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TRANSLATION

PRELIMINARY REPORT ON MULTI-VESSEL TRAWL SURVEY ON POLLOCK ON THE EASTERN BERING SEA CONTINENTAL SHELF IN THE SPRING OF 1981

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The multi-vessel trawl survey using commercial vessels for the purpose of estimating abundance of young pollock stocks, which has been conducted since 1976, was designed to be carried out as a joint Japan-U.S. research program in 1981. However, approval was not received from the U.S. Government for the joint operation and Japanese commercial vessels conducted research on their own as in the past.

This year two surveys (June and August-September) were planned, with June survey data already obtained. This spring survey was the fourth since 1978. The following is an outline of the survey.

In the past, surveys have been conducted by Danish seiners only but in 1981 a stern trawler of the landbased dragnet type (Hokutensen) also participated.

One hundred and twenty-six stations were established as in past years on the eastern Bering Sea continental shelf. Five surimi mothership fleets shared the designated stations almost equally with one haul conducted at each station using one or two of the catcher boats attached to the respective mothership (the stern trawler made 30-minute tows). Items covered at each station included the recording of catch composition by species, fork length composition and age structure (scales) collections from pollock and measurements of water temperature (surface and bottom layers).

Outline of the survey

The survey was conducted for 18 days (June 5 to 22) as follows: 33 stations (1 to 33) covered by the Akatsuki maru No. 1 (96.61 tons) and the Seiken maru No. 8 (96.94 tons, 1,200 hp) of the Nisshin maru No. 2 fleet during June 6 to 16; 33 stations (26 to 58) covered by the Mitsu maru No. 50 (124.10 tons, 1,300 hp) of the Mineshima maru fleet during June 7 to 22; 33 stations (51 to 86) covered by the Soho maru (124.70 tons, 1,300 hp) of the Hoyo maru fleet during June 5 to 22; 33

stations (82 to 114) covered by the Hokko maru No. 17 (124.54 tons, 1,300 hp) of the Shikishima maru fleet during June 5 to 22; and 21 stations (106 to 126) covered by the Mutsumi maru No. 52 (298.78 tons, 1,250 hp) of the Soyo maru fleet during June 5 to 8. The station numbers, area of responsibility, and sampling strata surveyed for each mothership fleet are illustrated in Fig. 1.

Five stations out of 126 were not occupied but at 24 stations hauls were duplicated by vessels thus making a total of 145 survey operations.

In 1981, with the Soyo maru fleet, where only stern trawl catcher vessels participated in the survey, fishing methods and gear used varied. For other fleets, the gear used for the survey had the same specifications as that for the preceding year.

It is difficult to compare catchability among vessels. Japanese and U.S. scientific research vessels have used parallel operations to compare catchabilities and a method which uses the ratio of the estimated biomasses in the same area. Because these surveys were conducted during the commercial fishing operations, it was quite difficult to use the above methods. However, it is necessary to establish some standard for comparison because of the participation of the stern trawlers this year.

Although there were some differences in timing, the catches made by Danish seiners (one haul each) and stern trawlers (30-minute tow each) at nine stations (106 to 114) in almost the same area were as follows--

	Flounders		Pollock		Total catch	
Station	Danish seine	Stern trawl	Danish seine	Stern trawl	Danish seine	Stern trawl
106	60	120	6,710	3,810	7,000	4,300
107	100	55	3,665	1,230	4,010	1,400
108	10	70	670	479	810	600
109	50	45	2,820	308	3,000	400
110	50	260	420	990	815	2,500
111	100	100	500	3,170	800	3,500
112	10	60	40	4,470	70	5,000
113	20	40	1,780	3,920	2,000	4,200
114	30	60	2,750	2,390	3,000	2,700
Total	430	810	19,355	20,767	21,505	24,600
Mean	47.8	90.0	2,150.6	2,307.4	2,389.4	2,733.3
St/Ds	1.884		1.073		1.144	

According to the above table, and comparing one haul by Danish seiners with a 30-minute tow by stern trawlers, stern trawlers caught 1.9 times as much flatfish, which have high dependency on the bottom, as did Danish seiners. This was despite the fact that stern trawlers used gear which had one meter separation between the groundrope and the net. Further, the stern trawlers caught 1.1 times more pollock, which are semi-pelagic, than did Danish seiners. The total catch by the stern trawlers and Danish seiners was not appreciably different: the catch by stern trawlers was about 1.1 times greater than that by Danish seiners because the catch was predominantly pollock. A comparison of CPUE of pollock taken by Danish seiners (71 to 100 GRT) engaged in the mothership-type surimi fishery and by small stern trawlers (101 to 200 GRT) in 1973 to 1980, showed CPUE of pollock taken by stern trawlers to be 1.7 to 4.3 times higher than by the Danish seiners. The average CPUE by stern trawlers was 2.4 times higher than by Danish seiner. As the CPUE value of the stern trawlers

was shown for one hour hauls, the CPUE for 30-minute hauls would be 1.2 times that of Danish seiners which is similar to the results of the 1981 survey.

