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Ichthyoplankton off Washington, Oregon and Northern California August 1980

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NOTICE

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By

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INTRODUCTION

This report describes the second in a series of cooperative U.S.-U.S.S.R. ichthyoplankton surveys conducted off the U.S. west coast from 48°-40°N. A similar report, based on the first of these cruises in April-May 1980, has already been produced (Kendall and Clark 1982). 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 91 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. Yu. K. Demidenko serving as chief scientist occupied these stations basically from north to south from 1 to 22 August 1980. 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. 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 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 8 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 22 taxa of eggs and 42 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 6-23 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 24, and from bongo samples in Figure 25.

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 Bothidae, with Pleuronectidae, Tactostoma macropus, and Psettichthys melanostictus second in abundance, depending on the measurement used (Figure 2). In the bongo net, eggs of Tactostoma macropus were most abundant according to two measurements, and Bothidae and Trachurus symmetricus according to the other two (Figure 4).

Larval catches in the neuston net were sparce but were dominated by Engraulis mordax according to two measurements, and by Sebastes sp. and Ronquilus jordani based on the others (Figure 3). In the bongo net, Engraulis mordax larvae dominated the catches based on all three measurements, including number of larvae caught (3,043) far more than the second in abundance, Sebastes sp. (567) (Figure 5). According to the other measurement (percent occurrence), Sebastes sp. was dominant.

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 (Figures 6-8) - Eggs of the northern anchovy, representing the spawning products of the northern subpopulation, were collected in the neuston net at nine stations in the northern part of the survey area, mainly close to the mouth of the Columbia River. These were probably the last remnants of this spawning which lasts from April through July (Richardson 1981, Kendall and Clark 1982). Larvae of northern anchovy were widely distributed in both neuston and bongo catches mainly north of 93°N. They were caught over the continental shelf and slope, but not at the shorewardmost stations. They were more numerous in bongo catches, but the lengths in the two nets were nearly identical ($\bar{x}$ = 10.18 mm SL, S.D. = 3.54 in neuston, $\bar{x}$ = 10.19 mm SL, S.D. = 3.09 in bongo). According to the simulation of size at age presented by Methot (1981) for larvae of this subpopulation, larvae at about 10 mm SL are about 11 days past yolk absorption, which occurs about 5 days after hatching. Thus, most of the larvae collected on this cruise had been spawned about 18-20 days prior to capture (counting 2 days for egg incubation), i.e. in early July. From the total range in lengths of larvae in both nets (2.6-29.0 mm SL) spawning would have been taking place for at least a 2-mo. period prior to the cruise. We collected northern anchovy eggs on the previous cruise in late April 1980 (Kendall and Clark 1982).

Osmeridae (Figure 9) - Unidentified smelt larvae were collected at six nearshore stations, five in the southern part of the survey area and the other at the northern end of the area. They ranged in length from 8.0-34.5 ($\bar{x}$ = 15.22) mm SL. These larvae probably represent the remnants of the population of smelt larvae that dominates the nearshore and estuarine larval fish community of this area in winter and spring (Richardson and Pearcy 1977).

Tactostoma macropus (Figures 10 and 11) - Eggs of this bathypelagic fish were frequently taken, but in low numbers, in both neuston and bongo catches, throughout the survey area, except at the shorewardmost stations. Often small larvae of this species were caught at the stations where these eggs occurred.

Stenobrachius leucopsarus (Figure 12) - The lanternfish larvae, ranging in length from 3.7-17.0 ($\bar{x}$ = 7.8) mm SL, were widely distributed, but in low abundance throughout the survey area. They were not as numerous, and did not dominate the lanternfish fauna to the extent that they do in spring (Waldron 1972, Richardson et al. 1980, Kendall and Clark 1982).

Tarletonbeania crenularis (Figure 13) - Larvae of this lanternfish occurred at nearly as many stations (38) in bongo samples as did Stenobrachius leucopsarus (42). They were widely distributed in low numbers, but were not found at the shorewardmost stations. They ranged in length from 2.7-18.8 ($\bar{x}$ = 8.2) mm SL. This subarctic-transitional species is most frequently caught in summer in the CALCOFI surveys and its greatest abundance occurs in the northern part of that survey area off central and northern California (Moser and Ahlstrom 1970).

Cololabis saira (Figure 14) - A few larvae of sauries, ranging from 5.1-30.0 ($\bar{x}$ = 17.5) mm SL, were widely distributed offshore, mainly in the northern part of the survey area in neuston catches. This distribution was further north, and the fish larger than observed in April-May 1980 (Kendall and Clark 1982).

Sebastes sp. (Figures 15 and 16) - Rockfish larvae were widely distributed, mainly in continental shelf waters in both neuston and bongo catches. No attempt was made to identify the species caught. There was quite a disparity in lengths between neuston and bongo catches, with those in the

neuston net larger than those in the bongo net ($\bar{x}$ neuston = 14.5, $\bar{x}$ bongo = 5.2 mm SL). These lengths are quite similar to those found in April-May 1980 (Kendall and Clark 1982).

Scorpaenichthys marmoratus (Figure 17) - Larvae of cabezon were caught in neuston tows, mainly over the continental slope in the northern half of the survey area. Although they were caught in 16 tows, only 37 larvae were found; they ranged from 4.8-31.4 ($\bar{x}$ = 7.9) mm SL.

Icichthys lockingtoni (Figure 18) - Eggs of the medusafish were caught widely in the bongo net. They occurred mainly over the outer continental slope in the southern part of the survey area. Eggs were also caught in April-May (Kendall and Clark 1982), indicating a protracted spawning season for this species in this area.

Bothidae (Figures 19 and 20) - Unidentified eggs of lefteye flounders (probably mostly early stage Citharichthys sp. eggs, although some Paralichthys californicus eggs may be present) were collected at nearshore stations in both the neuston and bongo nets.

Citharichthys sp. (Figures 21 and 22) - Eggs (mainly late stages) of sanddabs were found in neuston and bongo catches all along the coast. Their distribution extended further offshore in neuston tows than in bongo tows.

Pleuronectidae (Figure 23) - Unidentified eggs of righteye flounders occurred at scattered stations along the coast. They appeared to be mainly early stage eggs of Psettichthys melanostictus. Most were at one station off northern California where 6,870 eggs/1,000 m^3 were found.

Community Structure

Recurrent group analysis at a 0.4 affinity level of neuston catches showed two groups (Figure 24). One was composed of eggs of Bothidae and Citharichthys sp. The other was composed of eggs of Icichthys lockingtoni

and Tactostoma macropus, with larvae of three taxa (Tarletonbeania crenularis, Sebastes sp., and Cololabis saira) as associates. The first group occurred mainly near shore, the other more widely distributed over the continental slope and further offshore.

In bongo catches, two groups with the same basic distribution patterns emerged (Figure 25). One group, composed of eggs of three taxa of flatfishes, was found mainly at nearshore stations. The other group with complex interrelationships was composed of 10 taxa and was more widely distributed, mainly in offshore waters. Five species of myctophids were included in this group.

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Figure 24.--Results of recurrent group analysis on neuston catches (both fish eggs and larvae) from 1PO80, August 1980, 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.

Figure 25.--Results of recurrent group analysis on bongo catches (both fish eggs and larvae) from 1PO80, August 1980. Format as for Figure 24.

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
G001A	47 58.9	124 50.3	80 8 1	673.	1812	4.344	10.353	1750	0.030	20.220
G002A	48 0.7	125 3.6	80 8 1	581.	2110	2.035	3.623	2017	0.027	17.794
G003A	47 59.0	125 11.3	80 8 1	448.	2339	2.976	2.104	2324	0.033	21.756
G004A	48 1.5	125 23.6	80 8 2	1101.	230	3.358	2.728	215	0.026	17.008
G005A	48 1.3	125 54.8	80 8 2	1441.	455	3.096	2.576	440	0.031	20.654
G006A	47 39.1	125 16.0	80 8 2	1016.	1032	1.704	2.118	1017	0.030	19.962
G007A	47 39.8	124 56.3	80 8 2	1038.	1330	2.407	4.283	1315	0.040	26.955
G008A	47 40.4	124 34.0	80 8 2	742.	1720	4.408	13.671	1700	0.030	19.893
G009A	47 20.0	124 25.0	80 8 2	704.	1900	3.156	29.760	1847	0.051	33.955
G010A	47 19.8	124 46.9	80 8 2	1216.	2137	3.779	2.697	2110	0.032	21.611
G011A	47 18.7	125 13.3	80 8 3	1432.	105	3.299	2.900	50	0.024	16.260
G012A	47 20.0	125 41.5	80 8 3	2194.	420	3.071	2.673	404	0.024	16.074
G013A	47 29.3	126 25.5	80 8 3	3095.	930	3.505	2.504	910	0.021	14.148
G014A	47 19.5	127 9.0	80 8 3	2881.	1625	3.206	2.621	1612	0.030	19.909
G015A	47 0.0	124 59.0	80 8 4	1069.	400	4.734	4.750	315	0.027	18.290
G016A	46 59.0	124 37.1	80 8 4	1032.	637	3.510	6.697	625	0.025	16.978
G017A	47 1.1	124 17.4	80 8 4	684.	945	5.635	62.625	930	0.022	14.548
G018A	46 40.0	124 16.0	80 8 4	810.	1300	5.624	13.240	1245	0.024	16.173
G019A	46 40.8	124 37.4	80 8 4	952.	1530	4.877	5.289	1510	0.041	27.393
G020A	46 40.0	124 57.0	80 8 4	945.	1820	4.890	3.521	1805	0.027	18.077
G021A	46 20.5	124 11.0	80 8 5	725.	32	6.602	38.292	18	0.027	18.267
G022A	46 19.0	124 32.0	80 8 5	1126.	231	5.786	4.616	223	0.024	15.840
G023A	46 20.0	124 53.7	80 8 5	1423.	607	4.645	3.475	554	0.026	17.212
G024A	46 0.0	127 31.0	80 8 5	5094.	1850	5.955	3.299	1835	0.035	23.373
G025A	45 59.9	126 35.0	80 8 6	5092.	37	8.153	4.088	22	0.026	17.632
G026A	46 0.0	125 41.0	80 8 6	3933.	535	5.187	3.476	520	0.035	23.033
G027A	46 0.0	124 46.0	80 8 6	1802.	1114	6.747	4.469	1104	0.025	16.708
G028A	45 59.0	124 25.0	80 8 6	1126.	1420	4.773	5.794	1405	0.035	23.067
G029A	46 1.0	124 4.0	80 8 6	664.	1640	6.358	22.043	1625	0.036	23.977
G030A	45 40.0	124 4.0	80 8 6	809.	1945	5.694	10.254	1930	0.041	27.038
G031A	45 40.0	124 31.0	80 8 6	1368.	2227	8.230	4.555	2215	0.030	20.042
G032A	45 39.9	124 59.8	80 8 7	1862.	137	4.696	3.904	122	0.026	17.374
G033A	45 21.1	125 6.2	80 8 7	1407.	440	6.026	3.793	430	0.029	19.641
G034A	44 59.6	125 4.5	80 8 7	2115.	830	3.375	2.595	815	0.026	17.457
G035A	45 0.0	124 35.0	80 8 7	1491.	1210	8.157	4.154	1150	0.029	19.646
G036A	45 20.0	124 35.5	80 8 7	1534.	1615	6.452	2.973	1600	0.039	26.310
G037A	45 20.0	124 7.0	80 8 7	881.	1940	6.573	7.693	1927	0.034	22.687
G038A	45 0.0	124 7.0	80 8 7	812.	2217	5.497	6.882	2203	0.034	22.473
G039A	44 40.0	124 10.0	80 8 8	628.	48	3.801	12.427	30	0.027	17.962
G040A	44 40.0	124 31.0	80 8 8	1259.	327	5.354	5.309	232	0.025	16.864
G041A	44 40.0	124 59.0	80 8 8	2027.	635	7.125	3.602	605	0.037	24.801
G042A	44 40.0	125 57.0	80 8 8	4173.	1315	6.501	3.411	1245	0.031	20.472
G043A	44 40.0	126 52.0	80 8 8	5300.	1850	4.278	2.542	1835	0.039	25.683
G044A	44 40.0	127 49.0	80 8 9	5603.	48	7.407	3.662	35	0.023	15.312
G045A	44 40.1	128 46.7	80 8 9	5511.	620	6.485	3.768	600	0.031	20.441
G046A	44 19.3	125 13.4	80 8 9	1786.	2250	4.364	3.030	2235	0.027	18.151
G047A	44 0.0	125 11.0	80 810	1274.	230	7.566	3.986	213	0.026	17.451
G048A	44 1.2	124 44.0	80 810	1422.	600	6.405	6.790	550	0.030	20.244
G049A	44 20.0	124 42.5	80 810	1448.	915	8.850	9.292	900	0.032	21.102
G050A	44 19.0	124 14.5	80 810	934.	1305	3.694	10.358	1245	0.025	16.662
G051A	44 0.0	124 14.0	80 810	789.	1550	6.639	17.148	1535	0.026	17.078
G052A	43 39.0	124 20.0	80 810	900.	1845	4.037	5.496	1830	0.027	18.225
G053A	43 40.0	124 45.9	80 810	1415.	2127	2.558	2.552	2112	0.028	18.873
G054A	43 40.0	125 15.4	80 811	1305.	115	6.975	3.151	50	0.021	14.269
G055A	43 20.7	124 57.0	80 811	1286.	515	7.869	3.980	500	0.025	16.848
G056A	43 19.5	124 30.7	80 811	868.	700	6.518	7.749	700	0.025	16.862
G057A	43 2.0	124 35.8	80 811	718.	1130	7.093	9.247	1115	0.025	16.985
G058A	43 0.0	125 0.0	80 811	1730.	1450	6.301	3.744	1435	0.023	15.655
G059A	42 41.0	124 46.0	80 811	1457.	2020	7.071	4.283	2005	0.027	17.867
G060A	42 39.9	125 13.2	80 812	1790.	256	7.056	3.779	240	0.020	13.413
G061A	42 38.0	125 42.5	80 812	1562.	620	7.939	3.636	610	0.033	21.799
G062A	42 20.0	128 4.0	80 812	5006.	1840	6.558	3.916	1825	0.050	33.204
G063A	42 20.7	127 11.2	80 813	5231.	33	8.112	3.850	20	0.031	20.736

Table 1.--Data associated with bongo and neuston tows during cruise 1P080, August 1980.

