

CONDITION OF SABLEFISH AND POLLOCK IN THE GULF OF ALASKA IN 1981

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CONDITION OF SABLEFISH IN THE GULF OF ALASKA IN 1981

James W. Balsiger*

INTRODUCTION

The sablefish resource in the Northeast Pacific is found in waters off northern Mexico to the Gulf of Alaska, westward to the Aleutian region, and into the Bering Sea. Until 1977 the major fishing area was the Gulf of Alaska; since 1978 sablefish catches off Washington-California have surpassed those of the Gulf of Alaska. In 1979 the Washington-California catch was approximately two times the Gulf catch. In the Gulf of Alaska the species is taken predominately by longline gear in depths greater than 500 m.

There has been a U.S. fishery for sablefish in the Gulf of Alaska for more than 50 years, but exploitation rates were very low until Japan entered the fishery in the 1960's. Catches increased to 36,500 t in 1972 and subsequently decreased to 27,500 t in 1976 (Table 1). Evidence of declining stock abundance led to significant fisheries restrictions in 1977 through 1980 and total catches in those years were reduced substantially.

STOCK STRUCTURE

Experiments designed to identify sablefish stock structure in the Gulf of Alaska continue. The NMFS, ADF&G, and Japanese and Canadian fisheries scientists have all released tagged sablefish over the past several years. These experiments all suggest that sablefish throughout the Northeast Pacific are of one genetic pool. There is less agreement on the degree of interchange of fish between regions. Wespestad (1981) suggests that inter-regional migration is small in comparison to stock size within each region and agrees with previous

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TABLE 1. HISTORICAL CATCHES OF SABLEFISH IN METRIC TONS BY AREA AND NATION IN THE GULF OF ALASKA, 1958-80.

 GULF OF ALASKA (SHUMAGIN--SOUTHEASTERN)

YEAR	U.S.	CANADA	JAPAN A/	USSR	ROK B/	TOTAL
1958	--	C/	--	--	--	--
1959	967	C/	--	--	--	--
1960	1,348	C/	--	--	--	--
1961	606	C/	--	--	--	--
1962	684	C/	--	--	--	--
1963	617	C/	1,681	--	--	2,298
1964	1,173	C/	1,041	--	--	2,214
1965	1,048	C/	2,107	--	--	3,155
1966	1,051	C/	3,514	--	--	4,565
1967	947	C/	4,217	--	--	5,164
1968	112	C/	13,886	--	--	13,998
1969	302	C/	19,587	--	--	19,889
1970	369	C/	21,397	--	--	21,766
1971	270	15	25,636	--	--	25,921
1972	1,387	16	34,259	535	308	36,505
1973	867	16	29,246	109	58	30,296
1974	771	10	23,300	38	2,431	26,550
1975	1,088	16	21,561	33	3,000	25,698
1976	803	23	22,947	41	3,700	27,514
1977	828 D/	3	14,367	4	1,586	16,785
1978	1,813	0	6,458	4	665	8,940
1979	2,341	0	5,919	152	759	9,226 E/
1980	2,204	0	4,831	416	891	8,342

A/ JAPANESE CATCH IS REPORTED BY FISHING YEAR THROUGH 1976; ALL OTHERS ARE REPORTED BY CALENDER YEAR.

B/ INCLUDES CATCHES FROM OTHER AREAS IN THE NORTHEASTERN PACIFIC.

C/ DATA NOT AVAILABLE.

D/ TRAWL DATA ONLY; POT AND LINE CATCH NOT INCLUDED

E/ INCLUDES 55MT BY MEXICO

SOURCE: U.S. DATA THROUGH 1973 FROM FISHERY STATISTICS OF THE U.S., STATISTICAL DIGESTS 49-68; 1974-76 DATA FROM PMFC DATA SERIES, GROUND FISH SECTION; 1977-80 FROM ADF&G EXTENDED JURISDICTION SECTION. CANADIAN DATA 1971-76 FROM PMFC DATA SERIES, GROUND FISH SECTION; 1958-70 DATA NOT AVAILABLE. JAPANESE, USSR, ROK DATA FROM INPFC DOCUMENT 1883 AND PERS. COMM. T. SASAKI, FAR SEAS FISHERY LAB., SHIMIZU, JAPAN.

reports (Low 1976, Wespestad et al. 1977) that management of the resource is best conducted by discrete geographic regions. Sasaki (1980), however, on the basis of his tagging experiment, states there may be "...a considerable geographical mixing over an extensively broad range of areas even in comparatively short term....."

Currently, management of sablefish is by region, reflecting the majority opinion of little stock migration which could lead to local depletion. The 5 management regions in the Gulf of Alaska are West, Central, Yakutat, Southeast inside waters, and Southeast outside waters.

MAXIMUM SUSTAINABLE YIELD

Although the sablefish resource is managed by regions, the long-term productivity in each region is assumed to be related to the overall condition of the resource. Japanese and U.S. scientists have estimated MSY of the resources as a whole and apportioned MSY to each region based on historic production trends. The Japanese estimate of MSY for the entire resource from California to the Bering Sea is 69,600 mt (Anon. 1978). Using essentially the same general production model as the Japanese, but with a different weighting of data among regions, Low and Wespestad (1979) estimated MSY for the California to Bering Sea resource at 50,300 t.

By region, historical catches were Bering Sea (25%), Aleutian region (4%), Gulf of Alaska (47%), and British Columbia-Washington region (25%). The apportioned MSY estimates were then compared to MSY estimates derived by applying general production models region by region. The resulting mean and overall estimate of MSY was 25,100 mt for the Gulf of Alaska (Low and Wespestad 1979).

CATCH PER UNIT EFFORT

Japanese Longline Fishery Data

Until 1977, catch and effort statistics from the Japanese North Pacific longline fishery provided consistent information for assessing the condition of sablefish stocks in the Gulf of Alaska. CPUE in terms of kilograms of sablefish per 10 hachi units of effort are shown in Table 2A.

CPUE was generally greater than 200 in all INPFC areas prior to 1974. In 1975, CPUE dropped to as low as 154 in the Shumagin Area and was generally about 185 in the other areas. In 1976, CPUE increased in all areas of the Gulf of Alaska. From 1976 to 1977, CPUE dropped in all areas with the decline ranging from 13-34% and averaging 25%.

An alternate method for computing a standardized CPUE for this fishery was described by Sasaki (1978). Though he did not calculate CPUE by each INPFC area, the trend from 1967-1977 for the Gulf of Alaska (Table 2B) is nearly identical to CPUE values shown in Table 2A.

In 1978, fishing regulations in the Gulf of Alaska were changed to permit Japanese longliners to fish in depths shallower than 500 m in the Shumagin-Chirikof Region for Pacific cod. In 1979, the permission was extended to the rest of the Gulf. This resulted in a shift of Japanese longline fishing effort towards Pacific cod in depths of 100-300 m, while in the past all the effort was directed at sablefish in depths generally greater than 500 m. Target effort cannot be detected in the Japanese reported statistics; consequently, this source of information is appropriate for sablefish stock assessment only through 1977, when the data series ends.

Table 2.--Indices of blackcod abundance in the Gulf of Alaska, 1967-79.

A. CPUE (kg per 10 hachi)

Year	Shumagin	Chirikof	Kodiak	Yakutat	Southeastern	Shumagin-Southeastern
1967	184	234	175	175	301	212
1968	153	226	272	282	257	263
1969	239	246	239	238	229	235
1970	221	245	266	255	229	235
1971	177	206	207	223	204	207
1972	220	198	210	203	207	208
1973	214	216	213	206	203	209
1974	181	191	185	191	195	190
1975	154	188	181	186	184	177
1976	165	201	182	196	191	186
1977	144	133	133	142	139	139
1978	*	*	136	137	---	137
1979	*	*	60	74	---	---

B. Standardized CPUE (t per boat-day)

Year	Gulf of Alaska	Footnotes:
1967	7.97	* Prior to 1978, Japanese longliners were not permitted to fish in depths shallower than 500 m. Since 1978, some of these longliners have been permitted to fish in waters shallower than 500 m for Pacific cod. Therefore, the total longline fishing effort no longer reflects total effort on sablefish.
1968	9.90	
1969	8.82	
1970	9.22	
1971	7.80	--- No foreign longlining has been permitted east of 140° W longitude since 1978.
1972	7.82	
1973	7.85	
1974	7.12	
1975	6.66	
1976	6.98	
1977	5.22	

U.S. Observer Data

Beginning in 1977 a new data source for evaluating sablefish stocks became available as U.S. observers were deployed on Japanese longline vessels. The observers collected a variety of information, including depth of fishing gear. Categorizing the observer information from longline vessels by quarter of the year from 1977-1980, INPFC area and depth, 76 observations were available at depths shallower than 300 m, 6 observations between 300 and 500 m, and 188 observations at depths greater than 500 m. Of the 76 observations from shallower than 300 m, 73 (96%) showed cod as the most predominant species in the catch; from 300-500 m where little longline fishing occurs, 4 of 6 observations showed cod as most predominant; at depths greater than 500 m, all 188 observations showed that either sablefish (86 times in 188 observations) or rattails (102 times in 188 observations) were the predominant species in the catch. In the deeper than 500 m zone, in every case where sablefish was not the most abundant species by weight, it was the second most abundant. Only 4 times in the deep zone was cod ranked among the top 3 most abundant species by weight. On this basis, Japanese longline effort in the Gulf was identified as (1) directed at cod in the less than 300 m zone, or (2) directed at sablefish in the deeper than 500 m zone.

In 1977, then, a new data series of Japanese longline CPUE becomes available that does not suffer from the inadequacies, as described above, of the CPUE reported by the foreign longline fleet. These observer CPUE rates are shown in Table 3A. Comparing the combined CPUE's for the Shumagin to Yakutat area for 1977-1980, it appears that a 25% decline occurred from 1977-1979, but that in 1980 stocks recovered to about the 1977 level. On the basis of these data, there appears to be no decline in abundance of the sablefish stock in that portion of the Gulf of Alaska fished by foreign longline vessels.

Table 3A.--CPUE (t/1000 hooks) for sablefish in Japanese longline fishery for observed hauls from >500 m depth as determined by U.S. observers.

Year	Shumagin	Chirikof	Kodiak	Yakutat	Southeast	Shumagin-Yakutat
1977	.237	---	.247	.361	.428	.293
1978 ^{1/}	.236	.204	.241	.232		.232
1979 ^{1/}	.140	.202	.228	.268		.216
1980 ^{1/}	.286	.275	.350	.254		.298

Table 3B.--CPUE (t/1000 hooks) for large sablefish (greater than 67 cm) in the Japanese longline fishery for hauls from >500 m depth as determined by U.S. observers.