The above results suggest that the catchabilities of one Danish seiner haul and one 30-minute tow by small stern trawlers on the continental shelf are about the same with catchability by stern trawlers slightly higher. However, in the following sections, we have assumed that the catchabilities of pollock by Danish seiners and stern trawlers making one haul or one 30-minute tow, respectively, are the same because data were limited and there were some gaps in timing in the survey.

Results of the survey on pollock

1. Catches by station: distribution of pollock catch by station (Fig. 2)

In Area E, pollock density was high not only in waters deeper than 100 m but also in waters shallower than 80 m. This suggests the possibility of high density existing even in waters shallower than 50 m in 1981.

In Area M, pollock density was not high in waters deeper than 100 m south to southwest of the Pribilof Islands where density has been high in the past, but there was high density of pollock in waters slightly deeper than about 80 m. Density in waters around 50 m in depth was not as high as usual.

In Area W, the pollock density was high in waters deeper than 100 m and low in waters shallower than 80 m.

Throughout the survey area as a whole in 1981, high density of pollock was observed with substantial concentrations in waters shallower than 80 m.

2. Average fork length of pollock by station and area

In Area E, only large-sized fish with average fork length of over 35 cm were found, as was the case in the previous year. In particular, large-sized fish over 60 cm in average fork length were distributed in shallow areas around 50 m in depth. However, stations showing catch of pollock with fork lengths ranging between 30.0 and 39.9 cm were more numerous than in the previous year.

In Area M, large-sized fish approaching 40 cm in average length were distributed mainly in waters shallower than 100 m. Fish smaller than 25 cm in average length were more significantly represented than in the previous year. Fish of 30 to 40 cm range were distributed in depths ranging from 80 to 150 m. In this area, a trend toward larger sizes than in the previous year was observed.

In Area W, while only fish of over 30 cm in average fork length were found in the previous year, in 1981 fish in the 20 cm range in average length were significantly represented.

3. CPUE of pollock by stratum

Apparent CPUE values (kg per haul) by area by depth for the years 1978 to 1981 and by depth for the whole survey area for the same period are shown in Table 1. Yearly changes in CPUE values (tons per haul) by area and for the whole survey area are shown in Fig. 4 for the fall seasons of 1976 to 1980 and the spring seasons of 1978 to 1981.

In Area E, extremely high density was observed in waters shallower than 80 m in comparison with the previous year. In the depth zone of 80 to 100 m, however, which was about the center of distribution in the past, density was about one-half that of the previous year. In depths of 100 to 150 m and 150 to 300 m, where extremely low values were observed in the previous year, CPUE values were almost the same

as in 1979. On the whole, in Area E, the CPUE value in 1981 exceeded the value in 1978 which was previously the highest value (Table 1).

In Area M, while a high CPUE value was observed in waters shallower than 100 m in 1981, the CPUE in 100 to 150 m declined to about one-half that of the previous year and CPUE in 150 to 300 m exceeded somewhat that in the previous year. Throughout Area M, there has been a downward trend in CPUE during 1978 to 1981 (Table 1).

In Area W, observations were limited in waters shallower than 80 m and yearly fluctuations are large. At these stations sampled this year, there were no pollock. However, in depths of 80 to 150 m there was about a twofold increase in CPUE value from the previous year. In waters deeper than 150 m in depth, CPUE in 1981 was about 78% of that observed in 1980. Throughout Area W as a whole, CPUE in tons per haul declined slightly from that in the previous year.

CPUE values by depth for all areas combined have shown an increasing trend in depths of 50 to 80 m and CPUE in 1981 was twice that in the previous year. In depths of 80 to 100 m, large yearly fluctuations in CPUE have been observed. The 1981 value was slightly lower than in 1980. In depths of 100 to 150 m, CPUE in 1981 was not as high as in 1978 but there has been a year to year increase since 1979. In 150 to 300 m, fairly stable values have been observed after 1978 (Table 1).

For all depths and the survey area as a whole, the highest CPUE was observed in 1978. The value declined in 1979 but has shown a year to year increase since that time. The value in 1981 had recovered to about 95% of the value in 1978 (Table 1).

CPUE values in tons per haul throughout the survey area declined to the lowest level in 1979 but since then have shown an increasing trend (Fig. 4). Although fall data for 1981 are not yet available, we expect that the fall CPUE will exceed that of the previous year if the general agreement in trends between spring and fall CPUE remains as in the past.

4. Stock abundance and relative biomass according to length and age composition

The stock abundance expressed as relative biomass was calculated by multiplying the area at each stratum by the size composition in the CPUE. The age composition was estimated using the length-age key based on age determination from age characters (scales) collected on board. The yearly fluctuations found are shown in Table 2. The length composition and age composition throughout the survey area in 1981 are shown in Fig. 5 in comparison with those in 1979 and 1980.

