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Ichthyoplankton off Washington, Oregon and Northern California October—November 1981

June 1984

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By

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INTRODUCTION

This report describes the fourth in a series of cooperative U.S.-U.S.S.R. ichthyoplankton surveys conducted off the U.S. west coast from 48°-40°N. Earlier reports dealt with the cruise of the R/V TIKHOOKAENSKIY in April-May 1980 (Kendall and Clark 1982a), the cruise of the R/V POSEYDON in August 1980 (Kendall and Clark 1982b) and the cruise of the R/V POSEYDON in May-June 1981 (Clark, in prep). These surveys are designed to determine seasonal and spatial distributions 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 125 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 nearshore than offshore. The Soviet Research vessel MYS DALNYI with Dr. Demidenko serving as chief scientist occupied these stations basically from north to south from 24 October to 19 November 1981. At each station hydrographic casts at standard depths (0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500, and 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. Flowmeters 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 logarithm 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 19 taxa of eggs and 46 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.

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, logarithm of number in survey area, and mean number per 1,000 m^3 (for neuston) and mean number per 10 m^2 (for bongo). Average lengths of larvae are calculated and expressed as the mean plus or minus one standard deviation.

In the neuston net, eggs of Bothidae dominated catches with Icichthys lockingtoni, Trachipterus altivelis, Citharichthys spp. and Pleuronectidae of secondary abundance, depending on which measurement was used (Figure 2). In the bongo net, eggs of Bothidae, Bathylagidae, and Pleuronectidae dominated, with Citharichthys spp., Icichthys lockingtoni, Trachipterus altivelis, Parophrys vetulus, and Chauliodus macouni also in abundance (Figure 3).

Larval catches in the neuston net were dominated by Cololabis saira and Engraulis mordax, with Hexagrammos decagrammus, Scorpaenichthys marmoratus and Tarletonbeania crenularis of somewhat lesser importance (Figure 4). In the bongo net, Citharichthys spp. and Sebastes spp. larvae dominated, with Tarletonbeania crenularis and Protomyctophum crockeri also in abundance (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.

Engraulis mordax (Figure 6) - Larvae of the northern anchovy, representing the spawning products of the northern subpopulation, were collected at 12 neuston stations and 7 bongo stations. Most stations were located near the Oregon coast south of the Columbia River. Larval lengths were approximately 20±5 mm in both nets. No eggs were collected.

Bathylagidae (Figure 7) - Unidentified eggs of deep-sea smelts were collected in fairly consistent quantities throughout the survey area, occurring at 35% of the stations sampled.

Protomyctophum crockeri (Figure 8) - Larvae of flashlightfish were collected in bongo tows mainly in the southern two-thirds of the survey area. Larval lengths were 9±3 mm. Four juveniles were collected at 3 bongo stations and averaged 23±6 mm in length.

Tarletonbeania crenularis (Figure 9) - Larvae and juveniles of blue lanternfish were collected in moderate numbers throughout the survey area. Larval lengths were about 33±9 mm.

Cololabis saira (Figure 10) - Saury larvae were widely distributed in neuston catches along the Washington coast and throughout the survey area south of the Columbia River. Larval lengths averaged 19±8 mm. Saury juveniles were also very abundant, occurring at 29% of stations. Juvenile lengths ranged from 21 to 143 mm and averaged 55±20 mm. Four eggs were captured at a singled neuston station.

Trachipterus altivelis (Figures 11 and 12) - Eggs of king-of-the-salmon were taken in neuston and bongo catches throughout the survey area. One larva was collected in bongo nets but was too damaged to be measured.

Icichthys lockingtoni (Figure 13 and 14) - Eggs of medusa fish were widely distributed throughout the survey area and in moderate abundance in both neuston and bongo catches. Larval lengths averaged 9±3 mm.

Sebastes spp. (Figures 15) - Rockfish larvae were most often taken rather nearshore in bongo catches but also were found to some extent offshore. Fifteen larvae were collected at 10 stations in neuston tows. Lengths averaged 4±2 mm in bongo catches and 16±7 mm in neuston catches.

Hexagrammos decagrammus (Figure 16) - Larvae of the kelp greenling were found at extreme nearshore stations toward the southern end of the survey area in neuston collections. Lengths averaged 9±2 mm.

Scorpaenichthys marmoratus (Figure 17) - Cabezon larvae occurred generally nearshore in neuston catches and with moderate station abundances. Lengths were 8±2 mm.

Bothidae (Figure 18 and 19) - Unidentified eggs of lefteye flounder were collected at nearshore stations north of Cape Blanco in both neuston and bongo nets. A strong gradient in abundance is evident, with extreme nearshore stations having highest abundances. 58% and 44% of nearshore stations north of Cape Blanco were positive for bothid eggs in neuston and bongo collections respectively.

Citharichthys spp. (Figure 20 and 21) - Sanddab eggs were found in neuston and bongo catches all along the coast and in moderate abundance. Larvae were taken in low to moderate abundance but occurred further offshore than did eggs. Larval lengths averaged 5 mm with a coefficient of variation of 1.0 to 1.5 for both nets.

Citharichthys sordidus (Figure 22) - Pacific sanddab larvae were widely distributed along the coast in bongo catches where they occurred in moderate abundance. Positive stations tended to be near the coast. Lengths of larvae averaged 11±5 mm.

Pleuronichthys decurrens (Figures 23 and 24) - Eggs of curlfin sole were found in neuston and bongo catches all along the coast but typically at extreme nearshore stations. One larva was taken at a single neuston station and was 22 m in length.

Teleost type G (Figure 25) - Eggs of this unidentified teleost were taken throughout the survey area in relatively moderate abundances.

Community Structure

Recurrent group analysis at a 0.4 affinity level revealed no affinities in larvae of bongo catches, in eggs and larvae of bongo catches, or in eggs and larvae of neuston catches.

ACKNOWLEDGMENTS

We wish to thank the Soviet scientists, officers, and crew aboard the Soviet research vessel MYS DALNYI for their cooperative help at sea. Also, we wish to thank: Jay Clark and Steve Moulton who served as American scientists aboard the cruise; Jay Clark for data processing; Jim Peacock and his staff for drafting; Darlene Blythe and her staff for word processing; and Ethel Zweifel and her staff for printing and binding.

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Figure 25.--Distribution of eggs of Teleost Type G from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

STATION	POSITION LAT. N.	LONG. W.	DATE YYMMDD	AREA KM2	BONGO STATIONS TIME GMT	BONGO STANDARD HAUL FACTORS* A	B	NEUSTON STATIONS TIME GMT	NEUSTON STANDARD HAUL FACTORS* A	B
G001A	48 0.2	124 49.0	811024	719.	1900	4.525	13.711	1803	0.020	13.365
G002A	48 1.0	125 8.0	811024	872.	2132	5.953	4.687	2110	0.022	14.657
G003A	48 1.5	125 27.0	811025	1102.	123	3.994	3.195	113	0.031	20.773
G004A	48 1.0	125 48.0	811025	2345.	429	6.167	2.882	413	0.023	15.616
G005A	48 1.9	126 13.0	811025	2527.	900	4.680	2.854	815	0.024	16.284
G006A	47 42.0	125 13.0	811025	1742.	1509	4.842	2.783	1450	0.018	11.692
G007A	46 35.3	127 50.0	811025	5602.	915	5.023	2.838	852	0.016	10.369
G008A	46 36.0	128 50.0	811026	5146.	1525	4.887	3.017	1505	0.017	11.650
G009A	47 16.9	127 41.0	811026	3624.	2330	6.345	3.022	2317	0.021	13.850
G010A	47 20.3	127 5.0	811027	5068.	330	6.696	3.086	311	0.018	12.268
G011A	47 19.2	126 8.0	811027	5422.	907	6.959	2.864	825	0.023	15.633
G012A	47 22.8	125 9.0	811027	2064.	1503	4.592	2.456	1436	0.024	15.725
G013A	47 20.4	124 45.0	811027	787.	1810	4.436	4.526	1752	0.021	14.178
G014A	47 38.2	124 51.0	811027	872.	2105	5.596	5.540	2048	0.023	15.080
G015A	47 35.0	124 38.0	811027	680.	2308	4.362	9.087	2250	0.022	14.434
G016A	47 20.0	124 30.0	811028	678.	355	4.986	14.247	355	0.018	12.005
G017A	47 0.0	125 1.0	811028	2085.	1045	5.593	2.811	1012	0.021	13.983
G018A	47 1.3	124 42.0	811028	1087.	1350	5.768	6.554	1338	0.024	16.111
G019A	47 0.0	124 16.0	811028	924.	1638	7.664	22.541	1625	0.017	11.360
G020A	46 38.5	124 17.0	811028	697.	2020	4.079	9.485	2004	0.023	15.093
G021A	46 38.1	124 32.0	811028	961.	2216	5.691	5.173	2200	0.023	15.642
G022A	46 38.6	124 57.0	811029	1928.	116	5.507	2.767	102	0.019	12.724
G023A	46 20.5	124 54.0	811029	1943.	500	5.657	2.886	423	0.019	12.340
G024A	46 20.8	124 33.0	811029	970.	755	5.723	4.506	738	0.022	14.879
G025A	46 20.8	124 11.0	811029	755.	1025	3.809	15.869	1010	0.022	14.711
G026A	46 0.3	124 12.0	811029	677.	1355	5.644	7.525	1340	0.020	13.342
G027A	46 0.1	124 25.0	811029	887.	1556	5.987	4.908	1540	0.016	10.995
G028A	46 0.9	124 49.0	811029	1951.	1902	6.691	3.069	1845	0.018	12.332
G029A	46 0.4	125 48.0	811030	5140.	55	5.546	2.844	35	0.020	13.356
G030A	46 38.3	125 54.0	811030	5443.	613	6.631	3.113	543	0.021	13.713
G031A	46 34.0	126 51.0	811030	5848.	1200	5.396	2.398	1145	0.020	13.076
G032A	45 59.2	126 46.0	811030	5558.	1845	6.513	2.760	1827	0.019	12.438
G033A	45 58.0	127 50.0	811031	5345.	1725	6.722	3.069	1708	0.020	13.065
G034A	46 0.8	128 43.0	811031	5097.	2320	4.269	2.635	2301	0.018	12.205
G035A	45 19.0	128 33.0	8111 1	5482.	545	5.823	3.064	527	0.020	13.327
G036A	45 20.5	127 38.0	8111 1	5287.	1047	7.609	3.280	1032	0.022	14.541
G037A	45 20.1	126 40.0	8111 1	5213.	1617	6.646	3.150	1601	0.015	10.212
G038A	45 20.7	125 49.0	8111 1	5117.	2132	6.889	3.328	2113	0.020	13.070
G039A	45 38.0	124 51.0	8111 2	2340.	310	4.705	3.095	251	0.017	11.645
G040A	45 40.2	124 24.0	8111 2	1104.	640	5.845	5.266	545	0.017	11.166
G041A	45 40.0	124 5.0	8111 2	774.	845	6.270	9.646	825	0.019	12.370
G042A	45 21.5	124 6.0	8111 2	855.	1200	5.913	6.720	1115	0.019	12.930
G043A	45 21.1	124 28.0	8111 2	1044.	540	7.651	3.526	1455	0.016	10.862
G044A	45 20.0	124 49.0	8111 2	1893.	240	6.474	3.221	2221	0.018	11.978
G045A	44 59.0	124 49.0	8111 3	2001.	208	9.023	3.683	147	0.021	13.673
G046A	45 0.3	124 27.0	8111 3	1008.	630	5.732	2.525	450	0.023	15.050
G047A	44 59.5	124 7.0	8111 3	767.	900	4.798	7.496	831	0.024	16.121
G048A	44 40.7	124 14.0	8111 3	919.	1214	4.708	9.416	1152	0.021	14.132
G049A	44 40.0	124 32.0	8111 3	979.	1505	5.254	4.073	1439	0.019	12.704
G050A	44 41.0	124 53.0	8111 3	2031.	2320	5.418	2.617	2257	0.019	12.980
G051A	44 41.3	125 49.0	8111 4	5524.	540	6.187	2.678	505	0.017	11.373
G052A	44 39.5	126 45.0	8111 4	5376.	1105	5.962	2.592	1047	0.022	14.572
G053A	44 41.7	127 38.0	8111 4	5485.	1616	5.357	2.588	1601	0.018	11.706
G054A	44 40.0	128 35.0	8111 4	5495.	2150	6.787	2.805	2130	0.021	13.706
G055A	44 1.5	128 33.0	8111 5	5389.	310	5.361	2.437	251	0.019	12.497
G056A	44 1.2	127 42.0	8111 5	5719.	910	5.001	2.748	852	0.021	14.275
G057A	44 1.6	126 43.0	8111 5	5645.	1640	6.080	2.587	1625	0.018	11.833
G058A	44 0.0	125 50.0	8111 5	5355.	2310	5.783	2.702	2254	0.018	12.297
G059A	44 20.0	124 52.0	8111 6	2128.	525	6.018	2.675	445	0.016	10.898
G060A	44 19.5	124 32.0	8111 6	1008.	800	6.372	7.002	735	0.016	10.902
G061A	44 20.0	124 12.0	8111 6	768.	1010	4.843	11.006	955	0.019	12.735
G062A	44 0.0	124 15.0	8111 6	832.	1240	4.658	7.637	1225	0.019	12.413
G063A	44 0.0	124 35.0	8111 6	1025.	1515	5.086	4.238	1500	0.017	11.184

* "A" CONVERTS CATCH TO CATCH PER $10 M^2$, "B" CONVERTS CATCH TO CATCH PER $1000 M^3$ (SEE SMITH AND RICHARDSON 1977).

Table 1.--Data associated with bongo and neuston tows during cruise 1DA81, October-November 1981.

