U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

ENVIRONMENTAL IMPACT REPORT 1-76

Impact of Autumn-Winter Swarming of a Siphonophore ("Lipo") on Fishing in Coastal Waters of New England

by

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Errata

p. 4, para. 3,4

The siphonophores found in the Delaware II samples were misidentified as N. cara and have more recently been tentatively identified as Halistemma sp. Halistemma, according to Totten (1965) is typically found in warmer waters so its presence in the Delaware II samples is not surprising.

The distribution of N. cara stated in earlier literature (Bigelow, 1926) is borne out by the presence of this species only in the Albatross IV and Challenger samples, and by its absence in the Delaware II samples.

Figures 7, 8, Table 2

The siphonophores found at these stations were misidentified as N. cara; they have been tentatively identified as Halistemma sp.

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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 three-month maximum between October and December. A reduction was observed in mid to late December with some still observed in January.

Fishing nets dragged through this mass became clogged so 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, MA, and Portland, ME. Boston and Provincetown 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, ME, indicated that all of the 75 vessels there encountered a problem with the "lipo" at least once during the three-month period. 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 a conservative estimate of 60 inshore trawlers were involved and that up to 20% of fishing time was lost either in cleaning gear or not fishing.

In a recent (26 December 1975) letter to Mr. William Gordon, Regional Director of NMFS Northeast Region, Mr. 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.

IDENTIFICATION OF "LIPO"

The color of samples taken from fishing gear ranged from pink to grey and black. Fresh material was gelatinous, amorphous, with filaments and floats associated with it.

Salvatore Testaverde, a Gloucester Fisheries Commission member on the staff of the New England Aquarium, was the first in the scientific community to become concerned about the adverse impact of "lipo" on Fishing. He spearheaded the investigation by first sending a sample to Dr. John Kingsbury at Cornell University. Dr. Kingsbury was unable to identify the material, but did find a number of nematocysts in the mass. Testaverde then contacted scientists at the WHOI and National Marine Fisheries Service in Woods Hole, MA, and Narragansett, RI. Dr. Roland Wigley, NMFS, Woods Hole, received word from Dr. Ronald Larson at the University of Puerto Rico that the sample he received from an Albatross IV collection made in the Gulf of Maine was composed of tentacles, gastrozooids and a few floats of a large Physonectae siphonophore. Testaverde and scientists from the Northeast Fisheries Center, Fred Lux and Carolyn Rogers followed up this information and concluded that the organism was probably *Nanomia cara*, a colonial siphonophore common in the Gulf of Maine. Chris Martin from the University of Massachusetts Marine Laboratory and Charles Yentsch, Director of the Bigelow Biological Laboratory, corroborated these conclusions by looking at several additional samples (Fig. 1.). More recently Doug Biggs, siphonophore expert of the Woods Hole Oceanographic Institution examined several samples taken from Albatross IV and Delaware II surveys, as well as underwater photographs on Jeffries Ledge Helgoland site (Fig. 2) by H. West Pratt of the Northeast Fisheries Center. By applying biological stain to the nectophores of the siphonophore remains, Biggs observed the musculature and morphology of the radial canals. Using this method he was able to confirm the identity of the siphonophore as the species *Nanomia cara*.

N. cara is a cold water form found in the Gulf of Maine (Bigelow, 1926) and in the eastern North Atlantic (Hardy, 1970). There is little record of it south of Cape Cod, but as it is rarely recovered intact it may simply be overlooked in plankton samples (Hamner, et al, 1975). As a member of the suborder Physonectae, *N. cara* is characterized by the presence of a small (∿1mm) carbon monoxide filled float attached to the apex of the colony. It acts as a flotation device, and it is this bubble which allows the animal to be picked up by echo-sounding equipment. The colony is made up of nectophores, the pumping and locomotory organs, the reproductive organs including the male and female gonophores and the feeding and nutritive organs. It ranges in length from 10 to 45 cm (Totten, 1965). A similar southern and west coast species *N. bijuga*, separated from the southernmost range of *N. cara* by more than 1,000 miles, is felt to comprise a large portion of the deep scattering layer where they are often in concentrations as dense 3/10m^3 (Barham, 1963). Both species in this genus undergo extensive diel vertical migrations

which explains the differing depth ranges picked up by New England fishermen on their depth-sounding equipment. Early studies by Henry Bigelow in 1926 indicate that N. cara reaches maximum numbers in the fall and winter.

Because siphonophores are fragile, and almost impossible to recover intact in plankton nets, very little is known of their life history. Biggs estimates their generation time to range between 2 weeks and a month. The salmon-pink color reported by fishermen has also been identified in preserved samples as ripening female gonophores. The changes to grey and black probably indicate a breakdown of color pigment as a colony nears the end of its life cycle.

DISTRIBUTION

Helgoland Observations -- The siphonophore Nanomia cara was observed during the Helgoland mission (August 5-November 21, 1975) on Jeffries Ledge. Personnel on surface vessels noted its presence near the surface and H. Wes Pratt, a diver for the mission, reported that the siphonophore was the most numerous during August and September, scarce in October and November. During the periods when numerous, he estimated about one per cubic meter in the area of the Helgoland habitat. 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. They appeared very fragile. They were densest in the top 2-3 meters; 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 siphonophore masses occurred at depths of 40-100 meters 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 undergo vertical migrations. Fishermen encountered siphonophores from Stellwagen Bank off Massachusetts Bay to Rockland, Maine.

Plankton samples were taken in the Gulf of Maine on four Albatross IV cruises (75-12 II, III, 75-13, 75-14) as part of the Northeast Fisheries Center's MARMAP survey and monitoring program. The cruises included the period from October 7 to December 17, 1975. A Delaware II cruise (75-17) from October 15 to November 7, 1975, also part of the MARMAP program, sampled the area from Cape Cod to Cape Hatteras. A Challenge cruise (75-1), part of the Biome survey of the Northeast Fisheries Center, sampled the coastal waters of Maine from September 4-9, 1975. All samples were collected with paired Bongo samplers fitted with 0.333 mm and 0.505 mm mesh nets. Oblique tows 1.5-3.5 kn, were made through the water column from the surface to 10 m of the bottom or 100 m maximum depth. The Bongos were set out at 50 m/min and retrieved at 20 m/min, the maximum time of a plankton tow being approximately 23 minutes. Because of the fragile nature of N. cara, only fragments were available in the samples for examination. A total of 422 samples were examined

at a magnification of 10X by the NEFC Plankton Sorting Group at Narragansett, RI. A summary of N. cara occurrence is given in Tables 1-4. The distribution over the Continental Shelf and area plots showing relative abundance and size are given in Figures 3, 4, 5, 6, 7, 8, 9, and 10. We recognize the subjective nature of relative size and abundance information, but felt that horizontal projections of areal 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 miles from the coast) and only in stations north of Penobscot Bay (Fig. 9, 10, Table 1). This coincides with the inshore distribution of siphonophores found on Albatross IV cruises 75-12 (II, III) from October 7-November 18 (Fig. 3, 4, Table 3).

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 (December 2-17) sampled the southern portion of the Gulf of Maine, Georges Bank and the region south of Cape Cod (Fig. 5, 6, Table 4).

Plankton samples from the Delaware II cruise (October 15-November 7) had few siphonophores (Fig. 7, 8, Table 2). Four stations off the New Jersey and Long Island coast and 5 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. These siphonophores have also been identified as N. cara by Biggs. The presence of this species that far south is unusual and there are no previous reports of such a southerly distribution previously. This southerly distribution might be associated with surface drift. A ten-year average of inferred drift for September and October out to the 100 fathom line indicates a net movement out of the Gulf of Maine via South Channel to Cape Hatteras (Bumpus, et al., 1973).