According to Fig. 5, the majority of pollock are less than 40 cm in fork length. This general picture has not changed by year, but in 1981, a mode between 15 and 20 cm was remarkably pronounced and about three times as high as in the previous year. The mode between 20 and 30 cm was also fairly high in 1981 compared with 1979 and 1980. For pollock more than 40 cm, some of their length classes were lower than in 1980 but all were higher than in 1979 (Fig. 5).

In the age composition, pollock of age 3 were the most abundant as was the case in 1979 and 1980, but the representation of pollock age 4 and younger was greater than in the previous year (Table 2, excluding age 2 fish of 1978). In contrast, the representation of pollock age 5 and older was lower than in the previous year. Age 1 pollock (1980 year class) appeared in strength about 2.8 times that of the previous year. This was a very notable feature in 1981.

The stock abundance by area for ages combined (Table 2) was highest in the past in Areas M and W and only recently somewhat lower in Area M. Throughout the survey area, the stock abundance has shown an increasing trend from the low of 1979 and in 1981 reached its highest level reflecting the recent strong appearances of age groups. The strength of age 2 pollock, which are considered new recruits to the

fishery, has been proved by the Japan-U.S. joint research program, etc. On the assumption that the 1977 year class has a strength of 1.0, the strength of the 1978 year class was 0.9 and the 1979 year class was 1.2. The apparent strength of the 1978 year class at age 2 was somewhat lower but at age 3 its strength was 1.6 times that of the 1977 year class. As mentioned above, the appearance of the 1980 year class at the age of one is a good sign. According to the above results, the apparent strength of year classes since that of 1977 is good.

5. Distribution of bottom water temperature

The horizontal distribution of bottom water temperature is shown in Fig. 6. In 1979, the oceanographic conditions were warm with no observations of water mass lower than 1°C. In contrast with this, in 1980, a cold water mass appeared, resulting in a fairly cold oceanographic regime. In 1981, fairly warm conditions were apparent because the areas of temperature lower than 2°C were narrow. It is assumed that such warm conditions in 1981 caused the high density of pollock in shallower areas and the northern distribution of small-sized fish compared to the previous year.

Combining the above results, it is believed that conditions for pollock since production of the 1977 year class have been good (average 1.5 times for the 1978 to 1980 year classes) and this tendency will continue. Such strong year classes will be recruited one after the other to the fishery. The spring survey in 1981 endorsed the view that the pollock stock in the eastern Bering Sea, at least until 1983, will not show any decreasing trend.

TABLES 1 AND 2 AND FIGS. 1 TO 6 ARE IN ENGLISH IN THE JAPANESE DOCUMENT

Table 1. CPUE (in kg per haul) of pollock by stratum in June, 1978-1981.

Area	Year	Depth zone (m) 50/80	80/100	100/150	150/300	Depth Total
E	1978	146.8	4,931.5	2,002.0	2,396.2	1,731.3
	1979	476.7	922.1	1,250.3	567.4	783.8
	1980	993.4	2,456.8	484.2	102.0	1,098.0
	1981	2,530.7	1,012.2	1,120.2	531.0	1,733.6
M	1978	137.4	1,128.3	3,472.1	-	1,914.4
	1979	234.8	377.3	1,924.3	3,550.0	1,241.8
	1980	704.6	765.5	1,686.3	150.0	1,118.0
	1981	906.4	1,903.3	826.5	250.0	978.5
W	1978	130.0	540.0	1,738.9	2,820.0	1,618.6
	1979	11.0	47.4	521.4	935.0	484.4
	1980	800.0	511.3	1,798.9	3,701.7	1,851.2
	1981	0.0	1,230.0	3,092.4	2,893.1	2,570.6
Area Total	1978	142.8	3,166.6	2,439.5	1,887.0	1,764.0
	1979	370.7	636.9	1,242.8	1,568.2	870.2
	1980	889.8	1,672.9	1,365.2	1,591.6	1,269.2
	1981	1,856.7	1,318.7	1,689.4	1,418.1	1,665.8

Table 2. Age composition of pollock in relative population number (x 10^3) in June, 1978 - 1981.

