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**DEPARTMENT OF
COMMERCE**

**National Oceanic and
Atmospheric Administration**



**TRAWL FISHERIES OF
WASHINGTON, OREGON,
AND CALIFORNIA**

Preliminary Management Plan

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric
AdministrationTRAWL FISHERIES OF WASHINGTON,
OREGON, AND CALIFORNIA

Preliminary Fishery Management Plan

On the 4th of February, 1977, the Secretary of Commerce, through an appropriate delegation of authority to the Associate Administrator for Marine Resources of the National Oceanic and Atmospheric Administration and the Director of the National Marine Fisheries Service, published a Notice of Determination, Preparation, Issuance, and Implementation of Preliminary Fishery Management Plans at 42 FR 6873. In order that each Plan may have the widest possible circulation, the Secretary has decided that each should be published in the FEDERAL REGISTER.

Dated the 4th day of February, 1977
at Washington, D.C.

WINFRED H. MEIBOHM,
Associate Director, National
Marine Fisheries Service.

PRELIMINARY FISHERY MANAGEMENT PLAN
FOR TRAWL FISHERIES OF WASHINGTON,
OREGON, AND CALIFORNIADEPARTMENT OF COMMERCE, NATIONAL OCEANIC
AND ATMOSPHERIC ADMINISTRATION,
NATIONAL MARINE FISHERIES SERVICE,
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TABLE OF CONTENTS

1.0 INTRODUCTION
2.0 DESCRIPTION OF THE FISHERY
A. Areas and Stock Involved.
B. History of Exploitation.
C. The Contemporary Fishery.
(1) United States.
(2) Japan.
(3) U.S.S.R.
(4) Poland.
(5) Other Nations.
D. Impact on United States Fisheries.
E. Regulatory History and Violations.
(1) United States.
(2) Other Nations.
F. Cooperative Research and Statistical Exchange.
3.0 STATUS OF STOCKS
A. General Distribution and Abundance.
B. Current Status.
(1) Pacific Hake.
(2) Pacific Ocean Perch.
(3) Rockfishes (other than Pacific ocean perch).
(4) Dover Sole.
(5) Other Flounders.
(6) Sablefish.
(7) Jack Mackerel.
(8) Other Species.
4.0 TALLEY
A. Optimum Yield.
B. Total Allowable Catch.
(1) Pacific Hake.
(2) Rockfishes.
(3) Flounders.
(4) Sablefish.
(5) Jack Mackerel.
(6) Other Species.
5.0 REGULATIONS PERTAINING TO FOREIGN FISHING
A. Region-Wide Restrictions on Foreign Fishing.

B. Time-Area Closures.
C. Foreign Effort Limitations in Vessel-Days on the Grounds (to assure compliance with catch quotas).

D. Statistical Reports.

(1) Annual

(2) Monthly

E. Fleet Disposition Reports

F. Observers

G. Research

6.0 RELATION TO NATIONAL STANDARDS

7.0 REFERENCES

8.0 FOOTNOTES

9.0 APPENDICES

1.0 INTRODUCTION

Except for a few spurts caused by technological innovations and wartime markets, the U.S. trawl fishery in the Washington-California region developed gradually and without competition from the 1800's until 1965. Suddenly, however, in 1966 a Soviet expedition arrived in force, and almost overnight one species of great importance to U.S. trawlers was driven to commercial extinction, fishing grounds were physically preempted, and losses of U.S. fixed gear mounted.

During the following 10 years, not only was the Soviet presence maintained but fishing vessels flying the flags of Japan, German Democratic Republic, Federal Republic of Germany, Peoples Republic of Poland, Republic of Korea, Panama, Republic of China, and Bulgaria added to the impact this international fishery was having on U.S. interests.

This Preliminary Management Plan is in direct response to the legislative requirements mandated by Pub. L. 94-265 and deals with the foreign element of the Washington-California trawl fishery.

2.0 DESCRIPTION OF THE FISHERY

A. AREAS AND STOCK INVOLVED

The continental shelf off Washington, Oregon, and California is rather narrow, varying in width from less than a mile off the Monterey Peninsula in California to as much as 37 miles over Heceta Bank off southern Oregon. The total shelf area (0-100 fms) is about 30,000 square miles. By comparison, the very extensive shelf of the eastern Bering Sea averages some 400 miles in width and covers nearly 380,000 square miles. While the relatively limited continental shelf and upper slope habitat off Washington-California provides a much smaller harvest (about 270,000 mt. vs. 2,000,000 mt. total catch in 1974), productivity is high and groundfish resources of the region sustain fisheries of major importance to the U.S. West Coast fishing industry.

The bottomfish community in the Washington-California area is characterized by a diverse assemblage of both roundfish and flatfish species which are the subject of multispecies trawl fisheries. As many as 32-35 species are commonly landed by the domestic trawl fleet.

The most common and commercially important roundfishes are Pacific hake (*Merluccius productus*); the rockfishes, primarily the yellowtail rockfish (*Sebastes flavidus*), orange rockfish (*S. piniger*), bocaccio rockfish (*S. paucispinis*), chilipepper rockfish (*S. goodii*), sil-

vergray rockfish (*S. brevispinis*), Pacific ocean perch (*S. alutus*), and the short-spine thornyhead (*Sebastolobus alascanus*); Pacific cod (*Gadus macrocephalus*); sablefish, or blackcod (*Anoplopoma fimbria*); and lingcod (*Ophiodon elongatus*). These species occupy a variety of depths over the continental shelf and upper slope.

The Pacific hake is a semi-pelagic form found over a wide range of depths. It spawns in deep water beyond the continental shelf in the southern portion of its range off southern California and northern Baja California, and undertakes feeding migrations on the shelf and upper slope during the spring and summer as far north as southeastern Alaska. The rockfishes comprise both shallow and deepwater forms, with the extremes represented by *Sebastes flavidus*, found sometimes at the surface, and *Sebastolobus alascanus*, which is associated with the bottom to depths of 800 fms. Adult sablefish usually inhabit deeper waters of the slope while Pacific cod, lingcod, and juvenile sablefish are almost always found on the shelf.

The commercially important flatfish species are nearly as diverse as those of the roundfish group. Of primary value to the U.S. are Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), petrale sole (*Eopsetta jordani*), rock sole (*Lepidopsetta bilineata*), rex sole (*Glyptocephalus zachirus*), Pacific sanddab (*Citharichthys sordidus*) and starry flounder (*Platichthys stellatus*).

The starry flounder is a shallow water species commonly found in estuaries and even several miles upstream from the sea in larger river systems. Most other species occur primarily on the continental shelf, but Dover sole, rex sole, petrale sole and arrowtooth flounder (*Atheresthes stomias*) frequently inhabit the continental slope. Dover sole are commonly fished to depths of 400 fms and occur in commercial abundance to at least 600 fms.

The elasmobranchs (sharks and rays) are of minor commercial importance and are represented primarily by the spiny dogfish (*Squalus acanthias*), ratfish (*Hydrolagus Collei*), and several species of skates and rays (*Rajidae*).

Many bottomfish species exhibit seasonal bathymetric migrations, usually associated with spawning. During the winter, mature fish tend to move offshore and into gullies and canyons to spawn. It is during such migrations that bottomfish schools often become very dense and extremely vulnerable to trawl gear. These visits to deep water vary in length, but by early summer most species have returned shoreward to summer feeding grounds.

The eggs and larvae of most species are pelagic, drifting with coastal currents.

Individuals of certain species of bottomfish such as sablefish, petrale sole, and English sole undertake extensive coastal migrations: Sablefish tagged in Washington-Oregon waters have been recovered as far north as the Bering Sea and as far south as California; English

sole tagged off British Columbia, Canada, were recovered off California. Most bottomfish species, however, demonstrate little coastwide movement. Some lingcod, for example, are known to inhabit the same rocky reef throughout their lives. Tagging and morphometric studies have shown that even those species in which individuals undertake long migrations are, in general, relatively sedentary in behavior and the exchange of genetic material between distant areas is considered to be a very slow process.

B. HISTORY OF EXPLOITATION

Trawling began on the Pacific Coast in 1876 (Scofield 1948), when the paranzella net, or 2-boat trawl, was introduced in San Francisco Bay and towed by lateen-rigged sailboats. The method successfully produced catches which were larger than those by other fishing gear of the era and trawling within the Bay became widely accepted.

During the 1880's steam powered vessels began replacing sailing vessels, increasing fishing efficiency and range. By 1888, paranzella gear was fished exclusively by paired steam trawlers. In 1906, San Francisco Bay was closed to trawling because of overfishing and paranzella fishing had expanded to open ocean areas outside of San Francisco Bay. Off the Oregon-Washington coasts, beam trawls were the first type of trawl gear used when a small schooner began fishing in 1884 (Harry and Morgan, 1963). The beam trawl was an effective fishing gear which could be towed by a single

vessel. The otter trawl was introduced as early as 1908 but was not used on a regular basis until 1926, when two vessels began fishing the protected waters of Puget Sound. Diesel engines became available during the 1920's as did other technological advances which stimulated rapid growth and expansion of the trawl fishery. World War II created a high demand for food fish and for dogfish livers used in the production of vitamin A. The trawl fishery expanded to many productive offshore grounds off California, Oregon, and Washington and, by 1944, Washington trawlers were fishing as far north as Queen Charlotte Sound, Canada. Total U.S. trawl landings averaged about 9,070 metric tons during the 1926-40 period, increased sharply during the war years to an average of 22,222 m.t., and grew rather steadily to 54,138 m.t. by 1975. Species contributing most to the 1975 U.S. trawl landings were Dover sole (24 percent of the total landings), rockfish other than Pacific ocean perch (23 percent), Pacific cod (10 percent), petrale sole (8 percent), English sole (7 percent), lingcod (6 percent), and sablefish (6 percent). U.S. trawl landings from areas off Washington, Oregon, and California are presented in Table 1.

Foreign fishing came to the coasts of Washington, Oregon, and California about 1962 when Japanese and Soviet exploratory vessels appeared as an extension of their newly developed trawl fisheries in the Gulf of Alaska. Shortly thereafter, Japanese trawlers were fishing regularly for rockfish, primarily Pa-

cific ocean perch. The Pacific ocean perch resource off the Pacific Northwest is small relative to that originally found in more northern and westward areas; therefore, rarely did more than a dozen Japanese trawlers operate in the Washington-California area. Japanese perch catches peaked in 1968 at about 4,455 m.t. and subsequently declined precipitously to a few hundred metric tons.

A Soviet trawl fleet was attracted by the large unexploited Pacific hake resource in 1966, which was the first major foreign fishery to occur off the west coast of the contiguous states. The 1966 catch was 136,050 m.t. of hake and 10,010 m.t. of perch (Hitz, 1970). Soviet perch catches also declined rapidly and, under the terms of a U.S.-U.S.S.R. bilateral fisheries agreement, the U.S.S.R. agreed to discontinue targeting on perch or fishing in known perch areas. Soviet hake catches peaked in 1970 when about 226,000 m.t. were taken. From 1967 to 1972, U.S.S.R. hake catches ranged from 103,700 to 226,000 m.t. By agreement, the U.S.S.R. has limited its catch of Pacific hake to approximately 150,000 m.t. since 1973. In the beginning, the major portion of the catch was filleted for human consumption and small and otherwise unsuitable hake were reduced to meal. Recently, however, the average size of hake was decreased markedly, forcing a reduction in the proportion filleted and an increase in the amount headed, eviscerated, and frozen in the round.

