii (50%), copepodites and small copepods (31%), and copepod eggs (15%). No plant material was identified in the larval gut contents. Most of the larvae had 1 or 2 prey in their guts but some had anywhere from 3 to 8 prey (Figure 14).

Estimates of larval mouth size at hatching (5.8 mm) and at 10-mm SL are presented in Table 33 for both spawning sites based on fitted linear regressions to the data. The mouth breadth and mouth gape-90° measurements produced very similar predicted mouth sizes for a given larval length, while the mouth gape-60° resulted in smaller predicted mouth sizes, as expected. The Georges Bank larvae, from hatching to 10 mm, had a predicted mouth size range of 0.18-0.46 mm. In contrast, the Jeffreys Ledge larvae had considerably larger mouth sizes at the same lengths with a range of 0.31-0.67 mm. However, the discrepancy in mouth size between the two spawning sites may have been measurement error because different technicians measured the 2 groups of larvae.

The fine-mesh (0.053 mm) zooplankton data will now be presented in order to evaluate the potential prey field of recently-hatched herring larvae on the spawning grounds of Jeffreys Ledge and Georges Bank. Rank-difference coefficients (Tate and Clelland, 1959) were calculated among the number of species per m^3 at each depth level for both vertical series enumerated at each study site and no significant differences were found so the data were combined and averaged for Jeffreys Ledge (Table 34) and Georges Bank (Table 35). These tables list the number per m^3, percentage of total, and relative rank for each species or category at all depths sampled. Mean rank, frequency of occurrence, and sample dominance of each species were calculated as described by Fager and McGowan (1963). Also listed are total number per m^2, percentage composition, and rank based on total integrated abundance.

Invertebrate eggs were dominant at 3 depth levels on Jeffreys Ledge and had the highest overall mean rank. They were less abundant on Georges Bank but still dominant at one depth. The majority of eggs probably belonged to one of the larger species of copepods (Koga, 1968). They appeared to increase in numbers with increasing depth at both sites.

On Georges Bank, Oithona spp. nauplii were a dominant group at all 6 depths, and copepodites were dominant at 5 depths. The adults were present at all depths but were not among the dominant groups. On Jeffreys Ledge, Oithona spp. copepodites were dominant at 2 depths, adults at 1, and nauplii at 2. Both nauplii and adults seemed more abundant at the surface and upper levels than near the bottom. The number of copepodites was too variable to draw any firm conclusion about their depth distribution. Two general types of copepod nauplii were found: "Type A" was teardrop-shaped, and "Type B" was shaped more like a copepodite with a cephalothorax and urosome. "Type A" includes Oithona, Centropages, and Acartia species; "Type B" includes Pseudocalanus, Paracalanus, early-stage Calanus sp., and Metridia sp. "Type B" nauplii probably consisted mostly of Pseudocalanus sp., with some Paracalanus parvus and Metridia sp. They were a dominant group at 4 depths on Georges Bank, and 3 depths on Jeffreys Ledge. Their number at each level was too variable to detect any vertical distribution pattern. Adults and copepodites of Pseudocalanus were less numerous than the nauplii at both stations.

On Georges Bank, the next most abundant group of organisms was Centropages typicus nauplii. They were present at all depths in both areas, but not dominant at any. Copepodites and adults were much less numerous. "Type B" nauplii were less common on Georges Bank and Jeffreys Ledge. They were dominant at 1 depth level on Georges Bank and 3 on Jeffreys Ledge.

The total integrated abundance of the fine mesh microzooplankton grouped by 3 dominant categories, copepodities, nauplii, and others, is presented in Figure 15 by size class in terms of their average width, length, and volume. Note the different scales for Jeffreys Ledge and Georges Bank when comparing the graphs. Mouth gape of herring larvae is related more to the width or cross-sectional area of prey organism than length or volume. Therefore, most of the available prey organisms of larvae <10 mm - standard length with a mouth gape ranging from ca. 0.2-0.7 mm, having a prolate spheroid shape - would reside in the 0.26-0.50-mm length class and the corresponding 0-0.25-mm width class. Sherman et al. (1979) reported first-feeding herring larvae along the western coastal Gulf of Maine to be limited to food particles ranging 0.25-0.46 mm in length. According to Sherman and Honey (1971), Damkaer and Au (1974), Noskov et al. (1979), and Colton et al. (1981), newly hatched herring larvae fed mostly on copepod eggs, nauplii, and copepodites. Georges Bank had roughly 3 times more prey organisms available in the 0-0.25-mm width class than Jeffreys Ledge. The organisms on the Bank collected by fine mesh were mostly juvenile stages; on Jeffreys Ledge there were about 50% adults (and others) and 50% juveniles in this size class. On

Georges Bank the 0.26-0.50-mm length class and the 0.009-0.016-mm volume class had the greatest number of organisms. On Jeffreys Ledge the 0.0-0.25-mm length class and the 0.0-0.008-mm volume class predominated, but contained fewer organisms than on Georges Bank. Thus, the fine mesh data suggests that Georges Bank had 3 to 4 times as many potential prey organisms available for recently-hatched herring larvae as Jeffreys Ledge. However, these estimates of prey density are based on the total water column abundance (no./m^2); a more appropriate estimate would be based on density per unit volume (no./m^3). If only the type of prey items found in the larval guts (copepod nauplii, copepodites, and eggs) is summed from the fine mesh data enumerated in Tables 34 and 35, then the average density of all potentially available prey is the same on Jeffreys Ledge (5,303/m^3) as on Georges Bank (5,235/m^3). Assuming a typical range of sampling variability (C.V. 25-400%), patchiness of prey organisms for recently-hatched herring larvae on both spawning sites would be expected to range from 1,300 to 21,000/m^3.

DISCUSSION

Recently-hatched herring larvae and smaller zooplankton studied on Jeffreys Ledge and northeastern Georges Bank in October 1974 were found to be distributed throughout the water column. In shoal, tidally well-mixed waters one might expect a uniform vertical distribution of the smaller plankton. Only the larger, more developed organisms such as adult chaetognaths have the swimming capability to perform extensive vertical migrations

covering tens of meters. Herring larvae collected on both study sites were more abundant at middepth and substantially less abundant at the surface (1 m), day or night. Larvae on Jeffreys Ledge were slightly smaller, probably more recently-hatched than those on Georges Bank, and of uniform size throughout the water column. The size of larvae generally increased with depth on Georges Bank, in water twice as deep as that of Jeffreys Ledge. Also, some evidence is presented to indicate that larger larvae (7-12 mm) migrated into the surface water (<10 m depth) at night. These results are similar to other studies on small (<12 mm) herring larvae in relatively unstratified waters of the open ocean, although some conflicting observations have been made for larger larvae (see references in Introduction).

Most of the evidence indicates that herring larvae perform vertical migrations largely in response to changes in light intensity (Woodhead and Woodhead, 1955; Blaxter, 1973; Wales, 1975). However, these responses to light apparently are a complex function mediated by internal and external conditions.

Blaxter (1973) further reported some evidence for an endogenous rhythm of vertical migration by experimenting with larvae kept in continuous darkness over 48 hours. Perhaps the best model of the ontogeny of vertical migratory behavior of herring larvae has been summarized by Seliverstov (1974) based on studies along the Norwegian coast. He concluded that yolksac larvae did not respond to light at 12 hours after hatching but by 48 hours they develop a strong phototactic response and migrate into midwater. Woodhead and Woodhead (1955) also observed this phototac-

tic response of yolksac larvae to diffuse light during the first 5 days post hatching. At 3-5 days (6.63-7.44 mm) according to Seliverstov, the positive phototaxis weakens so that larvae stay near the bottom both day and night. After 5-7 days, when the larvae reach a length of 7.5 mm, they begin to exhibit diel movements, migrating into the surface layers by night. Laboratory studies by Seliverstov showed that 8-day old larvae respond negatively to light by day but have a weak photopositive response at night. Larvae 9-17 mm were observed to migrate from bottom (100 m) to surface.

Attempts to sort out the relative importance of environmental factors to the vertical distribution of herring in the field have not been very successful. Grainger (1978) was unable to find any significant correlation between the vertical distribution of small larvae (7-12 m) in Galway Bay, Ireland, and light intensity indexed as cloud cover, angle of the sun, and water turbidity. Graham and Sampson (1982) also did not find significant correlation between abundance of herring larvae in shallow and deep tows and incident light and phase of the tide in the Sheepscot Bay, Maine.

Sjöblom and Parmanne (1978) could not explain a seasonal reversal in the vertical distribution of Baltic herring larvae in the Gulf of Finland on the basis of light, or size of larvae, temperature, wind velocity and vertical distribution of zooplankton. They reported that temperature gradients as great as 4°C did not appear to prevent vertical migrations, although Höglund (1968) and Dubravin et al. (1976) noted that strong thermal

stratification prevented larvae from migrating into the warm surface water. Nevertheless, light intensity appears to have an overriding influence on their vertical distribution (also see Schnack, 1974).

The vertical distributions of larvae and their zooplankton food prey do not necessarily correspond (Schnack, 1974; Sjöblom and Parmanne, 1978), but migratory excursions of the larvae may be related to the search for optimal light intensity for feeding. Herring larvae require daylight conditions for feeding (Blaxter, 1973) and appear to have peak feeding periods after sunrise and prior to sunset (Cohen and Lough, 1982b; and other references therein). The intensity of feeding has been reported generally to decrease with depth and may be related to the concommitant decrease in prey and/or light intensity (Rudakova, 1971; Bjørke, 1971, 1978; Seliverstov, 1974). A detailed depth-feeding chronology study was not made of the Jeffreys Ledge and Georges Bank herring larvae so that these questions cannot be addressed here. The incidence of feeding (53%) and type of prey ingested by the Georges Bank larvae appear to be typical compared to other studies of field-caught, recently-hatched herring larvae (Bjørke, 1971, 1978; Schnack, 1972; Sherman and Honey, 1971), although a much lower feeding incidence has been reported in some studies, perhaps due loss of gut contents caused by the collection and preservation treatment (Hay, 1981). Herring larvae collected on the Jeffreys Ledge site were virtually devoid of gut contents, which may indicate that these more recently-hatched larvae were not sufficiently developed to successfully capture food items.

Although herring larvae begin feeding during yolksac absorption, their prey capture efficiency is very low at this time and continues to be low through the first 2 weeks of life (Rosenthal and Hempel, 1971; Blaxter and Staines, 1971). On both the Jeffreys Ledge and Georges Bank study sites the potentially available food organisms appeared to be distributed throughout the water column with average prey densities of about 5 prey per liter and an estimated range of 1-21 prey per liter. These prey densities are generally considered lower than the minimum abundance required for optimum feeding of small herring larvae (Rosenthal and Hempel, 1971). Beyer and Laurence (1981) estimated that first feeding larvae require an optimum density of 500-1000 nauplii per liter for maximum survival.

Herring apparently is one of the few species of fish whose larvae perform extensive vertical migrations in the water column. Their vertical distribution patterns exhibit considerable variability with age and habitat and appear to be a complex interaction of multiple factors. In order to understand the adaptive value of this behavior and the relative importance of a number of ecological factors, future studies will need to incorporate laboratory behavior-physiology experiments and detailed multifactorial field sampling into simulation models. Specific areas to be examined in greater detail are the effects of light intensity, water column stratification, turbulence, and patchy distribution of prey and predators on the larvae, as well as larval activity patterns induced by hunger-satiation thresholds, development of an air bladder as an aid in conserving energy,

(Hunter and Sanchez, 1976), and social behavior such as the early initiation of schooling.

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Table 1. Mean volume of water filtered by 20-cm bongo, 0.333-mm mesh net hauls at the selected sampling depths on the Jeffreys Ledge and Georges Bank vertical distribution study sites. An estimate of the percentage contamination of each net from the upper part of the water column during the setting and retrieving of the samplers is based upon the volume of water filtered by the control haul.

JEFFREYS LEDGE

Depth (m)	Mean Volume Filtered (m^3)	Std. Dev.	Control Haul Vol. Filtered (m^3)	Estimated Contamination (%)
1	59.0	5.9	0.3	0.5
10	62.5	6.0	3.1	5.0
20	66.4	6.2	6.1	9.2
30	70.4	5.9	9.2	13.1
40	74.1	6.8	12.2	16.5

GEORGES BANK

Depth (m)	Mean Volume Filtered (m^3)	Std. Dev.	Control Haul Vol. Filtered (m^3)	Estimated Contamination (%)
1	53.2	6.7	0.3	0.6
10	54.4	8.4	2.6	4.8
20	58.6	6.3	5.3	9.0
30	61.5	6.1	8.0	13.0
50	67.2	5.9	13.2	19.6
80	72.8	5.9	18.6	25.5

Table 2. Temperature and salinity observations at selected depths made on the Jeffreys Ledge vertical distribution study site (42°40'N, 70°25'W), 11-12 October 1974.

DEPTH (m)	TIME (h)												MEAN	S.D.
	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200		
1*	12.7°C 31.949°/oo	13.0 32.037	12.5 32.007	12.2 32.015	12.4 31.960	12.5 31.965	12.6 31.932	12.6 31.891	12.8 31.928	-- 31.952	13.2 31.994	13.1 31.960	12.7 31.966	0.31 0.412
10	12.2 31.943	12.3 ------	12.1 ------	12.2 32.001	12.2 ------	12.2 31.890	12.2 ------	12.2 ------	12.4 ------	12.5 31.971	12.7 ------	12.8 ------	12.3 31.951	0.22 0.0472
20	12.1 32.104	12.1 ------	12.0 ------	12.2 31.937	11.9 ------	11.8 31.958	12.2 ------	12.2 ------	12.1 ------	12.3 31.951	12.6 ------	12.3 ------	12.2 32.092	0.21 0.1337
30	10.0 32.274	10.5 ------	9.8 ------	10.0 32.224	9.9 ------	10.5 32.087	11.3 ------	11.5 ------	10.5 ------	9.5 32.204	10.0 ------	9.6 ------	10.3 32.197	0.63 0.0792
40	8.6 32.417	8.5 ------	8.8 ------	8.5 32.469	8.3 ------	8.4 32.466	8.6 ------	8.5 ------	8.9 ------	8.1 32.561	8.2 ------	8.2 ------	8.5 32.479	0.24 0.0601

*Surface bucket temperature readings; all others made by XBT.

Table 3. Temperature and salinity observations at selected depths made on the Georges Bank vertical distribution site (42°00'N, 66°40'W), 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1*	12.6°C 32.811°/oo	12.2 32.847	12.3 32.860	12.5 32.728	12.8 32.813	11.5 32.828	12.7 32.807	12.2 32.854	12.8 32.829	13.6 32.772	13.2 32.744	13.6 32.635
10	12.2 33.019	12.3 -	12.4 -	12.5 -	12.5 32.736	12.1 -	12.4 32.782	12.2 -	12.4 -	12.7 32.773	12.6 32.779	12.7 32.635
20	11.6 33.016	12.3 -	12.4 -	12.5 -	12.5 32.733	12.1 -	11.6 32.974	12.1 -	12.8 -	12.7 32.735	12.4 32.933	12.7 32.779
30	11.5 32.882	12.2 -	12.3 -	12.5 -	12.5 -	11.6 -	11.6 -	11.4 -	12.6 -	12.7 32.741	12.3 -	12.0 32.933
50	11.4 32.972	12.1 -	12.3 -	- -	12.5 32.781	11.5 -	11.6 33.009	11.2 -	12.2 -	12.2 32.772	12.0 -	11.9 33.024
80	11.4 32.757	12.0 -	12.3 -	- -	12.4 32.824	11.5 -	11.5 32.972	11.1 -	11.8 -	12.0 32.785	11.9 -	11.9 33.047

Depth (m)	Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Mean	S.D.
1*	- -	13.1 32.712	12.7 32.748	13.1 32.753	13.0 32.696	12.7 32.743	13.2 32.600	13.0 -	13.0 -	12.7 -	12.8 32.766	0.49 0.0737
10	- -	12.8 -	12.2 -	12.7 32.749	12.8 -	12.3 -	12.4 32.734	12.4 -	12.4 -	12.2 -	12.4 32.776	0.21 0.1089
20	- -	12.2 -	12.0 -	12.4 32.789	12.6 -	12.1 -	12.3 32.986	11.7 -	12.2 -	12.2 -	12.3 32.868	0.34 0.1203
30	- -	11.9 -	11.9 -	12.4 32.749	12.4 -	12.0 -	11.8 33.119	11.6 -	12.1 -	12.2 -	12.1 32.885	0.39 0.1552
50	- -	11.1 -	11.7 -	12.2 32.816	12.2 -	11.9 -	11.2 33.034	11.2 -	11.5 -	12.3 -	11.8 32.915	0.44 0.1200
80	- -	11.0 -	11.6 -	12.1 32.816	12.2 -	11.8 -	11.1 -	11.1 -	11.4 -	12.2 -	11.7 32.867	0.44 0.1155

*Surface bucket temperature readings; all others made by XBT.

Table 4. Relative abundance of zooplankton on Jeffreys Ledge for all day samples (20-cm bongo, 0.333-mm mesh net) collected over the period 11-12 October 1974.

SPECIES		MEAN RANK[1]	DOM[2]	Abundance[3] RANGE	MEDIAN	MEAN	DISP[4]	STD DEV	FREQ	%OCCUR
PSEUDOCALANUS ADULT (F)		44.11	1/ 28	213- 484571	45285	60844.9	135805.500	90901.44	28/ 28	100.0
CENTROPAGES T ADULT (M)		43.68	0/ 28	10436- 436906	48432	64915.1	100263.125	80675.88	27/ 28	96.4
CENTROPAGES T ADULT (F)		43.57	1/ 28	9156- 319146	47573	63539.5	70855.875	67098.06	27/ 28	96.4
CENTROPAGES SP COPEPODI(IM)		43.39	2/ 28	1919- 493226	17675	54918.7	172870.938	97436.38	28/ 28	100.0
PSEUDOCALANUS ADULT (M)		42.20	0/ 28	479- 519314	7974	34744.6	269021.125	96680.13	28/ 28	100.0
CALANUS F. COPEPODI(IM)		38.07	0/ 28	159- 64000	1925	4279.1	32966.480	11877.12	26/ 28	92.9
PSEUDO OR PARA COPEPODI(IM)		37.13	0/ 28	81- 140800	3273	10899.8	66320.000	26886.27	24/ 28	85.7
CLUPEA H. ADULT (UN)		36.45	0/ 28	2- 12509	375	1319.9	7184.770	3079.51	28/ 28	100.0
CALANUS F. ADULT (M)		32.68	0/ 28	81- 4977	721	830.1	1600.375	1152.62	21/ 28	75.0
CALANUS F. ADULT (F)		28.27	0/ 28	106- 9142	532	747.6	4273.664	1787.51	16/ 28	57.1
PARACALANUS P. ADULT (F)		26.05	0/ 28	159- 3812	673	533.7	1663.629	942.25	13/ 28	46.4
SAGITTA E. ADULT (UN)		25.64	0/ 28	1- 5	2	1.3	1.741	1.52	16/ 28	57.1
PADON SPP. ADULT (UN)		22.89	0/ 28	98- 1422	424	150.8	726.397	330.99	8/ 28	28.6
PARACALANUS P. ADULT (M)		22.63	0/ 28	2036- 56685	19803	4538.1	31835.070	12019.65	7/ 28	25.0
TEMORA L. ADULT (M)		22.36	0/ 28	53- 1828	406	188.0	882.859	407.36	9/ 28	32.1
METRIDA L. COPEPODI(IM)		22.02	0/ 28	98- 1828	363	151.4	935.329	376.34	8/ 28	28.6
CENTROPAGES H. ADULT (M)		21.86	0/ 28	49- 3754	186	185.2	2713.075	708.87	8/ 28	28.6
SPIRATELLA R. ADULT (UN)		21.52	0/ 28	49- 1828	195	123.0	1079.338	364.31	8/ 28	28.6
ACARTIA SPP. ADULT (M)		21.05	0/ 28	98- 1279	360	119.9	687.421	287.04	7/ 28	25.0
BIKOPLEURA D. ADULT (UN)		19.71	0/ 28	49- 711	106	53.5	507.652	164.75	5/ 28	17.9
BITHONA SP. ADULT (F)		19.63	0/ 28	98- 1422	673	102.4	960.632	313.57	4/ 28	14.3
BITHONA SP. ADULT (M)		19.38	0/ 28	49- 711	106	41.3	464.735	138.46	5/ 28	17.9
METRIDA L. ADULT (F)		19.11	0/ 28	49- 1706	842	122.8	1427.156	418.67	4/ 28	14.3
ACARTIA SPP. ADULT (F)		18.82	0/ 28	147- 4266	479	174.7	3729.866	807.26	3/ 28	10.7
EVADNE SPP. ADULT (UN)		18.64	0/ 28	159- 426	200	28.0	296.908	91.24	3/ 28	10.7
HYPERIIDEA ADULT (UN)		18.50	0/ 28	371- 1828	1706	139.5	1552.247	465.28	3/ 28	10.7
ACARTIA SPP. COPEPODI(IM)		18.36	0/ 28	200- 711	711	57.9	611.917	188.27	3/ 28	10.7
METRIDA L. ADULT (M)		18.34	0/ 28	106- 775	345	43.8	572.827	158.37	3/ 28	10.7
THYSANOESSA I. ADULT (UN)		18.34	0/ 28	170- 711	200	38.6	511.023	140.46	3/ 28	10.7
FISH EGG ADULT (UN)		18.34	0/ 28	53- 200	81	11.9	140.918	41.00	3/ 28	10.7
CENTROPAGES H. ADULT (F)		18.18	0/ 28	371- 13994	#######	513.0	13615.371	2642.95	2/ 28	7.1
BRACHYURA ZOEA (IM)		17.79	0/ 28	341- 711	#######	37.6	573.994	146.85	2/ 28	7.1
TEMORA L. ADULT (F)		17.75	0/ 28	360- 673	#######	36.9	546.545	142.00	2/ 28	7.1
HYDROZOA MEDUSA (IM)		17.75	0/ 28	49- 319	#######	13.1	279.901	60.65	2/ 28	7.1
BITHONA SP. ADULT (UN)		17.73	0/ 28	170- 371	#######	19.3	299.203	76.03	2/ 28	7.1
COPEPODA COPEPODI(IM)		17.68	0/ 28	81- 191	#######	9.7	154.029	38.68	2/ 28	7.1
ACATIA L. ADULT (F)		17.59	0/ 28	106- 360	#######	16.6	296.155	70.21	2/ 28	7.1
CARIDEA LARVA (IM)		17.20	0/ 28	812- 812	#######	29.0	812.000	153.45	1/ 28	3.6
ACARTIA C. ADULT (M)		17.18	0/ 28	295- 295	#######	10.5	294.999	55.75	1/ 28	3.6
MONSTRILLOIDA ADULT (UN)		17.13	0/ 28	341- 341	#######	12.2	340.999	64.44	1/ 28	3.6
HYDROZOA MEDUSA (UN)		17.13	0/ 28	319- 319	#######	11.4	318.998	60.29	1/ 28	3.6
TEMORA L. COPEPODI(IM)		17.09	0/ 28	345- 345	#######	12.3	344.999	65.20	1/ 28	3.6
OPHIUROIDEA ADULT (UN)		17.05	0/ 28	312- 312	#######	11.1	311.997	58.96	1/ 28	3.6
PELECYPODA LARVA (IM)		17.04	0/ 28	81- 81	#######	2.9	81.000	15.31	1/ 28	3.6
SIPUNCULIDA ADULT (UN)		17.04	0/ 28	81- 81	#######	2.9	81.000	15.31	1/ 28	3.6
CLADOCERA UNKNOWN (UN)		16.98	0/ 28	53- 53	#######	1.9	53.000	10.02	1/ 28	3.6

[1]Species or taxonomic groups were ranked within each sample on the basis of numbers of individuals. Ranks for each species or group were averaged over the total number of samples. Highest density sample was assigned highest rank.

