

The Foreign Fisheries off Washington, Oregon, and California, 1977-78

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Introduction

Under provisions of the Fishery Conservation and Management Act of 1976 (FCMA), the United States permits foreign fishing for various species off the coasts of Washington, Oregon, and California in the 200-mile Fishery Conservation Zone (FCZ). Although a foreign fishery was permitted on two of the major species found in large abundance, many species are permitted as by-catches because they cannot be completely avoided in the targeted fishery. A third group of species are those whose take is also incidental but which have the status of a prohibited species and must be returned to the sea when caught. Those commonly taken by trawlers are Pacific salmon, *Oncorhynchus* spp., and Pacific halibut, *Hippoglossus stenolepis*. Crab, taken very rarely by foreign trawlers, must also be returned to the sea.

ABSTRACT—United States observers placed aboard foreign fishing vessels off the coast of California, Oregon, and Washington monitored the fishing operations during 1977 and 1978. Based on observer data it was estimated that Soviet and Polish fleets took approximately 130,000 t of fish in 1977 and 99,000 t in 1978. About 98 percent of the catch consisted of Pacific whiting, *Merluccius productus*, the target species. It was also estimated that an incidental catch of around 14,600 Pacific salmon, *Oncorhynchus* spp., was taken in 1977 and 6,000 Pacific salmon were taken in 1978, mostly chinook salmon, *O. tshawytscha*. Other important commercial species of fish caught were from 500 to 700 t of rockfish annually and 2-4 t of flatfish.

Provisions of the FCMA require that foreign vessels accept U.S. observers without cost to the United States. The duties of the observers include monitoring the foreign fisheries to assure that national allocations are not exceeded, and to obtain data which will be useful in management of various fish stocks. Details of the information obtained by observers are given by Nelson et al. (1981). This paper relates the operations of the U.S. observer program on the northwest coast of the United States and presents a summary of data obtained in 1977 and 1978.

The Foreign Trawl Fishery

The foreign trawl fishery off the coast of Washington, Oregon, and California began about 1965 when Japanese and Soviet vessels extended their fishery southward from the Gulf of Alaska (Forrester et al., 1978). The characteristics of the Soviet fleet were given by Hitz (1968, 1970). Target species in the early years of the fishery were rockfish, *Sebastes* spp., primarily Pacific ocean perch, *S. alutus*. As these stocks declined, the target species was changed to Pacific whiting, *Merluccius productus* (then called Pacific hake). Japanese and Soviet vessels continued to fish off the coast, and these nations were joined by vessels of other nations for various periods of time. A vessel from Poland

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and one from East Germany appeared in 1973, South Korean vessels first arrived in 1974, two trawlers from West Germany came in 1975, and in 1976 vessels from Bulgaria and Taiwan first appeared in the fishery. In 1977, however, under FCMA only two nations, the U.S.S.R. and Poland, were given allocations of fish and were permitted in the fishery. In 1978 Mexico was also given an allocation of fish but its vessels did not appear in the fishery.

The recent fishery by Poland and the U.S.S.R. was composed almost entirely of large independent stern trawlers capable of both fishing and processing catches. These trawlers consisted of both the BMRT and RTM vessel classes. Descriptions of the Polish fleet are given by Wall et al. (1981), and those of the U.S.S.R. by Nelson et al. (1981).

Recent trawl nets used by vessels off the coast when targeting on Pacific whiting have vertical openings of 25-30 m and horizontal openings of 40-50 m. A heavy chain was used in lieu of bobbins on the footrope, and the codend mesh size was 120 mm in 1977 and 100 mm in 1978, the minimum size imposed by U.S. regulations. The Polish and Soviet fishing gear generally were similar in size, but on some Polish trawls rope lines were used instead of traditional trawl wings. A typical codend full of fish is shown in Figure 1. In fishing for Pacific whiting, the average trawling speed was around 4-4.5 knots.

The recent Pacific whiting fishing season extended from 1 June to 31 October or until the quota was reached, whichever occurred first. Before FCMA the fishing season was much longer, extending from early spring to fall. The fishing effort (number of vessels) has varied considerably over the years, reaching a peak of over 100 vessels in the mid-1970's. In recent years the effort has fallen drastically, and in 1977 and 1978 the total number of vessels fishing was 47 and 35, respectively. Of these vessels, the Soviets fished 41 in 1977 and 28 in 1978; Poland fished 6 vessels in 1977 and 7 vessels in 1978.

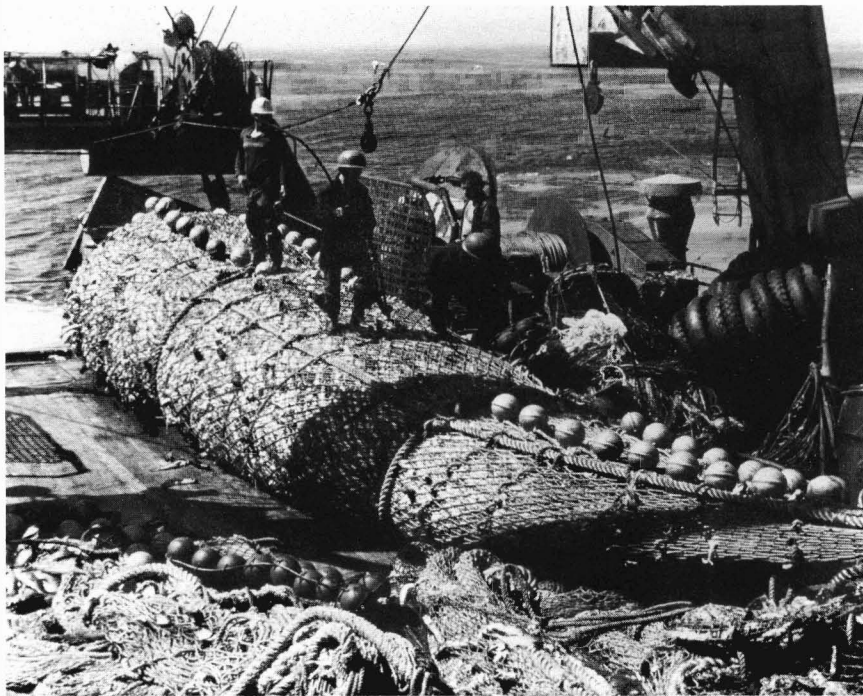


Figure 1.—Codend full of Pacific whiting is hauled aboard a Soviet trawler.