The surface temperatures at stations where samples yielded N. cara, ranged from 15.5 to 19.0°C and bottom temperatures ranged from 11.6 to 19.0°C. The only three stations which showed some vertical stratification were 5, 13, and 152 where the maximum ΔT from surface to bottom was 4.4°C. All other stations had a ΔT of <1°C. The Delaware II surface temperatures coincided closely with the highest surface temperatures at which siphonophores were found in Gulf of Maine samples. However, the bottom temperatures are almost all higher than those found in the Gulf of Maine. Since N. cara is a cold water species it would seem likely that the scattered specimens found south of Cape Cod were a primary result of surface drift from the center of maximal swarming in the Gulf of Maine.

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 miles of the coast, but by December the concentration was centered further 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 (Biggs, personal communication). 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 of the Northeast Fisheries Center 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 0.6°C (personal communication). Ed Cohen, NEFC, Woods Hole, in cooperation with the Atlantic Environmental Group 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) 20-23 year means. The 1975 monthly data (June-December) indicates that the southern portion of the Bay of Fundy is warmer than the 20-year monthly means.

Data from Challenge 75-1 and Albatross IV 75-12 shows siphonophores occurring in waters with surface temperatures as high as 18.5°C and bottom temperatures as high as 13.5°C. The respective temperature lows for the combined cruises were 10.0°C and 5.5°C. Maximum numbers of siphonophores were found at surface temperatures $\geq$6.0°C. Temperature data for the December cruise (Albatross IV 75-14) is not available at this time. However, 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 10°C to 14°C. Underwater observations indicated that the colonies were approximately 30 cm long and at densities close to $1/m^3$. 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 its seasonal distribution 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.

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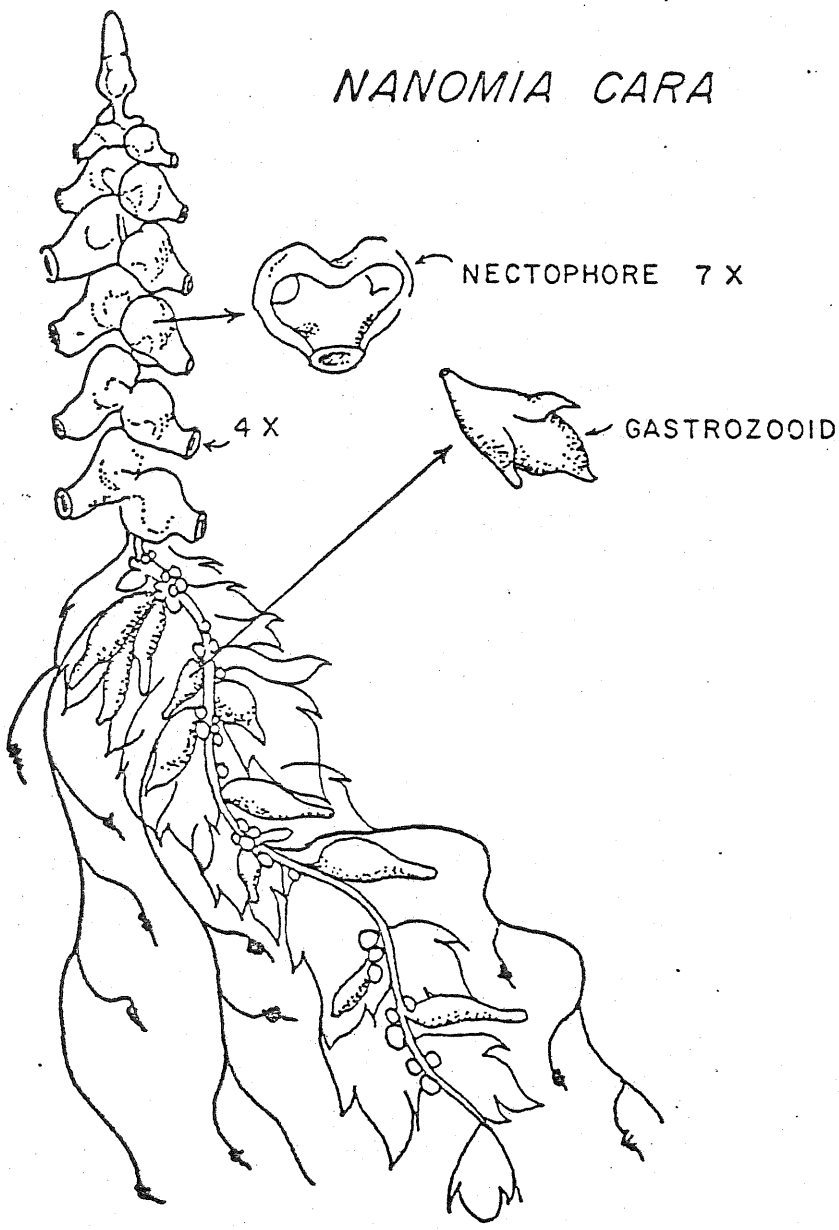

SCALE:

10 mm = 2.5 mm, or 4 X

ENLARGED STRUCTURES
10.5 mm = 1.5 mm, or 7 X

Fig. 1. The siphonophore Nanomia cara, redrawn from Hardy (1970). Individual structures approximately 4x although length of an entire living colony can exceed that illustrated here. Magnified structures approximately 7x.