[2]Dominance: Proportion of samples in which the species composed 50 percent or more of the individuals.

[3]Range, median, and mean numbers of individuals per 100 m^3 of water in samples in which the species was found.

[4]Dispersion: The ratio of the variance to the mean; the expected value for a random (Poisson) distribution is 1.0.

Table 5. Relative abundance of zooplankton on Jeffreys Ledge for all night samples (20-cm bongo, 0.333-mm mesh net) collected over the period 11-12 October 1974.

SPECIES			MEAN RANK[1]	DOM[2]	Abundance[3] RANGE		MEDIAN	MEAN	DISP[4]	STD DEV	FREQ	%OCCUR
CENTROPAGES T	ADULT	(F)	62.92	1/ 30	8112-	366545	41190	74777.3	57183.836	65391.52	30/ 30	100.0
PSEUDOCALANUS	ADULT	(F)	62.20	1/ 30	3413-	204800	40291	51517.9	43231.742	47193.31	30/ 30	100.0
CENTROPAGES T	ADULT	(M)	62.12	1/ 30	1994-	145341	48503	54404.0	39592.531	46411.14	30/ 30	100.0
PSEUDOCALANUS	ADULT	(M)	60.78	0/ 30	825-	138971	10666	22647.3	38892.473	29678.41	30/ 30	100.0
CENTROPAGES SP	COPEPODI	(IM)	60.02	0/ 30	997-	224193	15768	42999.4	74288.562	56518.68	29/ 30	96.7
CLUPEA H.	ADULT	(UN)	55.67	0/ 30	38-	3202	837	907.8	477.278	658.23	30/ 30	100.0
CALANUS F.	ADULT	(M)	51.78	0/ 30	350-	9142	1422	1546.1	2204.833	1846.32	25/ 30	83.3
CALANUS F.	COPEPODI	(IM)	49.72	0/ 30	213-	88562	781	3742.2	68762.688	16041.39	24/ 30	80.0
PSEUDO OR PARA	COPEPODI	(IM)	48.63	0/ 30	533-	26331	4400	4267.0	8690.203	6089.45	21/ 30	70.0
CALANUS F.	ADULT	(F)	41.05	0/ 30	45-	1279	758	367.7	531.946	442.26	16/ 30	53.3
SAGITTA E.	ADULT	(UN)	40.07	0/ 30	1-	51	3	4.4	21.922	9.82	18/ 30	60.0
TEMORA L.	ADULT	(M)	38.27	0/ 30	45-	2327	524	297.4	838.365	499.30	14/ 30	46.7
METRIDA L.	COPEPODI	(IM)	37.28	0/ 30	182-	1625	371	233.9	596.494	373.30	13/ 30	43.3
METRIDA L.	ADULT	(F)	35.28	0/ 30	175-	775	412	157.4	399.151	250.65	11/ 30	36.7
CENTROPAGES H.	ADULT	(M)	34.58	0/ 30	175-	147393	643	5070.7	142509.625	26881.75	10/ 30	33.3
PARACALANUS P.	ADULT	(M)	34.28	0/ 30	203-	17958	1126	1214.6	10518.684	3574.40	9/ 30	30.0
PARACALANUS P.	ADULT	(F)	33.18	0/ 30	350-	3490	1081	382.7	1771.744	823.47	8/ 30	26.7
CENTROPAGES H.	ADULT	(F)	32.72	0/ 30	90-	406	347	75.9	259.030	140.22	8/ 30	26.7
ACARTIA SPP.	ADULT	(M)	31.45	0/ 30	175-	2438	400	148.2	1400.405	455.31	7/ 30	23.3
METRIDA L.	ADULT	(M)	30.42	0/ 30	91-	731	531	92.9	531.070	222.16	6/ 30	20.0
SPIRATELLA R.	ADULT	(UN)	30.32	0/ 30	106-	764	406	81.5	430.815	187.34	6/ 30	20.0
TEMORA L.	ADULT	(F)	30.30	0/ 30	83-	1238	279	79.5	731.099	241.09	6/ 30	20.0
BITHONA SP.	ADULT	(F)	30.27	0/ 30	83-	812	180	61.4	459.594	167.99	6/ 30	20.0
ERYTHROPS E.	ADULT	(UN)	30.23	0/ 30	1-	415	73	24.6	278.422	82.82	6/ 30	20.0
BITHONA SP.	ADULT	(M)	29.43	0/ 30	175-	787	387	65.6	463.029	174.28	5/ 30	16.7
THYSANOESSA I.	ADULT	(UN)	29.32	0/ 30	2-	775	371	52.5	527.771	166.46	5/ 30	16.7
DICHELOPANDALU	ADULT	(UN)	29.17	0/ 30	1-	332	5	11.5	317.815	60.54	5/ 30	16.7
PODON SPP.	ADULT	(UN)	28.55	0/ 30	106-	1238	421	72.9	867.963	251.49	4/ 30	13.3
AMPHIPODA	UNKNOWN	(UN)	28.50	0/ 30	1-	415	23	15.4	371.630	75.73	4/ 30	13.3
AMPELISCA V.	ADULT	(UN)	28.40	0/ 30	1-	498	9	17.2	478.799	90.84	4/ 30	13.3
AXIUS OR CALL	LARVA	(IM)	27.90	0/ 30	175-	1651	1484	110.3	1435.606	397.99	3/ 30	10.0
FISH EGG	ADULT	(UN)	27.53	0/ 30	382-	812	787	66.0	675.636	211.22	3/ 30	10.0
ACATIA L.	ADULT	(F)	26.80	0/ 30	400-	691	#######	36.4	566.836	143.38	2/ 30	6.7
POLYCHAETA	LARVA	(IM)	26.72	0/ 30	831-	1238	#######	69.0	1040.232	267.85	2/ 30	6.7
MONOCULODES SP	ADULT	(UN)	26.67	0/ 30	2-	498	#######	16.7	495.876	90.91	2/ 30	6.7
BRACHYURA	ZOEA	(IM)	26.65	0/ 30	213-	1625	#######	61.3	1448.374	297.89	2/ 30	6.7
CUMACEA	ADULT	(UN)	26.65	0/ 30	371-	648	#######	34.0	530.876	134.28	2/ 30	6.7
CARIDEA	LARVA	(IM)	26.55	0/ 30	1-	775	#######	25.9	773.933	141.49	2/ 30	6.7
ANONYX L.	ADULT	(UN)	26.47	0/ 30	4-	166	#######	5.7	161.919	30.29	2/ 30	6.7
SIPUNCULIDA	ADULT	(UN)	26.43	0/ 30	1-	831	#######	27.7	829.933	151.71	2/ 30	6.7
MONSTRILLOIDA	ADULT	(UN)	26.35	0/ 30	1-	166	#######	5.6	164.943	30.30	2/ 30	6.7
TEMORA L.	COPEPODI	(IM)	25.77	0/ 30	345-	345	#######	11.5	345.000	62.99	1/ 30	3.3
BITHONA SP.	ADULT	(UN)	25.70	0/ 30	825-	825	#######	27.5	825.000	150.62	1/ 30	3.3
ONCAEA V.	ADULT	(M)	25.65	0/ 30	175-	175	#######	5.8	175.000	31.95	1/ 30	3.3
MEGANYCTIPHANE	ADULT	(UN)	25.65	0/ 30	6-	6	#######	.2	6.000	1.10	1/ 30	3.3
POLYCHAETA	LARVA	(UN)	25.65	0/ 30	175-	175	#######	5.8	175.000	31.95	1/ 30	3.3
ACATIA L.	ADULT	(M)	25.63	0/ 30	371-	371	#######	12.4	370.995	67.73	1/ 30	3.3
HYPERIIDEA	ADULT	(UN)	25.63	0/ 30	371-	371	#######	12.4	370.995	67.73	1/ 30	3.3
EVADNE SPP.	ADULT	(UN)	25.63	0/ 30	371-	371	#######	12.4	370.995	67.73	1/ 30	3.3
AXIUS OR CALL	JUVENILE	(IM)	25.62	0/ 30	5-	5	#######	.2	5.000	.91	1/ 30	3.3
PENAEIDEA	ADULT	(UN)	25.60	0/ 30	2-	2	#######	.1	2.000	.37	1/ 30	3.3
PLEUSYMTES G.	ADULT	(UN)	25.60	0/ 30	166-	166	#######	5.5	166.000	30.31	1/ 30	3.3
PENAEIDEA	LARVA	(IM)	25.58	0/ 30	412-	412	#######	13.7	411.997	75.22	1/ 30	3.3
BIKOPLEURA D.	ADULT	(UN)	25.58	0/ 30	387-	387	#######	12.9	386.999	70.66	1/ 30	3.3
ACARTIA SPP.	COPEPODI	(IM)	25.57	0/ 30	387-	387	#######	12.9	386.999	70.66	1/ 30	3.3
BRACHYURA	ZOEA	(M)	25.55	0/ 30	106-	106	#######	3.5	106.000	19.35	1/ 30	3.3
PANDALIS BOREA	ADULT	(UN)	25.53	0/ 30	2-	2	#######	.1	2.000	.37	1/ 30	3.3
OPHIUROIDEA	ADULT	(UN)	25.53	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3
PANDALIS BOREA	JUVENILE	(IM)	25.52	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3
PONTOGENEIA I.	ADULT	(UN)	25.50	0/ 30	83-	83	#######	2.8	82.999	15.15	1/ 30	3.3
SPIRONTOCARIS	ADULT	(UN)	25.48	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3
RACHOTROPIS B.	ADULT	(UN)	25.47	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3
PELECYPODA	LARVA	(IM)	25.47	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3
FORAMINIFERA	ADULT	(UN)	25.47	0/ 30	1-	1	#######	.0	1.000	.18	1/ 30	3.3

[1]Species or taxonomic groups were ranked within each sample on the basis of numbers of individuals. Ranks for each species or group were averaged over the total number of samples. Highest density sample was assigned highest rank.

[2]Dominance: Proportion of samples in which the species composed 50 percent or more of the individuals.

[3]Range, median, and mean numbers of individuals per 100 m^3 of water in samples in which the species was found.

[4]Dispersion: The ratio of the variance to the mean; the expected value for a random (Poisson) distribution is 1.0.

Table 6. Relative abundance of zooplankton on Georges Bank for all day samples (20-cm bongo, 0.333-mm mesh net) collected over the period 13-15 October 1974.

SPECIES	MEAN RANK[1]	DOM[2]	Abundance[3] RANGE	MEDIAN	MEAN	DISP[4]	STD DEV	FREQ	%OCCUR
CENTROPAGES T COPEPODI(IM)	92.76	1/ 42	86- 143277	35201	45669.6	30158.680	37112.48	42/ 42	100.0
CENTROPAGES T ADULT (M)	92.62	0/ 42	118- 134400	30435	36220.2	18341.996	25775.00	42/ 42	100.0
PSEUDOCALANUS ADULT (M)	91.50	0/ 42	106- 115200	16759	21703.8	15919.844	18588.22	42/ 42	100.0
CENTROPAGES T ADULT (F)	90.46	0/ 42	138- 97066	24914	26493.4	12166.293	17953.46	41/ 42	97.6
PSEUDOCALANUS ADULT (F)	89.26	1/ 42	228- 117333	5517	14290.2	39618.348	23794.02	41/ 42	97.6
CLUPEA H. ADULT (UN)	85.42	0/ 42	7- 5792	986	1453.3	1569.187	1510.15	41/ 42	97.6
CALANUS F. COPEPODI(IM)	84.01	0/ 42	8- 2477	962	928.8	450.268	646.68	40/ 42	95.2
EUPHAUSIACEA CALYPTOP(IM)	74.63	0/ 42	2- 2715	662	697.3	912.435	797.64	33/ 42	78.6
CENTROPAGES H. ADULT (F)	74.39	0/ 42	8- 3839	1059	872.0	1102.865	980.69	32/ 42	76.2
SAGITTA E. ADULT (UN)	73.95	1/ 42	1- 4980	37	414.2	2711.974	1059.31	36/ 42	85.7
CALANUS F. ADULT (M)	72.04	0/ 42	17- 1955	426	365.5	423.959	393.62	31/ 42	73.8
CALANUS F. ADULT (F)	68.31	0/ 42	4- 3011	639	513.0	1009.578	719.70	27/ 42	64.3
CENTROPAGES H. ADULT (M)	67.92	0/ 42	5- 4193	393	670.3	1783.317	1093.29	27/ 42	64.3
ZPFRAG INVERTEG(IM)	62.08	0/ 42	1- 853	350	196.8	333.607	256.24	23/ 42	54.8
BITHONA SP. ADULT (F)	58.81	0/ 42	3- 1706	571	324.5	785.670	504.96	19/ 42	45.2
BITHONA SP. ADULT (M)	58.36	0/ 42	1- 4266	433	384.5	1572.891	777.65	19/ 42	45.2
EUPHAUSIACEA NAUPLIUS(IM)	55.48	0/ 42	168- 1015	382	191.5	463.447	297.35	17/ 42	40.5
PSEUDOCALANUS COPEPODI(IM)	55.37	0/ 42	2- 31507	220	861.0	27298.613	4848.24	17/ 42	40.5
CALNOID SPP. COPEPODI(IM)	53.18	0/ 42	106- 853	228	120.6	372.385	211.91	15/ 42	35.7
METRIDA L. ADULT (F)	52.51	0/ 42	1- 1066	191	95.7	427.820	202.31	15/ 42	35.7
BIKOPLEURA D. ADULT (UN)	50.79	0/ 42	1- 1706	206	104.4	752.948	280.31	13/ 42	31.0
CARIDEA LARVA (IM)	50.39	0/ 42	1- 609	216	78.8	318.464	158.42	13/ 42	31.0
POLYCHAETA LARVA (IM)	49.33	0/ 42	1- 1052	204	81.8	463.201	194.69	12/ 42	28.6
CALNUS M. ADULT (F)	48.54	0/ 42	98- 1066	206	74.6	460.798	185.40	11/ 42	26.2
SIPUNCULIDA ADULT (UN)	48.31	0/ 42	1- 220	3	8.6	160.489	37.19	12/ 42	28.6
PASIPHAE JUVENILE(IM)	47.99	0/ 42	1- 8	1	.9	4.472	1.96	12/ 42	28.6
METRIDA L. ADULT (M)	46.58	0/ 42	44- 1066	185	64.2	538.733	186.03	9/ 42	21.4
METRIDA L. COPEPODI(IM)	45.83	0/ 42	175- 842	459	87.5	484.933	205.99	8/ 42	19.0
ERYTHROPS E. ADULT (UN)	45.58	0/ 42	1- 462	26	22.3	338.566	86.96	8/ 42	19.0
ANOMURE LARVA (IM)	45.06	0/ 42	1- 213	161	22.6	172.570	62.41	8/ 42	19.0
CALNUS M. ADULT (M)	44.55	0/ 42	106- 457	412	52.8	326.156	131.21	7/ 42	16.7
ONCAEA V. ADULT (F)	44.55	0/ 42	2- 308	196	28.2	204.509	75.96	7/ 42	16.7
AXIUS BR CALL JUVENILE(IM)	44.40	0/ 42	1- 16	2	.8	9.234	2.73	8/ 42	19.0
SPIRATELLA R. ADULT (UN)	44.39	0/ 42	98- 376	177	34.7	230.134	89.35	7/ 42	16.7
MONOCULODES SP ADULT (UN)	44.27	0/ 42	1- 350	2	13.5	261.295	59.50	7/ 42	16.7
BRACHYURA MEGALOPS(IM)	44.27	0/ 42	1- 4	1	.4	2.161	.88	8/ 42	19.0
SALPA F. ADULT (UN)	43.64	0/ 42	1- 103	6	4.4	71.664	17.81	7/ 42	16.7
ALTEUTHA D. ADULT (UN)	42.67	0/ 42	2- 154	44	6.1	104.912	25.34	5/ 42	11.9
HARPACTICOID S UNKNOWN (UN)	42.44	0/ 42	175- 228	203	24.3	185.960	67.27	5/ 42	11.9
THYSANOESSA I. ADULT (UN)	42.43	0/ 42	1- 220	4	7.6	174.892	36.45	5/ 42	11.9
ACATIA L. ADULT (F)	41.49	0/ 42	98- 308	153	17.0	207.490	59.31	4/ 42	9.5
AMPHIPODA UNKNOWN (UN)	41.25	0/ 42	1- 35	4	1.0	28.262	5.44	4/ 42	9.5
ACARTIA D. ADULT (F)	40.50	0/ 42	127- 412	213	17.9	296.660	72.88	3/ 42	7.1
FISH EGG ADULT (UN)	40.45	0/ 42	2- 127	46	4.2	102.555	20.67	3/ 42	7.1
TEMORA L. ADULT (M)	40.38	0/ 42	213- 426	412	25.0	360.913	95.03	3/ 42	7.1
EUPHAUSIACEA FURCILIA(IM)	40.31	0/ 42	196- 426	220	20.0	305.870	78.31	3/ 42	7.1
CANDACIA AR. COPEPODI(IM)	40.26	0/ 42	177- 426	185	18.8	301.916	75.26	3/ 42	7.1
PARAMETOPELLA ADULT (UN)	39.71	0/ 42	44- 324	#######	8.8	288.631	50.29	2/ 42	4.8
TEMORA L. ADULT (F)	39.44	0/ 42	127- 191	#######	7.6	161.719	34.99	2/ 42	4.8
BRACHYURA ZOEA (IM)	39.43	0/ 42	203- 220	#######	10.1	206.688	45.62	2/ 42	4.8
TEMORA L. COPEPODI(IM)	39.31	0/ 42	196- 206	#######	9.6	196.224	43.34	2/ 42	4.8
UNDINULA V. ADULT (F)	39.29	0/ 42	185- 213	#######	9.5	195.154	43.00	2/ 42	4.8
ANOMURE MEGALOPS(IM)	39.25	0/ 42	1- 206	#######	4.9	204.961	31.78	2/ 42	4.8
SAGITTA S. ADULT (UN)	39.20	0/ 42	1- 8	#######	.2	7.179	1.24	2/ 42	4.8
CUMACEA ADULT (UN)	39.04	0/ 42	1- 1	#######	.0	.976	.22	2/ 42	4.8
CENTROPAGES H. COPEPODI(IM)	38.55	0/ 42	1544- 1544	#######	36.8	1543.991	238.24	1/ 42	2.4
ZPFRAG LARVA (IM)	38.49	0/ 42	308- 308	#######	7.3	307.996	47.53	1/ 42	2.4
METRIDA L. ADULT (UN)	38.49	0/ 42	2133- 2133	#######	50.8	2132.994	329.13	1/ 42	2.4
HARPACTICOID S ADULT (UN)	38.48	0/ 42	228- 228	#######	5.4	228.000	35.18	1/ 42	2.4
BITHONA SP. COPEPODI(IM)	38.44	0/ 42	127- 127	#######	3.0	126.999	19.60	1/ 42	2.4
DENTIFIED IN ADULT (M)	38.44	0/ 42	164- 164	#######	3.9	164.000	25.31	1/ 42	2.4
EUPHAUSIACEA CALYPTOP(M)	38.44	0/ 42	228- 228	#######	5.4	228.000	35.18	1/ 42	2.4
EUPHAUSIACEA FURCILIA(F)	38.44	0/ 42	228- 228	#######	5.4	228.000	35.18	1/ 42	2.4
BIKOPLEURA D. ADULT (M)	38.43	0/ 42	412- 412	#######	9.8	411.999	63.57	1/ 42	2.4
PONTOGENEIA I. ADULT (UN)	38.43	0/ 42	350- 350	#######	8.3	349.999	54.01	1/ 42	2.4
PLEUSYMTES G. ADULT (UN)	38.43	0/ 42	433- 433	#######	10.3	432.998	66.81	1/ 42	2.4
PONTELLINA P. ADULT (F)	38.43	0/ 42	433- 433	#######	10.3	432.998	66.81	1/ 42	2.4
CANDACIA AR. ADULT (M)	38.42	0/ 42	98- 98	#######	2.3	98.000	15.12	1/ 42	2.4
CANDACIA AR. ADULT (F)	38.42	0/ 42	98- 98	#######	2.3	98.000	15.12	1/ 42	2.4
POLYCHAETA LARVA (UN)	38.42	0/ 42	5- 5	#######	.1	5.000	.77	1/ 42	2.4
ACARTIA C. ADULT (M)	38.40	0/ 42	412- 412	#######	9.8	411.998	63.57	1/ 42	2.4
HYPERIIDEA UNKNOWN (UN)	38.40	0/ 42	228- 228	#######	5.4	228.000	35.18	1/ 42	2.4
PELECYPODA LARVA (IM)	38.40	0/ 42	12- 12	#######	.3	12.000	1.85	1/ 42	2.4
BITHONA SPI. ADULT (F)	38.39	0/ 42	246- 246	#######	5.9	246.000	37.96	1/ 42	2.4
ACATIA L. ADULT (M)	38.38	0/ 42	103- 103	#######	2.5	102.999	15.89	1/ 42	2.4
BITHONA SPI. ADULT (M)	38.38	0/ 42	224- 224	#######	5.3	223.999	34.56	1/ 42	2.4
DENTIFIED IN ADULT (F)	38.38	0/ 42	114- 114	#######	2.7	114.000	17.59	1/ 42	2.4
GASTROPODA LARVA (IM)	38.38	0/ 42	191- 191	#######	4.5	191.000	29.47	1/ 42	2.4
IDOTEA B. ADULT (UN)	38.38	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
CALNUS M. COPEPODI(IM)	38.37	0/ 42	106- 106	#######	2.5	105.999	16.36	1/ 42	2.4
POLYCHAETA RTEG(UN)(IM)	38.37	0/ 42	168- 168	#######	4.0	168.000	25.92	1/ 42	2.4
ZPFRAG ZOEA (IM)	38.36	0/ 42	188- 188	#######	4.5	188.000	29.01	1/ 42	2.4
PSEUDOCALANUS RTEG(UN)(IM)	38.35	0/ 42	426- 426	#######	10.1	425.999	65.73	1/ 42	2.4
ONCAEA V. ADULT (M)	38.35	0/ 42	426- 426	#######	10.1	425.999	65.73	1/ 42	2.4
DICHELOPANDALU ADULT (UN)	38.35	0/ 42	4- 4	#######	.1	4.000	.62	1/ 42	2.4
CORYCAEUS SPP. ADULT (F)	38.32	0/ 42	196- 196	#######	4.7	196.000	30.24	1/ 42	2.4
ANONYX L. ADULT (UN)	38.31	0/ 42	2- 2	#######	.0	2.000	.31	1/ 42	2.4
OSTRACODA ADULT (UN)	38.29	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
ANOMURE ZOEA (IM)	38.24	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
CRANGON S. ADULT (UN)	38.23	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
ACHELIA S. ADULT (UN)	38.23	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
PAGURIDAE ADULT (UN)	38.23	0/ 42	1- 1	#######	.0	1.000	.15	1/ 42	2.4
PAGURIDAE ZOEA (IM)	38.23	0/ 42	2- 2	#######	.0	2.000	.31	1/ 42	2.4
HYPERIIDEA ADULT (UN)	38.18	0/ 42	2- 2	#######	.0	2.000	.31	1/ 42	2.4