STATION	POSITION LAT. N.	LONG. W.	DATE YYMMDD	AREA KM2	BONGO STATIONS* TIME GMT	STANDARD HAUL FACTORS A	B	NEUSTON STATIONS* TIME GMT	STANDARD HAUL FACTORS A	B
G064A	43 58.7	124 57.0	8111 6	1943.	1749	5.688	2.978	1734	0.016	10.850
G065A	43 40.1	124 59.0	8111 6	1880.	2347	5.670	2.779	2331	0.018	12.126
G066A	43 40.3	124 35.0	8111 7	1038.	252	5.317	3.475	233	0.018	11.744
G067A	43 39.7	124 18.0	8111 7	679.	500	4.582	5.951	448	0.017	11.075
G068A	43 20.2	124 29.0	8111 7	760.	750	4.598	6.664	735	0.018	11.718
G069A	43 19.9	124 48.0	8111 7	1037.	1042	5.499	2.722	1000	0.017	11.494
G070A	43 20.2	125 10.0	8111 7	2218.	1335	5.685	2.842	1317	0.019	12.724
G071A	43 19.0	126 4.0	8111 7	5335.	1858	6.655	2.856	1843	0.016	10.359
G072A	43 21.0	127 0.0	8111 8	5798.	24	6.164	2.949	6	0.017	11.217
G073A	43 19.0	127 57.0	8111 8	5682.	705	6.428	2.962	654	0.018	12.083
G074A	43 18.0	128 53.0	8111 8	5907.	1258	5.915	2.844	1215	0.021	13.710
G075A	42 40.0	128 54.0	8111 8	5640.	1810	6.903	2.913	1756	0.018	11.927
G076A	42 40.3	127 58.0	8111 8	5785.	2330	5.332	2.777	2314	0.015	9.855
G077A	42 39.0	127 0.0	8111 9	5844.	510	6.529	2.802	430	0.016	10.840
G078A	42 40.5	126 6.0	8111 9	5451.	1045	5.939	2.788	1000	0.016	10.524
G079A	42 59.9	125 14.0	8111 9	2185.	1634	5.746	2.685	1618	0.017	11.310
G080A	43 0.0	124 52.0	8111 9	1073.	1915	6.586	2.914	1900	0.016	10.952
G081A	42 59.0	124 34.0	811110	703.	56	5.803	8.534	38	0.018	11.837
G082A	42 39.0	124 34.0	811110	751.	455	6.054	6.510	417	0.021	14.128
G083A	42 39.0	124 52.0	811110	901.	730	5.762	2.770	710	0.023	15.169
G084A	42 39.6	125 11.0	811110	1939.	1030	6.645	2.769	1000	0.019	12.809
G085A	42 18.0	125 10.0	811110	2004.	1505	6.120	2.616	1415	0.019	12.916
G086A	42 20.5	124 49.0	811110	1007.	1804	5.089	2.313	1749	0.018	12.307
G087A	42 20.2	124 31.0	811110	693.	2035	5.659	7.164	2019	0.020	13.109
G088A	42 0.1	124 22.0	811110	857.	2342	5.706	9.671	2327	0.018	11.966
G089A	41 59.0	124 43.0	811111	1099.	236	5.712	2.608	220	0.022	14.866
G090A	41 59.7	125 5.0	811111	1827.	610	4.975	2.369	540	0.021	13.895
G091A	41 56.8	125 50.0	811112	5092.	11	5.394	2.684	2353 **	0.021	13.746
G092A	41 59.3	126 46.0	811112	5726.	630	6.574	2.774	600	0.017	11.260
G093A	41 59.5	127 41.0	811112	5984.	1245	5.806	2.765	1230	0.020	13.236
G094A	42 0.0	128 39.0	811112	6129.	1944	6.237	2.599	1912	0.018	12.093
G095A	41 19.5	128 22.0	811113	5653.	157	6.132	2.655	141	0.020	13.148
G096A	41 18.5	127 27.0	811113	5437.	745	7.144	2.989	713	0.018	11.932
G097A	41 19.5	126 36.0	811113	5341.	1245	6.871	2.875	1230	0.020	13.118
G098A	41 19.0	125 44.0	811113	4918.	1831	6.713	2.643	1814	0.021	13.746
G099A	41 1.0	124 54.0	811114	1687.	1837	6.557	2.655	1814	0.017	11.325
G100A	41 20.4	124 51.0	811114	1493.	2200	7.233	2.882	2145	0.018	12.011
G101A	41 39.5	124 56.0	811115	1930.	155	5.343	2.473	137	0.019	12.432
G102A	41 39.0	124 35.0	811115	1007.	515	5.291	2.544	445	0.019	12.510
G103A	41 39.5	124 16.0	811115	733.	740	5.246	11.658	728	0.035	23.563
G104A	41 20.2	124 16.0	811115	966.	1035	5.719	7.332	1020	0.021	14.297
G105A	41 19.7	124 37.0	811115	913.	1250	6.045	2.617	1230	0.024	15.794
G106A	40 59.6	124 37.0	811115	987.	2043	6.364	2.685	2028	0.021	13.800
G107A	41 0.0	124 16.0	811115	861.	2335	4.629	7.233	2319	0.019	12.445
G108A	40 40.0	124 32.0	811116	983.	253	6.543	2.833	235	0.018	11.786
G109A	40 39.8	124 52.0	811116	1033.	645	8.732	3.258	615	0.019	12.376
G110A	40 41.0	125 11.0	811116	2252.	1002	6.160	2.813	935	0.019	12.426
G111A	40 39.5	125 59.0	811116	5203.	1619	3.501	2.244	1603	0.018	11.822
G112A	40 39.5	126 52.0	811116	5240.	2257	8.636	3.222	2213	0.017	11.654
G113A	40 39.8	127 40.0	811117	5301.	530	7.564	3.038	512	0.018	11.720
G114A	40 41.0	128 36.0	811117	5580.	1410	4.455	2.332	1320	0.021	14.037
G115A	39 59.7	129 11.0	811121	5832.	1135	4.636	2.427	1102	0.019	12.835
G116A	40 0.9	128 17.0	811117	5630.	2117	5.905	2.660	2100	0.020	13.169
G117A	40 0.0	127 24.0	811118	5260.	220	6.718	3.184	201	0.018	11.765
G118A	39 59.0	126 33.0	811118	5546.	730	6.460	3.214	705	0.018	12.263
G119A	40 1.0	125 41.0	811118	3974.	1330	6.413	3.190	1256	0.017	11.409
G120A	40 21.0	125 12.0	811118	2108.	1738	4.873	2.332	1704	0.018	12.088
G121A	40 19.0	124 51.0	811118	1057.	2008	5.759	2.679	1948	0.020	13.355
G122A	40 20.8	124 30.0	811118	987.	2339	4.670	2.458	2323	0.020	13.377
G123A	40 0.0	124 51.0	811119	1453.	415	6.503	2.890	337	0.018	11.897
G124A	40 1.0	124 31.0	811119	1040.	735	6.519	2.937	645	0.018	12.218
G125A	39 58.5	124 12.0	811119	848.	1040	5.874	2.732	1105	0.018	11.741

* "A" CONVERTS CATCH TO CATCH PER $10M^2$. "B" CONVERTS CATCH TO CATCH PER $1000M^3$ (SEE SMITH AND RICHARDSON 1977).

** DATE FOR NEUSTON TOW 1 DAY PREVIOUS TO THAT SHOWN.

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	5.60	7.9520	10.4960	9.21
TELEOST TYPE E			9.9044	7.24
TELEOST TYPE F	1.60	8.2195		
TELEOST TYPE G			11.5931	14.77
DISINTEGRATED	4.00	7.6737	10.4065	7.90
ARGENTINIDAE			9.8360	5.74
BATHYLAGIDAE			11.7036	18.09
BATHYLAGUS SP.			11.1525	11.42
BATHYLAGUS OCHOTENSIS	0.80	6.9694	10.4390	7.47
CHAULIODUS MACOUNI	22.40	8.4982	11.3403	12.59
THERAGRA CHALCOGRAMMA			9.5587	9.16
COLOLABIS SAIRA	0.80	7.5799		
TRACHIPTERIDAE	3.20	7.1913		
TRACHIPTERUS ALTIVELIS	49.60	9.3489	11.3491	9.69
ICOSTEUS AENIGMATICUS	0.80	6.7148		
ICICHTHYS LOCKINGTONI	43.20	9.4739	11.2853	10.04
TETRAGONURUS CUVIERI	0.80	6.2171	9.9627	6.66
BOTHIDAE	22.40	10.2035	12.2676	152.09
CITHARICHTHYS SP.	14.40	8.8455	10.7950	27.59
PLEURONECTIDAE	13.60	8.6513	11.0921	61.34
PAROPHRYS VETULUS	8.80	8.3224	10.5567	28.13
PLEURONICHTHYS DECURRENS	6.40	7.3341	8.6363	4.71
PSETTICHTHYS MELANOSTICTUS	4.80	7.5489	9.8063	10.13

Table 2.--Fish eggs collected in bongo and neuston tows during cruise 1DA81, October-November 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	0.80	6.2802	9.5888	8.74
DISINTEGRATED	8.00	8.0226	10.8477	15.07
ENGRAULIS MORDAX	9.60	8.7170	9.8403	7.94
OSMERUS MORDAX			8.8084	6.54
MICROSTOMA MICROSTOMA			8.6972	5.87
BATHYLAGUS MILLERI			10.2197	5.76
BATHYLAGUS OCHOTENSIS			9.7121	5.44
CYCLOTHONE SP.			9.8615	5.66
ARGYROPELECUS LYCHNUS			8.7977	5.71
DANAPHOS OCULATUS			9.8566	6.16
CHAULIODUS MACOUNI			10.5392	6.69
TACTOSTOMA MACROPUS			9.0416	5.42
MYCTOPHIDAE	0.80	7.0503	10.1204	7.58
DIAPHUS THETA			9.8260	5.99
LAMPANYCTUS SP.			9.7780	4.94
LAMPANYCTUS REGALIS			10.0083	6.10
LAMPANYCTUS RITTERI			9.8632	6.65
STENOBRACHIUS LEUCOPSARUS	0.80	7.0472	9.7747	5.86
SYMBOLOPHORUS CALIFORNIENSE	0.80	7.0087		
TARLETONBEANIA CRENULARIS	3.20	7.7900	11.3438	10.45
DIOGENICHTHYS SP.			9.0132	5.34
PROTOMYCTOPHUM CROCKERI			10.9836	9.20
PROTOMYCTOPHUM THOMPSONI			10.3477	6.10
LESTIDIOPS RINGENS			10.7914	9.99
GADUS MACROCEPHALUS			9.0277	5.67
THERAGRA CHALCOGRAMMA	0.80	6.2802		
COLOLABIS SAIRA	52.00	9.2010	9.6557	8.64
TRACHIPTERUS ALTIVELIS			8.6634	4.67
MELAMPHAEIDAE			10.4485	7.83
SEBASTES SP.	8.00	7.9002	11.2235	17.62
SEBASTOLOBUS SP.			9.5337	6.19
HEXAGRAMMOS DECAGRAMMUS	3.20	8.0349		
HEXAGRAMMOS LAGOCEPHALUS	10.40	8.1281		
COTTIDAE	0.80	6.2214		
ARTEDIUS HARRINGTONI			8.6891	5.71
LEPTOCOTTUS ARMATUS	0.80	6.1586		
SCORPAENICHTHYS MARMORATUS	17.60	8.1121		
AGONIDAE			8.5850	5.25
CYCLOPTERIDAE	1.60	6.5320	9.6641	7.58
ICICHTHYS LOCKINGTONI	0.80	6.4572	10.5319	7.42
TETRAGONURUS CUVIERI			10.0142	9.55
CITHARICHTHYS SP.	4.00	7.5611	11.3168	22.12
CITHARICHTHYS SORDIDUS			10.8989	9.57
CITHARICHTHYS STIGMAEUS	0.80	6.3892	10.7692	7.89
GLYPTOCEPHALUS ZACHIRUS			8.7115	5.25
PAROPHRYS VETULUS	0.80	6.3571	9.6434	11.35
PLEURONICHTHYS DECURRENS	0.80	6.2619		
PSETTICHTHYS MELANOSTICTUS			8.6363	4.71

Table 3.--Fish larvae collected in bongo and neuston tows during cruise 1DA81, October-November 1981.

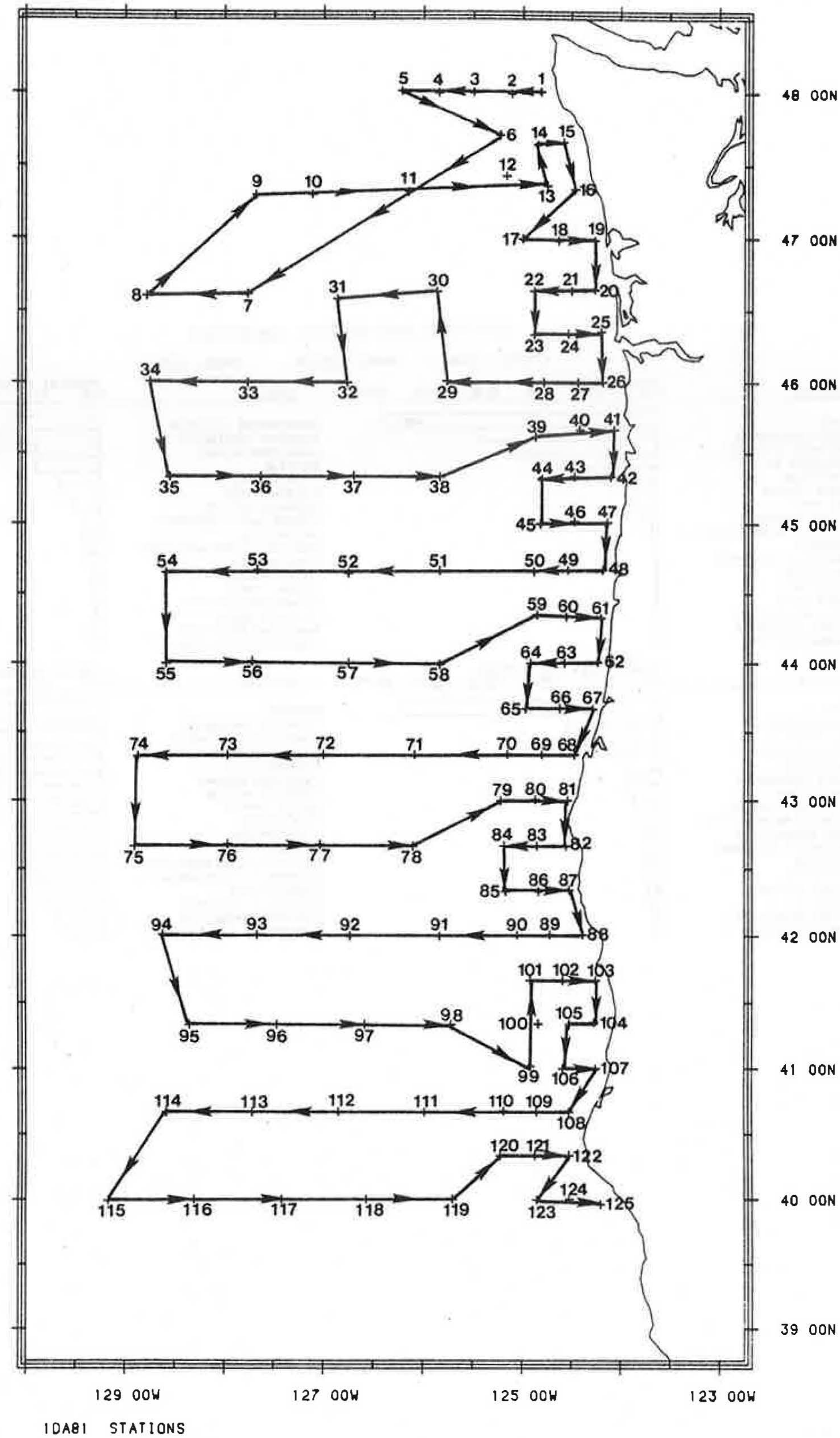

Figure 1.--Station locations and cruise track for cruise 1DA81, October-November 1981.