Table 1.—All nation catch (t) of groundfish off the coast of Washington, Oregon and California, 1966-78^{1, 2}.

Nation	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Bulgaria	—	—	—	—	—	—	—	—	—	—	—	—	—
E. Germany	—	—	—	—	—	—	—	—	—	2,000	50,200	—	—
W. Germany	—	—	—	—	—	—	—	—	—	—	—	—	—
Japan	136	10,643	4,676	1,201	1,592	1,805	5,920	12,281	17,421	5,313	5,286	—	—
S. Korea	—	—	—	—	—	—	—	—	129	3,714	13,777	—	—
Poland	—	—	—	—	—	—	—	2,436	44,651	50,871	25,138	17,298	27,251
Taiwan	—	—	—	—	—	—	—	—	—	—	—	—	—
U.S.S.R.	169,000	236,677	92,536	114,925	211,581	151,728	119,260	148,296	164,232	159,774	159,500	112,514	71,432
Total	169,136	247,320	97,212	116,126	213,173	153,733	125,180	163,013	226,433	221,672	253,901	129,812	98,683

¹Data from compilations provided by Northwest and Alaska Fisheries Center, National Marine Fisheries Service. See text footnote 1.

²East Germany fished in 1973 and 1974 for which no catch estimates were made; the catch listed for East Germany in 1975 was attributed to both East and West Germany. No catch estimates were available for Bulgaria which fished in 1976. Taiwan had a minor fishing effort in 1976 and early 1977 for which no catch estimates were made.

Table 1 lists the estimated catches of groundfish made off the coast by various nations (Murai et al.¹). No catch data were available from vessels fished by Bulgaria and Taiwan. Bulgaria fished five vessels in 1976

and conceivably could have caught an amount of fish similar to that estimated for Poland. Only two vessels from Taiwan fished in 1976 and seven were present for brief periods in 1977 prior to the effective date of FCMA on 1 March and thus likely would not have taken a large amount of fish. The data indicate that from 1966 and 1978 annual groundfish removals by foreign nations ranged from around 97,000 t to 254,000 t. Following the peak year of catches in 1976, catches declined as quotas were

¹Murai, S., H. Gangmark, and R. French. 1979. All nation removal of groundfish, herring, and shrimp from the eastern Bering Sea and north-east Pacific Ocean, 1964-78. Northwest and Alaska Fisheries Center, NMFS, NOAA, 2725 Montlake Blvd. East, Seattle, WA 98112. Unpubl. manuscr., 34 p.

imposed by the United States, and in 1978 catches were near the lowest of those estimated over the past 13 years.

An additional aspect of the foreign fishing operations was the joint-venture fishery in 1978 between U.S. fishermen and vessels of the Soviet Union. In this fishery, U.S. vessels delivered their catches to Soviet processing vessels. The fishery in 1978 was very limited and total deliveries by U.S. vessels were about 1,000 t. In intervals when U.S. vessels were not fishing, the Soviet ships fished for themselves and against their own quota.

Since 1969 Pacific whiting have predominated in the catch, forming over 93 percent of the species reported. Other important species taken were rockfish, flounders (various genera), sablefish, *Anoplopoma fimbria*; and jack mackerel, *Trachurus symmetricus*.

Foreign Fishing Regulations

Under the FCMA, foreign fisheries within the U.S. FCZ are fully regulated under conditions given in the Federal Register (1978). In essence, the purpose of the regulations is to enable the United States to exercise exclusive fishery management over the fisheries resources. Management authority includes such actions as issuing permits for foreign nations to fish, setting and collecting fees for the fisheries, establishing reporting requirements for the fisheries, facilitating enforcement of management measures, outlining certain prohibitions of fishing, initiating and carrying our observer programs, and establishing quotas for the various fisheries.

Prior to the enactment of the FCMA, regulation of foreign fisheries off Washington, Oregon, and California was very limited. Under terms of the International North Pacific Fisheries Convention, Japan was prohibited from fishing for salmon, Pacific halibut, and Pacific herring, *Clupea harengus pallasii*, of North American origin. There were no restrictions on fishing for other

species. The only real measure of control over foreign fisheries was through bilateral meetings with various nations or through member countries (Canada, Japan, and the United States) of the International North Pacific Fisheries Commission (INPFC). At these meetings the conditions of the stocks were discussed, and efforts were made to protect stocks that were judged to be depleted and to maintain other stocks that were considered to be in good condition.

The U.S. Observer Program

History

With the advent of the comprehensive foreign fishing activities off the coast, the United States became interested in all aspects of the conduct of the fishery. Despite many U.S. requests for the acceptance of observers on their fishing vessels, the foreign nations did not permit observers in the coastal fishery until 1975. That year Japan permitted an observer on a fishing vessel for 1 month and repeated the invitation for an observer for a similar period of time in 1976. The U.S.S.R. extended an invitation to allow three observers on three vessels for 1 month in 1976, and Poland allowed the equivalent of about 9 observer months during the season in 1976.

