APPENDIX B

History of Alaska Groundfish Fisheries and Management Practices

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ACRONYMS AND ABBREVIATIONS

ABCs	acceptable biological catch
AD	automatic differentiation
ADF&G	Alaska Department of Fish & Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
APA	Administrative Procedure Act
B	current stock size
BiOp	Biological Opinion
BSAI	Bering Sea and Aleutian Islands
CDQ	community development quota
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFZ	contiguous fishery zone
COAR	commercial operator's annual report
CSFR	continental shelf fishery resources
CZMA	Coastal Zone Management Act
DAH	domestic annual harvest
EA	environmental assessment
EBS	Eastern Bering Sea
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	environmental impact statement
EO	Executive Order
ESA	Endangered Species Act
F	fishing mortality rate
ft	feet or foot
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FRFA	Final Regulatory Flexibility Analysis
GHL	guideline harvest level
GOA	Gulf of Alaska
ICB	information collection budget
IFQ	individual fishing quota
INPFC	International North Pacific Fisheries Commission
IPHC	International Pacific Halibut Commission
IRFA	Initial Regulatory Flexibility Analysis
IR/IU	improved retention/improved utilization
kg	kilogram
km	kilometer
LLP	License Limitation Program
LOA	length overall

ACRONYMS AND ABBREVIATIONS (Continued)

m	meter
M	mortality rate
MFMT	maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MPAs	Marine Protected Areas
MSA	Magnuson-Stevens Act
MSST	minimum stock size threshold
MSY	maximum sustainable yield
mt	metric tons
mt/m^3	metric tons per cubic meter
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service
NOA	Notice of Availability
NPFMC	North Pacific Fisheries Management Council
OFL	overfishing level
OMB	Office of Management and Budget
ORR	Other Red Rockfish
OTC	official total catch
OY	optimum yield
pdf	probability density function
PRA	Paperwork Reduction Act of 1995
PSC	prohibited species catch
PSQ	prohibited species quota
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SCA	Steller Sea Lion Conservation Area
SCNO	sharpchin/northern
SEIS	Supplemental Environmental Impact Statement
SFA	Sustainable Fisheries Act of 1996
South Korea	Republic of Korea
SRRE	shortraker/rougheye
SSC	Science And Statistical Committee
TAC	total allowable catch
TALFF	total allowable level of foreign fishing
USFWS	U.S. Fish And Wildlife Service
U.S.	United States
U.S.S.R.	United Soviet Socialist Republic
VMP	Vessel Monitoring Program
VMS	Vessel Monitoring System
WPR	weekly production reports

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Section 1 Groundfish Fisheries and Management Prior to 1976

1.1 Alaska Native Subsistence Fisheries

Subsistence use of fish for food and trade existed before the first Asian and European explorers arrived on the shores of Alaska. These Native subsistence fisheries have traditionally focused on nearshore species such as salmon, herring, shellfish (molluscan and crustacean), and a few demersal or groundfish species such as cod, halibut, and rockfish. Subsistence fisheries account for small amounts of fish relative to the commercial fisheries, and they continue at the present time (North Pacific Fishery Management Council [NPFMC] 1979).

1.2 Early United States Domestic Fisheries

The commercial potential of the abundant Alaska salmon resource was not realized until the 1860s, when a technique for large-scale canning of salmon was developed. The first salmon cannery on the Pacific Coast opened in California in 1864, and salmon canneries were built in Alaska for the first time in 1878 (Cooley 1963).

The first commercial venture for Bering Sea groundfish occurred when a single schooner fished for Pacific cod in 1864. The Pacific cod fishery was conducted on a regular basis by 1882. The Bering Sea Pacific cod fishery reached its peak in during World War I when demand was high. This Bering Sea domestic fishery began declining after 1920 and continued until 1950 when economic conditions due to a decline in demand for Pacific cod caused the fishery to halt (NPFMC 1981).