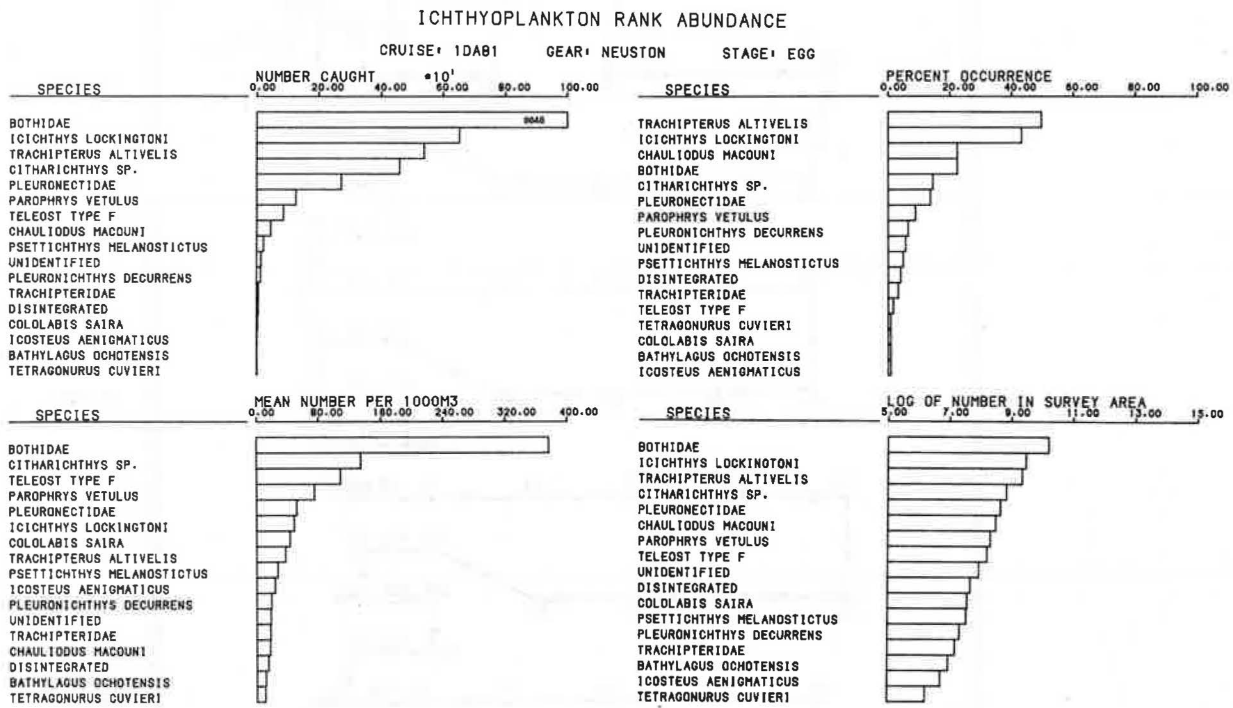

Figure 2.--Rank abundance of eggs caught in neuston tows during cruise 1DA81, October-November 1981.

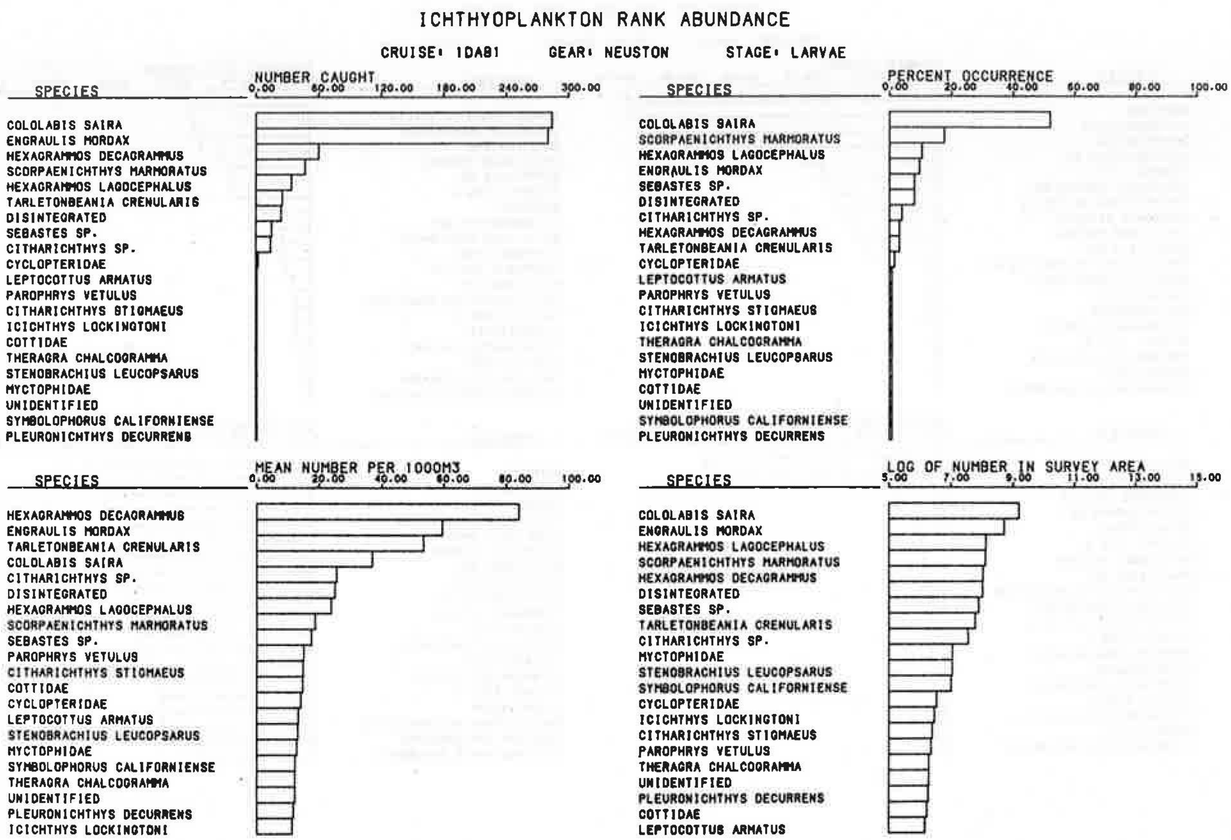

Figure 3.--Rank abundance of larvae caught in neuston tows during cruise 1DA81, October-November 1981.

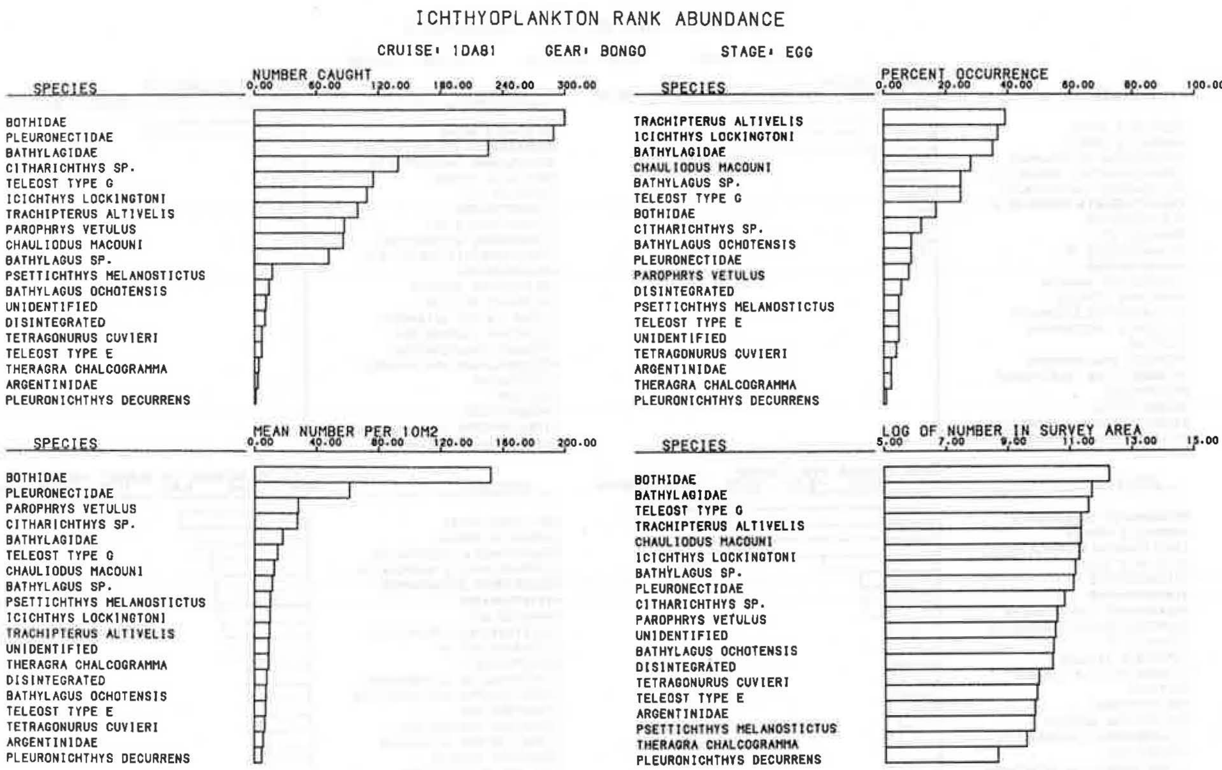

Figure 4.--Rank abundance of eggs caught in bongo tows during cruise 1DA81, October-November 1981.

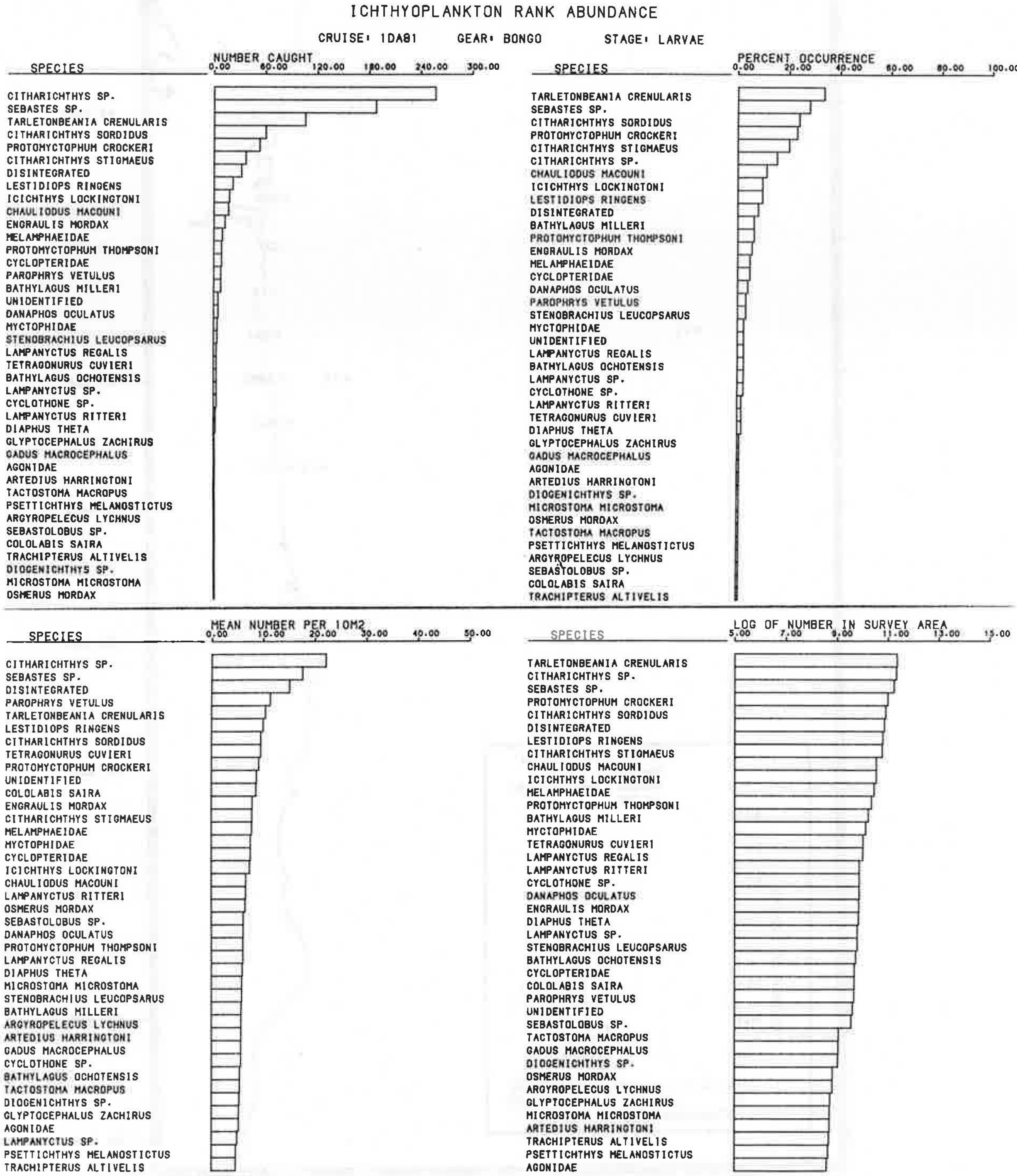

Figure 5.--Rank abundance of larvae caught in bongo tows during cruise 1DA81, October-November 1981.

