Section 20

IMPACT OF AUTUMN-WINTER SWARMING OF A SIPHONOPHORE ("LIPO") ON FISHING IN COASTAL WATERS OF NEW ENGLAND[1]

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PROBLEM

Early in August 1975, fishermen from Gloucester, MA, and Portland, ME, began to observe some fouling of their nets by a pink gelatinous material which was referred to as "lipo," the Sicilian word for slime. There was a gradual increase in the amount encountered, reaching a 3-mo maximum between October and December. A reduction was observed in middle to late December with some lipo still observed in January 1976.

Fishing nets dragged through this mass became clogged so that water could no longer readily pass through the meshes, decreasing the fishing efficiency of the nets. Fish were seldom caught in an area where lipo concentrations were high. From the information available, it is not clear whether this was due to decreased fishing efficiency of the nets or avoidance of the mass by fish.

IMPACT

Early reports caused no concern, but as more and more vessels lost fishing time because of having to clean gear, or not fishing for a day at a time in order to avoid the possibility of getting hung up in the lipo, interest in the phenomenon grew.

Hardest hit were the inshore trawlers, especially the whiting fishermen and the shrimpers who used small meshed nets. These fleets are concentrated primarily at Gloucester and Portland.

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[1]Summarized from Environmental Impact Report 1-76, MARMAP Contribution No. 112, and Environmental Impact Report 2-76, MARMAP Contribution No. 120.

[2]Northeast Fisheries Center, National Marine Fisheries Service, NOAA, Narragansett, RI 02882.

Boston and Provincetown, MA, port agents indicated that there was no problem, but these fleets fished offshore and used larger meshed nets.

Robert Morrill, NMFS port agent at Portland, indicated that all of the 75 vessels there encountered a problem with the lipo at least once during the 3-mo period (October-December 1975). He estimated an overall 20% loss of fishing time to the shrimp trawlers. Similar reports were received by James Thomas, State of Maine biologist at Boothbay Harbor, and Peter Marckoon, NMFS Port Agent at Rockland, ME.

Arv Poshkus, NMFS port agent in Gloucester, reported that, by a conservative estimate, 60 inshore trawlers were involved and that up to 20% of fishing time was lost either in cleaning gear or by not fishing.

In a recent (26 December 1975) letter to William Gordon, Regional Director of NMFS Northeast Region, Salvatore J. Favazza, Executive Secretary of the Gloucester Fisheries Commission stated that ". . . it (lipo) has caused an economic loss to Gloucester fishermen of at least $100,000 in 1975 and possibly as much as $300,000." Although no figures were made available for loss to the Maine shrimp industry, it is probable the losses were comparable.

DISTRIBUTION

Helgoland Observations

The siphonophore Nanomia cara was observed during the Helgoland underwater habitat mission (5 August-21 November 1975) on Jeffries Ledge (Rogers et al., in press). Personnel on surface vessels noted its presence near the surface and H. Wes Pratt, a diver for the mission, reported that siphonophores were most numerous during August and September, but were scarce in October and November. He estimated a density of about one per cubic meter in the area of the Helgoland habitat (Location X, Fig. 20.1) during the high density periods. The length of a total colony was approximately 30 cm. In situ, most of the animal was transparent except for the gonophores which were pink to salmon. The siphonophores appeared very fragile. They were densest in the top 2-3 m; below 15 m few were observed. Pratt stated that their daytime distribution was patchy in both space and time in the vicinity of the Helgoland habitat. Kevin McCarthy, a support diver for the mission, corroborated these observations.

Survey Results

According to reports from the fishermen, the siphoncphore masses occurred at depths of 40-100 m and were recorded on depth sounding equipment as being up to 50 m thick. They reported traces at the bottom during the daylight and off the bottom in the dark, indicating the ability of the siphonophores to migrate vertically. Fishermen encountered siphonophores from Stellwagen Bank off Massachusetts Bay to Rockland, ME.

Plankton samples were taken in the Gulf of Maine on four Albatross IV cruises (75-12 II, 75-12 III, 75-13, 75-14) as part of the MARMAP survey and monitoring program of the Northeast Fisheries Center (NEFC). The cruises included the period 7 October-17 December, 1975. A Delaware II cruise (75-17) 15 October-7 November 1975, also part of the MARMAP program, sampled the area from Cape Cod, MA, to Cape Hatteras, NC. A Challenge cruise (75-1), part of NEFC's Biome Survey, sampled the coastal waters of Maine 4-9 September 1975. All samples were collected with paired bongo samplers fitted with 0.333-mm and 0.505-mm mesh nets. Oblique tows, at 1.5-3.5 kn, were made through the water column from the surface to within 10 m of the bottom or to 100 m maximum depth. The bongos were set out at 50 m/min and retrived at 20 m/min, the maximum time of a plankton tow being approximately 23 min. Because of the fragile nature of N. cara, only fragments were available in the samples for examination. A total of 422 samples was examined at a magnification of 10X by the NEFC Plankton Sorting Group at Narragansett, RI. A summary of N. cara occurrence, as well as the occurrence of another siphonophore tentatively identified as Halistemma sp., was given in the more complete version of this report. The distribution over the continental shelf and area plots showing relative abundance and size are given in Figures 20.2-20.9. Although no siphonophores of the species N. cara were found in samples taken on the Delaware II cruise, Figures 20.6 and 20.7 were included to show more clearly that the normal range of N. cara does not extend very far south of Cape Cod. I recognize the subjective nature of relative size and abundance information, but felt that horizontal projections of area distributions would be a useful means for locating areas of maximal swarming. The samples are available for further examination and analysis should more precise data be required.

A September survey of coastal fish stocks in New England waters made during Biome operations yielded N. cara only in the offshore stations [15-20 mi (24-32 km) from the coast] and only in stations north of Penobscot Bay (Figs. 20.1, 20.8, 20.9). This coincides with the inshore distribution of siphonophores found on Albatross IV cruises 75-12 II and III, 7 October-18 November (Figs. 20.4, 20.5).

During this period the distribution of *N. cara* extended into the Bay of Fundy and occurred in almost all samples taken in the Gulf of Maine and eastward around the periphery of Georges and Browns Banks. The later cruise (2-17 December) sampled the southern portion of the Gulf of Maine, Georges Bank, and the region south of Cape Cod (Figs. 20.1, 20.4, 20.5).

Plankton samples from the *Delaware II* cruise (15 October-7 November) had few siphonophores (Figs. 20.6, 20.7). Four stations off the New Jersey and Long Island coasts and five stations somewhat clustered just north of Cape Hatteras were the only areas in which they were found. All stations were within the 15-fathom line. On first examination they appeared to be *N. cara*, but when D. C. Biggs, siphonophore expert from Woods Hole Oceanographic Institution, examined them he tentatively identified them as *Halistemma* sp. The species within this genus are typically tropic to temperate so their presence in these areas is not surprising.