Although Pacific cod fishermen reported that halibut were present in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) in the 1800s, the fishery did not develop in Alaska until after World War I (NPFMC 1981 and 1978). Market demand for halibut grew as technology developed to ice and preserve halibut long enough to make it to markers in the East and Midwest. Increased demand inspired fishermen to explore for larger halibut resources farther north. Small, infrequent landings of Bering Sea and GOA were made by United States of America (U.S.) vessels from the mid-1920s through the early-1950s. Domestic catches were being landed annually by the mid-1950s in the Bering Sea and GOA (NPFMC 1981 and 1978). Between 65 and 80 percent of the total domestic halibut landed annually from 1955 to 1975 came from the GOA (NPFMC 1978).

A sablefish fishery began around 1906 in the GOA inside waters, and was relatively unimportant until about 1935 when catch began to increase. The peak GOA harvest occurred in 1946 (approximately 2,800 metric tons [mt]). Since the inception of the GOA sablefish fishery, demand rather than stock size has dictated catch level. Harvest levels were high in the mid-1940s because of demand from vitamin manufacturing companies. Harvest levels began to decline after 1945 due to a corresponding expanded market for vitamins from other sources (NPFMC 1978).

A GOA bait fishery developed in response to the early Alaska halibut and crab fisheries. The bait fishery mainly occurred from Prince William Sound west to the Aleutians, with approximately two-thirds of the catch landed in Kodiak. The bait fish catch was typically taken as bycatch in the Kodiak shrimp fishery, and consisted largely of pollock, Pacific cod, and various flounder species. Vessels fishing for halibut would catch and retain Pacific cod for bait. In addition, crab vessels would trawl for bait (NPFMC 1978).

A small GOA domestic fishery for flounders and pollock started in 1976. In addition, small catches of rockfish were caught in the GOA halibut and sablefish fisheries (Browning 1980).

1.3 Foreign Distant Water Fisheries

Nationals from foreign countries have conducted groundfish fisheries in Alaskan waters: Japan (BSAI and GOA), the former United Soviet Socialist Republic (U.S.S.R.) (BSAI and GOA), Canada (BSAI and GOA), the Republic of Korea (BSAI and GOA), Taiwan (BSAI and GOA), Poland (BSAI and GOA), East Germany, and Bulgaria (NPFMC 1981 and NPFMC 1978). No catch statistics were provided until 1964, however, when the Soviet Union began to provide these data to the Food and Agricultural Organization of the United Nations. Obtaining accurate fishing mortality data was a general problem of the foreign distant water fisheries off Alaska.

1.3.1 Japanese Fisheries

The first Japanese expansion beyond Japanese coastal waters was to Sakhalin Island for salmon in the late 1700s. Later, as a result of Commodore Matthew Perry's success in 1854 to conclude an agreement with Japan to open its ports to American whaling vessels, a similar treaty between Japan and the Czar of Russia allowed joint occupation of Sakhalin Island, which lead to significant expansion of the Japanese salmon fishery along the Russian coast. In 1875, Japan gained access to the Kuril Islands in exchange for renouncing its rights to Sakhalin. Thirty years later, the 1905 Treaty of Portsmouth returned Sakhalin to Japan and provided a basis for further extension of Japanese fisheries in the Sea of Okhostk and the western Bering Sea. Japan's ability to catch and process fish from this northern area increased fivefold during the decade leading to the Russian Revolution but subsequent skirmishes with the Soviets caused Japanese fishermen to develop other distant water fisheries in the Yellow Sea and East China Sea during the 1920s. With this experience, Japanese fishermen initiated exploratory fishing in the eastern Bering Sea in 1930 (Miles *et al.* 1982).

Japanese exploratory fishing led to a groundfish meal fishery in 1933. Pollock was the principal species targeted for this reduction fishery. The fishery continued to operate through 1987 when declining fish meal prices caused the fishery to terminate (NPFMC 1981). From 1940 to 1941, Japanese trawlers fished for yellowfin sole in the eastern Bering Sea to supply a frozen food-fish market (Chitwood 1969 and BSAI FMP 1979). Early Japanese distant water fisheries in the eastern Bering Sea likely could have continued annually but for the hostilities of World War II.