Area	Year	Age 1	2	3	4	5	6	7	8	9	10	11	Total
E	1978	-	11,782	47,670	54,139	101,850	52,585	18,782	8,157	1,234	840	-	297,039
	1979	16,609	73,676	81,181	61,495	14,676	5,279	928	510	50	40	-	254,444
	1980	-	3,428	79,353	58,568	38,278	29,772	13,472	5,116	1,628	-	-	229,615
	1981	-	3,740	162,459	141,490	41,202	18,555	8,557	2,460	789	536	402	380,190
M	1978	819	136,556	225,000	88,212	37,008	9,432	849	-	-	-	-	497,875
	1979	14,808	135,139	199,191	104,430	22,508	9,537	2,368	57	25	-	-	489,062
	1980	35,056	113,032	151,711	72,028	16,003	5,602	1,788	127	19	-	-	395,366
	1981	5,078	49,046	160,780	57,867	20,699	5,741	1,830	548	128	64	-	301,781
W	1978	320	330,304	155,870	19,985	14,809	3,602	957	111	60	-	-	526,018
	1979	3,409	17,728	37,731	19,098	7,044	4,937	2,192	720	202	-	-	93,041
	1980	31,912	76,194	117,711	64,807	27,092	16,461	4,155	1,175	601	-	-	340,108
	1981	179,732	218,876	233,681	47,383	14,416	6,114	2,443	1,283	329	144	-	704,401
Total	1978	1,137	478,642	428,540	162,336	153,667	65,619	20,588	8,268	1,294	840	-	1,320,932
	1979	34,826	226,543	318,103	185,005	45,228	19,753	5,487	1,287	276	40	-	836,547
	1980	66,168	192,654	348,775	195,403	81,373	51,835	19,415	6,418	2,248	-	-	965,089
	1981	184,810	271,662	556,920	246,740	76,317	30,410	12,830	4,291	1,246	743	402	1,386,371

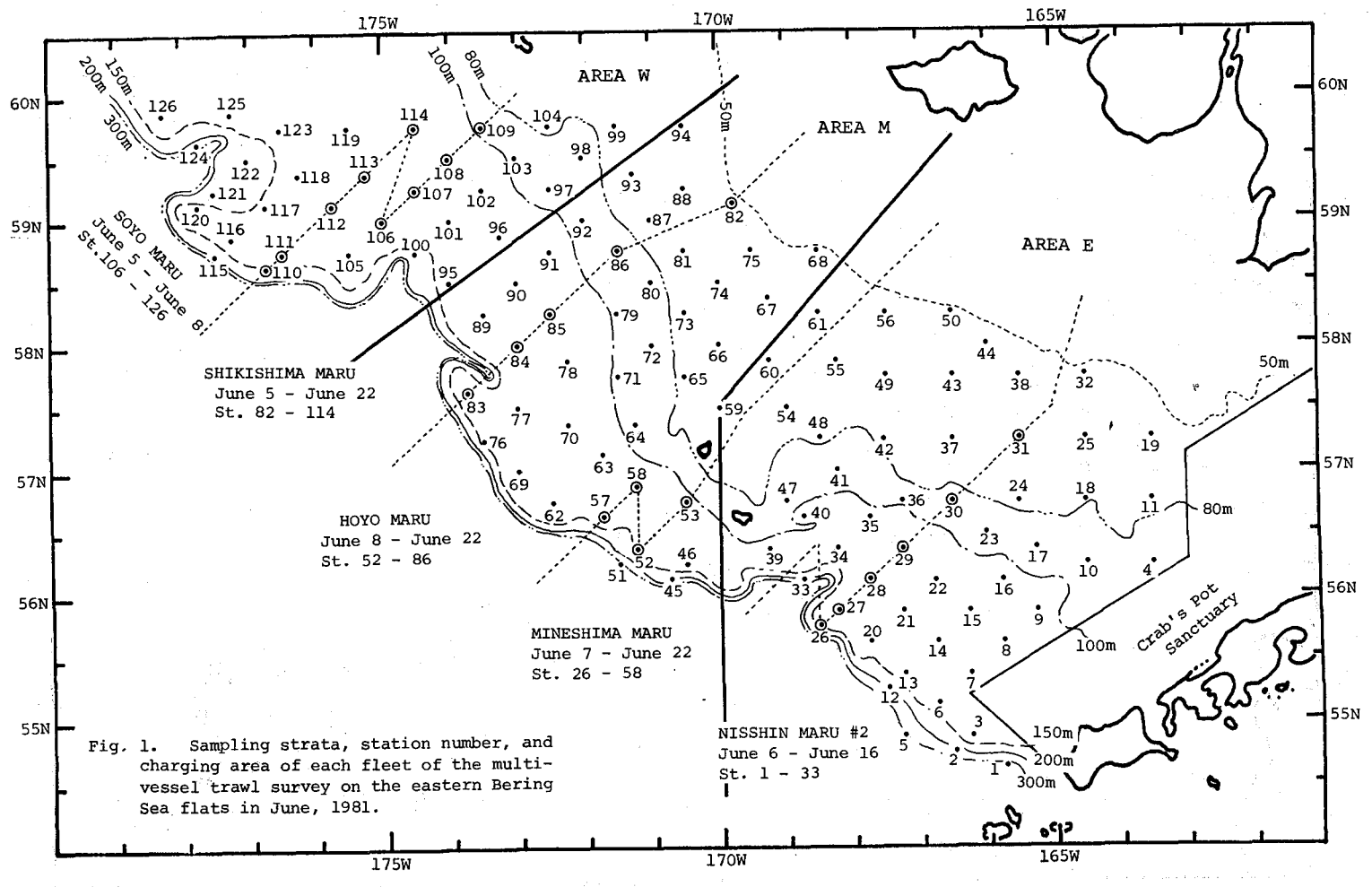

Fig. 1. Sampling strata, station number, and charging area of each fleet of the multi-vessel trawl survey on the eastern Bering Sea flats in June, 1981.