TABLE 1.—U.S. groundfish catches (metric tons) by trawl for areas off Washington, Oregon and California during 1960-75

Species	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Sablefish	1,062	679	827	837	808	906	971	662	664	1,088	1,358	1,460	2,485	3,583	2,743	3,164
Dover sole	6,502	5,404	5,800	6,817	6,654	6,507	6,251	4,846	5,741	8,387	9,349	8,946	12,721	12,221	11,353	12,609
English sole	2,144	2,384	2,939	2,780	2,759	2,964	3,754	3,568	3,423	2,466	2,229	2,149	2,356	2,549	2,567	3,000
Petrale sole	2,080	2,391	2,689	2,548	2,062	2,012	2,149	2,062	2,010	2,120	2,489	2,658	2,541	2,332	2,919	2,808
Rock sole	91	1	21	1	1	1	5	4	3	1	3	41	3	4	9	23
Other flatfish	2,284	1,950	2,313	2,141	2,092	2,048	2,510	2,581	1,639	2,524	2,328	2,228	3,911	2,771	2,730	3,463
Lingcod	909	798	726	698	575	629	638	775	818	823	964	1,388	1,796	2,361	2,470	2,075
Pacific cod	98	40	9	20	88	82	220	162	56	10	24	98	344	139	201	315
Pacific hake	(1)	(1)	(1)	(1)	(1)	(1)	1,031	7,436	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Pacific ocean perch	1,066	2,069	2,642	3,581	3,940	6,145	1,711	698	346	308	306	469	387	304	402	629
Other rockfish	7,916	6,255	6,861	6,538	4,920	5,288	6,174	5,545	5,056	4,470	5,555	5,387	7,823	9,577	8,531	9,447
Other	0	1	1	220	212	194	160	199	171	139	106	83	152	307	186	195
Industrial	2,337	4,484	3,547	2,941	3,418	3,888	2,646	2,909	2,320	2,260	1,354	2,574	500	416	250	266
Total	26,489	26,476	28,375	29,032	27,489	30,664	28,221	31,447	22,247	25,492	26,065	27,508	34,019	36,564	34,641	37,704

Trace.

Poland conducted exploratory trawling off the U.S. West Coast in 1973 and sent eight vessels to participate in the hake fishery during 1974. The size of this fleet increased in 1975 to 13 stern trawlers and three support vessels. Polish hake catches were 44,354 and 57,246 m.t. in 1974 and 1975, respectively.

Other nations to recently enter the hake fishery, but in a very limited way, are East Germany (one trawler, 1974-75), West Germany (one-two trawlers, 1973-75), and Bulgaria (three trawlers, 1976).

Approximate foreign trawl catches from areas off Washington, Oregon, and California during 1967-75 are found in Table 2.

C. THE CONTEMPORARY FISHERY

(1) *United States.* The domestic trawl fisheries in this region differ substantially from that of other nations. It is conducted by relatively small vessels (16-33 meters) which operate out of coastal processing plants and shore-based maintenance facilities. Little processing of the catch is done at sea and fish are usually iced or brined for delivery to processing facilities after trips of 1-7 days' duration. Many vessels are aged and were designed as "combination" vessels which can and do fish a variety of gear (Figure 1). Most U.S. trawlers operate as independent units, and the increased efficiency which might accrue by fleet operation does not occur.

On the other hand, foreign distant-water fleets are composed of large, modern, and self-sustaining vessels. These fleets typically include a variety of support vessels such as refrigerated transports, oil tankers, personnel and supply transports, hospital ships, tugs, patrol vessels, and research vessels. Fleet activities may be highly organized with vessels deployed in such a way as to optimize fishing and scouting operations. Most vessels fishing in the Washington-California area are factory stern trawlers which process their own catches and provide a variety of fishery products. Such vessels have substantial "staying" power, remaining on the grounds for long periods and seldom ceasing fishing due to weather conditions.

TABLE 2.—Groundfish catches (approximate) from the Washington-California area, 1967-75¹

[In thousands of metric tons]

Species and country	1967	1968	1969	1970	1971	1972	1973	1974	1975 (estimate)
Hake (includes catch from off British Columbia):									
United States.....	8	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)
U.S.S.R.....	206	104	162	226	152	117	153	150	154
Poland.....	0	0	0	0	0	0	2	44	57
Japan.....	0	0	0	1	(?)	(?)	3	(?)	(?)
Total.....	214	104	162	227	152	117	158	203	211
Flounders:									
United States.....	13	14	15	16	16	21	20	20	(?)
U.S.S.R.....	(?)	(?)	(?)	(?)	2	3	(?)	(?)	(?)
Poland.....	0	0	0	0	0	0	(?)	0	(?)
Japan.....	(?)	(?)	(?)	0	1	0	(?)	(?)	(?)
Total.....	13	14	16	16	18	23	20	20	(?)
Rockfishes:									
United States.....	6	5	6	6	6	8	10	12	(?)
U.S.S.R.....	38	16	3	3	2	2	6	3	2
Poland.....	0	0	0	0	0	0	(?)	(?)	3
Japan.....	6	4	(?)	(?)	(?)	2	5	10	(?)
Total.....	49	25	8	9	9	12	21	24	(?)
Sablefish:									
United States.....	1	1	1	1	3	4	6	6	8
U.S.S.R.....	(?)	(?)	(?)	1	1	(?)	(?)	(?)	(?)
Poland.....	0	0	0	0	0	0	0	(?)	(?)
Republic of Korea.....	0	0	0	0	0	0	0	(?)	3
Japan.....	1	(?)	1	(?)	(?)	1	(?)	(?)	(?)
Total.....	2	1	2	2	3	5	6	7	11
Jack mackerel:²									
United States.....	17	25	24	22	27	23	10	12	17
U.S.S.R.....	0	0	0	0	0	0	0	0	0
Poland.....	0	0	0	0	0	0	(?)	0	4
Japan.....	0	0	0	0	0	0	0	0	0
Total.....	17	25	24	22	27	23	10	(?)	(?)
Others:									
United States.....	11	3	3	2	4	3	3	2	(?)
U.S.S.R.....	4	8	3	7	(?)	3	3	5	3
Poland.....	0	0	0	0	0	0	(?)	(?)	2
Japan.....	2	1	(?)	(?)	(?)	3	4	14	(?)
Total.....	19	12	6	10	5	9	10	23	(?)

¹ Foreign catches as reported by foreign governments.² Trace.³ Plus.⁴ Catch, if any, included under "Others."⁵ Abundance much greater than implied by catches; Mexican catches not available for recent years.

(2) *Japan.* The few Japanese trawl vessels that fish in the area are licensed by Japan as a part of the North Pacific Trawl Fishery. Since 1967, Japan has limited the number of vessels in this fleet to 42 and they may only fish in waters

east of 170° E and north of 10° N (including the Bering Sea, Aleutian Islands, and south and east of the Pacific coast of the United States and Canada). By agreement, no more than two of those vessels may trawl south of 47°30' N lati-

tude at any one time during June 1–September 30. These vessels operate independently, either offloading their catches to refrigerator transports or delivering processed catches to Japan themselves. Typical factory trawlers now fishing in the North Pacific Trawl Fishery are 3,000 to more than 5,000 gross registered tons with crews of 130 or more (Figure 2). They are equipped with sophisticated electronic navigational and fish-finding devices and are capable of trawling in midwater and on rough seabeds.

There has been an almost continuous upgrading in that "real" fishing effort has increased significantly, in a number which is not reflected in the numbers of vessels employed or in the time devoted to actual trawling.

(3) *U.S.S.R.* Declining production in the traditional fishing areas of the eastern Bering Sea forced the Soviet Union to seek other grounds to the south and east off the coast of the United States and Canada. Rockfish and the virtually untapped Pacific hake resource off the British Columbia-California coast attracted Soviet exploratory vessels in the early 1960's and, later, a large production fleet in 1966 (Hitz, 1970). In 1966, the fleet was comprised mainly of side trawlers referred to as "medium fishing trawlers" (SRT's), but in addition there were other side trawlers designated as "fishing trawlers" (RT's), "medium fishing trawlers with freezers" (SRTM's), and "medium fishing trawlers with refrigeration" (SRTR's). Stern trawlers in the fleet included "large freezer fishing trawlers" (BMRT's) and "fishing trawlers with freezer" (RTM's). Gradually the side trawlers were replaced almost entirely by factory stern trawlers. The BMRT has been the most common factory trawler; it is 3,170 gross tons and carries a crew of about 90 compared to the SRT's 265–335 tons and crew of 22–26. The RTM is of the same general size as the BMRT but has the advantage of a larger deck area aft for handling fish and gear. Profiles of the Soviet trawlers mentioned above are shown in Figure 3.

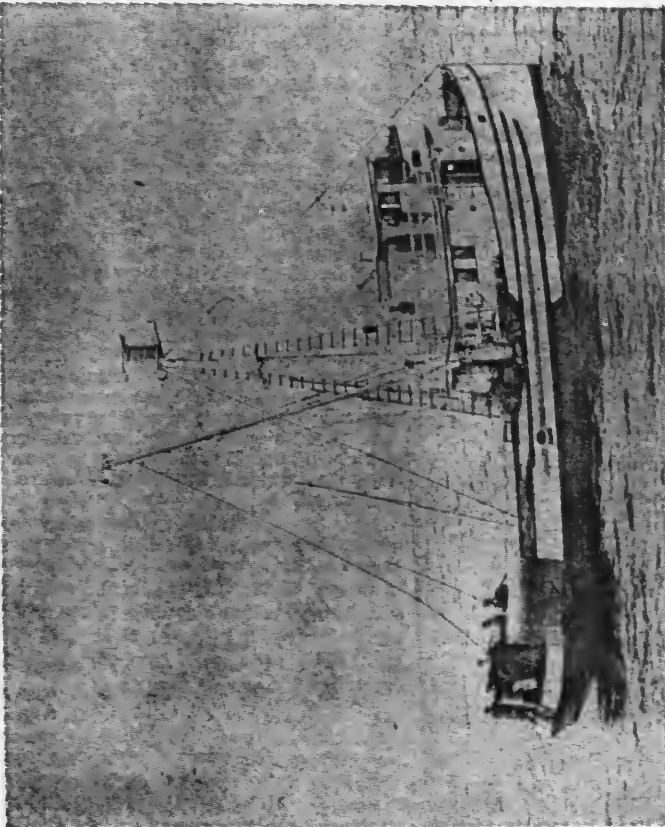


Figure 1.--Typical U. S. west coast combination vessel rigged for trawling.



Figure 2.--Typical Japanese factory stern trawler used in the northeastern Pacific Ocean.