Year	Shumagin	Chirikof	Kodiak	Yakutat	Southeast	Shumagin-Yakutat
1977	.123	---	.169	.211	.269	.179
1978	.140	.107	.141	.126		.132
1979	.085	.109	.117	.149		.117
1980	.133	.089	.174	.086		.131

^{1/} The area east of 140° W in Yakutat was closed to foreign longlining in 1978 and 1979.

Table 3B indicates CPUE rates for sablefish greater than 67 cm in the Japanese longline fishery. It can be seen from these values that although overall abundance was similar, there was a sharp decline in large fish in the Yakutat area from 1977 to 1980. Figure 1 also demonstrates the increasingly greater role played by small sablefish in the Yakutat CPUE from 1978 to 1980.

Japan-U.S. Cooperative Longline Survey

Each year since 1978, Japan and the U.S. have cooperatively conducted a longline survey in the Gulf of Alaska to study stock conditions of sablefish and other longline-caught species. Results of the 1978 to 1980 surveys are reported by Sasaki (1981) and shown in Table 4. The index of abundance is a summation of the CPUE of the longline gear for each of several depth categories multiplied by the area of the fishing grounds which lies in those depth categories. The results depicted in Table 4 are a good indicator of overall sablefish abundance in the Gulf, but cannot be compared to the trends suggested in Table 3 since the longline survey results include catches from all depth zones. Comparing the size distribution shown in Figure 2 to Figure 5, Figure 3 to Figure 6, and Figure 4 to Figure 7, clearly shows the predominance of small fish in the shallow water. Sasaki (1981) noted the presence of these fish and qualified his index values (shown in Table 4 as being strongly influenced by the abundance of the small fish in 1980. The longline survey found generally similar or slightly declining abundance from 1979 to 1980 for sablefish over 60 cm. Hence, Sasaki's conclusions on stocks from 1978-1980 do not differ markedly from conclusions drawn above based on the U.S. observer data: population abundance of sablefish for the combined Shumagin to Yakutat area has not changed dramatically in the last 3 years, though there is an increasing importance of small fish in index values, particularly in the Yakutat area.

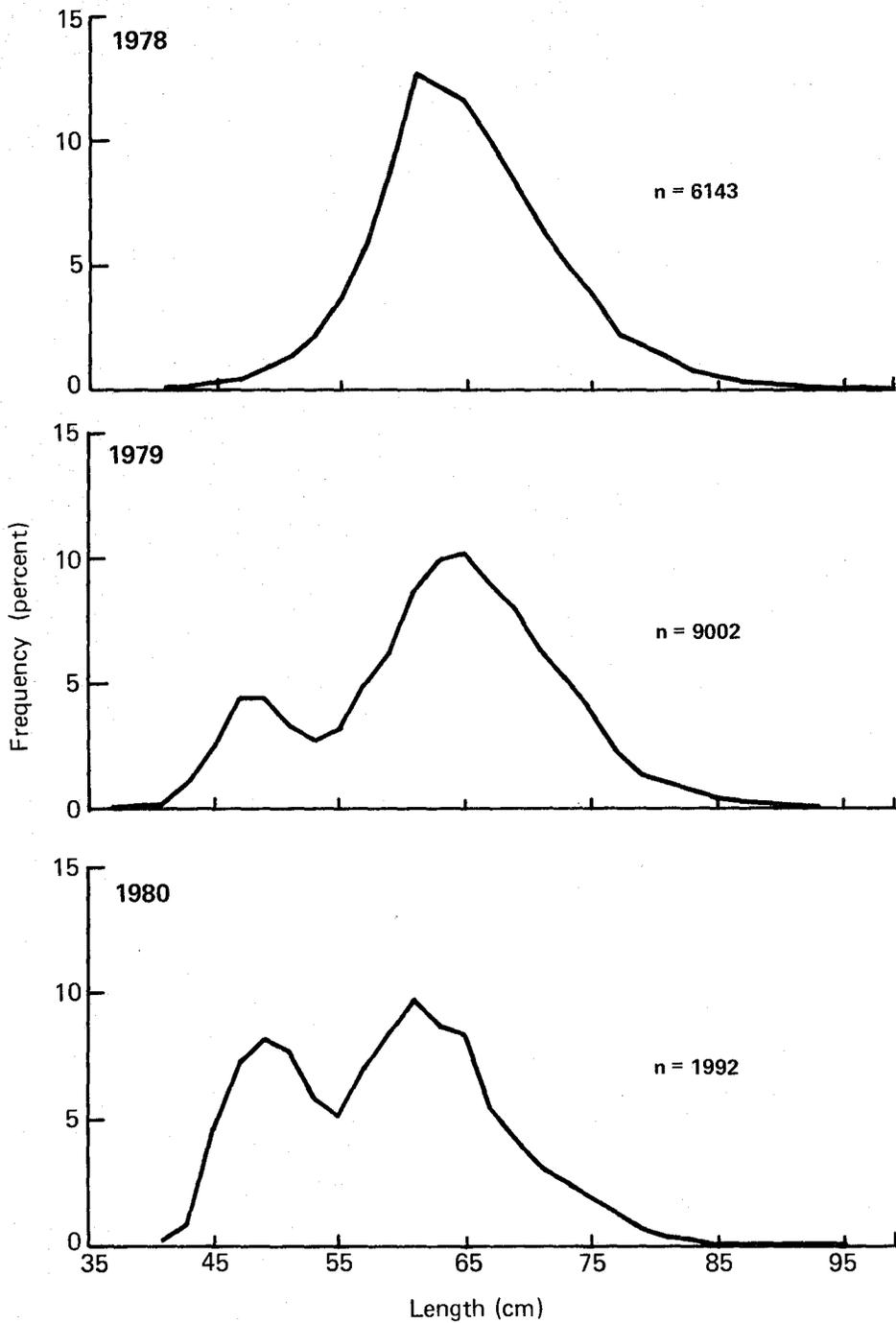


Figure 1.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Yakutat Area, deeper than 500 m, from 1978 to 1980.

Table 4.--Index^{1/} of sablefish stock size from the Japan-U.S. cooperative longline survey in the Gulf of Alaska.

Area	Index		
	1978	1979	1980
Shumagin	2,605	5,869	6,827
Chirikof	4,717	28,637	24,609
Kodiak	19,044	23,582	27,596
Yakutat	8,223	11,841	18,880
Southeastern	8,725	10,707	13,560
All Areas	43,314	80,636	91,472

^{1/} Index is a function of CPUE in numbers of fish.

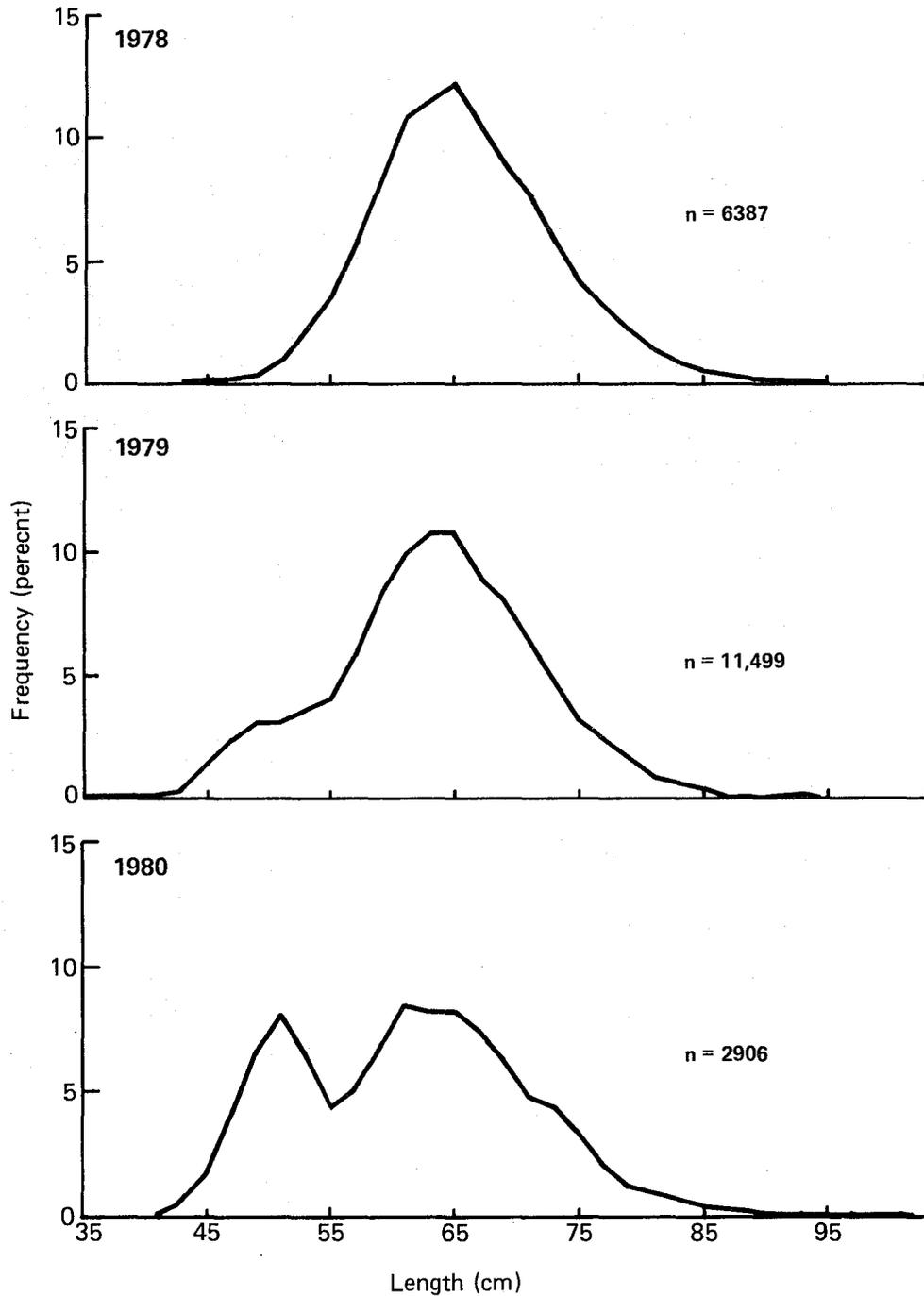


Figure 2.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Kodiak Area, deeper than 500 m, from 1978 to 1980.