In those years observer activities consisted primarily of observing the catches for incidence of Pacific halibut and salmon, collecting data on species composition, and taking biological data from samples of various species in the catch. Data were not used to make catch estimates for the entire fleet.

Commencing in 1977 under the FCMA, observers were scheduled routinely on foreign fishing vessels (Fig. 2, 3). In 1977 a total of 15 observers sampled aboard 26 of the 43 Soviet vessels participating in the Pacific whiting fishery and on 5 of the 6 Polish vessels present. Observer coverage (observer days/vessel days) was 23.9 percent on Soviet vessels and 37.2 percent on Polish vessels. In 1978 a total of 16 observers sampled

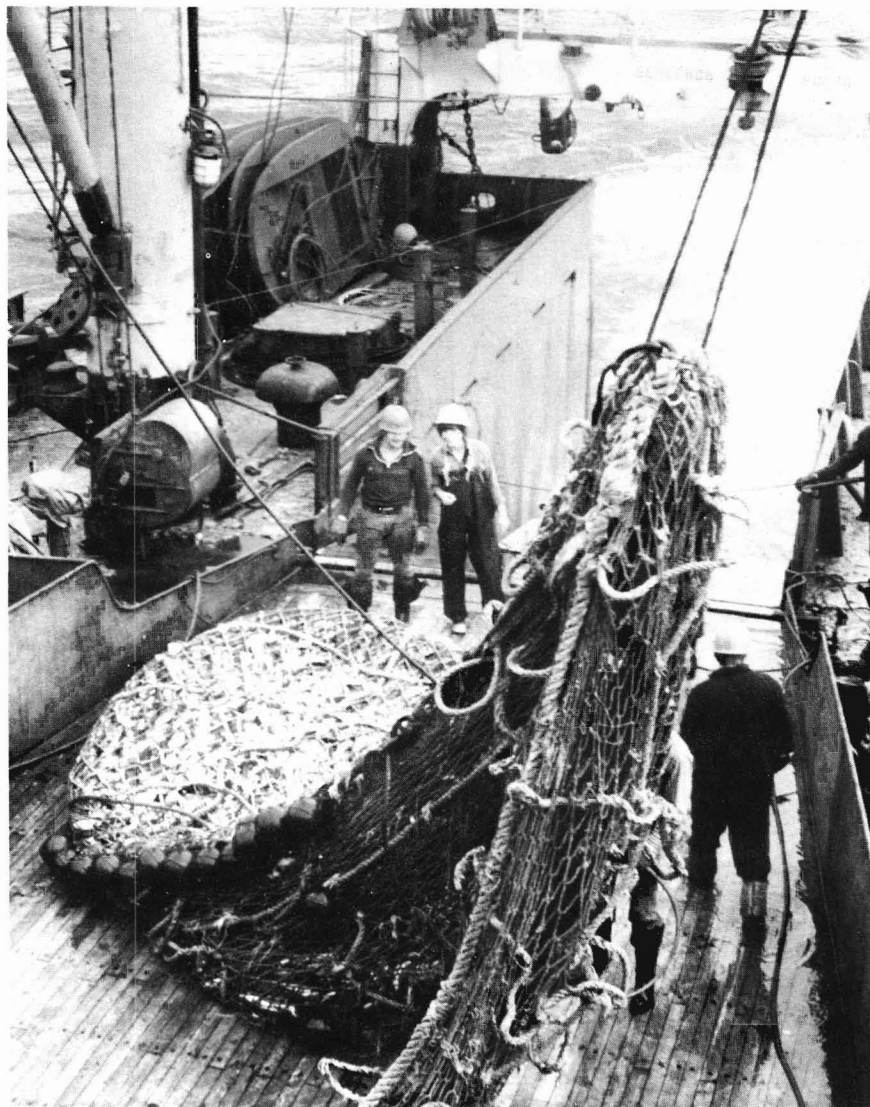


Figure 2.—U.S. observer Margaret Dawson (right center) looks over the catch on a Soviet trawler.

aboard 19 of the 28 Soviet vessels in the fishery and on 5 of the 6 Polish vessels present. Coverage in 1978 was 34.6 percent of the Soviet fishery and 34.9 percent of the Polish fishery. A U.S.-U.S.S.R. joint-venture fishery occurred in late September through October 1978, and observers were on the two participating Soviet vessels for the entire fishing period.

Purpose and Duties

The purpose of the observer program administered by the Northwest

and Alaska Fisheries Center is to monitor the foreign fisheries. Sampling procedures are designed to provide data on species composition of the catch, the incidence of prohibited species (salmon and Pacific halibut) occurring in the catch (Fig. 4), and the age and size composition of certain species. Details of observer duties and sampling procedures are given by Nelson et al. (1981).

On board the vessel the observer determined species composition either by taking representative basket

samples of various trawl hauls, then counting and weighing each species group in the samples, or by a direct method of separating out, counting, and weighing all species other than Pacific whiting in a trawl haul. The weight and number of whiting are then determined by subtracting the weight of other species from the estimated haul weight to give the weight of whiting and dividing this total by the average weight of whiting to give the number of whiting. The latter method was generally used on vessels fishing for whiting in the Washington, Oregon, and California region when the catches were averaging about 99 percent of this species. This whole-haul sampling method also provides the numbers of the prohibited species in the haul.

A unique part of the observer program at the Northwest and Alaska Fisheries Center is the technique of estimating foreign fleet catches based on observer sampling of a portion of the vessels in the fleet. This procedure, used in all areas, is described by Nelson et al. (1981).