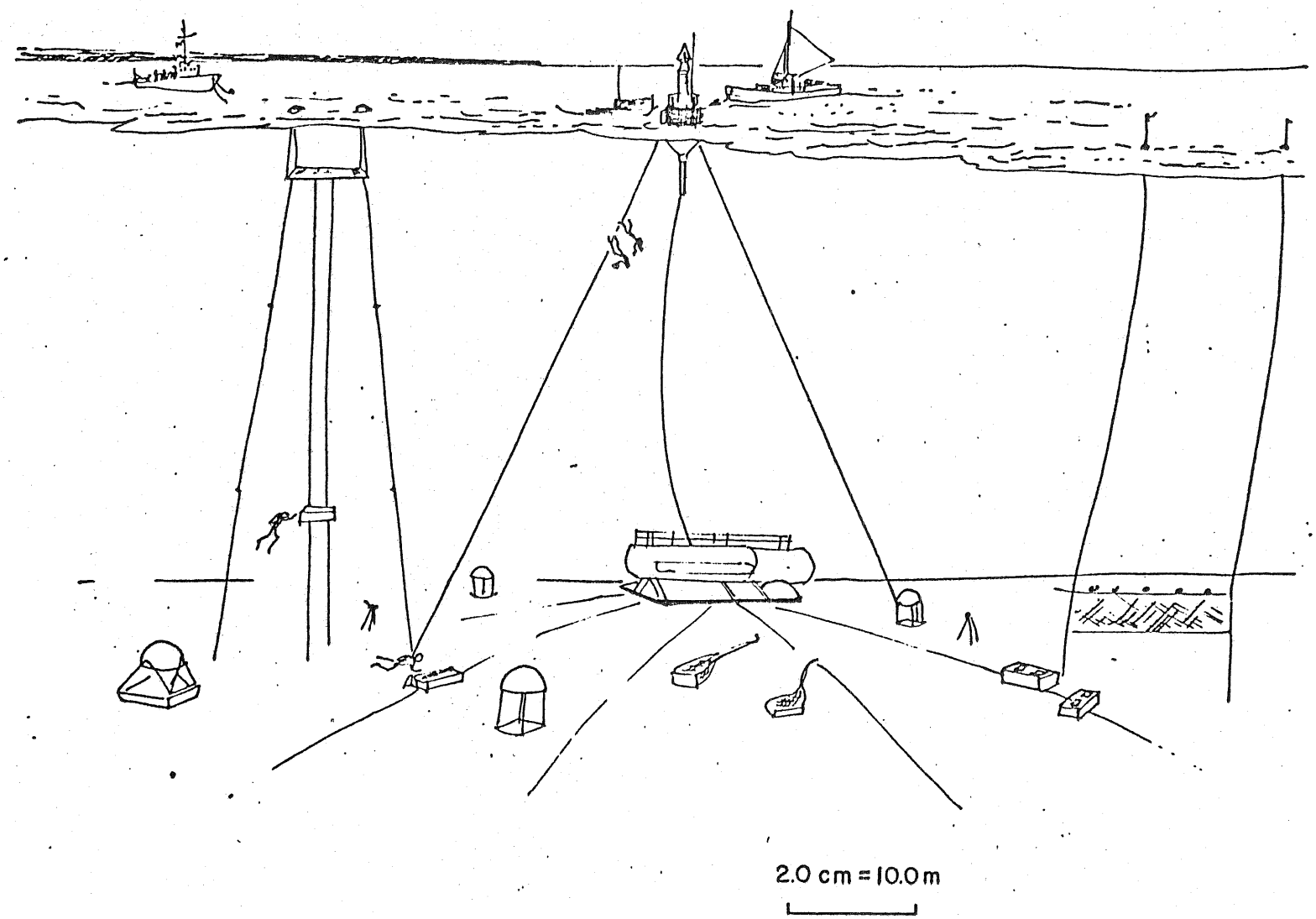

Fig. 2. Schematic of UWL Helgoland on site at Jeffries Ledge.

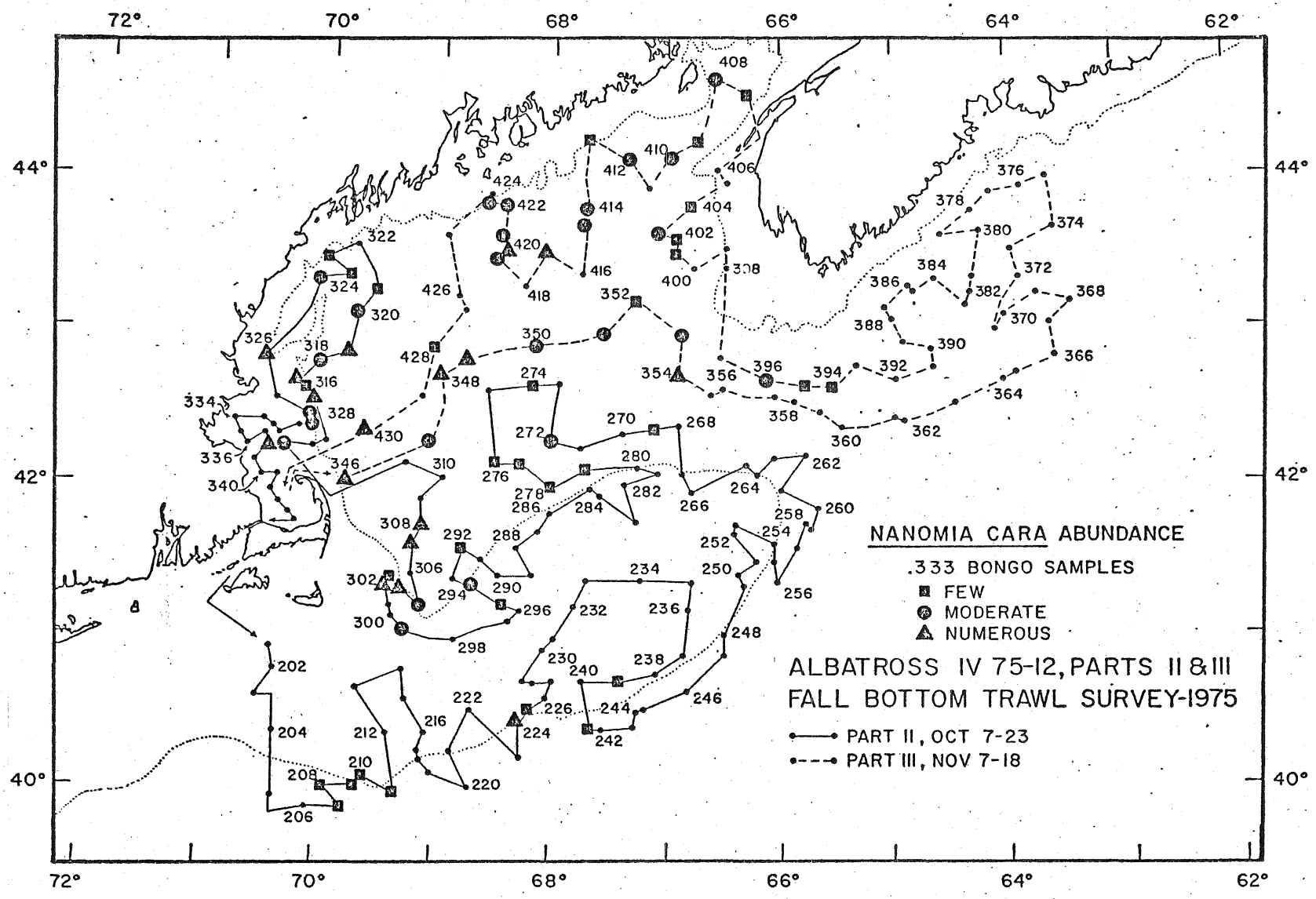

Fig. 3. Relative abundance of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

