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Ichthyoplankton off Washington, Oregon and Northern California
May—June 1981

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Ichthyoplankton off Washington, Oregon, and Northern California

May-June 1981

By

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INTRODUCTION

This report describes the third in a series of cooperative U.S.-U.S.S.R. ichthyoplankton surveys conducted off the U.S. west coast from 48°-40°N. Similar reports, based on previous cruises since April-May 1980, have already been produced (Kendall and Clark 1982a, 1982b). These surveys are designed to determine seasonal and spatial distribution of ichthyoplankton as background information for more detailed studies on early life history of fishes of the area. It is planned to conduct two such surveys each year, at different times of the year, so that after several years the complete annual cycle of fish egg and larval occurrence will be documented. These will be the first large-scale ichthyoplankton surveys of the area to sample all seasons. Results from these surveys eventually will be compared to those of the CalCOFI program off California and Baja California to the south, and to several smaller-scale surveys conducted previously off Washington and Oregon. In the meantime, we plan to present a data report such as this for each cruise, as soon as feasible.

METHODS AND MATERIALS

A grid of 123 stations laid out off the Washington, Oregon, and northern California coasts extended from 3 miles (5.6 km) to 200 miles (370 km) from shore (Figure 1). Stations were more closely spaced near shore than off shore. The Soviet Research vessel POSEYDON with Dr. Igor Zhuteyev serving as chief scientist occupied these stations basically from north to south from 9 May to 2 June 1981. At each station hydrographic casts at standard depths (0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600 m) were made as water depth permitted. Temperature, salinity, oxygen, phosphate, and silicate determinations were made aboard ship with these samples. Results of these measurements will be reported elsewhere. Paired neuston tows using 0.3 m high by 0.5 m wide Sameoto samplers (Sameoto and Jaroszynski 1969) with 0.505 mm mesh nets were made at 2.0 knots (1.03 m/sec) for 10 min at each station. A standard MARMAP bongo tow (Smith and Richardson 1977) with 60 cm, 0.505 mm mesh nets was made with a maximum of 300 m of wire out at each station. Flow-meters in the mouths of the nets were used to determine the volume of water filtered by each net. The Soviets retained one of the paired neuston and bongo samples, while the Americans retained the other. The American samples were processed by the Polish Plankton Sorting Center in Szczecin, Poland, where displacement plankton volumes were determined (for bongo samples) and all fish eggs and larvae removed. The fish eggs were counted; the larvae were identified, counted and measured. Fish eggs were later identified and counted by Ann C. Matarese at NWAFC. Identifications were made to the lowest taxonomic level possible, and in some cases "types" of unidentified eggs or

larvae were established, in hopes that with further study their identity could be established. Beverly Vinter at NWAFC checked larval identifications. Counts of fish eggs and larvae in the samples were converted to numbers per 10 m^2 of surface area for the bongo samples and numbers per 1,000 m^3 for the neuston samples. The log of the number of eggs or larvae in the survey area is based on the Sette and Ahlstrom census as used by Richardson (1981).

RESULTS

The station pattern (Figure 1) was occupied as planned (the Soviets added stations south of 40°N which they processed). Data associated with these stations are listed in Table 1. A summary of the catches of fish eggs and larvae are presented in Tables 2 and 3. Totals of 27 taxa of eggs and 58 taxa of larvae were found. Figures 2-5 illustrate the rank abundances of egg and larval catches in bongo and neuston tows for the cruise using several measures of abundance. Figures 6-25 show the geographic distribution, abundance at each station, and length frequencies of larvae of the more abundant taxa. Results of recurrent group analysis of eggs and larvae from neuston samples are shown in Figure 27, and from bongo samples in Figure 28.

Relative Abundances

The rank order of abundance among the taxa depends on the measure of abundance examined. Four measures of abundance for each net were used: total

numbers caught, percent occurrence, log of number in survey area, and mean number per 1,000 m^3 (for neuston) and mean number per 10 m^2 (for bongo).

In the neuston net, egg catches were dominated by Sebastolobus sp. in three of the abundance measurements. Bothidae, Icichthys lockingtoni, Trachipterus altivelis, and Microstomus pacificus eggs were also abundant, depending on what measurement used (Figure 2). In the bongo net, eggs of Myctophidae were most abundant according to three measurements, and Lyopsetta exilis according to the other one (Figure 4).

Larval catches in the neuston net were dominated by Stenobrachius leucopsarus according to two measurements, and by Cololabis saira and Diaphus theta based on the others (Figure 3). Sebastes spp. and Scorpaenichthys marmoratus larvae were also abundant in the neuston community. In the bongo net, Stenobrachius leucopsarus dominated all four abundance measurements. Also abundant were Diaphus theta, Sebastes spp. and Bathylagus ochotensis (Figure 5).

Distributions

While this is not intended to be a definitive report on these data, certain outstanding features of distribution of the more abundant taxa will be mentioned.

Bathylagidae (Figure 6) - Eggs of unidientified deep-sea smelt were widely distributed in the bongo tows, but in rather low abundance. The main concentrations were found in the southern half of the survey area, just off the continental shelf.

Bathylagus ochotensis (Figure 7) - Larvae of this deep-sea smelt were widely distributed off shore in bongo catches, occurring at 48% of the stations sampled. Their lengths ranged from 5.0-25.2 ($\bar{x}$=9.63) mm SL. Similar results in distribution and lengths were found in April-May 1980 (Kendall and Clark 1982a).

Myctophidae (Figure 8) - Unidentified eggs of lanternfishes were collected in bongo tows in offshore waters mainly in the southern two-thirds of the survey area. Similarities in distribution were also found in April-May (Kendall and Clark 1982a). Lanternfish have small eggs (0.75-0.85 mm diameter) and appear fragile, so more eggs may have been caught but ruptured or squeezed through the 0.505 mm mesh of the bongo net.

Diaphus theta (Figure 9) - Larvae of this myctophid were widely distributed in bongo catches from southern Washington to waters southward. They ranged from 2.5-9.0 ($\bar{x}$=5.01) mm SL.

Stenobrachius leucopsarus (Figures 10 and 11) - These lanternfish larvae dominated the catch in the bongo nets in numbers caught and in occurrence (71%). They were abundant throughout the survey area and ranged in size from 2.7-50.0 ($\bar{x}$=5.8) mm SL. The size and abundance of larvae was consistent with the results found in April-May 1980 (Kendall and Clark 1982a).

Cololabis saira (Figure 12) - Saury larvae were found in neuston catches primarily off the coast of California, as was the case in April-May 1980 (Kendall and Clark 1982a). Their lengths ranged from 6.0 to 33.5 ($\bar{x}$=16.89) mm SL.

Trachipterus altivelis (Figure 13) - Eggs of king-of-the-salmon were found widely distributed in the neuston catches throughout the survey area, occurring at 40% of the stations occupied.

Sebastes spp. (Figures 14 and 15) - Rockfish larvae were widely distributed in the bongo catches, mainly in the continental shelf waters. No attempt was made to identify the species caught. In the neuston catches larvae were found sporadically throughout the survey area in both near and offshore locations. The rockfish larvae in the neuston net were larger than in the bongo net ($\bar{x}$ neuston = 10.1, $\bar{x}$ bongo = 4.9 mm SL). Similar results were noticed in April-May 1980 (Kendall and Clark 1982a) and August 1980 (Kendall and Clark 1982b).

Sebastolobus sp. (Figure 16) - Eggs of the thornyhead dominated three of the four abundance measurements for neuston catches, but occurred at only 4% of the stations occupied. The eggs were concentrated at the nearshore stations near Coos Bay, Oregon.

Anoplopoma fimbria (Figure 17) - Sablefish larvae in the neuston catches were found in small concentrations in the northern one-third of the survey area. They ranged from 10.5-36.5 ($\bar{x}$=23.4) mm SL.

Scorpaenichthys marmoratus (Figure 18) - Cabezon larvae were found at nearshore stations in neuston catches, mainly off of the Washington coast. They ranged from 4.9-12.0 ($\bar{x}$=6.35) mm SL.

Icichthys lockingtoni (Figure 19) - Eggs of medusafish were widely distributed in the neuston catches. Medusafish eggs have also been collected in August 1980, indicating an extensive spawning season (Kendall and Clark 1982b).

Bothidae (Figures 20 and 21) - Unidentified eggs of lefteye flounders were found near shore in the northern half of the survey area in bongo catches, and throughout the whole survey area in neuston catches.

Pleuronectidae (Figure 22) - Unidentified eggs of righteye flounders were found near shore in the northern half of the survey area in the bongo catches.

Glyptocephalus zachirus (Figure 23) - Eggs of rex sole were found near shore mainly from the Columbia River to the southern end of the survey area.

Lyopsetta exilis (Figures 24 and 25) - Eggs and larvae of slender sole were found in bongo catches throughout the survey area at the near shore stations. Larvae were concentrated off Oregon as found in April-May 1980 (Kendall and Clark 1982a), while the catches off of Washington were patchy. The larvae ranged in length from 4.4-22.2 ($\bar{x}$=9.3) mm SL. The larvae were frequently part of the offshore assemblage off Oregon in March-April, as reported by Richardson et al. (1980).

Microstomus pacificus (Figure 26) - Dover sole eggs were collected in neuston tows all along the coast, the results similar as in April-May 1980 (Kendall and Clark 1982a).

Community Structure

Regroup analysis of the neuston data at an affinity level of 0.4 revealed only one group whose members had more than five occurrences (Figure 27). This group was composed of Icichthys lockingtoni and Trachipterus altivelis. Tarletonbeania crenularis and Cololabis saira had affinity levels greater than 0.40 with Trachipterus altivelis.

In bongo catches a complex pattern of interrelations between larvae of two groups of mesopelagic species was seen. Also a number of species had affinities with members of one or two of these groups, but not with all members. Another group of three taxa (*Lyopsetta exilis*, *Sebastes* spp. and *Glyptocephalus zachirus*), are mainly demersal as adults, but have an extended larval life and occur beyond the continental slope. A fourth group consisted of three taxa of flatfish eggs that are mainly found over the continental shelf.

ACKNOWLEDGMENTS

We wish to thank the Soviet scientists, officers, and crew aboard the Soviet research vessel POSEYDON for their cooperative help at sea. Also, we wish to thank: Elizabeth Dunning, and Susan Simon who served as American scientists aboard the cruise; Jim Peacock, Carol Hastings, and the staff in graphics; Darlene Blythe and her staff for word processing; and Ethel Zweifel and her staff for printing and binding.

LITERATURE CITED

Kendall, A. W. Jr., and J. B. Clark. 1982a. Ichthyoplankton off Washington, Oregon, and Northern California April-May 1980. NWAFC Proc. Rep. 82-11, 44 p.

Kendall, A. W. Jr., and J. B. Clark. 1982b. Ichthyoplankton off Washington, Oregon, and Northern California August 1980. NWAFC Proc. Rep. 82-12, 43 p.

Richardson, S. L. 1981. Spawning biomass and early life of northern anchovy, Engraulis mordax, in the northern subpopulation off Oregon and Washington. Fish. Bull., U.S. 78:855-876.

Richardson, S. L., J. L. LaRoche, and M. D. Richardson. 1980. Larval fish assemblages and associations in the northeast Pacific Ocean along the Oregon coast, winter-spring 1972-1975. Estuar. and Coast. Mar. Sci. 11:671-699.

Sameoto, D. D., and L. O. Jaroszynski. 1969. Otter surface sampler: a new neuston net. J. Fish. Res. Board Canada. 25:2240-2244.

Smith, P. E., and S. L. Richardson (editors). 1977. Standard techniques for pelagic fish egg and larvae surveys. FAO Fish. Tech. Pap. 175, 100 p.

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Figure 27.--Results of recurrent group analysis on bongo catches (both fish eggs and larvae) from 1P081, May-June 1981, at an affinity level of 0.4. Taxa in rectangles are members of recurrent groups. Lines connect taxa with affinities outside their groups. Numbers in parentheses following taxa names are the numbers of occurrences of that taxon.

STATION	POSITION LAT. N.	POSITION LONG. W.	DATE YYMMDD	AREA KM2	NEUSTON STATIONS TIME GMT	NEUSTON STANDARD HAUL FACTORS* A	NEUSTON STANDARD HAUL FACTORS* B	BONGO STATIONS TIME GMT	BONGO STANDARD HAUL FACTORS* A	BONGO STANDARD HAUL FACTORS* B
G001A	48 0.0	124 50.5	81 5 9	929.	2039	0.019	12.989	2059	5.078	10.579
G002A	48 1.0	125 13.0	81 5 9	1027.	2325	0.022	14.701	2345	7.931	4.866
G003A	47 59.9	125 35.4	81 510	1171.	235	0.024	15.722	258	6.828	3.772
G004A	48 0.0	125 56.7	81 510	1855.	600	0.032	21.172	620	6.587	3.092
G005A	48 0.0	126 17.4	81 510	1922.	939	0.027	18.186	1005	7.206	3.189
G006A	47 40.0	125 21.1	81 510	1689.	1502	0.030	20.039	1513	7.343	3.221
G007A	47 39.2	124 59.0	81 510	929.	1753	0.030	20.173	1805	7.257	4.507
G008A	47 39.7	124 36.9	81 510	1005.	2025	0.032	21.075	2040	5.880	15.891
G009A	47 19.7	124 26.4	81 510	953.	2300	0.019	12.430	2330	5.624	16.068
G010A	47 19.6	124 49.5	81 511	1123.	154	0.020	13.616	212	6.878	3.229
G011A	47 28.0	125 10.1	81 511	1654.	440	0.020	13.268	502	7.244	3.177
G012A	47 20.0	126 7.9	81 511	5142.	1154	0.027	17.767	1215	6.246	2.839
G013A	47 20.0	127 6.0	81 511	4464.	1702	0.019	12.567	1715	7.197	3.185
G014A	47 19.8	127 40.3	81 511	3231.	2320	0.019	12.540	2345	6.669	3.087
G015A	46 39.7	128 40.0	81 512	5083.	805	0.018	12.085	825	6.827	3.251
G016A	46 39.8	127 46.5	81 512	5213.	1343	0.017	11.134	1403	6.617	3.244
G017A	46 39.9	126 48.2	81 512	5345.	1917	0.019	12.398	1935	7.779	3.382
G018A	46 40.1	125 49.9	81 513	4843.	35	0.019	12.404	50	6.307	3.153
G019A	47 0.0	125 1.0	81 513	2118.	505	0.018	11.878	525	6.992	3.150
G020A	46 59.0	124 40.4	81 513	1020.	845	0.018	11.889	905	7.437	6.951
G021A	47 0.2	124 17.1	81 513	867.	1100	0.020	13.099	1115	8.576	21.989
G022A	46 39.5	124 15.8	81 513	994.	1431	0.019	12.359	1445	7.631	14.398
G023A	46 39.9	124 37.8	81 513	983.	1701	0.019	12.707	1715	7.483	5.543
G024A	46 40.0	124 59.9	81 513	1748.	1957	0.018	12.084	2015	7.824	3.417
G025A	46 20.2	124 54.2	81 513	1885.	2320	0.018	11.805	2330	7.290	3.344
G026A	46 20.0	124 33.4	81 514	931.	305	0.018	12.117	325	7.478	5.459
G027A	46 20.0	124 13.4	81 514	892.	530	0.018	11.704	610	7.533	24.300
G028A	45 59.0	124 8.5	81 514	931.	905	0.019	12.395	955	6.956	8.483
G029A	46 0.0	124 27.5	81 514	908.	1211	0.031	20.880	1230	8.749	5.400
G030A	45 59.9	124 48.9	81 514	1766.	1523	0.018	12.333	1550	7.233	3.333
G031A	46 0.0	125 46.1	81 515	4648.	2345	0.016	10.724	5	6.985	3.190
G032A	46 0.3	126 35.7	81 515	4796.	455	0.021	13.857	515	7.210	3.323
G033A	45 58.4	127 28.5	81 514	4987.	1114	0.021	14.218	1130	7.510	3.078
G034A	46 0.0	128 24.8	81 515	5092.	1734	0.020	13.304	1753	6.787	3.030
G035A	45 20.1	128 31.9	81 515	5265.	2300	0.018	12.107	2355	6.985	3.132
G036A	45 20.1	127 38.7	81 516	5376.	520	0.018	11.779	545	6.582	3.047
G037A	45 20.0	126 40.1	81 516	5548.	1137	0.020	13.571	1152	7.515	3.158
G038A	45 20.0	125 44.1	81 516	5285.	1711	0.019	12.997	1730	9.526	4.311
G039A	45 40.1	124 45.6	81 516	1872.	2230	0.019	12.934	2250	9.254	4.168
G040A	45 39.8	124 26.4	81 517	981.	50	0.018	12.290	110	6.422	3.755
G041A	45 39.2	124 5.0	81 417	801.	300	0.018	12.179	320	7.276	9.449
G042A	45 19.3	124 8.5	81 517	967.	550	0.019	12.921	605	6.553	5.903
G043A	45 20.0	124 29.4	81 517	974.	900	0.019	12.816	920	6.805	3.136
G044A	45 20.9	124 49.2	81 517	1893.	1319	0.020	13.136	1410	6.460	2.821
G045A	45 0.1	124 50.4	81 517	2010.	1825	0.017	11.338	1839	4.191	1.931
G046A	45 0.0	124 29.0	81 517	1028.	2045	0.019	12.833	2140	7.360	3.228
G047A	45 0.2	124 7.5	81 517	775.	2345	0.020	13.582	10	6.431	8.351
G048A	44 40.0	124 11.1	81 518	873.	305	0.018	12.287	325	6.505	11.216
G049A	44 39.8	124 32.9	81 518	1085.	600	0.020	13.462	615	6.704	4.190
G050A	44 40.0	124 53.9	81 518	1910.	910	0.019	12.638	925	6.827	3.330
G051A	44 40.1	125 49.8	81 518	5196.	1602	0.018	11.930	1618	6.981	3.232
G052A	44 39.8	126 44.2	81 518	5292.	2220	0.019	12.578	2150	7.399	3.303
G053A	44 40.4	127 36.9	81 520	5351.	815	0.019	12.543	900	7.154	3.194
G054A	44 40.0	128 29.9	81 520	4996.	1435	0.020	13.268	1456	7.454	3.358
G055A	44 0.2	128 26.0	81 520	5268.	2010	0.019	12.338	2030	7.708	3.488
G056A	43 59.9	127 33.2	81 521	4909.	127	0.018	12.162	145	7.898	3.464
G057A	44 0.0	126 45.2	81 521	5064.	625	0.017	11.272	640	7.623	3.481
G058A	44 0.0	125 50.1	81 521	5064.	1200	0.018	11.895	1215	7.538	3.396
G059A	44 19.9	124 55.2	81 521	2013.	1727	0.017	11.531	1753	8.098	3.521
G060A	44 19.4	124 34.1	81 521	993.	2015	0.017	11.034	2030	6.761	7.596
G061A	44 20.0	124 13.5	81 521	877.	2245	0.017	11.473	2300	6.682	12.149
G062A	43 59.7	124 15.1	81 522	831.	145	0.017	11.604	200	10.452	12.296
G063A	44 0.0	124 36.2	81 522	1013.	415	0.019	12.632	430	7.035	4.481

Table 1.--Data associated with bongo and neuston tows during cruise 1P081, May-June 1981.