Japan undertook major fleet rebuilding efforts after World War II to stimulate the economy, and to provide a protein source for the people. Most of the larger Japanese fishing vessels had been destroyed by the U.S. Navy during the war. Smaller vessels in the coastal fleet were inadequate for supplying sufficient food immediately after the war. Moreover, the Allied occupation of Japan severely limited expansion of Japanese fisheries. When these restrictions were liberalized in 1952, Japanese fisheries expansions to the north and west soon experienced conflict with Korean, Soviet, and Chinese fisheries (Miles *et al.* 1982). The Japanese post-war fishery had resumed in the BSAI by 1954 (NPFMC 1981). The primary technological achievements that allowed for early Japanese success was the use of mothership fleets, in which trawlers delivered catches to a factory ship, and the use of surimi processing technology (Fishery Agency of Japan 1976). This permitted use of an abundant pollock resource that was largely ignored by the U.S. and other countries due to its low value.

BSAI

The post-war Japanese fishery developed into four principal components: the mothership fishery, trawl fishery, longline-gillnet fishery, and the landbased trawl fishery. In the Bering Sea, the mothership fishery accounted for the largest share of the catch (NPFMC 1981). These fisheries are described below.

Mothership Fishery

From 1954 - 1957, the mothership fishery was relatively small consisting of two to four 8,000 gross ton freezer motherships with trawlers as catcher boats. The fleets typically operated between August to October off Bristol Bay targeting flounders, primarily yellowfin sole (NPFMC 1981).

From 1958 to 1963, the mothership fishery expanded throughout the Bering Sea. The flounder freezing fleet continued to fish for yellow fin sole. The longline-gillnet mothership operation was developed during this time period. A fleet consisted of 5,000 to 10,000 gross ton mothership accompanied by trawlers and Danish seiner that also fished with longlines and gillnets. The longline-gillnet mothership fleet fished for halibut, sablefish, herring, and Pacific ocean perch for freezing along the continental slope off Cape Navarin (Chitwood 1969 and NPFMC 1981). In the early 1960s, the mothership fleets expanded their area of operations to include the continental slope between the Pribilof Islands and Cape Navarin and Bowers Banks off the Aleutian Islands (NPFMC 1981). Fish meal operations were initiated during this time period utilizing 9,000 gross ton motherships with Danish seiners and pair trawlers as catcher boats. The fish meal fleet processed flounders in the eastern Bering Sea from April to September (NPFMC 1981). Also in 1963, after a 10-year ban on Japanese fishing for Pacific halibut east of 175°W was relaxed, a fleet of 5 Japanese motherships and 66 longline catcher vessels commenced fishing for halibut.

With decline in abundance of yellowfin sole in the early 1960s and the development of on-boards processing techniques for surimi, the main focus of the Japanese fisheries shifted to pollock. Fish meal and frozen products became by-products of pollock operations. The Japanese pollock fishery operated from mid-April through December and led to the largest Japanese groundfish fishery: by the early 1970s it peaked at 1.6 million mt (Fishery Agency of Japan 1976). The mother ship fleets fished for pollock along the outer continental slope and upper slope stretching from Cape Sarichef in the eastern Aleutian Islands to Cape Navarin. Most of this area is within the current U.S. Exclusive Economic Zone (EEZ). The flounder fishery became a winter fishery from 1969 to 1970, generally lasting from October to March, with winter fishing grounds north of Unimak Island and occasionally west and east of the Pribilof Islands (NPFMC 1981).