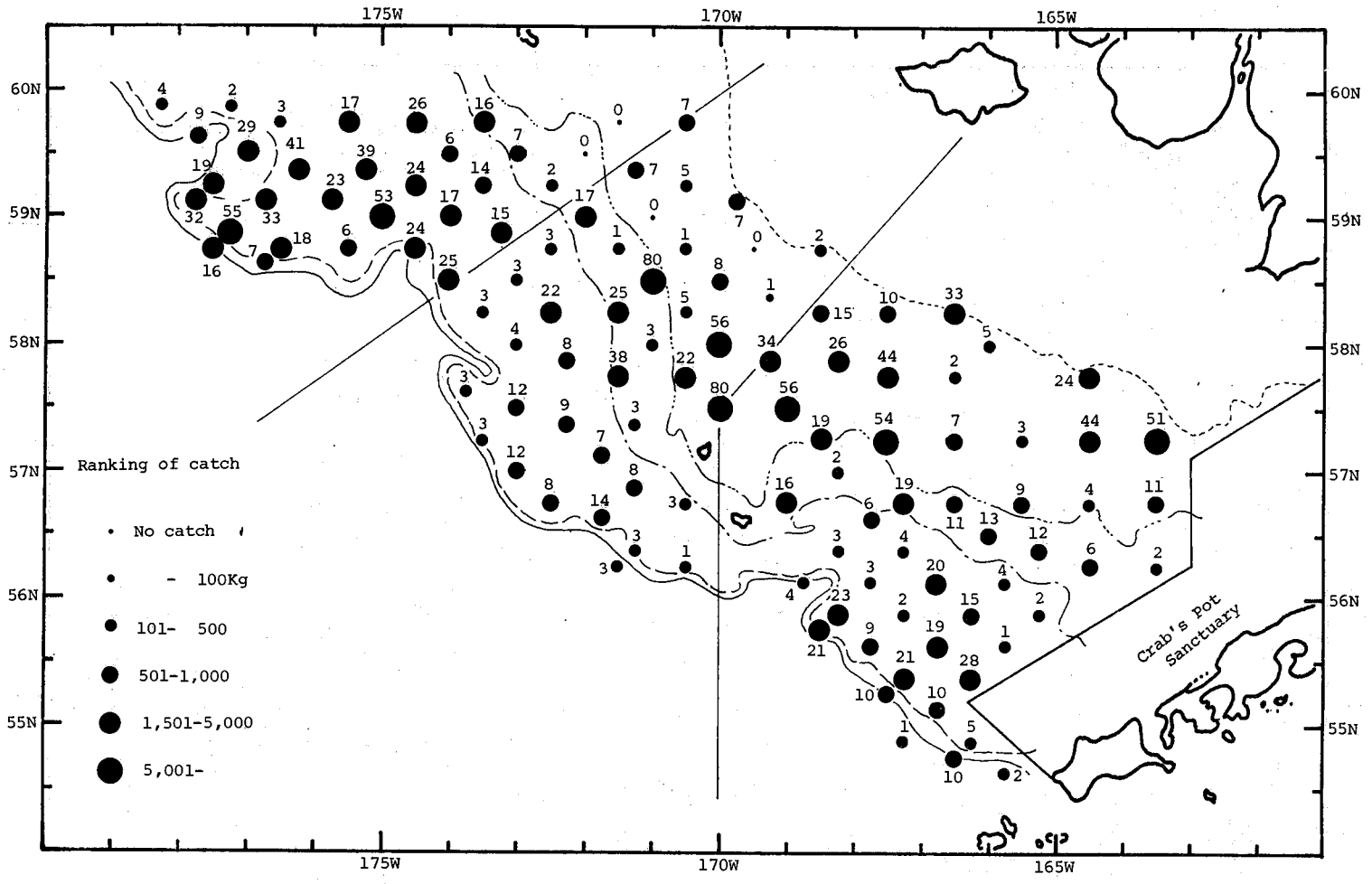

Fig. 2. Pollock catches (in 100 kg) of each station in June, 1981.