The Gulf of Maine samples showed that in October and early November the individual colonies of *N. cara* were generally small and constituted only a small portion of the zooplankton biomass. The December samples showed a greater range of small to large individuals and they often made up a more substantial portion of the zooplankton biomass. In general, in the earlier months the greatest mass of siphonophores was found within 15 mi (24 km) of the coast, but by December the concentration was centered farther offshore.

The colonies of *N. cara* also had a high density of lipids, probably as a result of feeding on overwintering populations of oil-rich calanoid copepods.[3] Biggs feels that the swarming of *N. cara* may be behavioral, that because of heavy concentrations of copepods, the siphonophores may be altering their swimming behavior to stay in areas of high food density. An effort will be made to determine if copepod abundance was greater during the fall and winter months of 1975 than in previous years.

Larry Davis, NEFC, Narragansett, RI, has been studying long-term temperature trends of the Gulf of Maine. According to his data, there has been a net warming trend in the autumn from 1968 through 1974. In 1975 the average temperature of an 8-year mean for the entire Gulf of Maine dropped 0.6C (Davis, Section 14). Ed Cohen,[4] in cooperation with the Atlantic Environmental Group

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[3]Personal communication from D. C. Biggs, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.
[4]Monthly temperature transect for the Gulf of Maine, August through December (unpub. doc.), NEFC, Woods Hole, MA 02543.

at Narragansett, RI, has been compiling temperature data on transects from Bar Harbor to Yarmouth and comparing the results to Colton and Stoddard's (1973) 20- to 23-year means. The 1975 monthly data (June-December) indicate that the southern portion of the Bay of Fundy is warmer than the 20-yr monthly means (Chamberlin et al., Section 15).

Data from *Challenge* 75-1 and *Albatross IV* 75-12 cruises show siphonophores occurring in waters with surface temperatures as high as 18.5C and bottom temperatures as high as 13.5C. The respective temperature lows for the combined cruises were 10.0C and 5.5C. Maximum numbers of siphonophores were found at surface temperatures of 6.0C and above. Fishermen reported that the siphonophores diminished in the coastal waters as temperatures dropped from autumn to winter.

SUMMARY

The lipo described by the fishermen is identified as a colonial siphonophore *Nanomia cara* which has a maximum growth peak in late fall when surface temperatures range from 10C to 14C. Underwater observations (Rogers et al., in press) indicated that the colonies were approximately 30 cm long and at densities close to 1/cu m. There is some indication that as nearshore waters cool, the numbers diminish, although it is not clear whether the siphonophores move offshore or if many of them die off.

The reasons for the explosive growth in the fall of 1975 are not yet fully understood, but the warmer than average water temperatures possibly leading to a higher than average autumn-winter density of food organisms may have triggered the swarming.

An attempt will be made through the MARMAP monitoring program to follow the seasonal distribution of lipo and correlate its presence and abundance with temperature and other factors which may appear important. Through this monitoring program it should be possible to alert the inshore fishing fleets to future siphonophore swarming.

LITERATURE CITED

BUMPUS, D. F.
1976. Review of the physical oceanography of Georges Bank. In Goulet, J. R., Jr. (compiler), The environment of the United States living marine resources - 1974, p. 13-1--13-17. U.S. Dep. Commer., Natl. Ocean. Atmos. Admin., Natl. Mar. Fish. Serv., MARMAP (Mar. Resour. Monit. Assess. Predic. Prog.) Contrib. 104.

COLTON, J. B., Jr., and R. R. STODDARD.
1973. Bottom-water temperatures on the Continental Shelf, Nova Scotia to New Jersey. U.S. Dep. Commer., NOAA Tech. Rep., NMFS CIRC-376, 55 p.

ROGERS, C. A., D. C. BIGGS, and R. A. COOPER.
In press. An aggregation of the siphonophere Nanomia cara Agassiz, 1865 in the Gulf of Maine: Observations from a submersible. Fish. Bull., U.S. 76:281-284.

Editors' note: Figures 20.10 through 20.12 are contours of abundance and size of siphonophore colonies for the data presented in Figures 20.2 through 20.5. In October-November the distribution of siphonophores apparently followed the mean circulation patterns in the Gulf of Maine-Georges Bank region (Bumpus 1976) with possible origins in the coastal regions. In December the apparent origin of the siphonophore distributions had moved south and again the distribution seemed to follow the mean circulation patterns.