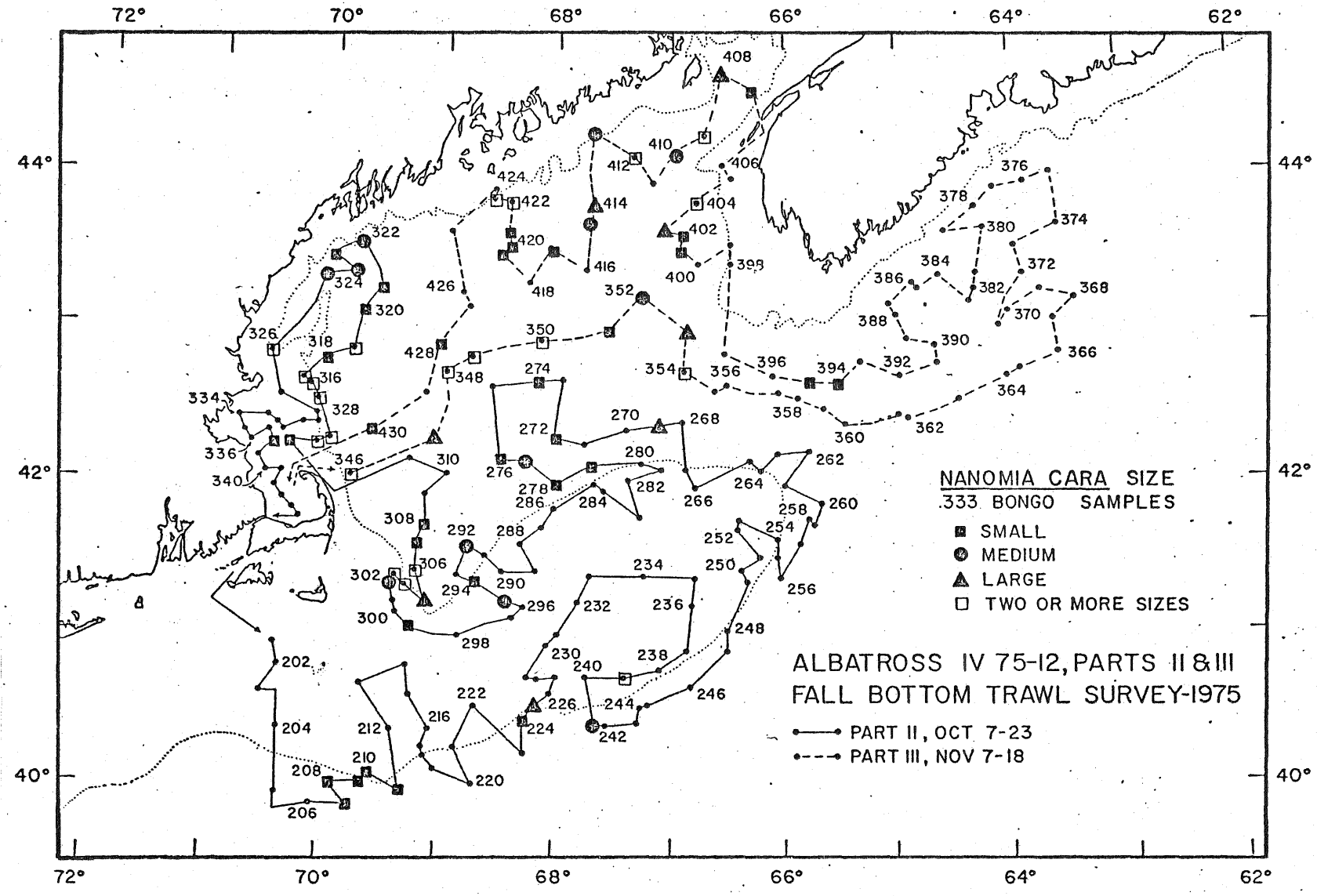

Fig. 4. Relative size of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

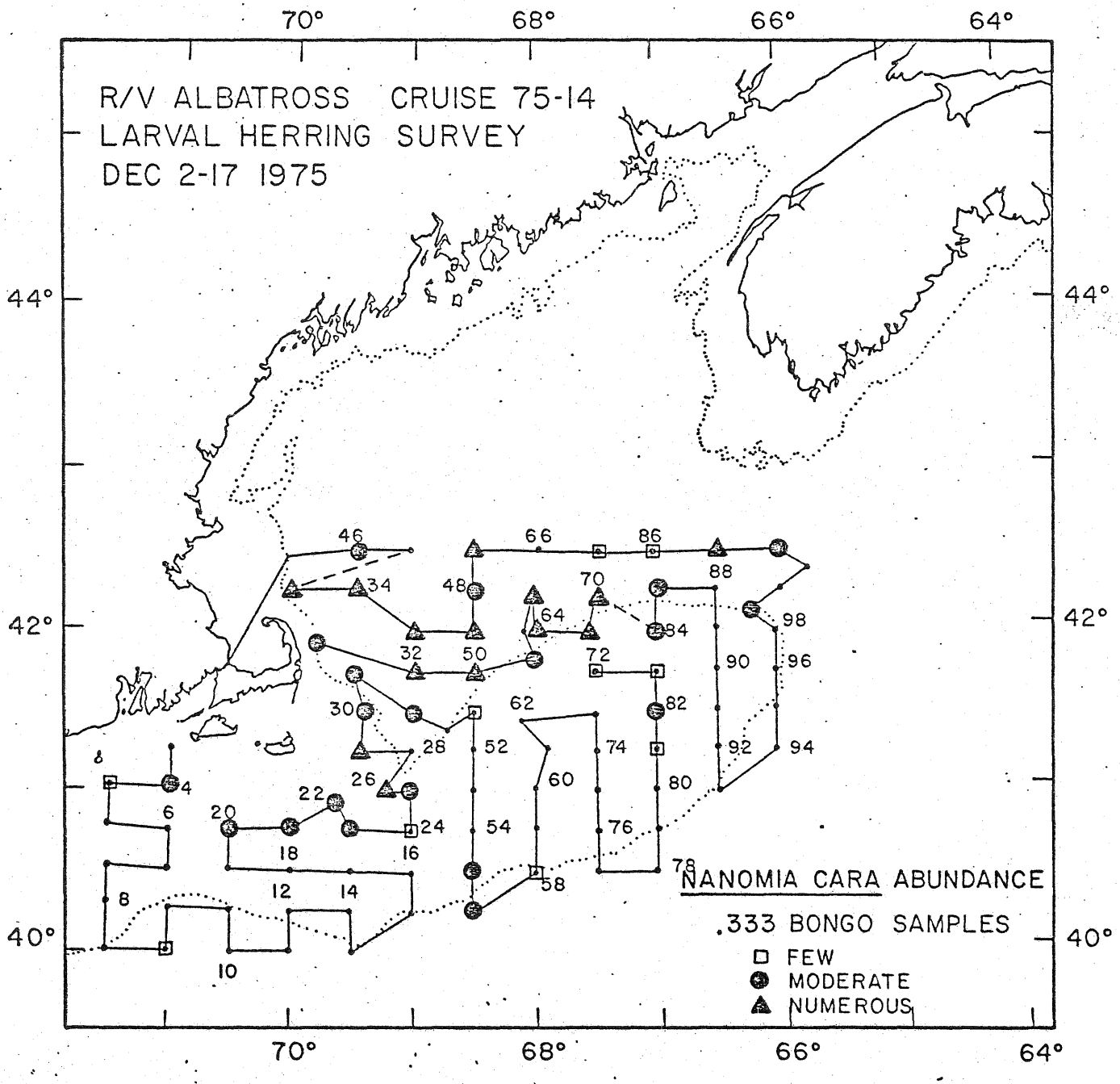

Fig. 5. Relative abundance of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