STATION	POSITION LAT. N.	POSITION LONG. W.	DATE YYMMDD	AREA KM2	NEUSTON STATIONS TIME GMT	NEUSTON STANDARD HAUL FACTORS* A	NEUSTON STANDARD HAUL FACTORS* B	BONGO STATIONS TIME GMT	BONGO STANDARD HAUL FACTORS* A	BONGO STANDARD HAUL FACTORS* B
G064A	43 59.9	124 57.9	81 522	1735.	740	0.016	10.920	755	7.573	3.458
G065A	43 40.0	125 1.4	81 522	1865.	1140	0.017	11.619	1200	6.668	3.368
G066A	43 40.0	124 41.2	81 522	1039.	1417	0.017	11.194	1435	6.587	3.229
G067A	43 40.0	124 21.5	81 522	943.	1638	0.017	11.371	1652	9.667	8.709
G068A	43 18.0	124 28.9	81 522	885.	1931	0.018	11.948	2030	7.279	9.706
G069A	43 19.6	124 51.1	81 522	1039.	2315	0.019	12.351	2335	7.512	3.295
G070A	43 20.0	125 10.9	81 523	2002.	315	0.019	12.755	435	7.217	3.404
G071A	43 20.0	126 2.4	81 523	5275.	1357	0.019	12.343	1413	8.032	3.492
G072A	43 20.0	126 57.9	81 523	5311.	1935	0.020	13.172	1955	7.481	3.400
G073A	43 20.0	127 49.6	81 524	5453.	130	0.019	12.543	150	7.797	3.450
G074A	43 19.6	128 46.4	81 524	5851.	715	0.018	12.010	735	7.692	3.561
G075A	42 40.2	128 48.6	81 524	5847.	1255	0.018	12.290	1315	6.715	3.276
G076A	42 40.0	127 53.9	81 524	5728.	1827	0.020	13.533	1840	7.293	3.361
G077A	42 40.0	127 0.0	81 525	5761.	45	0.020	13.533	20	7.134	3.365
G078A	42 40.1	126 6.1	81 525	5433.	540	0.026	17.142	610	7.267	3.412
G079A	43 0.0	125 14.3	81 525	1911.	1126	0.020	13.555	1150	7.146	3.452
G080A	43 0.4	124 55.1	81 525	1012.	1408	0.020	13.012	1431	7.782	3.384
G081A	42 59.9	124 33.9	81 525	698.	1658	0.016	10.976	1720	7.024	7.472
G082A	42 40.3	124 34.9	81 525	824.	2100	0.017	11.662	2115	6.489	6.555
G083A	42 39.8	124 55.2	81 526	1065.	1141	0.018	12.315	1203	6.326	2.775
G084A	42 40.0	125 16.5	81 526	2041.	1553	0.018	12.222	1613	6.733	3.019
G085A	42 19.8	125 11.9	81 526	1981.	1900	0.021	14.022	1920	7.236	3.066
G086A	42 20.0	124 52.1	81 526	1001.	2150	0.020	13.181	2205	7.246	3.007
G087A	42 20.5	124 32.5	81 527	876.	35	0.022	14.856	50	5.522	5.259
G088A	41 59.9	124 24.0	81 527	818.	340	0.020	13.050	425	5.846	7.794
G089A	41 59.9	124 43.1	81 527	995.	715	0.020	13.364	725	7.298	3.066
G090A	41 59.8	125 4.4	81 527	1893.	1010	0.019	12.822	1030	5.438	2.506
G091A	42 0.5	125 53.3	81 527	5064.	1503	0.019	12.415	1543	6.125	2.722
G092A	41 58.5	126 47.6	81 527	5601.	2100	0.019	12.625	2120	7.172	3.245
G093A	41 59.9	127 41.4	81 528	5548.	210	0.021	14.032	230	7.474	3.382
G094A	41 59.9	128 33.5	81 528	5559.	750	0.024	16.189	800	7.586	3.356
G095A	41 20.1	128 24.0	81 528	5707.	1300	0.019	12.812	1320	7.172	3.351
G096A	41 19.9	127 30.1	81 528	5490.	1824	0.017	11.413	1840	7.723	3.358
G097A	41 20.0	126 39.4	81 528	5251.	2335	0.019	12.856	2350	7.359	3.172
G098A	41 20.0	125 48.1	81 529	5215.	455	0.019	12.547	510	6.814	3.292
G099A	41 40.0	124 57.1	81 529	1950.	1015	0.017	11.461	1035	7.225	3.345
G100A	41 40.5	124 36.8	81 529	1035.	1303	0.017	11.625	1320	6.815	3.408
G101A	41 40.0	124 16.0	81 529	773.	1515	0.017	11.455	1530	7.144	14.289
G102A	41 20.2	124 18.0	81 529	981.	1810	0.019	12.464	1825	6.876	6.946
G103A	41 20.5	124 37.0	81 529	1041.	2055	0.017	11.312	2110	6.674	3.288
G104A	41 20.0	124 57.5	81 530	1882.	205	0.018	11.717	220	8.313	3.537
G105A	41 0.2	124 55.2	81 530	1823.	505	0.019	12.871	523	7.482	3.355
G106A	41 0.0	124 35.3	81 530	1008.	755	0.019	12.818	815	7.231	3.200
G107A	40 59.6	124 15.9	81 530	765.	1035	0.019	12.481	1050	6.292	9.391
G108A	40 41.0	124 28.0	81 530	900.	1313	0.017	11.395	1355	6.689	10.965
G109A	40 40.0	124 44.3	81 530	1101.	1617	0.019	12.357	2130	7.464	3.259
G110A	40 40.0	125 6.5	81 531	2130.	20	0.019	12.663	30	6.825	3.020
G111A	40 40.0	125 52.1	81 531	5042.	515	0.023	15.197	540	6.695	3.043
G112A	40 40.0	126 44.9	81 531	5445.	1107	0.022	14.823	1130	6.620	2.942
G113A	40 40.0	127 36.4	81 531	5369.	1647	0.019	12.997	1707	5.712	2.856
G114A	40 39.9	128 29.3	81 531	5495.	2310	0.019	12.660	2322	6.376	2.980
G115A	40 0.0	129 2.9	81 6 1	6550.	515	0.022	14.462	533	7.471	3.277
G116A	40 0.0	128 11.1	81 6 1	5568.	1110	0.019	12.429	1120	6.336	3.076
G117A	40 0.0	127 20.9	81 6 1	5517.	1623	0.021	13.854	1638	7.049	3.204
G118A	40 0.0	126 30.1	81 6 1	5592.	2150	0.017	11.322	2208	6.798	3.162
G119A	40 0.0	125 39.0	81 6 2	4455.	255	0.019	12.501	305	6.816	3.127
G120A	40 20.0	125 6.9	81 5 2	1812.	715	0.017	11.417	730	6.891	3.251
G121A	40 19.1	124 47.7	81 6 2	1061.	1005	0.018	11.983	1020	6.883	3.186
G122A	40 20.0	124 28.2	81 6 2	1002.	1241	0.017	11.454	1300	7.428	5.087
G123A	39 59.5	124 10.9	81 6 2	809.	1615	0.018	11.937			

*"A" Converts catch to catch per 10 m^2, "B" converts catch to catch per 1000 m^3

Table 1 (Continued)

STAGE: EGG

SPECIES	GEAR: 1 NEUSTON OCCUR. %	LOG NO. IN AREA	GEAR: 2 BONGO LOG NO. IN AREA	MEAN NO. PER 10M2
UNIDENTIFIED	5.69	7.6330	10.7316	9.07
TELEOST TYPE C			9.9087	7.54
TELEOST TYPE G			10.2106	30.83
DISINTEGRATED	1.63	7.2273	8.7289	5.62
ENGRAULIS MORDAX	0.81	7.3143		
ARGENTINIDAE			9.6131	10.04
NANSENIA CANDIDA			10.4671	9.78
BATHYLAGIDAE			11.3488	12.06
BATHYLAGUS SP.			10.7491	8.89
BATHYLAGUS OCHOTENSIS			9.8940	7.35
CHAULIODUS MACOUNI	4.88	7.6901	11.1292	9.03
MYCTOPHIDAE			12.5599	92.54
THERAGRA CHALCOGRAMMA			8.9600	9.67
COLOLABIS SAIRA	2.44	7.4891		
TRACHIPTERUS ALTIVELIS	39.84	9.0504	10.9462	8.65
SEBASTOLOBUS SP.	4.07	10.2139		
ICOSTEUS AENIGMATICUS	4.07	7.6518	10.4275	8.06
ICICHTHYS LOCKINGTONI	35.77	9.5293	10.7156	8.78
TETRAGONURUS CUVIERI			9.5870	7.36
BOTHIDAE	25.20	9.4683	11.5973	76.62
CITHARICHTHYS SP.	2.44	6.6974	10.3029	13.22
PLEURONECTIDAE	2.44	6.7390	11.0773	52.00
GLYPTOCEPHALUS ZACHIRUS	6.50	8.1193	10.7063	13.92
ISOPSETTA ISOLEPIS	0.81	6.2654	9.1225	7.90
LYOPSETTA EXILIS	6.50	7.5506	11.4497	37.07
MICROSTOMUS PACIFICUS	21.14	8.8655	10.6106	12.00
PLEURONICHTHYS DECURRENS	0.81	6.2803	8.6736	5.08
PSETTICHTHYS MELANOSTICTUS	1.63	6.8184	8.8274	7.53

Table 2.--Fish eggs collected in bongo and neuston tows during cruise 1P081, May-June 1981.

STAGE: LARVAE

SPECIES	GEAR: 1 NEUSTON OCCUR. %	GEAR: 1 NEUSTON LOG NO. IN AREA	GEAR: 2 BONGO LOG NO. IN AREA	GEAR: 2 BONGO MEAN NO. PER 10M2
UNIDENTIFIED			9.1689	7.08
DISINTEGRATED	4.07	8.0808	11.5295	19.19
CLUPEA HARENGUS PALLASI	2.44	7.1508	8.7654	7.28
OSMERIDAE	0.81	6.7969	9.5866	10.10
NANSENIA CANDIDA			10.4346	8.24
BATHYLAGIDAE			9.9640	8.46
BATHYLAGUS SP.			10.0159	21.63
BATHYLAGUS MILLERI			9.4823	6.82
BATHYLAGUS OCHOTENSIS	0.81	7.0029	11.6395	15.37
BATHYLAGUS PACIFICUS			10.7302	8.06
ARGYROPELECUS SP.			9.5963	7.27
CHAULIODUS MACOUNI			10.7306	8.65
SCOPELOSAURUS SP.			9.5870	7.36
MYCTOPHIDAE			10.3091	24.14
DIAPHUS THETA			12.3638	44.00
LAMPANYCTUS SP.			11.2428	15.40
LAMPANYCTUS REGALIS			10.7500	11.12
LAMPANYCTUS RITTERI			10.9483	10.90
STENOBRACHIUS SP.			9.5707	22.03
STENOBRACHIUS LEUCOPSARUS	2.44	7.3356	12.8612	98.61
TARLETONBEANIA CRENULARIS			11.4545	17.02
PROTOMYCTOPHUM CROCKERI			11.3947	13.15
PROTOMYCTOPHUM THOMPSONI			10.2599	8.61
LESTIDIOPS RINGENS			10.2984	8.68
GADIDAE			9.0300	11.25
MICROGADUS PROXIMUS			9.7340	10.62
BROSMOPHYCIS MARGINATA			9.6285	6.80
COLOLABIS SAIRA	18.70	8.6650		
TRACHIPTERUS ALTIVELIS			9.8002	8.30
MELAMPHAEIDAE			10.2037	7.00
SCORPAENIDAE			10.5580	10.58
SEBASTES SP.	13.01	8.3107	11.6873	32.19
SEBASTOLOBUS SP.	0.81	6.8026	10.3736	8.16
ANOPLOPOMA FIMBRIA	8.94	8.0807		
OPHIODON ELONGATUS	0.81	6.2044		
COTTIDAE	0.81	6.0606	9.2545	9.37
ARTEDIUS HARRINGTONI			9.7575	9.39
ARTEDIUS MEANYI			8.7715	5.88
RADULINUS ASPRELLUS			9.3081	7.27
SCORPAENICHTHYS MARMORATUS	8.94	8.2877		
AGONIDAE			9.4102	7.06
CYCLOPTERIDAE			10.5737	9.25
BATHYMASTER SP.	0.81	6.2576		
RONQUILUS JORDANI	8.13	7.7269	9.7246	11.49
STICHAEIDAE			8.8528	7.03
POROCLINUS ROTHROCKI			8.9600	9.67
AMMODYTES HEXAPTERUS	1.63	6.8406	9.0947	6.67
ICICHTHYS LOCKINGTONI			9.5710	7.45
CITHARICHTHYS SP.			8.7715	5.88
CITHARICHTHYS SORDIDUS			10.6162	9.52
CITHARICHTHYS STIGMAEUS	0.81	6.5175		
GLYPTOCEPHALUS ZACHIRUS			10.2895	9.31
HIPPOGLOSSOIDES ELASSODON			9.1479	7.29
ISOPSETTA ISOLEPIS			9.7953	8.27
LYOPSETTA EXILIS			11.1549	15.83
MICROSTOMUS PACIFICUS	1.63	6.7734	10.5152	9.43
PLATICHTHYS STELLATUS	0.81	6.1948		
PLEURONICHTHYS DECURRENS	0.81	6.5119		
PSETTICHTHYS MELANOSTICTUS			9.7638	7.83

Table 3.--Fish larvae collected in bongo and neuston tows during cruise 1P081, May-June 1981.

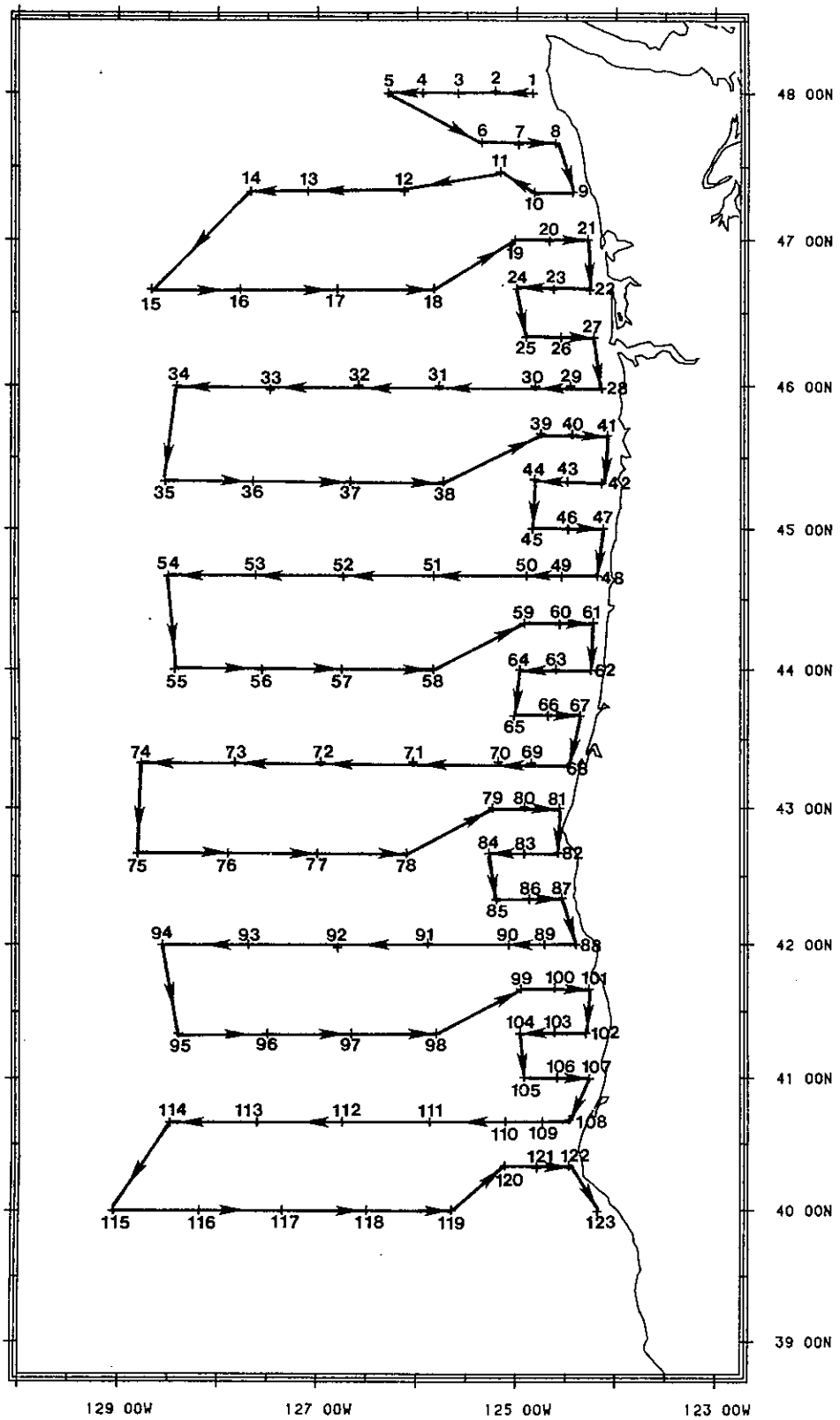

Figure 1.--Station locations for cruise 1P081, May-June 1981.