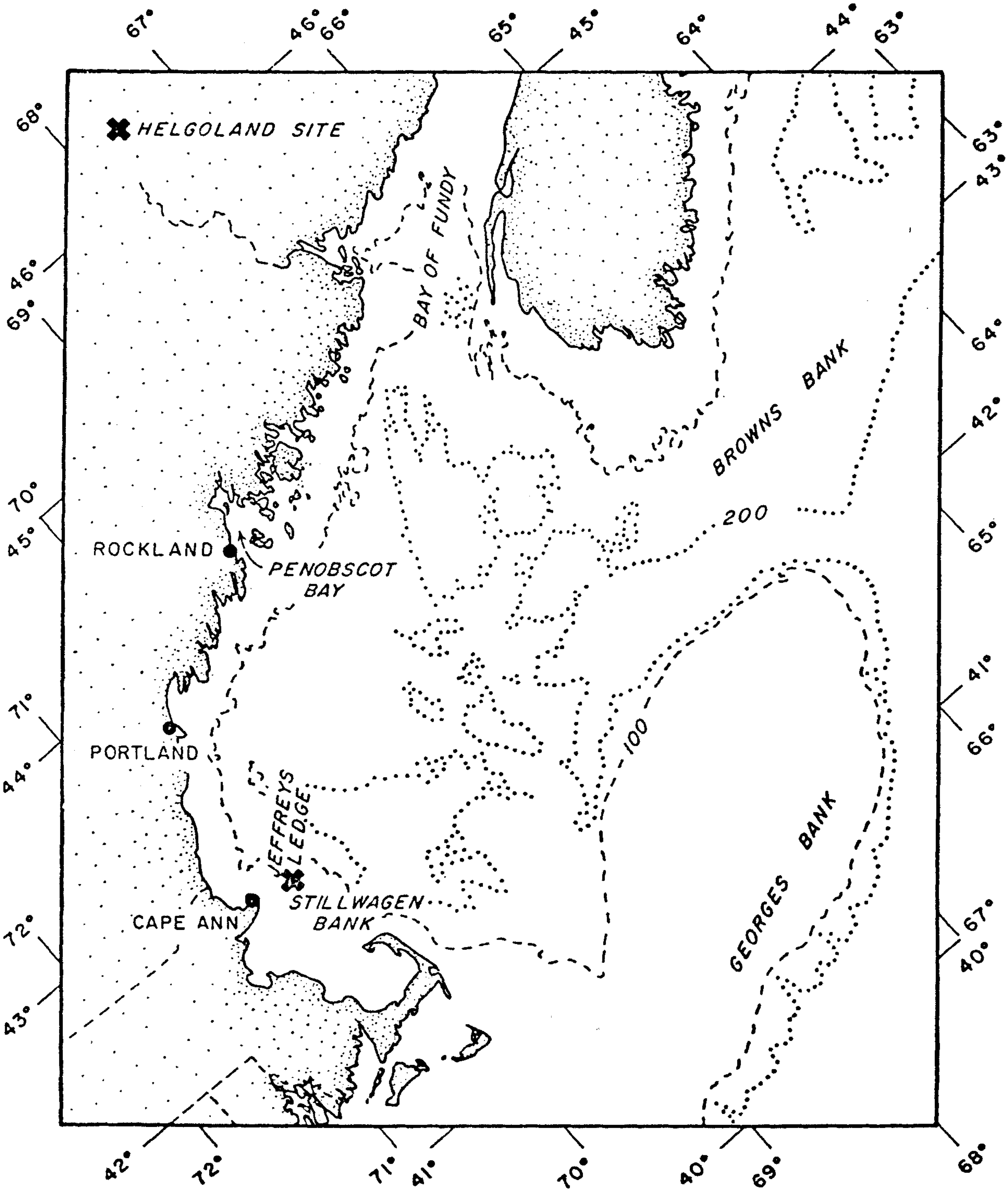

Figure 20.1.—Area in which bongo and neuston net tows were made to sample for the presence of siphonophores.

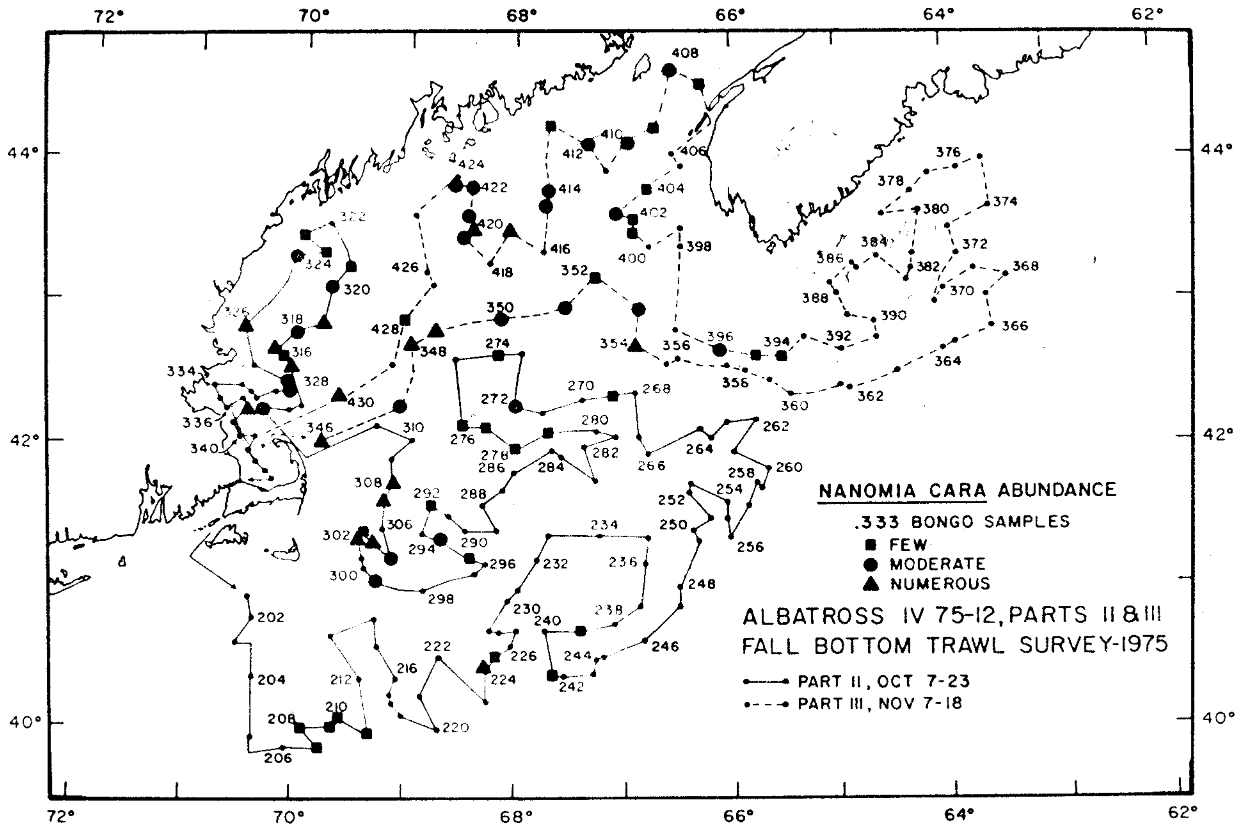

Figure 20.2.—Relative abundance of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in samples designated by a point.