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
G064A	42 22.5	126 17.5	80 813	4570.	545	6.163	3.114	445	0.031	20.695
G065A	42 12.4	125 24.3	80 813	2011.	1140	7.496	3.670	1120	0.033	22.003
G066A	42 20.0	124 58.0	80 813	1429.	1605	6.758	3.208	1545	0.031	20.360
G067A	42 20.0	124 32.0	80 813	940.	2000	4.363	6.620	1940	0.025	16.740
G068A	42 0.3	124 23.8	80 813	924.	2254	3.073	6.509	2241	0.036	23.963
G069A	42 0.0	124 50.2	80 816	1270.	420	4.163	2.334	900	0.031	20.877
G070A	42 0.0	125 16.0	80 816	1002.	1555	7.088	3.221	1540	0.036	23.870
G071A	41 40.0	124 15.0	80 816	1066.	2250	8.822	21.450	2235	0.055	36.364
G072A	41 40.0	124 50.9	80 817	1207.	1225	6.143	2.652	1210	0.049	32.854
G073A	41 42.0	125 10.0	80 817	1135.	1750	5.627	2.803	1737	0.037	24.689
G074A	41 18.6	124 17.6	80 818	1220.	245	6.062	11.948	220	0.024	16.202
G075A	41 22.6	124 48.6	80 818	1544.	540	5.568	3.111	540	0.042	27.708
G076A	41 20.7	125 11.1	80 818	1369.	935	6.406	3.506	910	0.025	16.446
G077A	40 58.3	125 4.4	80 818	1638.	1310	4.540	2.849	1255	0.032	21.369
G078A	41 0.0	124 38.5	80 818	1359.	1740	6.293	3.061	1725	0.044	29.267
G079A	40 59.1	124 13.2	80 819	638.	30	5.352	15.576	10	0.032	21.410
G080A	40 40.7	124 27.1	80 819	955.	345	3.348	11.615	330	0.033	21.700
G081A	40 40.5	124 52.8	80 819	1306.	630	5.909	3.456	620	0.035	23.261
G082A	40 41.9	125 20.3	80 819	2292.	1030	3.311	1.988	1015	0.035	23.495
G083A	40 19.9	124 28.8	80 820	981.	455	5.390	5.947	440	0.028	18.715
G084A	40 20.5	124 55.5	80 820	1752.	750	4.653	3.107	750	0.024	16.266
G085A	40 20.0	125 20.0	80 820	3264.	1155	3.839	2.123	1140	0.037	24.354
G086A	40 20.0	126 14.0	80 820	5792.	2030	5.513	3.515	2015	0.044	29.562
G087A	40 20.1	127 8.0	80 821	5721.	200	6.405	3.236	200	0.025	16.445
G088A	40 21.2	128 1.3	80 821	5561.	825	7.341	3.474	815	0.024	16.211
G089A	40 20.0	128 53.0	80 821	5346.	1418	5.806	3.128	1410	0.031	20.660
G090A	40 0.0	124 37.3	80 822	2245.	1330	4.556	2.680	1315	0.034	22.671
G091A	40 0.0	124 10.5	80 822	836.	1845	6.530	3.077	1830	0.031	20.857

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

Table 1 (Continued)

EGG	NEUSTON		BONGO	
SPECIES	OCCUR. %	LOG NO. IN AREA	OCCUR. %	LOG NO. IN AREA
UNIDENTIFIED	3.30	8.7350	9.89	10.5855
DISINTEGRATED	1.10	7.1077	1.10	9.4497
ENGRAULIS MORDAX	9.89	8.9369	4.40	10.3561
ARGENTINIDAE			5.49	9.9564
BATHYLAGIDAE	1.10	6.6308	4.40	10.1437
BATHYLAGUS WESETHI			1.10	9.4919
CHAULIODUS MACOUNI	5.49	7.8210	17.58	10.5794
TACTOSTOMA MACROPUS	30.77	9.2642	25.27	11.3470
COLOLABIS SAIRA	5.49	8.9288		
TRACHYPTERUS ALTIVELIS	4.40	7.5662	2.20	9.5272
TRACHURUS SYMMETRICUS	2.20	7.6641	1.10	10.5636
ICICHTHYS LOCKINGTONI	27.47	8.7785	20.88	10.7847
TETRAGONURUS CUVIERI	2.20	7.7947	1.10	9.4335
BOTHIDAE	34.07	9.7232	24.18	11.1516
CITHARICHTHYS SP.	27.47	9.0725	12.09	10.6951
PLEURONECTIDAE	10.99	9.1193	12.09	10.1149
GLYPTOCEPHALUS ZACHIRUS	5.49	7.2332	4.40	9.5771
ISOPSETTA ISOLEPIS			1.10	9.1164
LYOPSETTA EXILIS			2.20	8.9675
MICROSTOMUS PACIFICUS	2.20	6.8266	5.49	9.5241
PLEURONICHTHYS COENOSUS	4.40	7.1502		
PSETTICHTHYS MELANOSTICTUS	6.59	8.3407	4.40	9.8021

Table 2.--Fish eggs collected in bongo and neuston tows during cruise 1PO80, August 1980.

LARVAE

SPECIES	NEUSTON OCCUR. %	NEUSTON LOG NO. IN AREA	BONGO OCCUR. %	BONGO LOG NO. IN AREA
UNIDENTIFIED			2.20	10.0064
DISINTEGRATED	2.20	6.6104	3.30	9.1537
ENGRAULIS MORDAX	18.68	9.2637	31.87	12.4823
OSMERIDAE	6.59	7.8813	3.30	9.5398
BATHYLAGUS MILLERI			1.10	9.4335
BATHYLAGUS OCHOTENSIS			4.40	9.4866
ARGYROPELECUS SP.			1.10	9.4919
CHAULIODUS MACOUNI			21.98	10.5734
TACTOSTOMA MACROPUS			4.40	10.2850
MYCTOPHIDAE			1.10	8.5589
CERATOSCOPELUS TOWNSENDI	1.10	7.1310		
DIAPHUS THETA	2.20	7.2472	24.18	11.3449
LAMPANYCTUS REGALIS	1.10	7.1310	16.48	10.6630
LAMPANYCTUS RITTERI			4.40	10.0955
STENOBRACHIUS LEUCOPSARUS	2.20	7.4701	46.15	11.6123
SYMBOLOPHORUS CALIFORNIENSE			1.10	9.6109
TARLETONBEANIA CRENULARIS			41.76	11.2158
PROTOMYCTOPHUM CROCKERI	1.10	7.4321	12.09	10.3948
PROTOMYCTOPHUM THOMPSONI			18.68	10.5036
LESTIDIOPS RINGENS			3.30	9.8000
BENTHALBELLA DENTATA			1.10	9.0129
COLOLABIS SAIRA	15.38	8.3034	2.20	9.7239
SCORPAENIDAE	1.10	7.7804		
SEBASTES SP.	32.97	8.9741	63.74	11.5612
SEBASTOLOBUS SP.			6.59	10.1878
ARTEDIUS 1	1.10	6.7081	4.40	9.3854
ARTEDIUS 2	1.10	6.7643	1.10	8.6802
ARTEDIUS MEANYI			1.10	8.8154
SCORPAENICHTHYS MARMORATUS	17.58	8.0719	2.20	8.6817
AGONIDAE A			1.10	8.8700
CYCLOPTERIDAE			5.49	9.2109
TRACHURUS SYMMETRICUS	1.10	7.8508	2.20	10.9051
RONQUILUS JORDANI	1.10	7.5957	1.10	9.4040
STICHAEUS PUNCTATUS			1.10	8.8537
ICICHTHYS LOCKINGTONI	1.10	7.1518	4.40	10.2702
CITHARICHTHYS SP.			1.10	9.0851
CITHARICHTHYS SORDIDUS			1.10	9.0980
GLYPTOCEPHALUS ZACHIRUS			3.30	9.4691
LYOPSETTA EXILIS			8.79	9.8488
MICROSTOMUS PACIFICUS			1.10	8.8285
PSETTICHTHYS MELANOSTICTUS			1.10	8.6128

Table 3.--Fish larvae collected in bongo and neuston tows during cruise 1PO80, August 1980.

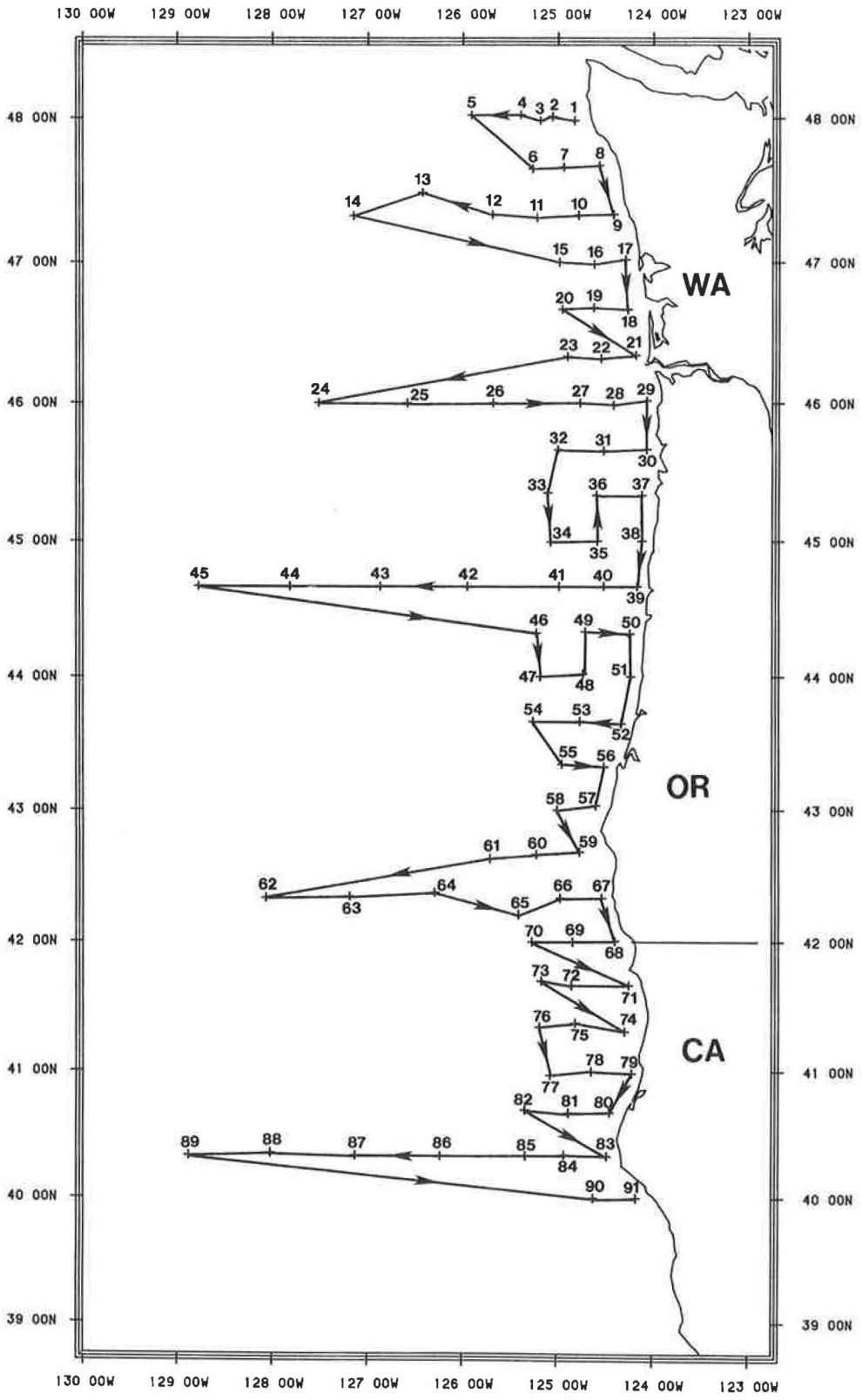

Figure 1.--Station locations and cruise track for cruise 1PO80, August 1980.

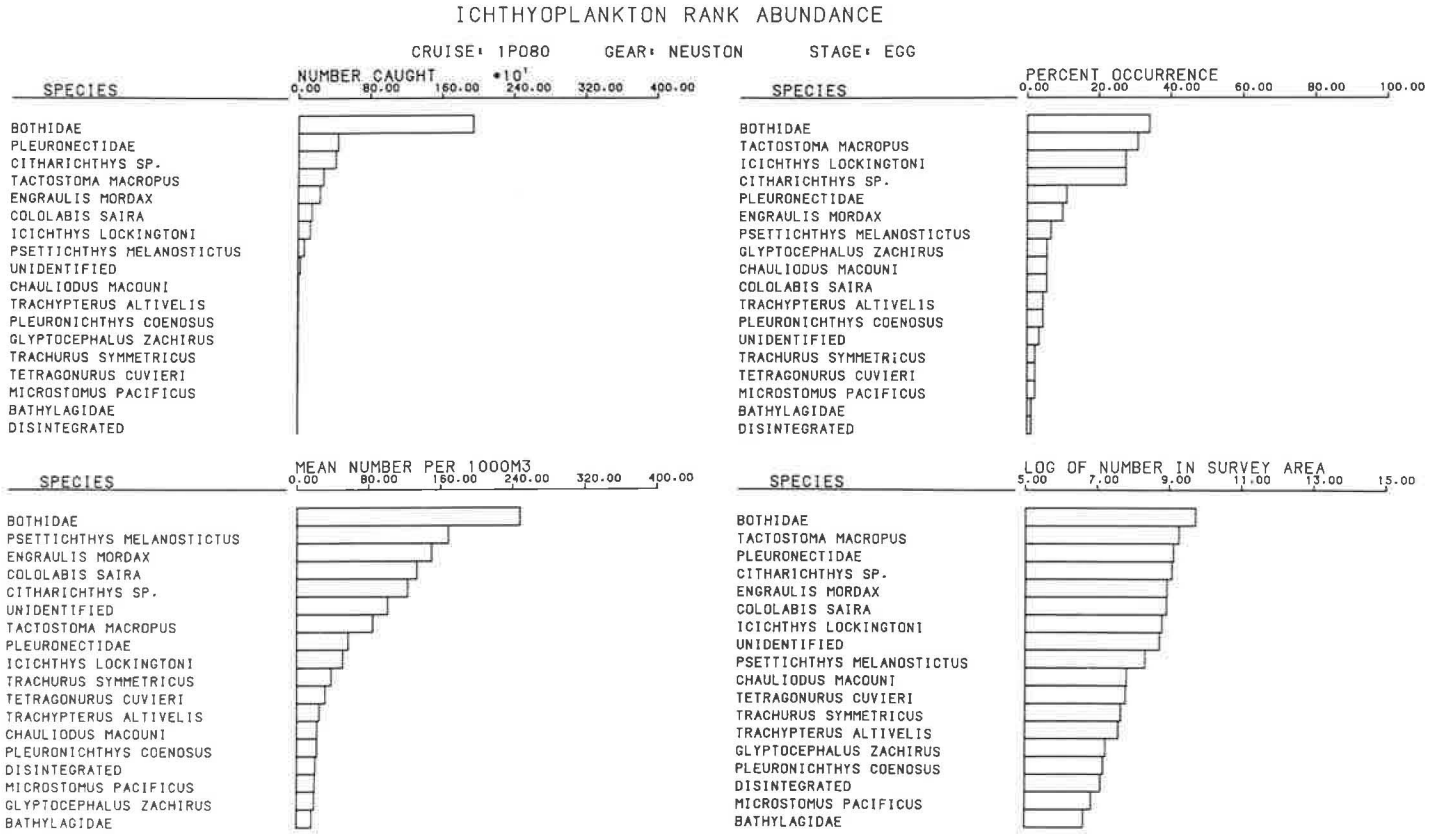

Figure 2.--Rank abundance of eggs caught in neuston tows during cruise 1P080, August 1980.