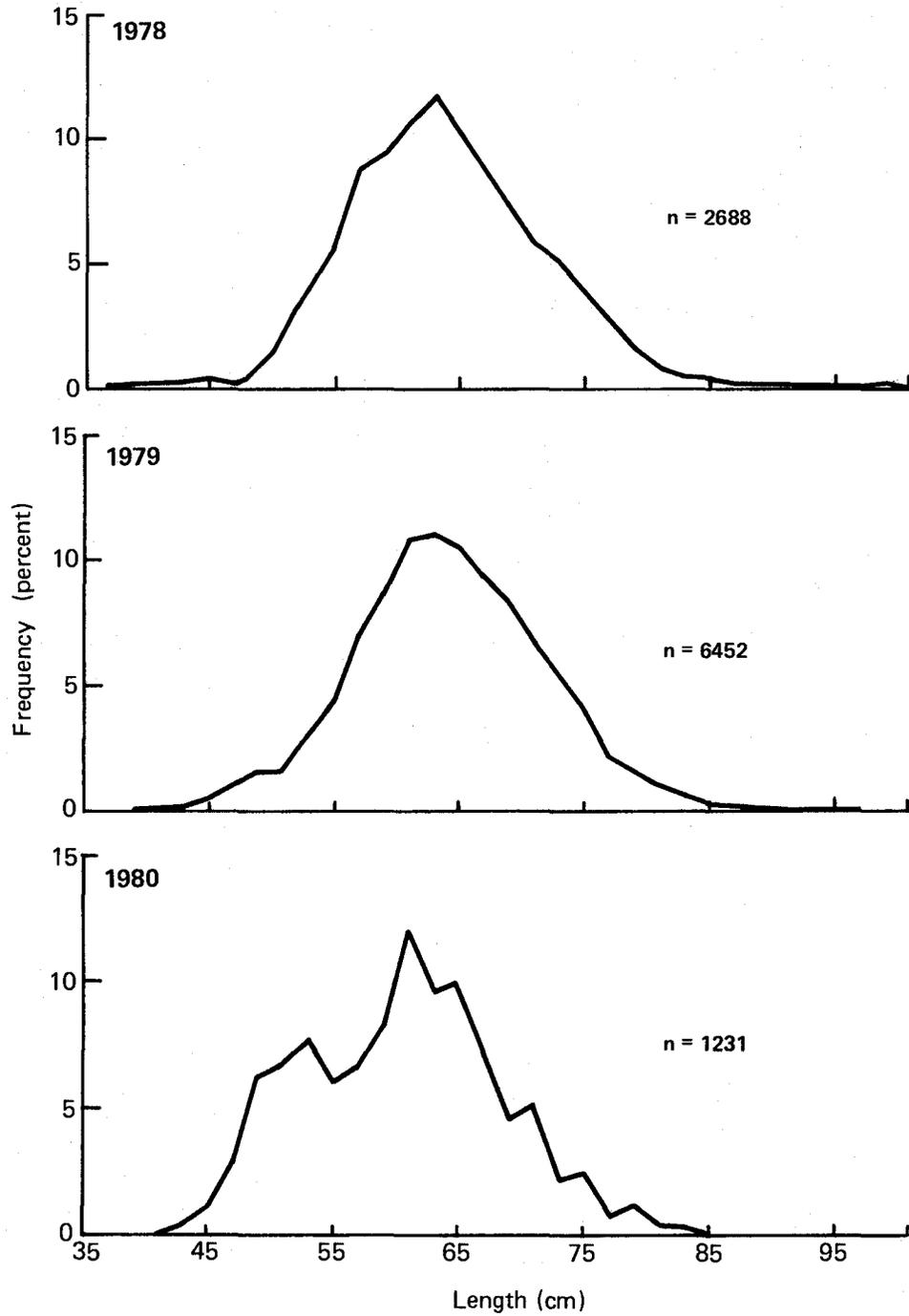


Figure 3.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Chirikof Area, deeper than 500 m, from 1978 to 1980.

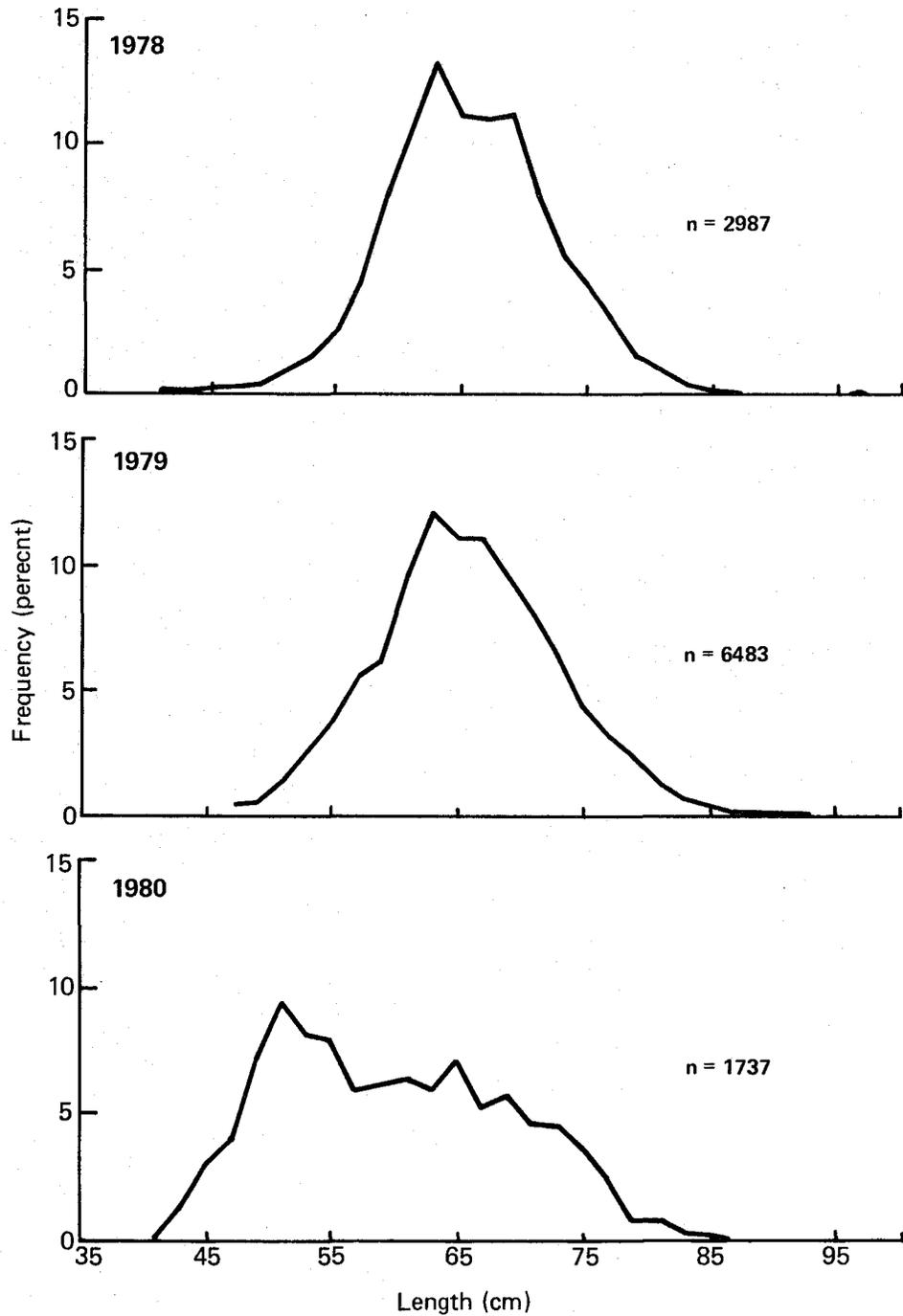


Figure 4.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Shumagin Area, deeper than 500 m, from 1978 to 1980.

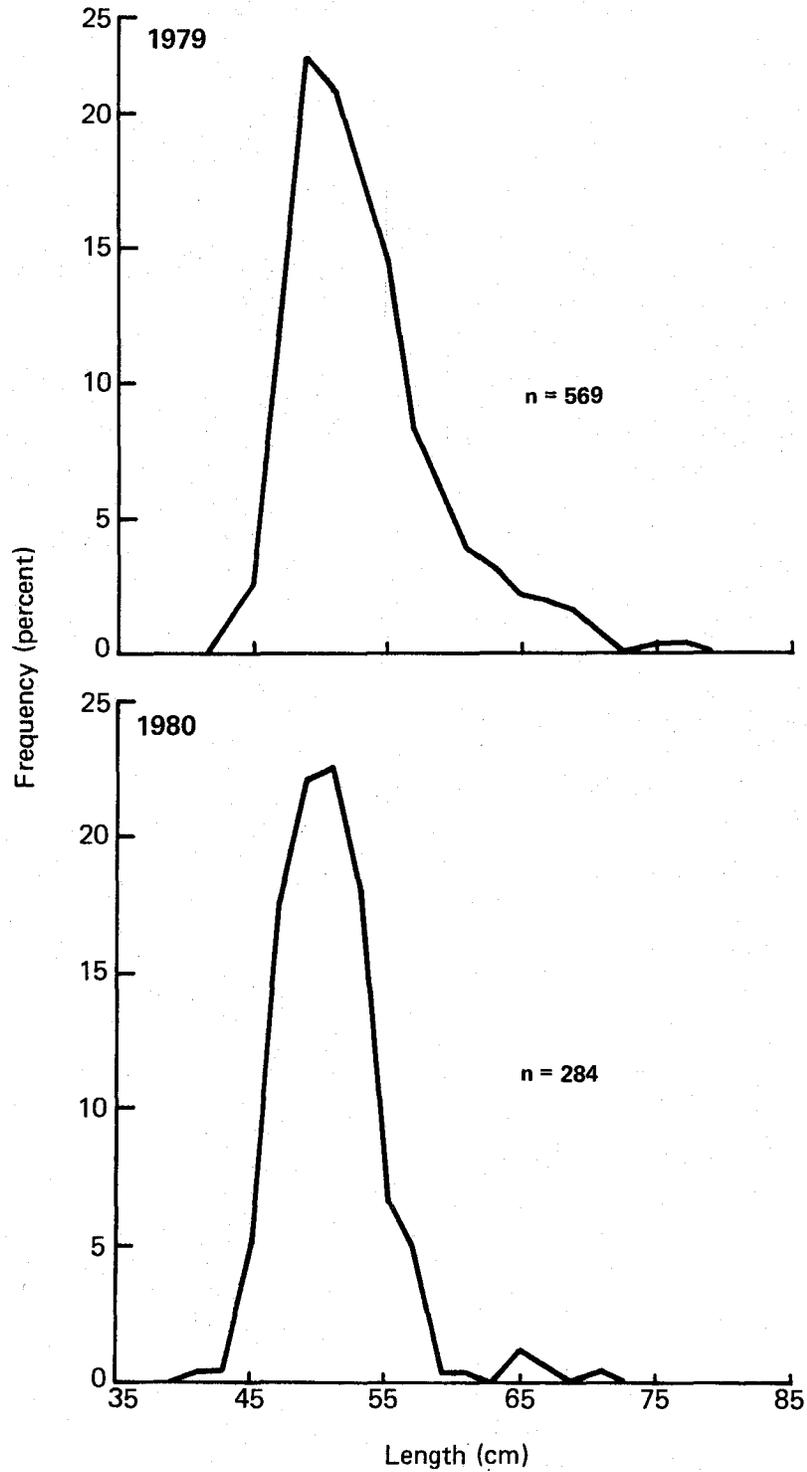


Figure 5.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Kodiak Area, shallower than 250 m, from 1979 to 1980.