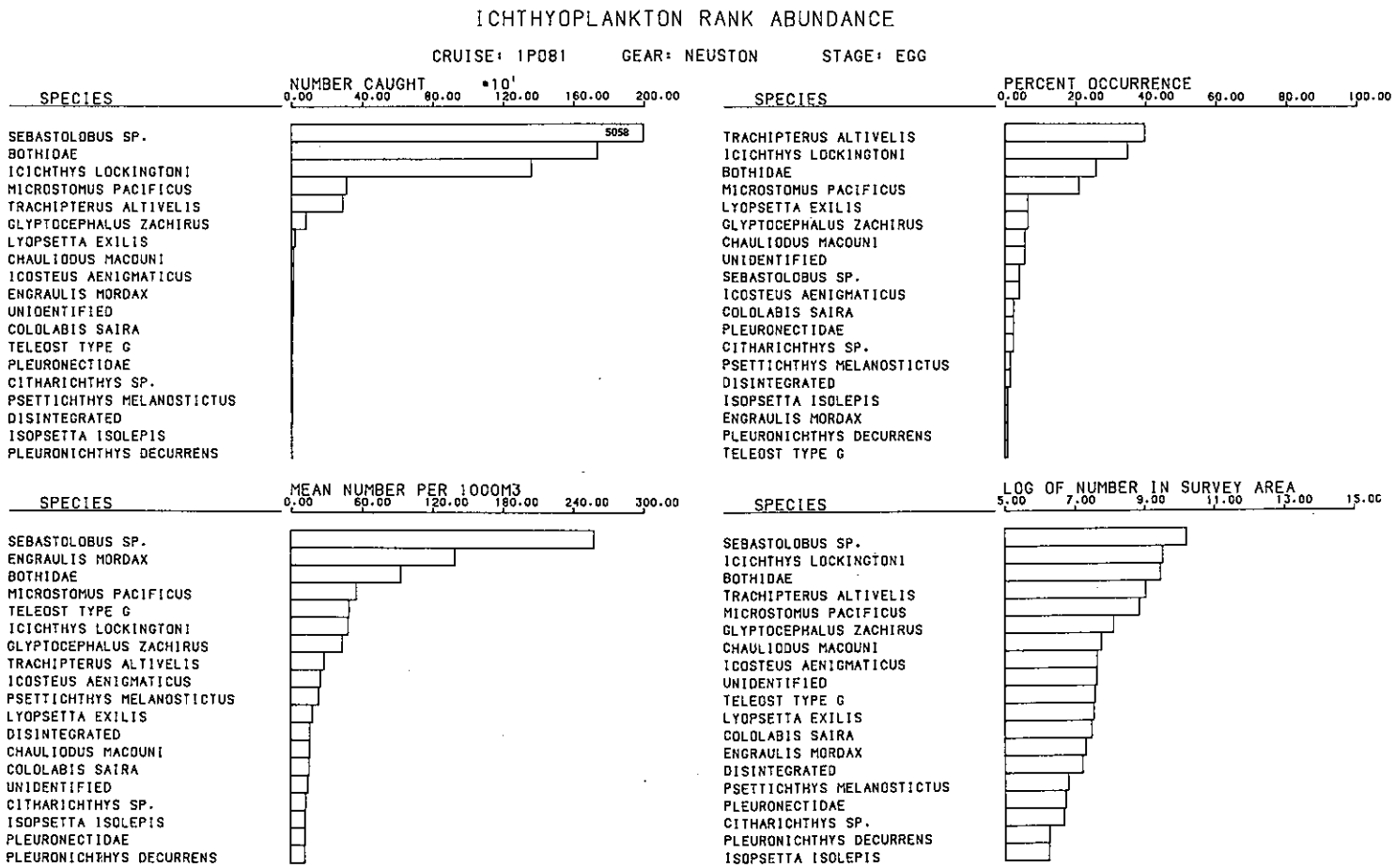

Figure 2.--Rank abundance of eggs caught in neuston tows during cruise 1P081, May-June 1981.

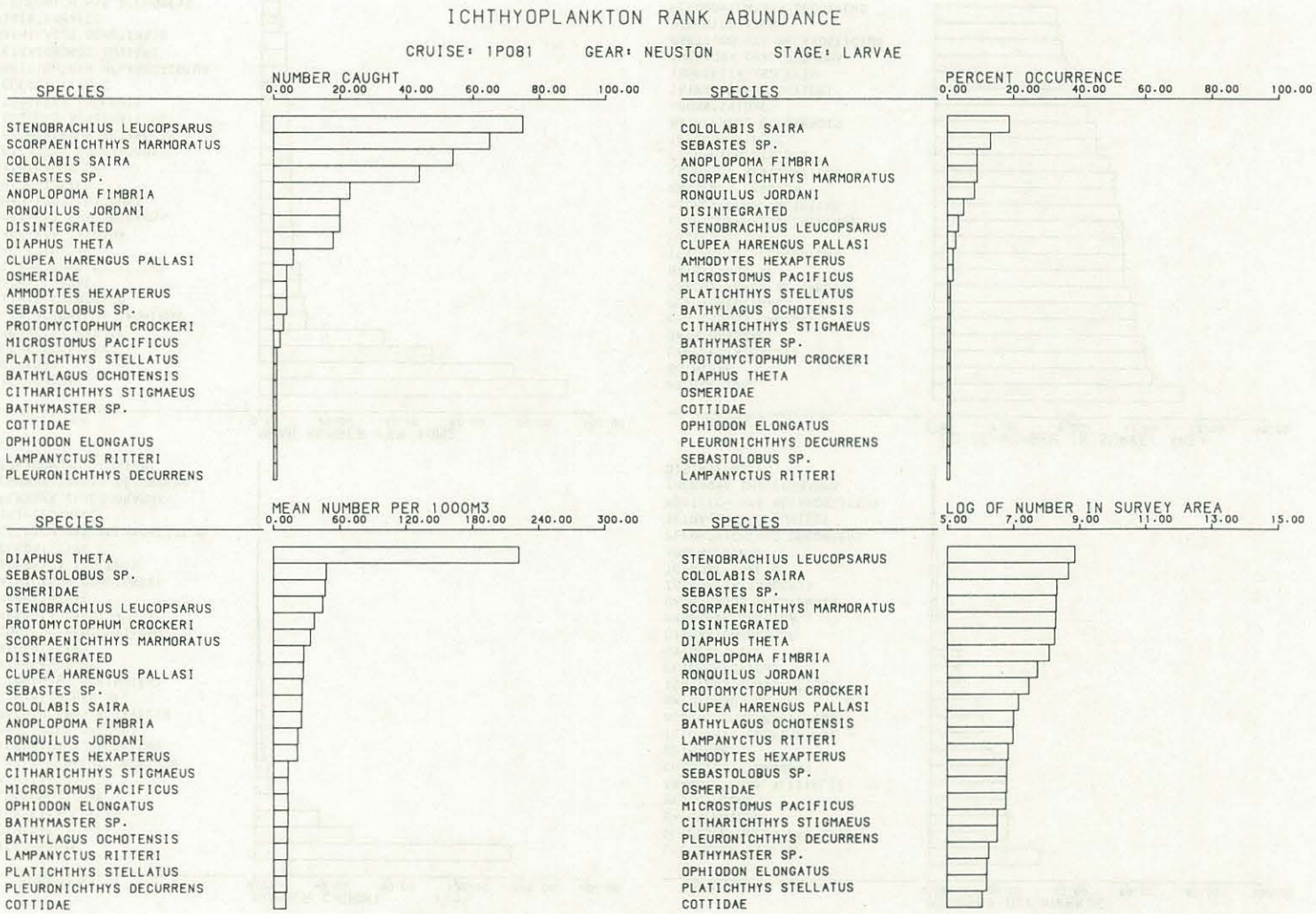

Figure 3.--Rank abundance of larvae caught in neuston tows during cruise 1P081, May-June 1981.

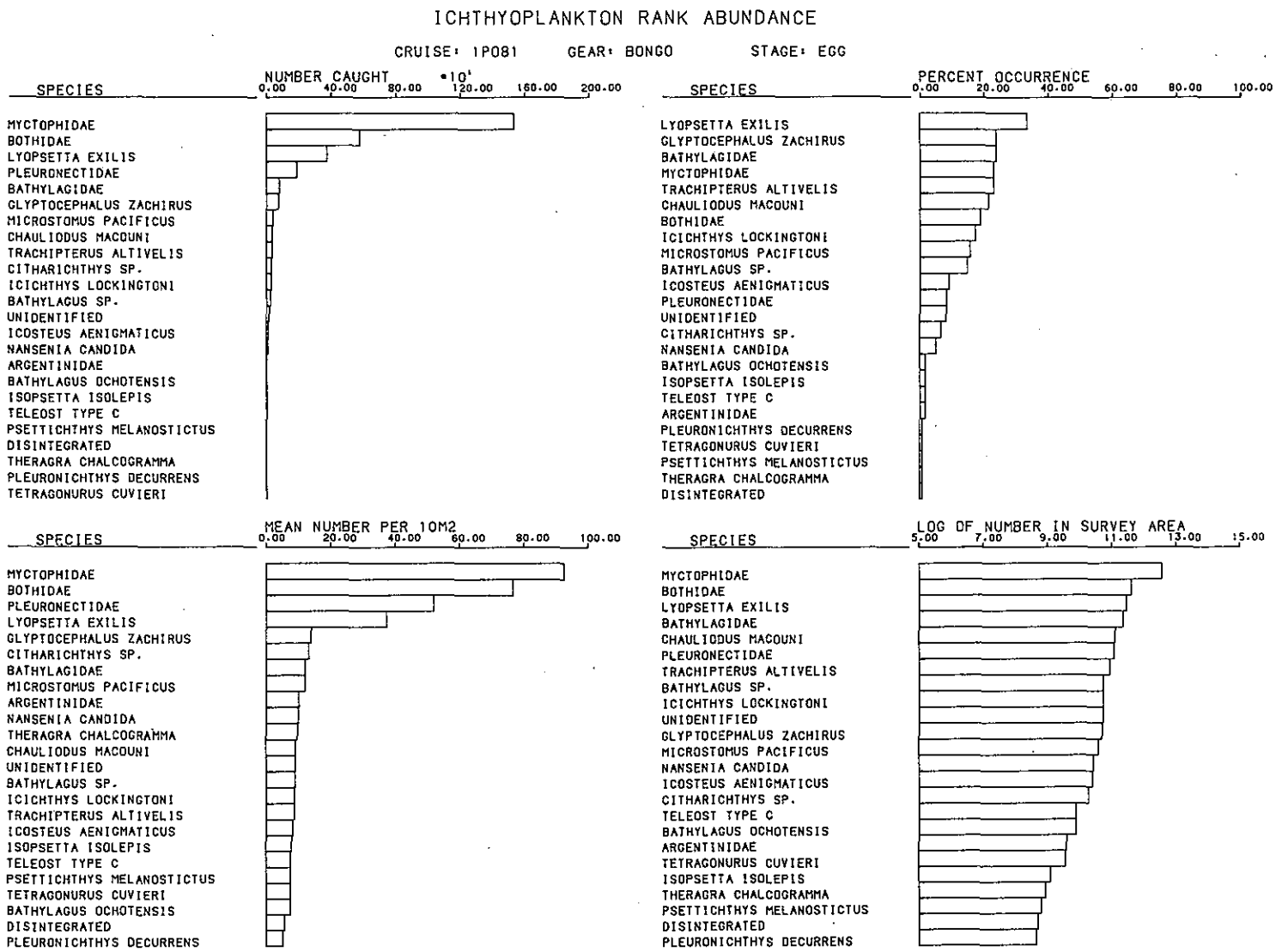

Figure 4.--Rank abundance of eggs caught in bongo tows during cruise 1P081, May-June 1981.

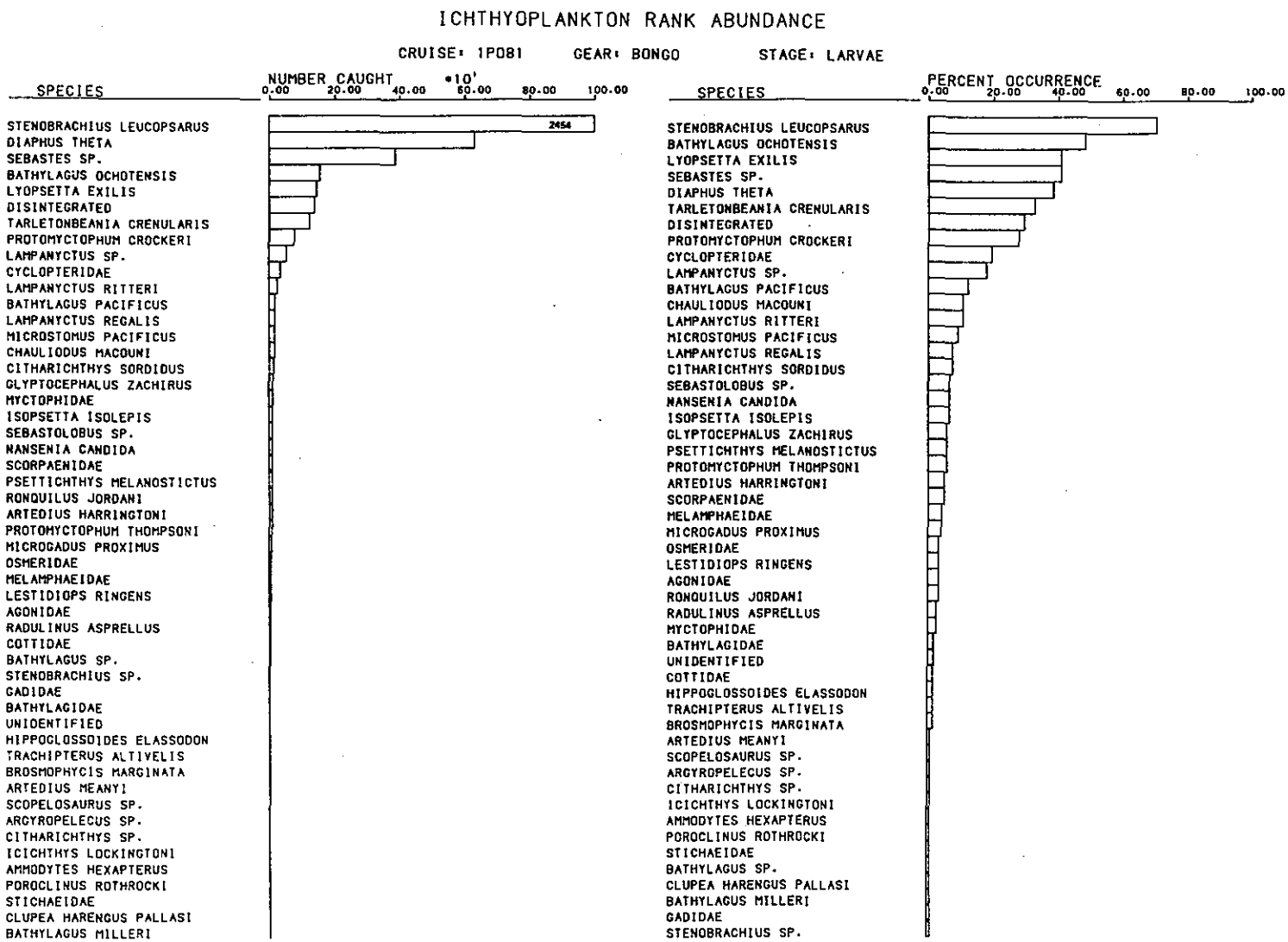

Figure 5.--Rank abundance of larvae caught in bongo tows during cruise 1P081, May-June 1981.