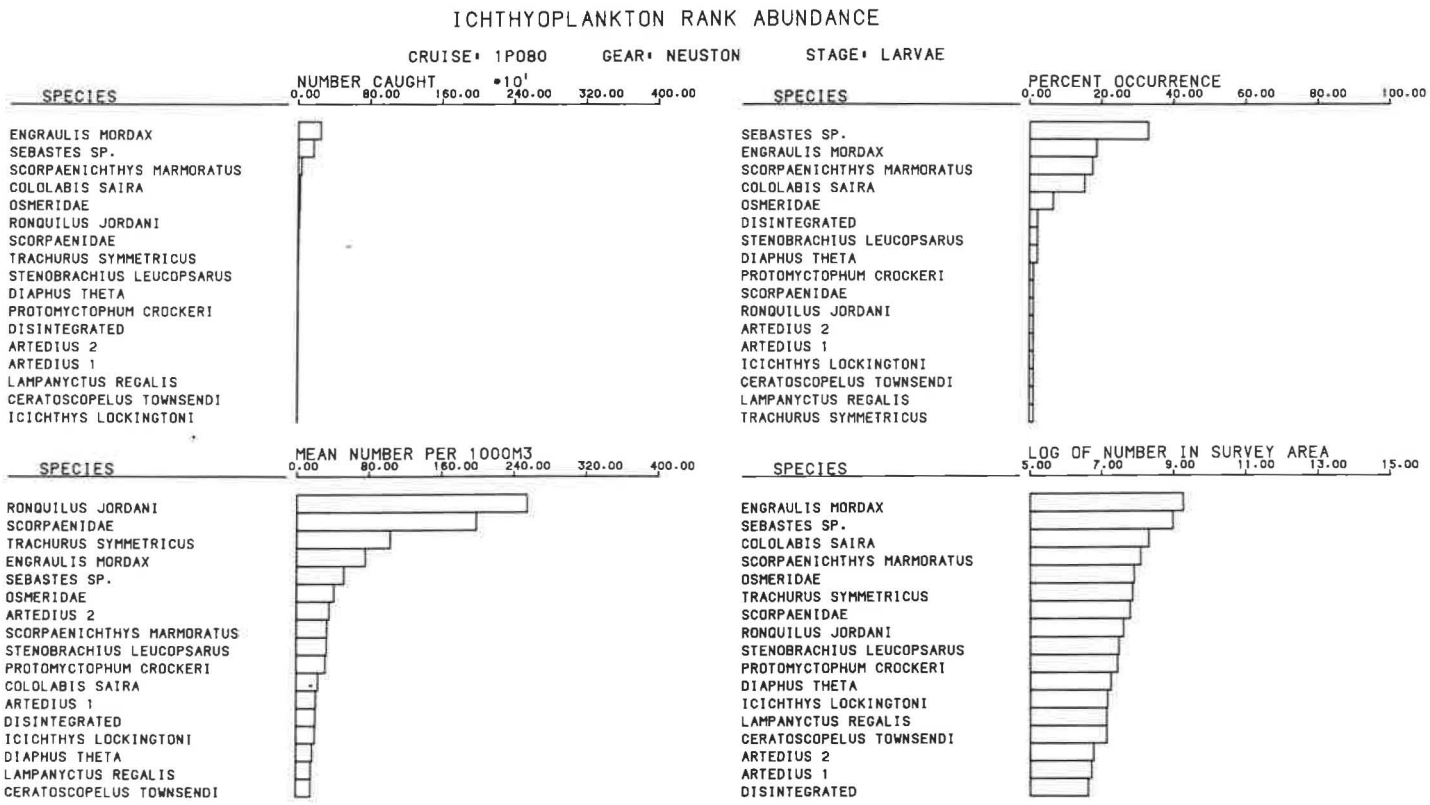

Figure 3.--Rank abundance of larvae caught in neuston tows during cruise 1P080, August 1980.

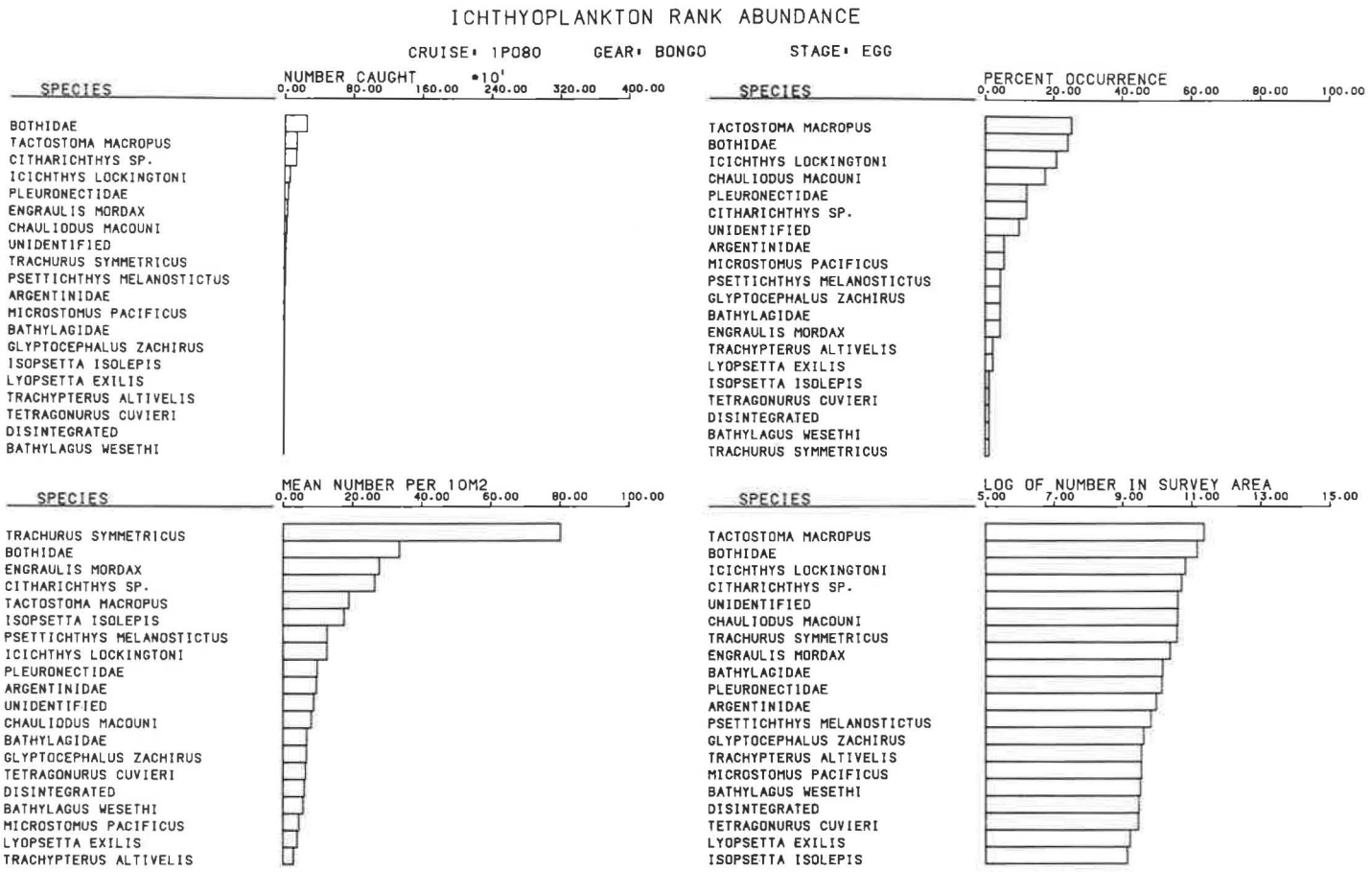

Figure 4.--Rank abundance of eggs caught in bongo tows during cruise 1P080, August 1980.

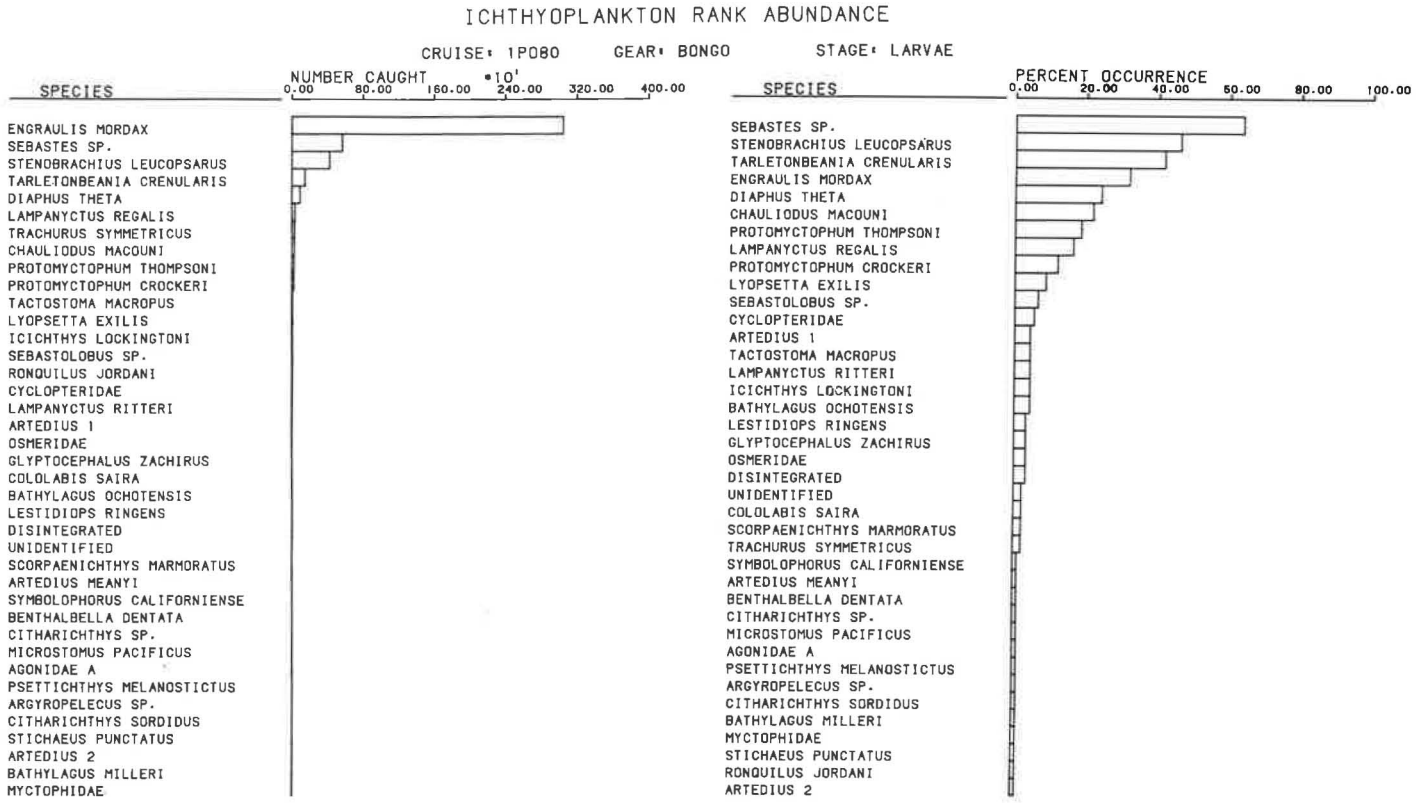

Figure 5.--Rank abundance of larvae caught in bongo tows during cruise 1P080, August 1980.

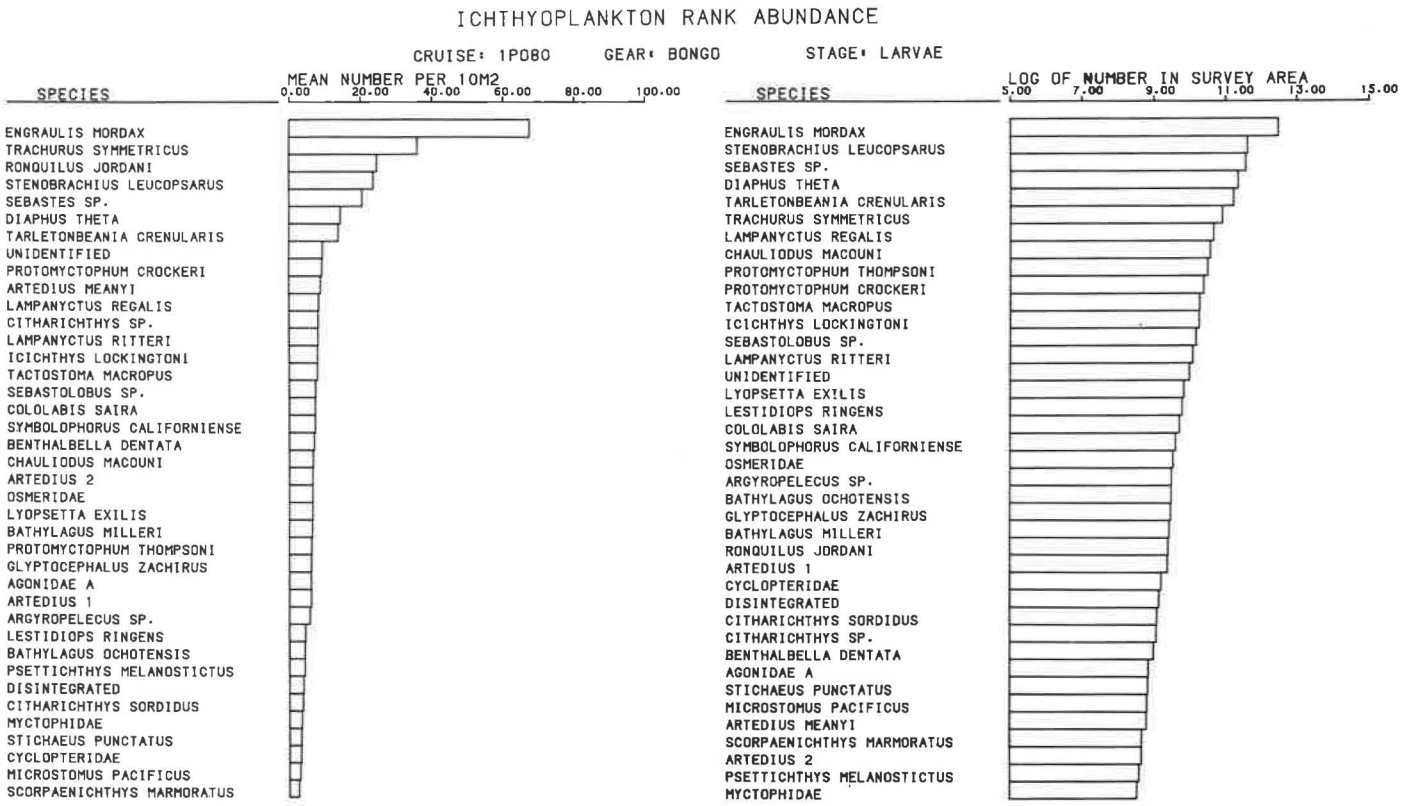

Figure 5 (Continued)