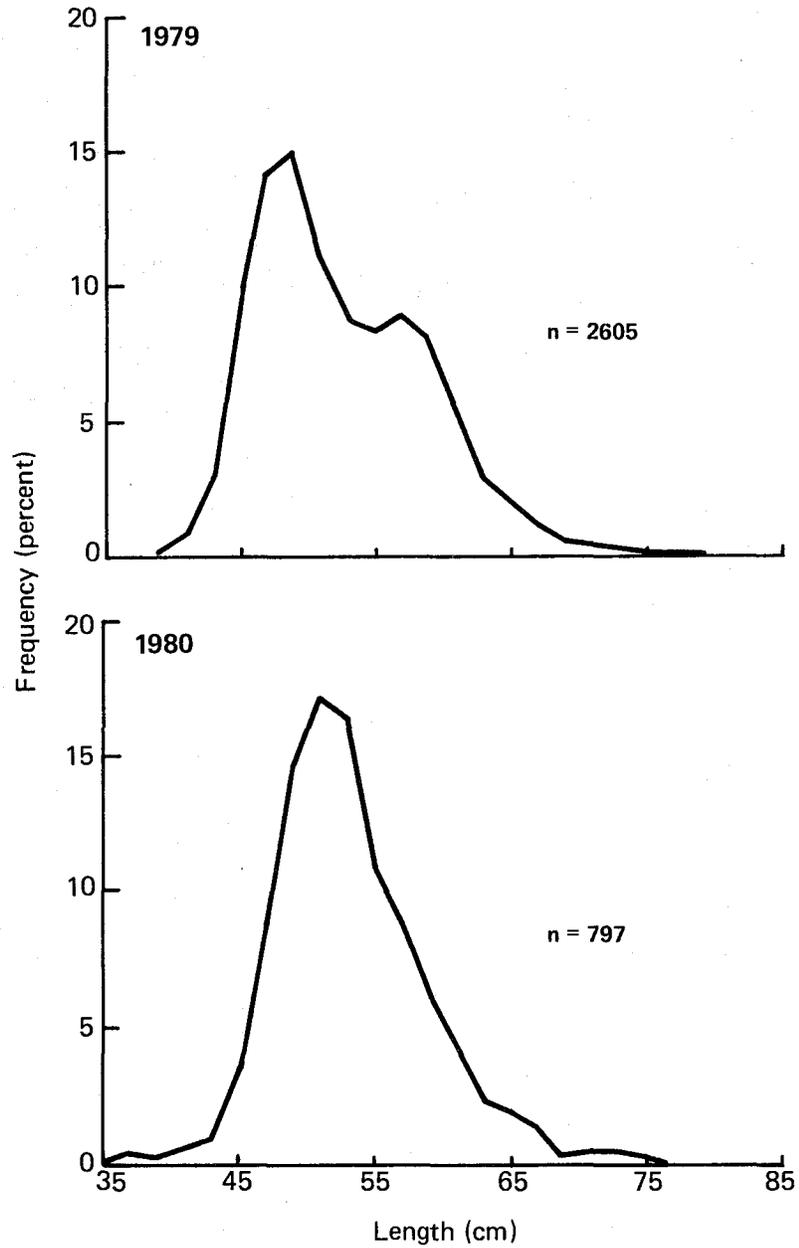


Figure 6.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Chirikof Area, shallower than 250 m, from 1979 to 1980.

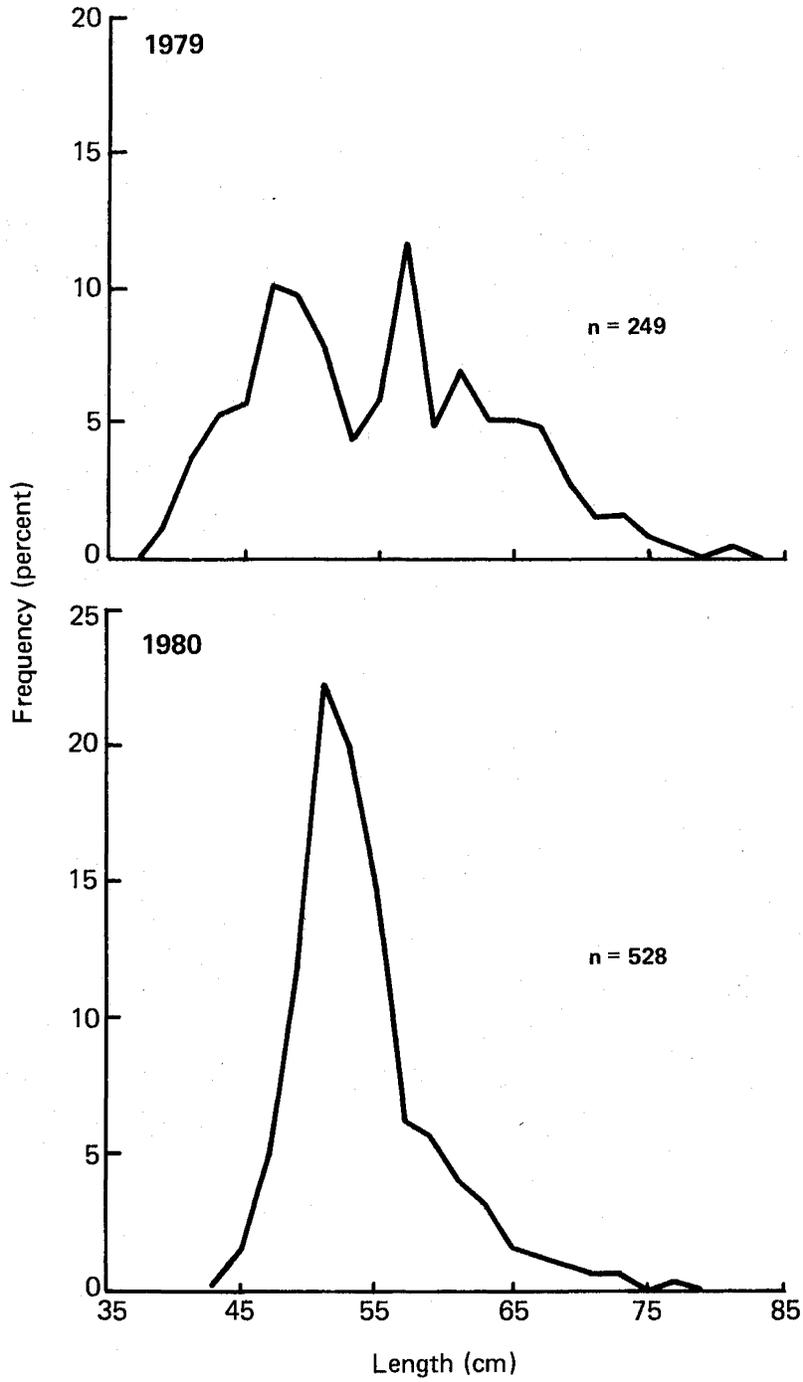


Figure 7.--Sablefish length/frequency by U.S. observers on Japanese longline vessels in the Shumagin Area, shallower than 250 m, from 1979 to 1980.

Preliminary data available from the 1981 longline survey show total catch of sablefish per longline set has increased nearly 50% from 1980 to 1981. Although this is from the raw data which must yet be converted to index values, it is apparent that Sasaki's index, when it becomes available, will show yet another increase from 1980 to 1981. Sasaki's index values, which are strongly influenced by small fish, may be early indications of rebuilding of the Gulf of Alaska sablefish stock.

U.S. Pot Index Survey

Zenger (1981) presented results from the U.S. pot index survey which has been conducted since 1978 in southeast Alaska. This survey has become the primary means of assessment for sablefish stocks in the Southeast Region since the foreign longline fishery no longer operates there. Zenger's results show population indices are off about 50% on marketable fish from 1980 to 1981. This decrease, which is supported by data from the U.S. sablefish fishery (Zenger, 1981), is contradictory to the initial indications of the 1981 Japan U.S. cooperative longline survey, as stated above. For the years 1978-1980, the U.S. pot index survey and the Japan-U.S. cooperative longline survey produced similar results showing declining numbers of large fish and increasing numbers of small fish.