[1]Species or taxonomic groups were ranked within each sample on the basis of numbers of individuals. Ranks for each species or group were averaged over the total number of samples. Highest density sample was assigned highest rank.

[2]Dominance: Proportion of samples in which the species composed 50 percent or more of the individuals.

[3]Range, median, and mean numbers of individuals per 100 m^3 of water in samples in which the species was found.

[4]Dispersion: The ratio of the variance to the mean; the expected value for a random (Poisson) distribution is 1.0.

Table 7. Relative abundance of zooplankton on Georges Bank for all night samples (20-cm bongo, 0.333-mm mesh net) collected over the period 13-15 October 1974.

SPECIES		MEAN RANK[1]	DOM[2]	Abundance[3] RANGE	MEDIAN	MEAN	DISP[4]	STD DEV	FREQ	%OCCUR
CENTROPAGES T	ADULT (M)	109.45	1/ 83	675- 125714	26544	32159.2	20623.801	25753.55	83/ 83	100.0
PSEUDOCALANUS	ADULT (M)	108.67	0/ 83	223- 269356	15277	20940.0	43740.895	30264.39	83/ 83	100.0
CENTROPAGES T	ADULT (F)	108.65	0/ 83	462- 66986	20906	23255.1	9116.008	14559.99	83/ 83	100.0
PSEUDOCALANUS	ADULT (F)	107.39	1/ 83	37- 91583	6400	13679.0	23984.066	18112.93	83/ 83	100.0
CENTROPAGES T	COPEPOD(IM)	107.36	2/ 83	858- 150400	25537	33670.9	30516.191	32054.79	80/ 83	96.4
CLUPEA H.	ADULT (UN)	103.25	0/ 83	8- 4348	1162	1366.8	1041.852	1193.31	83/ 83	100.0
CALANUS F.	COPEPOD(IM)	98.80	0/ 83	15- 27927	571	1393.3	7342.953	3198.53	78/ 83	94.0
CALANUS F.	ADULT (F)	98.75	0/ 83	31- 9200	667	1228.0	2177.933	1635.36	78/ 83	94.0
SAGITTA E.	ADULT (UN)	94.69	0/ 83	1- 48290	318	1088.4	25755.281	5294.44	75/ 83	90.4
CALANUS F.	ADULT (M)	94.46	0/ 83	41- 6400	732	926.0	1276.346	1087.12	72/ 83	86.7
EUPHAUSIACEA	CALYPTOP(IM)	79.86	0/ 83	12- 2666	551	396.1	701.267	527.03	51/ 83	61.4
CENTROPAGES H.	ADULT (F)	76.26	0/ 83	10- 3710	492	416.4	1129.098	685.65	45/ 83	54.2
OITHONA SP.	ADULT (M)	74.08	0/ 83	10- 218156	289	3556.2	170017.000	24589.05	44/ 83	53.0
OITHONA SP.	ADULT (F)	73.77	0/ 83	5- 239739	351	3641.0	187040.063	26096.05	44/ 83	53.0
OIKOPLEURA D.	ADULT (UN)	68.67	0/ 83	2- 1113	305	171.8	460.029	281.16	36/ 83	43.4
ZOOPLANKTON	INVERTEB(IM)	67.24	0/ 83	5- 3254	224	185.1	1026.160	435.93	34/ 83	41.0
THYSANOESSA I.	ADULT (UN)	67.14	0/ 83	1- 629	2	31.5	334.272	102.64	39/ 83	47.0
EUPHAUSIACEA	NAUPLIUS(IM)	66.92	0/ 83	6- 2206	214	145.9	651.217	308.19	34/ 83	41.0
CENTROPAGES H.	ADULT (M)	65.63	0/ 83	20- 2400	216	151.3	812.824	350.71	32/ 83	38.6
PSEUDOCALANUS	COPEPOD(IM)	64.99	0/ 83	12- 91269	384	1521.1	67938.000	10494.56	30/ 83	36.1
PASIPHAE	JUVENILE(IM)	63.04	0/ 83	1- 355	6	12.3	251.351	55.69	32/ 83	38.6
SPIRATELLA R.	ADULT (UN)	61.95	0/ 83	13- 2226	220	108.6	726.208	280.88	27/ 83	32.5
ERYTHROPS E.	ADULT (UN)	61.69	0/ 83	1- 935	20	52.7	449.732	153.97	27/ 83	32.5
AMPHIPODA	UNKNOWN (UN)	61.31	0/ 83	1- 2800	22	53.7	1806.817	311.52	27/ 83	32.5
MONOCULODES SP	ADULT (UN)	61.30	0/ 83	1- 212	4	12.9	139.793	42.39	28/ 83	33.7
CALNOID SPP.	COPEPOD(IM)	59.60	0/ 83	5- 300521	193	3964.0	274930.938	33012.57	23/ 83	27.7
CRANGON S.	ADULT (UN)	59.44	0/ 83	1- 731	4	10.5	612.119	80.15	26/ 83	31.3
METRIDA L.	ADULT (F)	59.41	0/ 83	44- 1010	228	79.6	385.417	175.20	23/ 83	27.7
BRACHYURA	MEGALOPS(IM)	58.19	0/ 83	1- 228	2	4.6	144.904	25.76	24/ 83	28.9
SIPUNCULIDA	ADULT (UN)	56.84	0/ 83	1- 246	2	10.0	188.183	43.41	21/ 83	25.3
ACATIA L.	ADULT (F)	55.77	0/ 83	20- 800	200	53.5	349.201	136.74	17/ 83	20.5
CARIDEA	LARVA (IM)	55.70	0/ 83	1- 433	110	35.9	258.855	96.34	18/ 83	21.7
ONCAEA V.	ADULT (F)	54.93	0/ 83	81- 479	163	38.5	236.706	95.46	16/ 83	19.3
METRIDA L.	ADULT (M)	54.78	0/ 83	84- 1219	181	48.5	495.476	154.95	16/ 83	19.3
CALNUS M.	ADULT (M)	54.54	0/ 83	86- 800	220	54.1	388.835	145.02	15/ 83	18.1
ANONYX L.	ADULT (UN)	54.54	0/ 83	1- 355	4	5.4	280.796	38.37	17/ 83	20.5
CALNUS M.	ADULT (F)	54.42	0/ 83	103- 595	220	48.4	296.866	119.82	15/ 83	18.1
POLYCHAETA	LARVA (IM)	54.38	0/ 83	1- 738	168	40.9	330.962	116.28	15/ 83	18.1
PARAMETOPELLA	ADULT (UN)	53.52	0/ 83	3- 581	209	37.0	310.746	107.28	13/ 83	15.7
ALTEUTHA D.	ADULT (UN)	53.25	0/ 83	5- 365	133	23.5	176.137	64.36	13/ 83	15.7
AXIUS OR CALL	JUVENILE(IM)	53.16	0/ 83	1- 355	2	4.8	318.612	38.34	15/ 83	18.1
EUPHAUSIACEA	FURCILIA(IM)	53.01	0/ 83	106- 412	206	36.1	236.896	92.43	13/ 83	15.7
METRIDA L.	COPEPOD(IM)	52.65	0/ 83	2- 882	220	43.9	463.659	142.71	12/ 83	14.5
TEMORA L.	ADULT (M)	51.81	0/ 83	44- 882	193	31.7	409.129	113.90	11/ 83	13.3
DICHELOPANDALU	ADULT (UN)	51.51	0/ 83	1- 200	3	3.2	153.805	22.08	12/ 83	14.5
FISH EGG	ADULT (UN)	51.22	0/ 83	6- 662	183	28.8	377.275	104.16	10/ 83	12.0
CUMACEA	ADULT (UN)	50.17	0/ 83	1- 331	9	7.5	229.486	41.47	9/ 83	10.8
SALPA F.	ADULT (UN)	50.16	0/ 83	1- 220	7	3.8	160.536	24.68	9/ 83	10.8
TEMORA L.	ADULT (F)	49.23	0/ 83	44- 371	110	12.9	213.114	52.44	7/ 83	8.4
PASIPHAE	ADULT (UN)	48.85	0/ 83	1- 13	1	.3	8.076	1.56	7/ 83	8.4
ANOMURE	LARVA (IM)	48.41	0/ 83	1- 371	52	8.2	273.606	47.38	6/ 83	7.2
CALNOID SPP.	NAUPLIUS(IM)	48.29	0/ 83	84- 67443	1049	848.3	57478.160	6982.75	5/ 83	6.0
OITHONA SP.	COPEPOD(IM)	48.25	0/ 83	108- 55755	319	839.2	46919.457	6274.86	5/ 83	6.0
MEGANYCTIPHANE	ADULT (UN)	48.12	0/ 83	1- 3	1	.1	1.802	.44	6/ 83	7.2
OITHONA SPI.	ADULT (F)	48.01	0/ 83	103- 433	206	14.0	272.632	61.86	5/ 83	6.0
CANDACIA AR.	ADULT (M)	47.99	0/ 83	185- 387	203	15.0	260.789	62.57	5/ 83	6.0
PANTOGENEIA I.	ADULT (UN)	47.98	0/ 83	1- 177	6	4.2	163.818	26.17	5/ 83	6.0
SAGITTA S.	ADULT (UN)	47.83	0/ 83	1- 31	4	.5	22.912	3.52	5/ 83	6.0
ANOMURE	MEGALOPS(IM)	47.67	0/ 83	1- 180	1	2.2	176.012	19.75	5/ 83	6.0
CANDACIA AR.	ADULT (F)	47.42	0/ 83	43- 216	136	6.4	160.398	32.03	4/ 83	4.8
HYDROZOA	MEDUSA (IM)	47.42	0/ 83	193- 355	262	12.9	276.961	59.84	4/ 83	4.8
HYPERIIDEA	ADULT (UN)	47.33	0/ 83	1- 457	105	8.0	374.505	54.90	4/ 83	4.8
CIROLANA P.	ADULT (UN)	47.10	0/ 83	1- 2	1	.1	1.356	.29	4/ 83	4.8
ONCAEA V.	ADULT (M)	46.89	0/ 83	104- 243	193	6.5	194.191	35.54	3/ 83	3.6
ACARTIA D.	ADULT (F)	46.87	0/ 83	114- 662	193	11.7	498.446	76.28	3/ 83	3.6
ZOOPLANKTON	INVERTEB(UN)	46.84	0/ 83	188- 1113	433	20.9	832.025	131.84	3/ 83	3.6
EUPHAUSIACEA	CALYPTOP(M)	46.81	0/ 83	43- 185	104	4.0	138.908	23.57	3/ 83	3.6
ACATIA L.	ADULT (M)	46.77	0/ 83	98- 220	168	5.9	173.660	31.89	3/ 83	3.6
SAGITTA MX.	ADULT (UN)	46.63	0/ 83	1- 3	3	.1	2.662	.47	3/ 83	3.6
CENTROPAGES T	ADULT (IM)	46.49	0/ 83	32524- 239304	#######	3275.0	213863.813	26465.30	2/ 83	2.4
GASTROPODA	LARVA (IM)	46.13	0/ 83	108- 278	#######	4.7	228.537	32.60	2/ 83	2.4
CALANUS F.	NAUPLIUS(IM)	46.08	0/ 83	1- 103	#######	1.3	101.992	11.30	2/ 83	2.4
LUCIFER F.	ADULT (UN)	46.07	0/ 83	2- 180	#######	2.2	177.994	19.76	2/ 83	2.4
AXIUS OR CALL	LARVA (IM)	46.05	0/ 83	1- 25	#######	.3	24.053	2.74	2/ 83	2.4
PLEUSTES P.	ADULT (UN)	46.02	0/ 83	1- 1	#######	.0	.988	.15	2/ 83	2.4
PELECYPODA	LARVA (IM)	45.98	0/ 83	1- 1	#######	.0	.988	.15	2/ 83	2.4
CENTROPAGES T	COPEPOD(M)	45.69	0/ 83	21403- 21403	#######	257.9	21402.945	2349.28	1/ 83	1.2
ISOPODA	UNKNOWN (UN)	45.69	0/ 83	243- 243	#######	2.9	242.999	26.67	1/ 83	1.2
PLEUROBRANCHIA	ADULT (UN)	45.68	0/ 83	843- 843	#######	10.2	842.996	92.53	1/ 83	1.2
CIRRIPEDIA	NAUPLIUS(UN)	45.66	0/ 83	77913- 77913	#######	938.7	77912.313	8552.03	1/ 83	1.2
ZOOPLANKTON	RTEG(UN)(IM)	45.63	0/ 83	393- 393	#######	4.7	392.990	43.14	1/ 83	1.2
MICROSETELLA N	ADULT (UN)	45.62	0/ 83	209- 209	#######	2.5	209.000	22.94	1/ 83	1.2
ACATIA L.	COPEPOD(IM)	45.61	0/ 83	18- 18	#######	.2	18.000	1.98	1/ 83	1.2
EUPHAUSIACEA	COPEPOD(IM)	45.60	0/ 83	492- 492	#######	5.9	491.998	54.00	1/ 83	1.2
TEMORA L.	COPEPOD(IM)	45.57	0/ 83	220- 220	#######	2.7	220.000	24.15	1/ 83	1.2
ANOMALOCERA P	ADULT (M)	45.57	0/ 83	43- 43	#######	.5	43.000	4.72	1/ 83	1.2
CALNOID SPP.	ADULT (F)	45.57	0/ 83	114- 114	#######	1.4	113.998	12.51	1/ 83	1.2
OENTIFIED IN	ADULT (F)	45.57	0/ 83	114- 114	#######	1.4	113.998	12.51	1/ 83	1.2
SPIRATELLA R.	ADULT (M)	45.57	0/ 83	312- 312	#######	3.8	311.998	34.25	1/ 83	1.2
EUPHAUSIACEA	NAUPLIUS(UN)	45.57	0/ 83	3339- 3339	#######	40.2	3338.991	366.50	1/ 83	1.2
EUPHAUSIACEA	CALYPTOP(UN)	45.57	0/ 83	86- 86	#######	1.0	86.000	9.44	1/ 83	1.2
OENTIFIED IN	ADULT (F)	45.55	0/ 83	20- 20	#######	.2	19.999	2.20	1/ 83	1.2
HYPERIA SPP	ADULT (UN)	45.55	0/ 83	297- 297	#######	3.6	296.988	32.60	1/ 83	1.2
HYCIDACEA	ADULT (UN)	45.54	0/ 83	168- 168	#######	2.0	167.999	18.44	1/ 83	1.2
PSEUDOCALANUS	ADULT (IM)	45.53	0/ 83	108- 108	#######	1.3	107.999	11.85	1/ 83	1.2
METRIDA L.	COPEPOD(IM)	45.53	0/ 83	108- 108	#######	1.3	107.999	11.85	1/ 83	1.2
EUCHAETA N.	ADULT (M)	45.53	0/ 83	108- 108	#######	1.3	107.999	11.85	1/ 83	1.2
OITHONA SP.	COPEPOD(M)	45.53	0/ 83	104- 104	#######	1.3	103.998	11.42	1/ 83	1.2
AMPHIPODA	UNKNOWN (F)	45.53	0/ 83	4- 4	#######	.0	4.000	.44	1/ 83	1.2
PLEUSYMTES G.	ADULT (UN)	45.53	0/ 83	3- 3	#######	.0	3.000	.33	1/ 83	1.2
POLYCHAETA	LARVA (M)	45.53	0/ 83	104- 104	#######	1.3	103.998	11.42	1/ 83	1.2
IDOTEA B.	ADULT (UN)	45.52	0/ 83	5- 5	#######	.1	5.000	.55	1/ 83	1.2
CIRRIPEDIA	NAUPLIUS(IM)	45.51	0/ 83	216- 216	#######	2.6	215.999	23.71	1/ 83	1.2
TRICHOPHAXUS E	ADULT (UN)	45.51	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
CTENOPHORA	ADULT (UN)	45.49	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
CANCER SPP.	JUVENILE(IM)	45.48	0/ 83	3- 3	#######	.0	3.000	.33	1/ 83	1.2
ANOMURE	ZOEA (IM)	45.46	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
SPIRONTOCARIS	ADULT (UN)	45.45	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
PASIPHAE	JUVENILE(UN)	45.45	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
CHIRIDOTEA SP.	ADULT (UN)	45.42	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2
PAGURIDAE	ADULT (UN)	45.42	0/ 83	1- 1	#######	.0	1.000	.11	1/ 83	1.2

[1]Species or taxonomic groups were ranked within each sample on the basis of numbers of individuals. Ranks for each species or group were averaged over the total number of samples. Highest density sample was assigned highest rank.