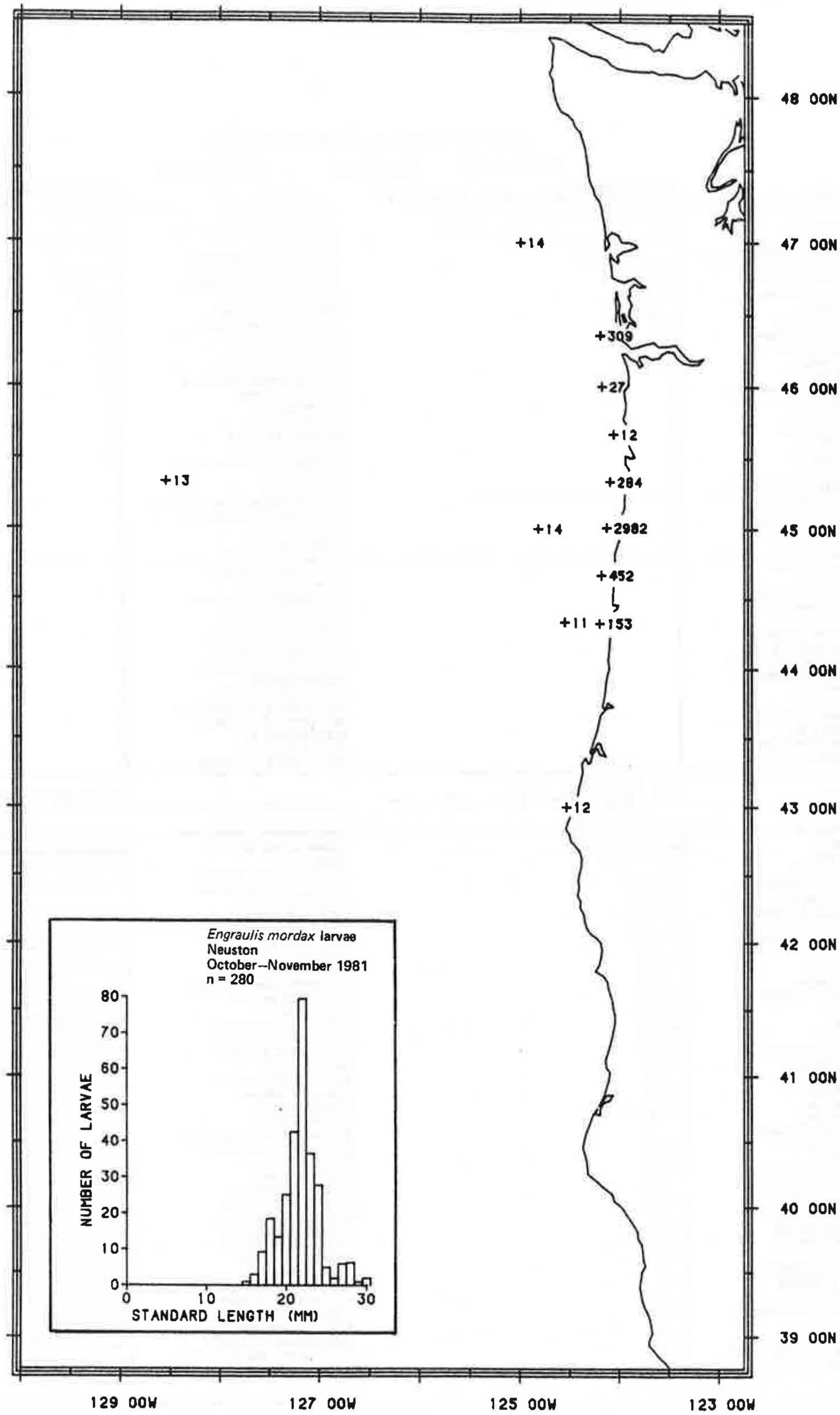

Figure 6.--Distribution and lengths of larvae of Engraulis mordax from neuston tows during cruise 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

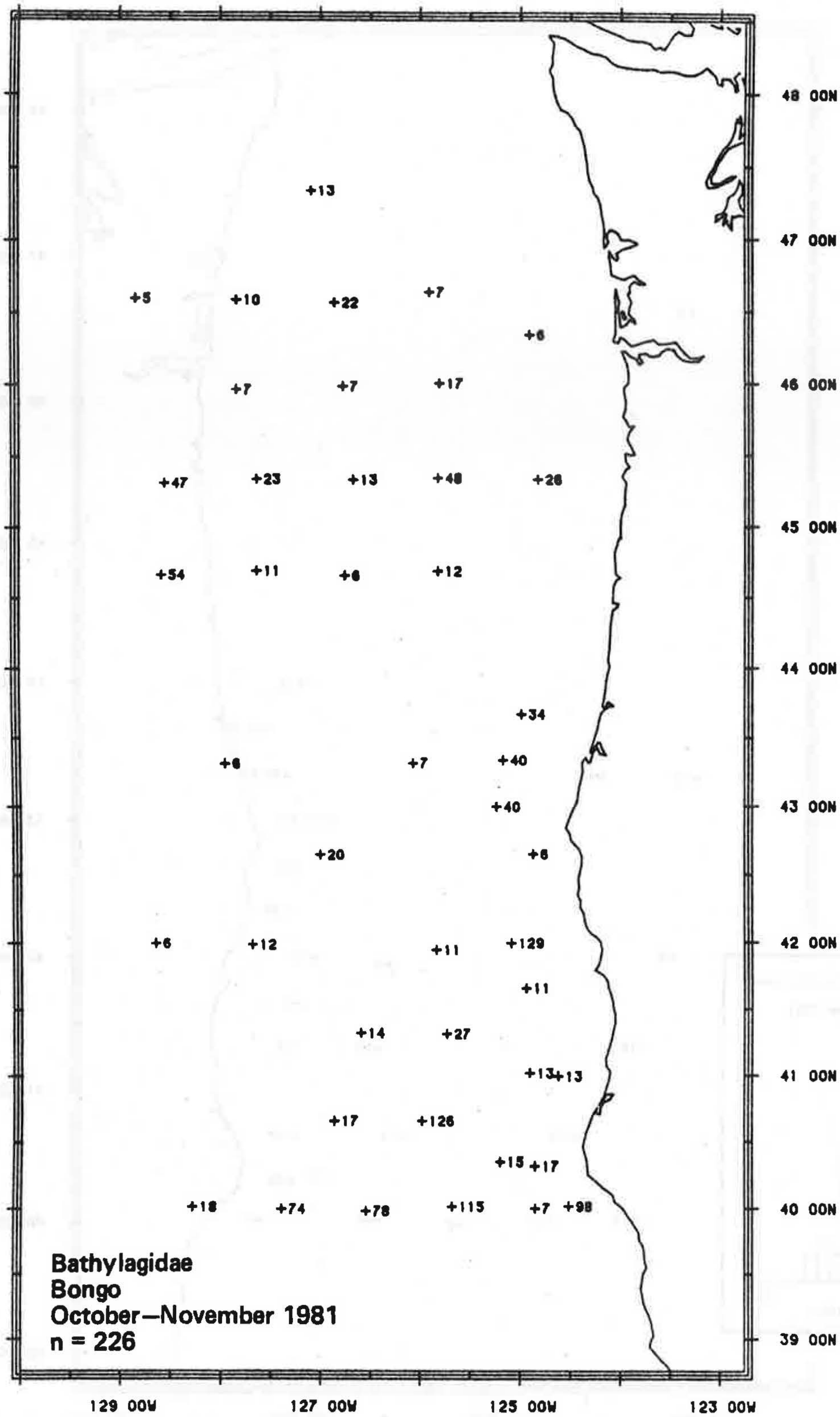

Figure 7.—Distribution of eggs of Bathylagidae from bongo tows during cruise 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

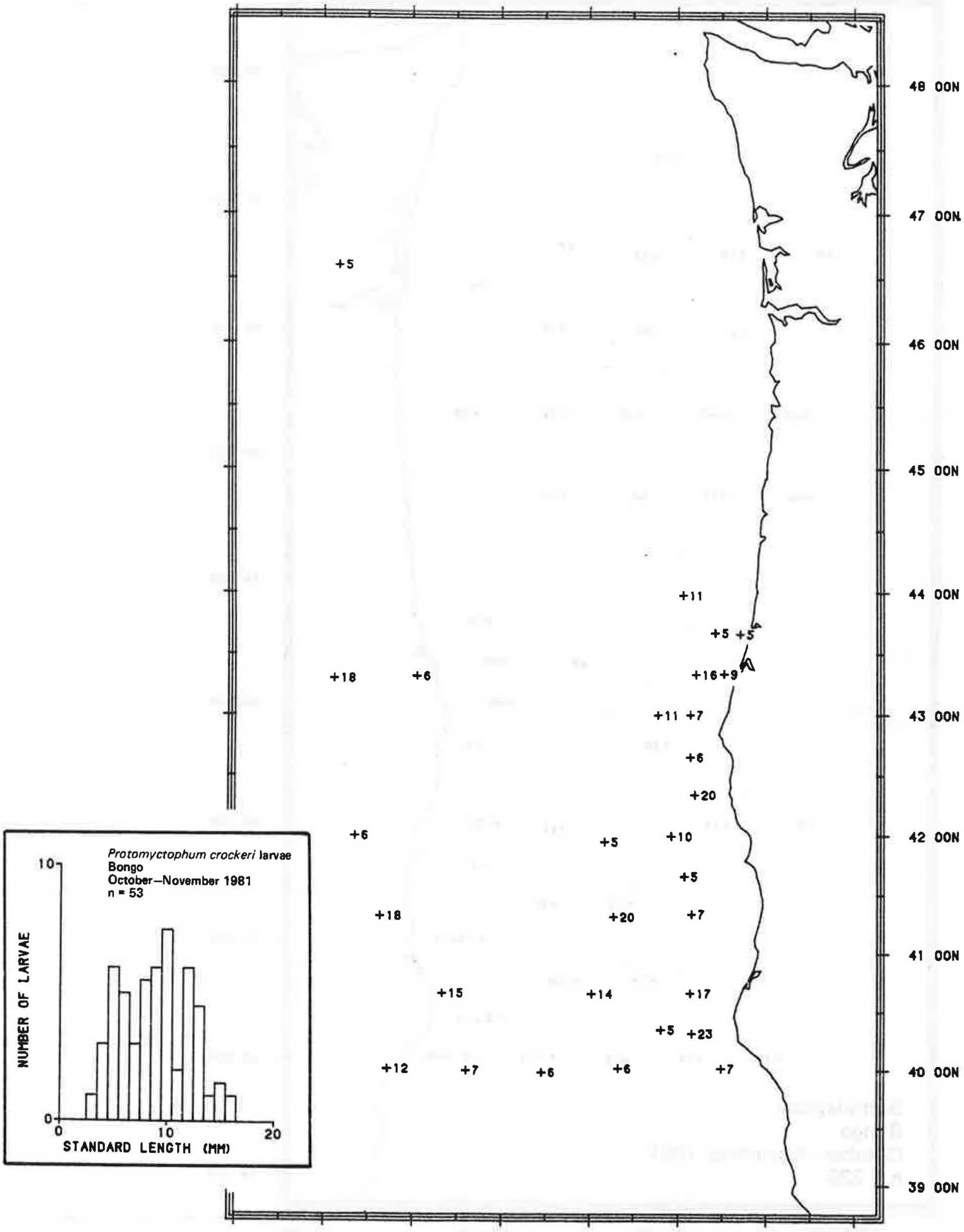

Figure 8.--Distribution and lengths of larvae of Protomyctophum crockeri from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

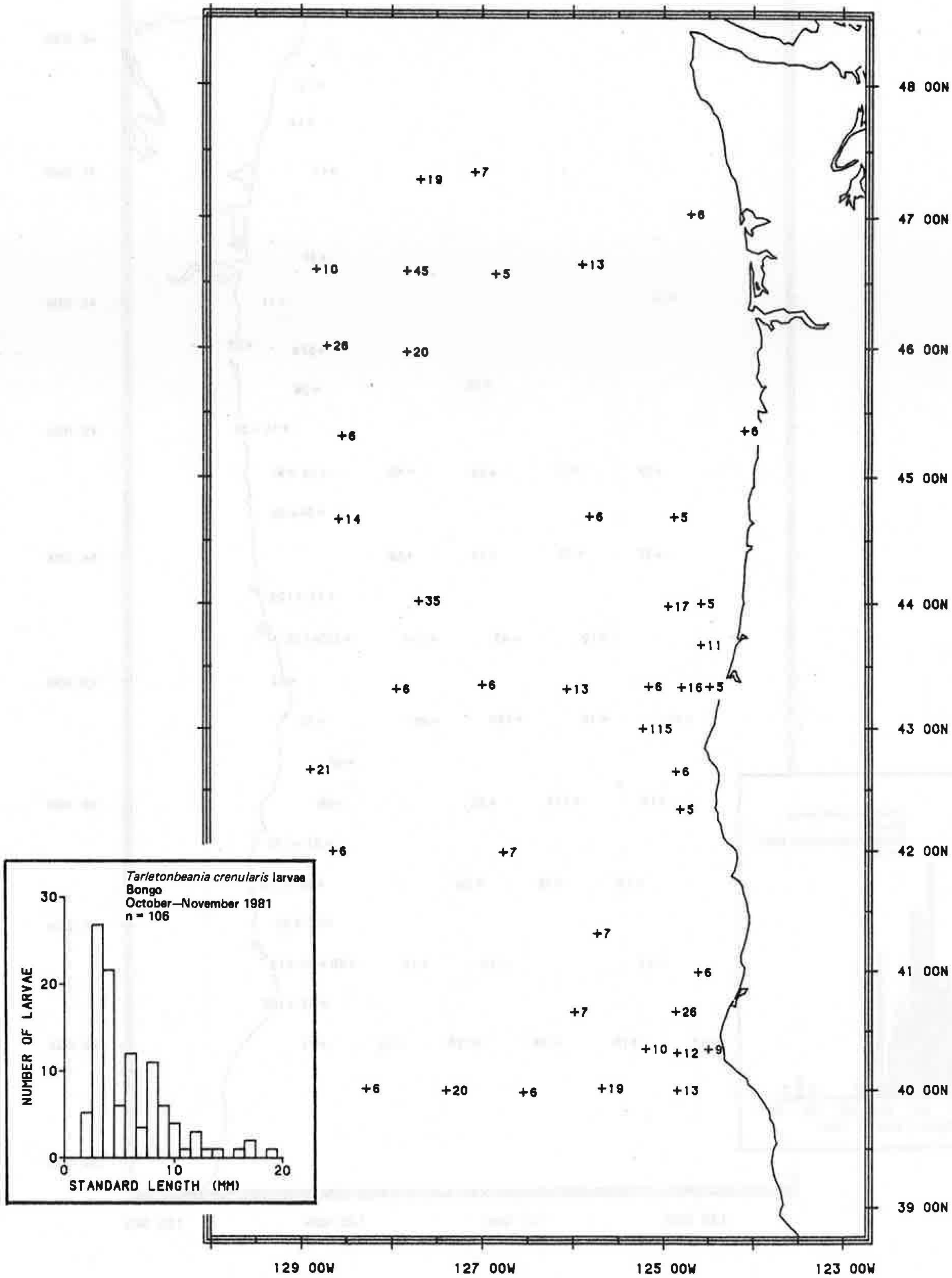

Figure 9.--Distribution and lengths of larvae of Tarletonbeania crenularis from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