EQUILIBRIUM YIELD

Determination of yield from a population of fish is dependent on the size at which an individual fish becomes available to the fishery. EY for sablefish, as presented in the FMP, is based on data from the Japanese longline fishery. Hence, the implicit size at entry to the fishery for which the EY figure is appropriate is the size of entry to the Japanese longline fishery. Figure 8

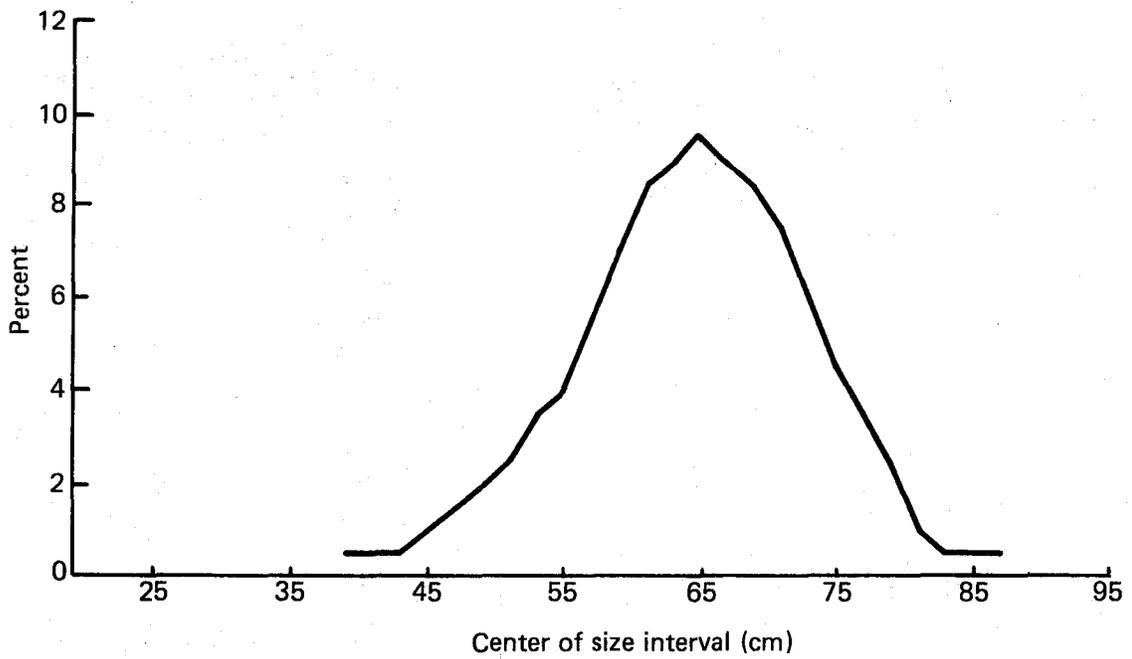


Figure 8.--Size composition of sablefish caught by the Japanese longline fleet in the Gulf of Alaska from 1967 to 1978.

shows the size distribution of fish taken by the Japanese longline fleet from 1969-1978 in all areas of the Gulf of Alaska. Table 5 demonstrates that although there is variability by year and area, the distribution has not changed significantly over time. Thus, the current EY reflects yields with sablefish entering the fishery from about 42 cm (1.2 lbs dressed weight) until the fully recruited sizes of 62-65 cm (4.2-4.8 lbs dressed weight) fish are 50% recruited at 55 cm (2.8 lbs dressed). Figure 9 shows the approximate proportion of fish of a given length which are recruited to the longline gear.

On the basis of the decline of CPUE from 1976 to 1977 (Table 2), Low et al. (1979) determined EY for the Gulf of Alaska to be 14,000 t. The FMP allocates 61% of the sablefish allocation to the area west of 140° W longitude. The EY for this area where foreign longlining is permitted would have been 8,540 t. Table 3 shows that the 1980 CPUE for this area is not different than the 1977 CPUE.

For size at entry, as shown in Figure 9, EY for the area west of 140° W can be estimated to remain at 8,540 t.

Due to the termination of foreign fishing in the eastern gulf, it is much more difficult to estimate EY for the area. Zenger and Hughes (1981) defined marketable size fish as those 57 cm or larger (3.0 lbs dressed), and estimated ABC of that portion of the stock at 2,580 t in 1980 for the Southeastern area. As a result of the 1981 pot index survey (Zenger 1981) showing a decline of 50% in this size range, which is roughly comparable to the size considered in the western area, EY for Southeast Alaska can be estimated at 1,290 t.

Almost no current information is available for the portion of the Yakutat area east of 140° W longitude. On the basis of U.S. observer estimates, sablefish stocks in the Yakutat area west of 140° W were judged to be as abundant, though of a smaller size, in 1980 as in 1977. As stated above, Southeast

Table 5.--Average size (cm) of sablefish taken by the Japanese longline fleet in the Gulf of Alaska from 1969-1978. (Data from foreign reported fishery statistics.)

Year	All Areas	Shumagin	Chirikof	Kodiak	Yakutat	Southeast
1969	67.2	-	65.2	-	68.7	-
1970	66.2	-	-	60.5	67.8	68.6
1971	65.4	61.4	60.6	63.6	66.3	66.0
1972	62.3	62.4	60.8	60.8	63.9	63.5
1973	62.8	63.2	61.2	63.7	63.7	64.4
1974	-	-	-	-	-	-
1975	67.1	66.4	-	-	-	67.9
1976	66.2	66.3	65.5	64.1	65.9	68.4
1977	64.7	-	60.9	-	64.6	65.0
1978	67.4	65.8	67.0	67.0	69.9	-
Average	64.6	64.5	62.0	63.5	66.3	65.7

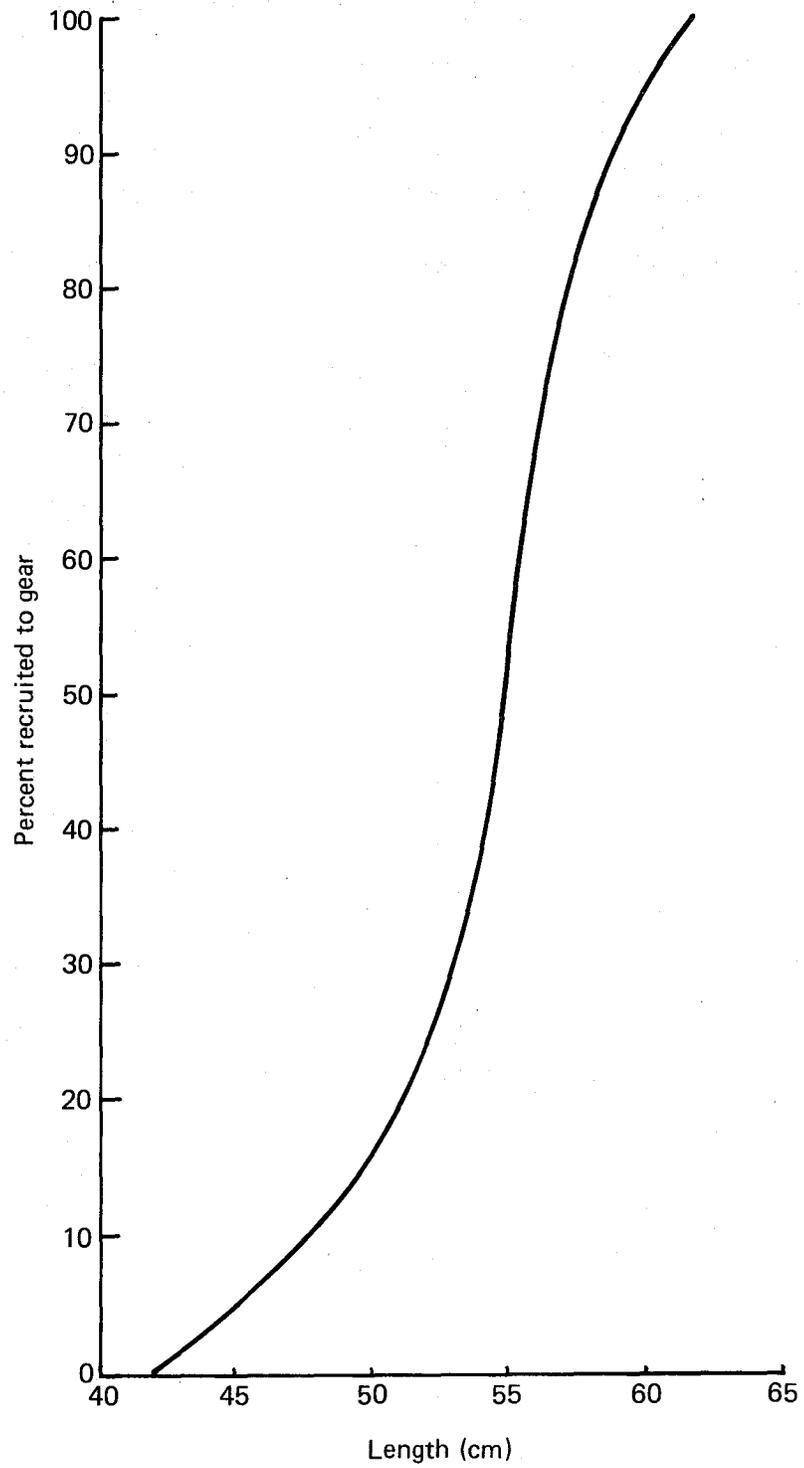


Figure 9.--Apparent recruitment of sablefish to longline gear as observed in the Japanese longline fishery.

stocks are thought to be off 50%. Assuming a general decline from west to east through Yakutat and Southeast suggests the stocks in the eastern part of Yakutat may be down 25%, this suggests EY values for the Gulf of Alaska, based on the size at entry shown in Figure 9 are:

<u>Western</u>	<u>Central</u>	<u>Yakutat W of 140° W</u>	<u>Yakutat E of 140° W</u>	<u>Southeast</u>	<u>Total</u>
2,225 t	4,075 t	2,240 t	1,135 t	1,290 t	10,965 t

STATUS OF POLLOCK IN THE GULF OF ALASKA

by M. Alton*

The total catch of pollock in the Gulf of Alaska in 1980 was 115 thousand t, most of which was taken by foreign trawlers from Japan, USSR, Republic of Korea, and Poland (Table 6). Joint venture fisheries landed 1,135 t (Table 7), and U.S. domestic fisheries caught 868 t.

The 1980 foreign catch by area and nation was similar to recent years (Table 8) and reflected allocation (Table 9). About 96 percent of the annual catch came from the Shumagin and Chirikof-Kodiak areas (Figure 10). Most of the Japanese catch came from the Chirikof-Kodiak area. Korean vessels took almost their entire pollock catch in the Shumagin area. U.S.S.R. and Polish fisheries caught slightly more fish in the Chirikof-Kodiak area than in the Shumagin area (Table 8). The total foreign pollock catch in the Yakutat-SE area was only 4.6 thousand t.

Joint venture fisheries occurred in the Shumagin and Chirikof-Kodiak areas. U.S. domestic landings came mainly from the Chirikof-Kodiak area. Estimates of equilibrium yield in 1980 for pollock (North Pacific Fishery Management Council, 1981) were assumed to be 57 thousand t for the Shumagin area, 95 thousand t for the Chirikof-Kodiak area, and 14 thousand t for the Yakutat-SE area for a total yield of 166 thousand t.

Catch Per Unit of Effort

The CPUE of Japanese surimi trawlers for the fourth quarter of the year was selected as a measure of relative abundance change in the Chirikof-Kodiak area for the years 1977-80 because (1) this vessel type targets on pollock, (2) there is a continuous series of substantial catch (Figure 11) and effort in the fourth quarter for these years, (3) CPUE of this vessel type within each year is highest in the fourth quarter (Table 10), and (4) the correlation

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Table 6.--Annual catch (t) of pollock by foreign nation, 1964-80.