Results of Observer Sampling: Estimated Foreign Catch, 1977-78

The estimated catch by U.S.S.R. and Poland in 1977 and 1978 is shown in Table 2. For these 2 years, Pacific whiting formed about 98 percent of the catch. The second and third dominant species were jack mackerel, about 0.9 percent of the catch, and rockfish, *Sebastes* spp., making up about 0.7 percent of the catch. The "other fish" category was composed of a variety of fish of which dogfish shark, *Squalus acanthias*; thresher shark, *Alopias vulpinus*; blue shark, *Prionace glauca*; squid; and lingcod, *Ophiodon elongatus*, constituted the greatest percentage by weight.

Incidence and Incidental Catch Of Salmon and Pacific Halibut

Salmon

Ever since the advent of foreign trawling off the coast of the United States, U.S. fishermen have been concerned about the possible vulnerabili-



Figure 3.—U.S. observer Gail Heineman collects biological data aboard a Soviet trawler.

Table 2.—Estimated weight (t) and composition (percent) of foreign catch in the California, Oregon, and Washington trawl fishery, 1977-78, based on U.S. observer data.

Species groups	1977			Composi- tion (%)	1978			Composi- tion (%)
	Est. weight (t)				Est. weight (t)			
	U.S.S.R.	Poland	Total		U.S.S.R.	Poland	Total	
Pacific whiting	110,208	16,805	127,013	97.8	70,106	26,721	96,287	98.1
Jack mackerel	1,642	363	2,005	1.5	673	214	887	0.9
Rockfish	430	90	520	0.4	500	204	704	0.7
Sablefish	72	5	77	0.1	57	41	98	0.1
Flounders	1	1	2	T ¹	2	2	4	T
Other fish	160	34	194	0.1	94	69	163	0.2
Total	112,513	17,298	129,811		71,432	27,251	98,683	

¹T indicates less than 0.005 percent.

ty of salmon, Pacific halibut, and crab (prohibited species) to trawls and the effects of catches on these stocks. Although the reported catch tonnage by the foreign nations in the coastal fishery does not include salmon or Pacific halibut, vessel captains, beginning in 1978, were required to report weekly on the number observed in the catch. During the early years of the foreign fishery, before observers were placed aboard the trawlers, there was some indication of the vulnerability of salmon to trawls as a result of several

fishing experiments by U.S. and Canadian trawlers. A review of the pertinent information on salmon was made by Larkins et al., 1970².

During the 1960's the U.S. Bureau of Commercial Fisheries (BCF, predecessor to the National Marine Fisheries Service) conducted a number

²Larkins, H. A., D. R. Johnson, and D. L. Alverson. 1970. A consideration of vulnerability of salmon to trawls. Northwest and Alaska Fisheries Center, NMFS, NOAA, 2725 Montlake Blvd., E., Seattle, WA 98112. Unpubl. manusc., 13 p.



Figure 4.—U.S. observer Joe Gnagey watches for prohibited species as the trawl catch is dumped below deck.

of cruises to develop and test mid-water trawl systems and determine the availability of pelagic fishes to mid-water trawls. These pelagic surveys by the BCF (now NOAA) research vessel *John N. Cobb* were carried out off the Washington-Oregon coast and in Puget Sound, Wash. In almost 100 hours of effective trawling effort, the catch of salmon totaled 0.25 pounds (0.11 kg)/hour in coastal waters and 0.66 pounds (0.30 kg)/hour in Puget Sound and Juan de Fuca Strait.

The BCF (now NOAA) research vessel *Miller Freeman* conducted

groundfish surveys in 1969 along the southern British Columbia, Washington, and northern Oregon coasts to collect biological data from rockfish and measure their relative abundance. No salmon were taken during 27.3 hours of bottom trawling using the BCF Universal trawl in which nearly 100,000 pounds of groundfish were caught. In May 1970 the *Miller Freeman* was employed 3 days off Eureka, Calif., to determine the availability of salmon to trawl operations of the type used by the Soviet Fleet while fishing for whiting. In 16

tows, 17 chinook salmon, *O. tshawytscha*, were caught. The catch rate was 1.01 salmon per hour of trawling.

The Canadian research vessel *G. B. Reed* fished off the coast of Vancouver Island in August 1970 to evaluate the vulnerability of salmon to Soviet trawlers. While equipped with an Engle³ midwater or a Universal Mark II trawl, and fishing at depths and speed similar to that of Soviet vessels, the *G. B. Reed* took two salmon in a catch of 36,000 pounds (16 t) of groundfish.

In other experiments, a Canadian fishing vessel employed a midwater trawl to survey Pacific herring populations off the west coast of Vancouver Island. The nets used were Engle trawls and tows were made within concentrations of fish detected by echo sounder. Salmon catches in four cruises of this survey averaged 20 pounds (9.1 kg) per tow and 57.4 pounds (26.1 kg) per hour. In other groundfish surveys in fall and winter 1969 off the west coast of Vancouver Island, the *G. B. Reed* in 65 on-bottom trawl hauls did not catch any salmon among over 222,000 pounds (101 t) of groundfish taken.

During 1966 and 1967 the catches of U.S. vessels participating in commercial trawl fisheries for Pacific whiting were examined for the incidence of salmon. During the 1966 fishery off the coast of Washington, the catch of four vessels landing about 3.6 million pounds (1,635 t) of Pacific whiting and 0.5 million pounds (227 t) of "incidental" species were examined. Only 39 pounds (17.7 kg) of salmon were observed in this catch. During the 1967 fishery a total of 5 pounds (2.3 kg) of salmon were observed in over 2 million pounds (909 t) of Pacific whiting examined. The catch of a large U.S. commercial trawler with processing capabilities, the *Sea Freeze Pacific*, was examined for salmon during four trips from November 1969 through September

³Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

1970. In 340 trawl hauls made from northern Washington to southeastern Alaska, a total of 124 salmon were taken in a catch of over 2.8 million pounds (1,273 t) of groundfish. The average salmon catch was 0.36 fish per haul or 0.1 fish/t of catch.