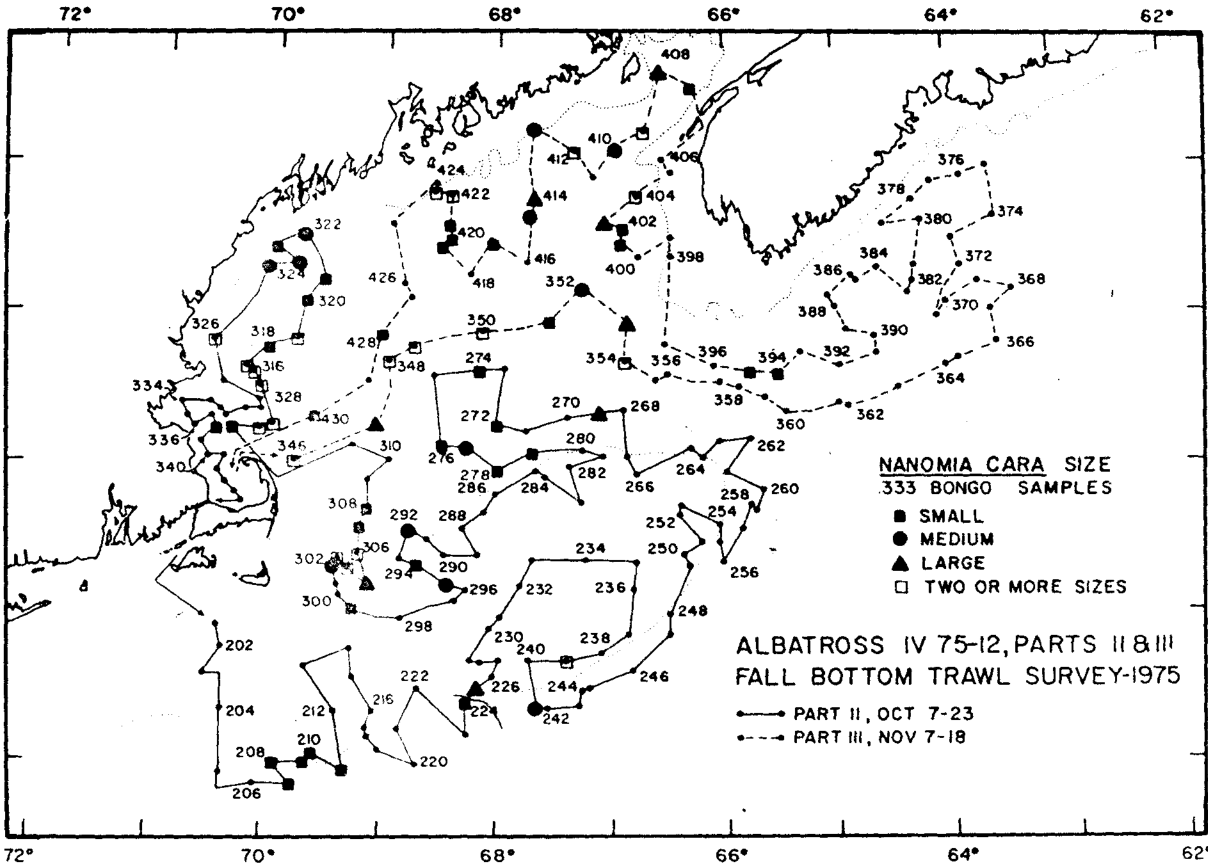

Figure 20.3.—Relative size of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in samples designated by a point.

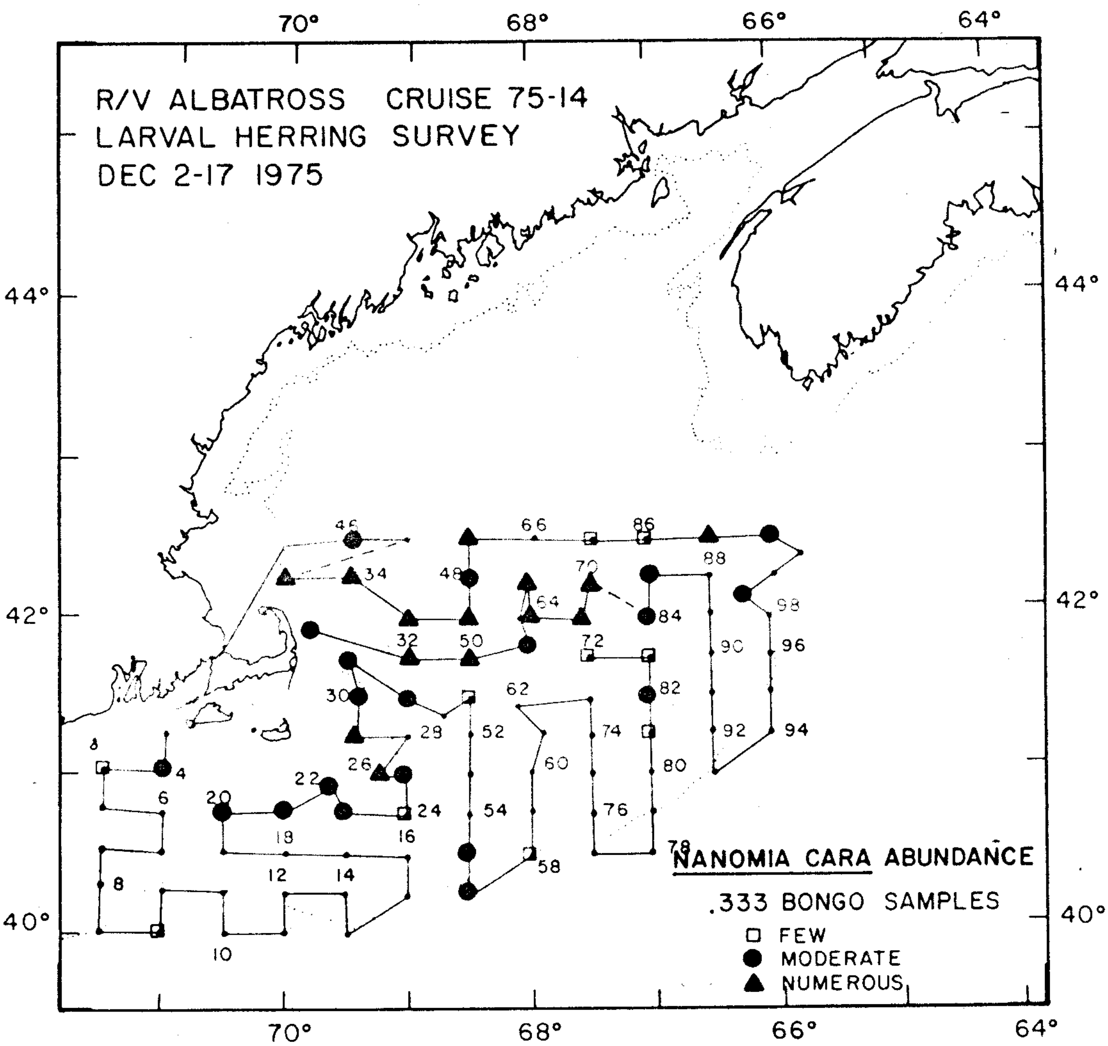

Figure 20.4.—Relative abundance of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in samples designated by a point.