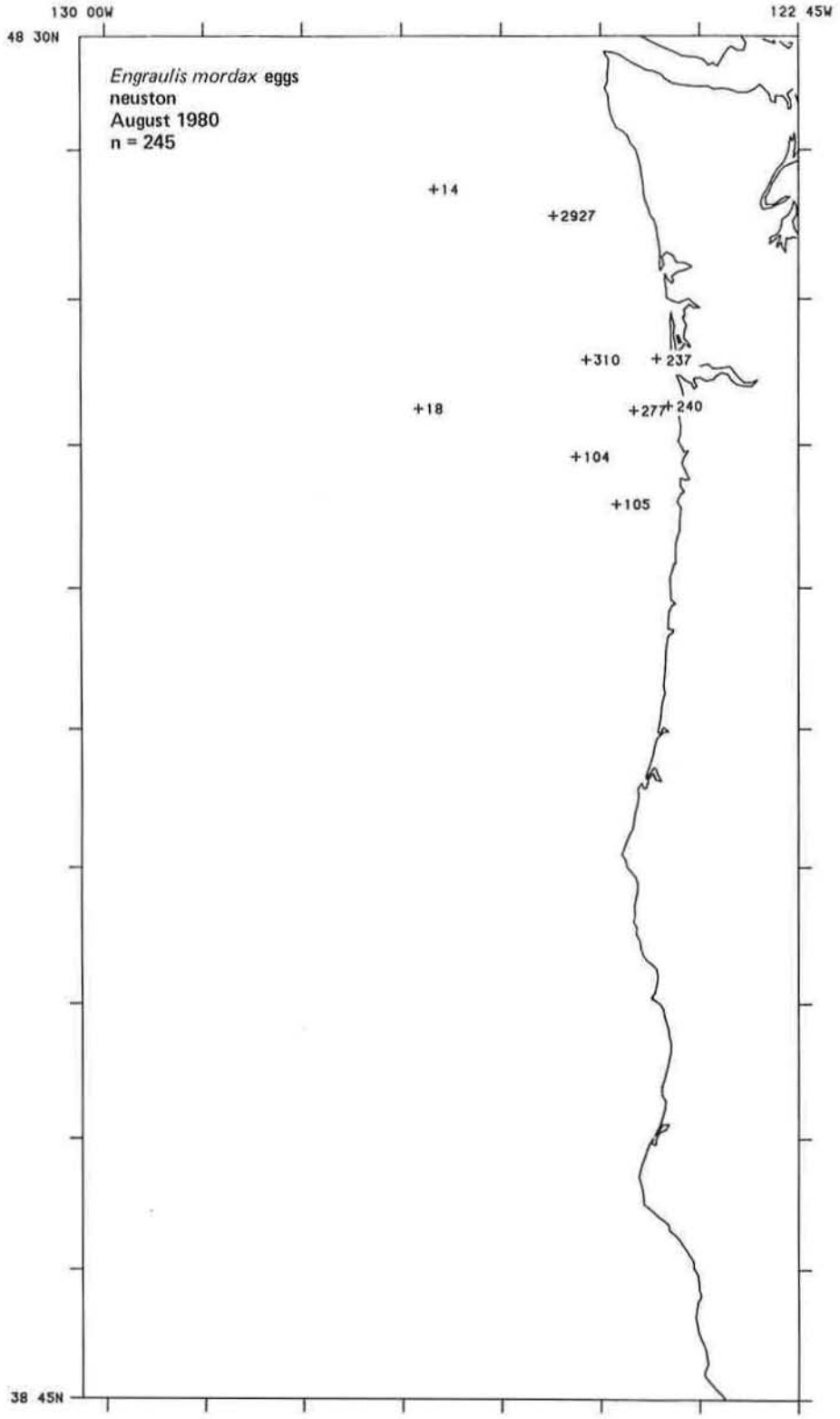

Figure 6.--Distribution of eggs of Engraulis mordax from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

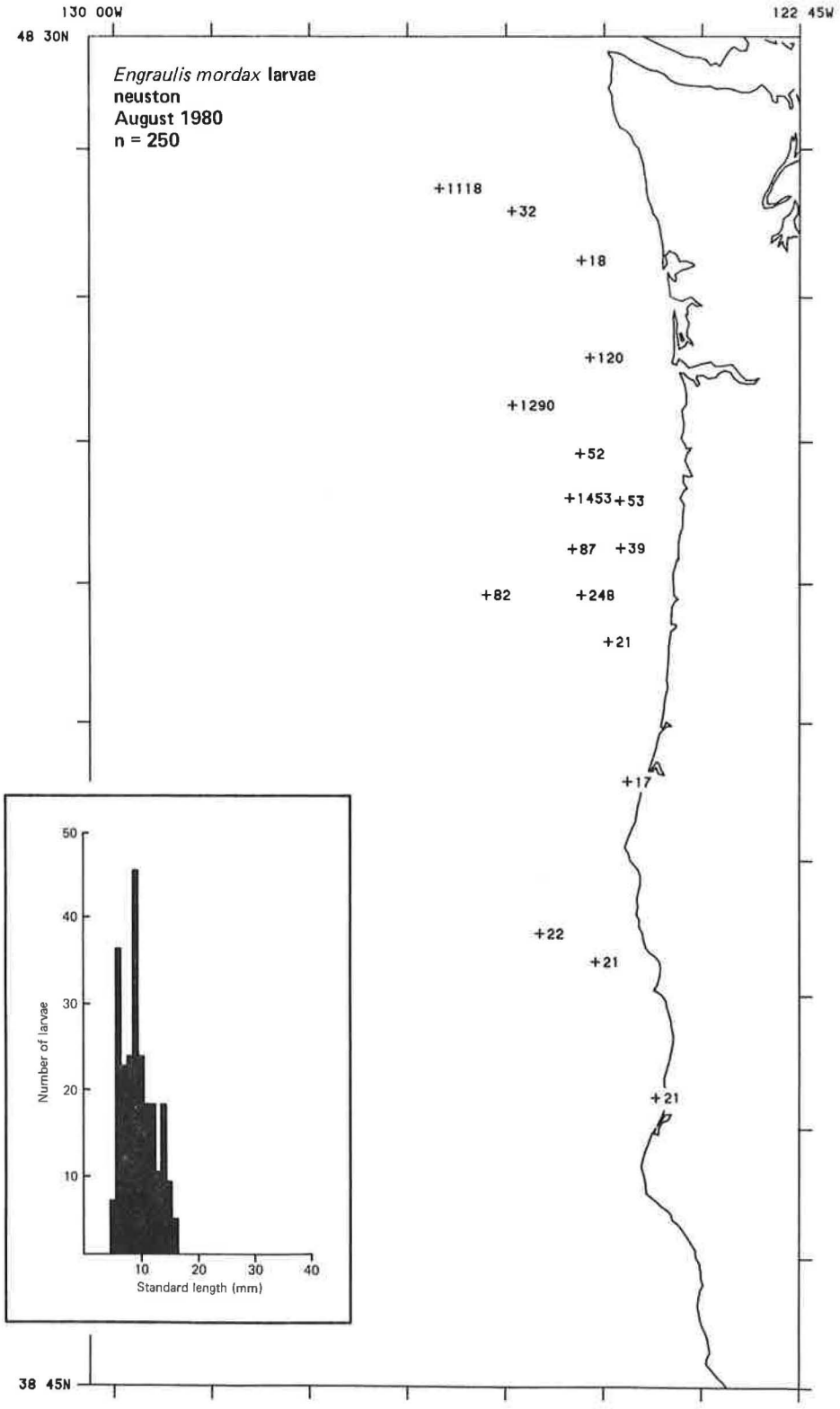

Figure 7.--Distribution and lengths of larvae of Engraulis mordax from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

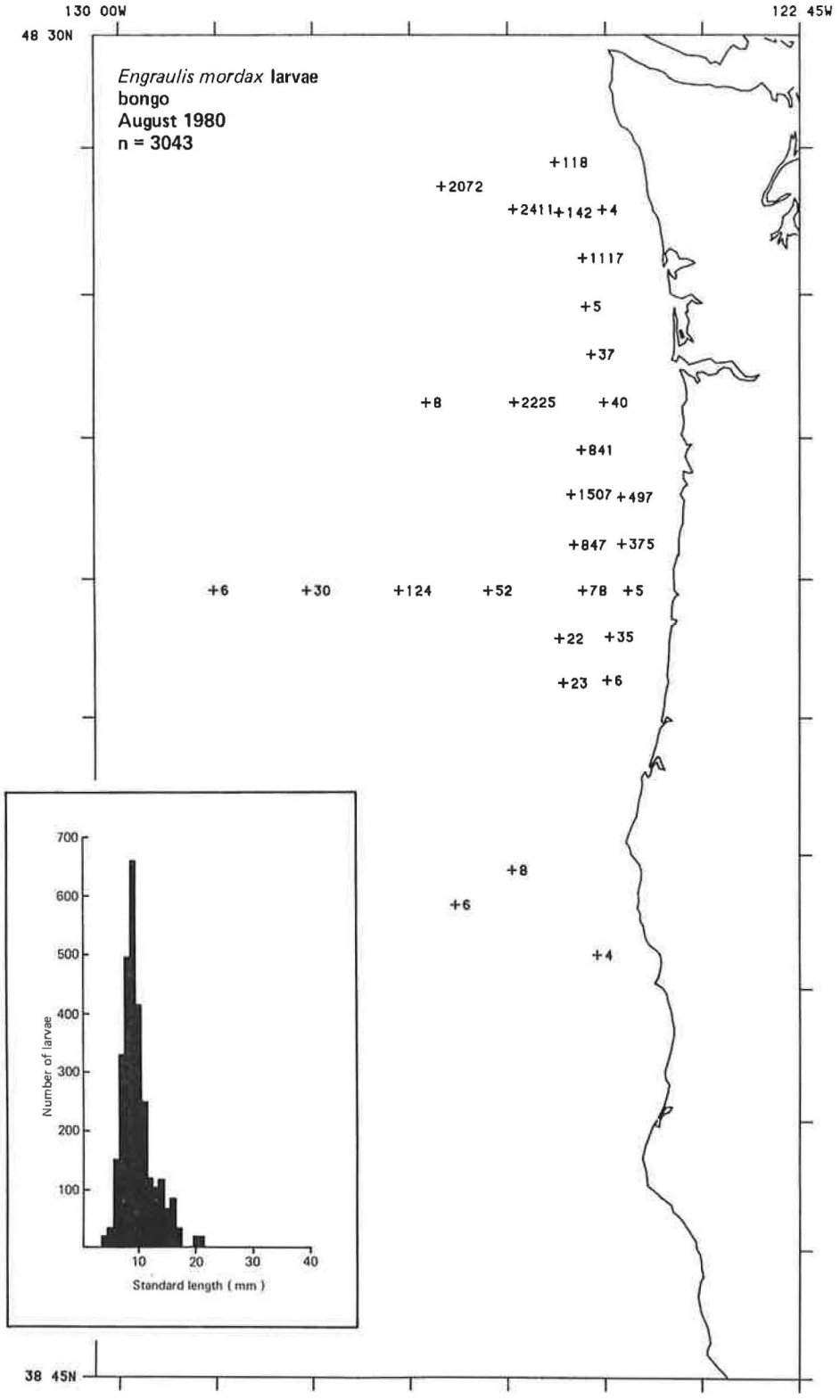

Figure 8.--Distribution and lengths of larvae of Engraulis mordax from bongo tows during cruise 1P080, August 1980. Abundance expressed as numbers per 10 m^2.

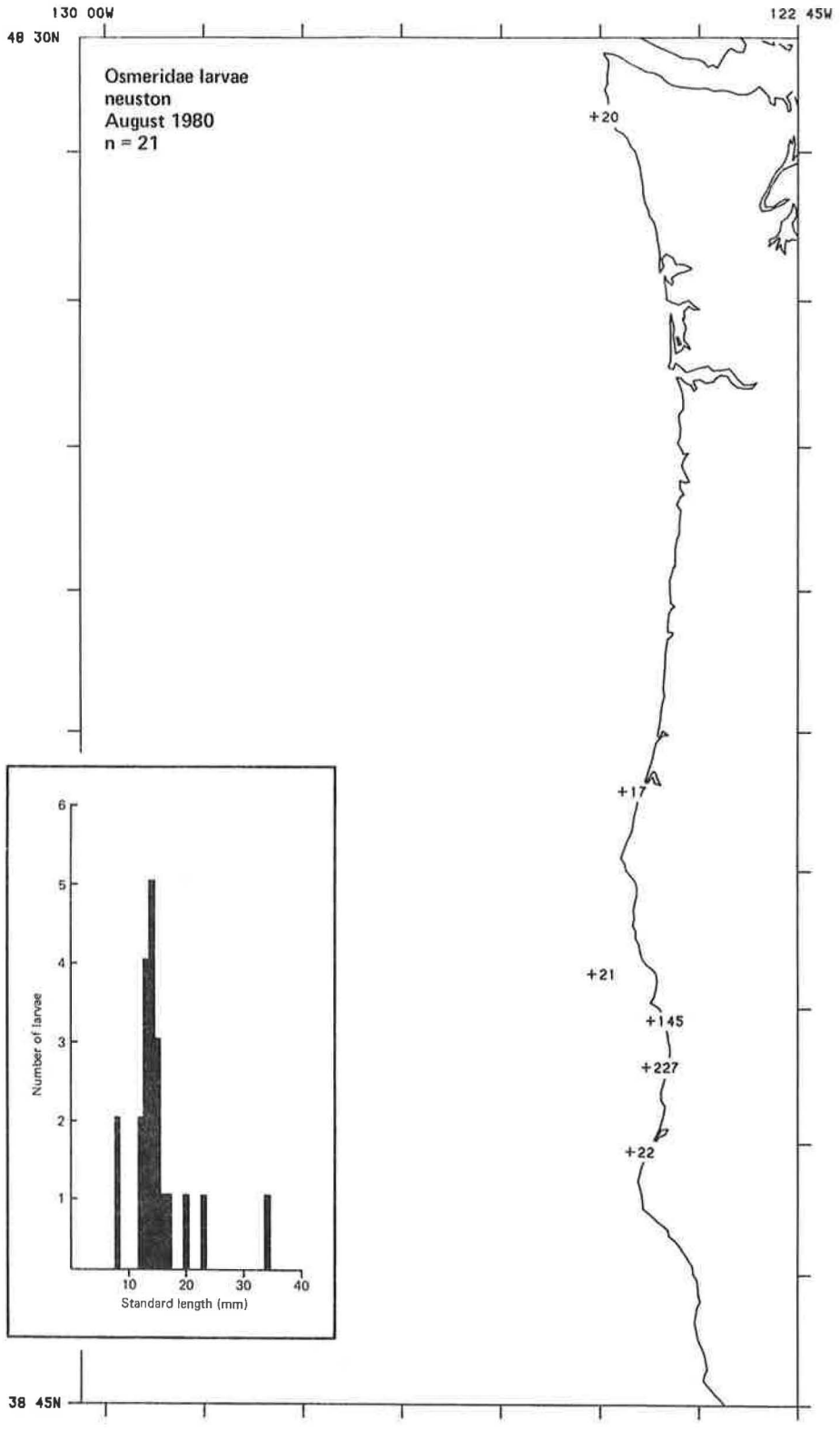

Figure 9.--Distribution and lengths of larvae of Osmeridae from neuston tows during cruise 1P080, August 1980. Abundance expressed as numbers per 1,000 m^3.