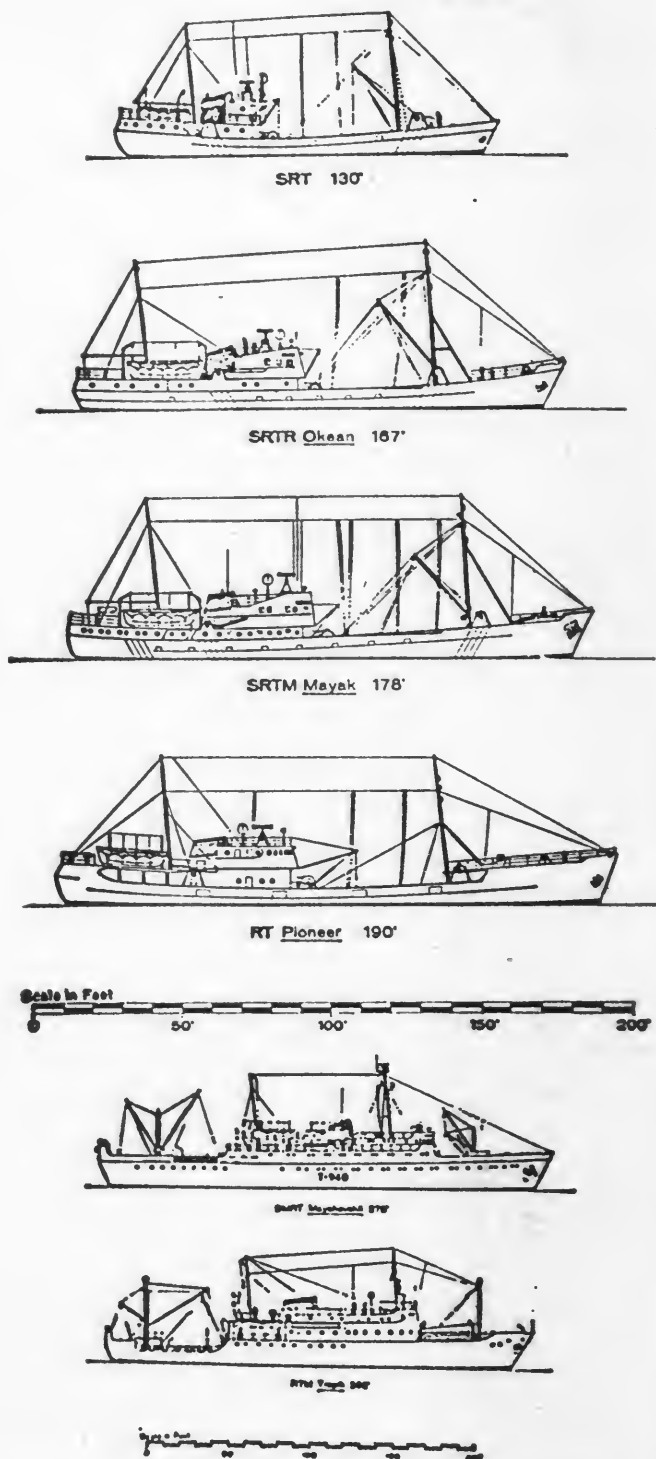


Figure 3.--Soviet vessel classes which have operated in the Washington-California trawl fishery.

Stern trawlers use nets with a variety of configurations and this gear seems to undergo frequent modification. They are always quite large with the bottom trawls having headropes at least 35 meters long and midwater trawls with headropes of at least 38 meters (Hitz, 1970). Bottom trawls have been fitted with large rollers (bobbins) along the footropes to allow operation over rough bottom. In recent years, however, the U.S.S.R. has agreed to lessen the impact on rockfish stocks by minimizing bottom trawling. Midwater trawls are aimed with the aid of net-sonde equipment, which relays information to the vessel's bridge regarding the position of the trawl relative to the seabed surface and fish concentrations.

The Soviet hake fishery is pursued under the expeditionary concept, whereby a variety of support and fishing activities are coordinated. During the peak of the season, 60 to 100 or more vessels may be involved in the fishery. In addition to fishing vessels, there usually are refrigerated transports, oil and water tankers, and personnel transports, not to mention tugs and patrol vessels. An expeditionary commander controls the activities of the fleet. Some vessels are usually deployed throughout the fishing area to scout for hake concentrations and to fish relatively small schools. The majority of the fishing vessels are usually divided among 2-3 areas where hake concentrations are greatest. As many as 30-35 BMRT's have been observed fishing in concert on large concentrations of fish.

(4) *Poland.* Poland is a rather recent participant in the hake fishery, appearing first in 1972 with an exploratory probe, then with a fleet of 8 vessels in 1974 and 13 vessels in 1975. Three fishing companies send vessels to the north-eastern Pacific Ocean, and it appears that most vessels operate independently, although organized fishing by 6-8 vessels has been observed. Trawlers are serviced by cargo vessels which resupply the fleet and accept frozen processed products for delivery to Mexican and European ports.

Most Polish fishing vessels are the relatively new (post-1970) "B-418" factory stern trawlers, built in Poland. They are 89 meters in length, 2,475 gross tons, and carry a crew of 80-98. They are equipped with mechanized filleting lines, are fully refrigerated, and have meal and oil plants. All fishing in the Washington-California area is midwater trawling with nets as long as 176 m, having a vertical mouth opening of 24 m and a horizontal opening of 75 m. Fish are located hydro-acoustically and the trawls are aimed with the aid of the latest electronic equipment.

Most of the catch is filleted except when hake are too small, in which case they are headed, eviscerated, and frozen in trays. Heads, viscera, and hake not suitable as a fresh-frozen product are delivered to shipboard meal and oil plants for reduction. The Polish hake catch in 1975 was 57,246 m.t.

(5) *Other Nations.* The German Democratic Republic (GDR) first sent a trawler to the northeastern Pacific Ocean in 1973. In subsequent years, as many as two GDR stern trawlers have been sighted off the west coast. These vessels are 82 and 86 m in length, 2,917 and 2,961 gross registered tons, and carry crews of 84. Such vessels are equipped with mechanized filleting lines and meal plants. The catch is almost entirely hake, most of which is filleted. Small hake are headed, eviscerated, and frozen in 8 kilo trays. GDR vessels appear to come and go throughout the season, spending part of the time off Mexico. Their 1974 hake catch was probably about 5,000 m.t.

Two Federal Republic of Germany factory stern trawlers appeared occasionally during 1975 and seemed to be targeting on hake. Little is known about the vessels or their catch.

In 1976, three Bulgarian stern trawlers were observed fishing for hake off northern California. These are also factory stern trawlers, but little else is known about the vessels, their operation, or catches.

D. IMPACT ON UNITED STATES FISHERIES

There have been a variety of impacts on U.S. fisheries due to the presence of the large foreign trawl fleet off Washington, Oregon, and California: preemption of fishing grounds; reduction in abundance of species of current or potential interest to the U.S. industry; and interference with or destruction of fixed gear deployed by U.S. sablefish fishermen.

The major impact on stocks of fish of past and current interest to U.S. fishermen has been confined mainly to Pacific ocean perch. U.S. perch catches from the area off Washington and Oregon averaged about 1,192 m.t. during 1956-60. Catches increased steadily after 1960 and reached a peak of 6,116 m.t. in 1965. U.S.S.R. and Japanese vessels arrived in large numbers in 1966 and in two years (1966-67) caught some 25,000 m.t. of perch. U.S. perch catches immediately plummeted, reaching a low of only 272 m.t. in 1969.

The U.S.S.R. has agreed to not target on perch and to avoid known perch grounds. However, even its incidental perch catch is of such a level as to prevent the rebuilding of stocks. In this instance, the foreign trawl fishery has nearly eliminated a relatively small but, to Northwest fishermen, important fishery.

The Pacific hake is of potential interest to U.S. fishermen in that it has been a large resource which could be harvested for both domestic and foreign markets. Recent studies and changes in foreign fishing strategies suggest that there has also been a substantial reduction in the size of that resource. Such evidence has cooled the optimism of U.S. entrepreneurs, processors, and fishermen. For the present, any U.S. desire to enter the hake fishery in a major way may have been pre-empted by the foreign presence.

Pre-emption of fishing grounds did occur during 1966-67 when the U.S.

mounted a small hake fishery to provide raw material for a fish meal plant and a pilot fish protein concentrate (FPC) facility. Short range U.S. vessels were forced to fish near processing plants on the south Washington coast where the Soviet fleet was concentrated. On several occasions, U.S. fishermen reported Soviet interference with their trawling operations. Later, in 1967, U.S. fishermen had difficulty locating the concentrations of hake observed in previous years and suggested that the very intensive Soviet trawling activity in the area had fragmented hake schools, resulting in a large number of small schools scattered over a wide area. This conflict was short lived as the U.S. offshore hake fishery was discontinued after 1967, when government subsidies terminated, fish meal prices became unfavorable, and the FPC production studies were drawing to a close. Similar physical pre-emptions have been regularly reported by U.S. trawlers and salmon trollers when large numbers of large trawlers appear on grounds where concentration of small domestic vessels have been operating. Rather than risk gear entanglement or collision, the smaller U.S. vessels often depart.

Gear conflicts have occurred between foreign trawls and U.S. sablefish traps and longlines. The problem became acute in the early 1970's when improving markets and new trap technology stimulated growth of the U.S. fishery. As fishermen began to adopt to a system whereby 10-15 traps are fished on a single groundline, their gear losses increased as foreign trawlers swept away entire strings of traps. An attempt was made to ease the problem by keeping foreign vessel captains apprised of fixed gear locations. Poor communications and haphazard navigation rendered that approach only partially successful. It was not until sablefish trap sanctuaries were established through recent bilateral agreements that the situation improved. U.S. sablefish fishermen fishing outside those sanctuaries continue to occasionally suffer gear loss or damage, but even there the recent reduction of on-bottom trawling by foreign vessels seems to have eased the conflict.

All of the above impacts have been induced primarily by the U.S.S.R. simply because the size of their trawling operation in the Washington-California region so overwhelms that of any other nation. The impact of the Soviet fishery on fish stocks cannot be fully evaluated due to the absence of adequate statistics from its fishery.

E. REGULATORY HISTORY AND VIOLATIONS

(1) *United States.* Trawl regulations have been imposed on the domestic fishery by states since early in the history of the West Coast trawl fishery. For about the first 60 years, regulations were set and enforced by the coastal states acting independently. However, as the industry grew, many fisheries overlapped state boundaries and were participated in by citizens of two or more states. Rational management and uniformity of regulation became a difficult problem which stimulated the formation of the Pacific

Marine Fisheries Commission in 1947. The Commission has no regulatory power but is an investigatory and research body with authority to submit specific recommendations to states for their adoption.

Early regulations took the form of area closures (i.e., San Francisco Bay closed to trawling in 1906) as concern about overfishing mounted. Minimum trawl mesh sizes were invoked in the early 1930's in California as the production of flatfish decreased. During 1935-40, voluntary mesh size limits were adopted by the trawl industry after San Francisco markets imposed minimum size limits on certain flatfishes and gear saving studies demonstrated that larger mesh sizes (5 inch) caught fewer unmarketable fish. Shortly thereafter mandatory minimum mesh sizes became necessary and such regulations have since been in effect. Presently, California and Washington impose minimum mesh sizes of 4½ and 3 inches, respectively. Oregon has no mesh size restriction except for the taking of Pacific hake when a minimum of 2½ inches is in effect. Another type of regulation currently used is area and season closure by California to protect spawning California halibut and reduce conflict with sport fishermen. Minimum fish size regulations are utilized by California to control the harvest of small California halibut (*Paralichthys californicus*) and by Oregon to prevent the harvesting of small Dover, English, and petrale sole, in addition to sturgeon (*Acipenser sp.*). Washington sets no area-seasonal closures or minimum fish sizes. Both California and Oregon require trawl vessel captains to maintain fishing log books so that appropriate statistics of the fishery can be compiled. Washington relies on sale of receipts and fisherman interviews to obtain necessary statistics.

An international research-regulatory body, the International Pacific Halibut Commission, has played a minor role in the regulations of the U.S. trawl fleet by prohibiting the taking of Pacific halibut (*Hippoglossus stenolepis*) by trawl.