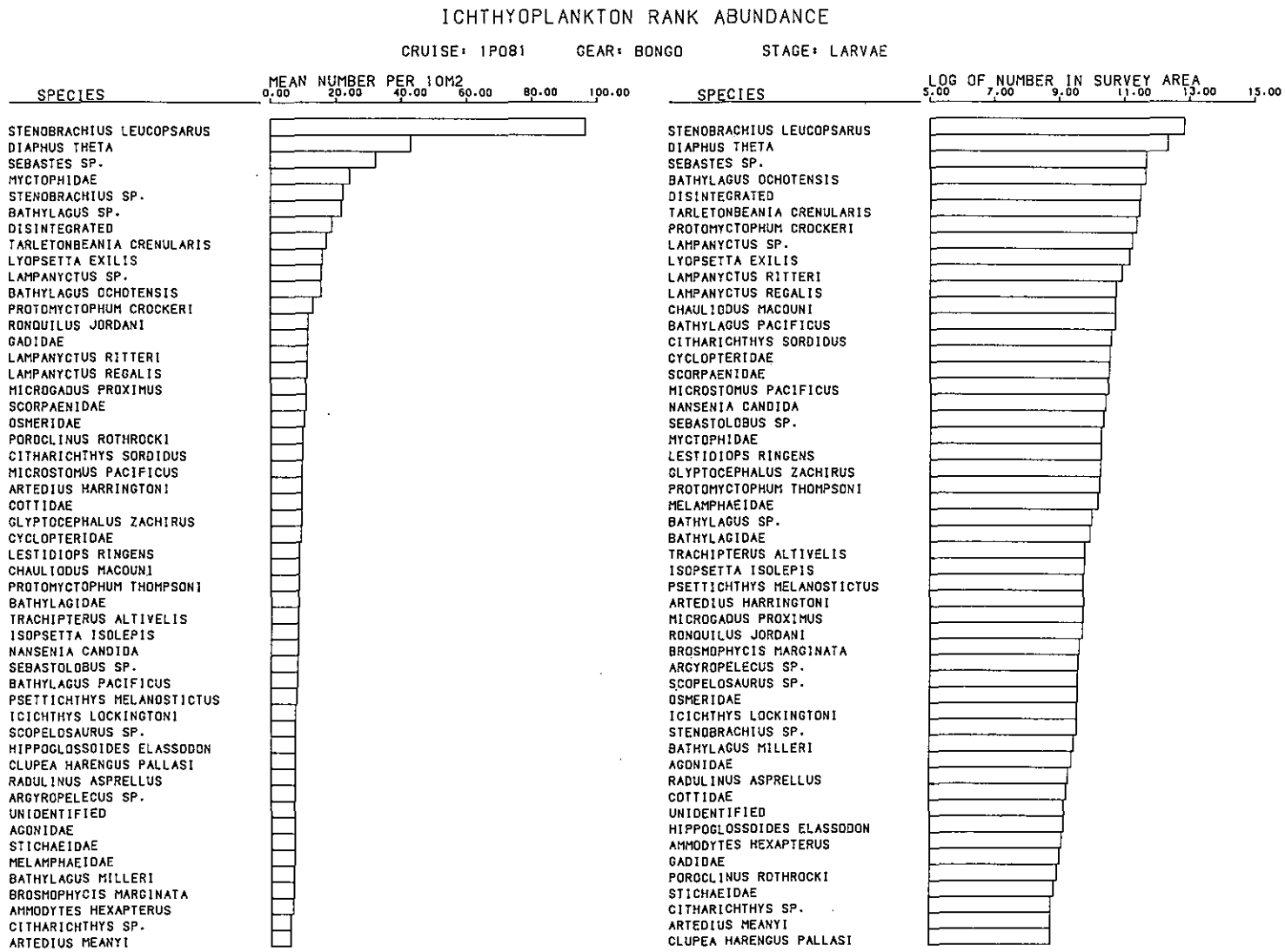

Figure 5 (Continued)

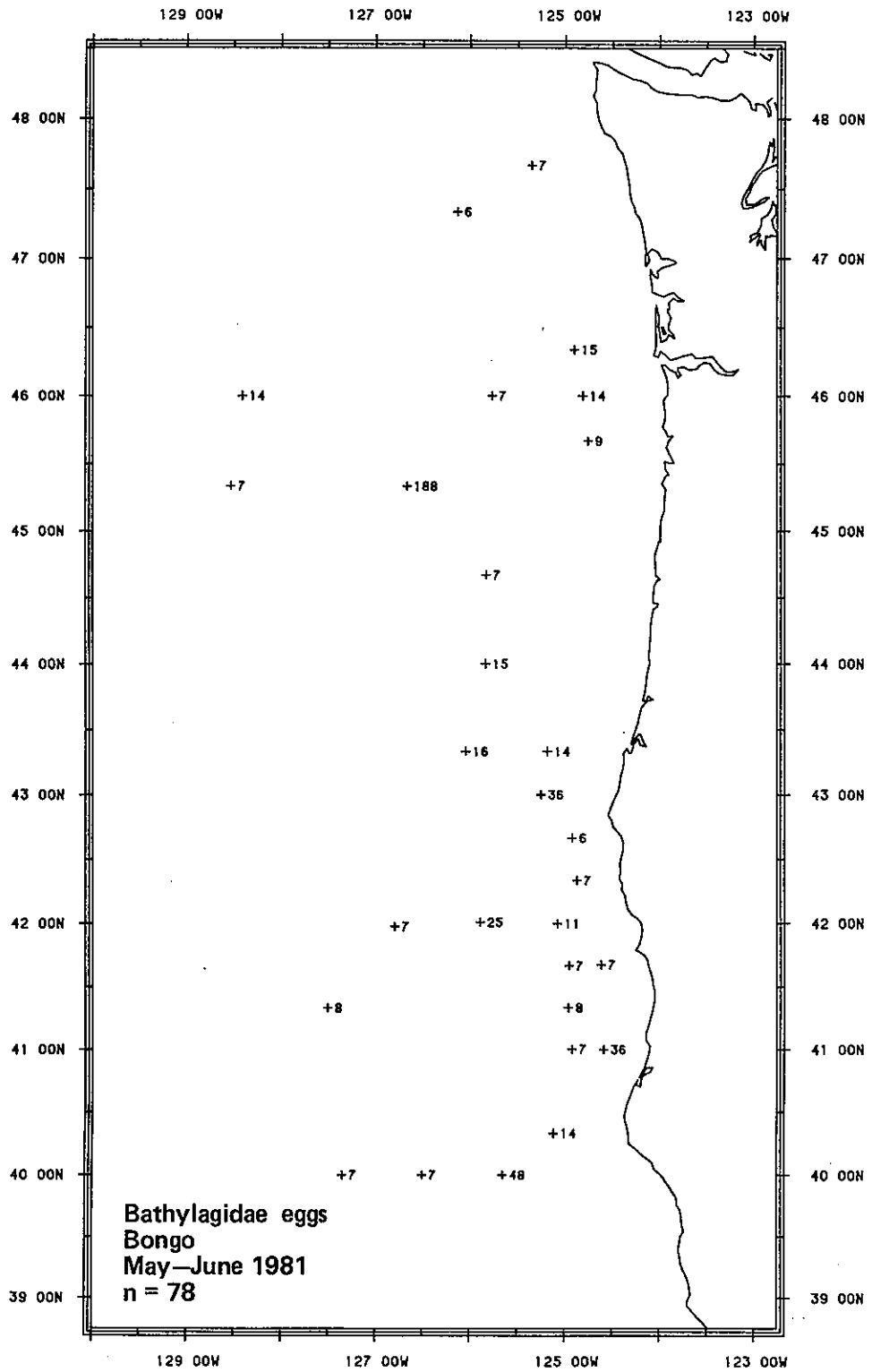

Figure 6.--Distribution of eggs of Bathylagidae from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

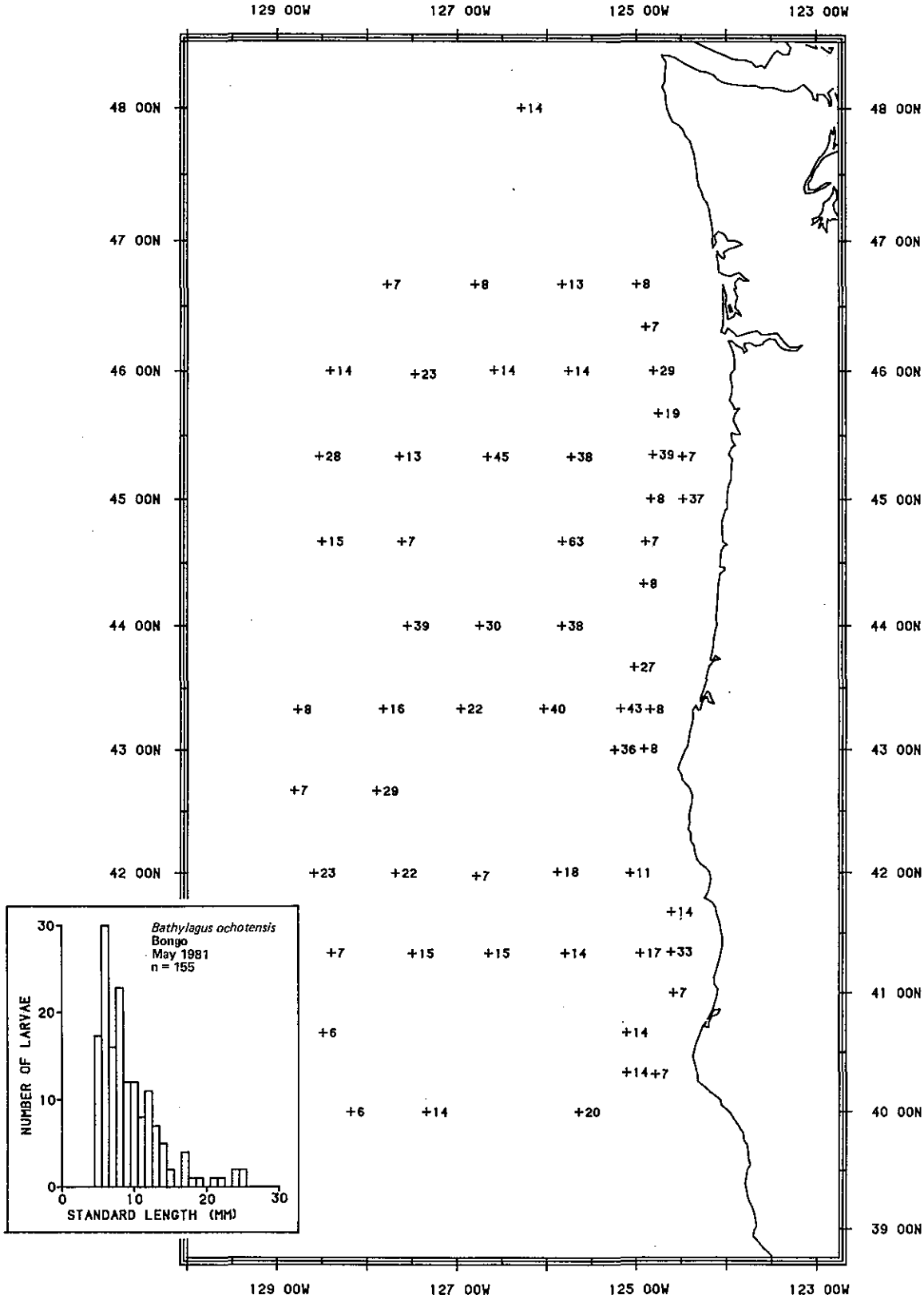

Figure 7.--Distribution and lengths of Bathylagus ochotensis from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

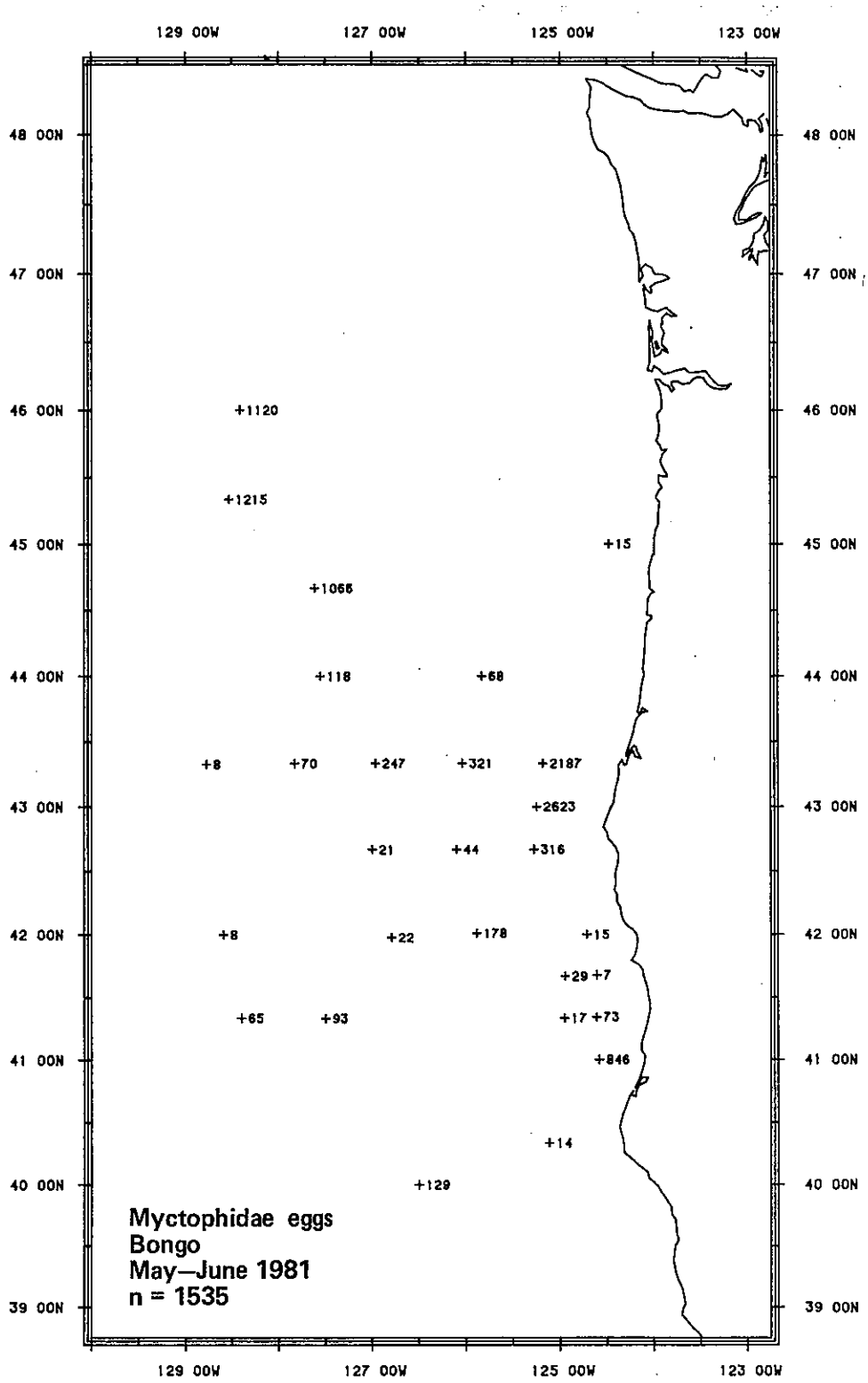

Figure 8.--Distribution of eggs of Myctophidae from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

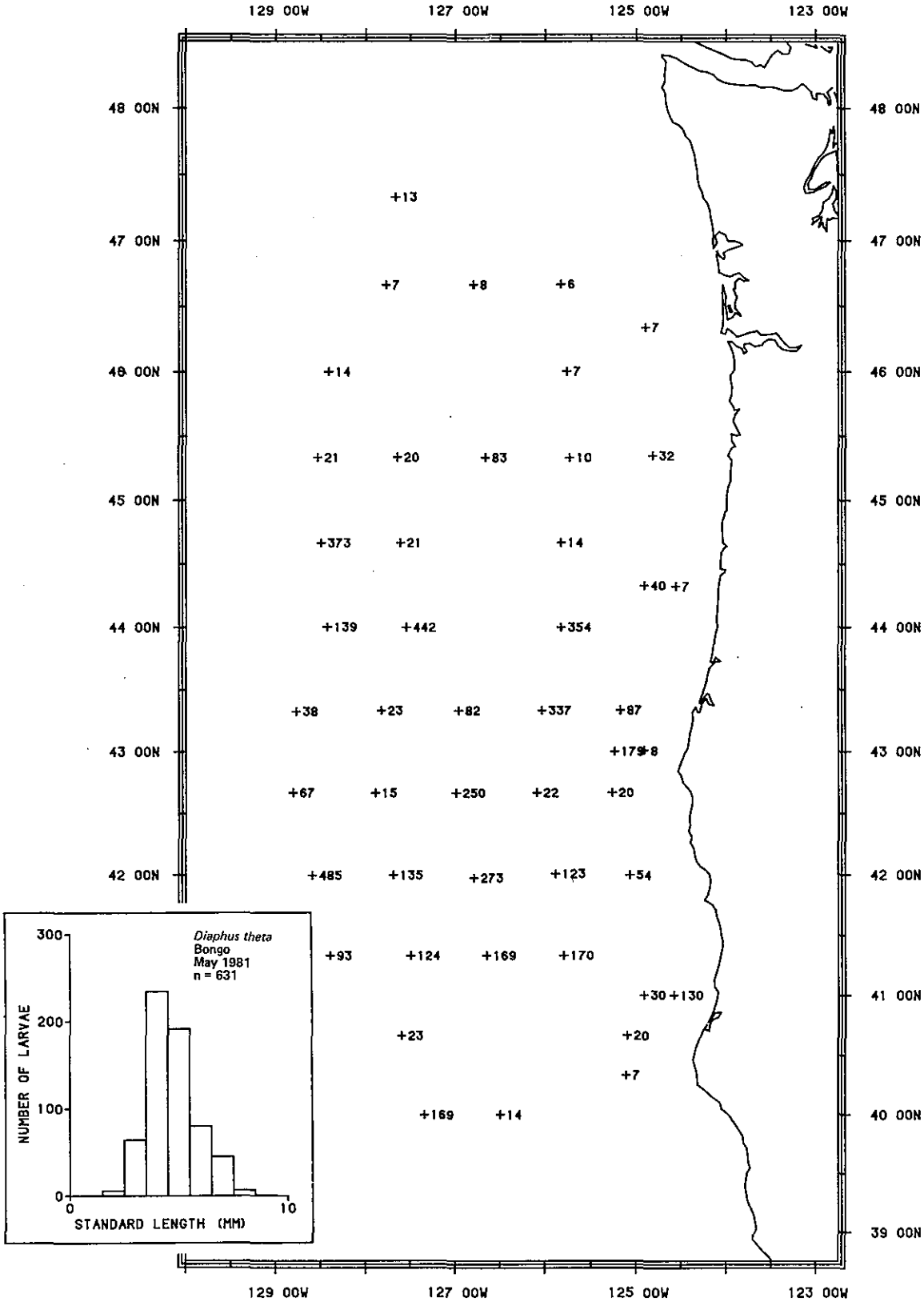

Figure 9.--Distribution and lengths of Diaphus theta from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