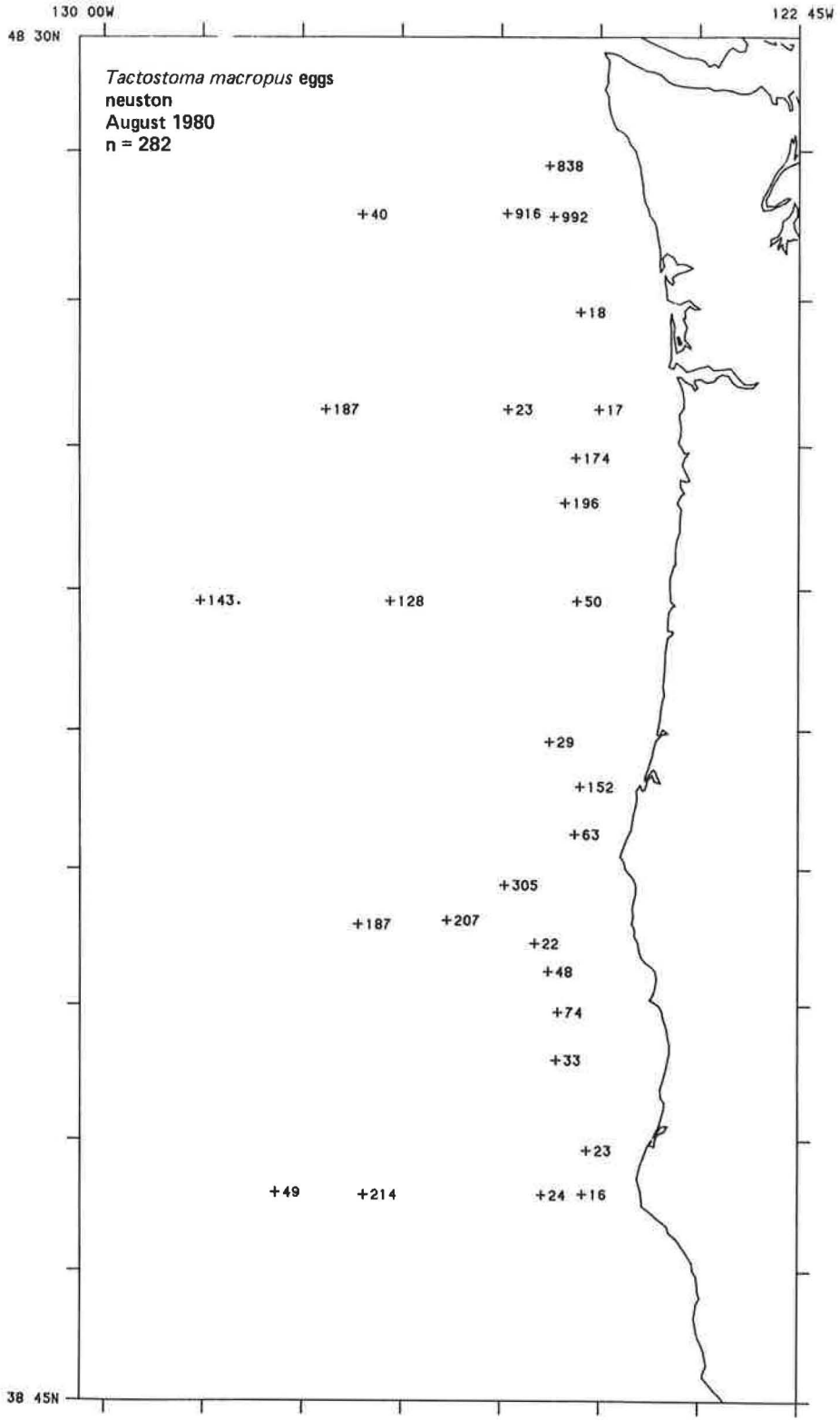

Figure 10.--Distribution of eggs of Tactostoma macropus from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per $1{,}000^3$.

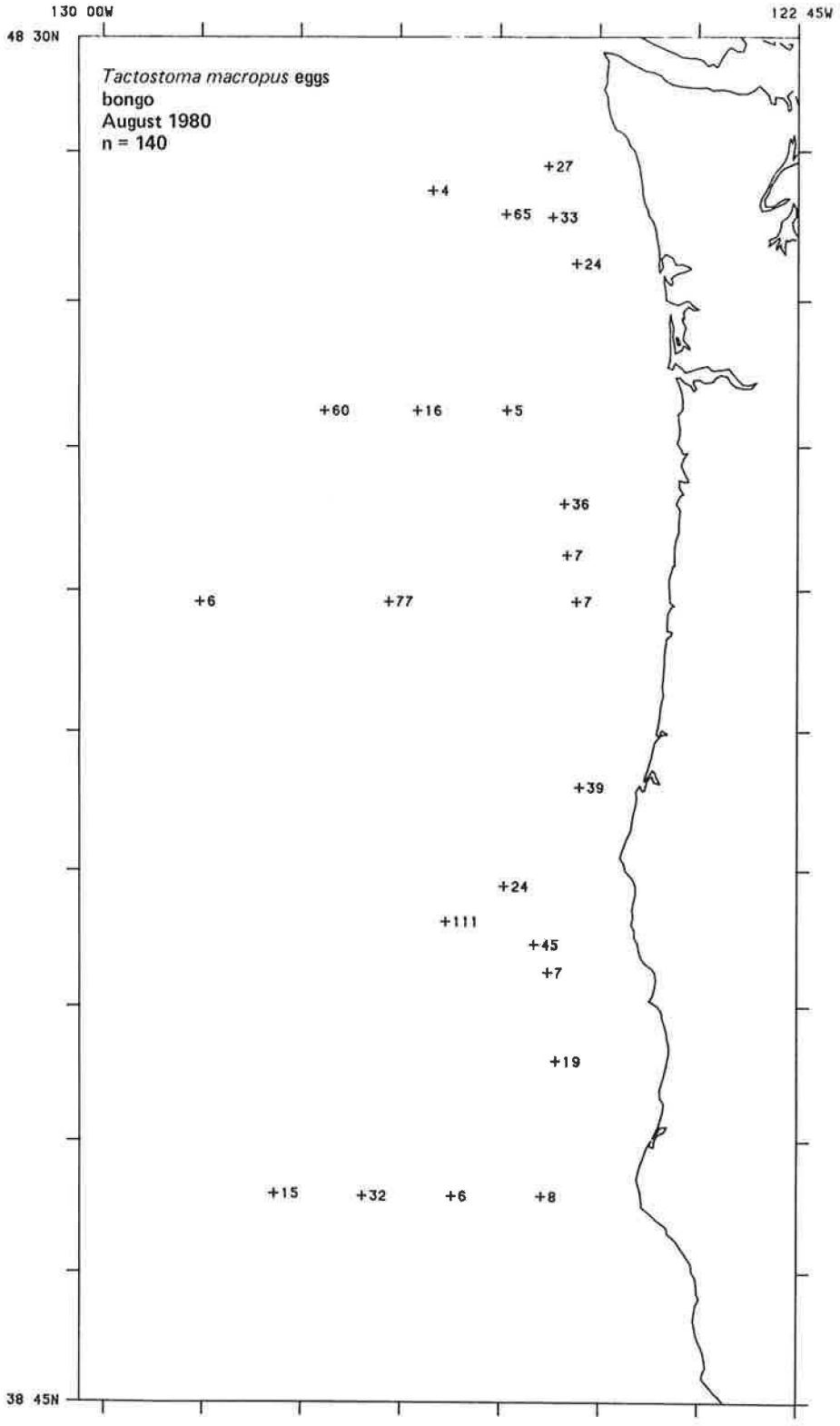

Figure 11.--Distribution of eggs of Tactostoma macropus from bongo tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 10 m^2.

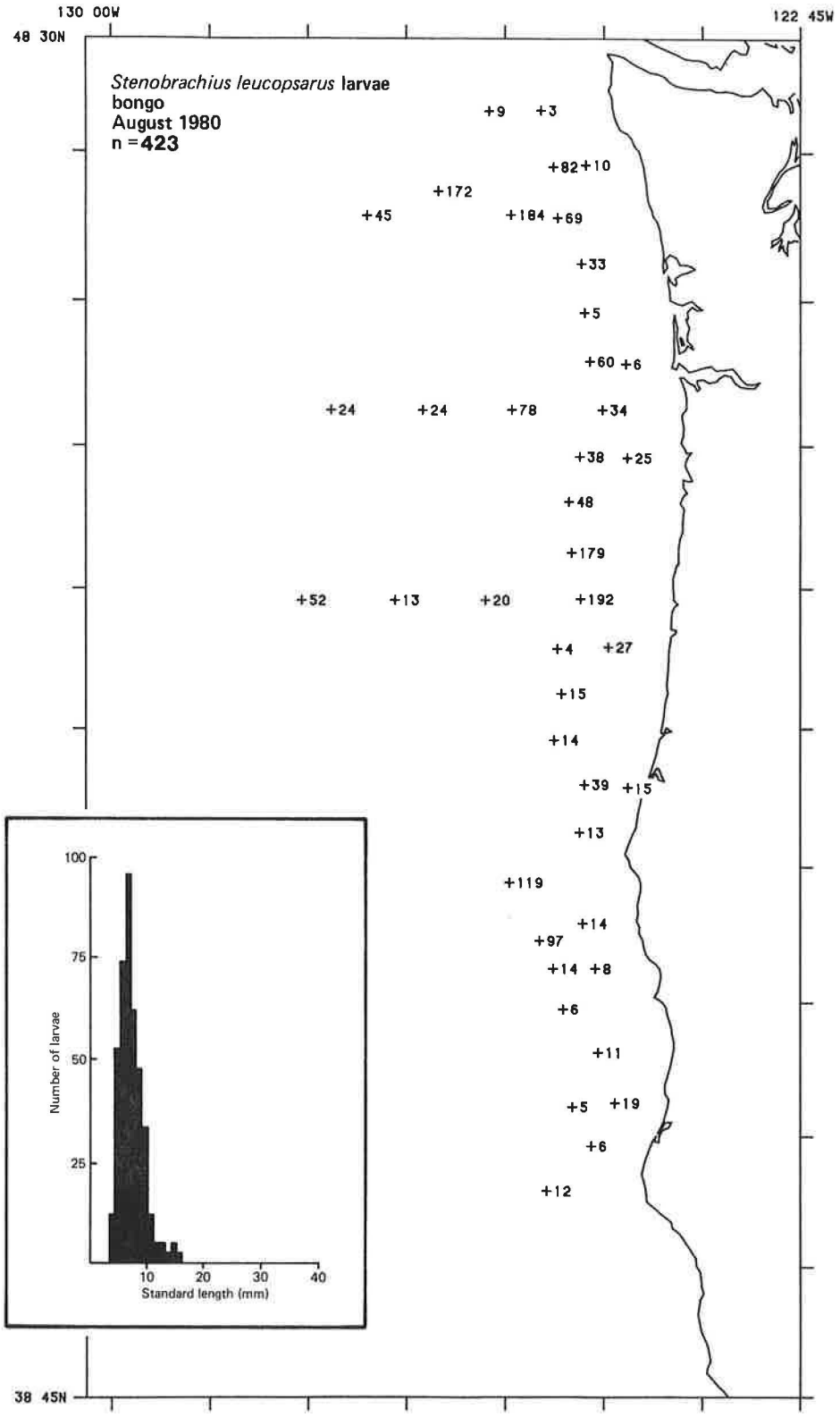

Figure 12.--Distribution and lengths of larvae Stenobrachius leucopsarus from bongo tows during cruise 1P080, August 1980. Abundance expressed as numbers per 10 m^2.