(2) *Other Nations.* Foreign trawl fisheries in the Washington-California region have not been subject to extensive regulation, but some restrictions were agreed to during bilateral fishery negotiations with several nations. These agreements also provide for cooperative research, exchange of fishery statistics, control of discharge of pollutants at sea, and loading zones within the U.S. contiguous fishery zone.

The first bilateral fishery agreement affecting trawl fisheries off Washington, Oregon, and California was signed in February 1967 by the U.S. and U.S.S.R. In return for privileges to fish and/or load in specified localities within the U.S. 3-12 mile contiguous fishery zone (CFZ), the U.S.S.R. agreed to certain restrictions on their fishing operations so as to provide U.S. fishermen the opportunity to fish grounds of traditional interest and to reduce gear conflicts between the two countries. Specific fishing restrictions were the prohibition of all Soviet trawling landward of the 110 m isobath off the south Washington coast

NOTICES

to preserve an area for U.S. sport and commercial salmon fishermen and the closure of several areas off Washington and Oregon for the protection of Pacific ocean perch stocks.

Renegotiating the agreement in 1971, the U.S. for the first time granted limited port call privileges to Soviet fishing and support vessels on the Pacific Coast. In return, out of continued U.S. concern for the status of perch stocks, additional areas were closed to Soviet trawling and the U.S.S.R. agreed not to conduct a specialized fishery for rockfish south of Cape Flattery, Washington.

In 1973, the area in which there would be no specialized Soviet rockfish fishery was extended northward from 48°10'N to 50°30'N latitude. In response to the U.S. view that the Pacific hake resource was being harvested at or above its potential yield, the U.S.S.R. agreed to limit its catch to the 1971 level of 150,000 m.t. during 1973-74. Additionally, the U.S.S.R. agreed not to conduct a special-

ized fishery for flounders and soles south of 48°10'N latitude.

The most recent renegotiation was in July 1975—principal modifications or new fishing restrictions (Fig. 4) are: no Soviet trawling year-round between 48°30' N and 47°45' N latitude off Washington to protect this particularly important perch ground; no Soviet trawling year-round in waters south of 38°10' N latitude to the U.S.-Mexico border and between 40° N and 47°45' N from November 1 to April 25 to reduce the incidental rockfish catch; no Soviet trawling November 1-June 30 in areas off the Klamath and Columbia Rivers to protect the traps of U.S. sablefish fishermen; the Soviet hake catch not to exceed 150,000 m.t.; an incidental U.S.S.R. rockfish catch of no more than 2,500 m.t.; and an incidental U.S.S.R. catch of other species of no more than 3,000 m.t. The 1975 U.S.-U.S.S.R. agreement also imposes new controls on the retention of Continental Shelf Fishery Resources.

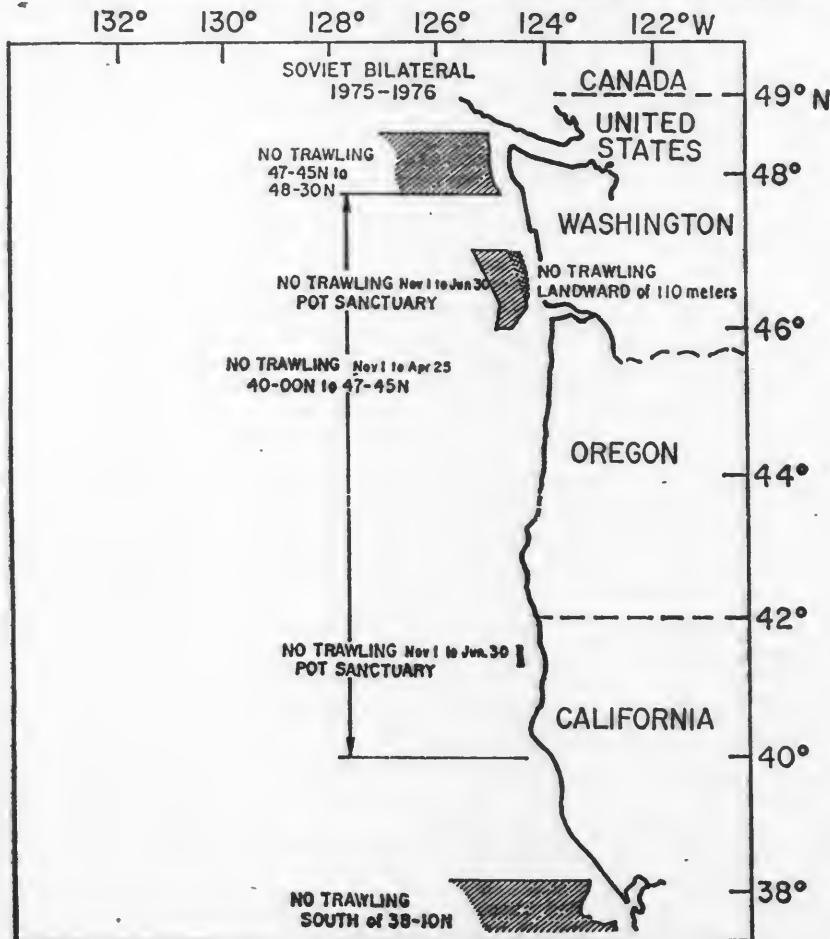


Figure 4.—Areas closed to U.S.S.R. trawling as defined in the 1975-76 US-USSR bilateral fisheries agreement.

The first U.S.-Japan bilateral fisheries agreement was signed in May 1967. This agreement related primarily to the conduct of Japanese fishing operations in the Bering Sea and Kodiak Island regions. Subsequent extensions, modifications, and renewals of the agreement have included more and more restrictions in the Washington-California region. In 1970, in exchange for a loading area off Washington, the Japanese agreed not to trawl or longline in the zone off the south Washington coast which is also closed to Soviet trawling. The most recent agreement (Dec. 1974) (Fig. 5) specified: no more than two

Japanese trawlers at any one time will fish south of 47°30' N latitude June 1-September 30; no Japanese trawling in the area off the south coast of Washington; no Japanese trawling between 48°30' N and 47°30' N latitude or south of 47°30' N latitude during October 1-May 1; the catch of rockfish from 47°30' N-50°30' N will not exceed 1,350 m.t.; 43° N-47°30' N, 200 m.t. and south of 43° N, 700 m.t.; the Japanese sablefish catch by longline south of 48°30' N will not exceed 250 m.t.; and the catch of other species from 47°30' N-43° N will not exceed 2,200 m.t. and south of 43° N, it will also not exceed 2,200 m.t.

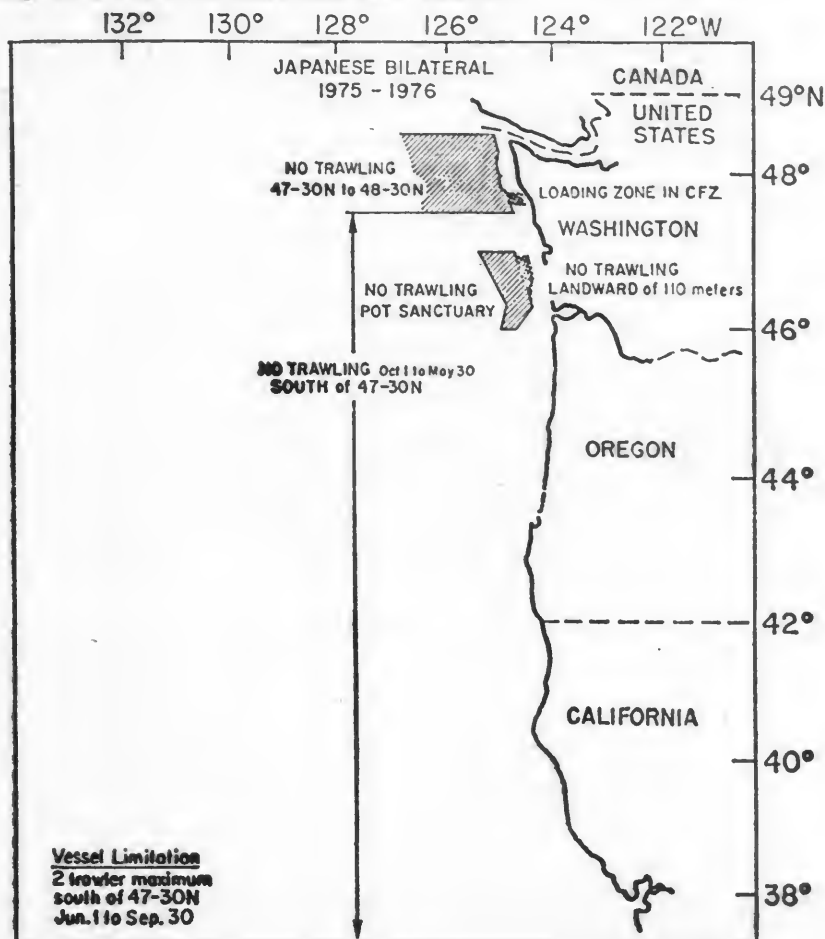


Figure 5.--Restrictions placed on Japanese trawl vessels as defined in the 1975-76 US-Japan bilateral fisheries agreement.

Poland did not enter into a bilateral fishery agreement until May 1975 and that agreement was renewed in early 1976. The main features of the agreement (Fig. 6) are: no Polish fishing for halibut and salmon and no specialized fisheries for species of special importance to the U.S. such as rockfish, sable-

fish, flounders, snails, northern anchovy (*Engraulis mordax*), Pacific (chub) mackerel (*Scomber japonicus*), and shrimp; no bottom trawling after October 1, 1975, south of 47°30' N latitude; no Polish trawling from 45°42' N to 47°30' N latitude and landward of 110 m of southern Washington (same as for

U.S.S.R. and Japan); no Polish trawling between 38°30' N latitude and the U.S.-Mexico border; no Polish trawling in the U.S. sablefish trap sanctuaries off the Columbia and Klamath Rivers; no Polish trawling from 47°30' N to 38°30' N latitude during November 1-May 31 and no fishing east of 125°40' W longitude after the hake catch reaches 26,000 m.t. or 936 vessel days are expended; and not more than seven vessels fishing

at any one time, between 47°30' N and 38°30' N latitude. These restrictions are designed to protect the hake resource, reduce the impact on rockfish and other important species, and to minimize gear conflicts. Other features of the agreement deal with protection of the living resources of the U.S. continental shelf, control of dumping pollutants at sea, cooperative research, and the exchange of research and commercial fisheries data.



Figure 6.--Restrictions placed on Polish trawl vessels as defined in the 1976 US-Poland bilateral fisheries agreement.

The trawling operations of the German Democratic Republic, the Federal Republic of Germany, and Bulgaria are not restricted because bilateral fishery agreements pertaining to fisheries of the northeastern Pacific Ocean do not exist with those nations.