[2]Dominance: Proportion of samples in which the species composed 50 percent or more of the individuals.

[3]Range, median, and mean numbers of individuals per 100 m^3 of water in samples in which the species was found.

[4]Dispersion: The ratio of the variance to the mean; the expected value for a random (Poisson) distribution is 1.0.

Table 8. Species list for the Jeffreys Ledge and Georges Bank vertical distribution study sites, October 1974.

Species common to both sites	Species occurring only on Jeffreys Ledge	Species occurring only on Georges Bank
Centropages typicus	*Ampelisca verrilli*	*Nannocalanus* (=*Calanus*) *minor*
Centropages hamatus	*Rhachotropis oculata*	*Candacia armata*
Pseudocalanus sp.	*Podon* sp.	*Euchaeta norvegica*
Calanus finmarchicus	*Evadne* sp.	*Pontellina plumata*
Metridia lucens	*Pandalus borealis*	*Acartia clausi*
Temora longicornis	*Foraminifera*	*Acartia danae*
Acartia longiremis	*Ophiuroidea*	*Microsetella norvegica*
Oncaea venusta	*Penaeidea*	*Anomalocera pattersoni*
Oithona spp.		*Undinula vulgaris*
Paracalanus parvus		*Oithona spinirostris*
Sagitta elegans		*Corycaeus speciosus*
Clupea harengus		*Alteutha depressa*
Spiratella (=*Limacina*) *retroversa*		*Monoculoides* sp.
Erythrops erythrophthalma		*Anonyx liljeborgi*
Axiis or *Callianassa* sp.		*Parametopella cypris*
Pleusymtes glaber		*Pleustes panoplus*
Pontogeneia inermis		*Trichophoxus epistomus*
Spirontocaris sp.		*Ciriolana polita*
Thysanoessa inermis		*Hyperia* sp.
Meganyctiphanes norvegica		*Idothea baltica*
Oikopleura dioica		*Chiridotea* sp.
Euphausiacea		*Crangon septemspinosa*
Amphipoda		*Dichelopandalus leptocerus*
Cumacea		*Lucifer faxoni*
Hyperiidea		*Cancer* sp.
Pasiphaea		*Salpa fusiformis*
Brachyura		*Pleurobranchia* sp.
Pelecypoda		*Sagitta setosa*
Polychaeta		*Sagitta maxima*
Fish egg		Hydrozoa medusae
		Anomura
		Gastropoda
		Isopoda
		Cirripedia
		Mysidacea
		Ctenophora
		Paguridae

Table 9. Vertical distribution of herring larvae (*Clupea harengus*) (No./100 m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	2	10	133	241	108	474	140	244	230	23	31	13	241	16	15.1
10	99	396	667	645	627	1,283	371	1,054	1,689	232	198	44	796	194	4.1
20	1,297	805	1,162	1,644	700	1,196	1,548	1,279	558	1,373	352	776	1,273	921	1.4
30	994	304	1,156	910	38	856	822	1,240	995	782	212	1,092	773	677	1.1
40	392	228	632	645	1,446	857	3,198	526	167	638	221	358	1,334	367	3.6
No./10 m^2	2,587	1,624	3,368	3,642	2,142	4,001	4,410	3,958	3,441	2,718	888	2,098	3,631	1,983	1.8
Weighted Mean Depth (m)	25.7	21.7	23.6	22.4	26.0	20.5	29.6	21.6	17.8	25.3	23.4	27.2	24.0	24.7	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 10. Vertical distribution of herring larvae (*Clupea harengus*) (no./100 m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	8	273	1,159	1,036	174	77	104	29	756	7	63	0
10	289	355	2,246	1,642	2,724	217	360	150	2,079	420	316	265
20	578	1,403	1,974	2,278	3,387	170	430	189	2,256	1,003	552	1,042
30	776	2,141	3,139	2,550	3,517	2,165	1,349	398	5,827	2,367	1,815	2,520
50	558	1,595	4,360	3,204	3,115	390	1,559	1,720	2,545	2,137	5,685	2,352
80	12	283	5	1,963	1,883	1,054	150	1,453	1,073	785	833	872
No./10 m^2	3,448	9,518	20,416	19,218	22,086	6,229	6,988	7,430	21,426	11,497	19,084	12,275
Weighted mean depth(m)	31.5	34.1	30.8	36.1	34.4	42.5	37.7	54.3	32.2	40.2	46.7	41.4

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	248	84	717	2,932	1,401	280	9	25	132	796	142	5.6
-	1,526	1,026	693	1,044	2,794	139	41	2,292	959	1,289	946	1.4
-	1,932	1,819	1,217	1,587	2,846	157	59	3,602	2,381	1,587	1,631	1.0
-	2,417	2,706	1,266	2,667	4,244	13	212	1,912	2,867	2,362	2,583	0.9
-	760	2,496	1,209	3,269	4,340	821	438	283	1,818	2,476	2,197	1.1
-	302	1,100	621	2,100	3,135	-	148	123	245	1,335	563	2.4
-	9,561	14,836	8,122	19,420	28,259	6,404	1,740	9,667	12,619	15,198	12,859	1.2
-	27.1	37.4	31.9	33.8	36.3	48.2	46.6	22.0	31.4	36.9	35.1	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 11. Abundance indices of recently-hatched herring larvae based on the repeated series of vertical hauls made on the Jeffreys Ledge and Georges Bank fixed stations. The arithmetic mean number /100 m^3, range, standard deviation, and coefficient of variation (CV) are shown for each depth level sampled, as well as for the total integrated depth index (number per 10 m^2). The 95% confidence limits (CL) for a single observation is represented as percentage of the mean.

JEFFREYS LEDGE (12 hauls)

Depth (m)	Mean number larvae per 100 m^3	Range	Standard deviation	CV SD/Mean	95% CL(%)
1	137	2- 474	141	1.03	4-2,740
10	609	44-1,689	506	0.83	12- 854
20	1,058	352-1,548	409	0.39	39- 254
30	1,713	38-1,240	389	0.23	13- 770
40	776	167-3,198	839	1.08	19- 529
Total No./10 m^2	2,906	888-4,410	1,074	0.37	40- 252

GEORGES BANK (21 hauls)

Depth (m)	Mean number larvae per 100 m^3	Range	Standard deviation	CV SD/Mean	95% CL (%)
1	453	0-2,932	709	1.56	2-6,164
10	1,027	41-2,794	922	0.90	10-1,022
20	1,470	59-2,846	1,074	0.73	10-1,000
30	2,232	13-4,244	1,360	0.61	7-1,423
50	2,126	390-5,685	1,473	0.69	18- 551
80	907	5-3,135	843	0.93	4-2,742
Total No./10 m^2	12,869	1,740-28,259	7,063	0.55	26- 386

Table 12. Vertical distribution of *Sagitta elegans* (no./100 m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	0	46	1,460	359	24	21	219	4	9	4	4	0
10	36	54	923	360	137	111	150	2	46	10	7	5
20	35	306	631	371	144	61	582	3	51	40	11	5
30	35	840	607	380	182	349	646	18	85	71	9	6
50	168	107	413	293	345	69	904	503	175	59	55	118
80	190	196	23	740	581	1,172	529	3,721	1,613	2,422	2,237	4,962
No./10 m^2	829	2,205	4,262	3,323	2,300	2,637	4,864	6,873	3,086	3,939	3,527	7,757
Weighted mean Depth (m)	53.4	34.8	16.9	37.3	49.9	57.4	39.8	69.8	65.9	69.8	71.3	71.9

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	14	864	1,218	277	127	89	5	2	14	466	5	93.2
-	70	876	355	245	100	10	17	3	22	327	18	18.2
-	91	919	316	244	135	38	16	24	27	344	28	12.3
-	482	1,005	358	739	271	3	64	75	43	454	46	9.9
-	1,659	822	193	1,303	475	1,149	1,198	522	28	597	161	3.7
-	732	943	392	3,125	2,881	-	2,812	3,785	435	1,039	2,235	0.5
-	6,137	7,204	2,888	9,681	6,214	4,693	7,345	7,123	848	4,807	3,873	1.2
-	52.0	32.0	22.3	55.1	61.8	54.4	65.5	69.1	61.9	42.7	66.2	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls - 0800-1600

Table 13. Vertical distribution of crustacean biomass (gm/100 m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	17.4	71.8	263.2	77.5	48.7	39.0	28.5	31.6	83.9	25.7	23.4	36.6	45.1	35.0	1.3
10	19.2	78.3	27.8	101.1	62.0	107.9	41.8	99.1	40.8	9.7	21.7	30.2	82.4	31.8	2.6
20	57.4	70.6	25.9	25.0	51.3	41.8	127.8	37.5	19.2	54.7	75.6	91.0	56.7	70.5	0.8
30	52.7	56.3	27.5	25.9	9.2	36.5	24.7	74.5	67.6	87.9	48.5	116.4	34.2	72.4	0.5
40	----	27.2	17.8	9.8	48.2	54.9	54.2	24.9	27.4	63.5	21.0	71.1	38.4	45.7	0.8
No./10 m^2	164.4	254.7	221.7	195.6	171.0	233.2	235.7	239.4	183.3	196.9	168.0	291.5	215.0	215.1	1
Weighted Mean Depth (m)	21.1	16.7	8.1	11.9	17.6	18.4	21.0	18.6	17.0	26.0	21.2	24.3	17.5	21.9	-

[1]Night hauls 2000-0400
Day hauls 0800-1600

Sunrise 0610 D.S.T.
Sunset 1722

Table 14. Vertical distribution of crustacean biomass (gm/100 m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	31.2	31.3	28.6	43.0	30.5	85.4	69.1	59.9	31.6	28.4	43.9	40.5
10	33.5	34.5	36.2	38.9	53.5	77.4	60.4	72.9	76.9	45.0	53.3	73.9
20	18.3	22.5	26.9	40.0	49.8	133.0	29.8	67.3	30.4	34.8	48.2	74.8
30	33.3	19.6	36.2	37.1	49.6	60.3	44.4	67.7	36.0	39.5	52.7	58.9
50	26.9	16.2	36.7	34.7	36.8	68.1	37.9	44.9	47.7	41.2	40.8	37.2
80	12.9	7.4	4.0	36.1	34.7	32.9	15.3	30.0	35.2	39.6	30.9	24.3
No./10 m^2	204.0	153.7	229.5	297.0	337.0	563.2	309.1	429.0	349.2	315.7	350.9	386.8
Weighted mean Depth(m)	27.0	22.0	25.9	30.2	30.1	25.3	23.0	26.1	29.8	33.0	28.6	25.7

Depth (m)	Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
1	-	102.5	93.0	48.3	29.5	20.6	38.8	50.0	58.1	41.9	48.7	39.4	1.2
10	-	57.9	40.2	35.4	33.1	19.6	31.9	59.6	35.1	47.8	42.7	52.2	0.8
20	-	34.9	32.5	29.1	28.9	17.6	30.5	45.6	35.6	43.3	41.8	40.8	1.0
30	-	44.5	23.3	32.8	52.2	26.8	4.2	66.3	44.7	47.3	36.7	44.6	0.8
50	-	26.0	15.8	20.9	48.3	31.8	34.8	50.7	30.0	30.3	36.6	36.3	1.0
80	-	18.1	16.9	14.0	32.8	45.1	-	19.1	22.3	20.2	25.8	26.5	1.0
No./10 m^2	-	303.0	219.0	211.1	325.0	234.9	227.3	385.1	275.3	289.1	295.3	310.1	1.0
Weighted mean Depth(m)	-	19.9	18.5	23.5	33.8	39.7	33.2	26.9	25.9	26.2	27.3	28.0	-

Sunrise 0610 D.S.T. 1/ Night hauls 2000-0400
Sunset 1722 Day hauls 0800-1600

Table 15. Vertical distribution of Centropages typicus adult males (No./m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	130	478	4,369	962	582	474	266	678	1,453	227	163	508	592	301	2.0
10	419	671	250	1,435	708	1,394	514	1,422	613	104	214	676	1,095	417	2.6
20	512	690	203	642	504	353	1,412	497	97	595	987	860	682	729	0.9
30	280	397	1,243	153	84	225	167	139	67	856	484	1,252	154	654	0.2
40	---	89	38	20	149	357	103	172	682	340	177	1,091	160	424	0.4
No./m^2	14,160	20,415	38,995	27,210	16,615	23,875	22,775	24,830	18,445	18,358	18,550	35,875	23,061	21,472	1.1
Weighted Mean Depth (m)	17.8	15.9	9.2	10.9	13.2	15.1	17.4	12.5	13.5	24.5	21.5	23.6	13.8	20.7	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 16. Vertical distribution of Centropages typicus adult females (No./m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night mean	[1]Day Mean	Ratio N/D
1	117	525	3,192	1,325	634	691	331	480	842	161	192	476	692	294	2.4
10	338	398	302	1,528	980	977	500	1,097	469	92	199	592	1,016	205	5.0
20	545	574	298	560	355	408	1,032	671	155	451	712	576	605	572	1.1
30	338	353	2,121	232	81	547	210	790	509	1,038	495	804	372	606	0.6
40	---	127	141	129	841	914	590	891	3,666	1,115	336	1,455	673	758	0.9
No./m^2	14,485	16,510	43,875	30,470	21,535	27,345	22,025	32,435	33,870	22,190	16,700	29,375	26,762	19,852	1.4
Weighted Mean Depth (m)	19.1	16.3	14.2	11.0	18.1	19.9	20.6	21.1	28.8	29.2	22.8	24.9	18.1	22.5	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 17. Vertical distribution of Centropages typicus immatures (No./m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	446	1,796	4,932	582	213	107	45	96	1,218	35	19	73	209	474	0.4
10	474	459	160	0	604	1,591	209	1,439	570	24	49	184	769	237	3.2
20	387	551	151	835	1,058	657	2,242	326	32	663	824	740	1,024	633	1.6
30	121	219	969	84	29	90	158	88	25	61	170	1,621	90	438	0.2
40	---	107	43	10	52	84	18	65	374	72	78	61	46	80	0.6
No./m^2	12,655	21,805	37,675	12,150	18,235	24,335	26,405	19,335	14,230	8,015	10,885	26,120	20,092	15,896	1.3
Weighted Mean Depth (m)	12.3	9.8	7.6	13.9	15.6	13.9	19.6	13.0	10.9	21.2	22.0	25.3	15.2	18.1	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 18. Vertical distribution of Centropages typicus adult males (no./m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	287	216	214	383	985	345	985	684	417	221	608	430
10	305	150	272	278	560	738	468	1,011	734	364	488	877
20	1,344	169	226	337	488	468	208	748	297	232	441	752
30	225	126	472	272	365	545	301	698	284	311	531	717
50	95	52	311	226	273	590	206	274	258	301	373	251
80	7	16	9	94	147	109	35	157	156	84	1	90
No./m^2	23,780	7,700	21,040	19,205	25,645	38,345	21,870	40,685	25,445	20,515	29,635	36,820
Weighted mean Depth(m)	19.2	18.4	26.7	23.9	26.7	26.6	15.6	21.1	22.6	27.0	21.4	21.8

Time (h) cont'd) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	1,257	1,051	218	352	234	286	523	471	469	420	415	1.0
-	842	351	236	346	129	382	814	333	523	376	518	0.7
-	265	226	172	279	112	283	447	301	333	280	529	0.5
-	294	132	232	328	173	7	488	304	512	283	412	0.7
-	137	56	134	460	116	254	199	173	246	263	242	1.1
-	72	35	21	258	68	-	70	52	47	86	62	1.4
-	26.270	14.530	12,315	28,300	10,095	18,345	28,570	18,360	25,440	21,009	25,714	0.8
-	13.5	11.0	22.2	31.4	25.0	21.2	19.6	20.4	21.6	23.0	22.0	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 19. Vertical distribution of Centropages typicus adult females (no./m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	204	138	123	277	84	219	445	587	260	-	464	448
10	177	89	196	204	306	366	334	670	632	265	282	547
20	971	117	149	285	360	323	140	459	258	220	293	417
30	164	160	260	244	281	305	235	415	252	228	275	544
50	90	90	201	164	266	295	192	316	286	297	288	229
80	7	21	8	141	199	98	27	229	230	144	1	118
No./m^2	17,315	7,715	13,110	16,150	20,930	21,405	15,695	31,785	24,580	19,180	19,410	27,535
Weighted mean Depth (m)	20.0	24.4	26.5	26.8	32.1	26.9	19.6	23.9	27.1	34.5	21.2	23.1

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	603	622	216	256	136	186	471	249	331	256	326	0.8
-	560	258	182	209	92	320	435	221	285	247	344	0.7
-	254	145	139	187	94	183	283	196	239	2,001	371	0.5
-	288	110	258	212	200	5	364	231	351	211	292	0.7
-	201	49	122	445	124	247	239	153	178	211	217	1.0
-	100	33	28	256	101	-	76	59	45	99	86	1.2
-	22,000	10,510	11,630	23,385	10,155	15,915	22,110	13,590	17,285	15,889	19,842	0.8
-	19.6	12.8	23.2	35.3	31.4	23.6	22.0	24.0	22.7	25.8	24.7	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 20. Vertical distribution of Centropages typicus immatures (no./m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	292	522	191	179	48	657	216	362	468	247	281	350
10	396	933	394	228	408	1,463	634	691	755	587	625	1,141
20	1,259	282	239	419	515	324	240	496	315	163	786	1,433
30	168	167	486	382	771	1,027	445	338	354	175	1,113	1,052
50	72	48	210	332	426	1,193	242	133	339	388	472	226
80	6	22	9	96	210	164	71	27	105	67	1	57
No./m^2	22,420	18,795	19,960	22,835	34,835	68,935	22,860	22,480	28,400	22,065	44,025	49,775
Weighted mean Depth (m)	18.0	13.1	24.0	29.3	32.4	27.0	23.3	18.4	22.2	25.0	25.5	21.4

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	709	1,504	85	95	287	69	379	1,051	597	335	469	0.7
-	278	775	897	399	225	550	68	644	704	597	693	0.9
-	144	401	356	573	165	602	21	440	557	383	708	0.5
-	176	163	490	1,016	211	12	428	349	714	500	561	0.9
-	51	40	144	597	78	269	108	47	298	353	263	1.3
-	30	23	38	227	55	-	40	24	64	99	46	2.2
-	12,130	23,070	24,475	43,765	11,275	22,805	12,505	22,865	34,715	29,482	32,638	0.9
-	13.0	9.8	21.2	33.2	20.8	22.8	23.5	13.1	21.5	24.4	21.0	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 21. Vertical distribution of Pseudocalanus sp. adult males (No./m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	5	13	85	91	41	58	21	11	8	11	53	13	44	19	2.3
10	70	8	110	109	44	95	51	41	16	7	69	16	68	34	2.0
20	251	78	531	560	180	52	272	105	150	332	378	384	234	285	0.8
30	565	223	519	717	58	388	241	1,390	333	573	280	277	559	384	1.5
40	---	29	82	96	149	292	238	210	781	56	32	34	197	38	5.2
No./m^2	11,710	3,300	12,435	14,795	3,770	7,100	6,935	16,465	8,935	9,455	7,695	7,005	9,813	7,833	1.3
Weighted Mean Depth (m)	27.0	26.9	23.0	23.9	24.3	27.9	26.9	29.7	33.0	26.6	22.2	24.1	26.5	25.4	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 22 Vertical distribution of Pseudocalanus sp. adult females (No./m^3) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Night Mean	[1]Day Mean	Ratio N/D
1	10	38	751	425	111	124	72	34	54	21	38	2	153	22	7.0
10	515	191	478	729	348	701	118	195	221	20	162	86	418	195	2.1
20	855	1,109	566	657	508	263	877	656	239	999	304	974	592	848	0.7
30	787	245	4,846	438	40	381	230	2,048	610	883	488	1,145	627	710	0.9
40	---	173	649	155	813	1,173	1,372	544	1,322	428	98	350	811	262	3.1
No./m^2	25,555	16,505	65,900	21,140	13,580	19,935	19,470	31,880	17,580	21,265	10,220	23,810	21,201	19,471	1.1
Weighted Mean Depth (m)	22.1	21.7	25.8	16.8	25.1	25.7	28.9	27.9	30.7	26.7	24.0	26.5	24.9	24.2	---