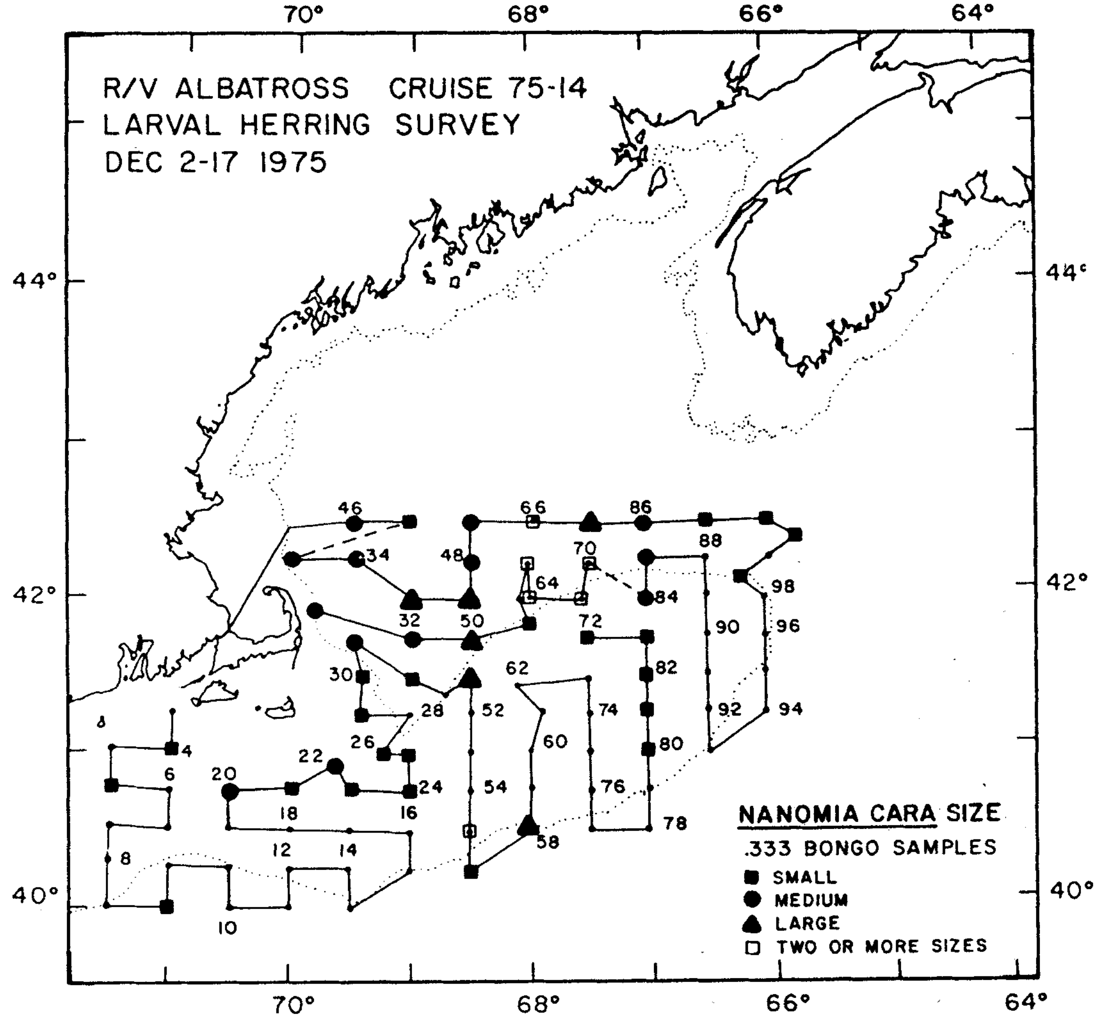

Figure 20.5.—Relative size of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in samples designated by a point.

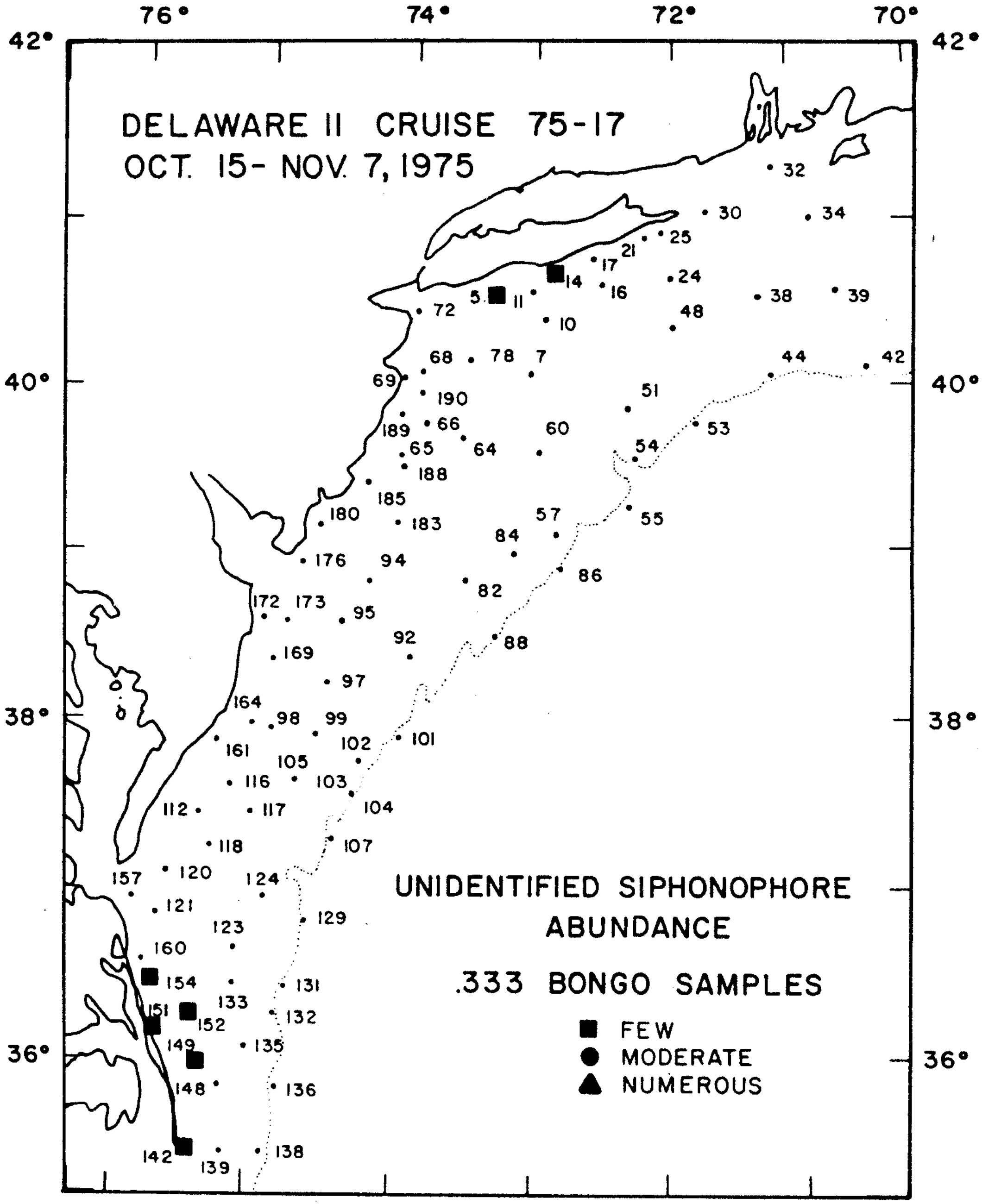

Figure 20.6.—Relative abundance of an unidentified siphonophore in bongo samples for each station location. No siphonophores were found in samples designated by a point.