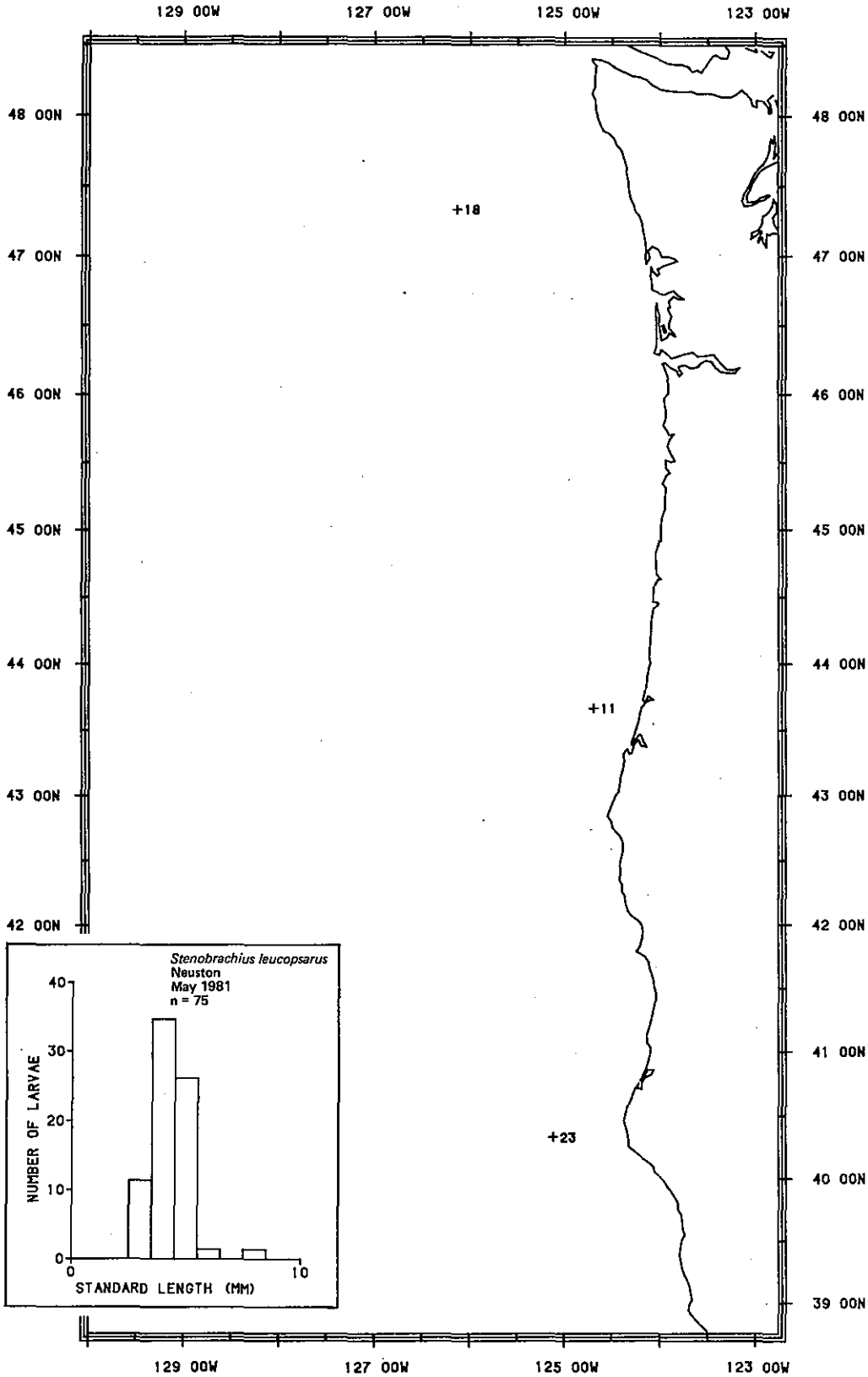

Figure 10.--Distribution and lengths of Stenobrachius leucopsarus from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

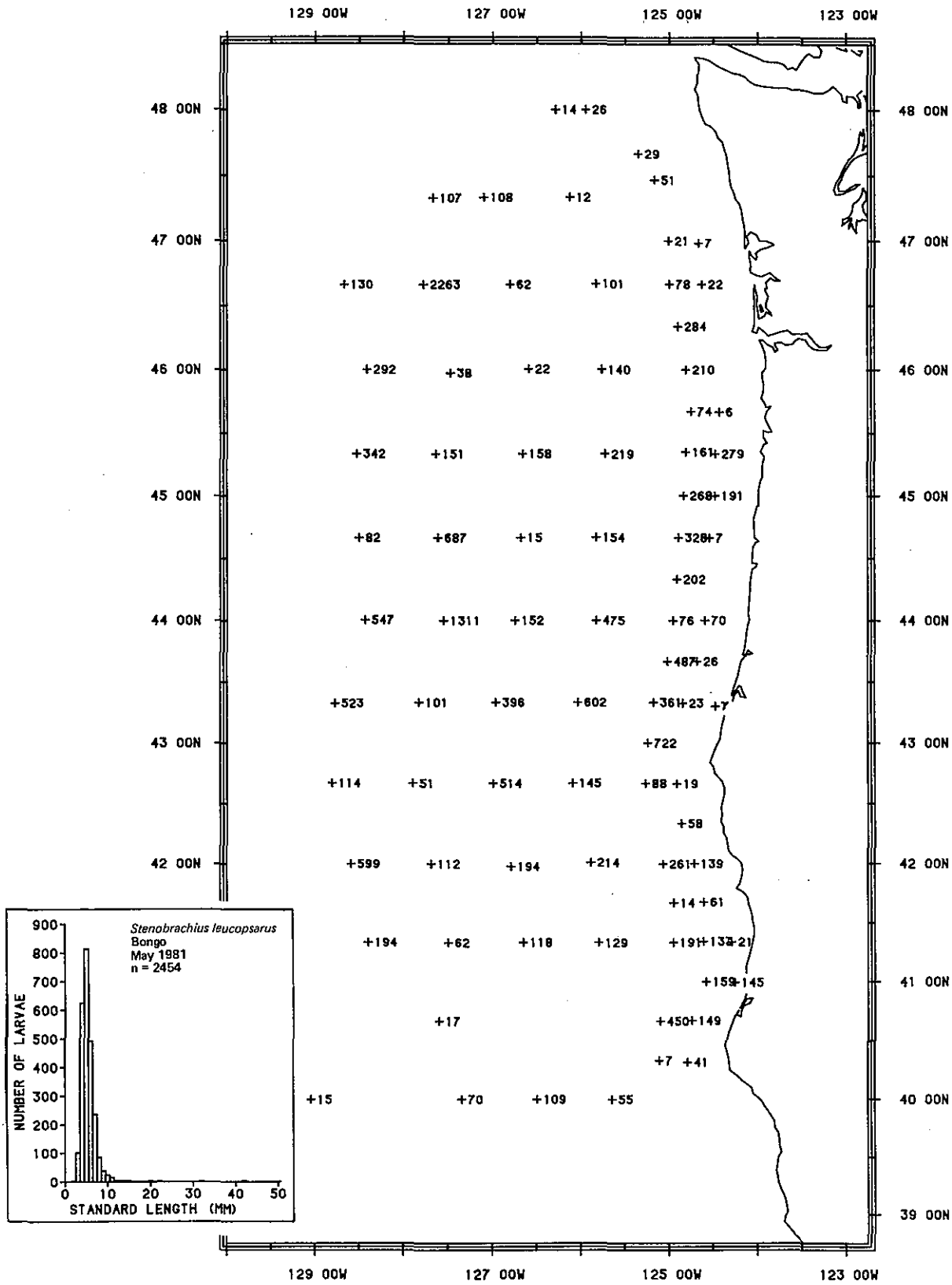

Figure 11.--Distribution and lengths of Stenobrachius leucopsarus from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

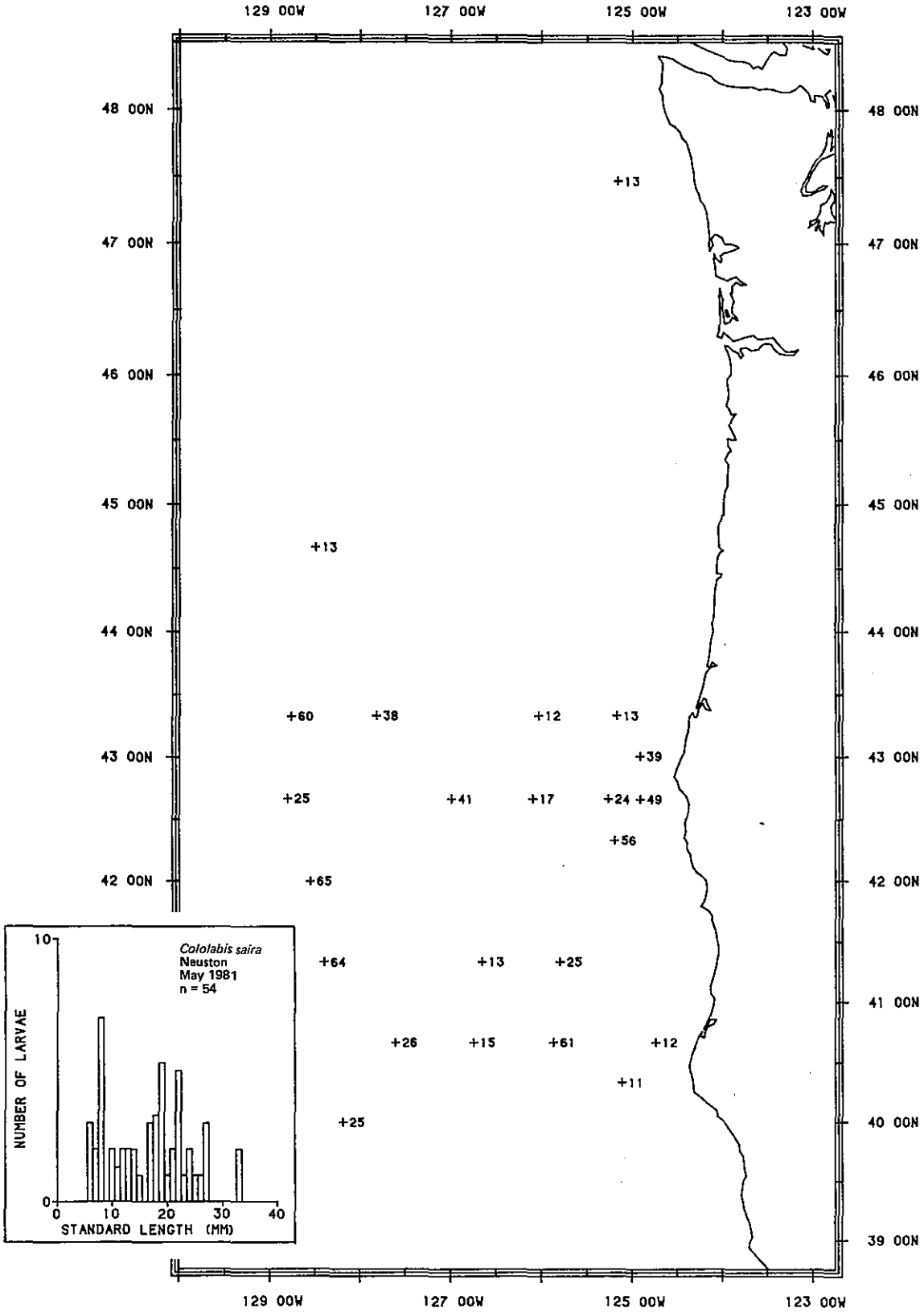

Figure 12.--Distribution and lengths of Cololabis saira from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

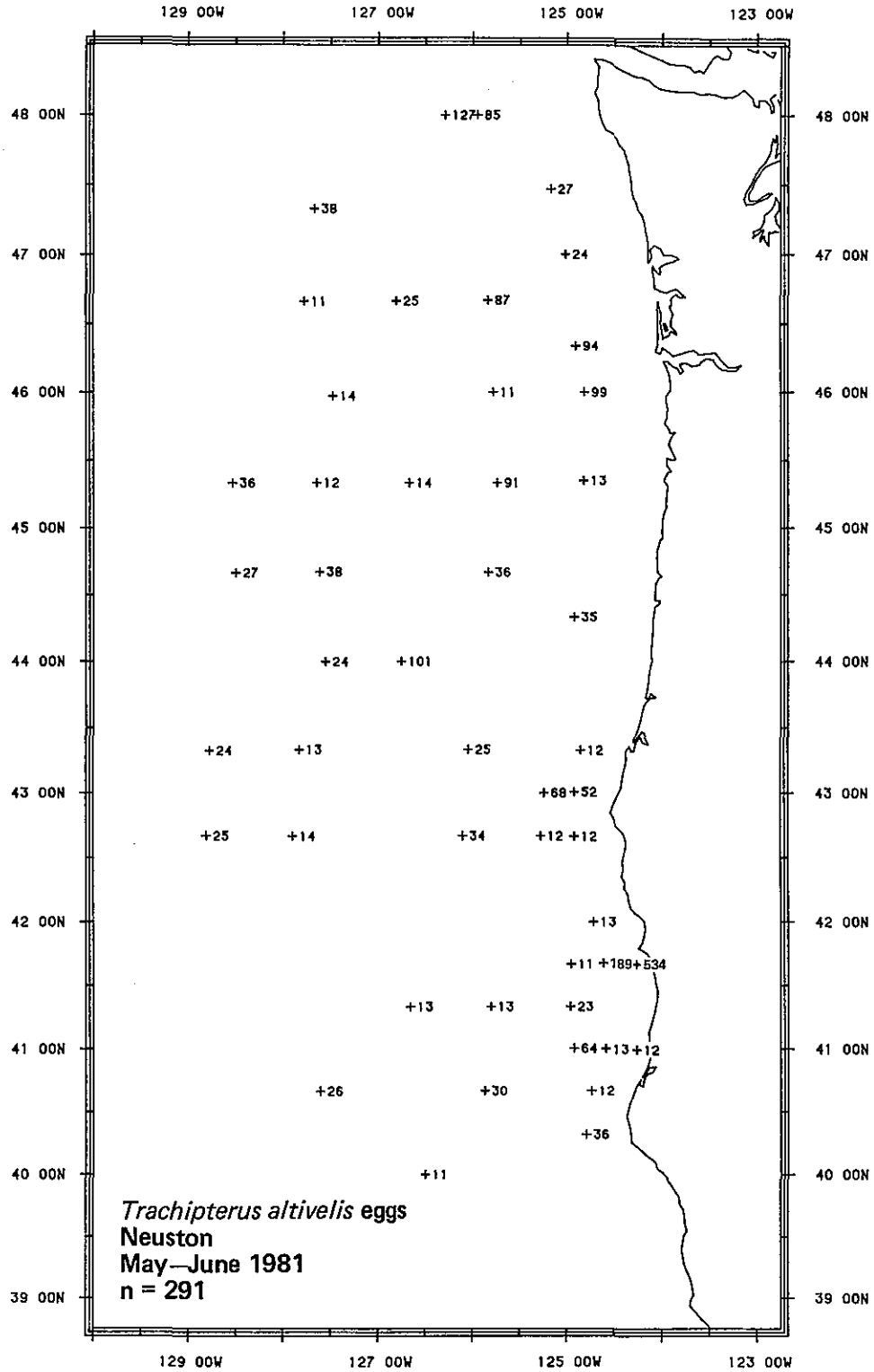

Figure 13.--Distribution of eggs of Trachipterus altivelis from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