Trawl Fishery

The trawl fishery consisted of independent factory trawlers larger than 500 tons that both fished and processed their own catch into either surimi or frozen product. From 1954 - 1959, approximately one to three independent trawlers fished in the eastern Bering Sea for yellowfin sole. By 1960, trawlers began exploiting halibut, sablefish, Pacific ocean perch, and other species for freezing along the continental slope in the central and northern Bering Sea and in Aleutian Island waters. In 1967, the number of licenses for independent trawlers was increased resulting in a independent fleet composed of larger trawlers equipped with surimi machinery. The main effort of the independent trawlers switched to pollock in the eastern Bering Sea with the number of vessels generally increased form a low in mid-winter to a peak in summer. In the Aleutian Islands, the independent trawlers targeted Pacific ocean perch and to a lesser degree pollock and

other groundfish species. Maximum fishing effort was concentrated along the shelf edge in the central and western part of the chain in summer and early fall. By 1970, approximately 80 percent of the total groundfish catch in the independent trawl fishery was pollock (NPFMC 1981).

Longline-Gillnet Fishery

The longline-gillnet fishery consisted of independent vessels that when filled with fresh or frozen fish would return to Japan. From 1963 to 1966 approximately 18 vessels fished for herring and sablefish in the eastern Bering Sea and along the Aleutian Islands. This was a sporadic fishery with only a few vessels fishing each year through 1972 (NPFMC 1981).

Landbased Trawl Fishery

The landbased trawl fishery was conducted by independent 100 to 350 ton Danish seiners and stern trawlers that were prohibited by regulation from transshipping their catch in offshore waters, and therefore return to Japan when storage capacity was filled.

GOA

In 1960, several small trawlers were diverted from the Japanese fleet in the Bering Sea to carry out exploratory fishing operations in the GOA. Exploratory fishing probes continued through 1962. In 1963, the Japanese initiated a trawl fishery for groundfish in the GOA (Chitwood 1969 and NPFMC 1978). The GOA fishery developed into two major components: trawl fishery and longline fishery. The Japanese GOA fishery was less extensive than the fishery in the Bering Sea from the standpoint of catch volumes. From 1970 to 1974, Japans total GOA groundfish harvest averaged 99, 000 mt compared to 1,706,000 mt in the Bering Sea (NPFMC 1978).

Trawl Fishery

The GOA Japanese trawl fishery primarily targeted Pacific ocean perch, although substantial amounts of other groundfish were taken. The majority of the Japanese Pacific ocean perch catch was obtained from the Kodiak, Yakutat, and southeastern GOA areas starting in 1968. There was major upgrading of the Japanese fishing fleet over the years in terms of vessel size, horsepower, fishing gear efficiency, navigation equipment, and fish-finding devices. The average size of factory trawlers increased from around 1,500 to 2,500 gross tons between 1967 and 1975 (NPFMC 1978).

Longline Fishery

The GOA Japanese longline fishery initially used bottom gillnets, but these were soon replaced with longlines and occasionally traps. Over time the average size of vessels in the sablefish fishery increased from about 350 to approximately 500 gross tons (NPFMC 1978).

1.3.2 Early Russian and Soviet Fisheries

The earliest Russian explorers sought fur-bearing animals rather than fish. The first small-scale fishing enterprise began in 1785 at the Karluk River on Kodiak Island to provide dried salmon to Russian fur traders. In the early 1800s, the Russian American Company shipped small quantities of salted salmon to St. Petersburg, Russia.

Like Japan, the Soviet Union undertook a major rebuilding effort after losing much of its fishing fleet in World War II. Unlike Japan, however, the Soviet Union had little prewar experience with distant water fisheries. Their fisheries expansion effort substantially accelerated in 1955. Most Soviet fishing vessels at that time were built in East Germany and Poland and sent to the Soviet Union as war compensation (Kravanja 1976). The Soviets adopted existing fishing technology developed in other countries, most notably the stern factory trawler (a British invention), which allowed the use of much larger trawl nets than those used on traditional side trawlers. The strategy of deploying fleets of such trawlers that work together with support vessels, including processor, cargo, and provisioning vessels, was mainly a Soviet achievement (Pruter 1976). The decision to speed the building of these distant water fishing fleets was made by the highest levels of U.S.S.R. government in 1956. By 1975, the Soviet fishing fleet was the largest in the world, consisting of over 5,400 distant water vessels and accounting for at least half of the world's total gross tonnage of such vessels (Pruter 1976). The total Soviet catch in 1975 (of all aquatic organisms including plants, fish, and marine mammals) was 10.3 mt; six times the amount it harvested in 1950, and exceeded only by Japan.