The review by Larkins et al. (footnote 2) concluded that salmon are susceptible to trawls and their availability to trawls varied depending on area, season, target species, and yearly variation of salmon on the grounds. The average rate of incidental catch of salmon while trawling for groundfish and Pacific whiting was less than 2 pounds (0.9 kg) per hour. It was also judged that maximum towing speeds of 2,000-2,500 hp stern trawlers (characteristic of Soviet BMRT vessels) using large midwater trawls will not exceed 6-7 knots.

Finally, from the information available, it does not appear that foreign fishing activities involved in exploiting Pacific whiting and rockfish would catch significant quantities of salmon. It was also concluded that even the highest average catch rates observed do not seem adequate in an economic sense to support an overt trawl fishing effort directed toward harvesting salmon.

To determine the incidental catch of salmon or other prohibited species on foreign trawlers, it appeared obvious that the use of observers would provide direct means of obtaining incidence rates. Although observers were permitted on some foreign vessels in 1975 and 1976, the coverage was generally insufficient to provide reliable estimates of the incidence of salmon. In 1977 and 1978, however, under the FCMA, observers were placed in sufficient numbers and were able to collect data deemed adequate for estimating the incidental salmon catch. Observers were instructed in ways to provide reliable estimates of the incidence (number of fish per ton of catch) of salmon and to sample for average weight of fish.

In the estimating procedure observers sampled portions of the trawl catch (and at times the entire trawl haul) for the incidence of

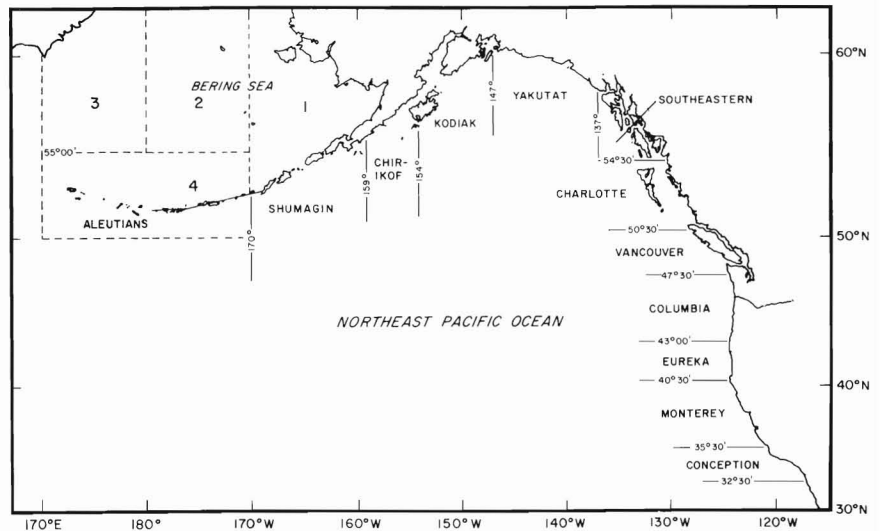


Figure 5.—Statistical areas of the northeastern Pacific Ocean.

salmon. These data were then extrapolated to the total haul weight for the trawl hauls sampled, thence to the total day's catch. The average weight of the individual was obtained by dividing the mean weight of fish per metric ton of catch by the mean number per metric ton. The estimating procedure is given by Nelson et al. (1981) in their Table 7.

The average incidence of salmon (number of salmon per metric ton of catch) by Soviet and Polish trawlers is given in Table 3. Area divisions of the region off California, Oregon, and Washington are shown in Figure 5. Salmon occurred in trawl catches in the Eureka and Columbia areas but not in the limited fishing that took place in the Monterey area. The incidence of salmon on foreign vessels averaged between 0.02 and 0.07 fish per metric ton in the Eureka area and about 0.1 fish in the Columbia area. There was not a great difference in average incidence rates between the 2 years although the overall average was slightly higher in 1977 than in 1978. The incidence on the U.S. vessels delivering fish to Soviet processing vessels (0.02) was somewhat lower than that of the foreign trawlers. The incidence rate of salmon, 0.1 fish per metric ton of catch, for foreign trawlers was similar to that shown by

Table 3.—Average incidence (no. per metric ton of catch) and average weight of salmon (kg) taken in Soviet, Polish, and joint-venture fisheries off California, Oregon, and Washington, 1977-78.

Nation-statistical area	1977		1978	
	Avg. incidence	Avg. wt.	Avg. incidence	Avg. wt.
U.S.S.R.				
Monterey	0	—	0	—
Eureka	0.065	3.6	0.019	4.9
Columbia	0.115	3.0	0.050	3.9
Poland				
Monterey	—	—	—	—
Eureka	0.040	3.2	0.052	2.2
Columbia	0.108	3.7	0.121	2.4
U.S.-U.S.S.R. joint-venture fisheries ¹				
Columbia	—	—	0.021	2.4

¹U.S. trawlers delivering their catch to Soviet processors.

the *Sea Freeze Pacific* in the area from northern Washington to southeastern Alaska.

The average weight of salmon was about 3.4 kg (7.5 pounds) in 1977; in 1978 the average weight was around 4.4 kg (9.7 pounds) on Soviet vessels and 2.3 kg (5.1 pounds) on the Polish vessels. The fish taken by U.S. trawlers participating in the joint venture were similar in size to those taken by the Polish trawlers.