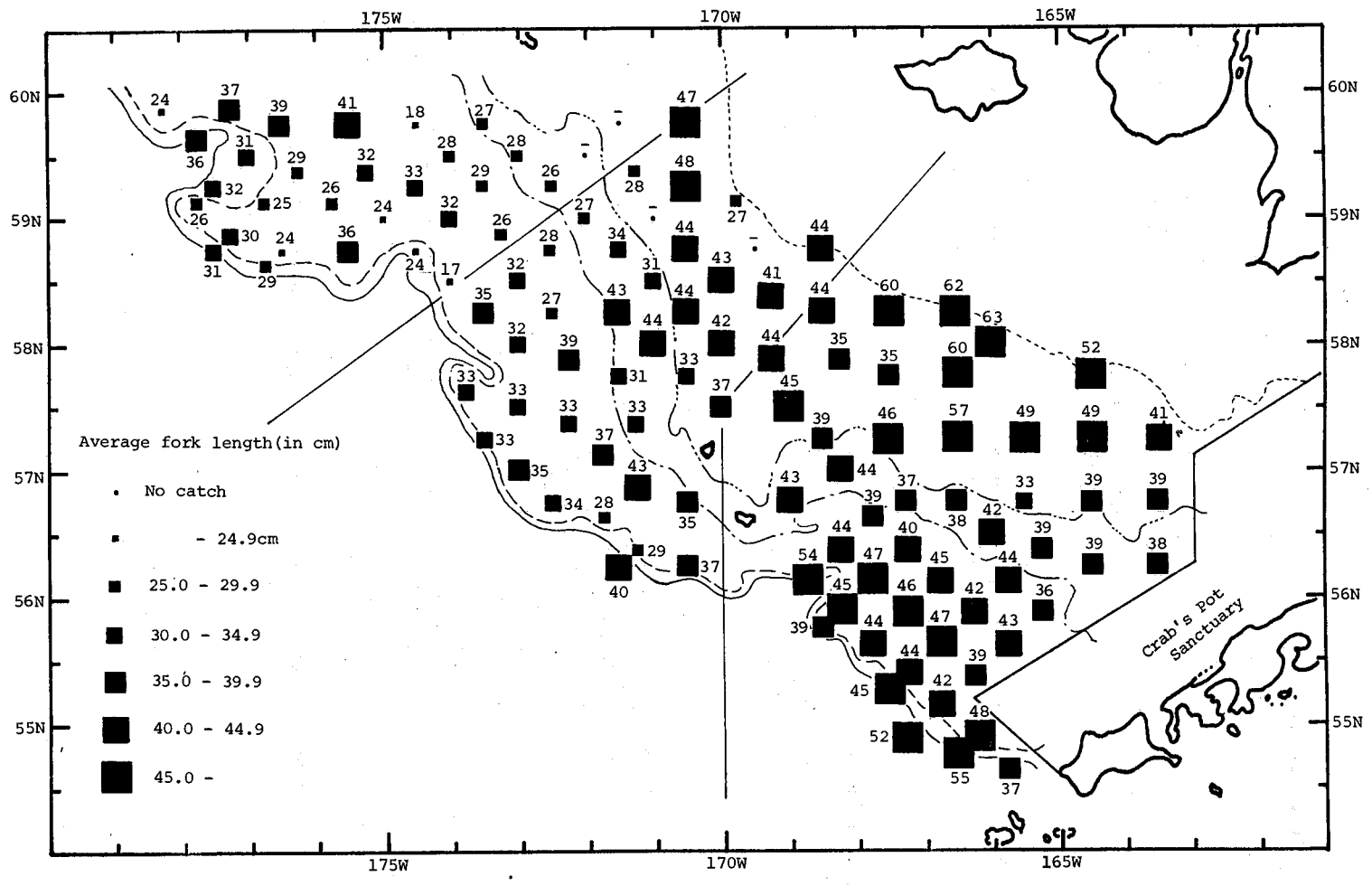

Fig. 3. Average fork length (in cm) of pollock of each station in June, 1981.