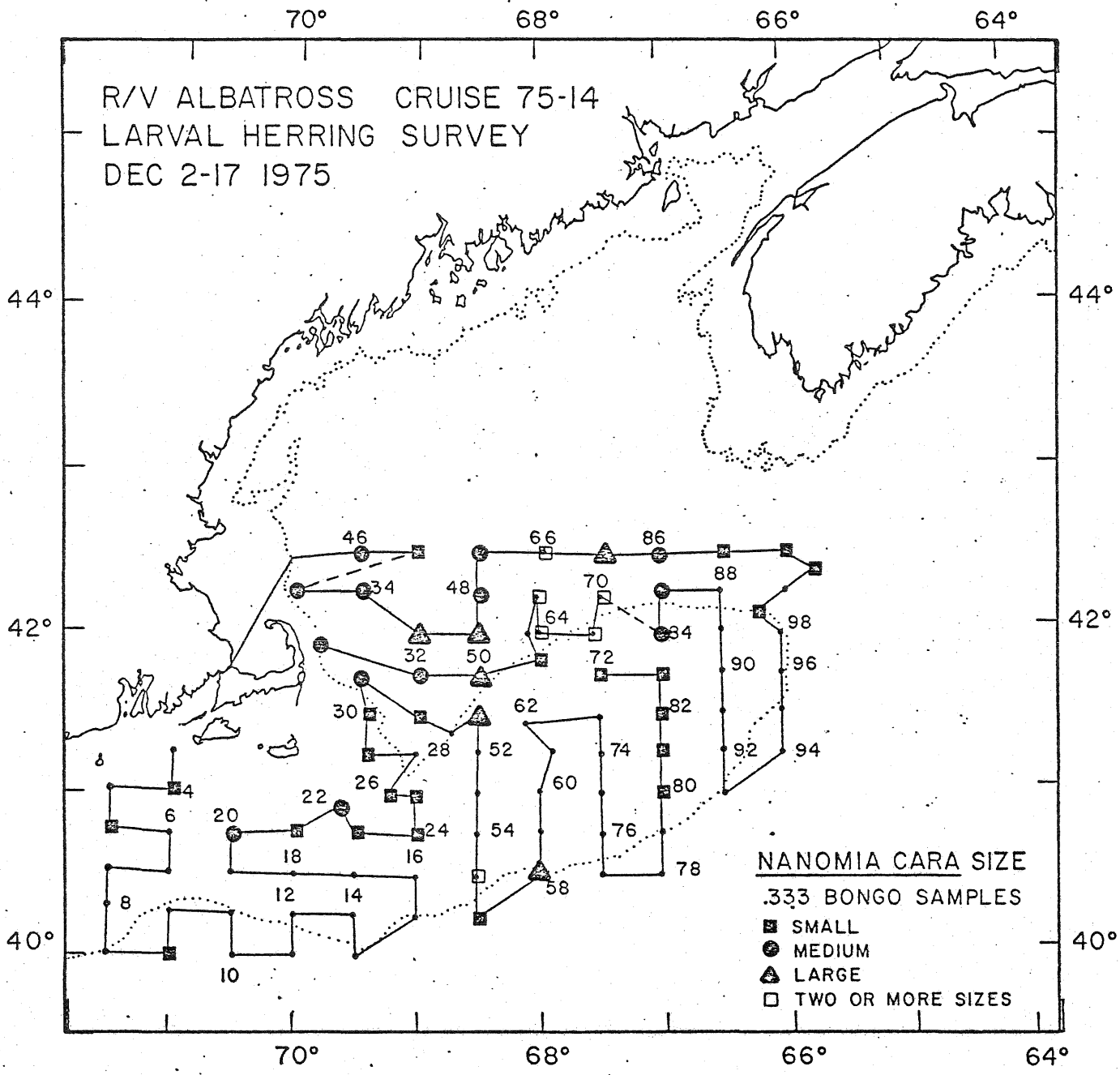

Fig. 6. Relative size of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

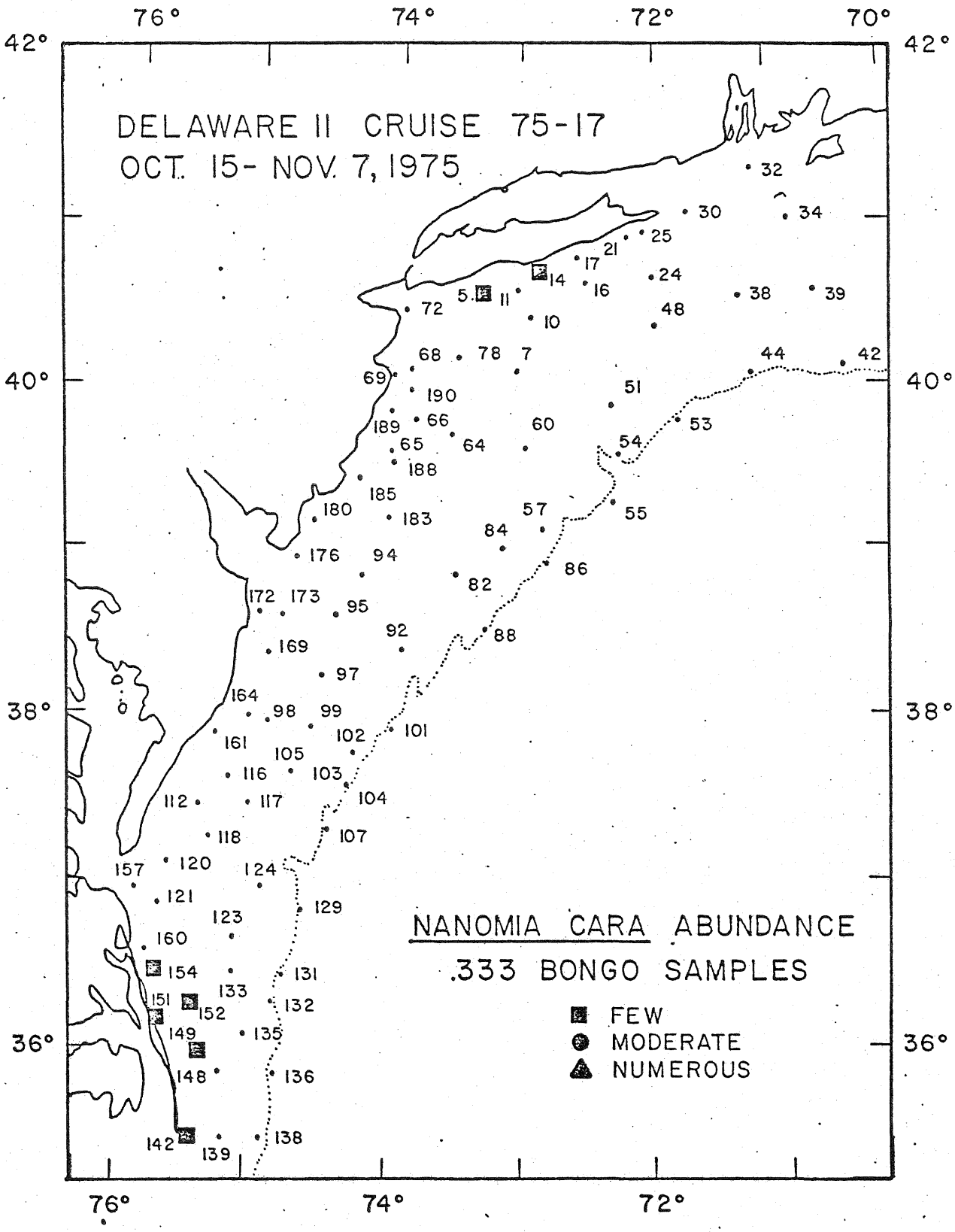

Fig. 7. Relative abundance of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