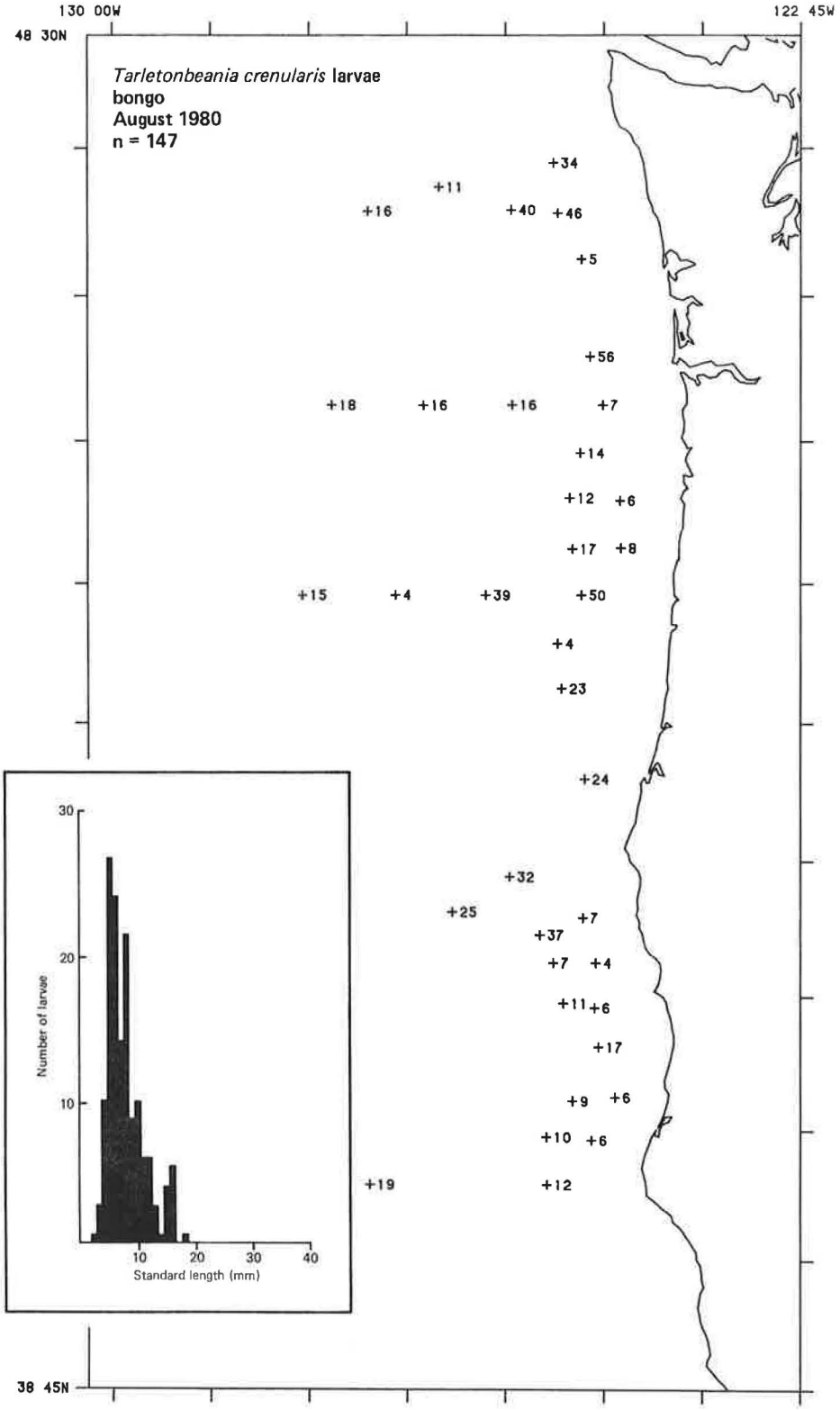

Figure 13.--Distribution and lengths of larvae of Tarletonbeania crenularis from bongo tows during cruise 1P080, August 1980. Abundance expressed as numbers per 10 m^2.

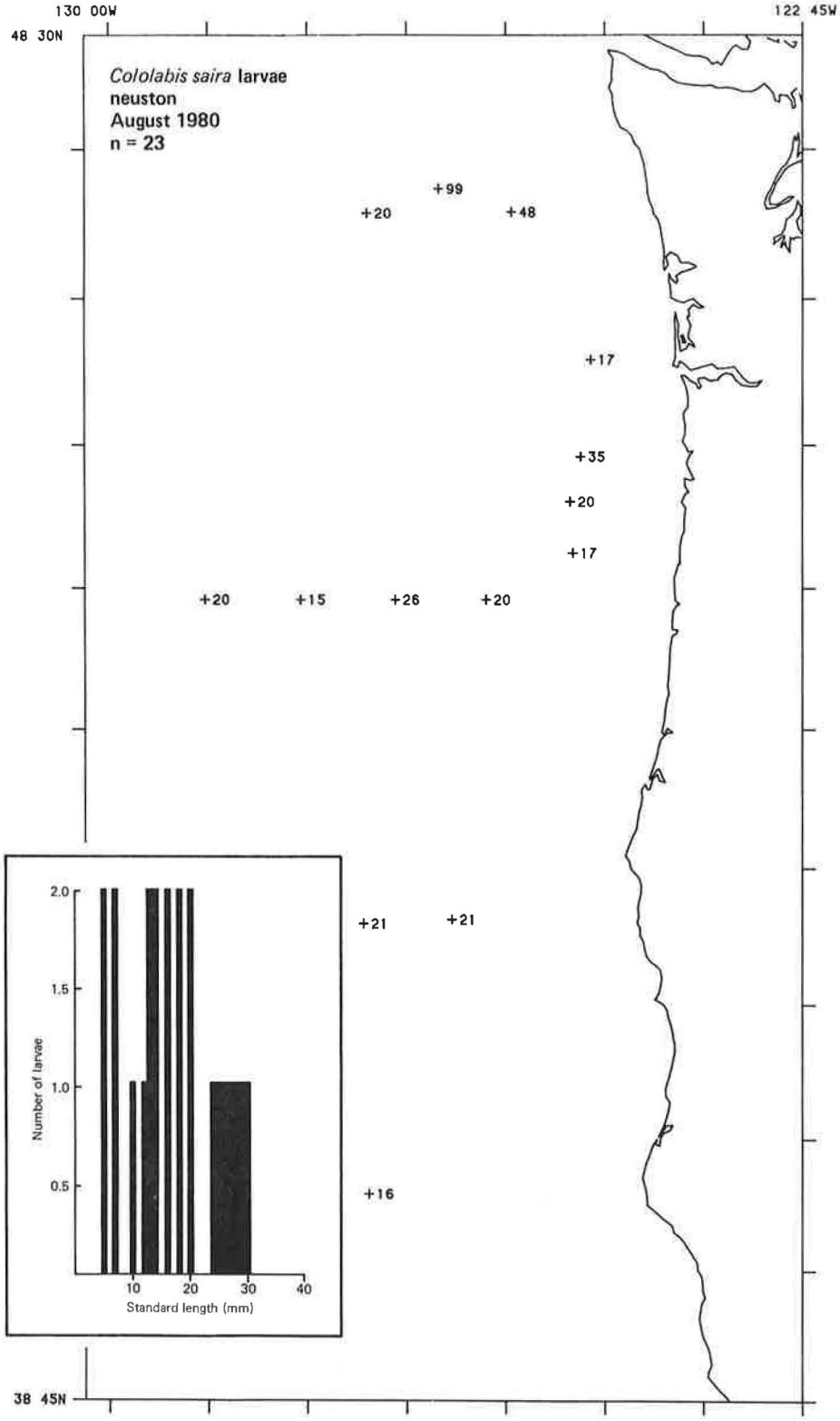

Figure 14.--Distribution and lengths of larvae of Cololabis saira from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

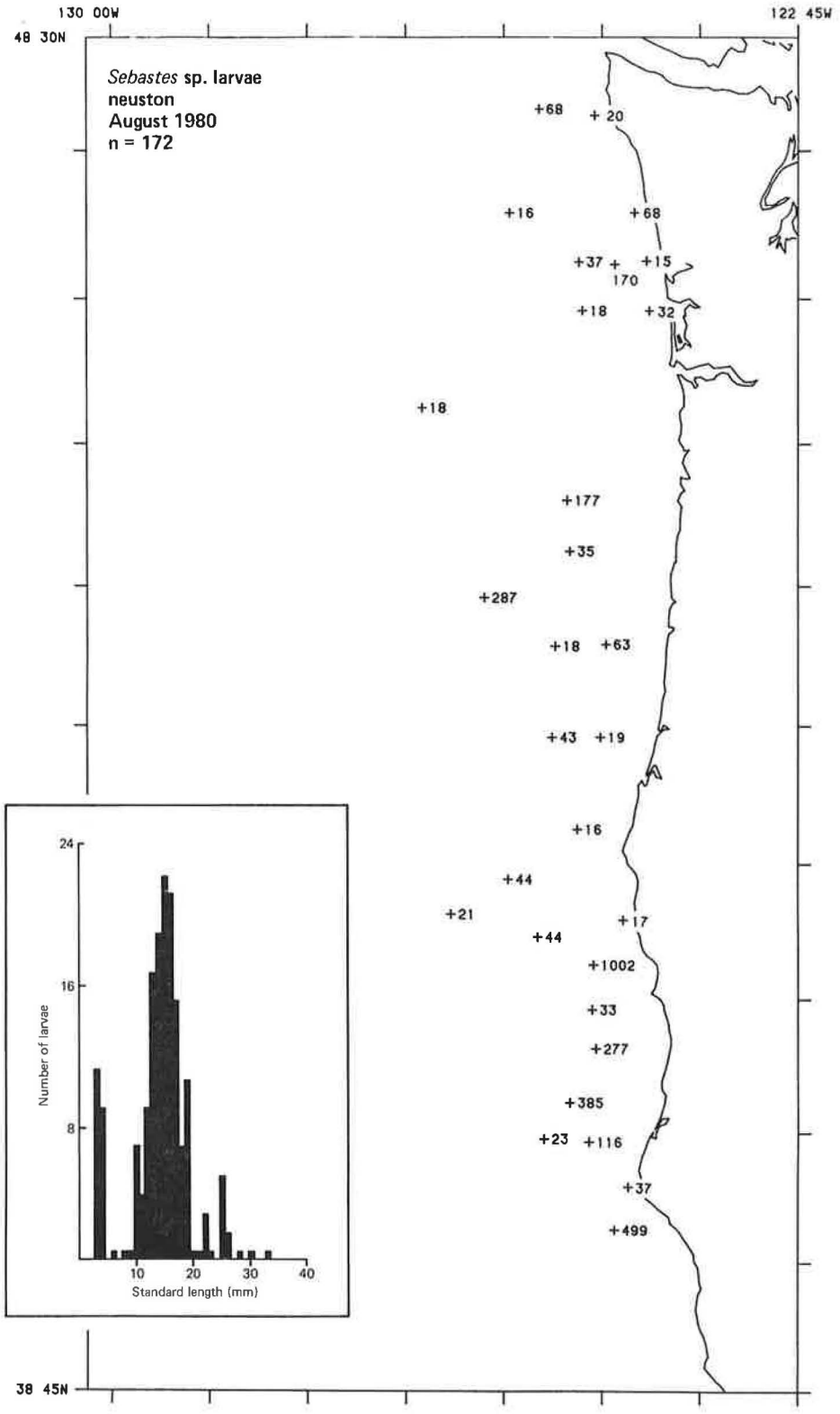

Figure 15.--Distribution and lengths of larvae of Sebastes sp. from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

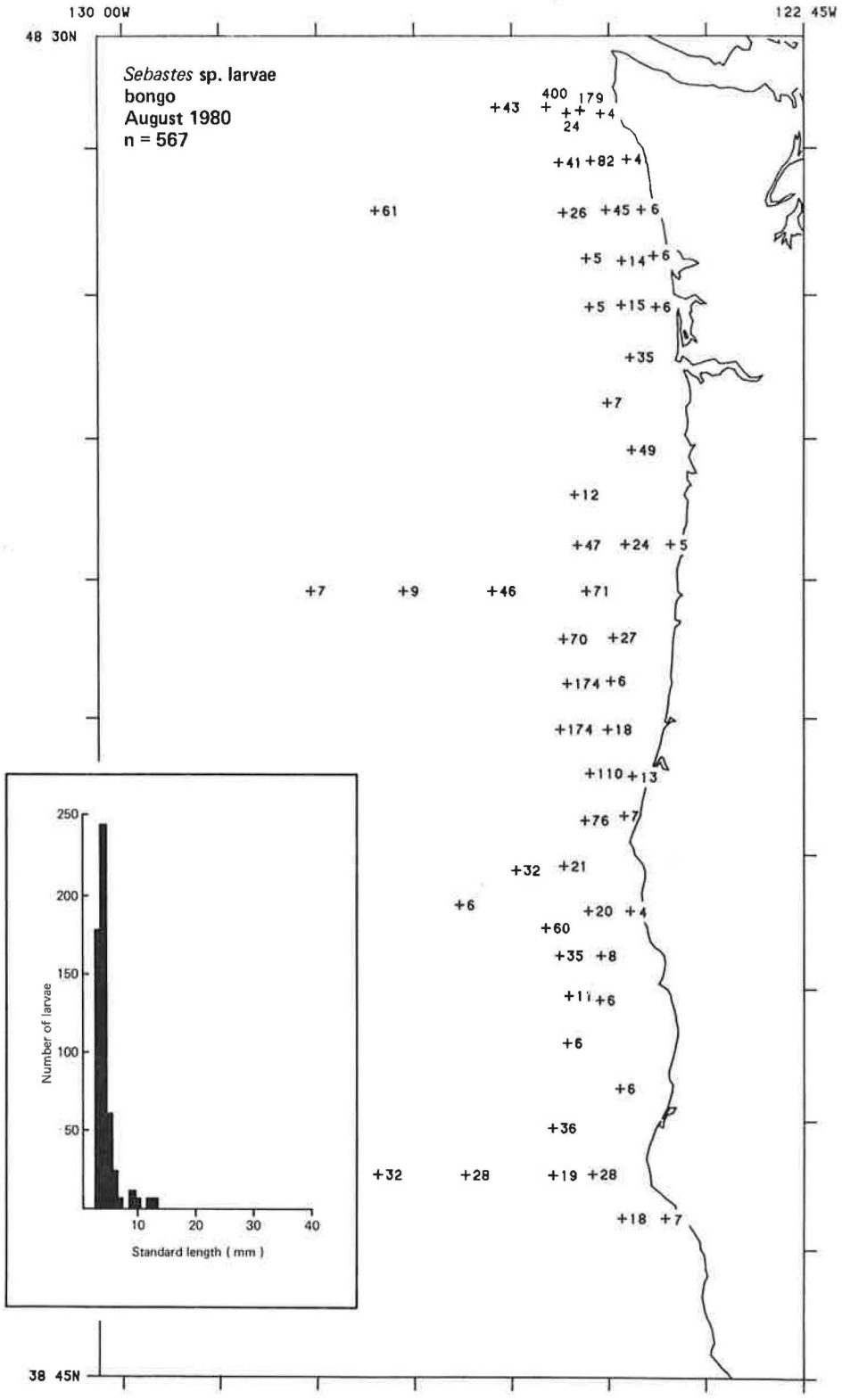

Figure 16.--Distribution and lengths of larvae of Sebastes sp. from bongo tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 10 m^2.