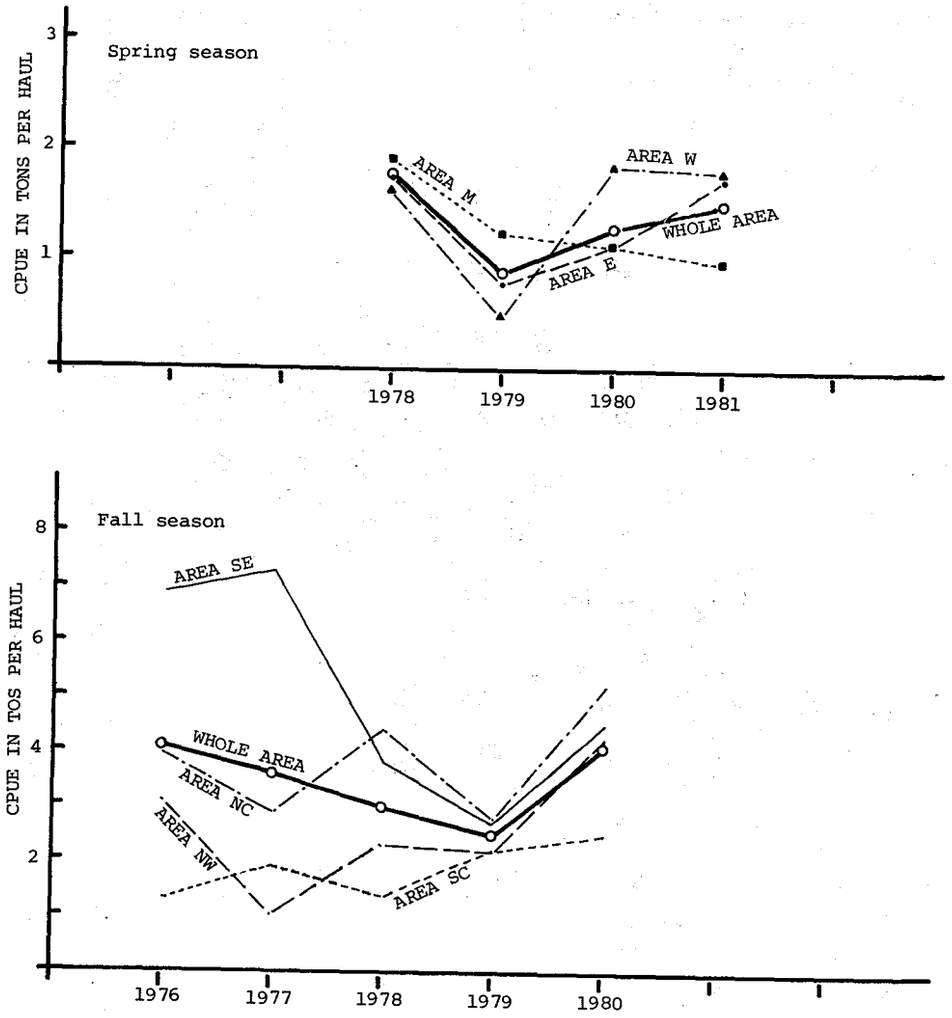

Fig. 4. CPUE of pollock (in tons per haul) in Spring season(1978-1981) and Fall aeason(1976-1980).