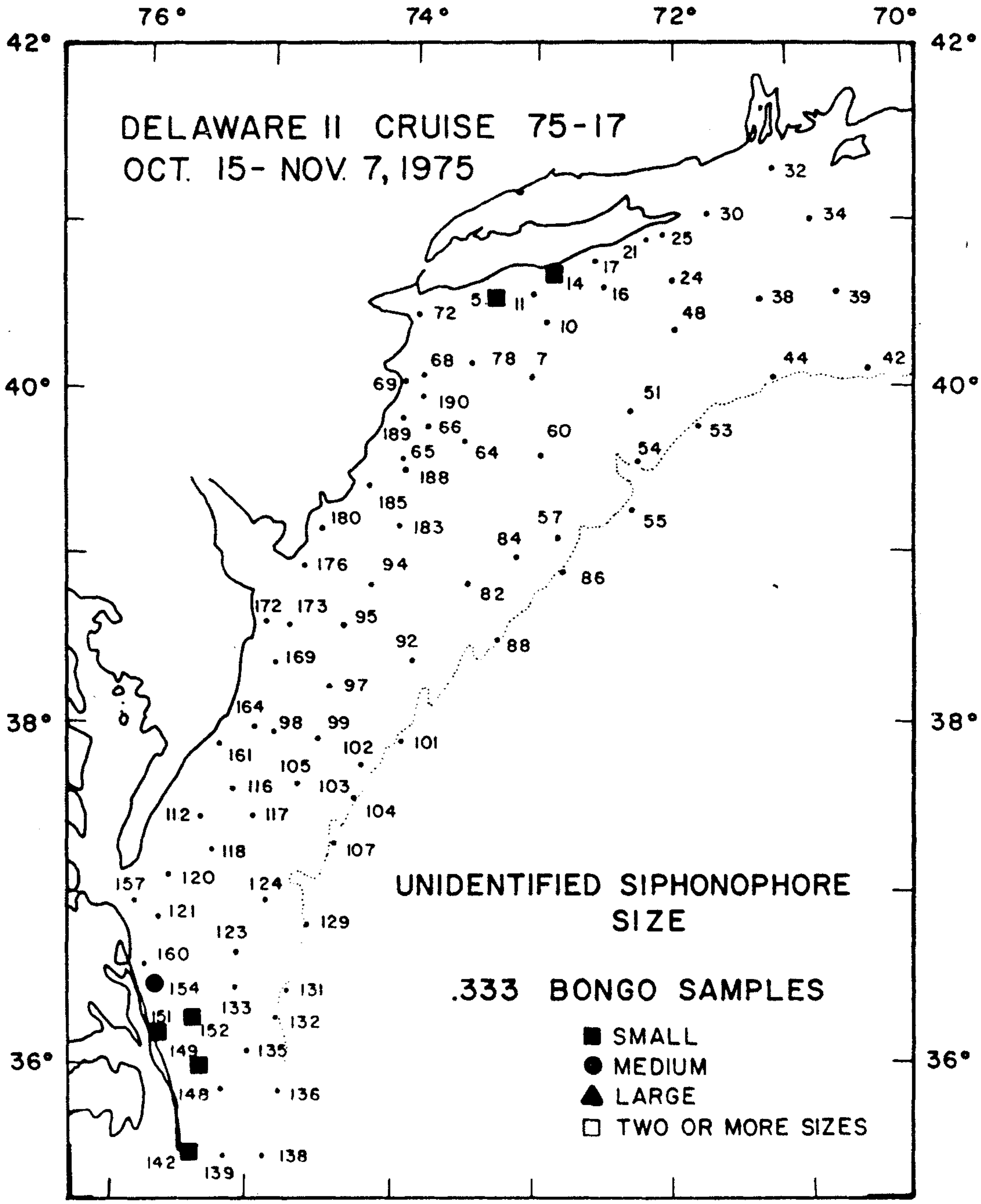

Figure 20.7.—Relative size of an unidentified siphonophore in bongo samples for each station location. No siphonophores were found in samples designated by a point.

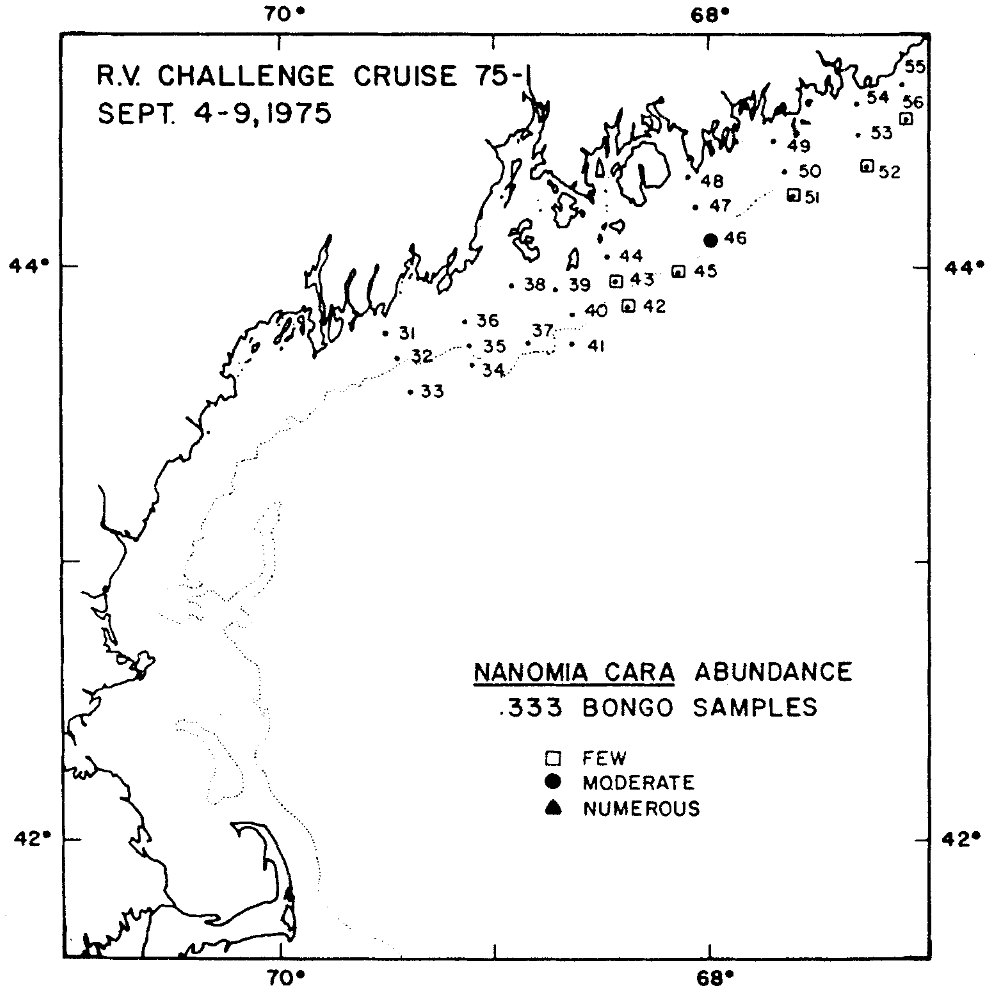

Figure 20.8.—Relative abundance of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in designated by a point.