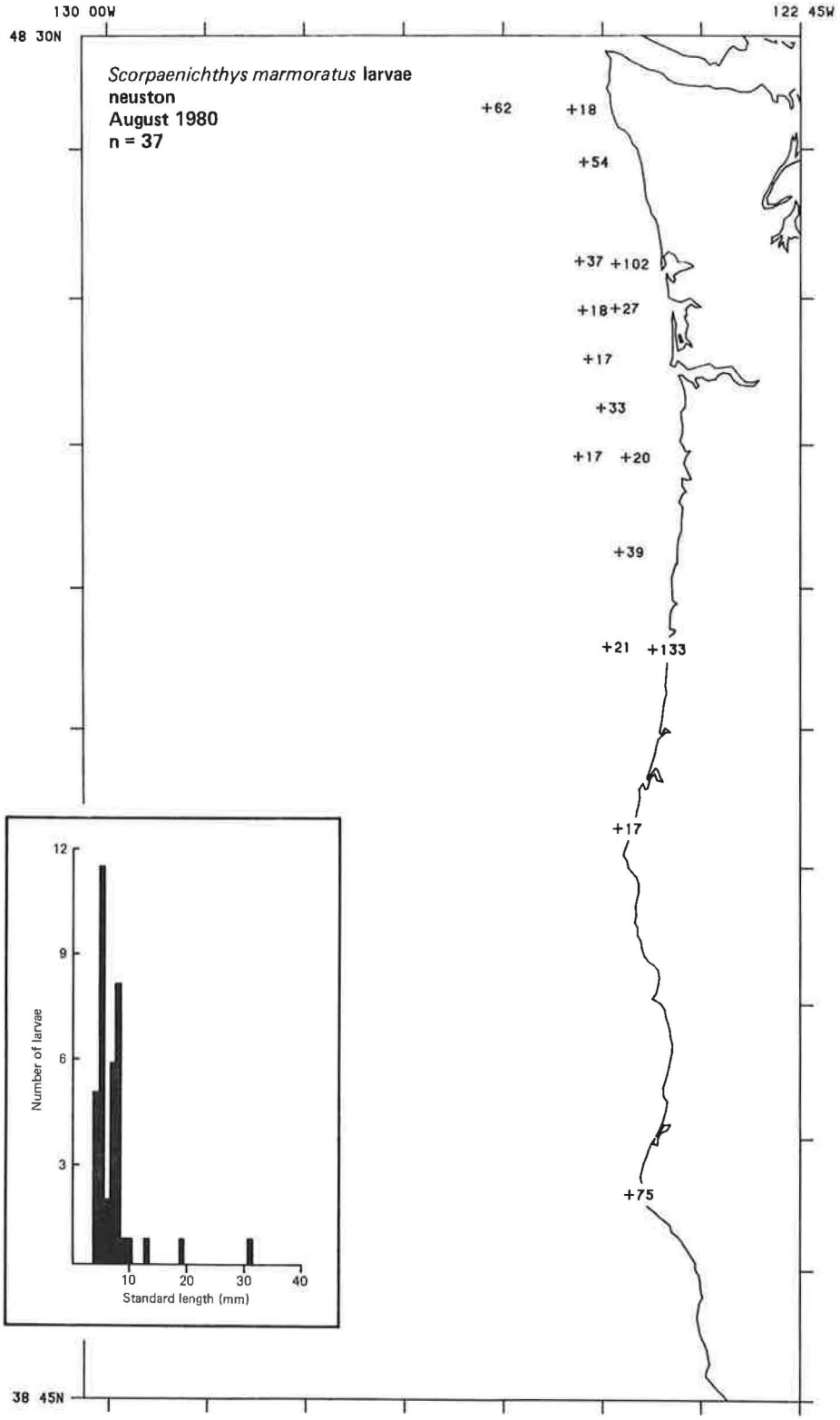

Figure 17.--Distribution and lengths of larvae of Scorpaenichthys marmoratus from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

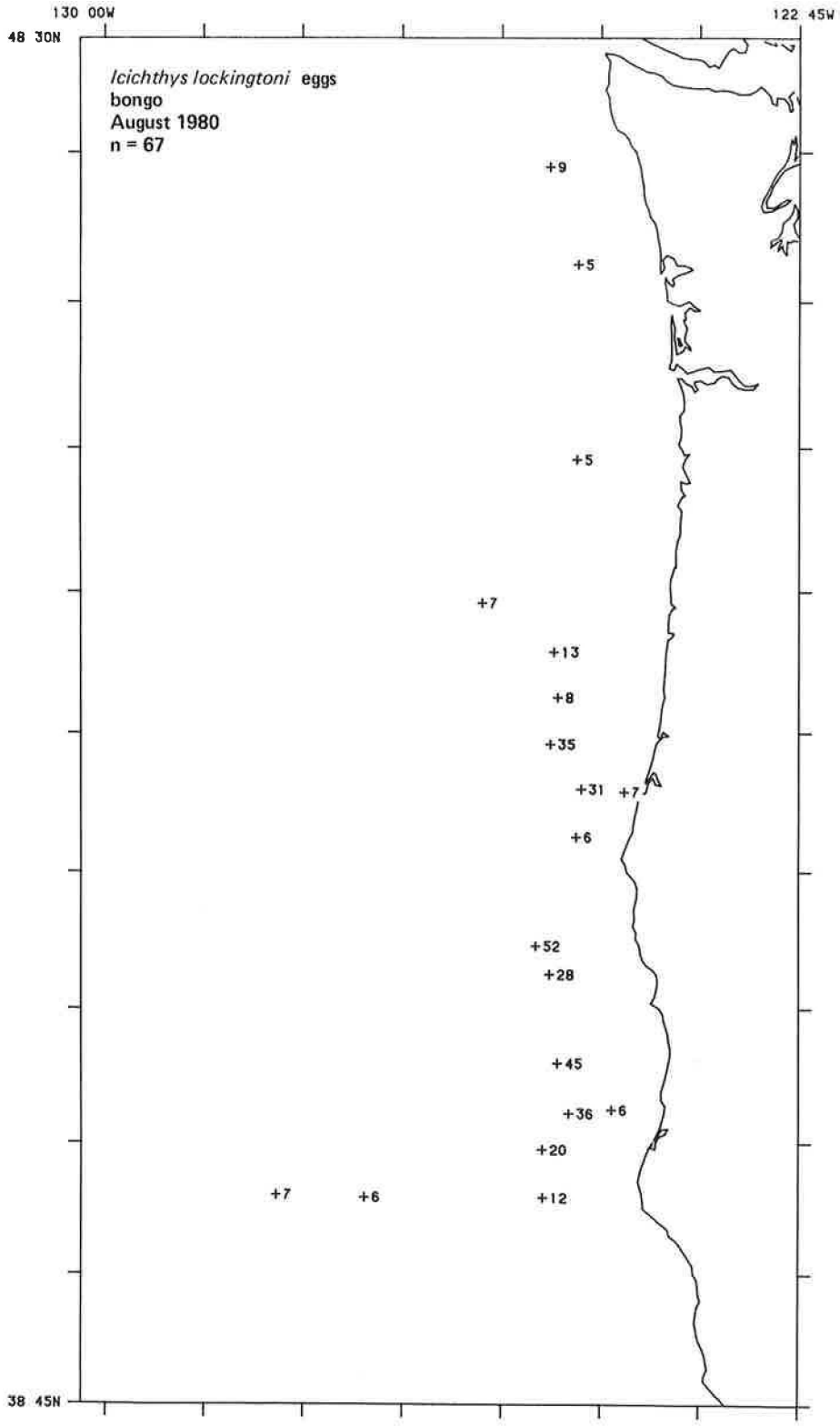

Figure 18.--Distribution of eggs of Icichthys lockingtoni from bongo tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 10 m^2.

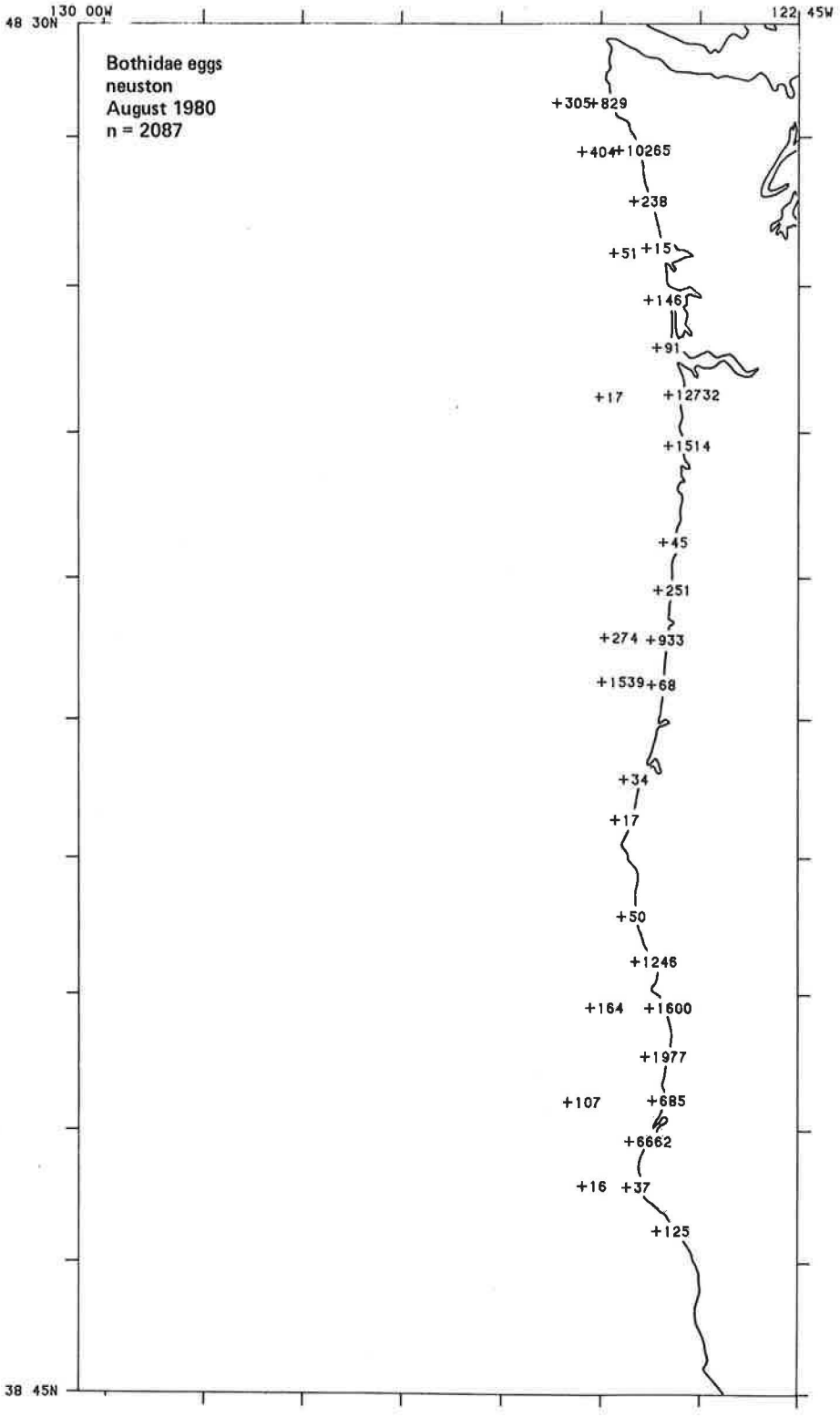

Figure 19.--Distribution of eggs of Bothidae from neuston tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 1,000 m^3.

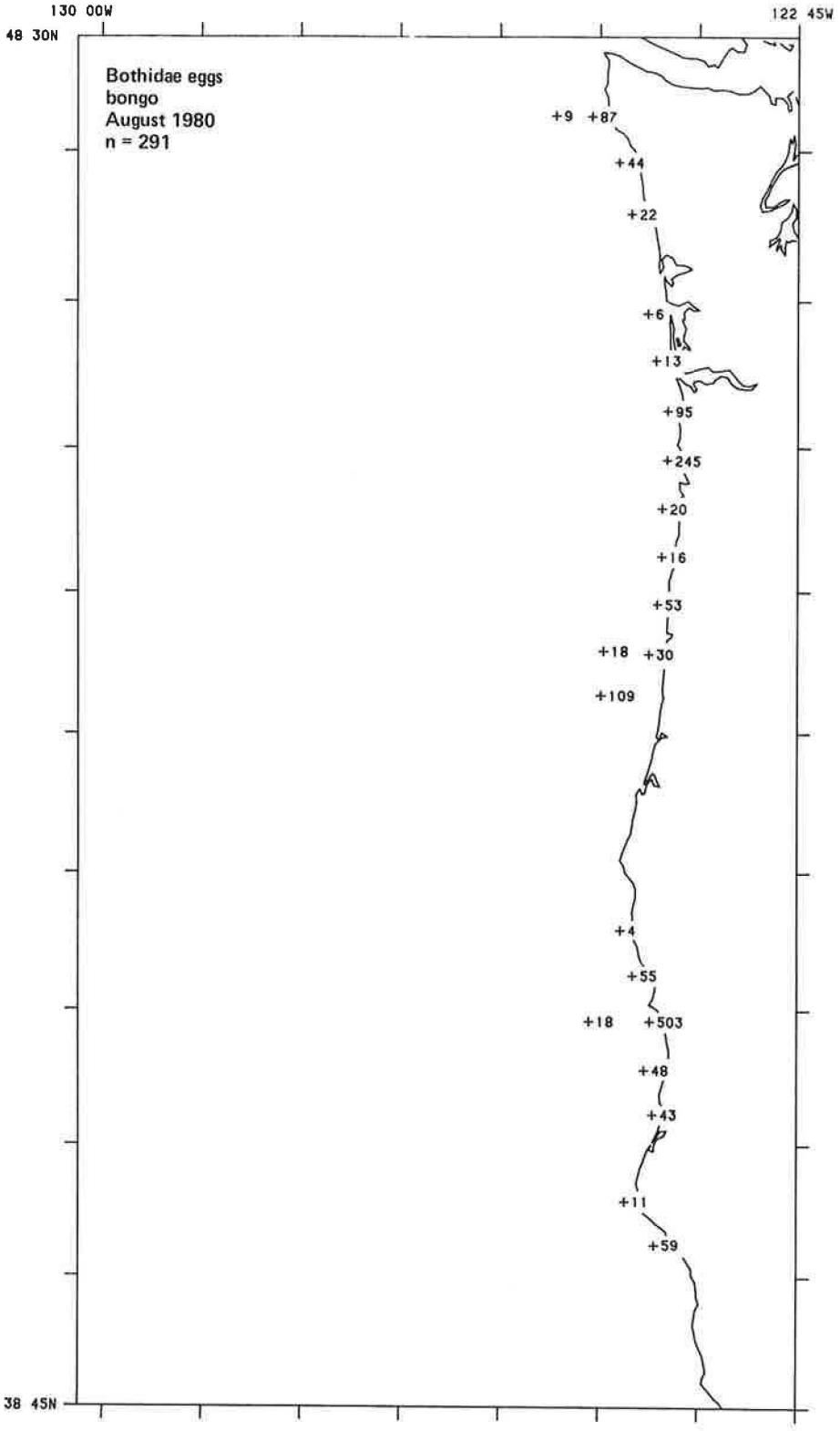

Figure 20.--Distribution of eggs of Bothidae from bongo tows during cruise 1PO80, August 1980. Abundance expressed as numbers per 10 m^2.