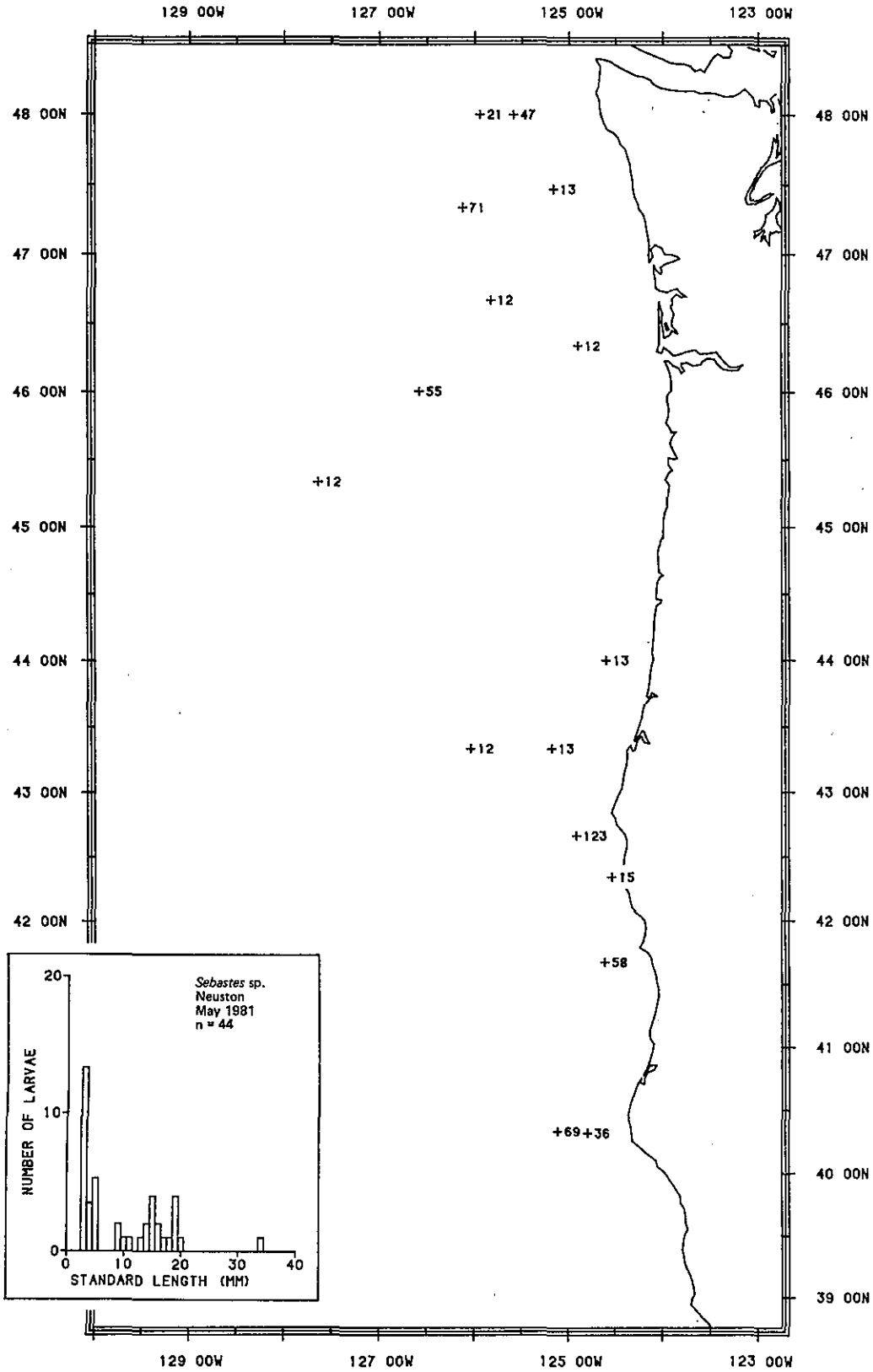

Figure 14.--Distribution and lengths of Sebastes sp. from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

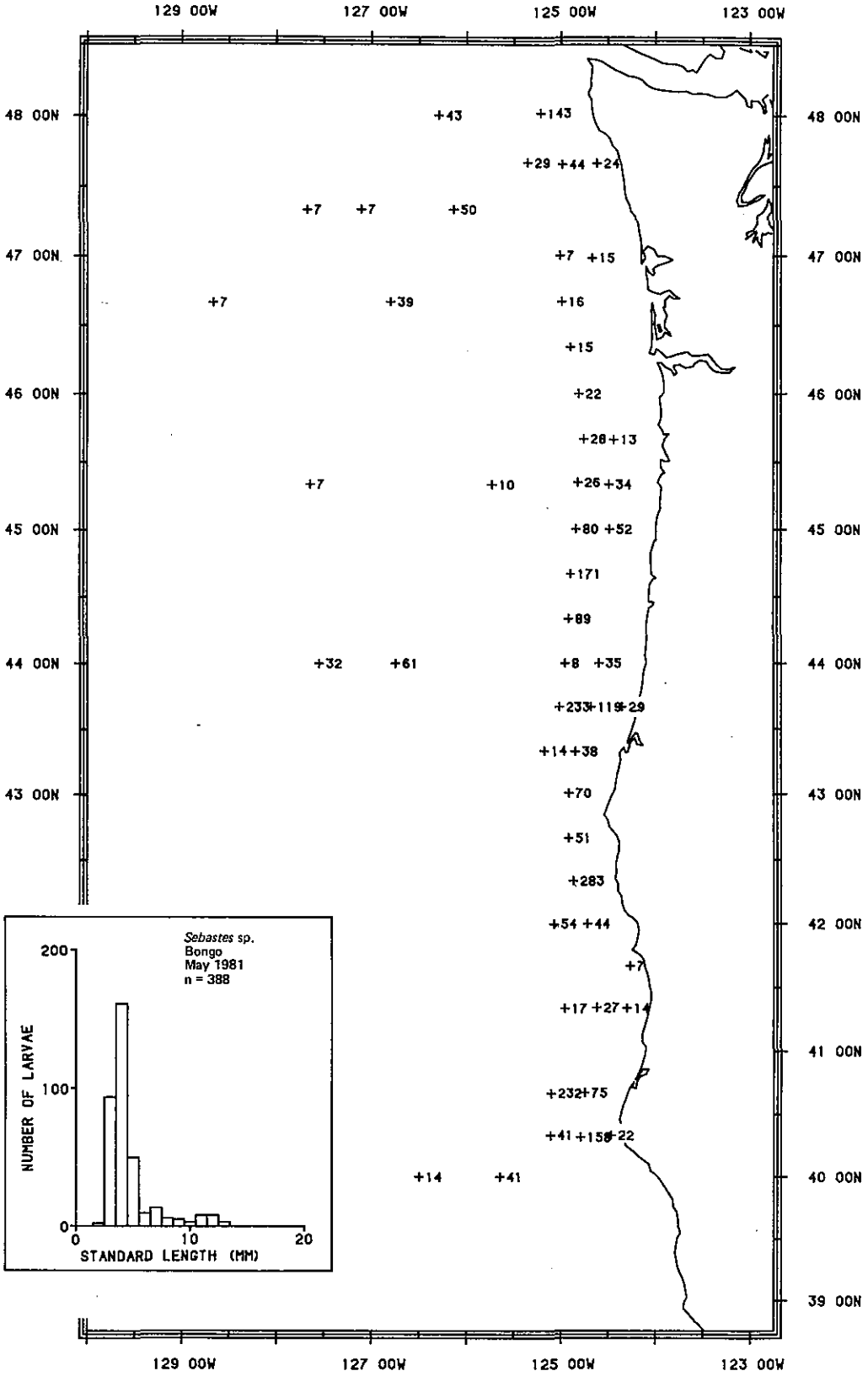

Figure 15.--Distribution and lengths of Sebastes sp. from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

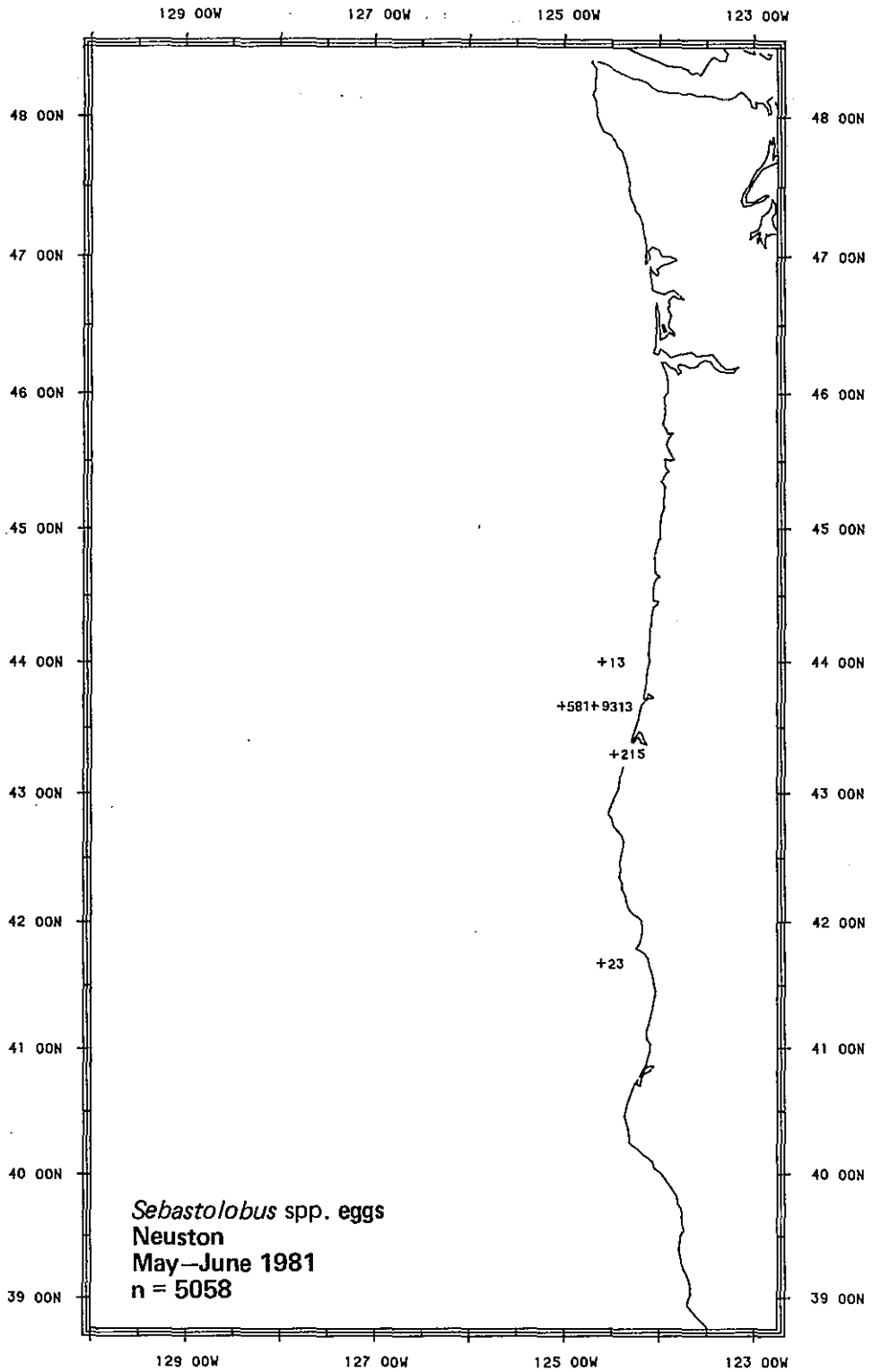

Figure 16.--Distribution of eggs of Sebastolobus sp. from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

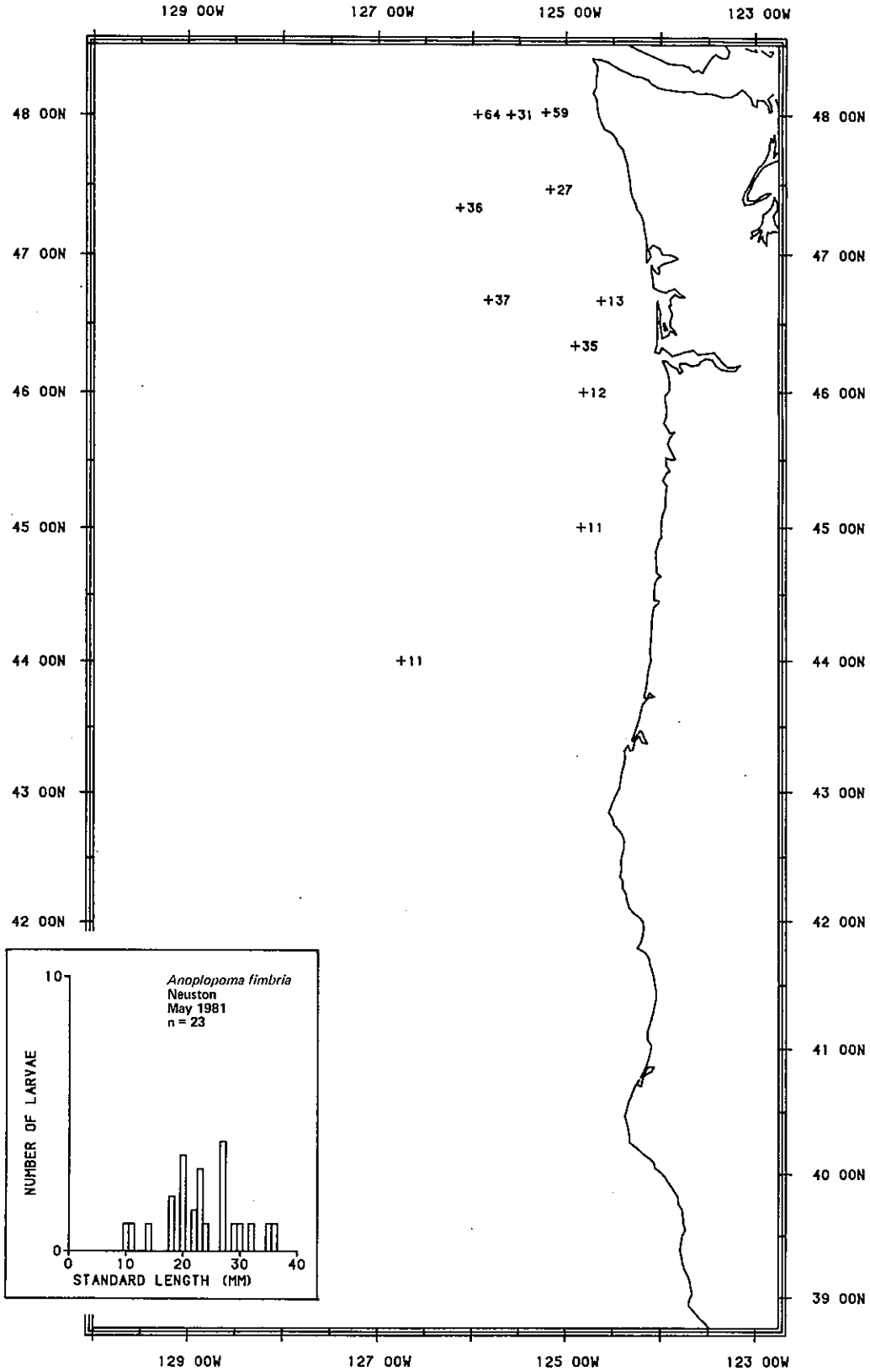

Figure 17.--Distribution and lengths of Anoplopoma fimbria from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

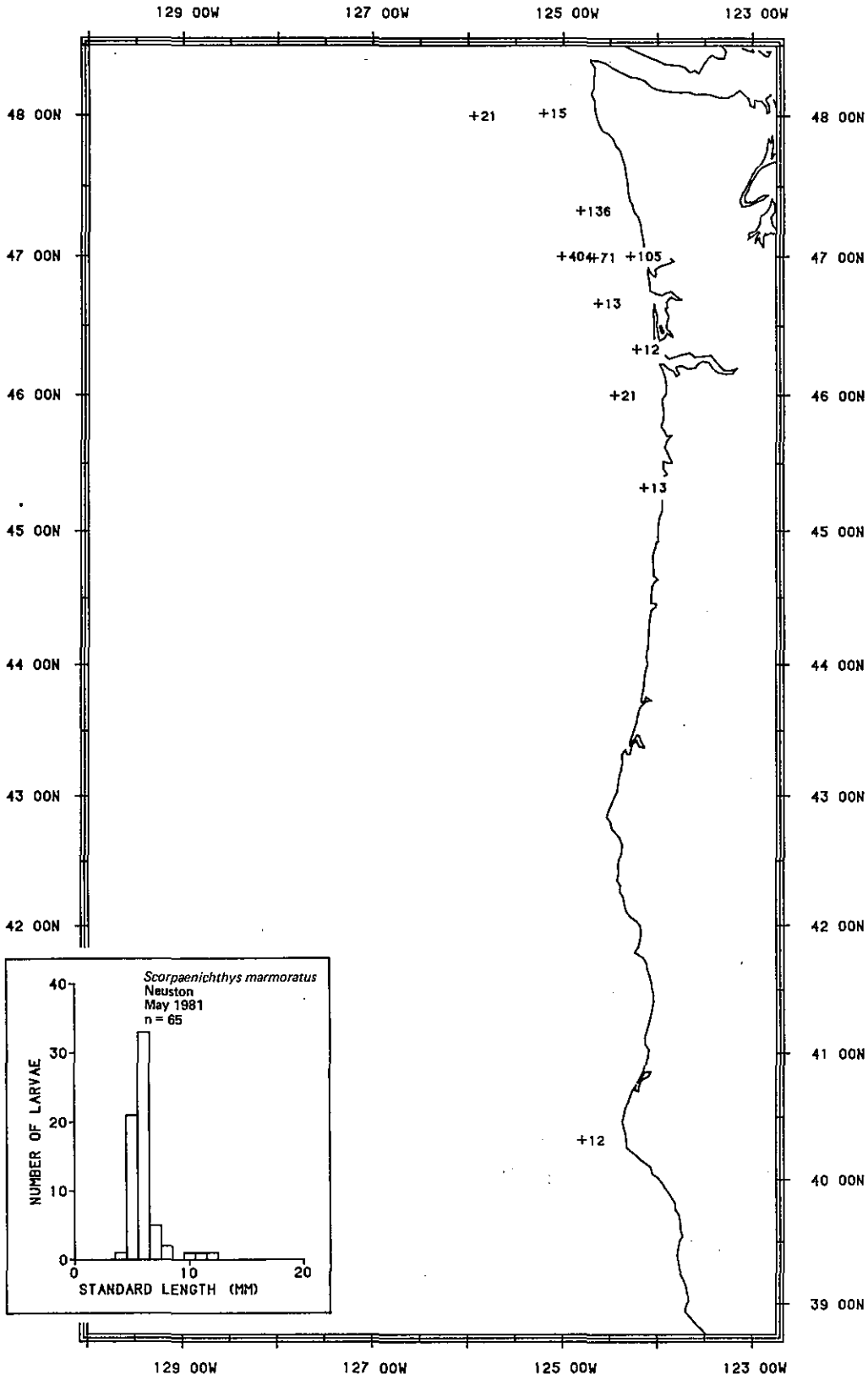

Figure 18.--Distribution and lengths of Scorpaenichthys marmoratus from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