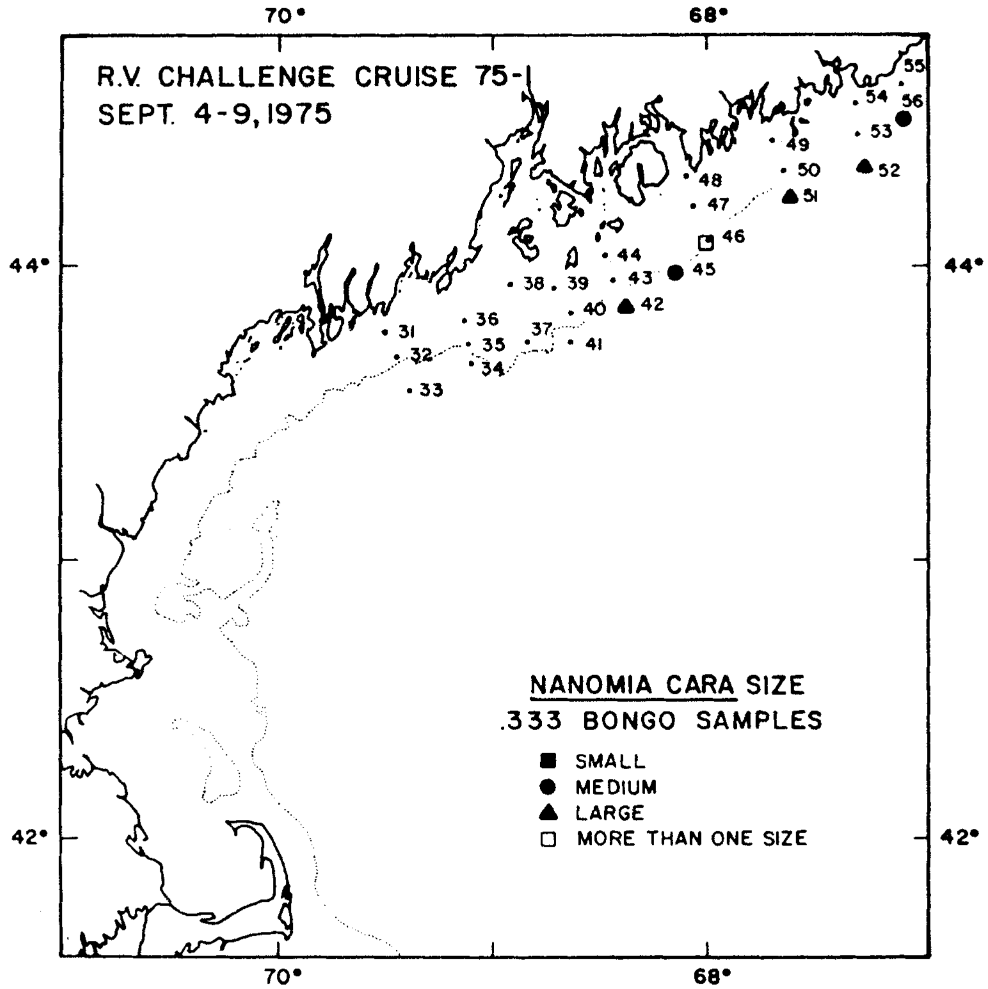

Figure 20.9.—Relative size of *Nanomia cara* in bongo samples for each station location. No siphonophores were found in samples designated by a point.

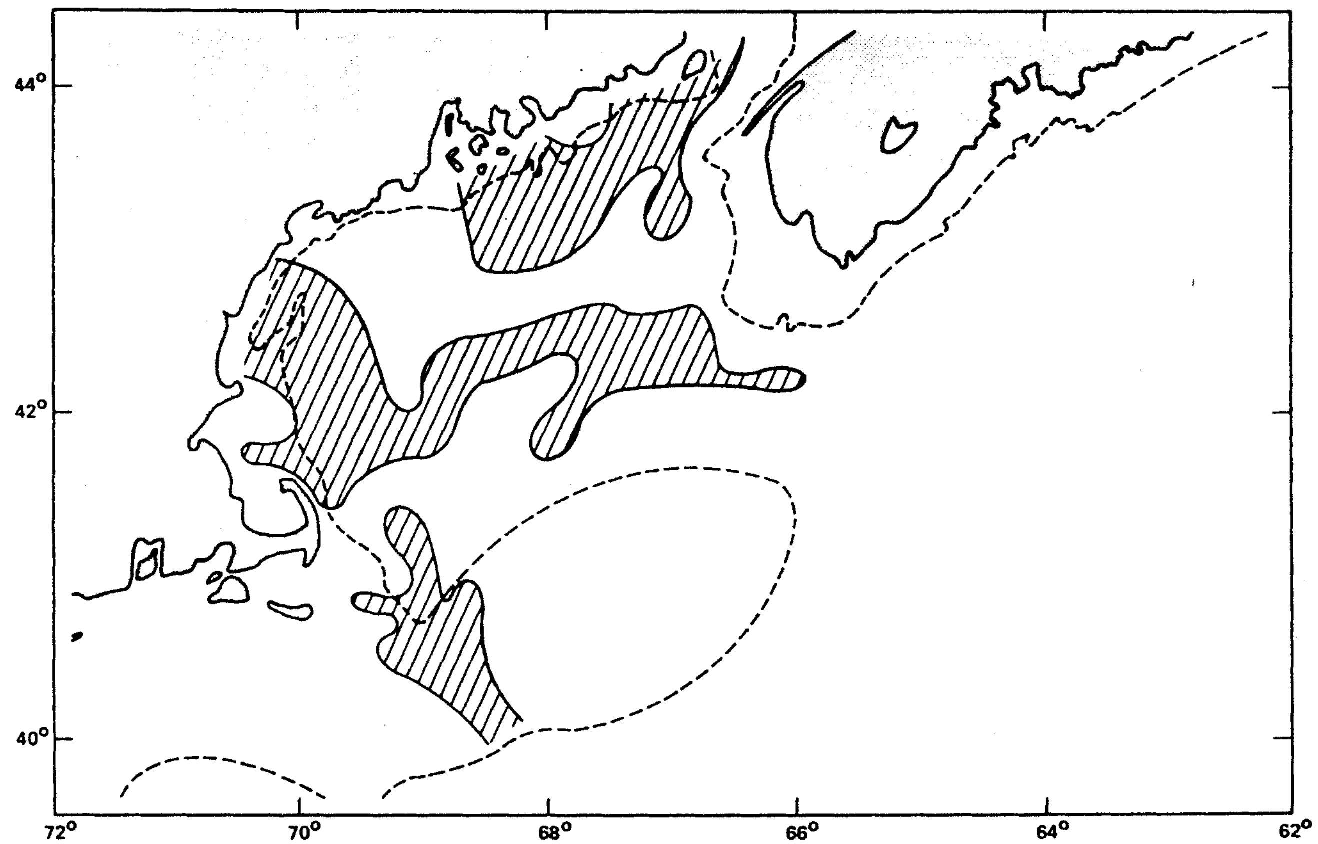

Figure 20.10.—Lipo: moderate/numerous (shaded areas), RV *Albatross IV* 75-12, 7 October-18 November 1975.