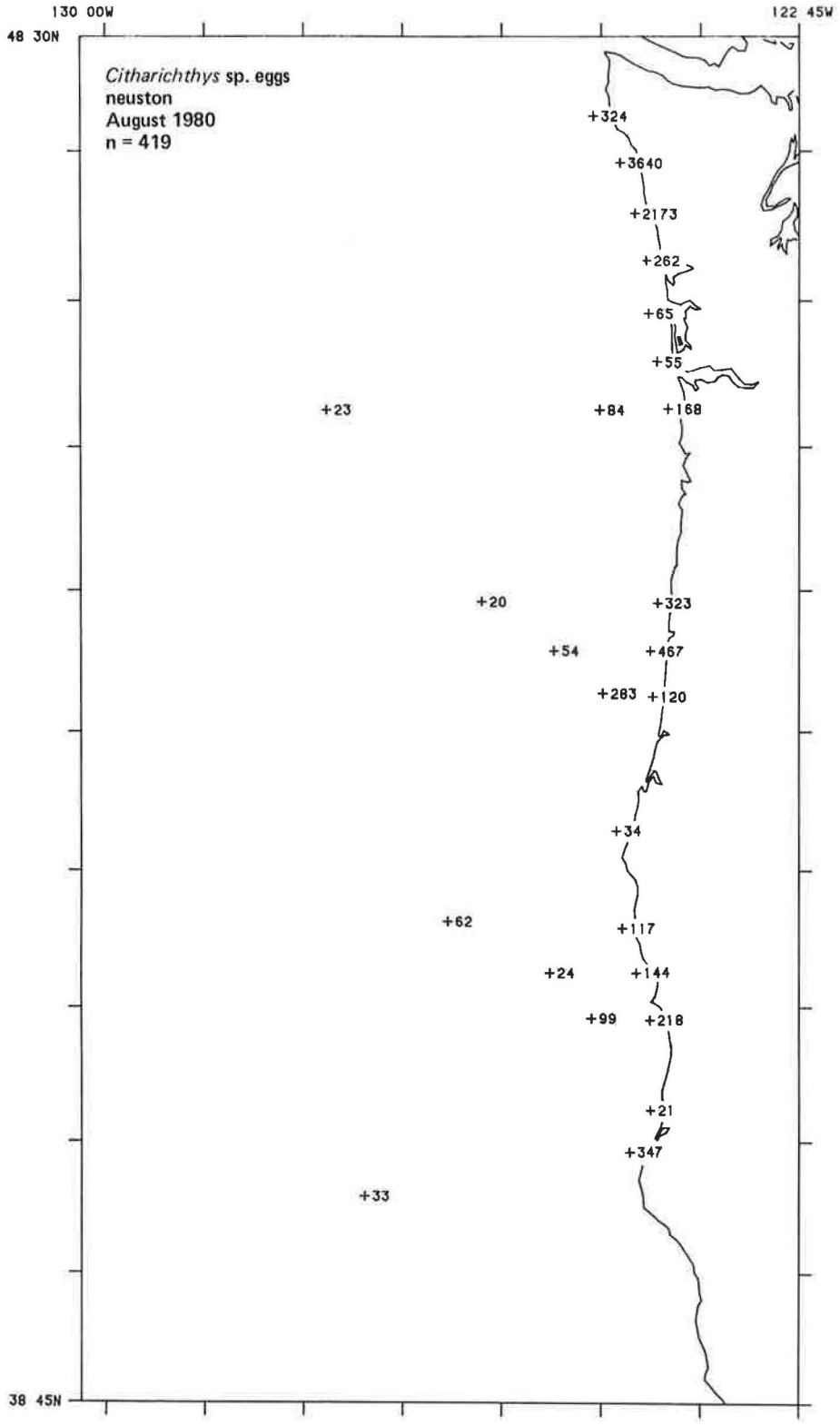

Figure 21.--Distribution of eggs of Citharichthys sp. from neuston tows during cruise 1P080, August 1980. Abundance expressed as numbers per 1,000 m^3.

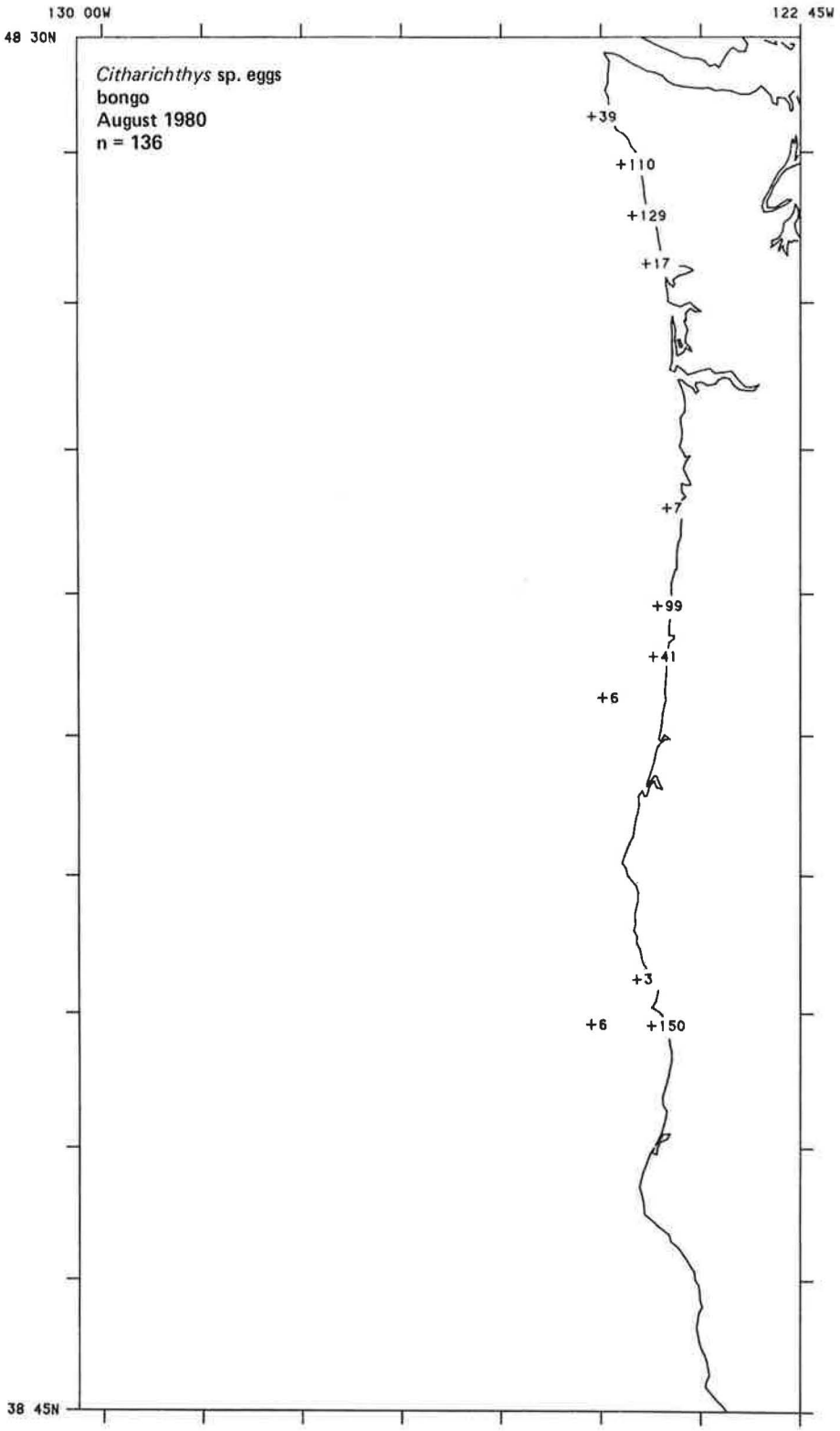

Figure 22.--Distribution of eggs of Citharichthys sp. from bongo tows during cruise 1P080, August 1980. Abundance expressed as numbers per 10 m^2.

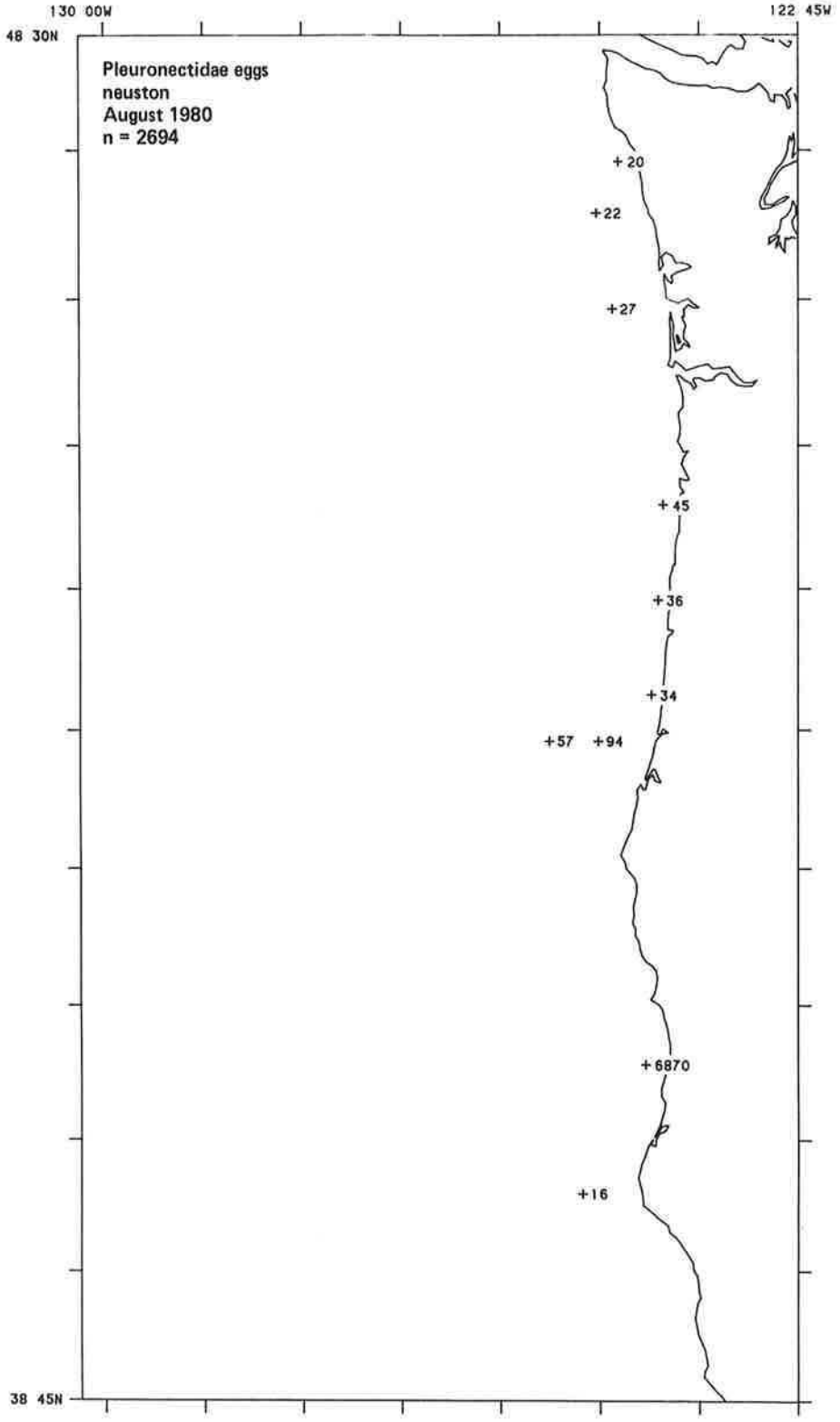

Figure 23.--Distribution of eggs of Pleuronectidae from neuston tows during cruise 1P080, August 1980. Abundance expressed as numbers per 1,000 m^3.

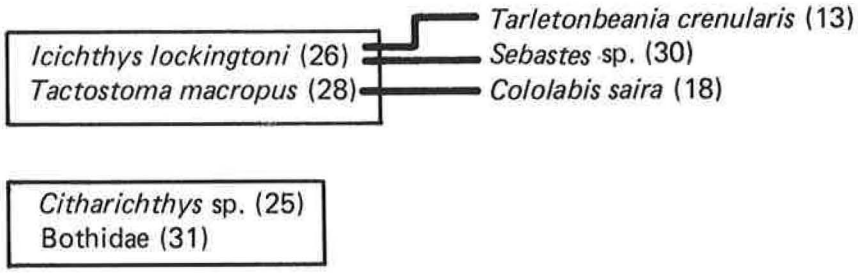

Figure 24.--Results of recurrent group analysis on neuston catches (both fish eggs and larvae) from 1PO80, August 1980, at an affinity level of 0.4. Taxa in rectangles are members of recurrent groups. Lines connect taxa with affinities outside their groups. Numbers in parentheses following taxa names are the numbers of occurrences of that taxon.

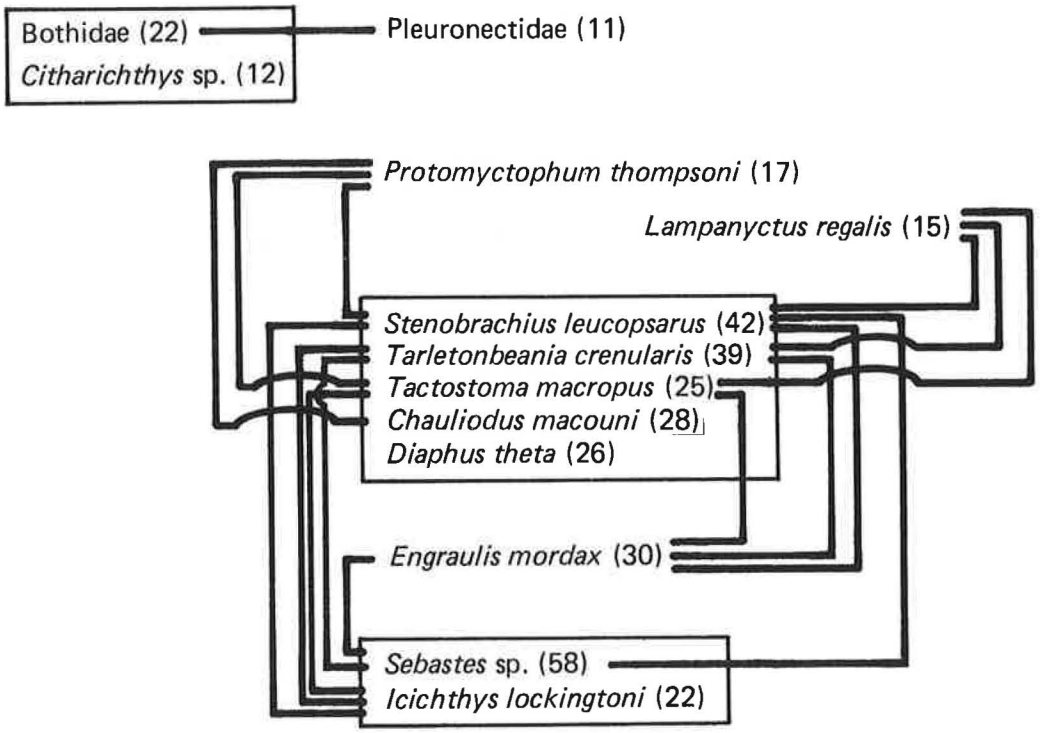

Figure 25.--Results of recurrent group analysis on bongo catches (both fish eggs and larvae) from lPO80, August 1980. Format as for Figure 24.