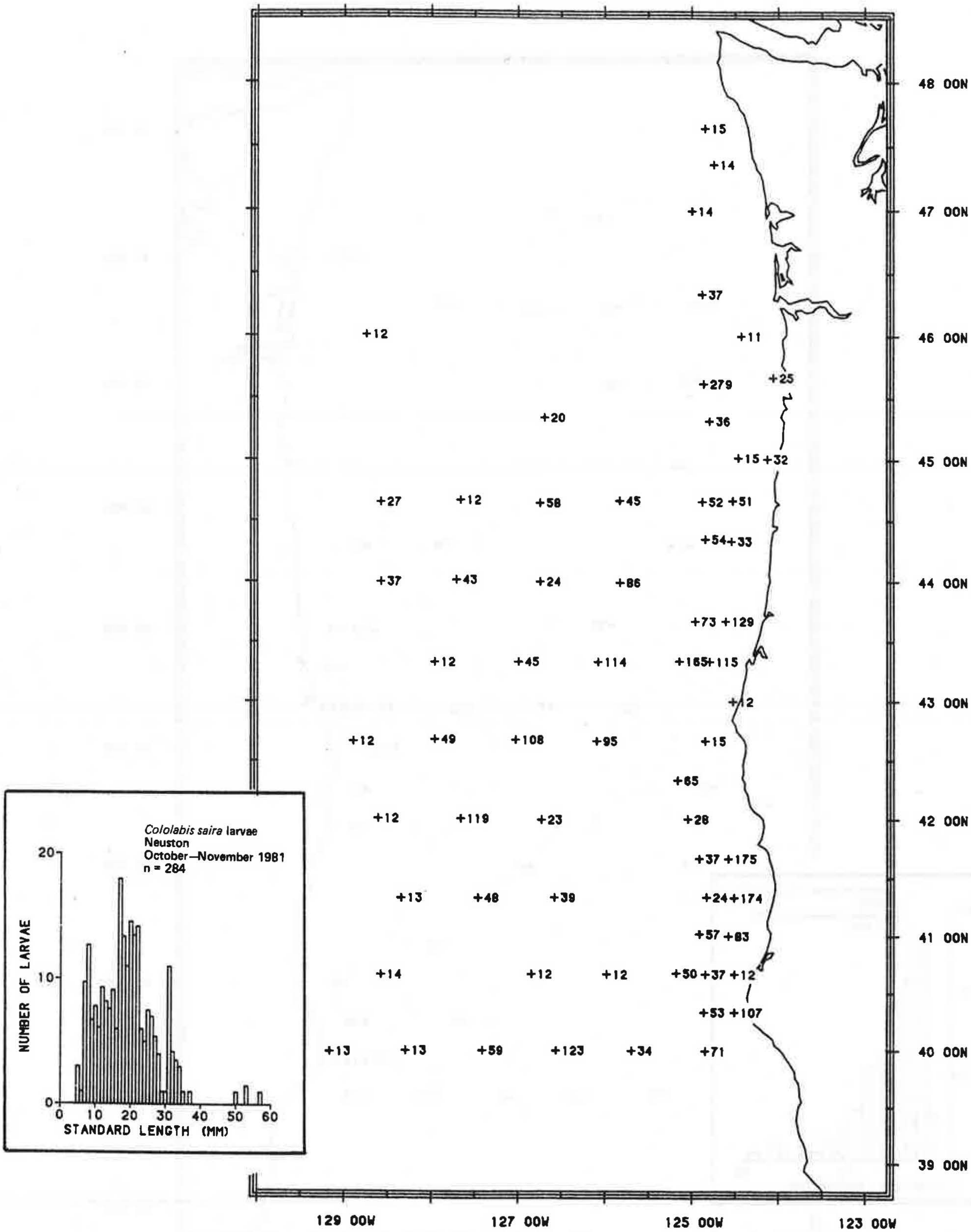

Figure 10.--Distribution and lengths of larvae of Cololabis saira from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

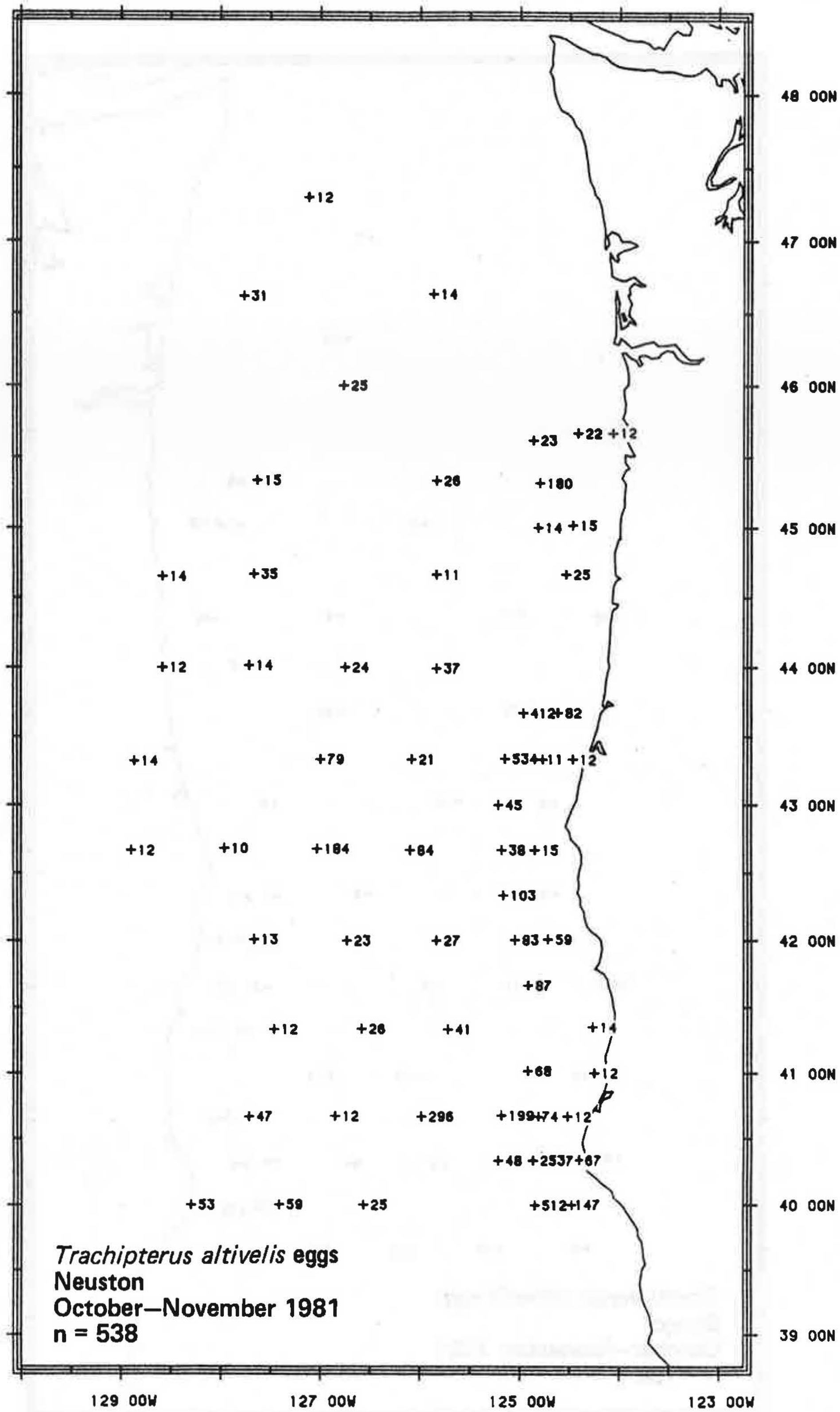

Figure 11.--Distribution of eggs of Trachipterus altivelis from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

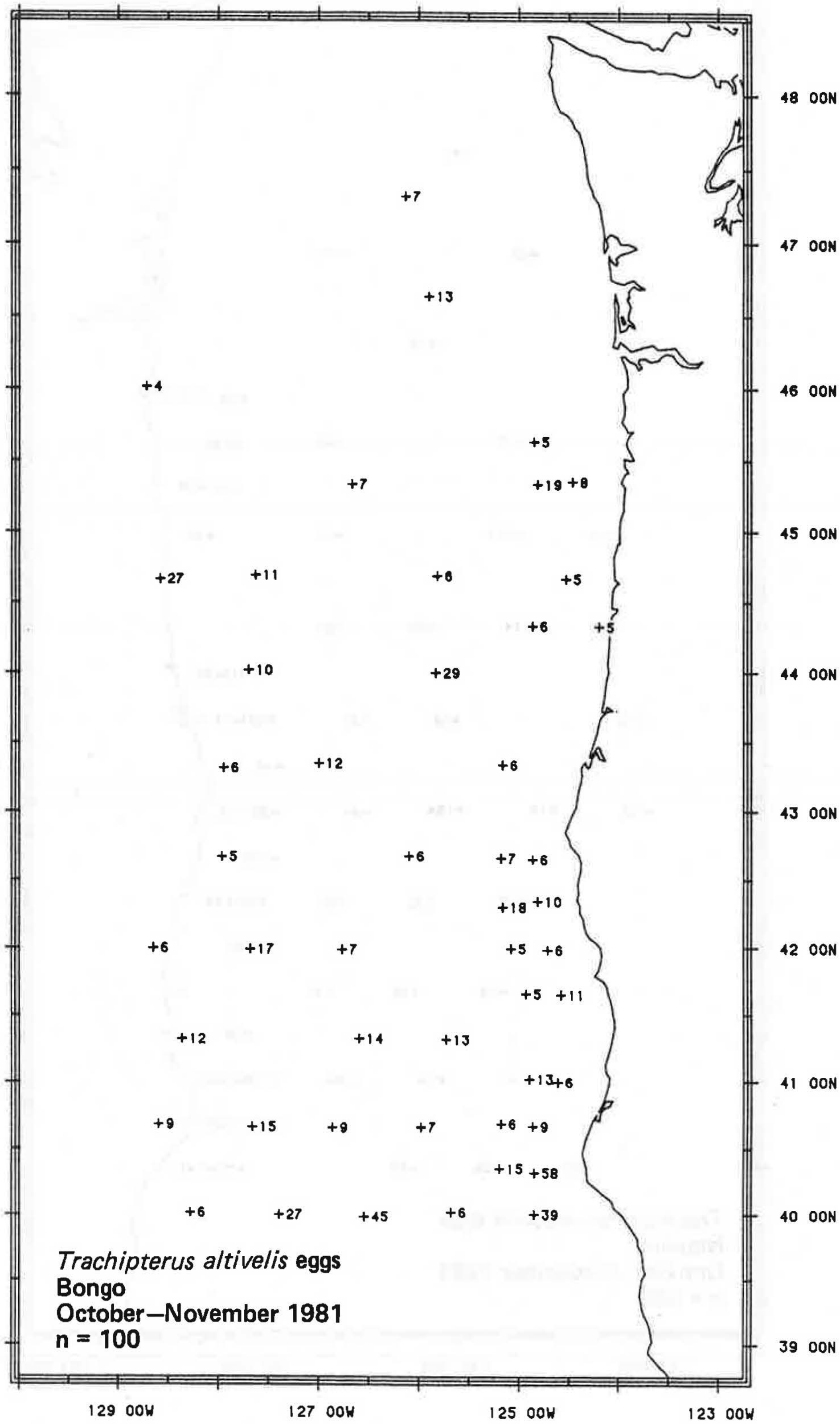

Figure 12.--Distribution of eggs of Trachipterus altivelis from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

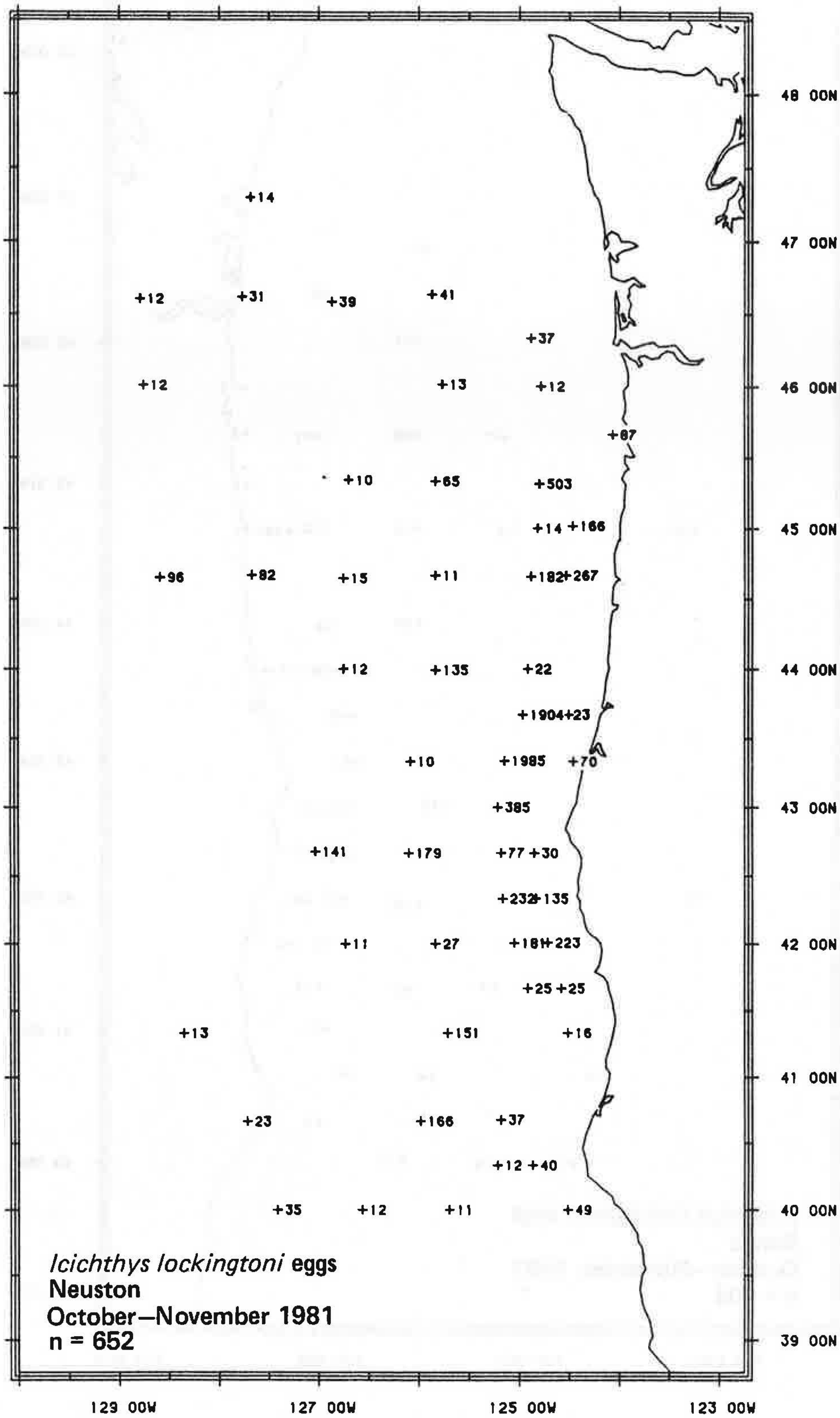

Figure 13.--Distribution of eggs of Icichthys lockingtoni from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