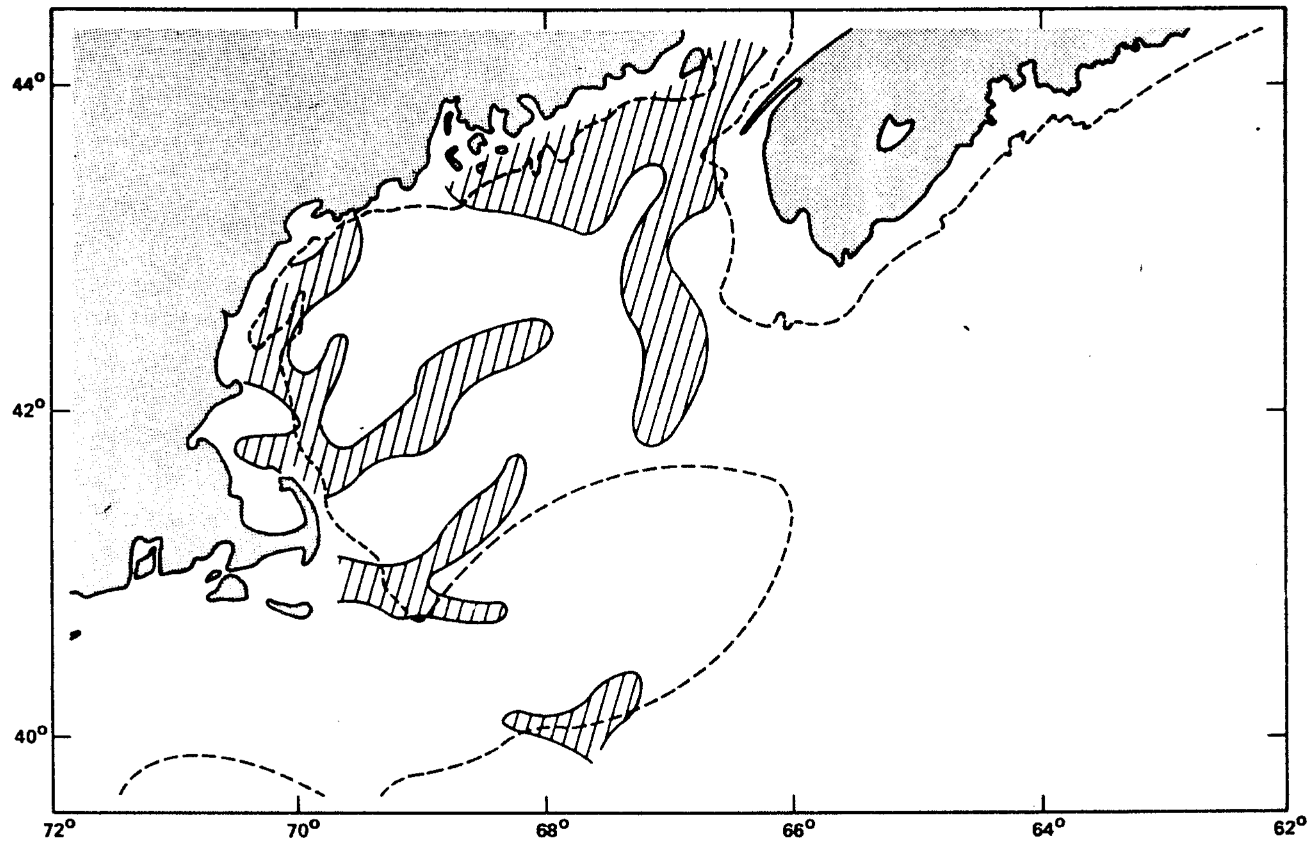

Figure 20.11.—Lipo: medium/large (shaded areas) RV *Albatross IV* 75-12, 7 October-18 November 1975.

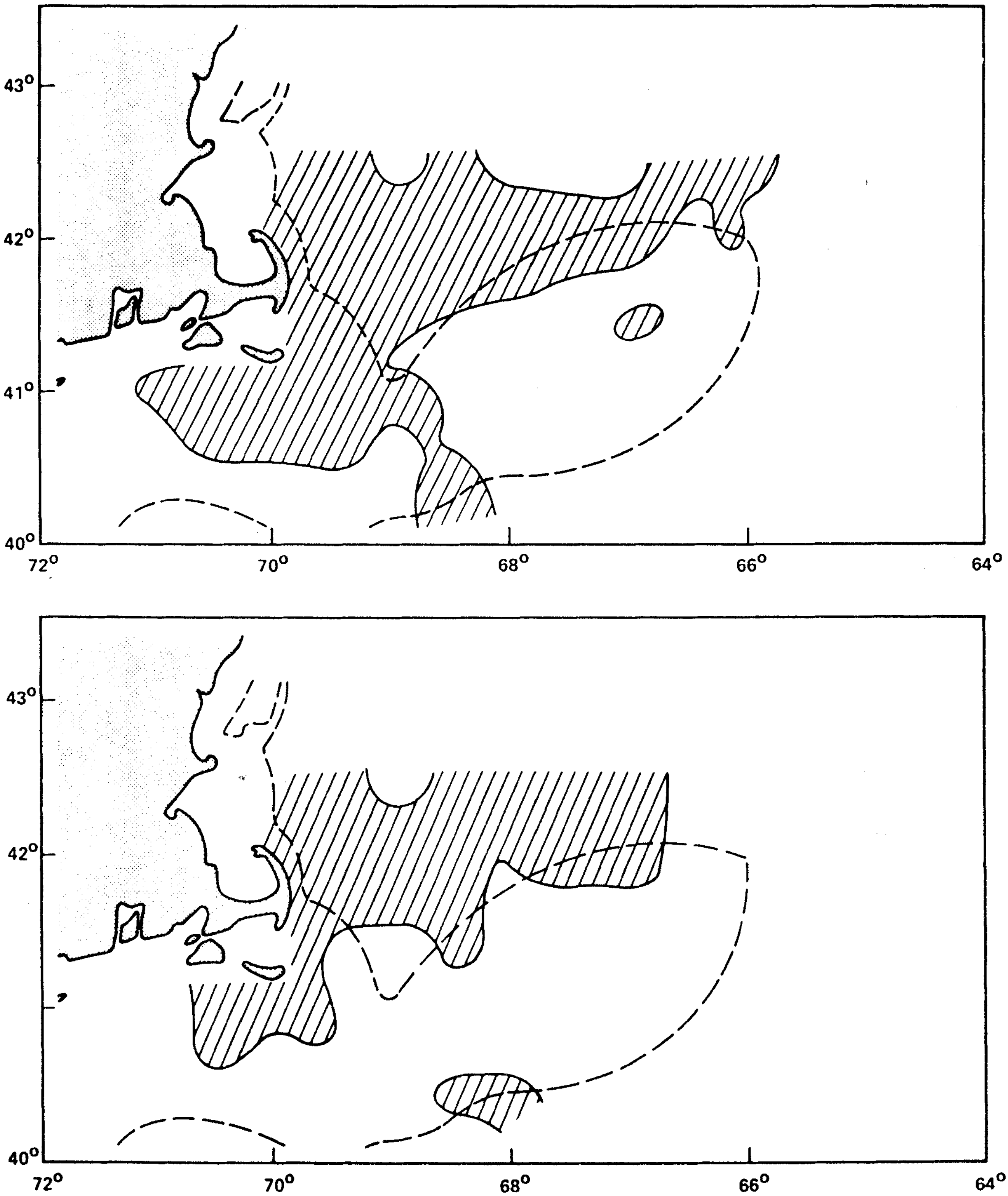

Figure 20.12.—Areas of moderate/numerous (upper) and medium/large (lower) siphonophores, RV *Albatross IV* 75-14, 2-17 December 1975.

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