Surveillance and enforcement of such a myriad of fishery agreements have been difficult and at times ineffective. Area and time closures have been the type of restriction easiest to monitor with regular air and surface patrols by U.S. Coast Guard and NMFS personnel continuously assessing the distribution and activities of foreign vessels. Such sur-

veillance is only occasionally hampered by the unavailability of aircraft and vessels or long periods of adverse weather. Verified violations of closed areas or the contiguous fishery zone have been rare, with only a single vessel (Polish) having been apprehended for intrusion into the CFZ. Reports from U.S. fishermen and others, however, indicate that many violations occur which have not been documented by enforcement officials. Most law enforcement action has come as a result of loss of U.S. sablefish trap gear due to foreign trawling or violation of agreements prohibiting the dumping of pollutants. Verified violations and gear conflicts are summarized in Table 3.²

It is much more difficult to adequately monitor foreign adherence to agreed catch levels and avoidance of non-target species. Until recently, U.S. observers have not been invited on foreign commercial vessels, so all monitoring has been through air and surface patrols and occasional boardings. Such observations can only provide gross estimates of the size of the annual catch, but do allow a limited assessment of species composition. For example, during a 2-year period (1974-75), 25 Soviet vessels were observed taking substantial rockfish catches, contrary to the U.S.-U.S.S.R. bilateral agreement. U.S. observers are now being deployed on some Soviet and Polish trawlers to more accurately determine catch size and composition.

TABLE 3.—Summary of verified violations and gear losses in the Washington-California region attributable to foreign fishing vessels, 1972-May 1976

Country	Violations of CFZ ¹	Oil pollution	U.S. gear losses	Total
U.S.S.R.	0	(?)	7	7
Poland	1	0	0	1
Japan	0	0	0	0
East Germany	0	0	0	0
West Germany	0	0	0	0
Republic of Korea	0	6	9	15
Republic of China	0	0	0	0
Bulgaria	0	0	0	0

¹ Contiguous fishery zone (3 to 12 miles from coast).
² Although some minor oil pollution by the U.S.S.R. has been observed on occasion, it has not been possible to document it for specific vessels.

F. COOPERATIVE RESEARCH AND STATISTICAL EXCHANGE

All current bilateral fishery agreements provide for cooperative research and exchange of research and fishery data.

There have been several attempts to mount cooperative surveys of the Pacific hake resource involving research vessels of the U.S. and U.S.S.R. Most attempts have failed or have been only marginally successful. Failures can be traced to poor and untimely communications between U.S. and U.S.S.R. principals, lack of understanding of the technical aspects and needs of respective research programs, and failure of the U.S.S.R. to meet commitments as scheduled. The first U.S.-U.S.S.R. cooperative hake survey was in 1969 when a portion of the population was estimated, using hydroacoustic techniques. The two countries agreed to exchange results in an effort to identify sources of variation and to develop a means of rendering the results compatible. Point estimates of stock abundance were compared and found to differ, but the Soviets failed to provide the basic data required to determine sources of variation. Another attempt was made in 1974 to evaluate and standardize U.S. and Soviet hydroacoustic systems and techniques. Late arrival of the Soviet research vessel forced abandonment of the original experimental design and adoption of a rapidly conceived alternative plan. The field work was completed in September 1974 and the results of the

U.S. analysis were forwarded to the U.S.S.R. in March 1975 as agreed. The Soviets, however, have yet to provide their results. Finally, a synoptic U.S.-U.S.S.R. survey of the hake resource was scheduled for the fall of 1975, but several last minute changes in the schedule and operation of the Soviet research vessel forced the U.S. to conduct the survey on its own.

Some measure of success has been achieved through the cooperative execution of U.S. and U.S.S.R. egg and larvae surveys. Such surveys have been conducted off California by NMFS scientists at the Southwest Fisheries Center, LaJolla, California, for a number of years and while they acknowledge problems similar to those described above, data generated through Soviet participation have been useful.

Since 1972, the U.S.S.R. has participated in a cooperative sablefish tagging program coordinated by NMFS. Soviet scientists have tagged and released several thousand sablefish, which has contributed substantially to the success of the program.

The Republic of Korea has participated only in the cooperative sablefish tagging program. The ROK entered the program in 1973 but has tagged only about 160 fish.

While the possibilities of cooperative study have been discussed and encouraged with Poland, there are presently no active programs.

There are no cooperative programs and none scheduled with Japan, Bulgaria, the German Democratic Republic, or the Federal Republic of Germany.

Fishery statistics have been received from the U.S.S.R. since 1967 but in such gross units and of such questionable accuracy as to be of limited usefulness; some improvement in format has been noted in recent submissions. East and West Germany, Bulgaria, and the Republic of Korea have reported no useful fishery statistics to date.

Japan and Poland have provided by far the most detailed fishery statistics for the region but, because of the small scale of their operations, their data have been only of limited use.

Limited biological data, of little practical value, have been exchanged between the U.S. and U.S.S.R. and the U.S. and Poland. Consequently, it has been mutually agreed that future collections and exchanges will occur only when specific data needs are identified.

3.0 STATUS OF STOCKS

A. GENERAL DISTRIBUTION AND ABUNDANCE

The species of traditional importance to the area's trawl fisheries are listed in Table 2; their relative abundance can be inferred from the magnitude of recent catches. With the exception of a small Polish catch of jack mackerel (*Trachurus symmetricus*) and the very recent ROK longline and pot fishery for sablefish, the foreign fisheries have, since 1968, generally targeted exclusively on Pacific hake. Catches of other species in the aggregate have, reportedly, been less than 20 percent of the total and usually taken only as a by-catch of the hake fishery.

Even though most of the trawl species are found throughout the area, only hake and jack mackerel appear to be represented by single stocks. Both spawn offshore of Baja, California and southern California, the hake during winter and the jack mackerel during spring. In the summer the adults range from Baja, California to off British Columbia, with hake found generally over the Shelf and jack mackerel well beyond the Shelf. The other species are believed to be distributed in more or less discrete and localized stocks along the coast with varying amounts of interchange between them. Sablefish individuals are known on occasion to travel long distances (>1,000 miles); most, apparently, do not.

Pacific ocean perch are found in commercial concentrations only north of southern Oregon. As a group, "other rockfish" (i.e., other than Pacific ocean perch) are found throughout the area, but species composition varies greatly with latitude, depth, and hydrography.

B. CURRENT STATUS

Because of the multi-species nature of the U.S. fisheries, the different priorities established by the three State fishery agencies for assessing the various stocks off their respective coasts, and the relatively small scale of the domestic fisheries, coastwide estimates of MSY for many species have not been made. With the exception of hake, Pacific ocean perch, petrale sole, and—very recently—sablefish, most species are believed to be in generally healthy condition and are probably being exploited at a level somewhat under MSY. Some stocks on some

grounds may be overfished; others may be substantially underutilized.

Specific comments concerning the major groundfish resources of the area follow.

(1) *Pacific Hake*. Soviet and U.S. estimates of MSY, based on a variety of survey results and population analyses in the late 1960's and early 1970's, ranged from 120,000 to 270,000 mt (National Marine Fisheries Service, 1966, 1968, 1974). The research upon which these estimates were made was conducted during the period that the exceptionally strong 1961 year class was abundant by the time they were recruited to the adult segment of the population (Dark, 1975). Catches of record during the 10-year history of the fishery have varied between 104,000 and 226,000 mt; they were over 200,000 mt in 1974 and 1975, and quotas which apply to 1976 would allow a third consecutive annual catch of 200,000+ mt. Although a large amount of fishery, biological and surveillance data which bear on the condition of the hake resource are available, none of the data sets are complete. Nonetheless, the aggregate of information that is available leaves little doubt that the hake population is at the lowest level of abundance of record:

(a) Reported Soviet fishery statistics are inadequate for standard CPUE analyses. On the basis of U.S. surveillance information, however, tonnage of the Soviet hake fleet has increased 64 percent from 1966-75 and reported hake catch/observed gross registered tonnage has decreased from a peak of 1.45 in 1970 to 0.59 in 1975 (Table 4).

TABLE 4.—Soviet hake fleet tonnage versus reported hake production

Year	Number of side trawlers	Number of stern trawlers	Total gross registered tonnage (in thousands)	Reported hake catch (in thousands of metric tons)	Catch (gross registered tonnage)
1966	171	39	160	128	0.80
1967	126	48	(?)	206	(?)
1968	38	56	170	104	.61
1969	18	44	127	162	1.28
1970	8	55	156	226	1.45
1971	6	64	183	152	.83
1972	5	41	122	117	.96
1973	20	62	178	153	.86
1974	0	94	254	150	.63
1975	0	97	262	154	.59

(b) After 7 years (1966-72) of intense Soviet fishing (annual hake catches ranging from 104,000 to 226,000 mt), Polish vessels entered the fishery in 1973. From 1973-75, combined Soviet and Polish effort (in terms of vessel-days on the grounds as determined from U.S. surveillance operations) increased 78 percent, but reported catch increased only 26 percent (effort trends for last 3 years of record are shown in Table 5).

(c) Both NMFS and Soviet surveys have shown that: (a) juvenile hake (ages 1-4) concentrate off California year round; (b) adult hake are on their offshore spawning grounds from December through April and unavailable to the trawl fishery on the Continental Shelf; (c) most adult hake migrate northward to off Oregon, Washington, and British Columbia where they are available on the Continental Shelf from June to

October; and (d) from 1967-72, 93 percent of the Soviet catch was from north of California (Alverson and Larkins, 1969; Nelson and Larkins, 1970). Since 1972, however, the foreign fisheries have shifted southward and to the spring months (Table 5), suggesting a heavier reliance on juvenile hake. This implication is supported by NMFS law enforcement agents who have boarded Soviet vessels early in the season and report seeing large proportions of juvenile hake in the catches and changes in processing from filleting large fish to freezing small fish in the round.

(d) Hydroacoustic surveys by NMFS have, in recent years, shown a sharp reduction in both the number and areal distribution of hake schools in the northern California-British Columbia area where adult fish were normally concentrated in earlier years (Dark and Nelson, 1976).

TABLE 5.—Soviet and Polish hake fishing effort¹

Year	Country	Effort (vessel days on grounds)			Total	Percent of effort prior to June
		California	Oregon	Washington		
1973	U.S.S.R.	427	5,081	336	5,844	14
	Poland	0	24	26	50	0
	Total	427	5,105	362	5,894	14
1974	U.S.S.R.	4,314	2,611	79	7,004	35
	Poland	77	636	0	713	0
	Total	4,391	3,247	79	7,717	32
1975	U.S.S.R.	5,465	3,400	2	8,867	53
	Poland	1,210	362	6	1,754	42
	Total	6,675	3,762	8	10,621	51

¹ From U.S. surveillance records.

(e) Standardized larvae surveys encompassing the hake spawning grounds have shown, in recent years, a severe contraction in the spawning area—in early 1976 there was an alarmingly low abundance and restricted distribution of larvae (only 6 percent of the occupied stations had hake larvae whereas, in earlier years, more than 70 percent of the same stations contained larvae) (Smith, 1976). What this portends for the future is unknown—it does, however, indicate a sharply reduced abundance of adult hake currently in the population.

Regardless of whether the reduction in hake abundance has been primarily caused by overfishing, by natural conditions which have adversely affected recruitment or survival, or by a combination of these two factors, the hake resource in its present condition cannot sustain catches in excess of 200,000 mt—the annual total removals in the last 3 years of record. All evidence suggests that the resource is at the lowest recorded level of abundance with no reliable indications of any improvement in the deterioration of the population. Under these conditions, severe conservation action is required, one aspect of which is to reduce removals substantially below that of recent years.