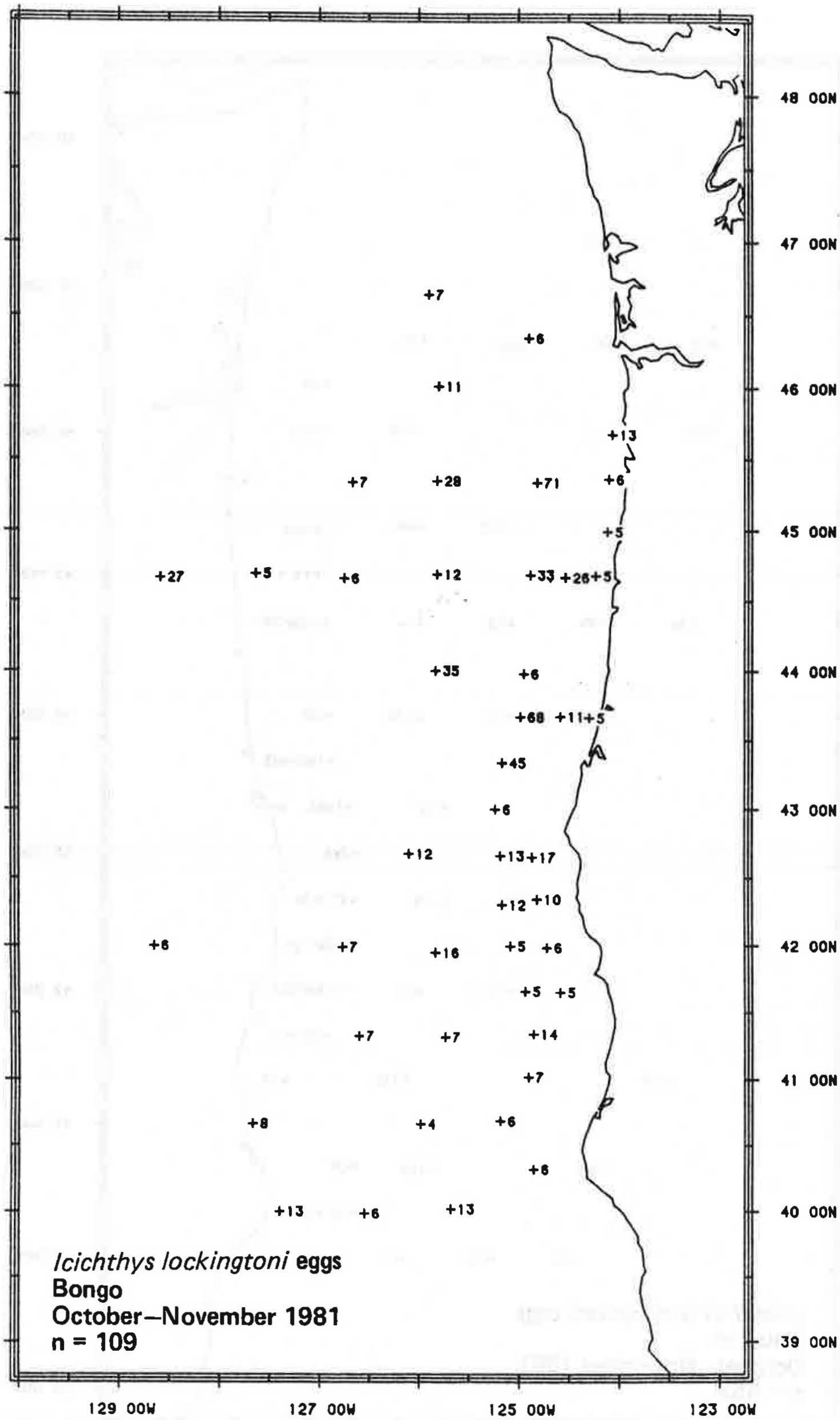

Figure 14.--Distribution of eggs of Icichthys lockingtoni from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

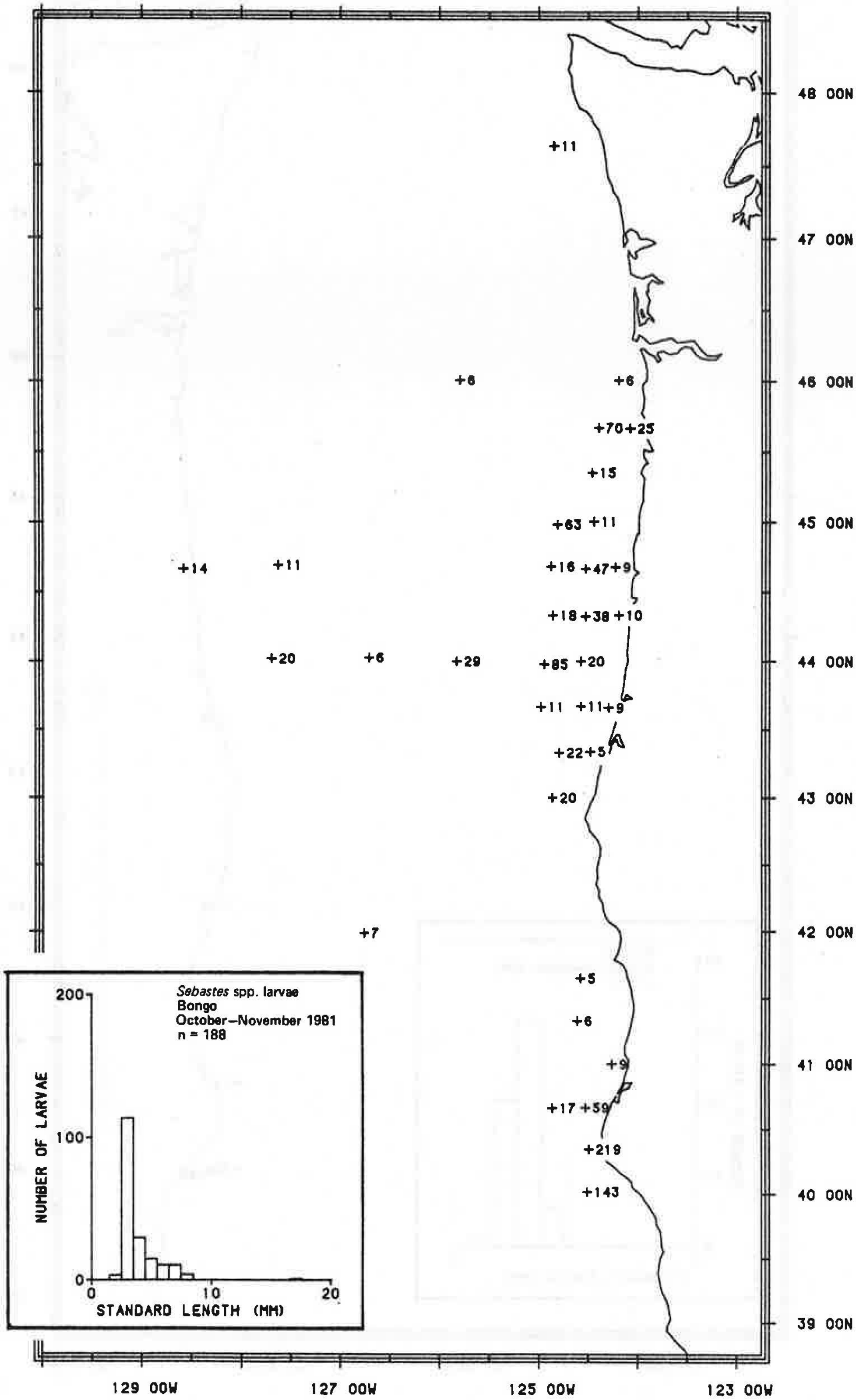

Figure 15.--Distribution and lengths of larvae of Sebastes spp. from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

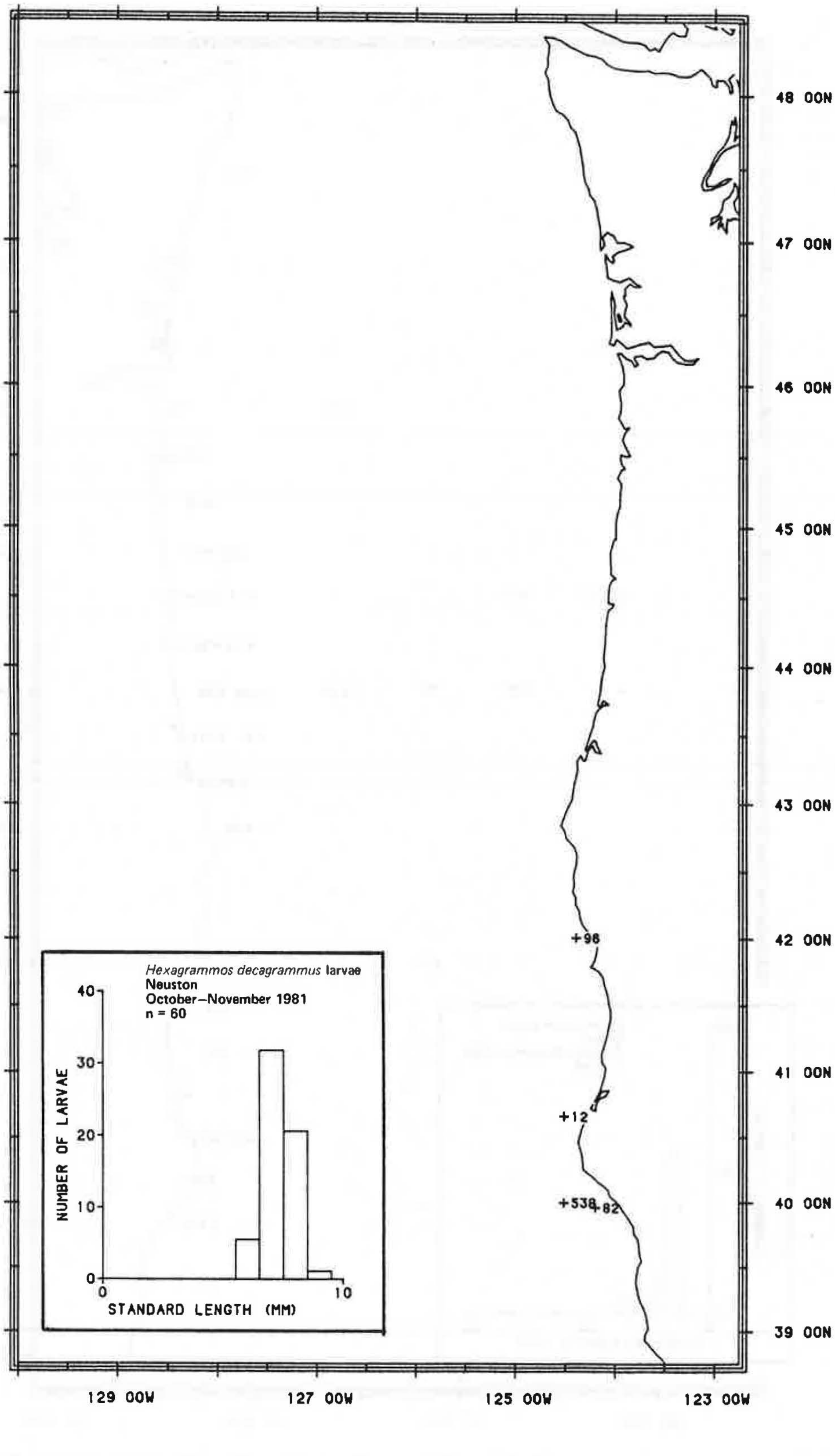

Figure 16.--Distribution and lengths of larvae of Hexagrammos decagrammus from neuston tows during cruise, 1DA81, October–November 1981. Abundance expressed as numbers per 1,000 m^3.

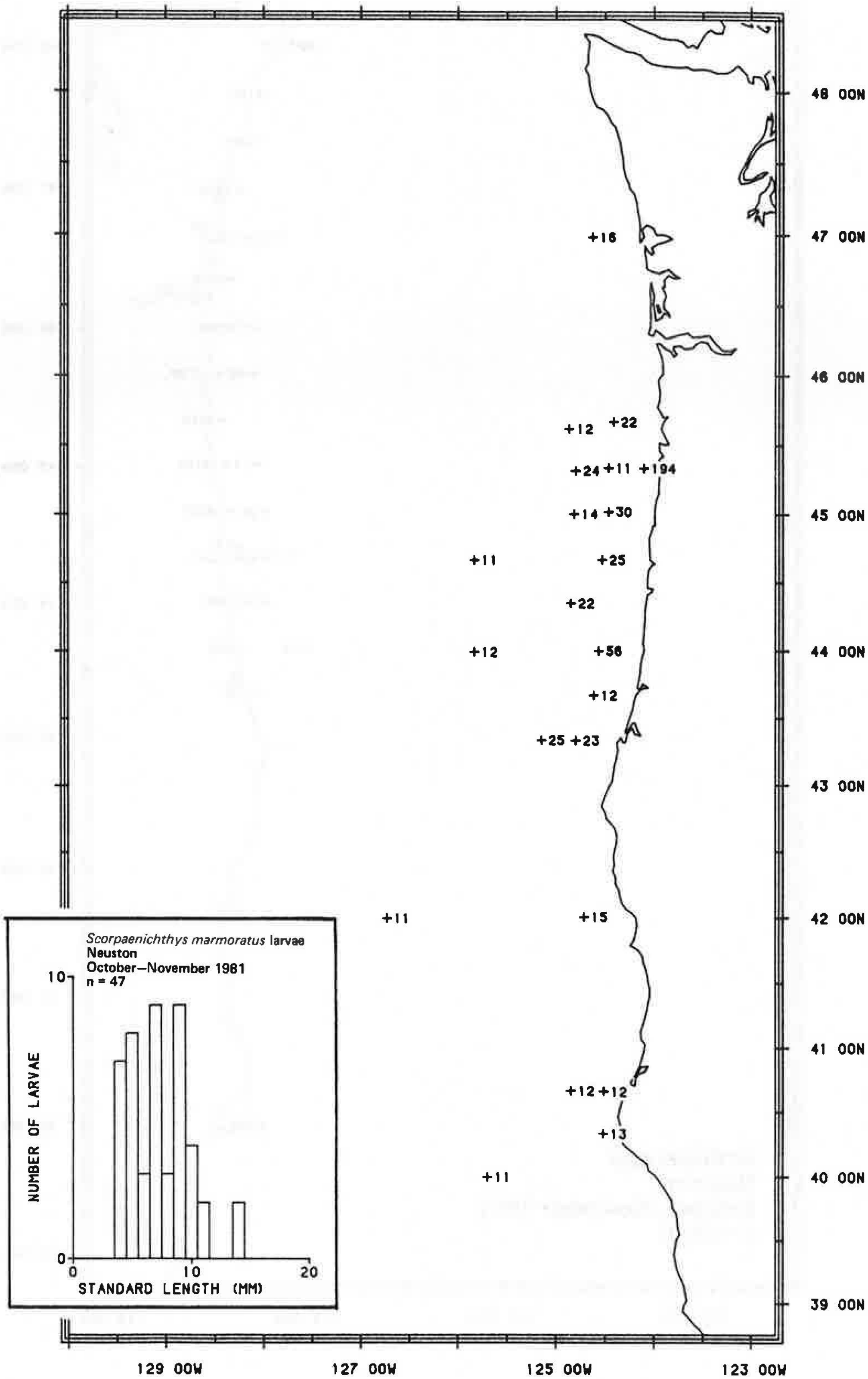

Figure 17.--Distribution and lengths of larvae of <u>Scorpaenichthys marmoratus</u> from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