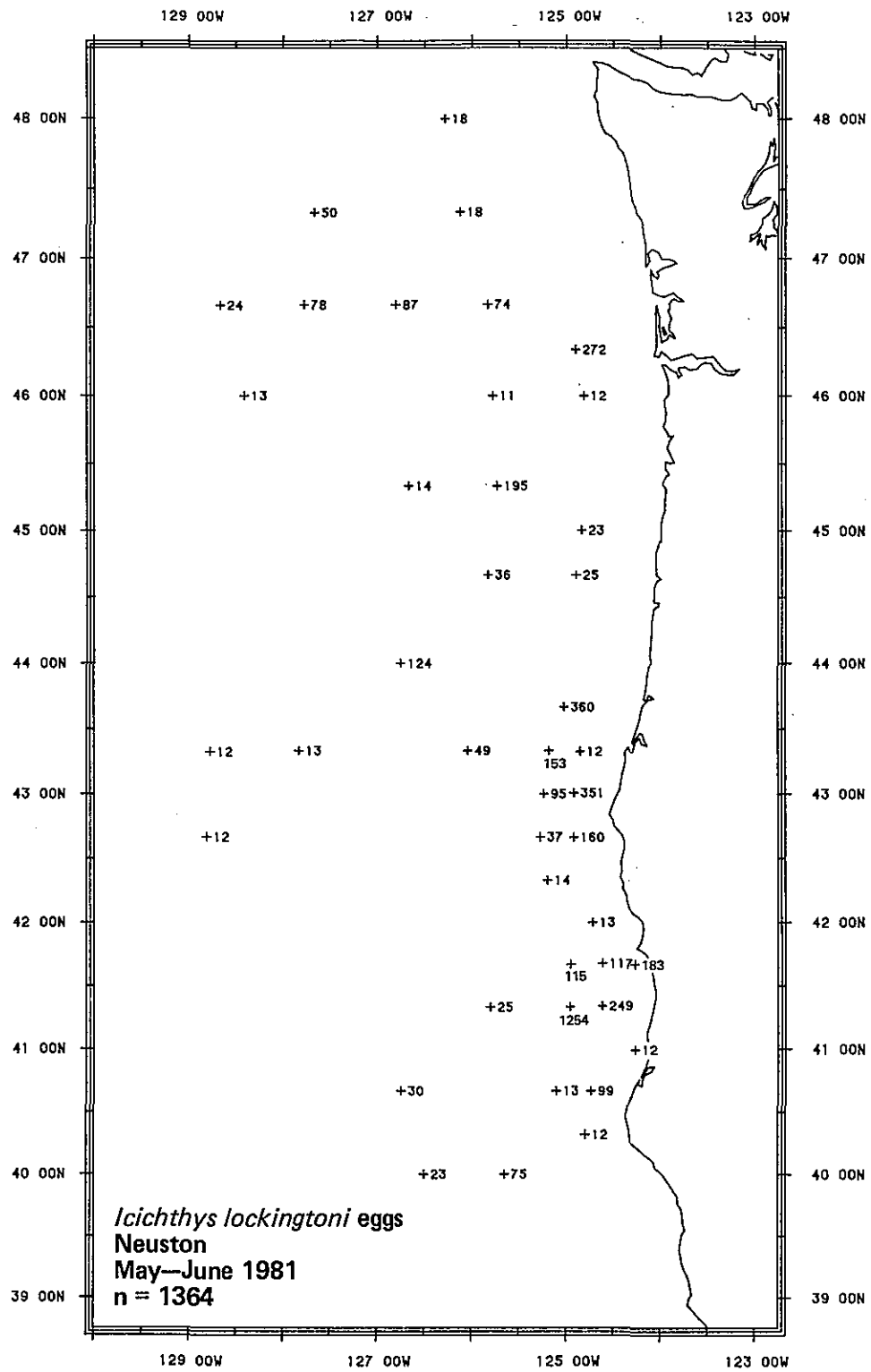

Figure 19.--Distribution of eggs of Icichthys lockingtoni from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

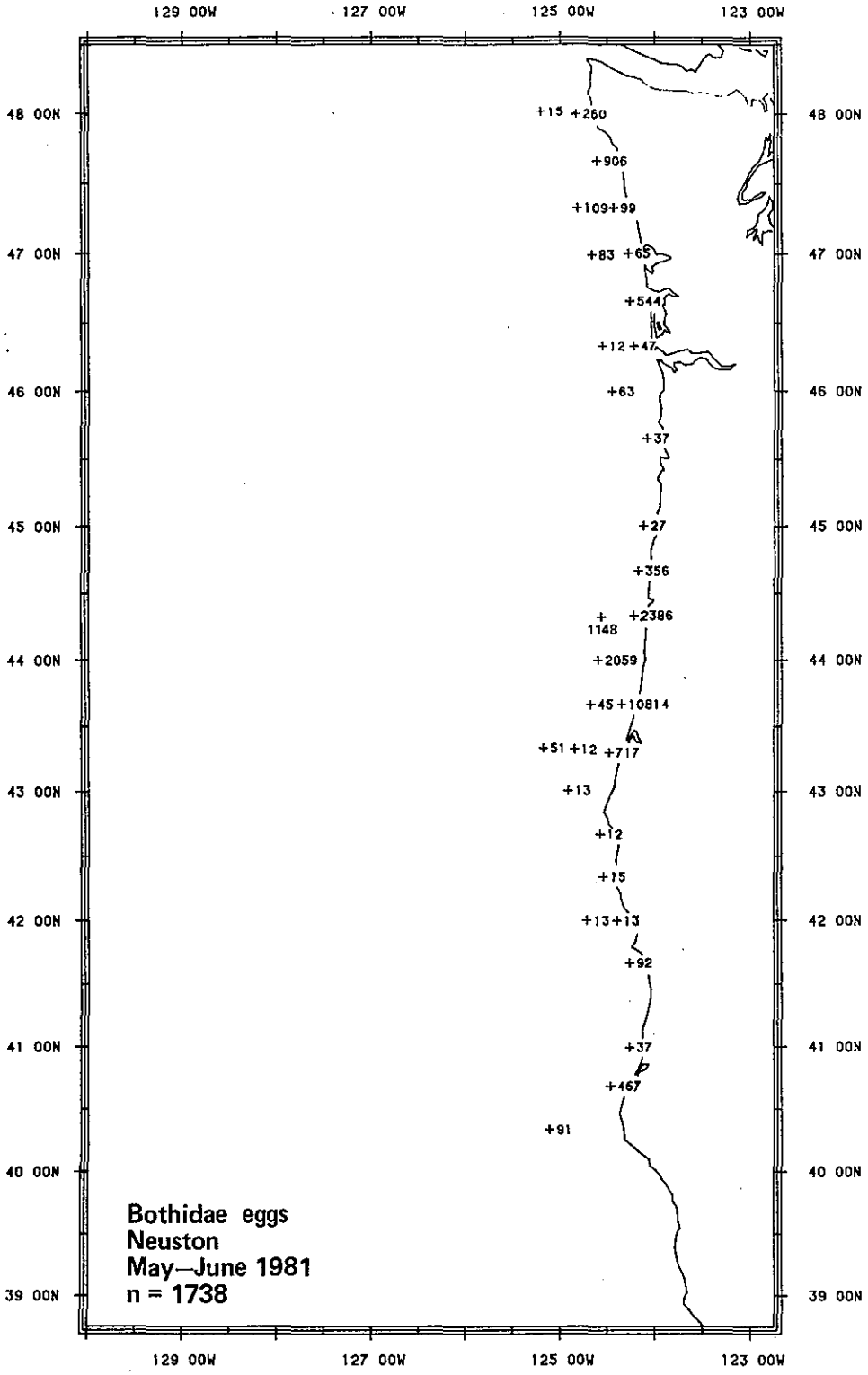

Figure 20.--Distribution of eggs of Bothidae from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

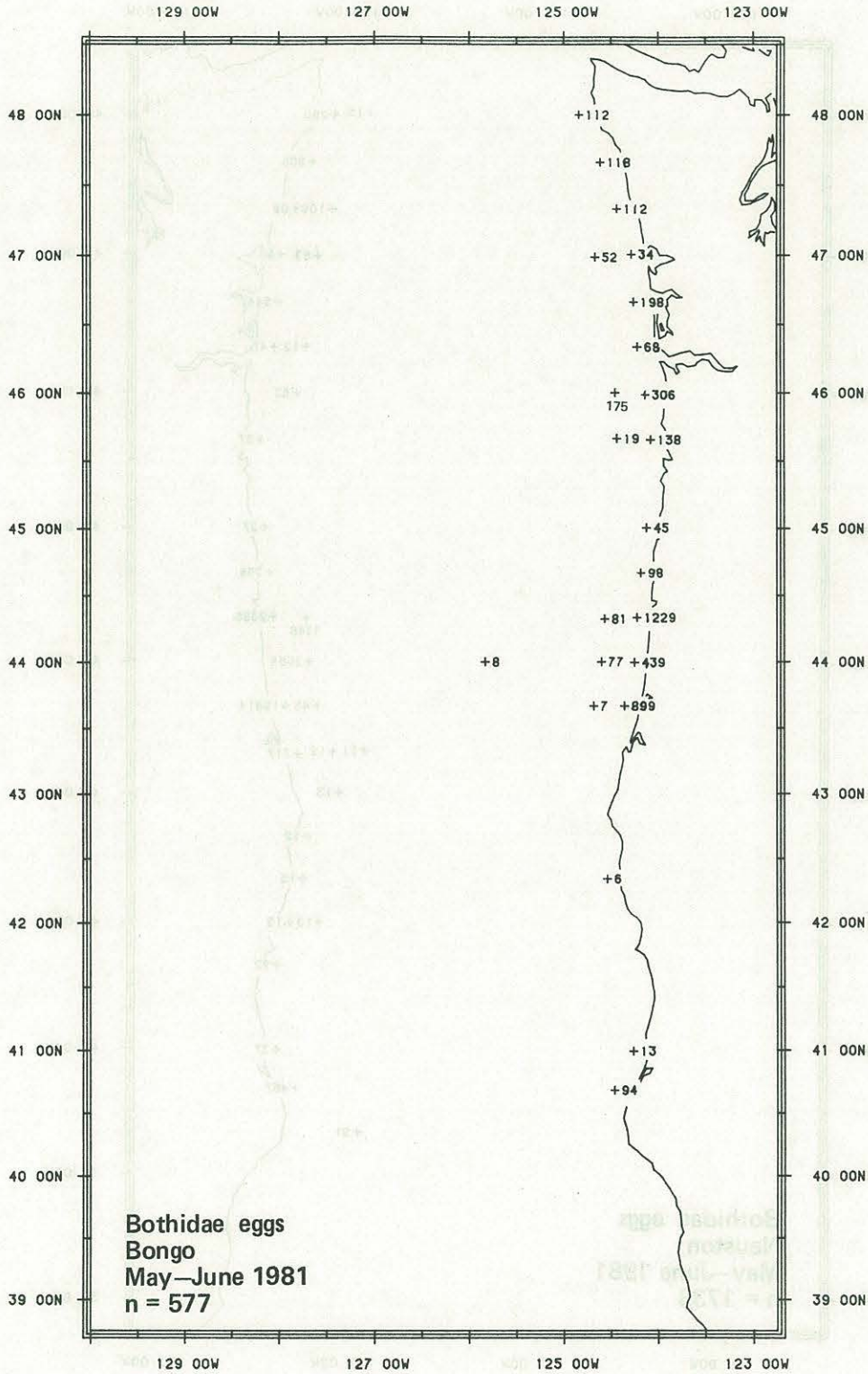

Figure 21.--Distribution of eggs of Bothidae from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

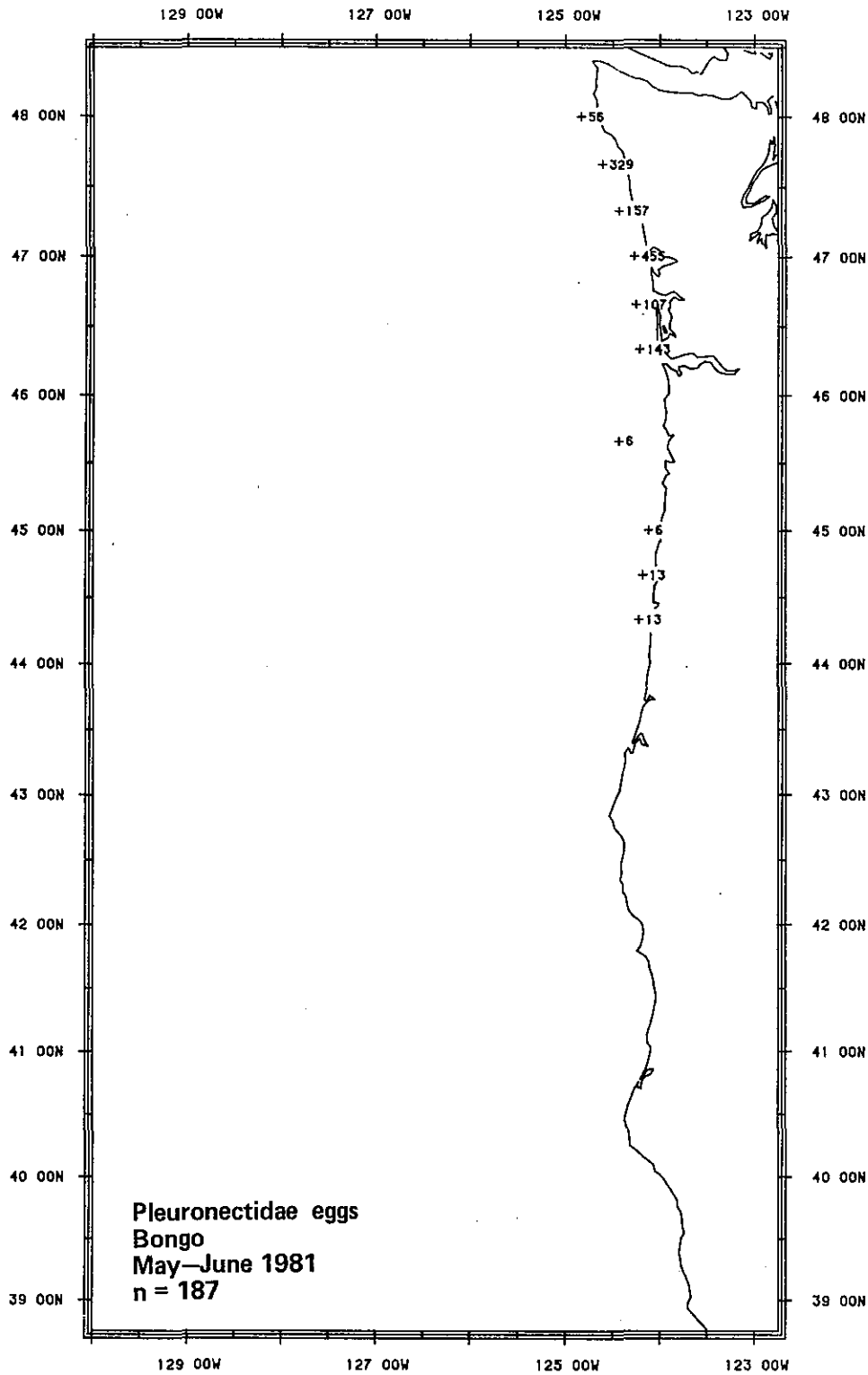

Figure 22.--Distribution of eggs of Pleuronectidae from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