	Japan	USSR	ROK	Poland	Mexico	Total
<u>Year</u>						
1964	1,126	Unknown				1,126
1965	2,749	"				2,749
1966	8,932	"				8,932
1967	6,276	"				6,276
1968	6,164	"				6,164
1969	17,553	"				17,553
1970	9,343	"				9,343
1971	9,018	440				9,458
1972	13,696	20,385				34,081
1973	6,706	30,130				36,836
1974	30,433	31,000	447			61,880
1975	13,032	39,949	5,900	631		59,512
1976	11,796	37,825	36,906	---		86,527
1977	41,953	41,588	35,579	1,256		120,376
1978	26,093	41,956	27,052	1,226		96,327
1979	31,920	17,300	25,739	19,551	8,677	103,187
1980	37,897	37,001	25,013	13,085	---	112,996

Table 7.--Pollock catch (t) in joint venture fisheries in the Gulf of Alaska in 1980.

Area	U.S.-ROK	U.S.-USSR	Total
Shumagin	35 (Aug)	77 (Mar)	112
Chirikof	496 (Apr-May)	-	496
Kodiak	527 (Apr-Jun)	-	527
Total	1,058	77	1,135

Table 8.--Pollock catch (t) by area and foreign nation in the Gulf of Alaska (1977-80).

Nation	Year	Shumagin	Chirikof-Kodiak	Yakutat-Southeastern
Japan	1977	8,626	25,969	7,358
	1978	3,539	19,026	3,528
	1979	1,366	27,700	2,862
	1980	378	32,975	4,544
ROK	1977	34,166	1,413	-
	1978	26,268	784	-
	1979	23,312	-	2,427
	1980	24,926	-	87
USSR	1977	13,981	27,262	345
	1978	1,494	40,462	-
	1979	170	17,087	43
	1980	15,495	21,506	-
Poland	1977	-	1,256	-
	1978	-	1,226	-
	1979	249	19,302	-
	1980	5,848	7,237	-
All nations	1977	56,773	55,900	7,703
	1978	31,301	61,498	3,528
	1979 ^{2/}	30,218	67,597	5,372
	1980	46,647	61,718	4,631

^{1/} For 1977, reported catch by foreign nations indicated; for 1978-80, a "best blend" estimate as described by Wall, French, and Nelson, 1981, was used.

^{2/} Includes catch by Mexico

Table 9.--Foreign fisheries allocations (mt) of Gulf of Alaska pollock by nation and area in 1979^{1/} and 1980^{2/}.

Nation	Shumagin		Chirikof-Kodiak		Yakutat-Southeastern		All areas	
	1979	1980	1979	1980	1979	1980	1979	1980
Japan	3,042	360	30,878	40,915	4,359	5,470	38,279	46,745
USSR	16,436	16,025	30,008	24,917	3,864	none	50,308	40,942
ROK	22,116	24,878	none	none	5,914	3,727	28,030	28,605
Poland	9,489	12,293	10,034	15,172	none	none	19,523	27,465
Mexico	6,842	none	3,510	7,611	1,818	5,806	12,170	13,417
All nations	57,925	53,556	74,430	88,615	15,955	15,003	148,310	157,174

^{1/} Dec. 1, 1978 to Oct. 31, 1979.

^{2/} Nov. 1, 1979 to Oct. 31, 1980.

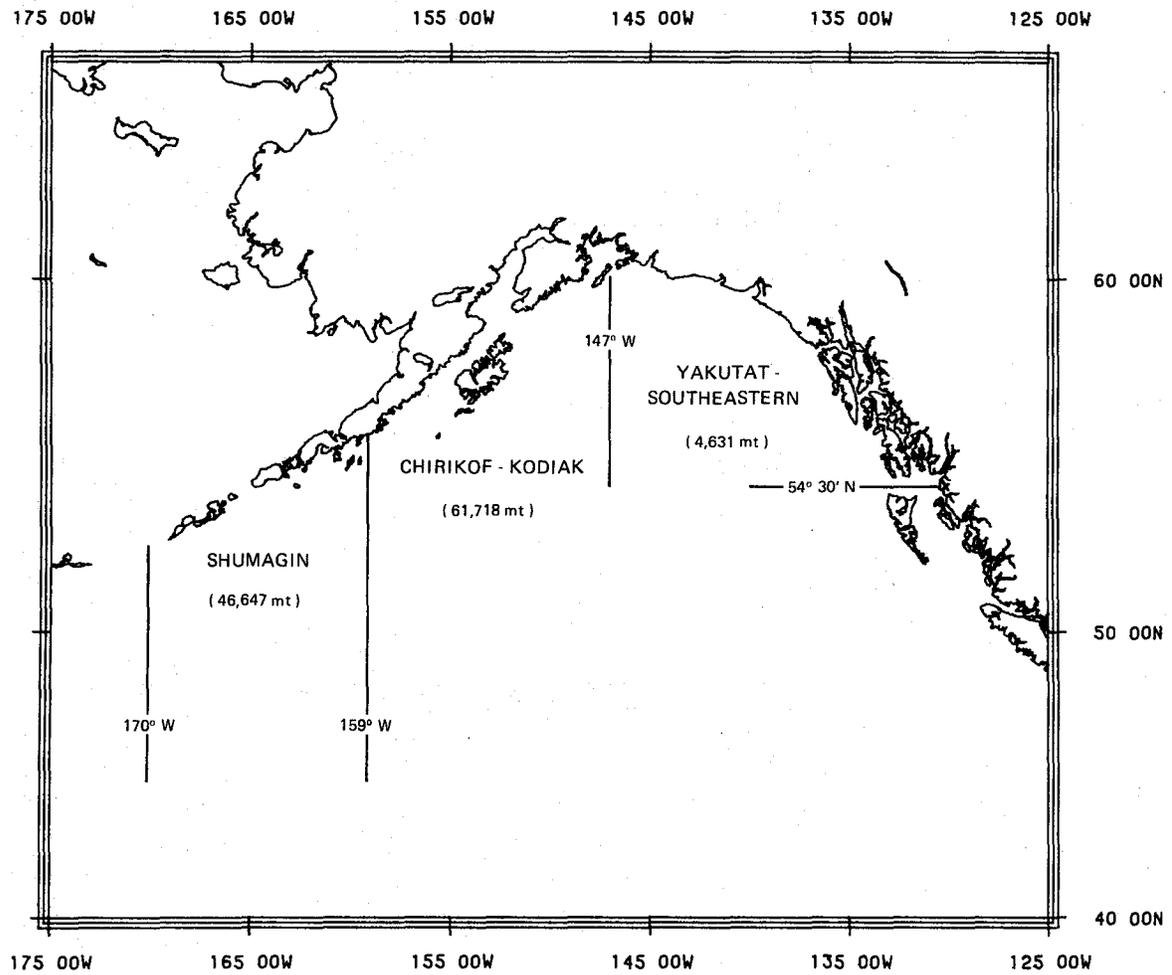


Figure 10.--Regulatory areas of the Gulf of Alaska showing total foreign pollock catch in 1980.

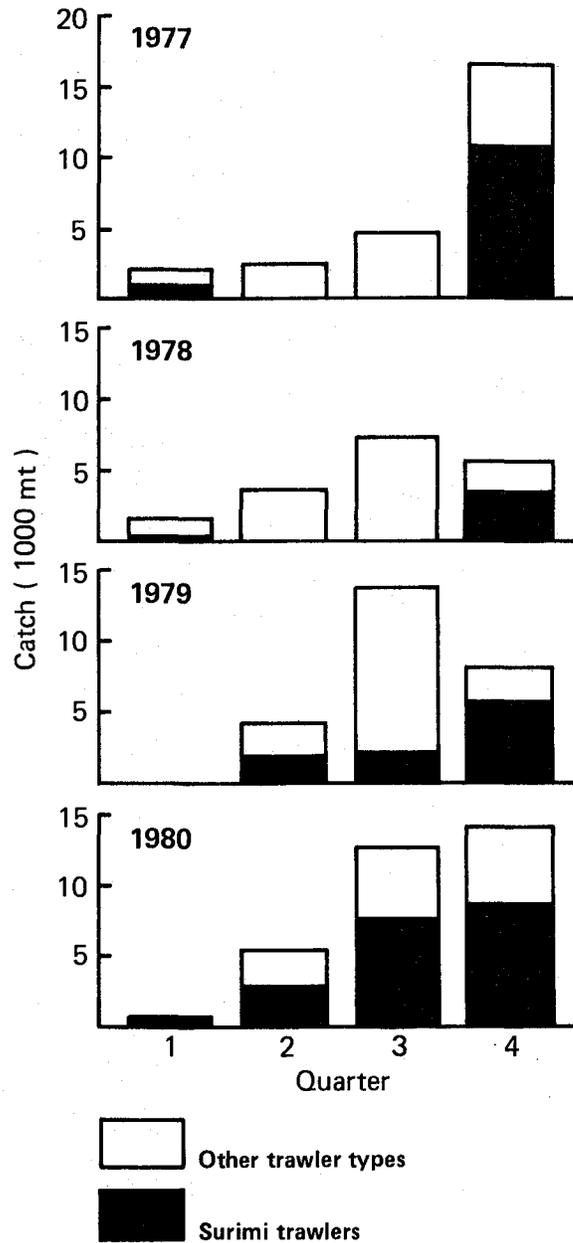


Figure 11 .--Quarterly catch of pollock by surimi and other types of trawlers in the Japanese fisheries in the Chirikof-Kodiak area, 1977-80.

Table 10--CPUE of pollock (t/hr) by Japanese surimi and vessel class 7^{1/} trawlers in the Shumagin and Chirikof-Kodiak areas by quarter of the year (1977-80).

Year	Shumagin				Chirikof-Kodiak			
	SURIMI				SURIMI			
	Quarter				Quarter			
	1	2	3	4	1	2	3	4
1977	-	-	-	17.2	8.1	-	-	15.4
1978	-	-	-	2.3	6.6	-	-	6.5
1979	-	-	0.8	4.2	-	4.9	1.6	7.9
1980	-	-	-	-	3.3	4.6	6.8	7.8
	CLASS 7				CLASS 7			
1977	* *	-	2.6	7.3	1.6	2.5	2.2	4.2
1978	2.3	1.8	2.6	*	1.8	3.0	1.5	3.8
1979	-	-	1.5	3.5	-	1.3	2.7	3.8
1980	-	-	-	-	-	2.5	2.3	4.0

^{1/} CPUEs based on catch and related effort in 1° x 1/2° blocks and months where the all-species catch contained 30% or more pollock.