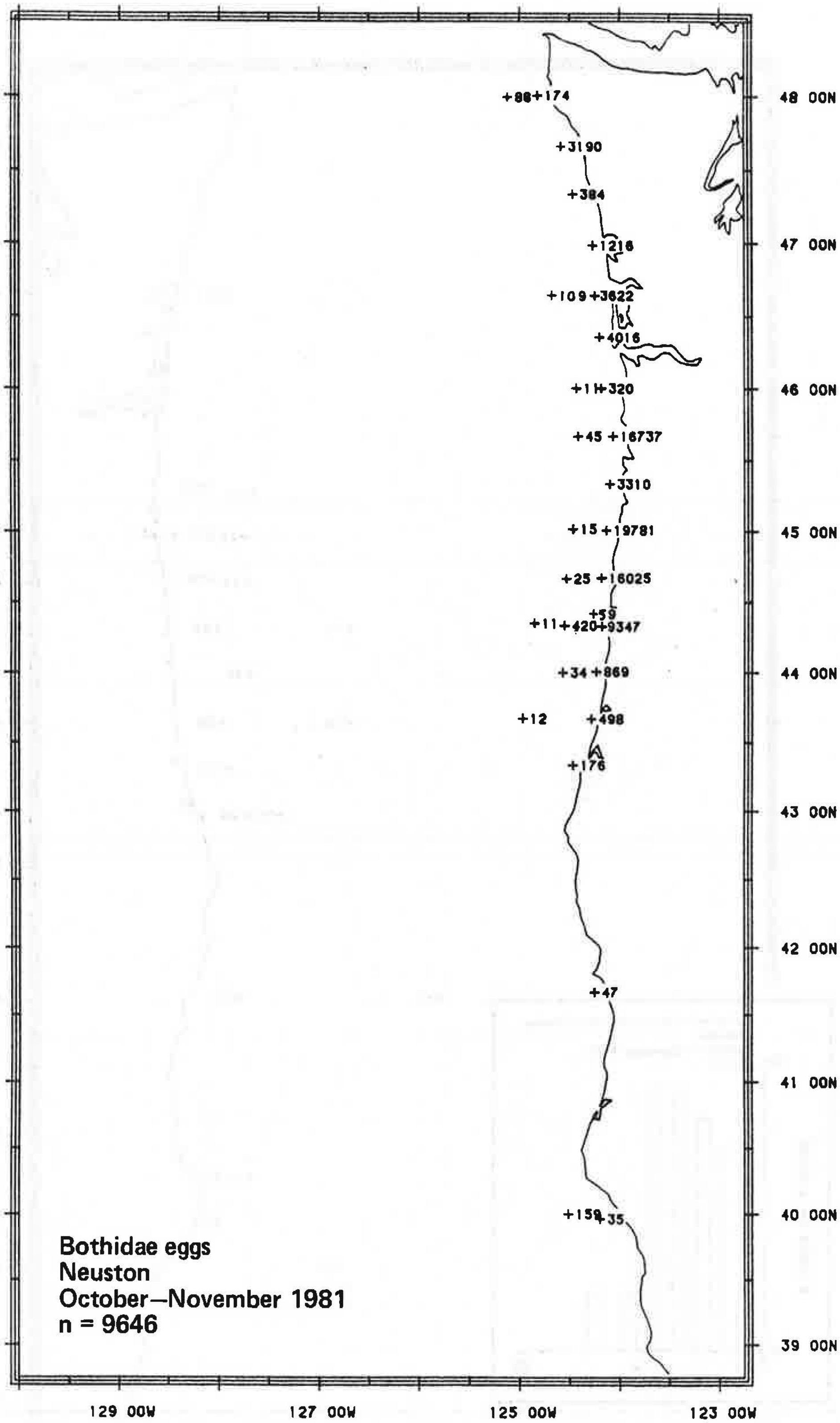

Figure 18.--Distribution of eggs of Bothidae from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

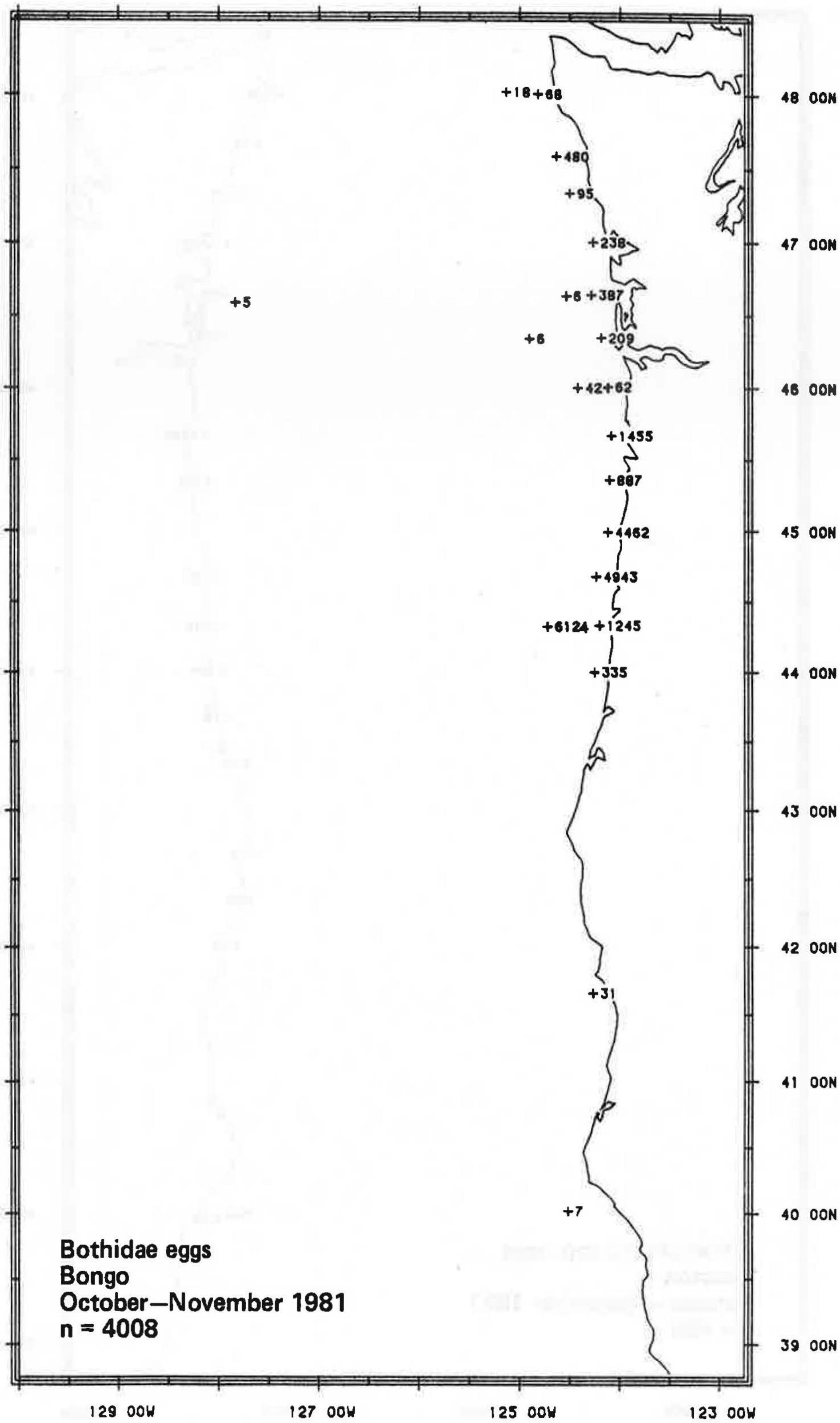

Figure 19.--Distribution of eggs of Bothidae from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

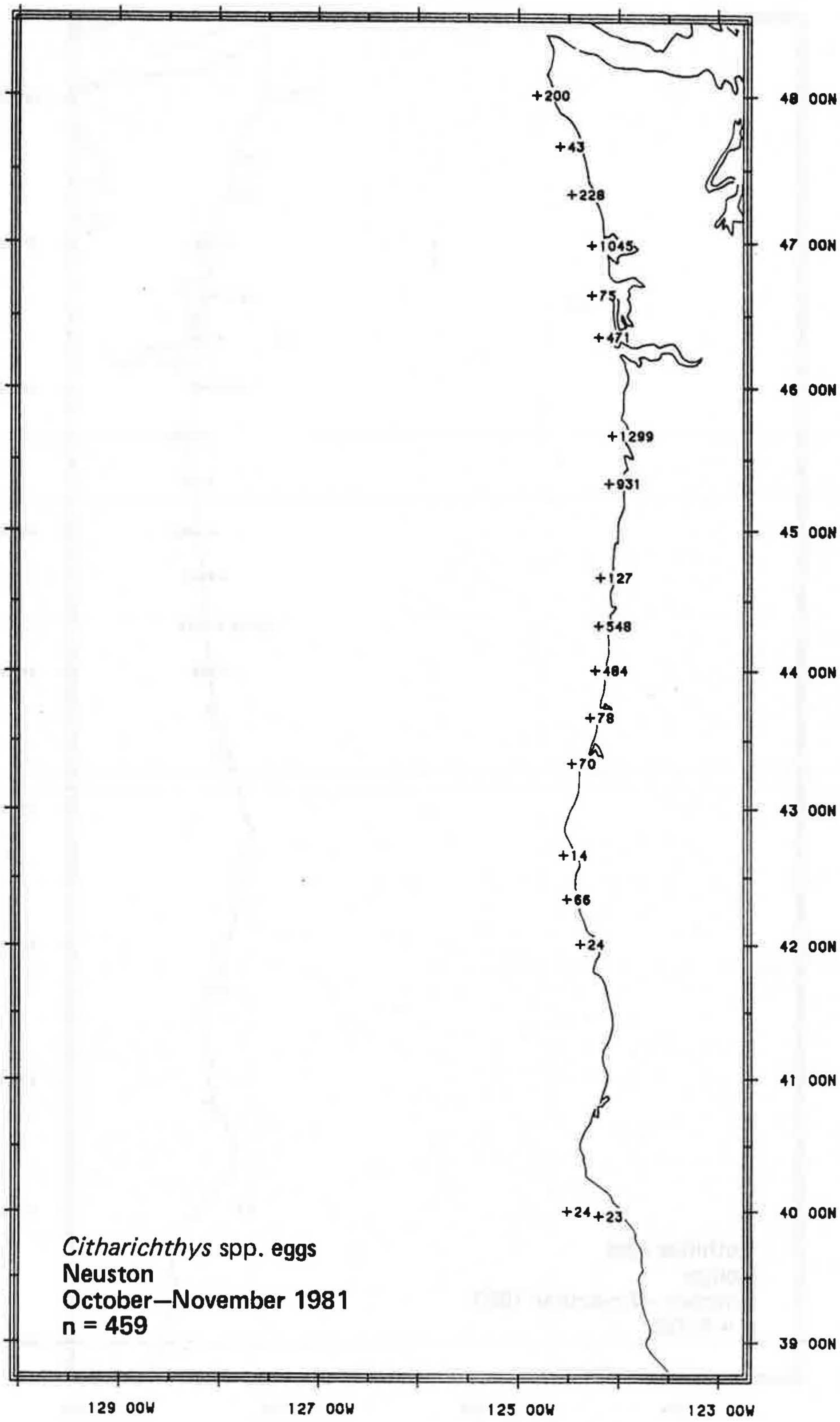

Figure 20.--Distribution of eggs of Citharichthys spp. from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

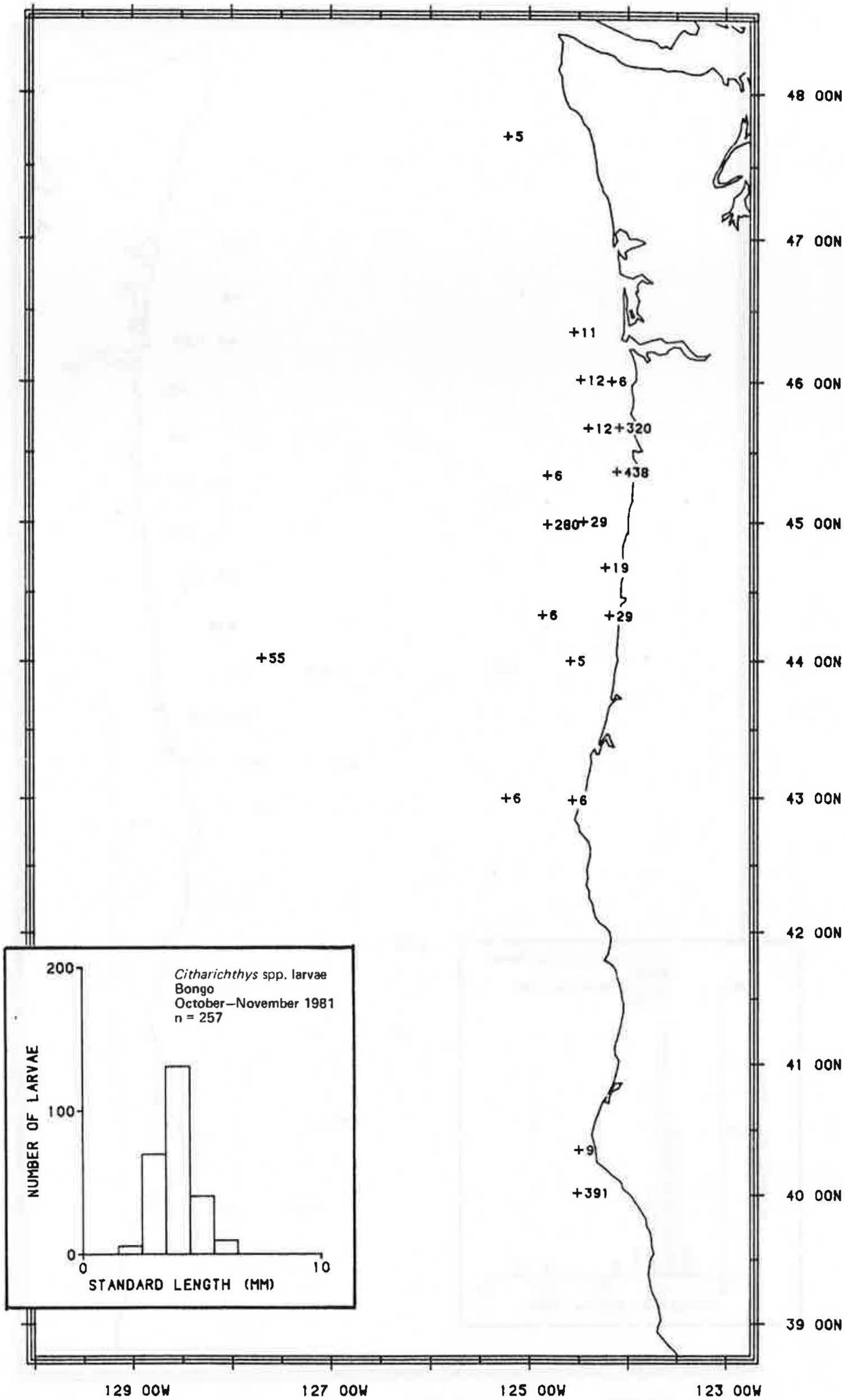

Figure 21.--Distribution and lengths of larvae of Citharichthys spp. from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