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 23. Vertical distribution of Pseudocalanus sp. adult males (no./m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	69	62	34	11	56	35	88	62	73	95	57	96
10	219	638	96	119	186	244	181	239	367	252	345	299
20	1,152	153	96	114	182	2,694	143	154	140	123	146	194
30	398	282	246	338	412	253	309	473	351	169	306	398
50	160	119	110	140	153	438	237	240	234	226	193	149
80	5	17	2	158	93	128	131	71	167	312	1	149
No./m^2	24,100	15,680	8,560	13,325	15,360	46,220	16,205	18,400	19,055	28,180	14,625	17,340
Weighted mean Depth (m)	23.5	20.7	28.9	37.8	31.2	25.6	33.9	31.3	31.9	29.5	25.4	30.1

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	105	91	59	86	146	331	73	112	55	94	80	1.2
-	330	216	168	179	164	499	320	212	298	205	285	0.7
-	169	132	102	162	100	176	118	147	158	390	294	1.3
-	508	268	303	320	361	10	272	351	438	282	344	0.8
-	218	119	125	186	210	72	182	151	214	179	190	0.9
-	72	42	120	78	163	-	92	65	72	102	110	0.9
-	19,665	11,560	12,465	14,460	16,480	12,523	14,755	14,165	17,835	16,716	19,329	0.9
-	28.6	26.5	33.0	30.7	33.7	11.0	29.2	28.3	29.9	29.2	28.4	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 24. Vertical distribution of Pseudocalanus sp. adult females (no./m^3) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400
1	13	14	18	7	2	12	37	75	11	2	5	0
10	81	20	28	17	12	37	72	184	56	13	15	17
20	1,173	59	41	19	30	67	195	272	45	13	12	21
30	366	191	64	33	28	277	397	372	132	31	35	51
50	391	254	88	73	76	26	614	916	200	75	75	324
80	9	34	37	249	136	516	59	566	601	782	3	409
No./m^2	28,005	10,585	4,495	6,450	4,790	13,645	25,045	41,905	17,060	14,340	2,740	15,380
Weighted mean Depth (m)	28.2	41.0	38.1	59.1	54.5	53.0	39.4	45.6	57.3	67.7	39.3	59.5

Time (h) cont'd 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Night[1] mean	Day[1] mean	Ratio N/D
-	50	9	5	8	14	18	30	11	14	13	8	1.6
-	56	62	21	4	30	29	49	27	55	31	38	0.8
-	56	132	15	8	77	50	109	73	58	63	199	0.3
-	252	168	67	56	225	1	336	335	79	132	147	0.9
-	347	182	97	82	594	147	258	197	71	198	190	1.0
-	107	120	162	196	803	-	144	85	38	253	275	0.9
-	15,430	10,855	6,245	5,990	31,410	6,775	15,380	12,280	4,730	11,570	13,505	0.9
-	41.4	40.1	53.2	58.1	56.6	41.6	40.7	40.0	34.3	49.4	46.6	-

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 25. Vertical distribution of *Calanus finmarchicus* denoted by presence (+) or absence (-) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Life Stage	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Positive Hauls N	D
1	Male	-	-	-	+	+	+	+	+	-	+	+	+	5	3
	Female	-	+	-	+	+	+	+	-	-	+	+	-	4	3
	Copep.	+	+	-	-	+	+	+	+	+	+	+	+	4	5
10	Male	+	-	+	+	+	+	+	+	+	+	+	+	5	4
	Female	+	-	+	+	-	-	+	-	+	+	+	-	2	3
	Copep.	+	+	+	+	+	+	+	-	+	+	+	+	4	5
20	Male	-	+	+	+	+	+	-	+	+	+	-	+	4	3
	Female	+	-	+	-	+	+	+	+	+	+	+	-	4	3
	Copep.	+	+	+	+	+	+	+	-	+	+	+	+	4	5
30	Male	+	+	+	+	+	+	+	-	+	-	+	+	4	4
	Female	+	+	+	-	+	-	+	-	-	+	-	+	2	4
	Copep.	+	+	+	-	+	+	+	+	+	+	+	+	4	5
40	Male	(NO	+	+	+	+	+	-	-	+	-	+	-	3	2
	Female	SAMPLE)	+	-	-	+	-	-	+	-	-	+	+	2	3
	Copep.		+	+	+	+	-	-	+	+	+	+	+	3	4
													TOTALS: Male	21	16
													Female	14	16
													Copep.	19	24
														54	56

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Day hauls 0800-1600 Sunset 1722

Table 26. Vertical distribution of *Calanus finmarchicus* denoted by presence (+) or absence (-) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Life stage	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200
1	Male	-	+	+	+	+	+	+	-	+	+	+
	Female	+	+	+	+	+	+	+	+	-	+	-
	Copep.	+	-	+	+	+	+	+	+	+	+	+
10	Male	+	-	+	+	+	+	+	+	+	+	-
	Female	-	+	+	+	+	+	+	+	-	+	-
	Copep.	+	+	+	+	+	+	+	+	+	+	+
20	Male	-	+	+	+	+	+	+	+	+	+	+
	Female	-	+	+	+	+	-	+	+	+	-	-
	Copep.	+	+	+	+	+	+	-	+	+	+	+
30	Male	+	+	+	+	+	+	+	+	+	+	-
	Female	+	+	+	+	+	+	+	+	+	-	+
	Copep.	+	+	+	+	+	+	+	+	+	+	+
50	Male	+	+	+	+	+	+	+	+	+	+	+
	Female	+	+	+	+	+	+	+	+	+	+	+
	Copep.	+	-	+	-	+	+	+	+	+	+	+
80	Male	+	+	-	+	+	+	+	+	+	-	+
	Female	+	+	+	+	+	+	+	+	+	+	+
	Copep.	+	+	+	+	+	+	+	+	-	-	+

Depth (m)	Life stage	Time (h) cont'd) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Positive hauls[1] N	D
1	Male	-	(no	+	+	+	+	-	+	-	-	-	9	3
	Female	-	haul)	+	+	+	+	+	+	+	-	-	10	2
	Copep.	+		+	+	+	+	+	+	-	+	+	10	7
10	Male	-		+	+	+	+	-	+	+	+	-	9	4
	Female	-		+	+	+	+	+	+	+	+	+	10	3
	Copep.	+		+	+	+	+	+	+	+	+	+	10	7
20	Male	+		+	+	+	+	+	+	+	+	-	10	5
	Female	-		+	-	+	+	+	+	+	+	+	8	3
	Copep.	+		+	+	+	+	+	+	+	+	+	9	7
30	Male	+		+	+	-	+	+	+	+	+	+	9	6
	Female	+		+	+	+	+	+	+	+	+	+	10	6
	Copep.	+		+	+	+	+	+	+	+	+	+	10	7
50	Male	+		+	+	+	+	+	+	+	+	+	10	7
	Female	+		+	+	+	+	+	+	+	+	+	10	7
	Copep.	+		+	+	+	+	+	+	+	+	+	9	7
80	Male	+		+	-	-	-	-	(no	+	+	+	4	6
	Female	+		+	-	+	+	-	sample)	+	+	-	7	6
	Copep.	+		+	-	+	+	+		+	+	+	8	5
												Total Male	51	31
												Female	55	27
												Copep.	56	40
													162	98

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 27. Vertical distribution of euphausiid larvae denoted by presence (+) or absence (-) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Life stage	TIME (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Pos. hauls 1/ N	D
1	Furcilia	-	-	-	-	-	-	-	-	+	-	-	-	(no	-	-	-	-	+	-	-	-	-	1	2
	Calyptopsis	+	+	+	+	+	-	-	+	+	+	+	+	haul)	-	-	+	+	+	+	-	+	+	7	7
	Nauplius	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	+	-	+	-	-	-	2	0
10	Furcilia	-	-	+	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	2	0
	Calyptopsis	-	-	+	+	+	+	-	-	+	+	+	+		-	-	+	+	+	+	+	+	+	8	6
	Nauplius	-	+	+	+	+	-	-	-	+	-	-	-		-	+	+	+	+	+	+	+	+	8	2
20	Furcilia	-	-	-	+	-	-	-	-	+	-	-	-		-	-	+	-	-	-	-	-	-	2	1
	Calyptopsis	-	+	+	+	+	-	+	+	+	+	+	+		+	+	+	+	+	-	-	+	+	8	6
	Nauplius	-	-	-	-	+	+	-	-	+	+	+	+		+	-	-	-	+	-	+	+	+	3	6
30	Furcilia	-	+	+	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	2	0
	Calyptopsis	+	+	+	+	+	+	-	+	+	+	+	+		-	+	+	+	+	+	-	+	-	8	6
	Nauplius	-	+	+	+	+	+	+	-	+	+	+	+		+	+	-	-	+	+	-	+	+	8	6
50	Furcilia	-	-	+	+	+	-	-	-	-	-	-	-		-	-	-	-	-	-	+	-	-	3	0
	Caloptopsis	+	+	+	+	+	-	-	-	+	-	+	+		-	+	+	+	+	+	-	-	+	8	5
	Nauplius	-	-	+	-	+	-	+	-	+	-	+	+		+	+	-	+	+	-	-	-	+	6	4
80	Furcilia	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	(no	-	-	-	0	0
	Caloptopsis	-	-	-	+	+	-	+	-	-	-	+	-		-	+	+	+	-	sample)	+	-	+	6	2
	Nauplius	-	-	-	+	+	-	-	-	-	-	-	-		-	-	+	-	-		-	-	-	3	0
																						Furcilia		10	3
																						Calyptopsis		45	32
																						Nauplius		30	18
																								85	53

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 28. Vertical distribution of Centropages hamatus denoted by presence (+) or absence (-) on Georges Bank over the sampling period 13-15 October 1974.

DEPTH (M)	Life stage	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Pos. N	hauls[1] 0
1	Male	-	+	-	-	-	-	-	-	+	+	+	-	(No	+	-	+	-	-	-	-	-	-	1	3
	Female	-	+	-	+	-	-	+	-	+	+	+	+	haul)	-	-	+	+	-	-	-	-	+	4	5
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
10	Male	-	+	-	-	+	-	-	-	+	+	+	-		-	-	+	+	+	+	-	-	+	5	4
	Female	+	+	+	+	+	-	-	-	+	+	+	-		-	+	+	+	+	-	-	-	+	7	5
	Copep.	-	-	-	-	-	-	-	-	-	+	-	-		-	-	-	-	-	-	-	-	-	0	1
20	Male	-	-	+	-	-	-	-	-	+	+	+	-		-	-	+	+	+	-	-	-	-	4	3
	Female	+	+	+	+	+	-	-	-	+	+	+	+		-	+	+	+	+	-	-	+	+	7	7
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
30	Male	-	+	+	-	-	-	-	-	+	+	+	+		+	+	+	+	+	-	-	+	-	5	5
	Female	+	+	+	+	-	-	-	-	+	+	+	+		+	-	+	+	+	-	-	-	-	5	5
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
50	Male	-	-	-	-	+	-	-	-	+	+	+	+		-	-	+	+	+	-	-	+	+	4	6
	Female	+	+	+	+	+	-	-	-	+	+	+	-		+	+	+	+	+	-	-	+	+	7	6
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
80	Male	+	+	-	+	+	-	+	-	+	+	+	-		+	+	+	+	-	(No	-	+	+	6	6
	Female	-	-	+	+	+	+	-	-	+	+	+	-		+	+	+	+	-	sample	-	-	+	7	4
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	0	0
																							Male	25	27
																							Female	37	32
																							Copep.	0	1
																								62	59

Sunrise 0610 D.S.T.
Sunset 1722

[1]Night hauls 2000-0400
Day hauls 0800-1600

Table 29. Vertical distribution of *Oithona* spp. denoted by presence (+) or absence (-) on Georges Bank over the sampling period 13-15 October 1974.

DEPTH (M)	Life stage	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Pos. hauls[1] N	D
1	Male	-	+	-	+	-	+	-	+	-	+	-	+	(No	-	-	+	+	-	-	-	-	-	4	1
	Female	-	+	-	-	-	+	-	+	-	+	+	-	haul)	-	+	-	-	+	-	-	+	+	3	4
	Copep.	+	+	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	1
10	Male	-	+	+	+	+	-	+	+	+	-	-	+		+	+	+	-	-	+	-	-	-	7	2
	Female	+	+	+	-	+	-	+	+	+	-	+	+		-	+	-	-	-	+	+	-	-	5	4
	Copep.	-	+	+	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	2	0
20	Male	-	+	-	+	+	+	-	-	+	+	+	+		-	+	+	-	+	+	-	+	-	7	5
	Female	-	-	+	+	+	+	-	-	+	-	+	-		-	-	-	-	-	-	-	-	-	4	2
	Copep.	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	1	0
30	Male	-	+	+	-	+	-	+	+	+	-	+	+		-	+	-	-	+	-	-	+	+	5	5
	Female	-	-	+	-	+	+	+	+	+	+	-	-		-	+	+	+	+	-	-	+	-	8	3
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
50	Male	-	-	-	+	+	+	-	+	+	+	+	+		-	+	+	-	+	-	-	-	-	6	4
	Female	-	-	+	+	+	+	-	+	+	+	+	-		+	+	-	+	+	-	-	-	-	7	3
	Copep.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0	0
80	Male	-	-	+	+	-	-	+	-	-	+	+	-		+	+	-	+	-	(No	-	-	-	5	2
	Female	-	+	+	+	-	-	+	-	+	+	+	-		+	+	+	+	-	sample	-	-	-	6	3
	Copep.	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-		-	-	-	1	0
																							Male	34	19
																							Female	33	19
																							Copep.	4	0
																								37	38

Sunrise 0610 D.S.T.
Sunset 1722

[1]Night hauls 2000-0400
Day hauls 0800-1600

Table 30. Vertical distribution of *Metridia lucens* denoted by presence (+) or absence (-) on Jeffreys Ledge over the sampling period 11-12 October 1974.

Depth (m)	Life Stage	Time (h) 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200	[1]Positive Hauls N	D
1	Male	-	-	-	-	-	-	-	-	-	+	-	-	0	1
	Female	-	-	+	+	+	+	+	+	-	-	-	-	5	0
	Copep.	-	-	-	+	-	-	+	+	-	-	-	-	3	0
10	Male	-	-	-	-	-	-	+	-	-	-	-	-	1	0
	Female	-	-	+	-	-	-	-	-	+	+	-	-	0	1
	Copep.	-	-	-	-	-	-	+	+	+	+	-	+	2	2
20	Male	-	-	-	-	-	+	-	-	+	-	-	-	1	0
	Female	-	-	-	-	-	-	-	-	+	-	+	-	0	1
	Copep.	-	-	+	-	-	+	-	-	+	-	+	-	1	1
30	Male	-	+	-	+	-	+	-	+	-	-	+	-	3	2
	Female	-	-	-	+	-	+	+	+	-	-	-	-	4	0
	Copep.	-	-	+	-	-	+	+	-	-	-	+	-	2	1
40	Male	(NO SAMPLE)	-	-	-	-	-	-	-	-	-	-	-	0	0
	Female		-	+	-	-	-	-	-	-	-	-	-	0	0
	Copep.		-	-	-	-	-	-	-	+	-	+	-	0	1
													TOTAL	22	10

[1]Night hauls 2000-0400 Sunrise 0610 D.S.T.
Dat hauls 0800-1600 Sunset 1722

Table 31. Vertical distribution of *Metridia lucens* denoted by presence (+) or absence (-) on Georges Bank over the sampling period 13-15 October 1974.

Depth (m)	Life stage	Time (h) 1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	1200
1	Male	-	-	+	-	-	-	-	-	-	-	-
	Female	-	+	+	+	-	+	+	-	-	-	-
	Copep.	-	-	+	-	-	-	-	-	-	-	-
10	Male	+	-	-	+	-	+	+	-	-	-	-
	Female	-	-	-	-	+	-	-	-	-	-	-
	Copep.	+	-	-	-	-	-	-	-	+	-	-
20	Male	+	-	-	-	+	-	-	-	-	-	+
	Female	+	-	-	-	-	-	-	-	-	+	+
	Copep.	-	-	-	-	-	-	-	-	-	-	+
30	Male	-	-	-	-	-	-	-	-	+	-	-
	Female	-	-	-	+	+	-	-	-	-	-	-
	Copep.	+	-	-	-	-	+	-	-	+	-	-
50	Male	+	-	+	-	-	-	-	-	+	-	-
	Female	+	-	+	-	+	-	-	-	+	+	-
	Copep.	-	-	-	-	-	-	-	-	+	-	+
80	Male	-	-	-	-	+	-	-	-	-	-	-
	Female	-	-	-	-	-	-	-	-	+	+	+
	Copep.	-	-	-	-	-	-	-	+	+	-	-

Depth (m)	Life stage	Time (h) cont'd 1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	1000	Positive hauls[1] N	D
1	Male	-	(no	-	+	+	-	-	+	-	-	-	4	0
	Female	-	haul)	-	-	+	+	+	-	+	-	-	7	0
	Copep.	-		-	-	+	+	+	-	-	-	-	4	0
10	Male	-		-	-	+	-	-	-	-	-	-	4	1
	Female	-		-	-	-	-	+	-	-	-	-	2	0
	Copep.	-		-	+	-	+	-	-	-	-	-	2	2
20	Male	-		+	-	-	-	-	-	-	-	-	1	2
	Female	-		-	-	-	-	-	-	+	+	-	0	4
	Copep.	-		+	+	-	-	-	+	-	-	-	2	1
30	Male	-		-	+	-	-	-	-	-	-	-	1	1
	Female	-		-	-	-	-	-	-	+	-	+	2	1
	Copep.	-		-	-	-	-	-	-	-	-	-	1	2
50	Male	-		-	-	+	-	-	-	-	+	+	2	4
	Female	+		-	-	-	-	-	-	+	+	+	2	6
	Copep.	-		-	+	-	-	-	-	-	-	-	1	2
80	Male	-		+	-	-	-	-	(no	-	-	+	1	1
	Female	-		-	+	-	-	-	sample)	-	-	+	1	4
	Copep.	-		-	-	+	-	-		-	-	-	1	1
											Totals	Male	13	9
												Female	14	15
												Copep.	11	8
													38	32

Sunrise 0610 D.S.T.
Sunset 1722

1/ Night hauls 2000-0400
Day hauls 0800-1600

Table 32. Summary of larval herring prey items from daylight samples collected on Georges Bank (13-15 October 1974, 30 m depth) and Jeffreys Ledge (11-12 October 1974, 20 m depth).

Larval length class (mm)	No. larvae examined	No. larvae feeding	Prey Items			
			Copepod nauplius	Unident. Copepod or fragment	Copepod egg	Invert. egg
GEORGES BANK						
6	17	10	8	1	3	
7	16	7	2	4		1
8	6	3	2	2	1	
9	1	1	1	1		
Total	40	21	13	8	4	1
JEFFREYS LEDGE						
6	14					
7	16	1	1			
Total	30	1	1			

Table 33. Regression summary of various larval herring mouth size measures versus standard length and the predicted mouth size of larvae at hatching and at 10 mm SL from the Georges Bank and Jeffreys Ledge vertical distribution study sites, October 1974.

	Slope	Intercept	Std. Error	Correlation (R)	N	Predicted Mouth Size (mm) at: [4]Hatch (5.7 mm SL)	10 mm SL
GEORGES BANK							
[1]Mouth Breadth (mm)	0.040	0.050	0.033	0.848	78	0.28	0.45
[2]Mouth Gape - 90° (mm)	0.040	0.064	0.044	0.773	78	0.29	0.46
[3]Mouth Gape - 60° (mm)	0.025	0.039	0.027	0.773	78	0.18	0.29
JEFFREYS LEDGE							
[1]Mouth Breadth (mm)	0.027	0.307	0.045	0.516	60	0.46	0.58
[2]Mouth Gape - 90° (mm)	0.039	0.284	0.043	0.682	53	0.44	0.67
[3]Mouth Gape - 60° (mm)	0.027	0.160	0.028	0.698	60	0.31	0.43

[1]Measured as maximum skull width.

[2]Maxillary length x $\sqrt{2}$; assumes 90° articulation of larval jaw (Shirota, 1970).

[3]Maxillary length x $\frac{1}{2}\sqrt{3}$; assumes 60° articulation of larval jaw (Shirota, 1970).

[4]Mean size (0.54 mm SD) of 100 newly hatched yolksac larvae (Formalin preserved) from egg bed samples collected by divers on Jeffreys Ledge study site (38 m depth), 8 October 1974.

Table 34. Relative abundance of fine-mesh (0.053-mm) zooplankton at sampled depth levels on Jeffreys Ledge. Species or taxonomic group densities represent the average of two samples collected 11 October 1974 at 1000 and 22000 h.