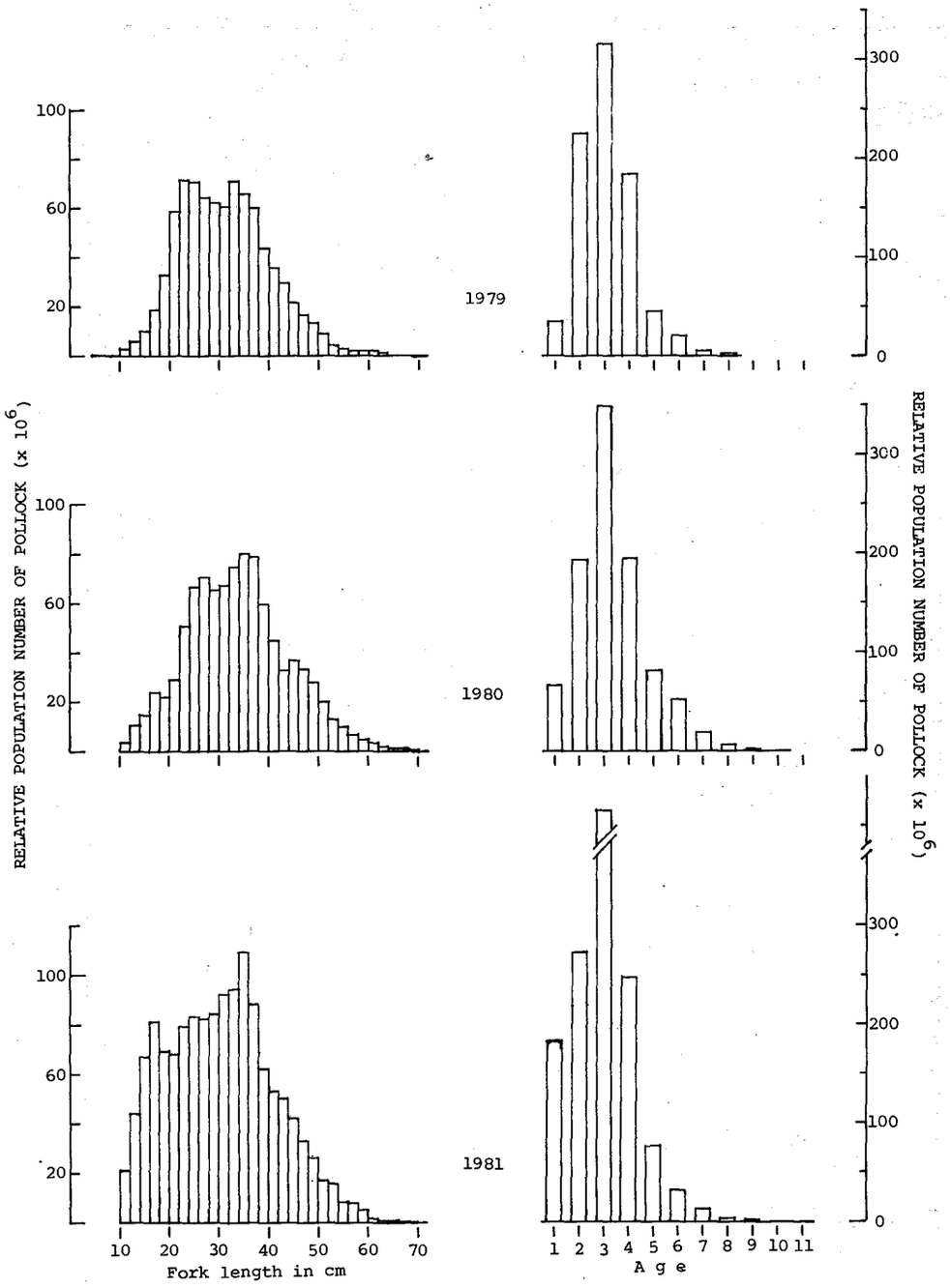

Fig. 5. Size and age composition of pollock in relative population number by year in June, 1979-1981.

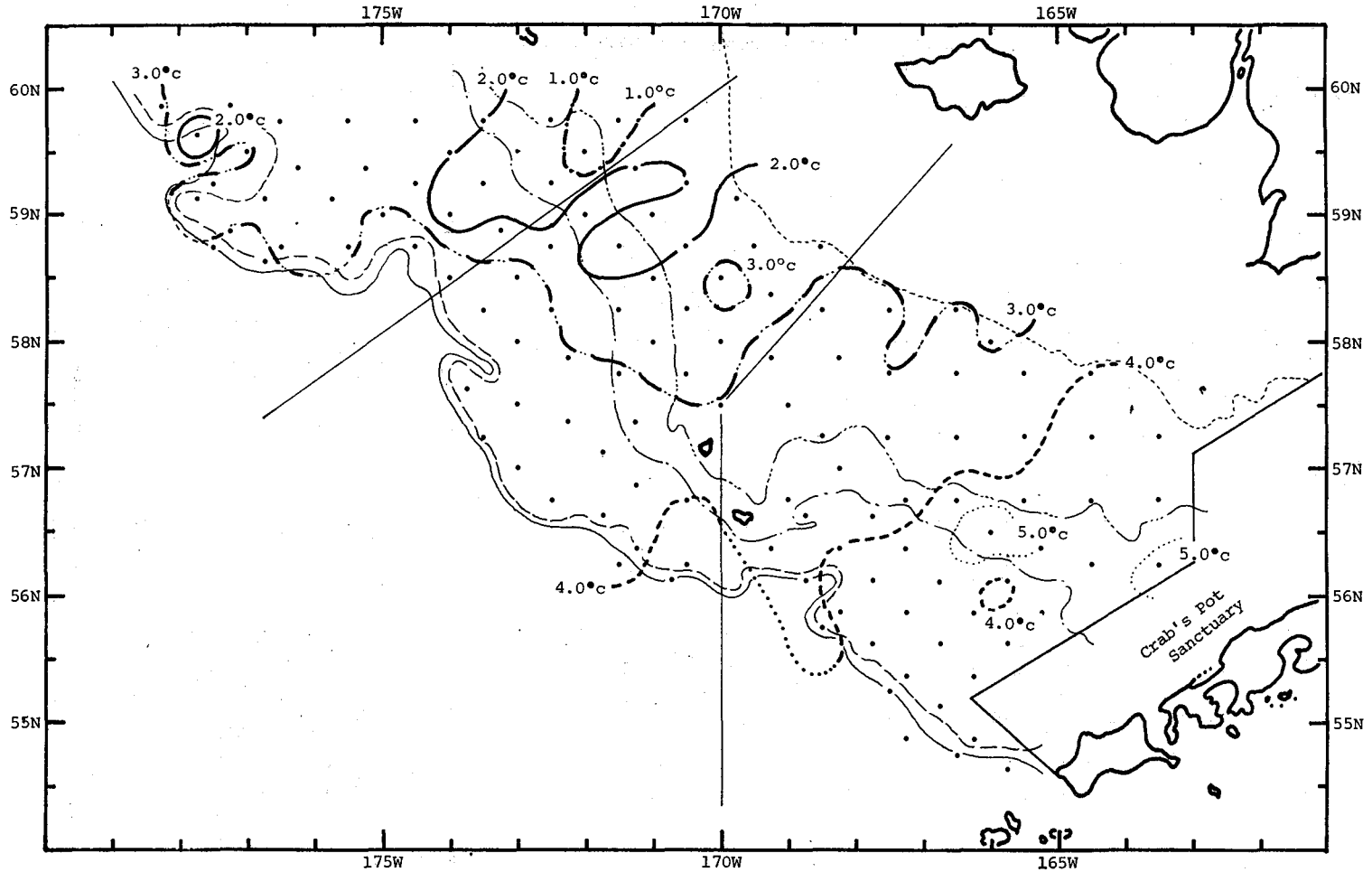

Fig. 6. Horizontal distribution of bottom water temperature (°C) in June, 1981.