*Insignificant catch

($r = 0.80$) of surimi trawler CPUE with that of Japanese class 7 freezer trawler in the fourth quarter. Most of the Japanese catch of pollock in the Chirikof-Kodiak area are taken by the surimi and class 7 freezer trawlers, but the latter vessel type takes a larger proportion of other groundfish than do the surimi trawlers.

For the Shumagin area, the CPUE of Korean trawlers of a gross tonnage greater than 3,000 was calculated. This tonnage class fished in the Shumagin area for all four years (1977-80) and appears to have targeted almost exclusively on pollock.

For the years 1977-1980, CPUE of surimi trawlers in the Chirikof-Kodiak for the fourth quarter declined sharply from 15.4 t/hr in 1977 to 6.5 t/hr in 1978, rose to 7.9 in 1979, and leveled to 7.8 in 1980.

In the Shumagins, the CPUE of pollock by Korean stern trawlers (>3,000 gt) declined from 7.3 t/hr in 1977 to 5.9 t/hr in 1978 and 1979, then rose slightly to 6.3 t/hr in 1980 (Table 11). The CPUE of Japanese trawlers for the fourth quarter also show a decline from 1977 but of a greater magnitude than that of the Korean trawlers in the Shumagins area.

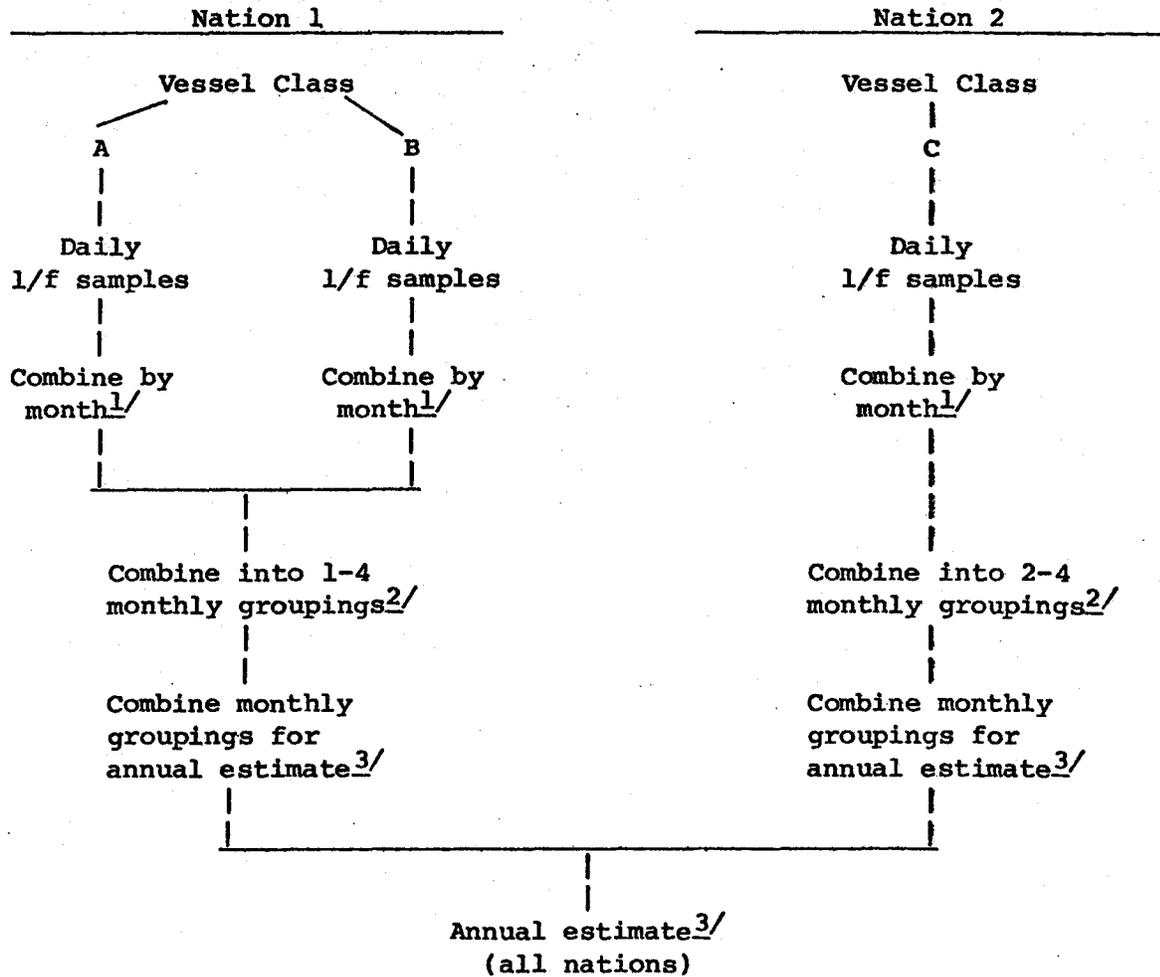
Length and Age Composition

Estimates of the length and age composition of pollock in the foreign trawl fisheries for the years 1976-80 were taken from U.S. observer data. Weighting procedures were used to estimate the length composition beginning with the length frequency samples collected by an observer trip day for each nation, vessel class, and area (Figure 12). Only the data from the Shumagin and Chirikof-Kodiak areas were examined. Age data were grouped for all vessel classes and nations for each area by time periods for conversion of length frequency to age (Figure 12).

Table 11.--CPUE (t/hr) of Korean trawlers of greater than 3,000 gt in the Shumagin area (based on reported catch and effort for the July to December period of each year).

	Year			
	1977	1978	1979	1980
CPUE	7.3	5.9	5.9	6.3

Figure 12. --Schematic showing weighting procedures for estimating length composition of annual all nation pollock catches for a given geographical area.



1/ Daily length frequency sample (1/f) is weighted by the daily catch in numbers of specific observer trip vessel.

2/ Monthly length frequencies are weighted by "best blend" catch in numbers by vessel class and for given nation.

3/ Weighted by "best blend" catch in numbers.

The average length of pollock taken in the Shumagin area for the years 1977-1980 has ranged between 43.8 and 45.9 cm with 50 percent of the annual catch consisting of fish greater than 44 or 45 cm (Table 12). The length composition of the Shumagin and Chirikof-Kodiak catch was similar in 1977, but for subsequent years the length of fish taken in the Chirikof-Kodiak area was much smaller than in 1977.

The similarities and differences in length of fish between areas and among years can be explained by examination of the age composition of the catch (Figures 13 and 14). In 1977, the 1972 year class was strong in both areas as 5-year-olds. Age 3 fish representing the 1975 year class dominated the catch in the Chirikof-Kodiak area in 1977 and accounted for the decrease in the size of fish between 1977 and 1978. Age 3 fish were again important in the Chirikof-Kodiak catch in 1979, and in 1980, a strong showing of 2-year-olds occurred in the fisheries. It appears that three strong year classes (1975, 76, 78) have occurred in the fisheries of the Chirikof-Kodiak area during 1978-1980.

In the Shumagin fishery, there has been a noticeable lack of young ages (2-3) as compared to the Chirikof-Kodiak areas. The similarity between the two areas is in the presence of the strong 1972 year class in the fisheries in 1977.

DISCUSSION

The high CPUE of pollock in both the Shumagin and Chirikof-Kodiak areas in 1977 relative to subsequent years may be accounted for by the presence of the strong 1972 year class as 5 year olds. In the Shumagin area, an estimated 60 percent of the total catch by weight in 1977 was of this year class, and for the Chirikof-Kodiak area that year, the figure was 57 percent. This year class appears to have been sharply reduced, as reflected by the drop in its CPUE by

Table 12.--Length of pollock (cm) taken by foreign trawlers in the Shumagin and Chirikof-Kodiak areas (1977-80).

Year	Range	Median	Mean
--Shumagin--			
1977	24-65	43.5	43.8
1978	12-68	45.4	44.5
1979	21-67	45.3	45.9
1980	20-66	44.1	44.8
--Chirikof-Kodiak--			
1977	20-61	43.0	43.2
1978	14-71	28.1	30.6
1979	16-69	36.0	37.3
1980	14-75	29.0	32.7