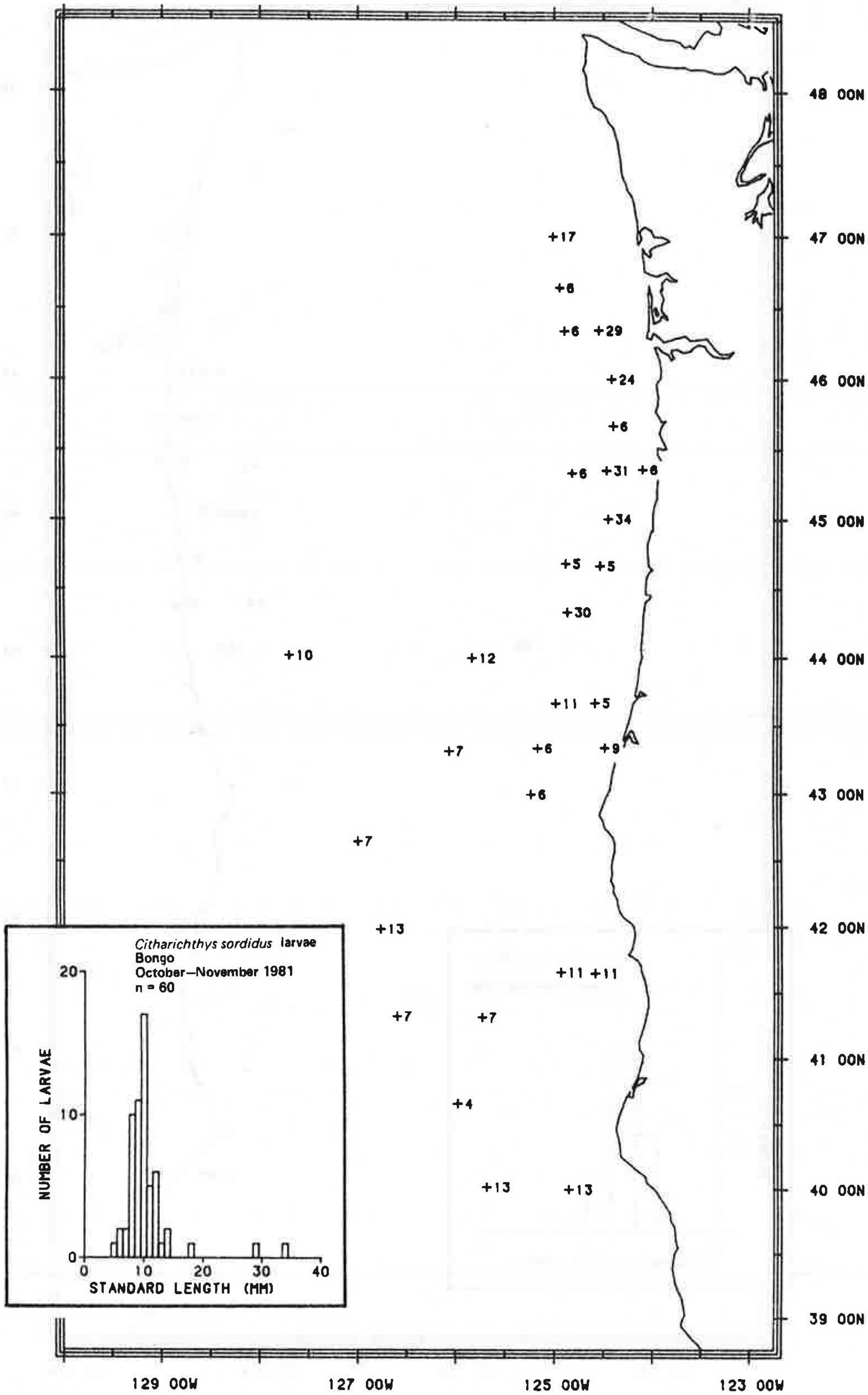

Figure 22.--Distribution and lengths of larvae of Citharichthys sordidus from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

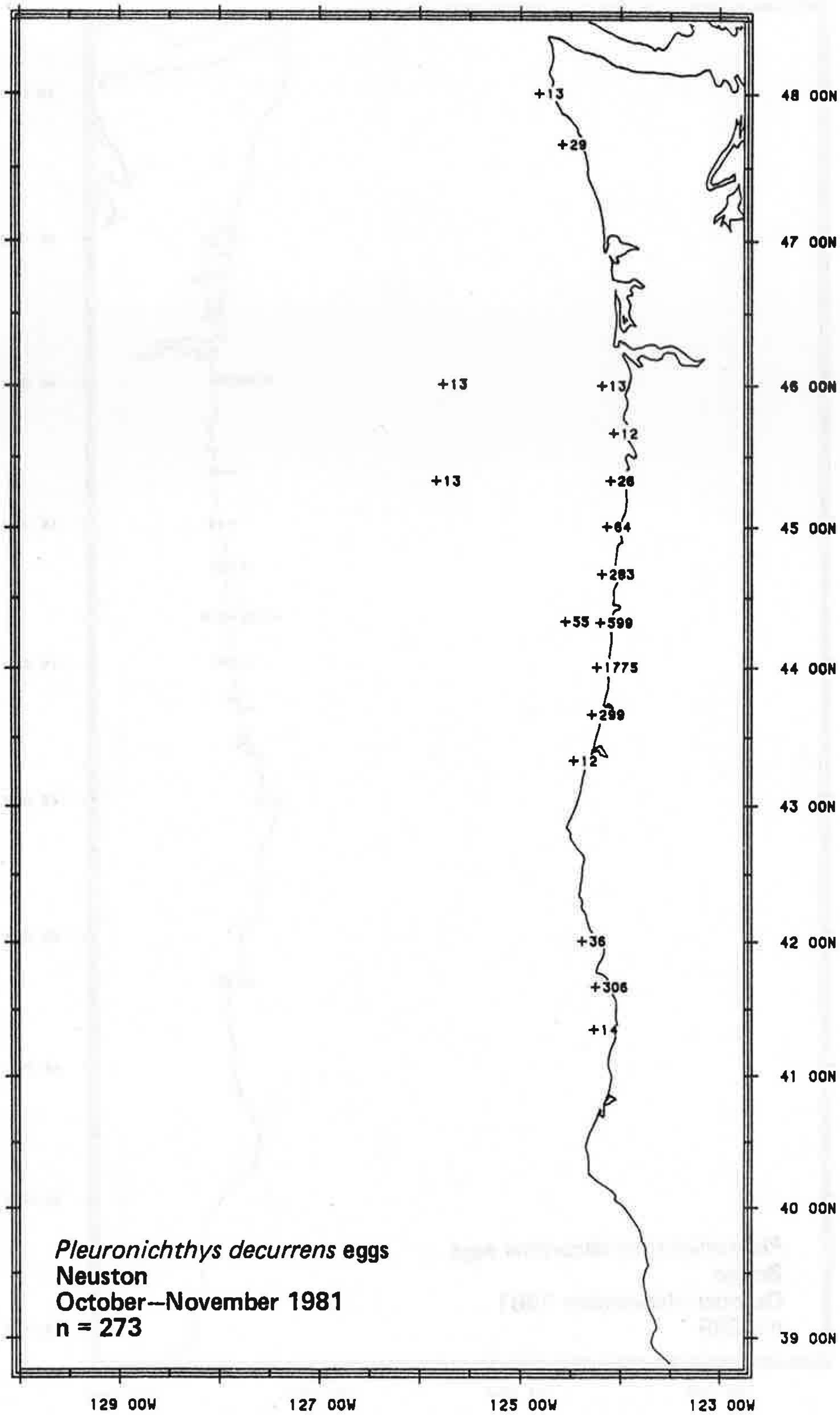

Figure 23.--Distribution of eggs of Pleuronichthys decurrens from neuston tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 1,000 m^3.

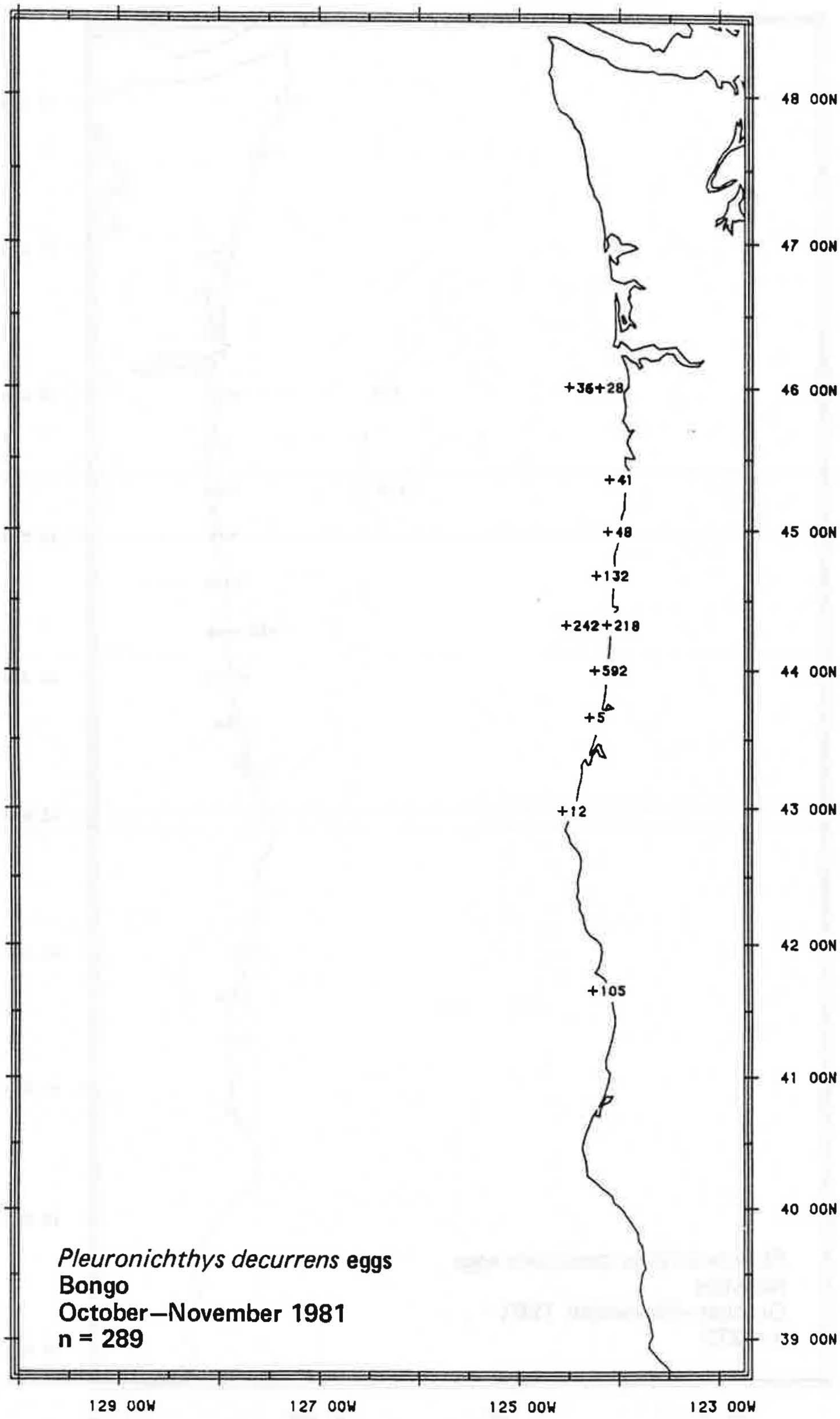

Figure 24.--Distribution of eggs of Pleuronichthys decurrens from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.

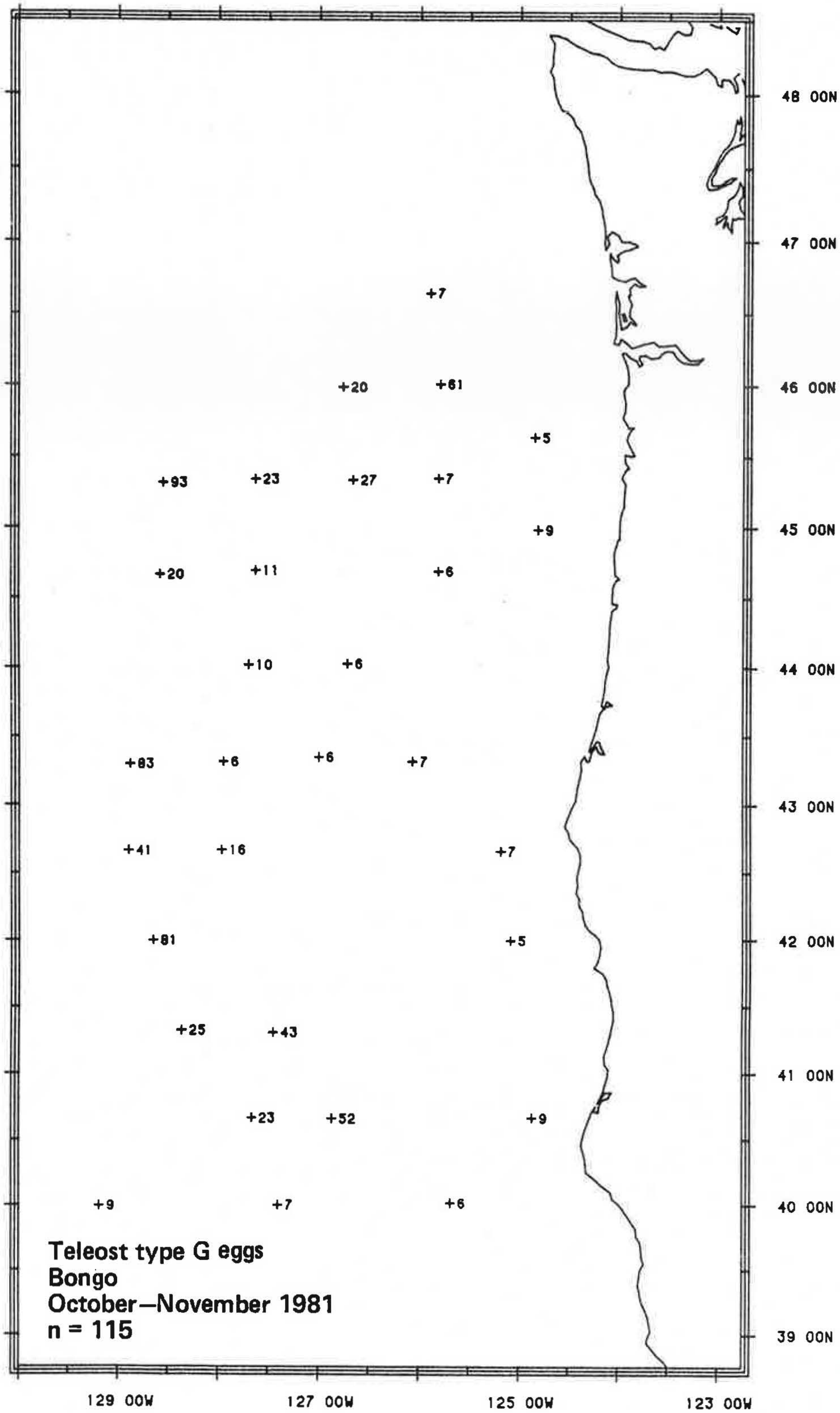

Figure 25.--Distribution of eggs of Teleost Type G from bongo tows during cruise, 1DA81, October-November 1981. Abundance expressed as numbers per 10 m^2.