(2) *Pacific Ocean Perch*. There has been a consensus among international fishery scientists that stocks of this species were depleted by the Soviet and Japanese fisheries in the mid- and late 1960's and that they remain at critically low levels (National Marine Fisheries Service, 1974). Because of the longevity (greater than 30 years of age) inherent in this species and their slow growth rate, stock recovery would—under the best of conditions—be a long process. A population dynamics analysis (Gundersen, et al. 1976) indicates that the equilibrium yield of the perch population—in its current condition—is approximately 1,500 to 2,500 m.t., whereas this population in a healthy condition would have the potential of sustaining an annual catch of 5,000 to 6,000 m.t. Recent U.S. catches of this species have been less than 1,000 tons. Even though the primary foreign nations fishing in the area have agreed not to fish purposely for any of the rockfish species, a significant catch is taken incidental to the hake fishery. The portion of that inci-

dental rockfish catch, which is Pacific ocean perch, appears to be large enough to prevent stock rehabilitation.

(3) *Rockfishes (other than Pacific ocean perch)*. The information base for assessing the condition of the various stocks and species which make up this complex is poor. The species composition of the U.S. and foreign catch of "other rockfish" is not precisely known and the relative abundance and potential yield of each of the various stocks and species cannot be individually estimated. On certain important trawl grounds there is evidence that relatively small increases in catch are followed immediately by significant declines in catch per unit of effort of U.S. trawlers (Baxter 1976; DiDonato 1976). There is also reason to believe that because of mixing of species on the trawl grounds MSY's for each individual species can never be achieved because as the production of one stock is maximized it may result in an overexploitation of another stock which occupies the same grounds. Conversely, if the production from one stock is kept to that level that would produce its MSY, other stocks on the same grounds might have to be substantially underexploited.

(4) *Dover Sole*. Total United States-Canadian landings of this species from the northeastern Pacific in 1975 were 14,000 m.t., an all-time high. Of this total, 90 percent was taken in the Washington-California region.

Resource assessment surveys by the State of Oregon during 1971-75 indicate an exploitable biomass off Washington and Oregon of about 40,000 m.t. Catch from off California divided by presumed exploitation rate provides an estimate of exploitable biomass there of about 80,000 m.t. Therefore, standing stock of commercial-sized Dover sole for the entire region is in the order of 120,000 m.t. (Loeffel 1976).

Analyses of catch curves and exploitation rates indicate that natural mortality (M) is 0.16 off Oregon, and is presumed to be about the same off California; off Washington, M is estimated to be 0.28.

If production can be maximized when $F=M$ (Tiurin 1962), when $M=0.16$ (that estimated for the portion of the population off Oregon and California where the bulk of the resource occurs), a first ap-

proximation of MSY is 19,000m.t. (120,000 m.t. \times 0.16).

The Dover sole resource is considered to be in good condition inasmuch as past production has been below MSY and recruitment appears to have remained within the normal range.

(5) *Other Flounders*. This complex includes English, rock, petrale, and rex soles, starry flounder, and arrowtooth flounder. The 1975 U.S. catch of these species, in the aggregate, was 10,800 m.t. in the Washington-California region.

Exploitable biomass of this complex, determined as for Dover sole above, is about 126,000 m.t. (Loeffel 1976). Catch rate and population dynamic analyses—of varying degrees of completeness and precision among species—indicate that all stocks but those of petrale sole are healthy and many could sustain significant increases in yield; petrale sole have been slightly overfished in the past and stocks remain in a somewhat depressed state. For the complex as a whole, an exploitation rate of 0.12 is believed appropriate (taking into account species differences in natural mortality, growth, and recruitment), resulting in a potential yield of about 15,000 m.t. (126,000 m.t. \times 0.12).

Most of the potential for increased harvest exists within 12 miles of the coast. Beyond 12 miles, the only species with substantial potential for increased production is arrowtooth flounder, a species often found in close association with Dover sole (fully utilized by U.S. fishermen; see preceding section) and rex sole (heavily, although not fully utilized by U.S. fishermen). Therefore, it is unlikely that a fishery for this species can be developed without adversely affecting existing Dover sole and rex sole fisheries.

(6) *Sablefish (see Separate Preliminary Management Plan for the Sablefish Fishery)*. On the basis of domestic and foreign fishery CPUE trends and a population dynamics analysis, MSY for the Washington-California region is estimated to be 5,000 to 7,000 m.t. (Low 1976). There may be a deepwater component of the sablefish population off California that could provide additional sustained production (Isaacs, et al. 1975), but its status is neither documented nor is its relation to the remainder of the population understood.

The domestic market for this species has expanded recently which coupled with the continuing development of an efficient pot fishing technique, has resulted in substantial increases in U.S. production over the past three years.

The reported U.S. catch of sablefish in 1974 was 6,444 m.t.; the preliminary figure for 1975 is close to 8,000 m.t. Reported foreign trawl catches have been small (~250 m.t.) and the Japanese longline catch is restricted by the current bilateral agreement to 250 m.t. The ROK longline and pot fishery, which began on a very small scale in late 1974, grew quickly in 1975 to an estimated production of 3,000 m.t. and is even more of a factor in 1976 (estimated catch through

April of 2,300 m.t. with continuing effort which will produce additional 450 m.t./month).

(7) *Jack Mackerel*. The jack mackerel population(s) may extend as far offshore as 800 to 1,200 miles, as far north as the Gulf of Alaska and as far south as Cape San Lucas. The spawning biomass of jack mackerel in the early 1960's was estimated to be 1.3 to 2.2 million m.t. in (the California Cooperative Oceanic Fisheries Investigation survey region and 2.1 to 4.8 million short tons in the eastern Pacific (Ahlstrom 1968). California Department of Fish and Game estimated that 0.6 to 1.4 million m.t. were available to the U.S. fishery in 1972. The offshore portion of the stock is apparently less densely schooled and consists of older fishes. Like many fishery resources, the jack mackerel exhibit wide fluctuations in year class strength.

Most of the Mexican and U.S. commercial catches are taken between Point Conception, California and Cape Colnett, Baja California. Although most are caught within 50 miles of the mainland, a significant amount is harvested near islands and banks up to 100 miles offshore. This fishery relies primarily on juvenile and young adult fish. Combined U.S. and Mexican catches for 1970-1973 average about 23,000 m.t., although more recent U.S. catches are now less because of destruction by fire of the major U.S. processing plant. California landings were 11,500 and 16,700 m.t. in 1974 and 1975, respectively. There is some indication that the availability of jack mackerel in the near shore fishing grounds has become less.

Jack mackerel is not a target species for the California recreational fisheries. The species is caught throughout the year by the local southern California purse seine fleet. It is a valuable alternative fishery to northern anchovy, Pacific bonito (*Sarda chiliensis*), bluefin tuna (*Thunnus thynnus*), and squid. Pacific mackerel (*Scomber japonicus*), a species presently protected by a State of California fishing moratorium law, is taken incidentally in the purse seine fishery for jack mackerel. At current

population levels, this incidental catch is about one percent of the jack mackerel catch. Jack mackerel is canned and also used in the pet food industry.

Except for Mexico and the U.S., the jack mackerel population(s) north of the U.S.-Mexico border is apparently targeted on only by Poland which reported a 1975 catch of approximately 4,000 m.t. in the region. Provisional statistics for 1976 show the Polish catch of this species to be only 785 m.t. Jack mackerel catches by Soviet and Japanese trawlers have, according to limited observer data, been less than one percent of the total.

The potential yield from the jack mackerel population(s) has been estimated to be between 191,000 to 408,000 m.t. (MacCall, Stauffer, and Troadec, 1976). Catch and age data show that the stock undergoes wide fluctuations in year class strength; therefore, a constant value for MSY does not apply. Considering the large size of the entire standing stock, the inshore segment of the population appears to respond inordinantly to very low levels of fishing mortality. Little is known about the impact of exploitation on the offshore portion of the stock.

(8) *Other Species*. This category includes Pacific cod, lingcod, grenadiers (*Coryphaenoides* sp.), sharks, skates, and sculpins. The first two are very important to U.S. fishermen even though they are relatively small in this region—they are probably being harvested near or at MSY levels. The other species are of unknown abundance and condition and are not known to be a target of or of particular interest to either the domestic or foreign fisheries.

4.0 TOTAL ALLOWABLE LEVEL OF FOREIGN FISHING

A. OPTIMUM YIELD

The concept of optimum yield incorporates consideration of a broad range of socio-economic factors relating to impacted fisheries, as well as the biological characteristics of the exploited stocks. In the time and with the data available, it has not been possible to make other than a cursory evaluation of socio-economic

factors; hence for the purpose of this Preliminary Management Plan optimum yields are considered as equivalent to total allowable catches (TAC's). These figures have been determined on the basis of biological information concerning the characteristics of exploited resources, with certain adjustments to accommodate for the quality of the data base. Although regulations in this Preliminary Plan deal only with the activities of foreign vessels, the reduction in fishing levels implied by the TAC's in this Plan should result in improved stock conditions and, therefore, improve the economic viability of the U.S. fishery. Further adjustments of TAC's to attain optimality are anticipated in succeeding iterations of the management plan.

B. TOTAL ALLOWABLE CATCH

Pertinent information concerning stock condition, sustainable yields under current conditions, U.S. capacity, and the surplus available for foreign use is summarized in Table 6, following.

Rationales for differences, when they occur, between Maximum Sustainable Yield (or Equilibrium Yield) and Total Allowable Catch are as follows:

(1) *Pacific Hake*. Because of the evidence that stock abundance is declining, the total hake catch will be reduced to no more than 150,000 metric tons (the low end of the estimated range of MSY), and the juvenile segment of the population, which represents future spawning potential and recruitment to the adult segment of the population, will be protected from exploitation by appropriate time-area closures. Furthermore, if in early 1977 the abundance of hake larvae remains as low and the distribution of those larvae remain as confined as they were in early 1976, the total catch in 1977 will, on an emergency basis, be adjusted even further downward.

There has recently been expressed an interest by U.S. processors for developing a domestic hake fishery with an initial production of 12-15 million pounds (5,400 to 6,800 m.t.). Accordingly, this amount of the TAC will be allocated to the U.S. in 1977.

TABLE 6.—Total allowable level of foreign fishing in the Washington-California trawl fishery (metric tons)

Species	Data base	1974 U.S. catch	1974 foreign catch	Estimated MSY	Estimated EY	Status	1977 TAC	Expected U.S. catch	Total allowable level of foreign fishing
Pacific hake ¹	Fair	(?)	214,000	150,000-250,000	150,000	Current abundance lower than past years of record.	150,000	6,800	143,200. ¹
Pacific Ocean perch	Good	600	11,500	5,000-6,000	1,500-2,500	Depleted in 1966-68; no sign of recovery.	<1,000	<1,000	Incidental catch only, not to exceed 1.3 pct of hake catch.
Other rockfishes	Poor	9,600		>18,000		Complex probably underutilized, certain stocks may be fully or overutilized.	18,000	18,000	
Flounders	Fair-good	22,400	(?)	30,000-35,000		Healthy; slightly underutilized in biological sense but near optimum economic yield to U.S. fishermen.	31,000	31,000	Incidental catch only, not to exceed 0.1 pct of hake catch.
Sablefish	Fair	6,444	600	5,000-7,000		Appears fully utilized except for unknown deepwater component. 1975-76 Republic of Korea fishery plus growing U.S. fishery probably exceeded MSY by 3,000 t.	7,000	7,000	Incidental catch only, not to exceed 0.2 pct of hake catch. See separate management plan for the sablefish setline and trap fishery.
Jack mackerel	Poor	11,500	(?)	210,000-450,000		Although underutilized population appears unstable and seems to respond inordinately to low levels of fishing.	55,000	51,000	4,000—from north of 39° N. only.
Others	Poor-excellent	3,300	12,000	(?)	(?)	Small stocks which generally are moderately to heavily used by U.S. fishermen.	4,200	4,200	Incidental catch only, not to exceed 0.5 pct of hake catch.