The estimated incidental catch of salmon by foreign trawlers was computed by multiplying the average incidence rate for each month/area by

the estimated foreign catch for the appropriate month/area. The results (Table 4) show an estimated catch of 14,627 salmon (48.9 t) in 1977 and 5,915 fish (19.9 t) in 1978. The decrease in salmon catch in 1978 was attributed to the somewhat lower incidence rate in 1978 compared to 1977 and to the reduced groundfish catch in 1978. In the limited joint-venture fishery by the U.S.-U.S.S.R. in 1978, 19 salmon were estimated to have been taken incidentally.

The salmon taken in the trawls were predominantly chinook salmon. This species formed 91 percent of the salmon catch in 1977 and 95 percent in 1978. Coho salmon, *O. kisutch*, made up 7 percent of the salmon catch in 1977 and 5 percent in 1978. Other species of salmon observed in small numbers were chum salmon, *O. keta*, and sockeye salmon, *O. nerka*.

Table 4.—Estimated catch of salmon (in numbers of fish and metric tons) by foreign trawlers and joint-venture fisheries off California, Oregon, and Washington.

Nation-statistical area	1977		1978	
	No.	Wt.	No.	Wt.
U.S.S.R.				
Monterey	0	—	0	—
Eureka	2,461	8.7	347	1.7
Columbia	10,727	34.8	2,534	10.0
Poland				
Monterey	0	—	0	—
Eureka	270	0.9	322	0.7
Columbia	1,169	4.5	2,702	6.7
Total	14,627	48.9	5,905	19.1
U.S.-U.S.S.R. joint-venture fisheries			19	0.04

Pink salmon, *O. gorbuscha*, were not observed. A few steelhead trout, *Salmo gairdneri*, were observed in the trawl catches (eight in 1977 and one in 1978).

Pacific halibut

Although traditionally fished by setline vessels, it has long been known that Pacific halibut are commonly taken in bottom trawls. Hoag (1971) studied the effects of domestic (United States and Canada) trawling for groundfish on Pacific halibut stocks off British Columbia, Canada. He found that the incidental catch of Pacific halibut by the domestic fleet for the years 1962-69 ranged from 2.496 million pounds (1,132.5 t) to 4.228 million pounds (1,918.3 t). The upper limit of the annual loss in yield was estimated at 3.6 million pounds (1,633.4 t).

The incidence and incidental catch of Pacific halibut by foreign trawlers in the coastal fishery was determined in the same manner as for salmon and the same estimating procedures were used. The incidence and incidental catch of Pacific halibut by foreign trawlers is quite low off the coasts of California, Oregon, and Washington which is the southern range of the species' distribution (Table 5). The incidence of Pacific halibut averaged less than 0.01 fish per metric ton of catch and occurred only in the Columbia area. The average weight of the Pacific halibut taken in 1977 was quite large (17.98 kg) compared to those in 1978 (4-6 kg).

Table 5.—Average incidence (no. per metric ton of catch) and average weight (kg) of Pacific halibut taken in Soviet, Polish, and joint-venture fisheries off California, Oregon, Washington, 1977-78.

Nation-statistical area	1977				1978			
	Average incidence	Average weight	Est. no. halibut	Total wt. (t)	Average incidence	Average weight	Est. no. halibut	Total wt. (t)
U.S.S.R.								
Monterey	0	—	—	—	0	—	—	—
Eureka	0	—	—	—	0	—	—	—
Columbia	0.001	17.98	66	1.3	0.004	6.28	231	1.4
Poland								
Monterey	0	—	0	—	0	—	—	—
Eureka	0	—	0	—	0	—	—	—
Columbia	0	—	—	—	T ¹	4.00	9	.04
Total		66	1.3				240	1.44

¹T indicates less than 0.0005

The total estimated incidental catch of Pacific halibut was 66 fish (1.3 t) in 1977 and 240 fish (1.4 t) in 1978. No halibut were taken by U.S. vessels fishing in the joint-venture fisheries with Soviet processors in 1978.

Species Composition and Estimated Catch of Rockfish and Flatfish

The estimated incidental catch of rockfish by foreign trawlers off the coast of California, Oregon, and Washington was about 520 t in 1977 and 703 t in 1978 (Tables 6 and 7). In 1978 we estimated the joint-venture fisheries took about 14 t of rockfish. A total of 28 species in 1977 and 33 species in 1978 was identified by observers in the coastal fishery. The majority of the rockfish were taken in the Columbia area; no rockfish were observed in catches in the limited fishery in the Monterey area.

The predominant species of rockfish in the foreign catches was the widow rockfish, *S. etomelas*, followed by the yellowtail rockfish, *S. flavidus*. These two species formed about 79 percent of the foreign rockfish catch in 1977 and 74 percent in 1978. The catch of about 20 t of Pacific ocean perch in 1977 and 39 t in 1978 made up about 4 percent and 6 percent of the rockfish, respectively, for the 2 years. Most of these were from the Columbia area. This species is of special concern to the United States because of its relatively low abundance and its value to the domestic fishery.

For the U.S. vessels fishing for the joint venture fisheries (Fig. 6), the widow and yellowtail rockfish were also the predominant species of the rockfish taken, forming about 73 percent of the rockfish catch. Pacific ocean perch made up about 6 percent of these catches.

The incidental catch of flatfish by foreign trawlers was very small, amounting to about 1.9 t in 1977 and 3.7 t in 1978 in the Columbia area (Table 8). No flatfish were observed in the other areas. The catch by U.S. vessels delivering fish to foreign processors was only 0.08 t in 1978. Of the

Table 6.—Total estimated catch (metric tons) of rockfish by species by foreign trawlers off the California, Oregon, Washington coast, June-October, 1977.