Organism	1m	10m	20m	30m	40m	Total integrated abundance			Mean rank all depth levels	Dominance[1]	Frequency of occurrence
	No./m^3	No./m^3	No./m^3	No./m^3	No./m^3	No./m^2	%	Rank			
Invertebrate egg	348	675	1,158	1,059	1,876	47,359	20.09	23	12.4	3/5	5/5
Type B nauplius	646	541	1,063	823	865	33,027	14.01	22	11.6	3/5	5/5
Oithona sp. copepodite	1,019	633	730	693	600	26,944	11.43	19	11.2	2/5	5/5
Oithona sp. adult	944	1,217	501	542	480	27,116	11.51	20	10.8	1/5	5/5
Oithona sp. nauplius	1,268	1,029	440	296	338	21,265	9.02	18	10.6	2/5	5/5
Calanus finmarchicus nauplius	1,044	892	945	602	314	27,681	11.74	21	8.7	3/5	5/5
Pseudocalanus sp. adult	50	46	154	563	647	1,411	5.99	12	7.2	0/5	5/5
Centropages typicus copepodite	149	93	177	84	121	4,805	2.04	15	6.6	0/5	5/5
Centropages typicus nauplius	323	163	130	82	152	5,428	2.30	16	6.4	0/5	5/5
Pseudocalanus sp. copepodite	50	256	111	83	58	17,577	7.46	17	4.6	0/5	5/5
Type A nauplius	75	-	-	-	81	884	0.37	10	3.0	0/5	2/5
Harpacticoid	50	-	-	212	38	2,552	1.08	14	2.6	0/5	3/5
Centropages typicus adult	50	-	89	62	-	1,560	0.66	13	1.9	0/5	3/5
Euphausiid nauplius	50	-	-	-	40	454	0.19	7	1.6	0/5	2/5
Nannocalanus minor adult	-	-	-	-	76	760	0.32	8.5	1.3	0/5	1/5
Unidentified copepod adult	-	--	-	-	76	760	0.32	8.5	1.3	0/5	1/5
Spiratella sp.	-	47	89	-	-	1,319	0.56	11	0.9	0/5	2/5
Euchaeta norvegica copepodite	-	-	-	-	38	380	0.16	2.5	0.4	0/5	1/5
Gastropod larva	-	-	-	-	38	380	0.16	2.5	0.4	0/5	1/5
Metridia sp. copepodite	-	-	-	42	-	424	0.18	4.5	0.3	0/5	1/5
Oncaea venusta adult	-	-	-	42	-	424	0.18	4.5	0.3	0/5	1/5
Unidentified copepodite	-	-	43	-	-	432	0.18	6	0.2	0/5	1/5
Bivalve larva	50	-	-	-	-	50	0.02	1	0.2	0/5	1/5

[1]Proportion of samples in which the species was among those comprising 50% of the individuals.

Table 35. Relative abundance of fine-mesh (0.053-mm) zooplankton at sampled depth levels on Georges Bank. Species or taxonomic group densities represent the average of two samples collected on succeeding days, 14-15 October 1974, 1000 h.

Organism	1m	10m	20m	30m	50m	80m	Total integrated abundance			Mean rank all depth levels	Dominance[1]	Frequency of occurrence
	No./m^3	No./m^3	No./m^3	No./m^3	No./m^3	No./m^3	No./m^2	%	Rank			
Oithona sp. nauplius	2,281	2,121	1,590	1,458	1,157	848	100,429	22.36	21	14	6/6	6/6
Oithona sp. copepodite	751	1,319	746	1,174	1,250	736	78,913	17.57	20	12.6	5/6	6/6
Type B nauplius	1,020	569	1,069	646	1,003	810	67,650	15.07	19	12.2	4/6	6/6
Centropages typicus nauplius	564	414	646	671	533	177	33,431	7.44	18	10	0/6	6/6
Oithona sp. adult	751	620	373	406	533	165	29,733	6.62	17	9.8	0/6	6/6
Centropages typicus copepodite	322	310	279	239	334	230	21,869	4.87	15	8.3	0/6	6/6
Pseudocalanus sp. copepodite	242	415	273	455	178	218	21,355	4.76	14	7.9	0/6	6/6
Calanus finmarchicus nauplius	242	543	348	693	40	155	20,994	4.68	13	7.3	1/6	6/6
Invertebrate egg	-	78	50	48	67	743	25,291	5.63	16	4.9	1/6	5/6
Type A nauplius	-	-	398	95	224	42	19,232	4.28	12	4.8	0/6	4/6
Pseudocalanus sp. adult	54	-	249	96	133	83	8,651	1.93	11	4.3	0/6	5/6
Harpacticoid	-	52	124	48	67	155	8,165	1.82	10	3.3	0/6	5/6
Spiratella sp.	-	-	-	48	44	41	2,604	0.58	8	1.8	0/6	3/6
Calanus finmarchicus copepodite	54	104	-	48	-	-	1,465	0.33	6	1.7	0/6	3/6
Unidentified copepodite	268	-	-	-	-	31	3,603	0.80	9	1.5	0/6	2/6
Polychaete larva	-	52	50	-	44	-	1,846	0.41	7	1.1	0/6	3/6
Fish egg	-	52	-	-	-	31	1,401	0.31	5	1	0/6	2/6
Bivalve larva	107	-	-	-	44	-	991	0.22	4	1	0/6	2/6
Pseudocalanus sp. nauplius	-	-	-	-	-	42	336	0.07	1	0.9	0/6	1/6
Nannocalanus minor adult	-	52	-	-	-	-	464	0.10	2	0.3	0/6	1/6
Euphausiid nauplius	-	-	-	-	-	21	630	0.14	3	0.2	0/6	1/6

[1]Proportion of samples in which the species was among those comprising 50% of the individuals.

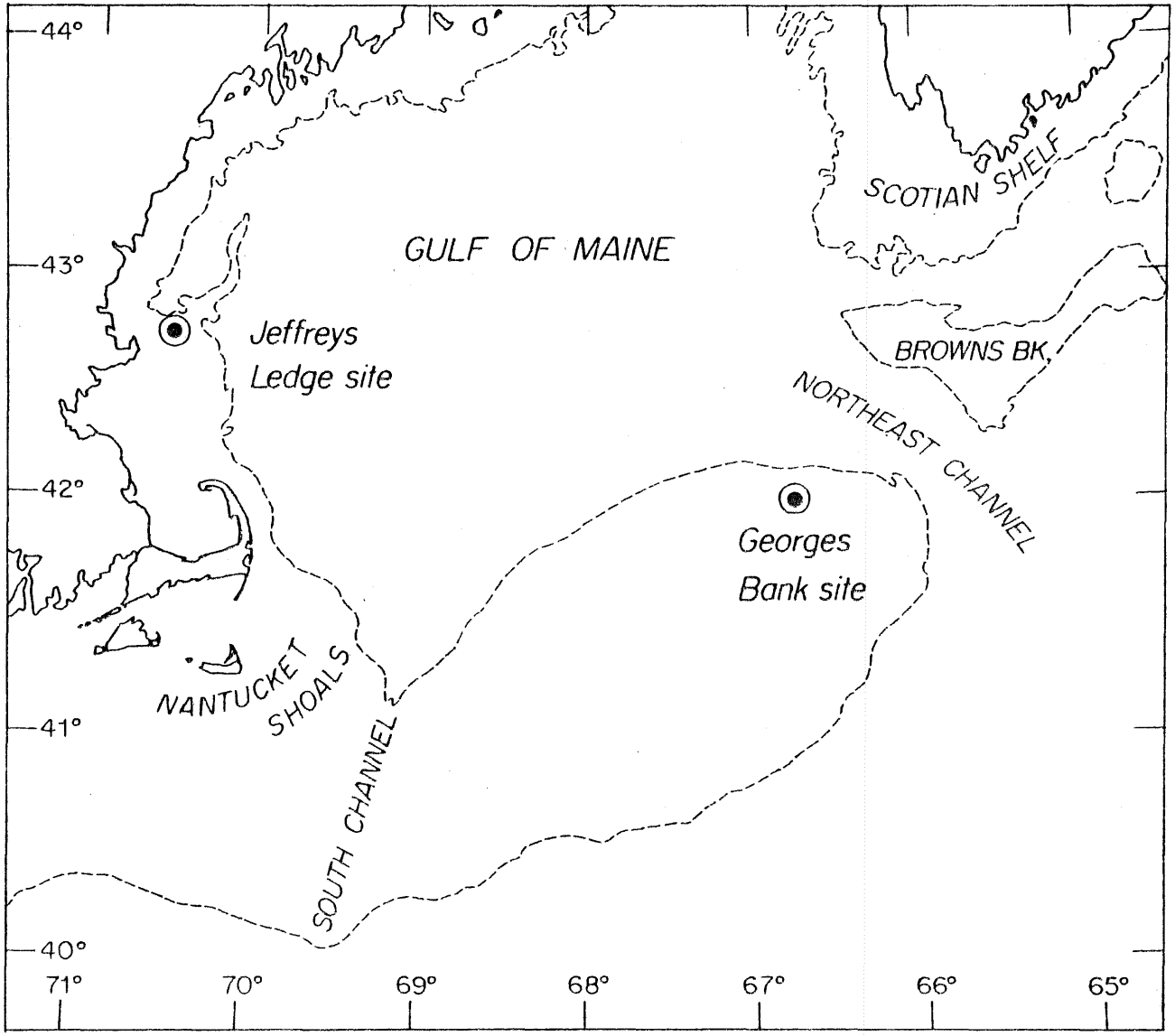


Figure 1. The Jeffreys Ledge and Georges Bank vertical distribution study sites, R/V DELAWARE II, Cruise 74-12, 11-15 October 1974.

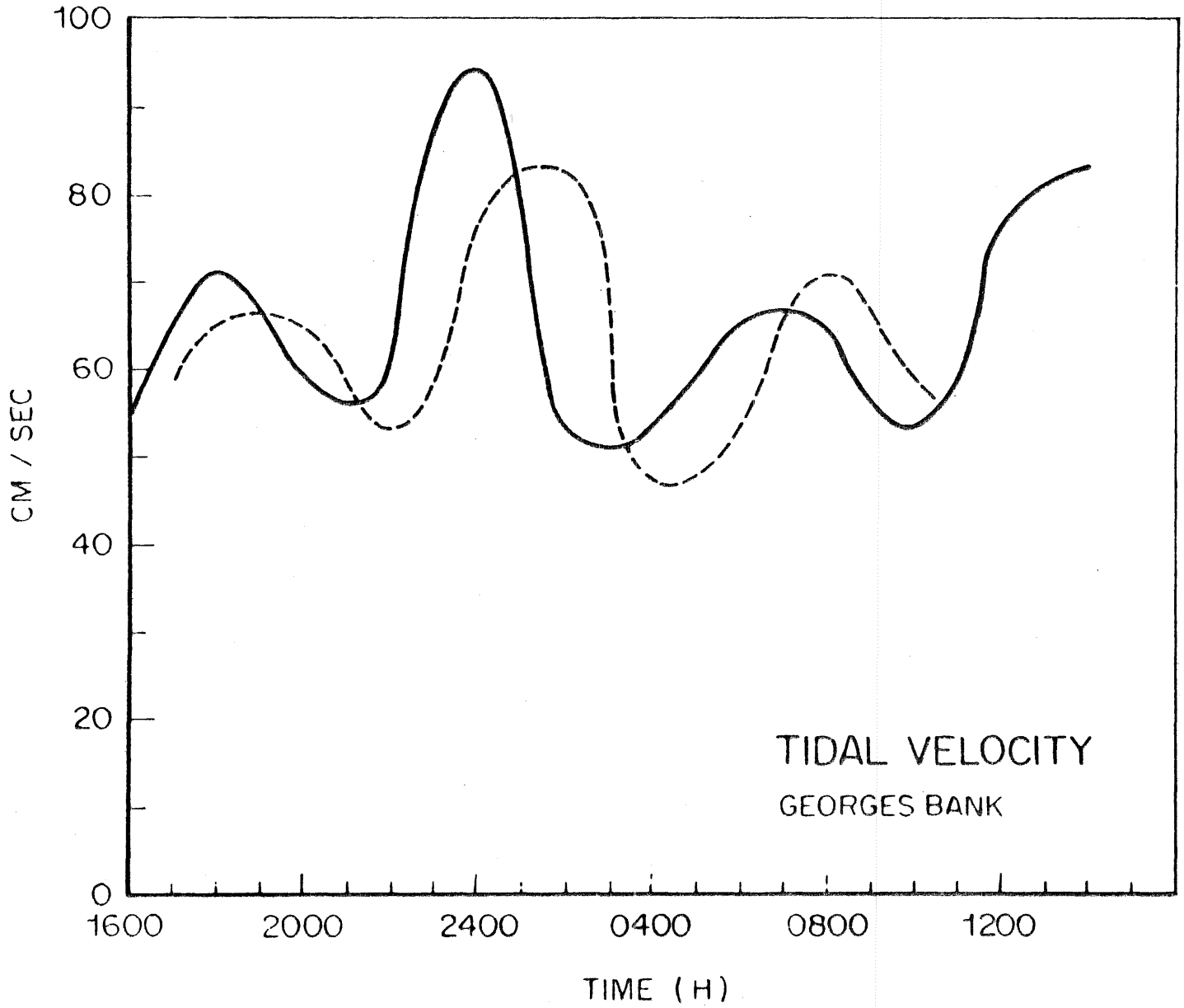


Figure 2. Tidal velocity curve on Georges Bank (41°50'N, 66°37'W) near vertical distribution study site, 13-15 October 1974. The dotted line represents a continuation of the solid line over the sampling period.

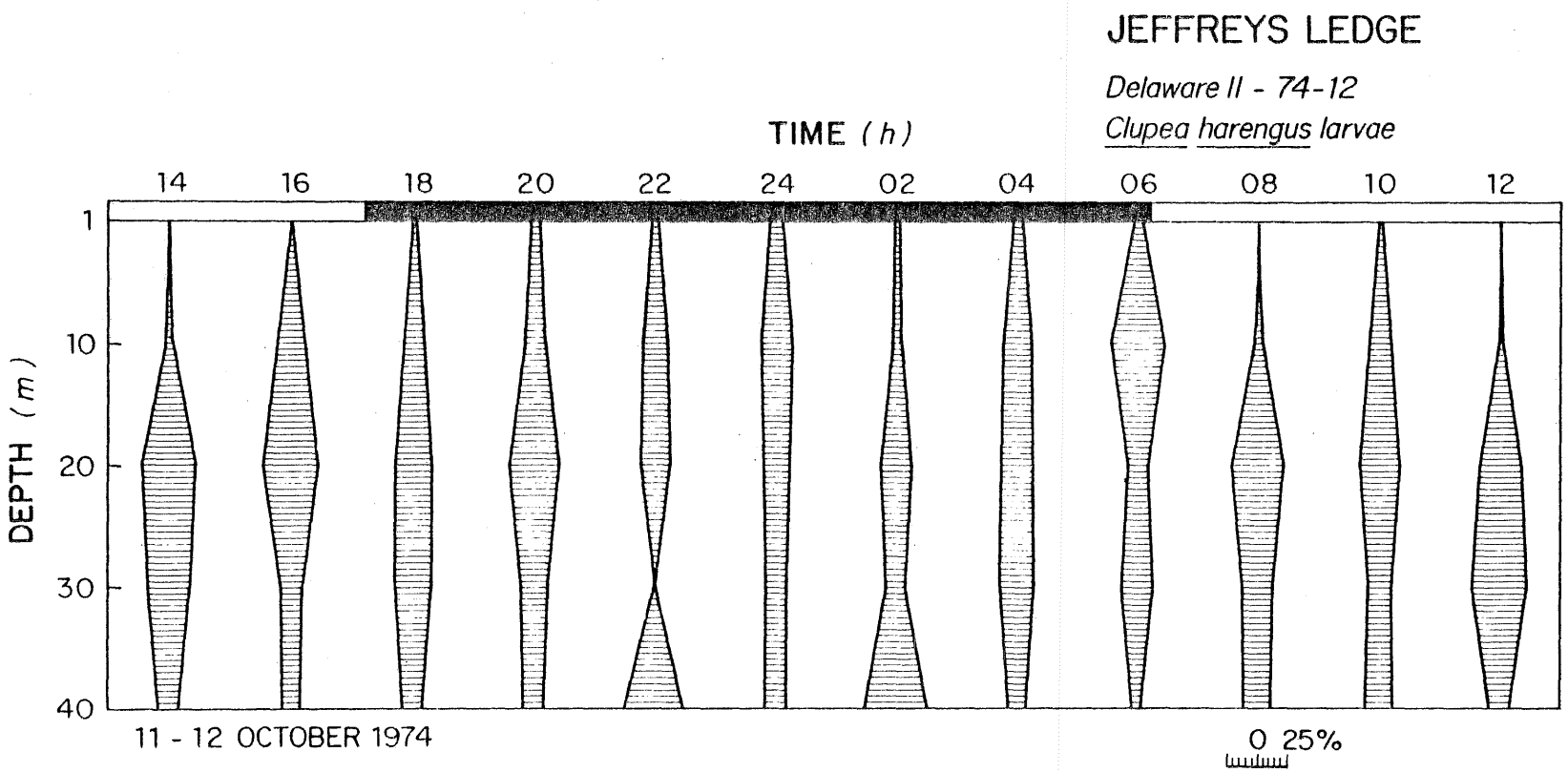


Figure 3. Vertical distribution of herring larvae (Clupea harengus) on Jeffreys Ledge (42°40'N, 70°25'W), 11-12 October 1974. Sunset was at 1722 D.S.T. and sunrise, 0610. The density of larvae at each depth level is expressed as a percentage of the total caught in the hour indicated.

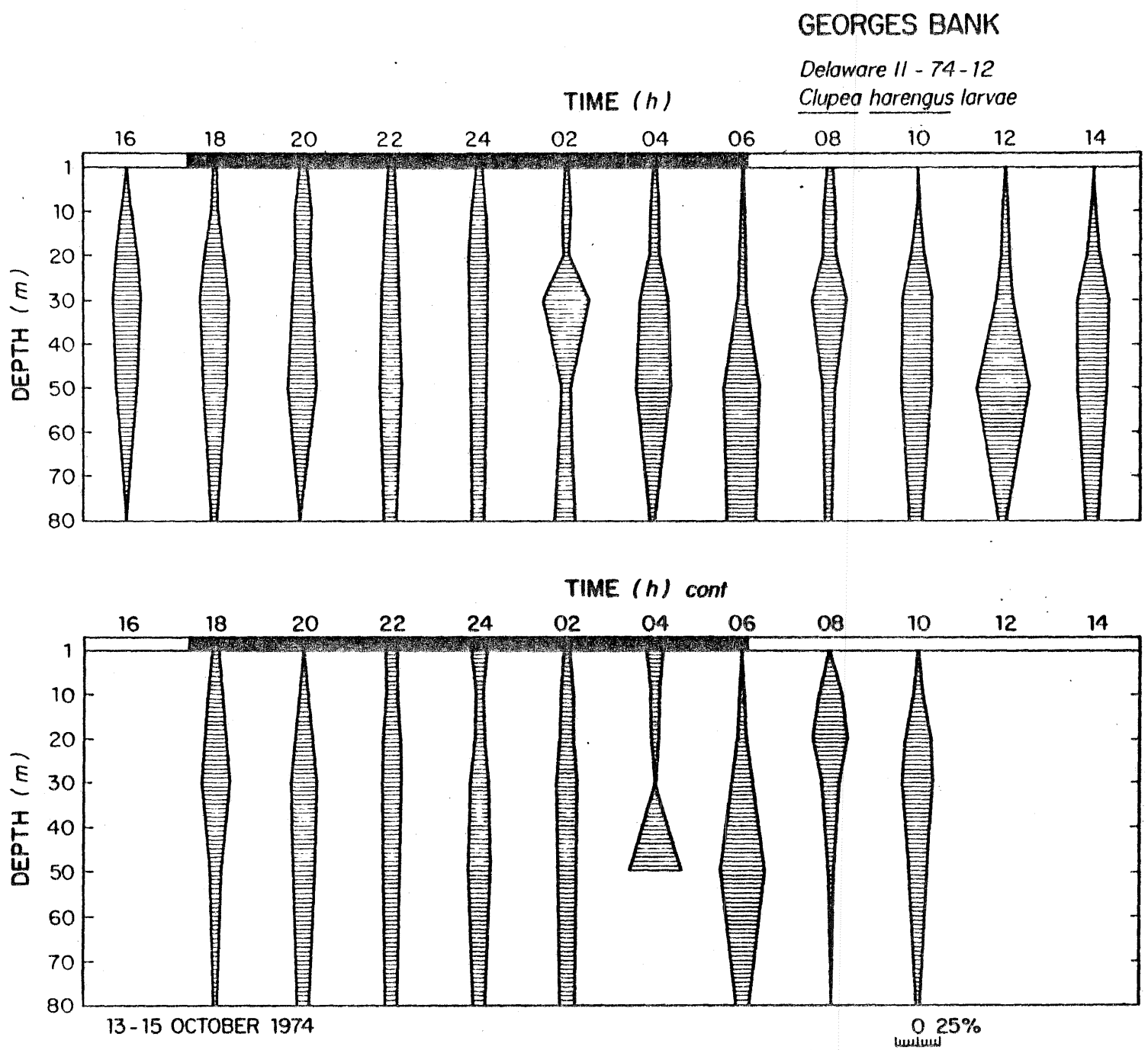


Figure 4. Vertical distribution of herring larvae (Clupea harengus) on Georges Bank (42°00'N, 66°40'W), 13-15 October 1974. Sunset was at 1722 D.S.T. and sunrise, 0610. The density of larvae at each depth level is expressed as a percentage of the total caught in the hour indicated.