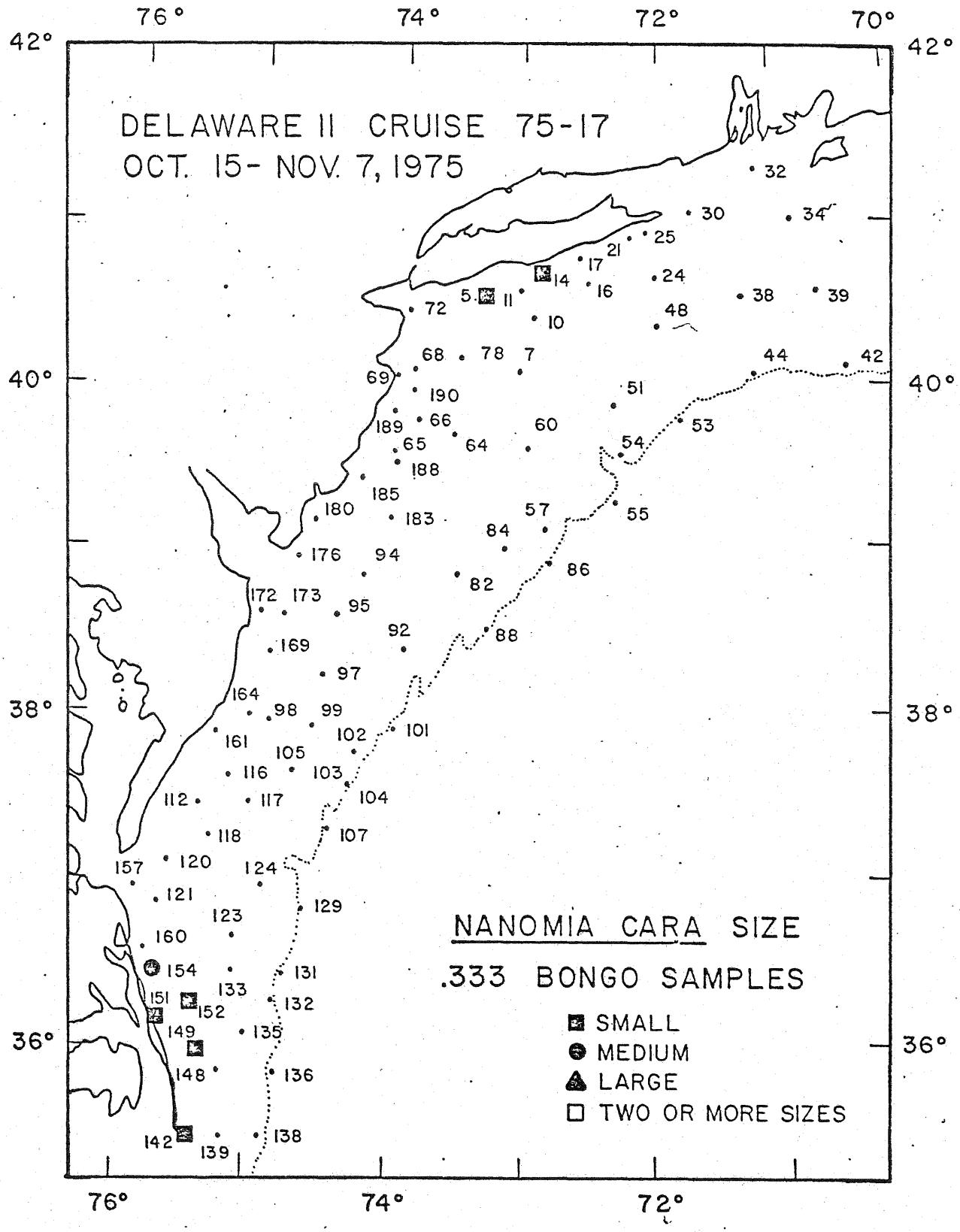

Fig. 8. Relative size of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

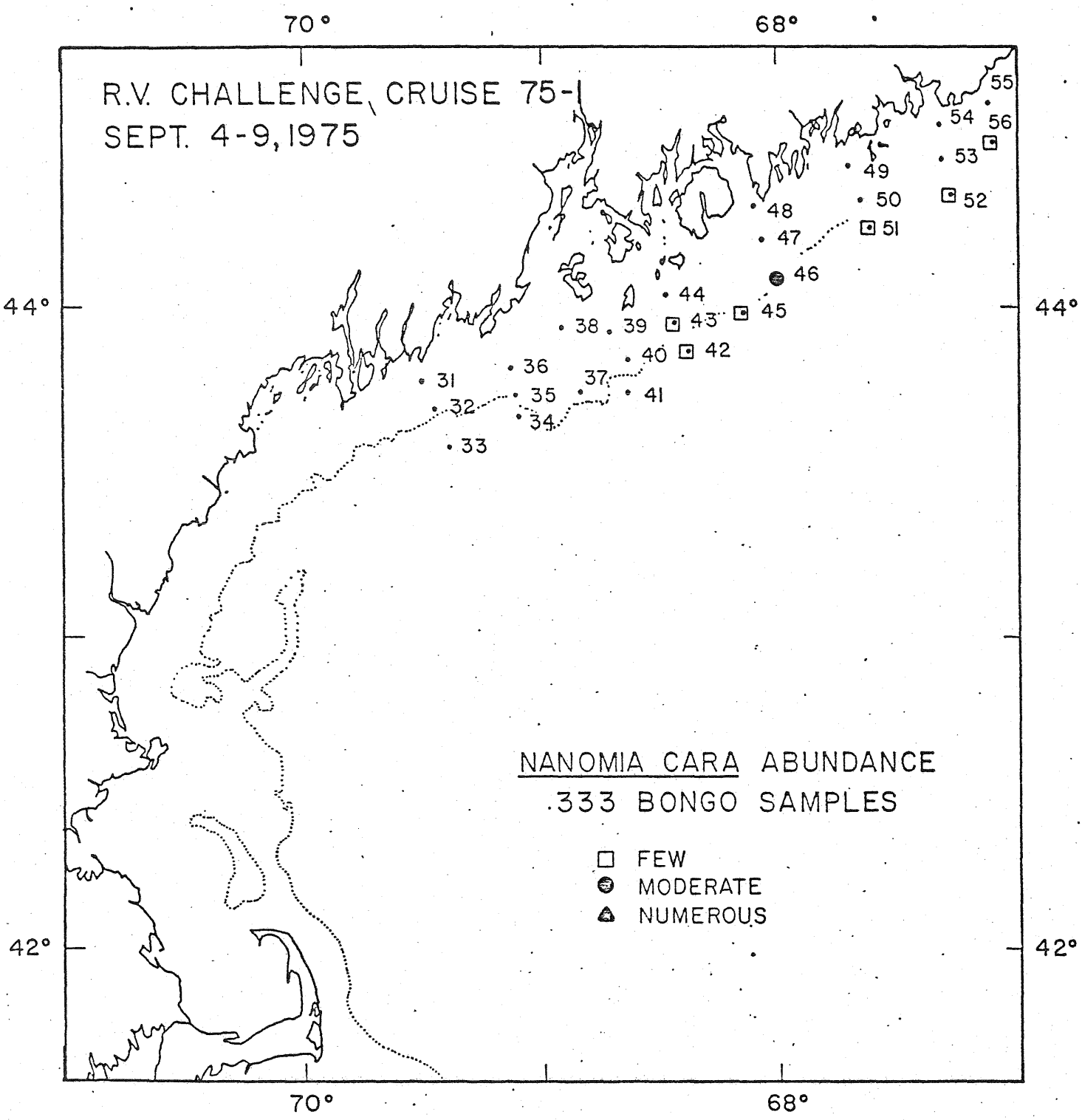

Fig. 9. Relative abundance of Nanomia cara in .333 Bongo samples for each station location. No siphonophores were found in samples designated by a point.

Table 1. Summary of station locations for .333 mm mesh Bongo samples.

Challenge Cruise 75-1
September 4-9, 1975

			Siphonophores	
Station	Latitude	Longitude	Present	Absent
31	43°47'	69°29'		X
32	43 45	69 22		X
35	43 45	69 22		X
36	43 50	69 05		X
38	44 00	68 57		X
39	43 57	63 42		X
40	43 51	68 38		X
41	43 47	68 37		X
42	43 53	68 23	X	
43	43 59	68 26	X	
45	43 59	68 10	X	
46	44 06	68 00	X	
47	44 13	68 04		X
48	44 19	68 06		X
49	44 24	67 40		X
50	44 20	67 41		X
51	44 15	67 40	X	
52	44 22	67 15	X	
53	44 30	67 20		X
54	44 35	67 19		X
55	44 36	67 09		X
56	44 29	67 09	X	

Table 2. Summary of station locations for .333 mm mesh Bongo samples.