Common and scientific names	Catch by statistical area		Total (t)	Percentage of rockfish catch
	Eureka	Columbia		
Aurora, <i>Sebastes aurora</i>	—	0.55	0.55	0.1
Black, <i>S. melanops</i>	—	0.36	0.36	0.1
Bocaccio, <i>S. paucispinus</i>	1.10	11.58	12.68	2.5
Brown, <i>S. auriculatus</i>	—	0.59	0.59	0.1
Canary, <i>S. pinniger</i>	0.02	7.26	7.28	1.5
Chilipepper, <i>S. goodei</i>	0.02	8.38	8.40	1.7
Copper, <i>S. caurinus</i>	—	1.18	1.18	0.2
Darkblotched, <i>S. crameri</i>	0.12	14.07	14.19	2.8
Dusky, <i>S. ciliatus</i>	—	0.63	0.63	0.1
Greenstriped, <i>S. elongatus</i>	—	1.74	1.74	0.3
Longspine thornyhead, <i>Sebastolobus altivelis</i>	—	0.11	0.11	T ¹
Pacific ocean perch, <i>Sebastes alutus</i>	0.49	19.31	19.80	4.0
Pink, <i>S. eos</i>	—	0.10	0.10	T
Redbanded, <i>S. babcocki</i>	—	1.97	1.97	0.4
Redstripe, <i>S. proriger</i>	—	11.15	11.15	2.2
Rosy, <i>S. rosaceus</i>	—	0.11	0.11	T
Rougheye, <i>S. aleutianus</i>	—	2.57	2.57	0.5
Sharpchin, <i>S. zacentrus</i>	—	0.13	0.13	T
Shortbelly, <i>S. jordani</i>	0.01	—	0.01	T
Shortraker, <i>S. borealis</i>	—	2.41	2.41	0.5
Shortspine thornyhead, <i>Sebastolobus alascanus</i>	—	8.37	8.37	1.7
Silvergray, <i>Sebastes brevispinis</i>	—	0.99	0.99	0.2
Splitnose, <i>S. diploproa</i>	0.28	9.17	9.45	1.9
Vermilion, <i>S. miniatus</i>	—	0.13	0.13	T
Widow, <i>S. entomelas</i>	68.57	298.91	367.48	73.7
Yelloweye, <i>S. ruberrimus</i>	0.06	0.74	0.80	0.2
Yellowmouth, <i>S. reedi</i>	—	1.23	1.23	0.2
Yellowtail, <i>S. flavidus</i>	10.24	14.10	24.34	4.9
Total	80.9	417.8	498.7	

¹T indicates trace (<0.005 t and 0.05 percent).

Table 7.—Total estimated catch (metric tons) of rockfish by species by foreign trawlers and U.S. trawlers delivering catches to foreign processing vessels off California, Oregon, and Washington coast, June-October, 1978.

Species of rockfish	Foreign trawler catch				JV Vessels ¹	
	Eureka	Columbia	Total	Percent	Columbia	Percent
Aurora, <i>Sebastes aurora</i>	—	0.01	0.01	T	—	—
Bank, <i>S. rufus</i>	—	0.02	0.02	T	—	—
Black, <i>S. melanops</i>	1.03	8.38	9.41	1.3	—	—
Blackgill, <i>S. melanostomus</i>	—	0.68	0.68	0.1	—	—
Blue, <i>S. mystinus</i>	0.64	—	0.64	0.1	—	—
Bocaccio, <i>S. paucispinus</i>	0.93	23.21	24.14	3.4	1.10	7.9
Brown, <i>S. auriculatus</i>	0.48	0.13	0.61	0.1	—	—
Canary, <i>S. pinniger</i>	2.01	30.87	32.88	4.7	0.09	0.6
Chilipepper, <i>S. goodei</i>	0.15	0.71	0.86	0.1	—	—
Copper, <i>S. caurinus</i>	—	0.01	0.01	T	—	—
Darkblotched, <i>S. crameri</i>	3.25	1.36	4.61	0.7	T	T
Dusky, <i>S. ciliatus</i>	—	0.02	0.02	T	—	—
Greenspotted, <i>S. chlorostictus</i>	—	0.01	0.01	T	—	—
Greenstriped, <i>S. elongatus</i>	—	0.70	0.70	0.1	0.01	0.1
Harlequin, <i>S. variegatus</i>	—	T	T	T	—	—
Olive, <i>S. serranoides</i>	0.16	6.81	6.97	1.0	—	—
Pacific ocean perch, <i>S. alutus</i>	3.97	35.34	39.31	5.6	0.87	6.2
Redbanded, <i>S. babcocki</i>	3.97	1.17	1.17	0.2	—	—
Redstripe, <i>S. proriger</i>	—	12.61	16.58	2.4	1.66	11.9
Rosethorn, <i>S. helvomaculatus</i>	—	T	T	T	—	—
Rougheye, <i>S. aleutianus</i>	0.04	1.47	1.51	0.2	—	—
Sharpchin, <i>S. zacentrus</i>	—	0.02	0.02	T	—	—
Shortraker, <i>S. borealis</i>	0.01	1.40	1.41	0.2	0.01	0.1
Shortspine thornyhead, <i>Sebastolobus alascanus</i>	—	1.91	1.91	0.3	0.01	0.1
Silvergray, <i>Sebastes brevispinis</i>	2.86	4.49	7.35	1.0	—	—
Splitnose, <i>S. diploproa</i>	15.20	3.98	19.18	2.7	0.01	0.1
Stripetail, <i>S. saxicola</i>	—	0.02	0.02	T	—	—
Starry, <i>S. constellatus</i>	0.08	—	0.08	T	—	—
Vermilion, <i>S. miniatus</i>	0.16	1.15	1.31	0.2	T	—
Widow, <i>S. entomelas</i>	39.31	264.57	303.88	43.2	6.27	44.9
Yelloweye, <i>S. ruberrimus</i>	0.04	0.01	0.05	T	T	T
Yellowmouth, <i>S. reedi</i>	1.44	9.40	10.84	1.5	T	T
Yellowtail, <i>S. flavidus</i>	7.30	209.66	216.96	30.9	3.92	28.1
Total	83.03	620.12	703.15		13.95	

¹U.S. vessels delivering catches to U.S.S.R. processing vessels.