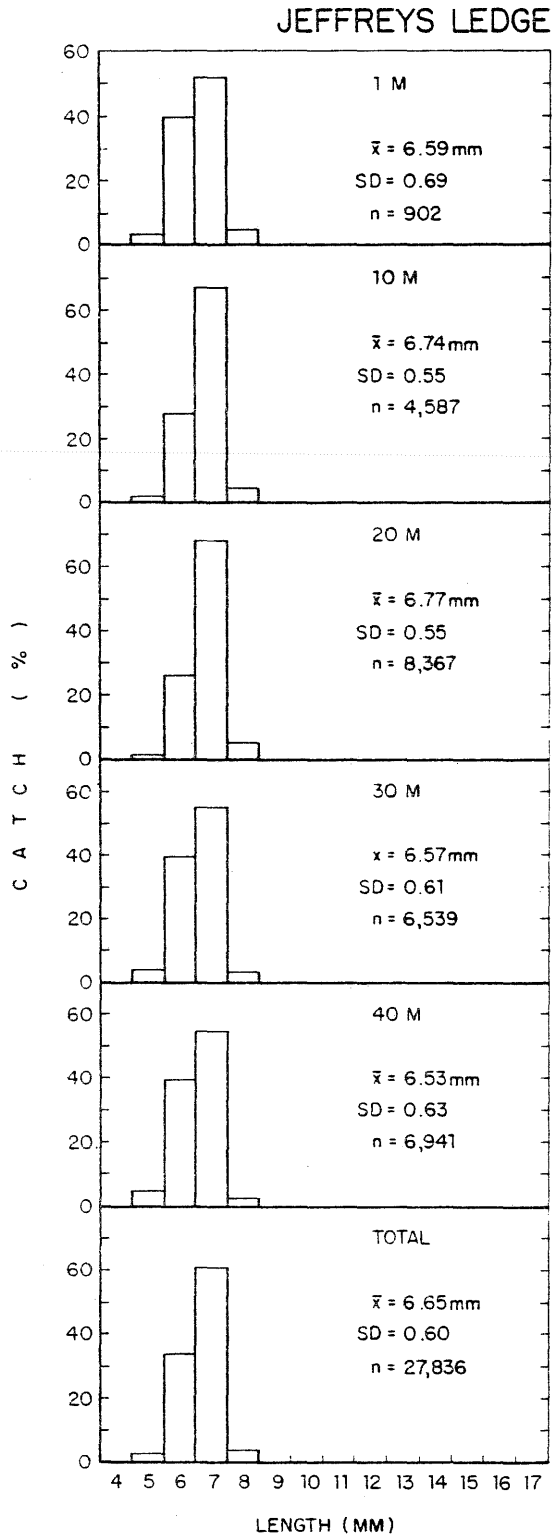


Figure 5. Length frequency distribution of total larval herring catches by depth level on Jeffreys Ledge, 11-12 October 1974.

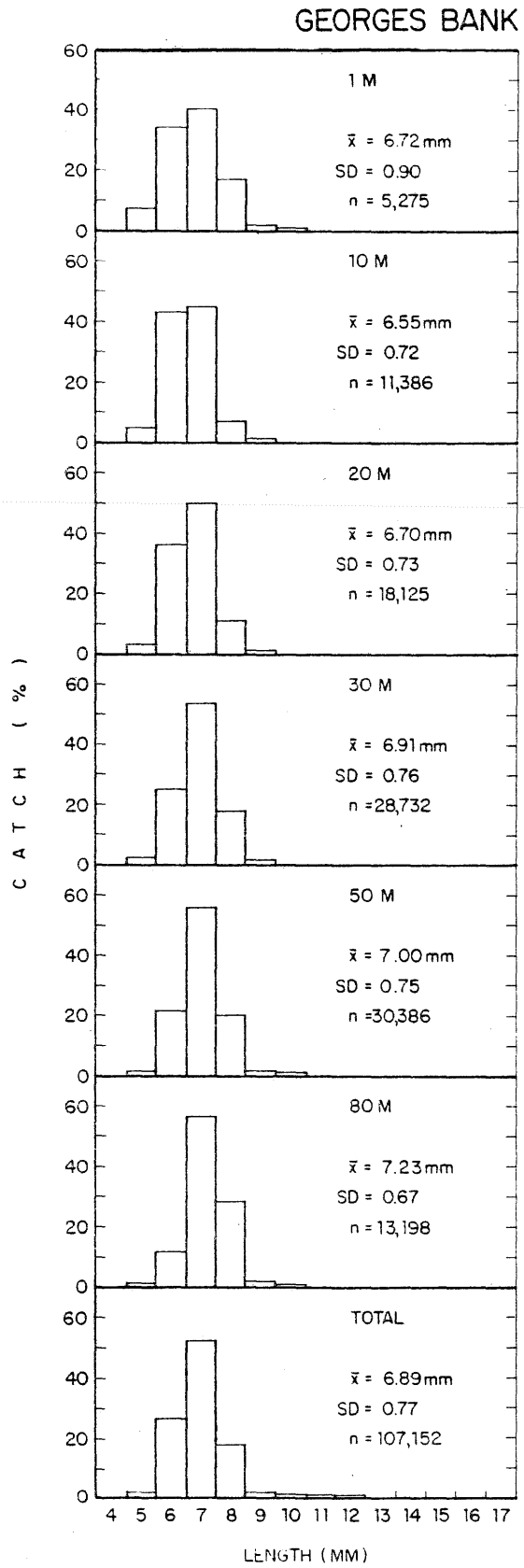


Figure 6. Length frequency distribution of total larval herring catches by depth level on Georges Bank, 13-15 October 1974.

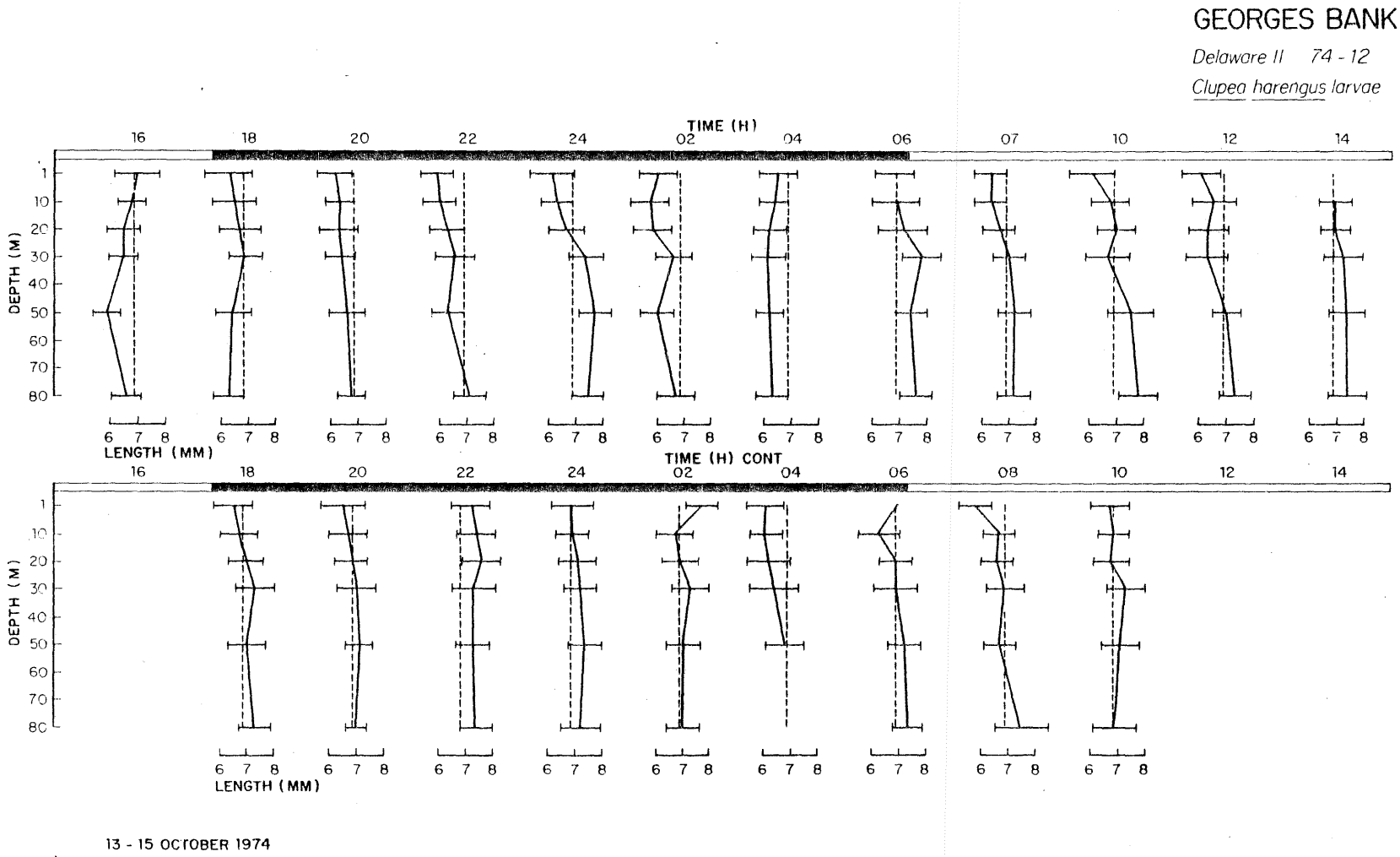


Figure 7. Mean length (±1 standard deviation: horizontal bar) of herring larvae caught at each depth level sampled at the hour indicated over the period 13-15 October 1974 on Georges Bank. The vertical dotted line for each haul represents the grand mean length of larvae over all samples.

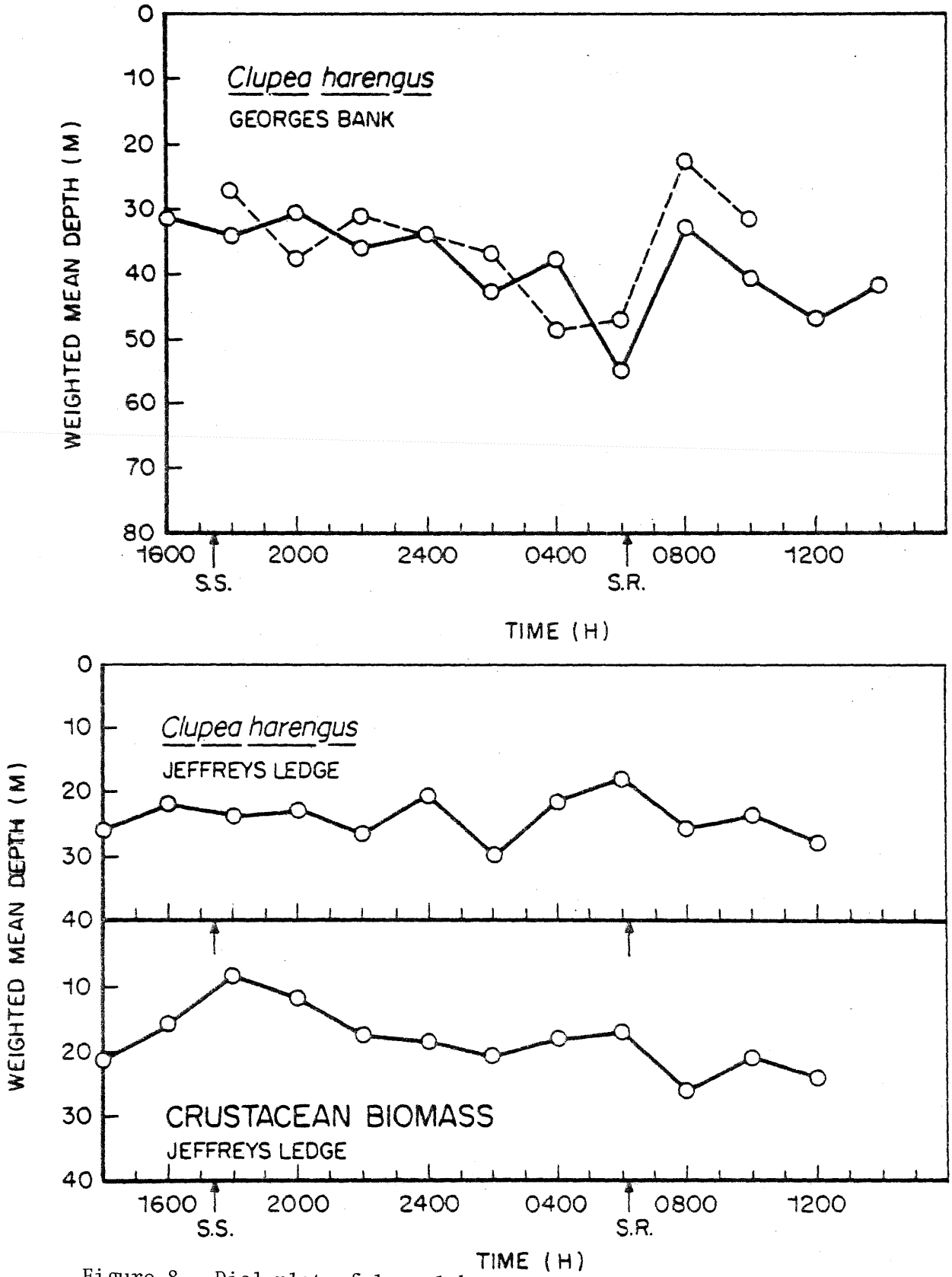


Figure 8. Diel plot of larval herring (Clupea harengus) weighted mean depths for each vertical haul made on Georges Bank over the sampling period 13-15 October 1974 and of larval herring and crustacean biomass on Jeffreys Ledge over the sampling period 11-12 October 1974. The broken line (empty circles) on the Georges Bank plot represents the continued sequence of tows. S.S.: sunset 1722 D.S.T.; S.R.: sunrise 0610.

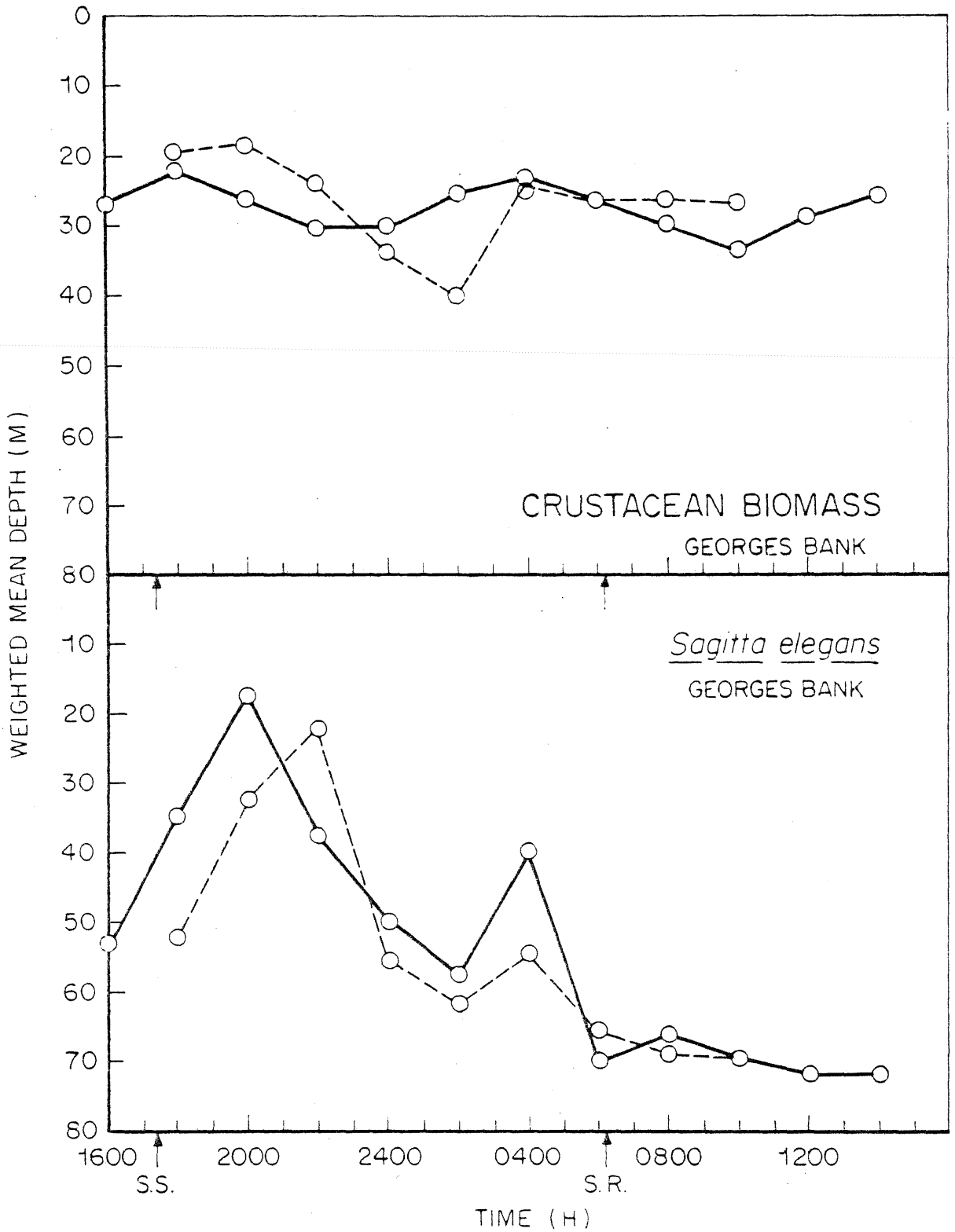


Figure 9. Diel plot of crustacean biomass and Sagitta elegans weighted mean depths for each vertical haul made on Georges Bank over the sampling period 13-15 October 1974. The broken line (empty circles) represents the continued sequence of tows. S.S.:sunset 1722 D.S.T.; S.R.: sunrise 0610.

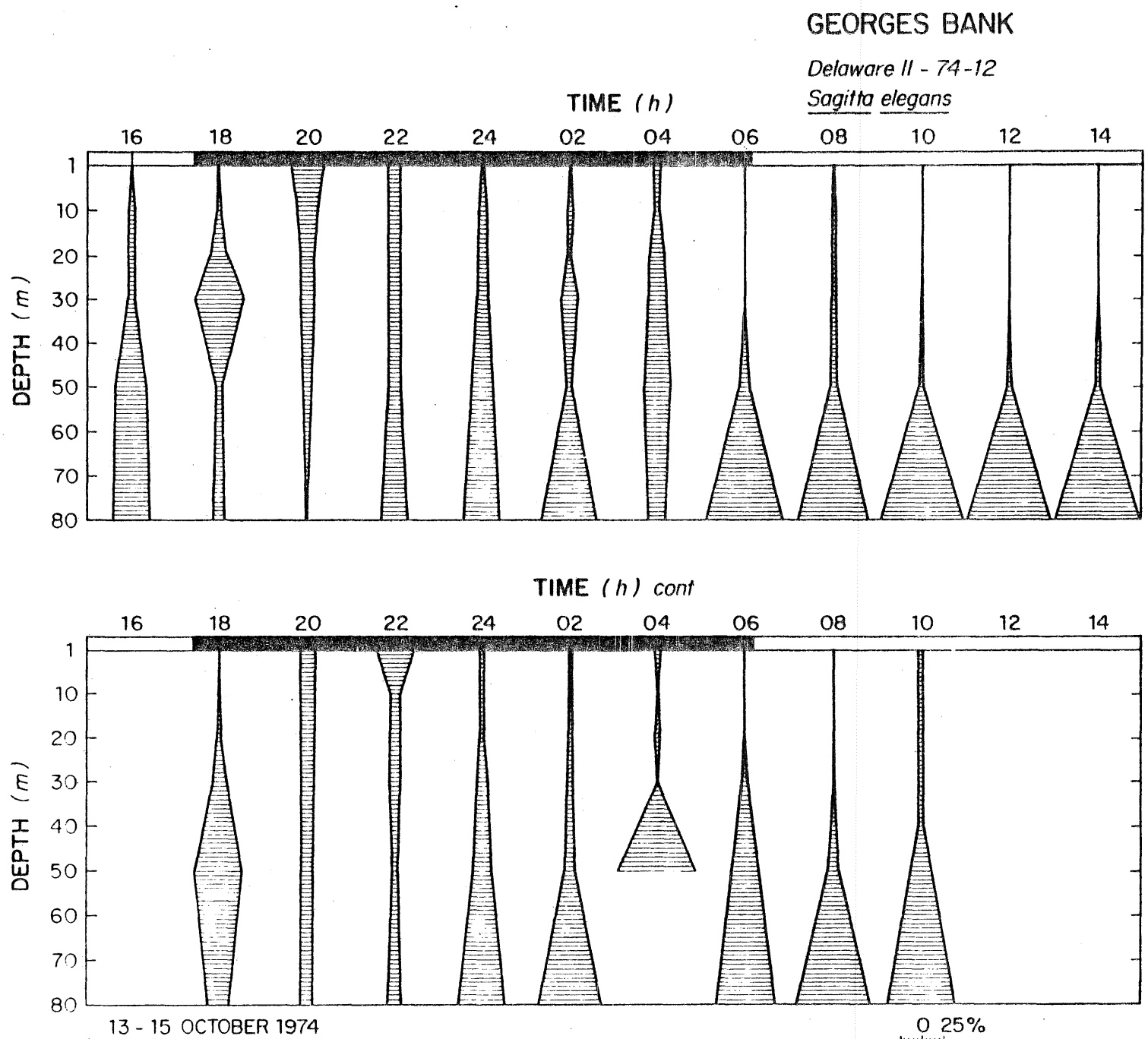


Figure 10. Vertical distribution of Sagitta elegans on Georges Bank (42°00'N, 66°40'W), 13-15 October 1974. Sunset was at 1722 D.S.T. and sunrise, 0610. The density of organisms at each depth level is expressed as a percentage of the total caught in the hour indicated.