¹ Includes that portion of resource and fishery which occurs off British Columbia.

² Trace.

³ If provisional indications of extremely low abundance of adults in 1976 are confirmed in 1977 TAC will be reduced to no more than 100,000 t.

⁴ Mexican catch unknown.

⁵ Not applicable.

(2) *Rockfishes*. If Pacific Ocean perch stocks are to be brought back to the level of abundance that will provide MSY, the total catch must be kept substantially below the current yield for a period of perhaps 8 to 15 years. Assuming that U.S. fishermen will continue to take less than 1,000 m.t. the foreign catch will have to be held near zero for rebuilding to begin to occur.

Taking into account the importance of the "other rockfish" complex to U.S. fishermen, the fact that it is made up of many small stocks and several species, the observation that at least in certain areas increases in catch result in reduced catch rates, the slow growth and low reproductive potential associated with this family which implies that stocks can sustain only a low level of fishing mortality, and the lack of evidence that shows that substantial increases in total catch can be sustained—the total allowable catch of this complex will not be increased until fishery performance indicates that a higher production level can be sustained. Accordingly, no surplus of rockfish (including Pacific ocean perch) is available for foreign fishermen, although an incidental catch, not to exceed 1.3 percent of the hake catch, will be allowed. Observed catches by Soviet and Polish trawlers in 1976 contained an average incidental rockfish component (including Pacific ocean perch) equal to 1.07 percent of the hake catch.

(3) *Flounders*. Considering the healthy condition of the Dover sole population, total allowable catch will be set at 17,000 m.t., allowing an increase in catch of 3,500 m.t. from 1975. Increasing domestic market demands indicate that the U.S. trawl fleet will be fully capable of harvesting the TAC; accordingly, no surplus is available for foreign fishermen.

Total allowable catch of the "other flounder" complex will be held at the

level of 1975—12,000 m.t.—all of which is expected to be taken by the domestic trawl fleet. Accordingly, as with Dover sole, no surplus is available for foreign fishermen although an incidental catch of all flatfishes combined, not to exceed 0.1 percent of the hake catch, will be allowed. (Observed catches by Soviet and Polish trawlers in 1976 contained an average incidental flatfish component equal to 0.01 percent of the hake catch.)

(4) *Sablefish*. Inasmuch as the current U.S. catch is of itself somewhat in excess of MSY, there is no surplus of sablefish available for foreign fishermen; only an incidental catch, not to exceed 0.2 percent of the hake catch, will be permitted in the foreign trawl fishery. (Observed catches by Soviet and Polish trawlers in 1976 contained an average incidental sablefish component of 0.12 percent of the hake catch.)

(5) *Jack Mackerel*. The jack mackerel resource is believed to be very large and, on the whole, underexploited. Estimates of biomass, however, are not current and little is known of the population or stock structure. Abundance of the inshore segment of the resource fished by the domestic purse seine fleet appears to fluctuate and there are indications that this fishery has had a significant impact on that part of the resource available to it. Therefore, increases in catch of this species will be made in a controlled manner until fishery performance and other indicators of stock conditions indicate that higher yields can be sustained without adverse effect on the domestic, inshore fishery. Accordingly, the TAC for 1977 is set at 55,000 m.t., about twice the production of the last year of record. The U.S. catch in 1977 is projected to be in the order of 51,000 m.t. (several new processing facilities account for this increase), all to be taken south of 39° N latitude. This results in a total of 4,000 m.t. can be made available to foreign fishermen, equal to the highest foreign

catch of record. All of this amount is to be taken north of 39° N latitude (from where it came in the past) so that: (1) competition for fish schools and grounds between large foreign trawlers and small U.S. purse seiners is avoided; and (2) fishery information pertaining to the northern and offshore segment of the resource is obtained for assessment of stock interrelationships and the condition of that segment of the resource.

(6) *Other Species*. Because it is impossible to manage each of the components of the "other species" category separately, and knowing that at least some of the included stocks are small and locally distributed, only a small incidental catch, not to exceed 0.5 percent of the hake catch, will be allowed in the foreign trawl fishery. (Observed Soviet and Polish trawl catches in 1976 contained an average incidental "other species" component of 0.46 percent to the hake catch.)

5.0 REGULATIONS PERTAINING TO FOREIGN FISHING

Considering the conditions of the various stocks, the TAC's in relation to U.S. harvesting capacity, and U.S. fishing activity in the area, the foreign trawl fisheries over the Continental Shelf will be confined primarily to hake and jack mackerel.

All foreign vessels operating in this Management Unit must obtain a permit from the Secretary of Commerce.

A. REGION-WIDE RESTRICTIONS ON FOREIGN FISHING

1. In areas over the Continental Shelf where foreign trawling is permitted, fishing will be directed only to Pacific hake and jack mackerel (to protect other species which are generally under full or optimum utilization by the U.S. fisheries).†

2. Foreign fishing by pelagic trawl only (to prevent catch of flounders and other bottomfish important to U.S. fisheries).*

3. No retention of salmon, Pacific halibut, or Continental Shelf Fishery Resources taken in trawls (to prevent covert targeting on species of special importance to U.S. fishermen).*

4. Minimum mesh size for trawls used landward of 125°40' W longitude will be 4.33 inches (110mm), stretched measure; and no liners will be permitted in the cod end of the trawl (to prevent catch of Pacific herring (*Clupea harengus pallasii*), juvenile Pacific hake and rockfish).*

5. No foreign fishing within 12 miles of the base line used to measure the Territorial Sea (to prevent conflict with U.S. recreational fishermen and crab pots, to prevent catch of inshore species important to U.S. recreational and commercial fishermen).*

* Identical to current bilateral arrangements.

† Similar to current bilateral arrangements but somewhat more restrictive.

‡ New restriction.

B. TIME-AREA CLOSURES

1. 47°30' N to U.S.-Canada boundary—closed year round to all foreign fishing except Canadian* (to prevent high incidental catch of rockfish, to prevent foreign preemption of and gear conflicts on traditionally important U.S. trawl grounds).*

2. U.S.-Mexico boundary to 39° N—closed year round to all foreign fishing (to prevent high incidental catch of rockfish, to prevent exploitation of juvenile Pacific hake, to separate foreign jack mackerel trawl fishery from domestic purse seine fishery for anchovy and jack mackerel).**

3. 39° N to 47°30' N, landward of 125°40' W—closed November 1 to May 31 to all foreign fishing (to prevent fishing for juvenile Pacific hake and for species other than hake).*

4. "Columbia River Pot and Recreational Fishery Sanctuary" (Appendix A) closed year round to all foreign fishing (to prevent conflict with U.S. sablefish pot gear and with concentrations of small recreational boats).†

5. "Klamath River Pot Sanctuary" (Appendix A) closed year round to all foreign fishing (to prevent conflict with U.S. sablefish pot gear).*

6. 39° N to 47°30' N landward of 125°40' W closed to foreign trawling by fishermen of a nation for the remainder of the calendar year when either that nation's allocation of any species or species group authorized for this Management Unit, or its vessel-day limitation is exceeded. (The intent of this provision is to discourage foreign fishermen from targeting on depleted species/stocks and to prevent any further by-catches after the allotted catch has been taken. This provision places the burden of responsibility on the foreign fleets to avoid targeting on such species/stocks and to develop fishing gear and fishing practices which will minimize or eliminate their incidental capture).‡

C. FOREIGN EFFORT LIMITATIONS IN VESSEL-DAYS IN THE GROUNDS (TO ASSURE COMPLIANCE WITH CATCH QUOTAS) †

1. Landward of 125°40' W.—a. U.S.S.R.—Soviet hake quota—14 m.t./vessel-day on the grounds (based on observed Soviet catch rates in 1976).

b. All others—Hake quota—46 m.t./vessel-day on the grounds (based on observed Polish catch rates in 1976; information obtained during courtesy boardings of vessels from other countries, excluding Japan, indicated that catch rates were generally similar to those of Polish vessels).

2. Seaward of 125°40' W.—None, unless effort builds to point where catch limitations could be exceeded.

D. STATISTICAL REPORTS

(1) Annual. Each nation whose fishermen operate in the Area shall report* by May 30 of the following year annual catch and effort statistics, as follows: Effort in hours trawled, by vessel class,

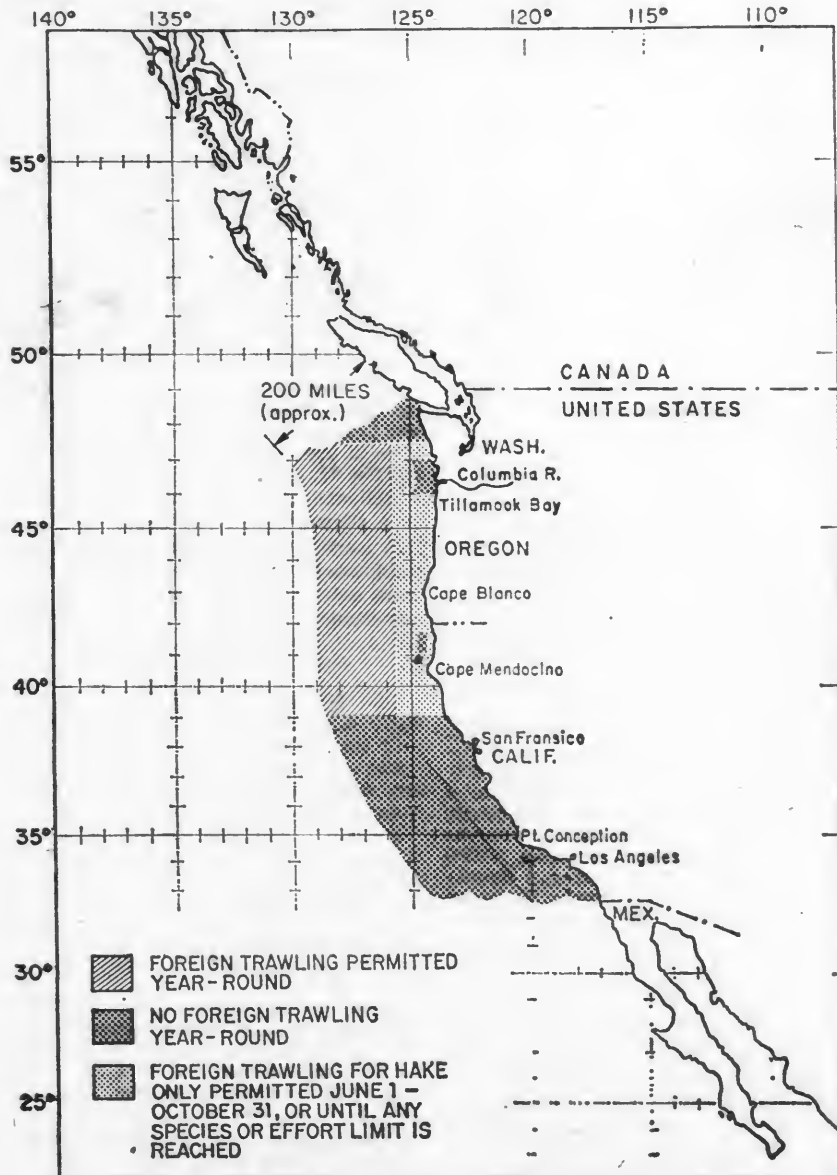


Figure 7.—Time-area closures pertaining to foreign trawl fishing in the Washington-California Region.

by gear type, by month, by $\frac{1}{2}^\circ$ (Lat.) \times 1° (Long.) statistical area; Catch in metric tons, by vessel class, by gear type, by month, by $\frac{1}{2}^\circ$ (Lat.) \times 1° (Long.) statistical area, by the following species groupings:

Pacific hake, Jack mackerel, Pacific ocean perch, other rockfishes, sablefish, Dover sole, other flounders, anchovies, herring, any other species taken in excess of 1,000 m.t., other fishes.