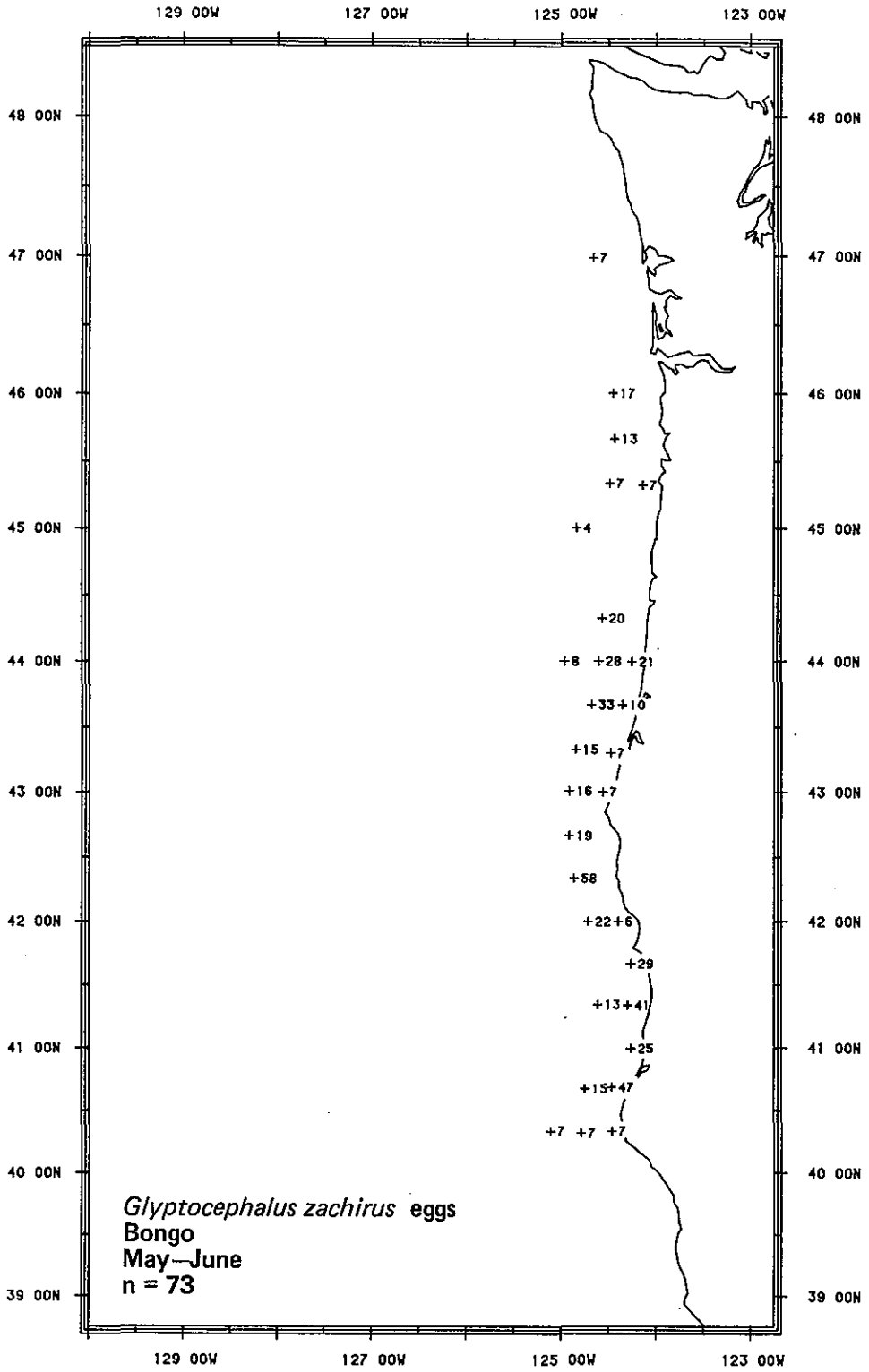

Figure 23.--Distribution of eggs of Glyptocephalus zachirus from bongo tows during cruise 1PQ81, May-June 1981. Abundance expressed as numbers per 10 m^2.

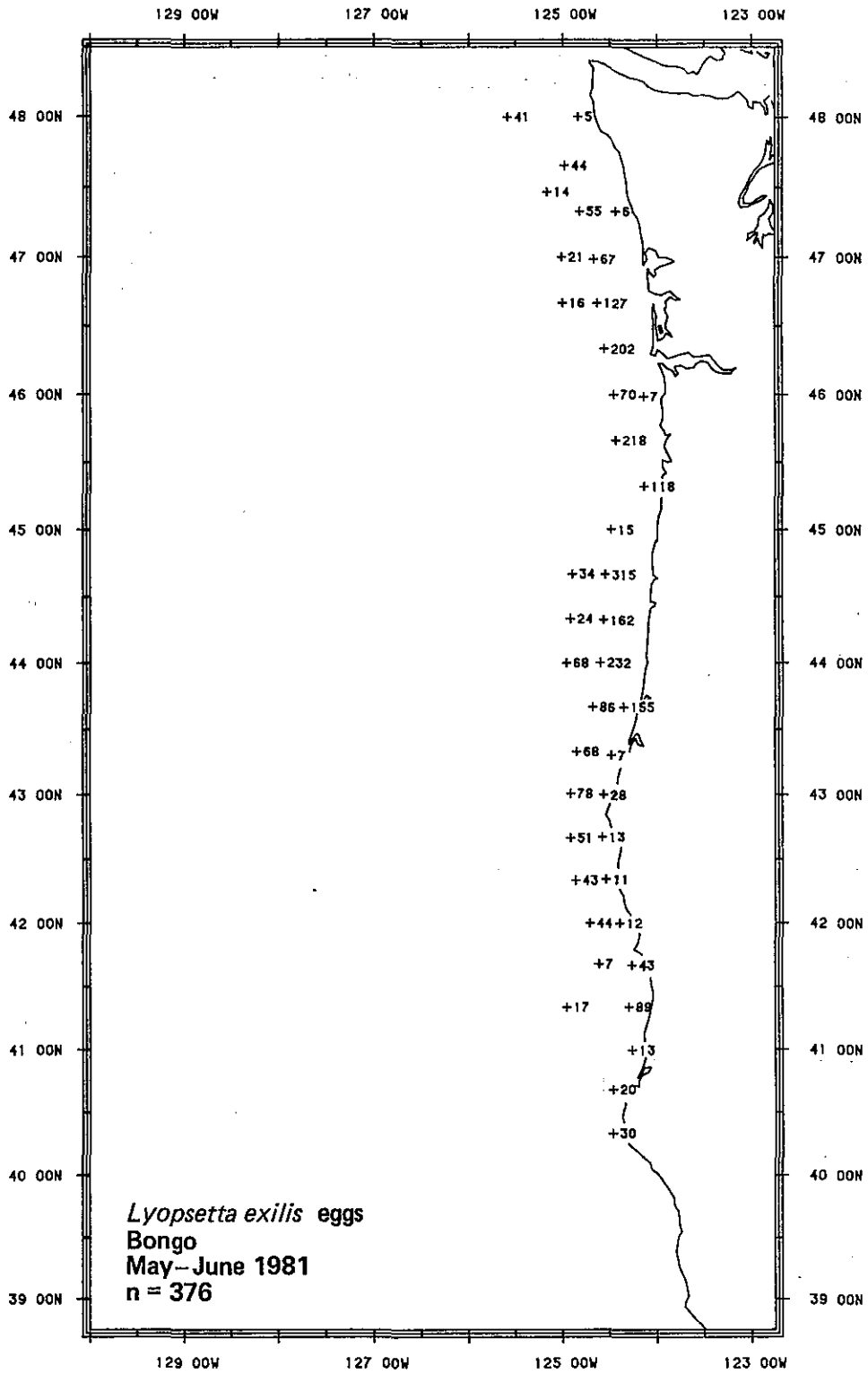

Figure 24.--Distribution of eggs of Lyopsetta exilis from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

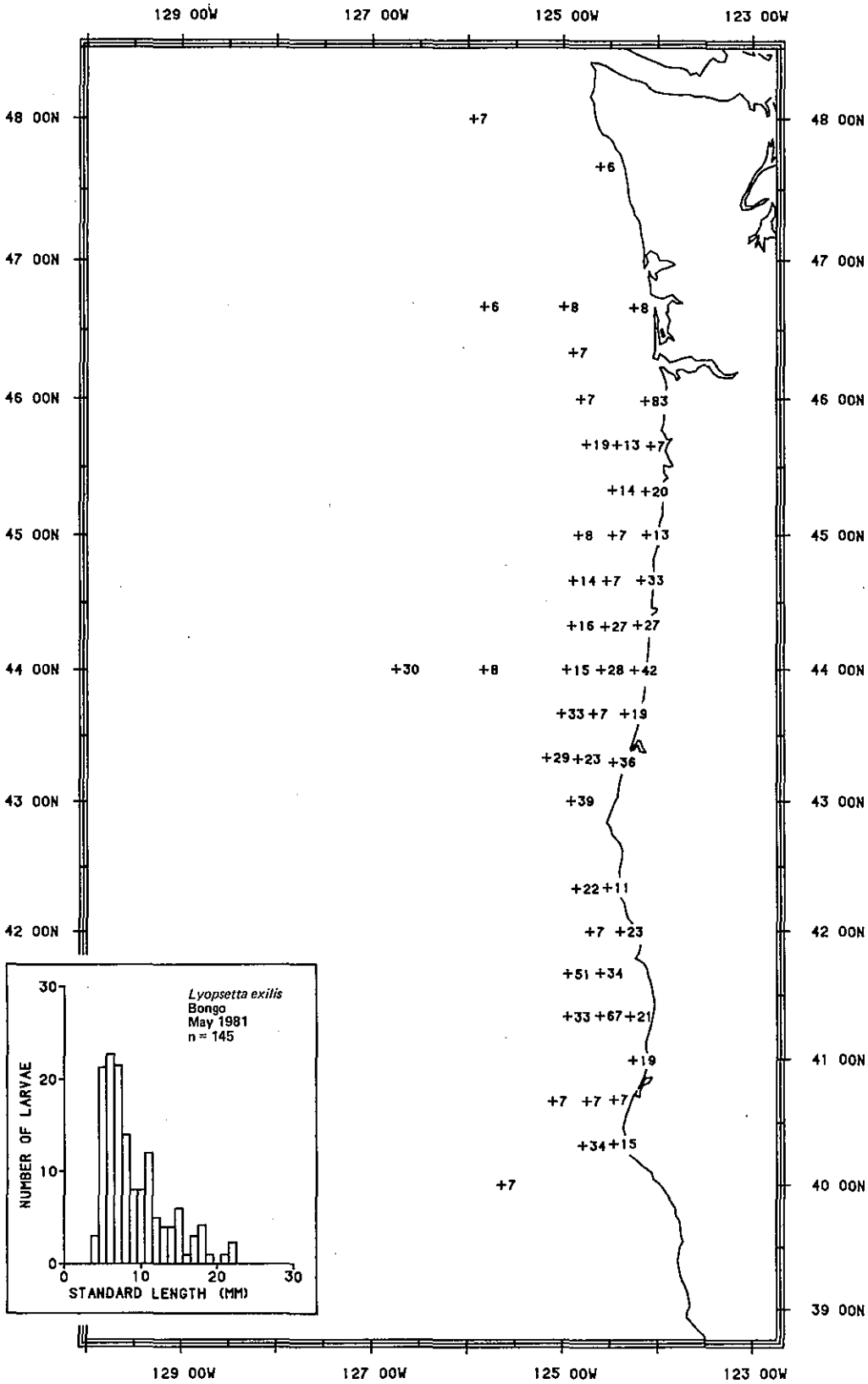

Figure 25.--Distribution and lengths of Lyopsetta exilis from bongo tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 10 m^2.

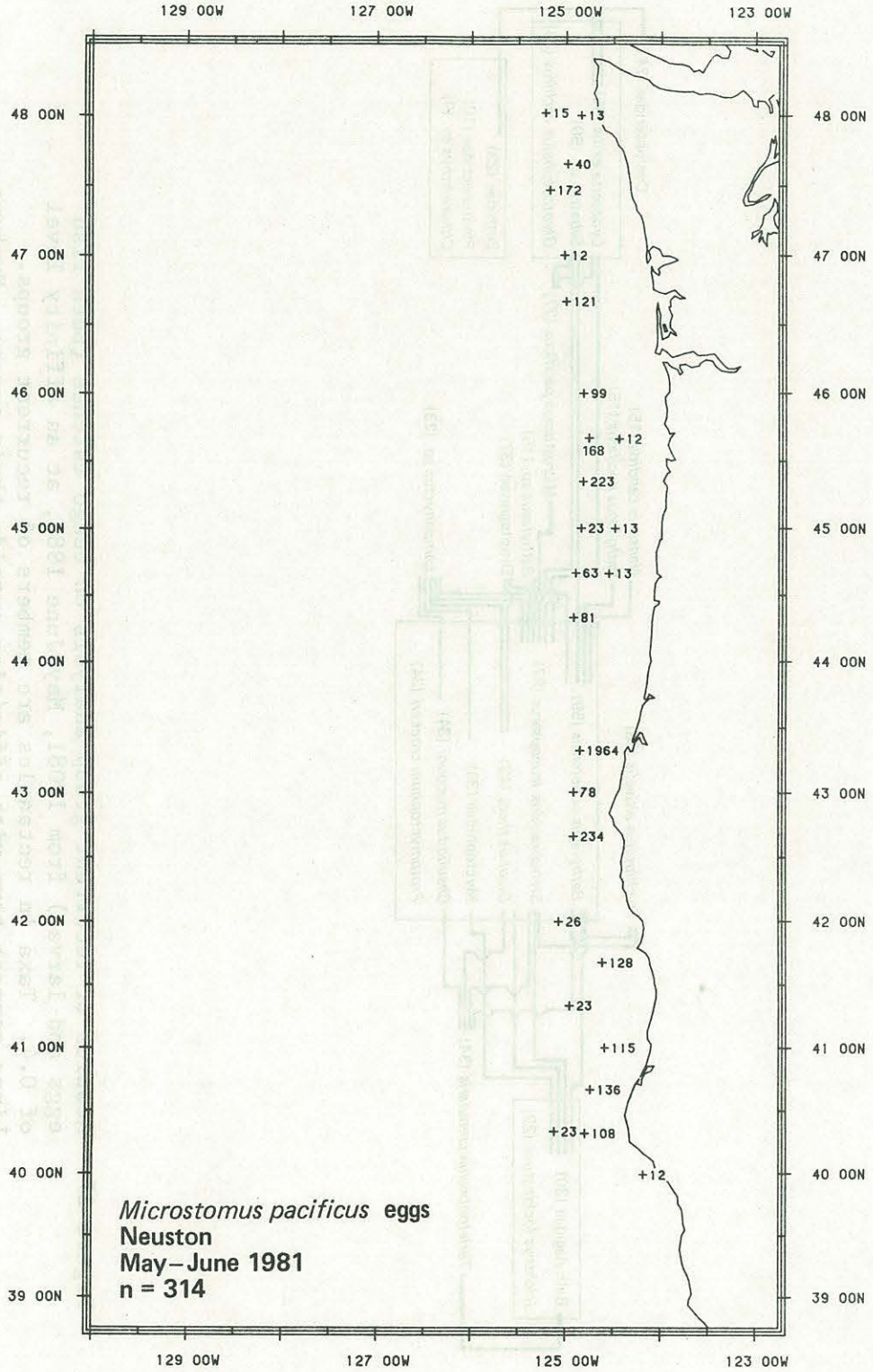

Figure 26.--Distribution of eggs of Microstomus pacificus from neuston tows during cruise 1P081, May-June 1981. Abundance expressed as numbers per 1,000 m^3.

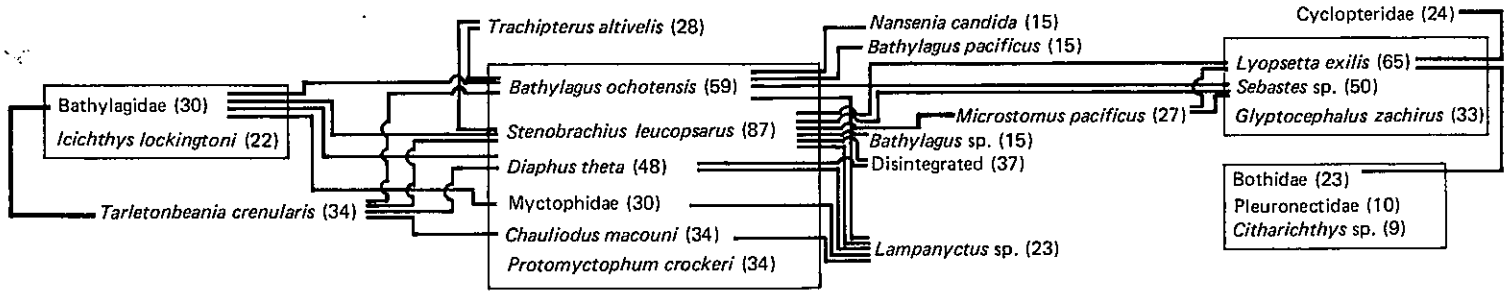

Figure 27.--Results of recurrent group analysis on bongo catches (both fish eggs and larvae) from 1P081, May-June 1981, at an affinity level of 0.4. Taxa in rectangles are members of recurrent groups. Lines connect taxa with affinities outside their groups. Numbers in parentheses following taxa names are the numbers of occurrences of that taxon.