BSAI

The Soviets began commercial fishing operations off Alaska in the eastern Bering Sea in 1959. By late 1963, as many as 100 fishing and support vessels from the Soviet Union were operating off Alaska at any given time year-round (Chitwood 1969). Three major fisheries developed in the BSAI: a flounder fishery in the southeastern Bering Sea, a rockfish fishery primarily in the Aleutian Islands, and a pollock fishery along the outer continental shelf from Unimak Pass to northwest of the Pribilof Islands (NPFMC 1981).

Flounder Fishery

Throughout its history, the Soviet flounder fishery was a winter operation typically extending from November to April, peaking in February or March. The primary target was yellowfin sole, and to a lesser extent other flounders such as rock sole, flathead sole, Alaska plaice, starry flounder, and arrowtooth flounder. From 1959 to 1963, the flounder fleet was comprised of approximately 30 trawlers supported by a factory ship and refrigerated transport vessels. Effort was increased over the next two years with the number of increasing from 40 trawlers in 1964 to 50 to 60 trawlers in 1965. The number of flounder fishery trawlers peaked from 1966 to 1968, reaching 70 - 100. The Soviet effort for flounders began declining in 1969. The number of trawlers during peak flounder fishing months was between 50 and 80 from 1969 to 1972. This decline was presumably due to the lower abundance of yellowfin sole. In 1972, the reported Soviet flounder catch was 13,000 mt, a decline compared to 70,000 mt report in the three previous years. The flounder fishery failed to develop in 1973 when effort was limited to a two-week by four trawlers. The Soviets did not resume the flounder fishery after 1973 (NPFMC 1981).

Rockfish Fishery

The Soviet rockfish fishery (Pacific ocean perch and other rockfish) began in 1960 along the edge of the continental shelf in the eastern and central Bering Sea. In subsequent years the fishery concentration of effort was shifted to the Aleutian Islands and the GOA, with directed effort in the Bering Sea eventually being eliminated. Rockfish catches were headed, eviscerated, frozen, and transported via refrigerated vessels to the Soviet Union. The early Aleutian Island fishery years were the most productive with reported catches of 61, 000 mt in 1964 and 71,000 mt in 1965. Although the catch volume increased in 1965, catch per trawler declined requiring increased search time for Pacific ocean perch concentrations. Fishing effort was sporadic in 1966 presumably due to the reduced abundance of rockfish. The level of effort continued to decrease over time with relatively few vessels targeting Pacific ocean perch in the Aleutian Islands (NPFMC 1981).

Pollock Fishery

In 1967, a Soviet fishery was established for sablefish and large flounders (arrowtooth and Greenland turbot) north of the eastern Aleutian Islands (Dutch Harbor area). This fishery eventually developed into the Soviet pollock fishery. Initially fishing was at depths of about 550 to 730 m on the deep-water plateau. In 1968, the fishing area was extended north along the edge of the continental shelf to the central Bering Sea targeting sablefish and arrowtooth flounder north of Dutch Harbor and pollock, cod, rockfish, and various flatfish farther north. The Soviets continued to fish predominantly two areas, the first immediately north of the eastern Aleutian Islands and the second northwest of the Pribilof Islands. The emphasis of the fishery shifted to pollock in 1971, with catches increasing from approximately 36,000 mt in 1970 to 234,000 mt in 1971. The pollock fishery catch peaked in 1974 with a reported total catch of 310,000 mt (NPFMC 1981).