Delaware II - Cruise 75-17
October 15 - November 7, 1975

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
10-2-5	40°34'	73°25'	X	
1-2-7	40 01	73 05		X
1-4-10	40 22	70 00		X
7-1-13	40 38	73 03	X	
1-5-16	40 36	72 38		X
8-2-17	40 44	72 33		X
5-1-21	40 52	72 13		X
5-3-24	40 40	71 58		X
2-2-30	41 02	71 45		X
5-4-32	41 21.1	71 18		X
5-5-34	40 57	70 55		X
6-3-38	40 30	71 15		X
6-4-39	40 30	70 44		X
7-2-42	40 05	70 33		X
7-3-44	40 31	71 14		X
6-8-48	40 25	71 56		X
2-3-51	39 54	72 19		X
4-1-53	39 49	71 49		X
3-2-54	39 34	72 14		X
4-2-55	39 18	72 18		X
4-1-57	39 14	72 50		X
2-6-60	39 35	73 01		X
73-1-64	39 41	73 36		X
20-1-65	39 34	74 03		X
17-1-66	39 48	73 55		X
16-1-67	39 57	74 03		X
17-2-68	40 03	73 50		X
13-3-72	40 24	73 56		X
1-8-78	40 08	73 33		X
13-2-79	39 18.6	73 36.8		X
74-2-82	38 45	73 34		X
74-4-84	38 57	73 16		X
76-1-86	38 51	72 54		X
75-2-88	38 33	73 16		X
71-9-91	38 10	73 46		X
70-2-92	38 20	73 58		X
69-2-94	38 49	74 18		X
69-3-95	38 34	74 22		X
69-5-97	38 08	74 30		X
69-6-98	37 58	74 52		X
69-7-99	37 55	74 34		X
72-1-101	37 54	74 00		X
70-4-102	37 49	74 15		X
71-2-103	37 40	74 16		X

Table 2. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
65-1-105	37°41'	74°40'		X
68-1-107	37 24	74 28		X
35-1-108	37 27	75 25		X
65-1-116	37 38	75 13		X
65-2-117	37 29	75 05		X
65-3-118	37 15	75 19		X
38-1-120	37 06	75 37		X
38-2-121	36 52	75 39		X
65-4-122	36 46	75 26		X
65-5-123	36 40	75 07		X
65-6-124	36 58	74 57		X
68-2-129	36 50	74 38		X
64-1-131	36 27	74 46		X
61-1-133	36 29	75 07		X
61-2-134	36 14	75 01		X
64-2-136	35 56	77 48	X	
62-2-138	35 37	74 52	X	
61-3-139	35 31	75 08		X
43-2-142	35 27	75 27		X
44-3-146	35 37	75 15		X
42-2-147	35 45	75 29		X
41-2-149	37 58	75 20		X
40-1-151	36 10	75 41	X	
61-5-152	36 21	75 24	X	
40-2-154	36 27	75 44	X	
37-1-156	36 31	75 48		X
37-2-157	36 54	75 49	X	
30-1-161	37 52	75 18		X
28-1-164	38 03	75 01		X
29-2-169	38 26	74 53		X
25-1-172	38 44	74 58		X
26-2-173	35 42	74 51		X
22-1-176	38 54	74 44		X
21-1-180	39 08	74 39		X
73-5-183	39 11	74 08		X
18-1-185	39 22	74 20		X
20-2-188	39 29	74 01		X
17-3-190	39 58	73 51		X

Table 3. Summary of station locations for .333 mm mesh Bongo samples.

Albatross IV - Cruise 75-12 Parts II, III
October 7-23, 1975
November 7-18, 1975

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
201	40°58'	70°25'		X
202	40 50	70 23		X
203	40 40.5	70 31.5		X
204	40 26	70 21		X
205	40 00	70 21		X
206	39 57	70 04		X
207	39 55	69 46	X	
208	40 05.5	69 57.5	X	
209	40 06	69 38.5	X	
210	40 09.5	69 35.5	X	
211	40 01	69 18	X	
212	40 27.5	69 24.5		X
213	40 43.5	69 40		X
214	40 51	69 17		X
215	40 39.5	69 16.5		X
216	40 26.0	69 04.5		X
217	40 19	69 08.5		X
218	40 15	69 07		X
219	40 11	69 01.5		X
220	40 05	68 44.5		X
221	40 19	68 51.4		X
222	40 36	68 41.4		X
223	40 18.5	68 17		X
224	40 29.5	68 16	X	
225	40 35.8	68 11.5	X	
226	40 40.5	68 01.3		X
227	40 47	67 59		X
228	40 45	68 09		X
229	40 46.5	68 16.5		X
230	40 58.5	68 03		X
231	41 04	67 58		X
232	41 16.4	67 48		X
233	41 26	67 42		X
234	41 25.5	67 13		X
235	41 26	66 47		X
236	41 14	66 48		X
237	40 57.3	66 52.5		X
238	40 49.2	67 07.5		X
239	40 45	67 24.5	X	
240	40 46	68 44		X
241	40 27.5	67 38	X	

Table 3. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
242	40°27.5'	67°34.5		X
243	40 28.5	67 17.5		X
244	40 34.3	67 13.5		X
245	40 35.5	67 12		X
246	40 42	66 49		X
247	40 57.5	66 30		X
248	41 05.5	66 31		X
249	41 23.8	66 19.5		X
250	41 28.2	66 23		X
251	41 34	66 11.5		X
252	41 47.5	66 25.5		X
253	41 48	66 25.8		X
254	41 42.0	66 02.3		X
255	41 35	66 02		X
256	41 27	66 01		X
257	41 40.3	65 50		X
258	41 50	65 45		X
259	41 47.7	65 43		X
260	41 56.5	65 39		X
261	42 03	65 59		X
262	42 17.2	65 46		X
263	42 15.3	66 03		X
264	42 09	66 13		X
265	42 12.5	66 18.5		X
266	42 01.5	66 45.5		X
267	42 08.3	66 51.5		X
268	42 27.7	66 53.5		X
269	42 25	67 05.5	X	
270	42 23.5	67 23.5		X
271	42 17.5	67 45.4		X
272	42 20	68 00	X	
273	42 42.5	67 55.5		X
274	42 42	68 10	X	
275	42 40.5	68 34		X
276	42 12.3	68 30	X	
277	42 12.5	68 17.8	X	
278	42 02.5	67 58.0	X	
279	42 09	67 41.5	X	
280	42 11	67 14		X
281	42 08	67 04		X
282	42 04.8	67 21.4		X
283	41 48	67 16		X
284	41 58.5	67 34.0		X
285	42 02	67 40.1		X
286	41 51.8	68 00		X
287	41 44	68 07		X
288	41 38.5	68 19.2		X