²T indicates trace (<0.005 t and 0.05 percent).

12 species of flatfish observed over the 2 years, the predominant species was the arrowtooth flounder, *Atheresthes stomias*, which formed 80 percent of the catch in 1977 and 72 percent in 1978.

Summary

During the period 1965 to 1 March 1977 (when the FCMA was implemented) eight nations fished at various times off the coasts of Washington, Oregon, and California. The number of foreign vessels on the grounds totaled over 100 at the peak of fishing in 1974. Total catches amounted to as much as 254,000 t in 1976 and averaged around 170,000 t between 1966 and 1978. During this period a few U.S. observers were placed on vessels in 1975 and 1976 by invitation of the host country.

In recent years, the foreign fleets have consisted of large factory trawlers of 2,100 to 3,800 gross tons capable of both fishing and processing the catches.

In 1977 and 1978 following implementation of the Act, the United States began routine placement of observers aboard foreign vessels fishing off the coasts of California, Oregon, and Washington. During the fishing season 15 observers sampled aboard Soviet and Polish vessels in 1977 and 16 observers were placed in 1978. These observers were placed aboard the vessels primarily to monitor the foreign fisheries to insure that the fleets complied with U.S. regulations and also to obtain data to help assess the biological condition of various stocks of fish.

From data obtained by observers it was estimated that the foreign fleets took approximately 130,000 t of fish in 1977 and 99,000 t in 1978. About 98 percent of the catch consisted of Pacific whiting, the target species. Special sampling procedures were used to determine the incidental catch of salmon and Pacific halibut which are taken during trawling for Pacific whiting. These species are especially important to U.S. fishermen and consequently the regulations prohibit their retention. It was estimated that



Figure 6.—A U.S. trawler delivers its catch to a Soviet processing ship during joint-venture fisheries.

Table 8.—Total estimated catch (metric tons) of flatfish by foreign trawlers and U.S. joint-venture trawlers off the California, Oregon, and Washington coasts, June-October, 1977-78.

Common and scientific name	1977 catch		1978 catch			
	Foreign trawlers		Foreign trawlers		JV vessels ¹	
	t	%	t	%	t	%
Arrowtooth flounder, <i>Atheresthes stomias</i>	1.49	80.1	2.64	72.1	0.001	1.3
Deepsea sole, <i>Embassichthys bathybius</i>	0.05	2.7	—	—	—	—
Dover sole, <i>Microstomus pacificus</i>	0.08	4.3	0.51	13.9	0.063	79.7
English sole, <i>Parophrys vetulus</i>	0.01	0.5	T	—	0.007	8.9
Flathead sole, <i>Hippoglossoides elassodon</i>	T ²	—	0.06	1.6	—	—
Greenland turbot, <i>Reinhardtius hippoglossoides</i>	0.01	0.5	0.25	6.8	—	—
Pacific sanddab, <i>Citharichthys sordidus</i>	T	—	0.01	0.3	T	—
Petrale sole, <i>Eopsetta jordani</i>	0.01	0.5	—	—	—	—
Rex sole, <i>Glyptocephalus zachirus</i>	0.21	11.3	0.13	3.6	0.002	2.5
Rock sole, <i>Lepidopsetta bilineata</i>	—	—	0.06	1.6	T	—
Slender sole, <i>Lyopsetta exilis</i>	T	—	—	—	—	—
Starry flounder, <i>Platichthys stellatus</i>	—	—	T	—	0.006	7.6
Total	1.86	—	3.66	—	0.080	—

¹U.S. joint-venture vessels delivering catches to U.S.S.R. processing vessels.

²T indicates trace, <0.005 t and 0.05 percent.

approximately 14,600 salmon were taken incidentally in 1977 and about 6,000 in 1978. Between 91 and 95 percent of the salmon catch was chinook. Pacific halibut were relatively scarce

in the catches in this area (the southern range of their distribution); an estimated 66 were taken in 1977 and 240 in 1978. In a joint-venture fishery in 1978 in which U.S. vessels

delivered catches to Soviet trawlers, 19 salmon and no Pacific halibut were observed.

Rockfish taken by foreign trawlers while trawling for Pacific whiting amounted to about 520 t in 1977 and 703 t in 1978. Of these, the predominant species was the widow rockfish which formed 79 percent of the catch in 1977 and 74 percent in 1978. Pacific ocean perch, an important rockfish for U.S. fishermen, made up 4 percent and 6 percent, respectively, of the total rockfish catch in 1977 and 1978. The foreign trawlers took few flatfish in their catches; these species totaled about 2 t in 1977 and 4 t in 1978. Arrowtooth flounders predominated in the flatfish catches.

The fishery by foreign nations off the coasts of Washington, Oregon, and California has been shown to take substantial catches of species which would otherwise not be utilized. The placement of observers on these vessels has enabled the United States to monitor the foreign fisheries, determine their impact on species of importance to U.S. fishermen, and to acquire valuable information for studies on condition of the stocks.

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