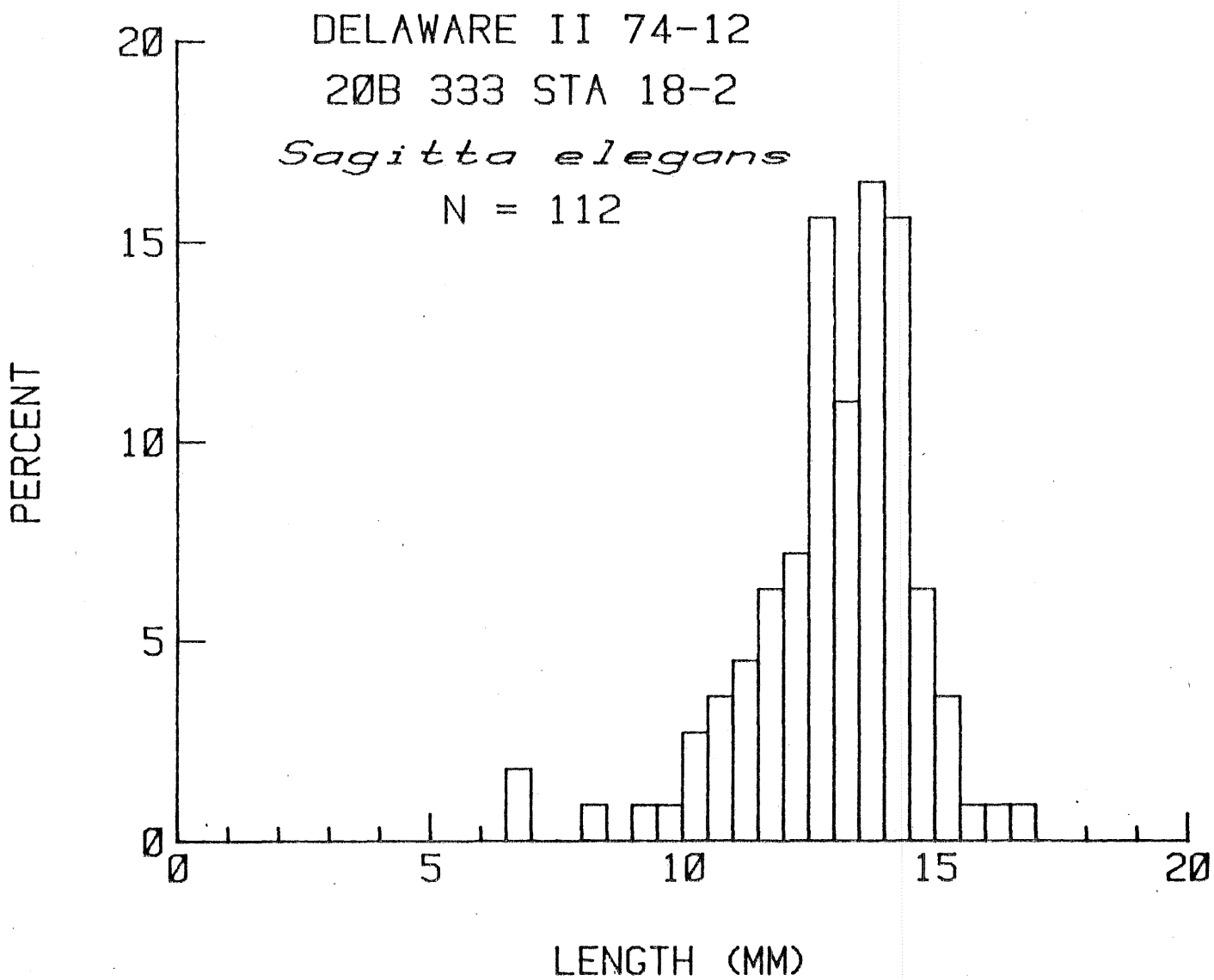
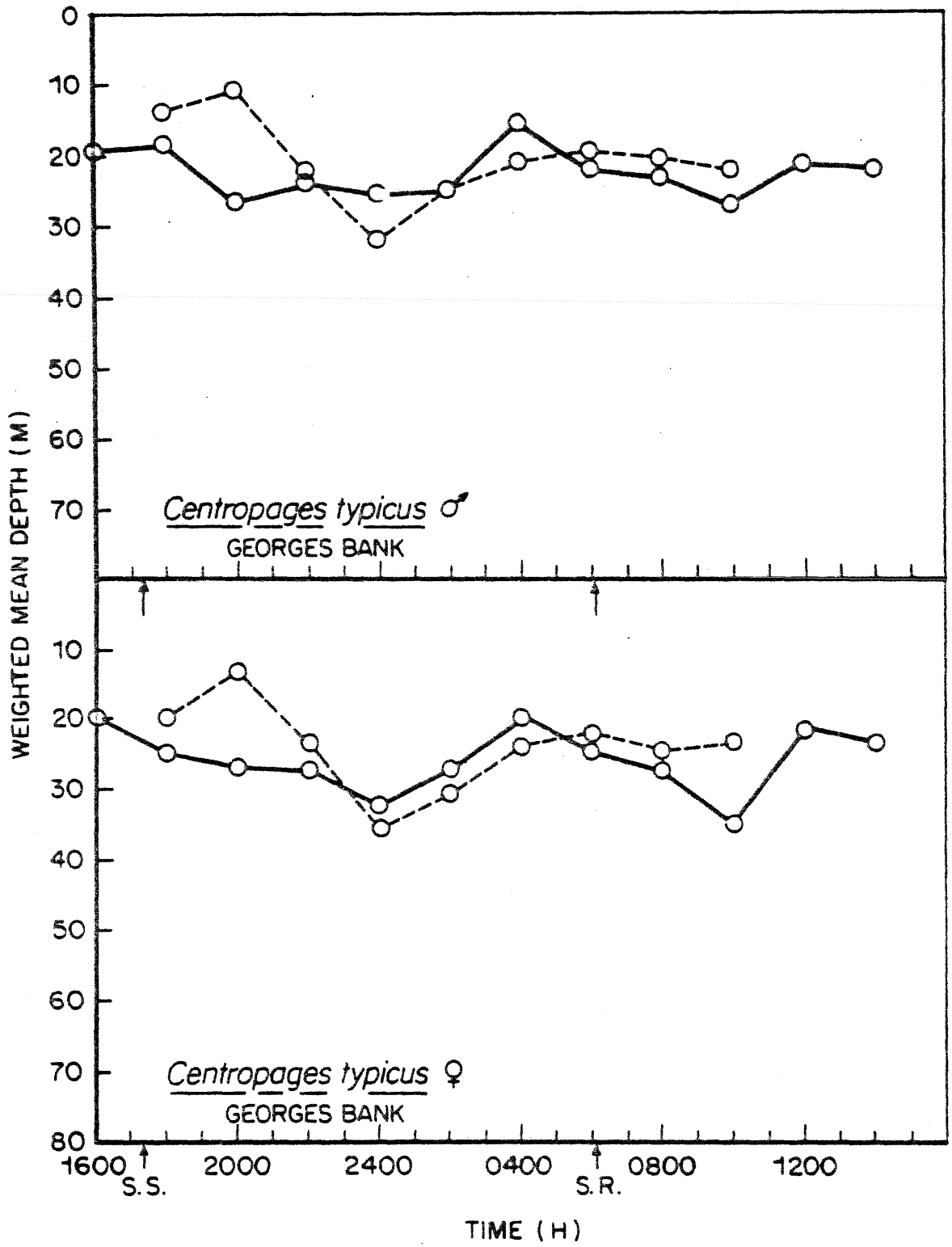


Figure 11. Length frequency distribution of Sagitta elegans on Georges Bank from a 50-m depth haul, 0200 h, 20-cm bongo, 0.333-mm mesh net.

Figure 12. Diel plot of Centropages typicus adult male and female weighted mean depths for each vertical haul made on Georges Bank over the sampling period 13-15 October 1974. The broken line (empty circles) represents the continued sequence of tows. S.S.: sunset 1722 D.S.T.; S.R.: sunrise 0610.



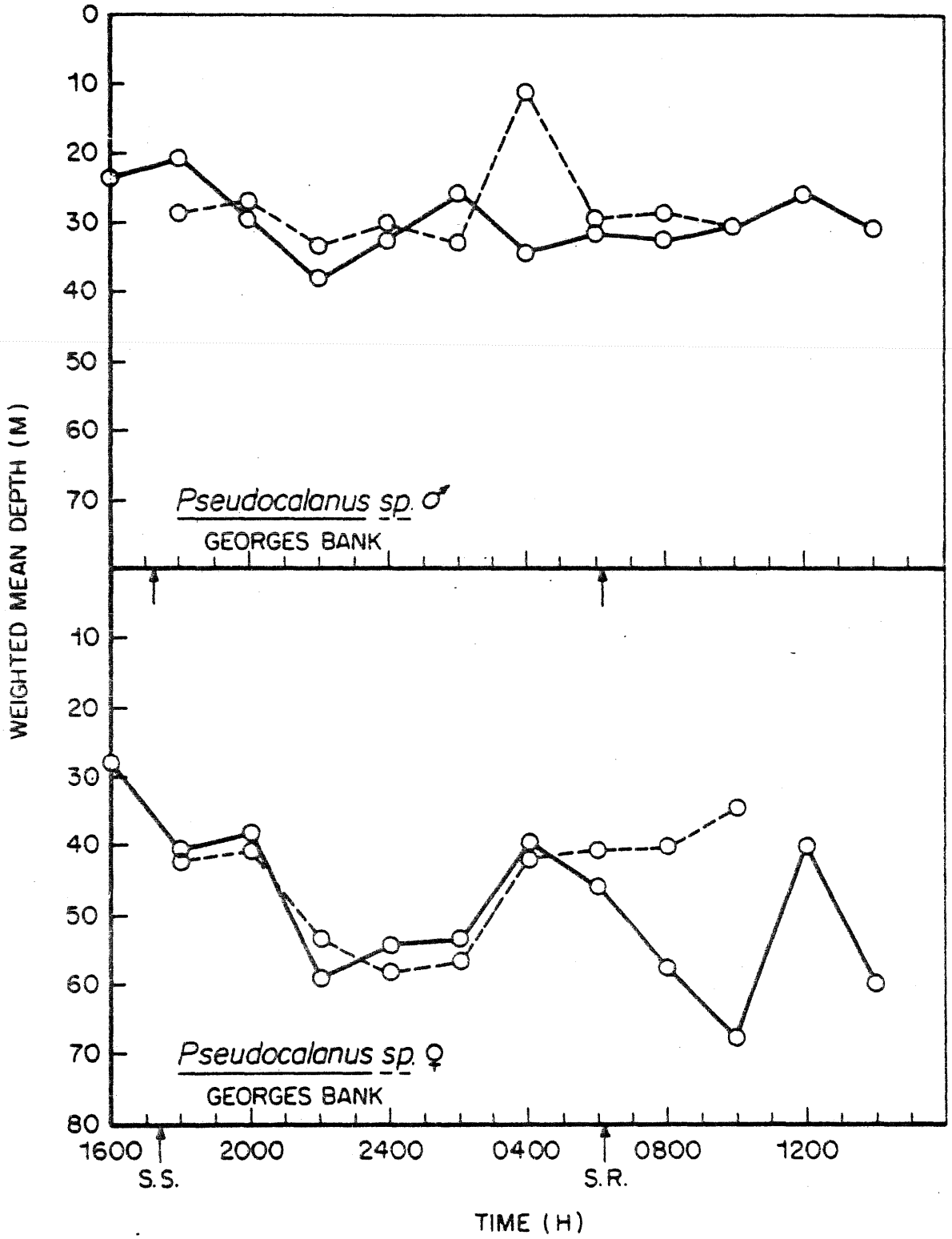


Figure 13. Diel plot of Pseudocalanus sp. adult male and female weighted mean depths for each vertical haul made on Georges Bank over the sampling period 13-15 October 1974. The broken line (empty circles) represents the continued sequence of tows. S.S.: sunset 1722 D.S.T.; S.R.: sunrise 0610.

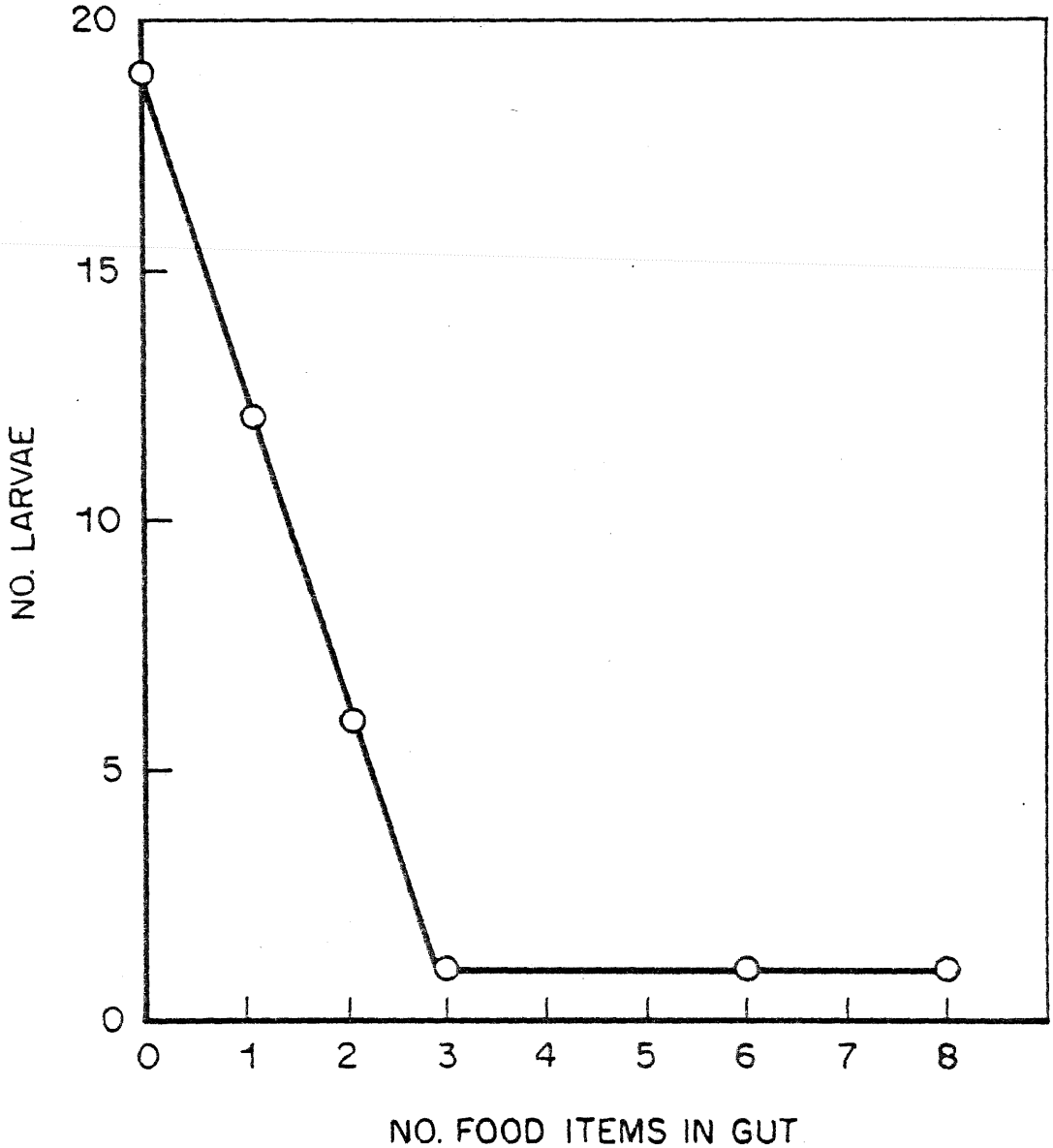


Figure 14. Frequency distribution of the number of larval herring food items per gut for the Georges Bank study, 13-15 October 1974, daylight hauls, 30 m depth.

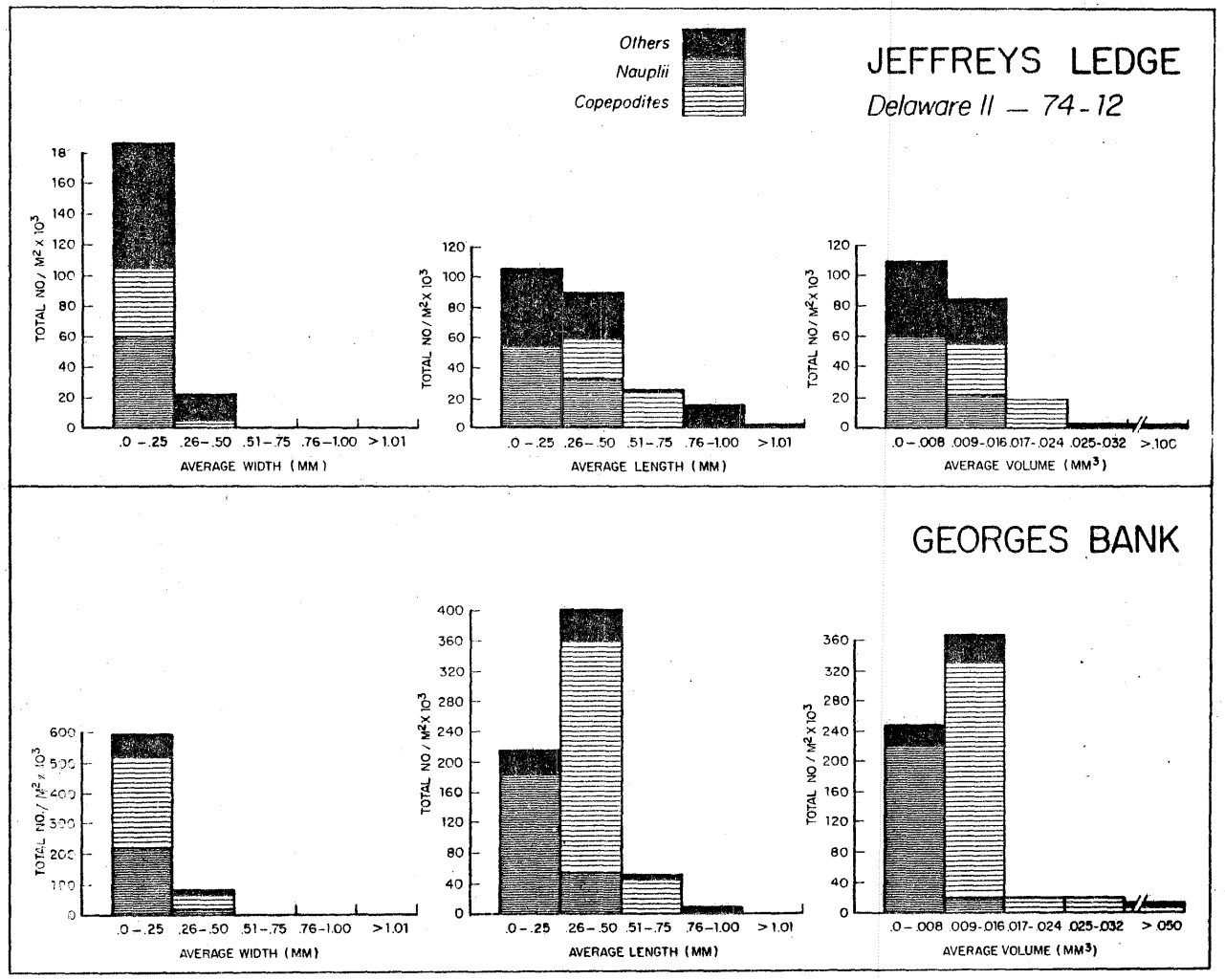


Figure 15. Total integrated abundance of fine-mesh (0.053 mm) zooplankton grouped by three dominant categories (copepodites, copepod nauplii, others) versus size classes based on width, length, and volume for the Jeffreys Ledge and Georges Bank study sites.