Table 3. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
289	41°29'	68°10'		X
290	41 28.5	68 28		X
291	41 33.5	68 37		X
292	41 38	68 46	X	
293	41 27.3	68 50.5		X
294	41 23	68 41.5	X	
295	41 17.5	68 23	X	
296	41 13.5	68 15		X
297	41 10	68 31.5		X
298	41 02	68 50.5		X
299	41 06	69 13.4	X	
300	41 12	69 21.5		X
301	41 13.5	69 22		X
302	41 23	69 25	X	
303	41 25	69 22	X	
304	41 22	69 19	X	
305	41 16.8	69 08	X	
306	41 28	69 13.4	X	
307	41 40.6	69 12.5	X	
308	41 46.5	69 08	X	
309	41 57.6	69 09.3	X	
310	42 05.8	68 57		X
311	42 12.5	69 18		X
312	42 18	70 20.5	X	
313	42 17.5	70 06.4	X	
314	42 19	70 00	X	
315	42 33	70 00.5	X	
316	42 39	70 10	X	
317	42 42	70 13	X	
318	42 50	70 02.5	X	
319	42 53.5	69 48.5	X	
320	43 08.5	69 43.5	X	
321	43 18	69 33	X	
322	43 35.6	69 45.4	X	
323	43 30.5	70 00.5	X	
324	43 23	69 47	X	
325	43 21	70 02	X	
326	42 51	70 30	X	
327	42 33	70 26.5		X
328	42 29.3	70 07		X
329	42 25.7	70 05.5		X
330	42 26	70 15.5		X
331	42 22.5	70 26.3		X
332	42 24	70 26		X
333	42 26	70 32		X
334	42 30.3	70 35.3		X
335	42 25.5	70 39.4		X

Table 3. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
336	42°19.2'	70°37.7'		X
337	42 22	70 30.5		X
338	42 18.1	70 29.1		X
339	42 02	70 28.5		X
340	42 10.8	70 26		X
341-345 no date - LxL samples available				
346	42 05	69 47.5	X	
347	42 17.5	69 02	X	
348	42 44	68 58	X	
349	42 51	68 45	X	
350	42 56	68 07	X	
351	43 02	67 31.5	X	
352	43 17	67 15	X	
353	43 01	66 50	X	
354	42 42	66 48.5	X	
355	42 37	66 34		X
356	42 40	66 28		X
357	42 39	66 01		X
358	42 37	65 50		X
359	42 32	65 36		X
360	42 27	65 28		X
361	42 31	66 58		X
362	42 30	66 54		X
363	42 36	64 26		X
364	42 46	64 51		X
365	42 48	63 52		X
366	42 54	63 32		X
367	43 08	63 39		X
368	43 16	63 24		X
369	43 19	63 43		X
370	43 11	64 01		X
371	43 05	64 04		X
372	43 26	63 52		X
373	43 36	63 58		X
374	43 45	63 33		X
375	44 05	63 39		X
376	44 00	63 51		X
377	43 58	64 07		X
378	43 50	64 20		X
379	43 42	64 35		X
380	43 43	64 13	-	-
381	43 25	64 19		X
382	43 19	64 19		X
383	43 14	64 21		X
384	43 24	64 39		X
385	43 29	64 49		X
386	43 22	64 51		X
387	43 25	65 03		X
388	43 08	65 00		X

Table 3. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
389	42 59	64 53		X
390	42 57	64 38		X
391	42 50	64 38		X
392	42 45	64 58		X
393	42 50	65 20		X
394	42 42	65 30	X	
395	42 42	65 47	X	
396	42 44	66 06		X
397	42 53	66 33		X
398	43 29	66 29		X
399	43 37	66 29		X
400	43 28	66 45		X
401	43 34	66 54	X	
402	43 40	66 53	X	
403	43 43	67 02	X	
404	43 51	66 47	X	
405	44 01	66 29		X
406	44 07	66 33		X
407	44 36	66 19	X	
408	44 41	66 34	X	
409	44 18	66 42	X	
410	44 12	66 58	X	
411	43 59	67 11		X
412	44 11	67 21	X	
413	44 18	67 42	X	
414	43 50	67 41	X	
415	43 46	67 42	X	
416	43 25	67 46		X
417	43 33	68 03	X	
418	43 19	68 15		X
419	43 31	68 30	X	
420	43 34	68 25	X	
421	43 40	68 27	X	
422	43 52	68 28	X	
423	43 52	68 36	X	
424	43 55	68 35		X
425	43 38	68 57	X	
426	43 15	68 50		X
427	43 10	68 47		X
428	42 55	69 02	X	
429	42 36	69 08		X
430	42 22	69 38	X	

Table 4. Summary of station locations for .333 mm mesh Bongo samples.

Albatross Cruise 75-14
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Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
1	41°11'	71°00'		X
4	41 00	71 00	X	
5	41 00	71 25		X
305 (5.1)	40 45	71 30	X	
405 (5.2)	40 29.5	71 30		X
6	40 43.5	71 00		X
7	40 30	71 00		X
8	40 16	71 30		X
308 (8.1)	40 00	71 30		X
9	39 59.5	70 59.5	X	
309 (9.1)	40 15	71 00		X
10	40 00	70 31		X
11	40 15	70 30		X
12	40 15	69 59		X
13	40 01	69 59		X
14	40 15	69 30		X
314 (14.1)	39 59	69 30		X
15	40 15	69 00		X
16	40 30	69 00		X
17	40 30	69 30		X
18	40 30	69 59.5		X
19	40 30	70 30		X
20	40 44	70 30	X	
21	40 40.5	70 00	X	
22	40 54.7	69 38	X	
23	40 45	69 29	X	
24	40 44	69 00	X	
25	41 00	69 00	X	
26	41 00	69 15	X	
27	41 14.5	69 25	X	
28	41 15	69 01		X
29	41 30	69 00	X	
30	41 30	69 25.5	X	
31	41 44	69 30	X	
32	41 44	69 00	X	
33	41 58.5	69 00	X	
34	42 14	69 27.5	X	
35	41 55	69 52	X	
36	42 17	70 00	X	
46	42 30	69 30	X	
346 (46.1)	42 30	69 00	X	
47	42 30	68 30	X	
48	42 14	68 30	X	
49	41 57	68 33	X	
50	41 44.2	68 29.5	X	

Table 4. Summary of station locations for .333 mm mesh Bongo samples.

Station	Latitude	Longitude	Siphonophores Present	Siphonophores Absent
51	41 29	68 30	X	
351 (51.1)	41 22	68 46		X
52	41 14	68 31		X
53	41 00	68 30		X
54	40 45	68 30		X
55	40 29	68 30	X	
56	40 14	68 30	X	
58	40 31	68 01	X	
59	40 45	68 00		X
60	41 00	68 00		X
61	41 15.5	67 52.5		X
62	41 25	68 05		X
63	41 50	68 00	X	
64	41 59.3	67 59.2	X	
65	42 14	67 59.5	X	
66	42 29.5	68 00	X	
69	42 29	67 32	X	
70	42 15	67 30	X	
71	41 59	67 37.5	X	
72	41 49	67 34	X	
73	41 29	67 30		X
74	41 13	67 30		X
75	40 58.7	67 30	333 Sample Lost	
76	40 45	67 30		X
77	40 30	67 31		X
78	40 30	67 00		X
79	40 43	67 00		X
80	41 00	66 59	X	
81	41 15	67 00	X	
82	41 30	67 00	X	
83	41 45	67 00	X	
84	41 58.5	66 59.3	X	
85	42 15	67 00	X	
86	42 30	67 00	X	
87	42 30	66 30	X	
88	42 16	66 30		X
388 (88.1)	42 07	66 17.5		X
89	42 00	66 31		X
90	41 43	66 30		X
91	41 29	66 29.2		X
92	41 13.5	66 30		X
93	41 00	66 30		X
94	41 15	66 00		X
95	41 30.8	66 00		X
96	41 45.5	65 59.5		X
98	42 01	66 00		X
99	42 15	66 00		X
399 (99.1)	42 24	65 44	X	
101	42 29	66 01.5	X	