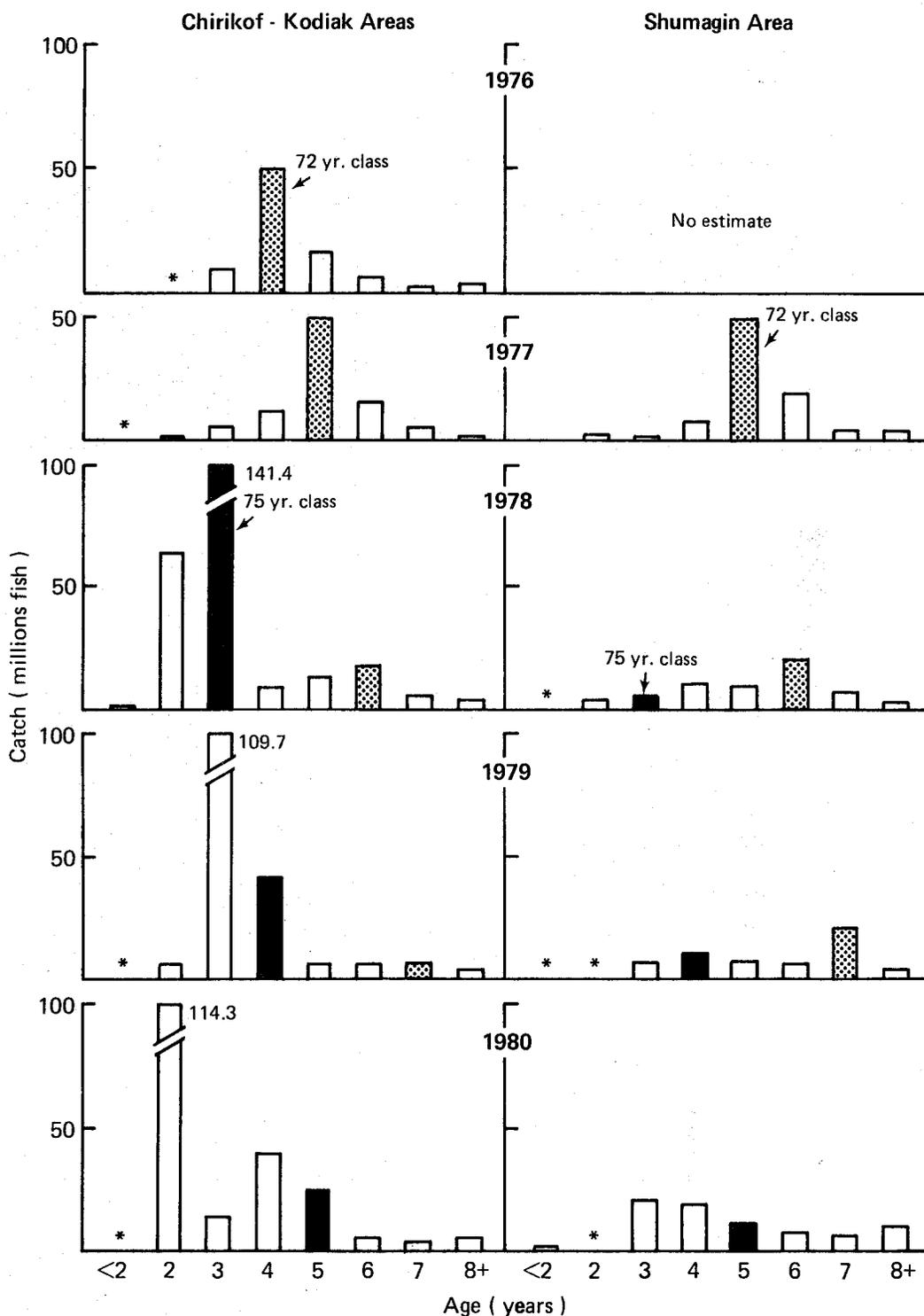


Figure 13 .--Age composition of annual pollock catch (numbers) in the foreign trawl fisheries in the Chirikof-Kodiak and Shumagin areas.

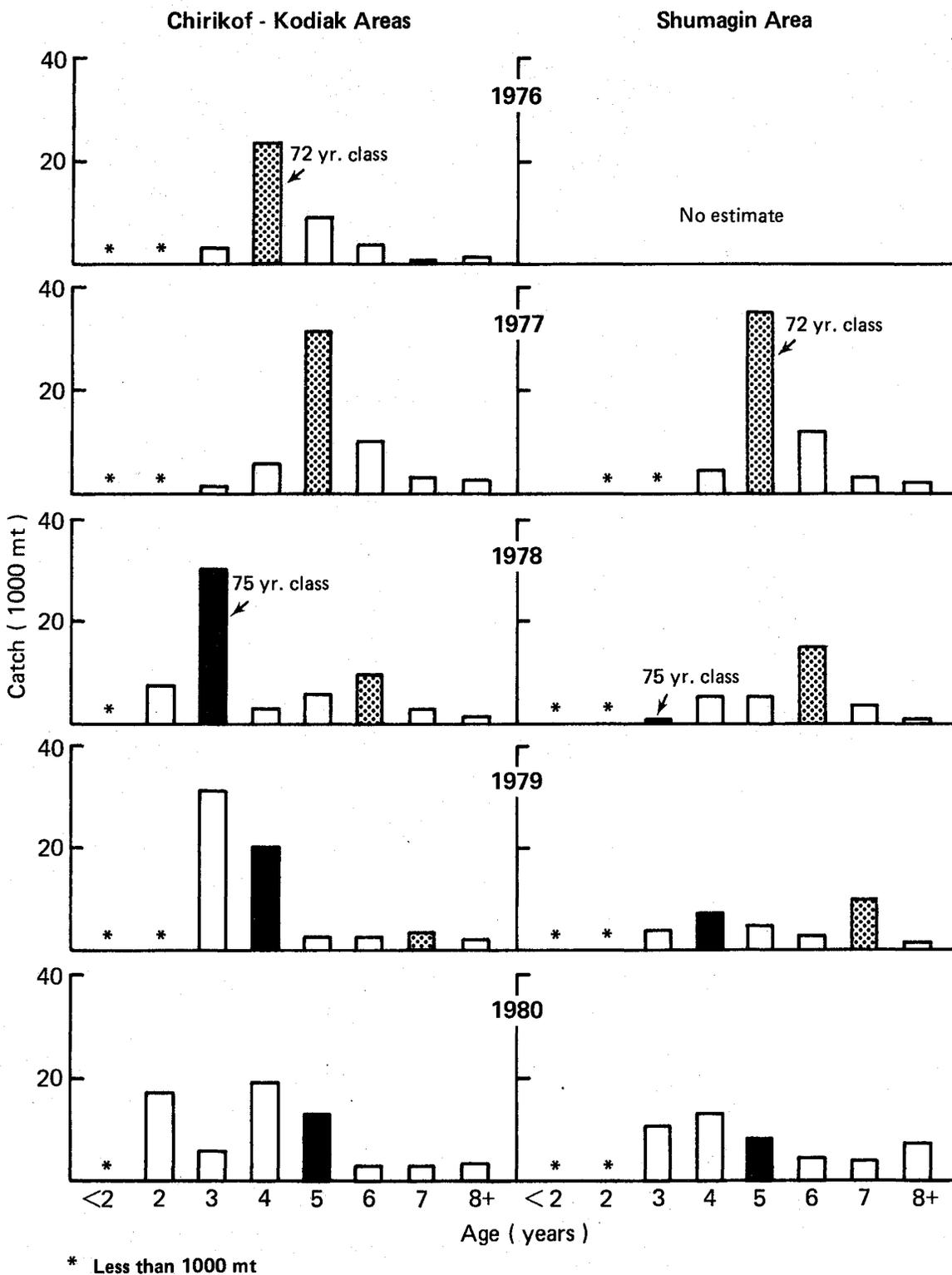


Figure 14.--Age composition of annual pollock catch (weight) in the foreign trawl fisheries in the Chirikof-Kodiak and Shumagin areas.

surimi trawlers between the fall of 1977 and the fall of 1978 (12.1 to 2.2 thousand fish per hour) in the Chirikof-Kodiak area.

In 1978, another year class (1975) emerged that supported the bulk of the Chirikof-Kodiak fishery that year and contributed importantly to the fishery along with a strong 1976 year class in 1979 (Figure 14). Additional evidence that these consecutive year classes were strong comes from results of hydroacoustical-trawl assessment studies of pollock in 1980. In that year, a major spawning area for pollock was discovered in the Shelikof region near Kodiak Island (Nelson, Williamson, and Nunnallee, 1981). These authors estimated that in April of 1980 there was a biomass of pollock in that region totaling 600 to 700 thousand tons comprised mainly of the 1976 year class (45%) as 4-year-olds and the 1975 year class (28%) as 5-year-olds. Biomass from a spring 1981 survey was estimated at 600 to 800 thousand t, but age composition of this biomass is not yet available.

The emergence of two strong year classes and possibly a third (1978 year class) in the Chirikof-Kodiak area in recent years and the absence of such strength of these year classes in the Shumagin area supports the present policy of separating these areas for catch allocation purposes. The high biomass of spawning pollock found in the Chirikof-Kodiak region in both 1980 and 1981 is a healthy sign and raises questions as to the nature of the interchange of pollock between the Chirikof-Kodiak and Shumagin areas and the adequacy of current estimates of equilibrium yield.

Further analysis will be required of the fisheries and acoustical survey information for updating estimates of equilibrium yield.

REFERENCES CITED

- Anonymous, 1978. Report of the meeting between U.S. and Japanese scientists for the exchange of information on the condition of fishery stocks in the Bering Sea and northeastern Pacific. U.S. Dep. of Commerce, NOAA, NMFS, NWAFC, Seattle, WA (Unpubl.).
- Low, L.L. and V. Wespestad. 1979. General production models on sablefish in the North Pacific. INPFC Doc. 2197. 16 p.
- Low, L., M. Alton, V. Wespestad, and E. Brown. 1979. Condition of groundfish resources in the Gulf of Alaska. INPFC Doc. 2212. 43 p.
- Low, L.L., G.K. Tanonaka, and H.H. Shippen. 1976. Sablefish of the northeastern Pacific Ocean and Bering Sea. U.S. Dep. Commerce, NOAA, NMFS, NWAFC, Seattle, WA (Processed Rept.), 115 p.
- Nelson, M., N. Williamson, and E. Nunnallee. 1981. Preliminary report of 1980 and 1981 acoustic-trawl surveys of spawning walleye pollock (Theragra chalcogramma) in Shelikof Strait-Chirikof Island region of the Gulf of Alaska. MS, Northwest and Alaska Fisheries Center.
- North Pacific Fishery Management Council. 1981. Fishing management plan for the Gulf of Alaska groundfish fishing. N. Pac. Fish. Man. Council, Anchorage, Alaska.
- Sasaki, T. 1978. Recalculation of longline effort and stock assessment of blackcod in the North Pacific. Fishery Agency of Japan, Far Seas Fish. Res. Lab., Shimizu, Japan. (INPFC Doc. 2080).

- Sasaki, T. 1980. Trends in blackcod, Pacific cod, and other groundfish stocks in the Gulf of Alaska based on the results of longline surveys in 1978 and 1979. Fishery Agency of Japan, Far Seas Fish. Res. Lab., Shimizu, Japan. (INPFC Doc. 2304).
- Sasaki, Takashi. 1980. An interim report on U.S.-Japan blackcod tagging experiments conducted in the Aleutian Region and Gulf of Alaska in 1978 and 1979. Fisheries Agency of Japan. 13 p.
- Wall, J., R. French, and R. Nelson, Jr. 1981. Foreign fisheries in the Gulf of Alaska, 1977-78. Marine Fisheries Review (in press).
- Wespestad, V., K. Thorson, and S. Mizroch. 1977. Movement of sablefish in the northeastern Pacific Ocean and Bering Sea. U.S. Dep. Commerce, NOAA, NMFS, NWAFC, Seattle, WA (Unpubl.).
- Wespestad, V. 1981. Movement of sablefish (Anoplopoma fimbria) in the North-east Pacific, as determined by tagging program (1971-1980). Submitted to Fish. Bull.
- Zenger, H. 1981. Relative abundance and size composition of sablefish in the coastal waters of southeast Alaska, 1978-1981. Unpublished manuscript.
- Zenger, H. and S. Hughes. 1981. Changes in relative abundance and size composition of sablefish in the coastal waters of southeast Alaska, 1978-1980. NOAA Tech. Mem. NMFS F/NWC-7, U.S. Dep. Commerce, NMFS, 27 p.