(2) Monthly. In addition to the annual statistical report in 1., above, each nation will report* by the end of the following month, provisional monthly fishery information as follows: Effort in vessel-days on the grounds (by vessel-class and gear type); and Catch in metric tons of Pacific hake, jack mackerel, rockfishes, flounders, and others, for each of the following areas: (Figure 8): Conception, Monterey, Eureka, Columbia, Vancouver (including that portion off Canada).

to foreign fishermen, and regulations pertaining to foreign fishermen) have been designed to be consistent with the seven national standards listed in P.O. 94-265.

TAC's are entirely for the purpose of preventing overfishing (Standard No. 1), are based upon the best scientific evidence available (Standard No. 2), and apply to the extent possible to individual stocks or stock complexes throughout their range (Standard No. 3).

Inasmuch as this document deals solely with foreign fisheries, that provision of the legislation concerning non-discrimination among residents of States (Standard No. 4) does not apply.

Those regulations which isolate the foreign Pacific hake fisheries from fisheries for other species (2.4.1; 2.4.2) will promote efficiency in resource utilization out procedures (2.4.5), and observers trials for gear conflict, incidental catch of non-target species, and exploitation of juvenile fish which have not reached the size where cohort production is maximized.

The conversions of catch quota to effort limitation (2.4.3) will allow for the termination of a fishery prior to quota completion in the event of an unforeseen reduction in abundance; monthly catch reports (2.4.4), check-in/check-out procedures (2.4.5), and observers monitoring fishery performance (2.4.6) will permit the timely detection of anomalies in the catch or the fishery (Standard No. 6).

Reliance upon easily monitored time-area closures (2.4.1; 2.4.2) and upon effort as well as catch limits (2.4.3), will minimize that surveillance and enforcement activity required to assure foreign compliance to this Plan (Standard No. 7).

7.0 REFERENCES.

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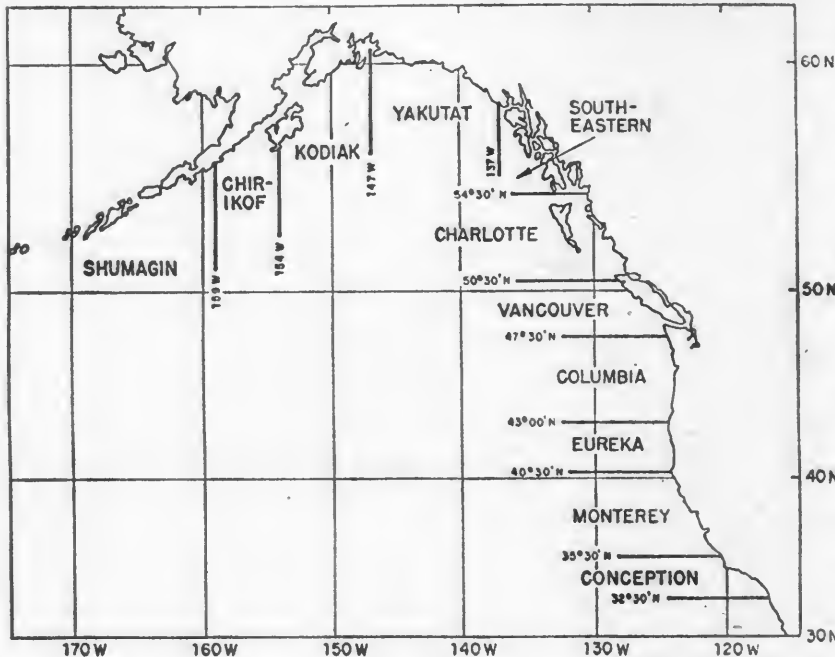


Figure 8. Area divisions of the Northeast Pacific region.

E. FLEET DISPOSITION REPORTS

The appropriate fleet commander or individual vessel master will report* by radio prior to the commencement of fishing the arrival in the area covered by this Plan of each fishing and processing vessel, giving the vessel's name and other identifying marks (such as U.S. Permit No.), size, and intended target species. A similar report* will be made at the time of departure of each vessel from the area. These reports, augmented with U.S. surveillance observations, observer reports, and monthly catch and effort reports, will be used to monitor adherence to effort limitations.

F. OBSERVERS

All vessels of each nation operating in the area will have available at no cost to the U.S., accommodation for one U.S. observer. Observers will be assigned to individual vessels and for periods at the discretion of the U.S. to measure daily catch rates; estimate species, size, and age composition; collect other biological data as appropriate; determine location and duration of hauls; and, observe gear dimensions and performance.

All observer programs pertaining to foreign trawl fisheries will be administered by the Northwest and Alaska Fisheries Center, National Marine Fisheries Service. Observer coverage and activity will be scheduled in consultation with the Pacific Management Council, NMFS Southwest Fisheries Center and Southwest and Northwest Regional Offices, and the Commander, U.S. Coast Guard, Pacific Area.

G. RESEARCH

Bona fide fishery or fishery-related research (but not exploratory fishing where commercial quantities of fish are retained) by foreign governments will be encouraged. Valid results of such research will be considered by the management entity in determining total allowable catches and other management measures. Cooperative U.S.-foreign research ventures will be planned and executed when they are found to be in the best regional interest of the U.S.

6.0 RELATION TO NATIONAL STANDARDS

The prescriptive measures contained in this Preliminary Fishery Management Plan (total allowable catches, allocations

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8.0 FOOTNOTES

¹ A complete listing of violations and gear conflicts is available from the Northwest and Alaska Fisheries Center, NMFS, Seattle, Washington.

² U.S.-Mexico 23,000 m.t.; Poland 4,000 m.t.

³ As allowed by the U.S.-Canada bilateral agreement.

⁴ All references to TAC are for the entire Pacific hake population, including that portion which will be available for harvest off Canada. The total allowable level of foreign fishing off the United States coast will be 143,200 m.t. less that reserved by Canadian authorities for use by their fishermen or allocated by them to third party fishermen operating off the Canadian coast.

⁵ To the Director, Northwest Region, National Marine Fisheries Service, Seattle, Washington.

9.0 APPENDICES

APPENDIX A

1. The "Columbia River Pot and Recreational Fishery Sanctuary" is that area between 46° N and 47° N Latitude landward of straight lines connecting the following coordinates in the order listed:

North latitude:	West longitude
47°00' -----	125°20'
46°20' -----	124°40'
46°00' -----	124°55'

2. The "Klamath River Pot Sanctuary" is that area encompassed by straight lines connecting the following coordinates in the order listed:

North latitude:	West longitude
41°37' -----	124°34'
41°37' -----	124°30'
41°20' -----	124°28'
41°20' -----	124°32'
41°37' -----	124°34'

APPENDIX B

Summary

CONDITIONS AND RESTRICTIONS

Subpart E—Wash., Ore., Calif., Trawl Fishery

Definitions. (a) Unless otherwise defined herein, the terms used in this subpart will have the meanings ascribed to them. (b) The conditions and restrictions in this subpart shall apply to all species of fish and invertebrates taken by trawl gear. (c) The regulatory area for taking those species listed in (b) above is the area seaward of the States of Washington, Oregon, and California over which the United States exercises fisheries jurisdiction.

Catch quota and effort limitation. (a) The 1977 maximum catch quotas for foreign fishermen in the Washington, Oregon and California area is as follows:

Species	Catch quota (metric tons)
Hake -----	143,200 (see footnote 4 on page 82).
Pacific Ocean perch and other rockfish	Incidental catch only, not to exceed 1.3 pct. of hake catch.
Flounders -----	Incidental catch only, not to exceed 0.1 pct. of hake catch.
Sablefish -----	Incidental catch only, not to exceed 0.2 pct. of hake catch.
Jack mackerel	4,000.
Others -----	Incidental catch only, not to exceed 0.5 pct. of hake catch.

(b) Foreign effort limitations in vessel days on the grounds are as follows:

(1) Landward of 125°40' W.—Soviet: hake quota +14; Others: hake quota +46.

(2) Seaward of 125°40' W.—none at this time.

Open season. The open season for each nation's directed fishing for Pacific hake shall begin at 0001 hours on 1 June 1977 and terminate at 2400 hours on 31 October 1977, or until that nation's allocation of any species listed in 2.0 or the vessel-day limitation is reached. The open season for each nation's directed fishing for jack mackerel shall begin at 0001 hours on 1 March 1977 and terminate when that nation's catch allocation is reached.

Closed areas. (a) Fishing by foreign vessels is prohibited in the following areas:

(1) 47°30' N. latitude to the U.S.-Canada boundary.

(2) U.S.-Mexico boundary to 39°00' N. latitude.

(3) "Columbia River Pot and Recreational Fishery Sanctuary" is that area bounded by the following coordinates: 47°00' N., 125°20' W.; 46°20' N., 124°40' W.; 46°00' N., 124°55' W.

(4) "Klamath River Pot Sanctuary" is that area bounded by the following coordinates: 41°37' N., 124°34' W.; 41°37' N., 124°30' W.; 41°30' N., 124°28' W.; 41°20' N., 124°32' W.; 41°37' N., 124°34' W.

(5) 39° N. latitude to 47°30' N. latitude landward of 125°40' W. longitude prior to June 1, 1977 and after October 31, 1977.

Gear restrictions. (a) No foreign vessel fishing for Pacific hake, under this subpart, shall use any gear other than a pelagic trawl with a minimum mesh size of 4.33 inches (110 mm), stretched measure. No liners will be permitted in the cod end of the trawl.

(b) It shall be unlawful for any foreign fishing vessel fishing under this subpart to attach any protective device to pelagic fishing gear or to employ any means that would, in effect, make it possible to fish for demersal species or any device or method which would, otherwise, have the effect of diminishing the size of the meshes.

Statistical reporting.—(a) **Annual.** Each nation whose fishermen operate in the Area shall report by May 30 of the following year, annual catch and effort statistics, as follows: Effort in hours trawled, by vessel class, by gear type, by month, by ½° (Lat.) x 1° (Long.) statistical area; Catch in metric tons, by vessel class, by gear type, by month, by ½° (Lat.) x 1° (Long.) statistical area, by the following species groupings:

Pacific hake, Jack mackerel, Pacific Ocean perch, Other rockfishes, Sablefish, Dover sole, Other flounders, Anchovies, Herring, Any other species taken in excess of 1,000 m.t., Other fishes.

(b) **Monthly.** In addition to the annual statistical report in (a) above, each nation will report by the end of the following month, provisional monthly fishery information as follows: Effort in vessel-days on the grounds (by vessel-class and gear type); and Catch in metric tons of Pacific hake, jack mackerel, rockfishes, flounders, and others for each of the following areas:

Conception, Monterey, Eureka, Columbia, Vancouver (including that portion of Canada).

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