GOA

By 1962, Soviet trawling operations had expanded into the GOA. The Soviet GOA fishery was a classic example of pulse fishing where massive fishing effort of local stocks generates an early buildup in catches, followed by declining yields when abundance falls off, and a shift of effort to other species or different fishing grounds. Pacific ocean perch was initially the principal target species. With the decline of Pacific ocean perch stocks in the late 1960s and early 1970s, the Soviet fisheries shifted to less exploited fish such as pollock, Atka mackerel, and flounder. The relative importance of the GOA Soviet groundfish fishery compared with the Soviet fisheries in the Bering Sea and Washington-California area diminished over time. From 1962 to 1965, when Pacific ocean perch were still present in large concentrations, the GOA catch comprised approximately 60 percent of the total Soviet groundfish harvest (excluding herring) from all Pacific waters off the U.S. and Canada. From 1970 to 1974, the comparable figure was less than 9 percent of total groundfish harvest despite Soviet efforts to maintain their catches by diverting to other target species (NPFMC 1981).

1.3.3 Canadian Fisheries

Small and infrequent halibut landings were made by Canadian vessels in the Bering Sea between 1928 and 1950, but catches were not landed every year until the mid-1950s. The number of Canadian vessels fishing for halibut increased throughout the mid-1960s and then steadily declined until 1970 in the Bering Sea (NPFMC 1981). Canadian halibut fisheries expanded from the coastal waters of British Columbia into the Gulf of Alaska after World War I. The largest proportion of the total halibut landed annually by both U.S.

and Canadian vessels from 1955 through 1975, between 65 and 80 percent, came from the GOA (GOA FMP 1978).

1.3.4 Distant Water Fisheries of Other Nations

The Republic of Korea (South Korea) lost substantial fishing capacity during World War II but delayed rebuilding and expanding into distant water fisheries due to the outbreak of the Korean War in 1950. In 1966, a South Korean vessel from the Pusan National Fisheries College conducted exploratory fishing off Alaska (Chitwood 1969), and vessels from that country began a pollock fishery in the eastern Bering Sea in 1968 (Miles *et al.* 1982).

Neither North Korea nor China developed significant distant water fisheries in areas off Alaska before 1976. Taiwan began fishing for sablefish and pollock off Alaska in 1970. Poland, East Germany, and Bulgaria, late arrivals in the distant water fisheries off Alaska, were also unsuccessful at developing significant fisheries in Alaskan waters (Miles *et al.* 1982).

1.3.5 Foreign Distant Water Fisheries Summary

The cumulative catch of groundfish by all nations during the period 1954–1974 was estimated to be over 22 million mt, of which Japan accounted for over 15 million mt, 67 percent; the Soviet Union nearly 6 million mt, 25 percent; and the U.S. about 1.5 million mt; 6 percent (Pruter 1976). The remainder was accounted for by fisheries from other nations, such as South Korea, Poland, East Germany, West Germany, Taiwan, and Canada. Catch statistics reveal the growth and magnitude of the foreign groundfish harvest off Alaska during the late 1950s through the early 1970s. Of particular note were the high catches of yellowfin sole in the Bering Sea, which peaked in 1962, and high catches of slope rockfish (e.g., Pacific ocean perch) in the GOA during the period 1963–1968. Both of these stocks were overfished, and while yellowfin sole is believed to have recovered, the slope rockfish stocks are still rebuilding.

While the groundfish species targeted by Japan, the Soviet Union, and other foreign fisheries off Alaska during this pre-EEZ period were not significant traditional fisheries for Alaska's fishermen, the effect on domestic fisheries was fourfold.

1. Inadequate catch statistics prevented U.S. scientists from determining whether distant water fisheries were causing overfishing of target stocks.

2. Bycatch of salmon, halibut, and crab in the distant water fisheries likely had a significant negative effect on harvests of these species by Alaskan fishermen.

3. A wide variety of gear types were used by foreign fleets; gear included variously configured benthic trawls, tangle nets (essentially large mesh trawls used to capture crabs), hook-and-longline gear, and a variety of pots. Such gear was used with little concern for its effects on fish habitat or for gear conflicts with American fishermen.

4. The development and support of the foreign distant water fisheries off Alaska, as a matter of government policy by the participating nations, amounted to subsidies to which U.S. fishermen had relatively little ability to respond in kind. The result was effective preemption of the groundfish fisheries by the foreign distant water fisheries until 1977.

1.4 Fisheries Management Prior to 1976

The Tlingits in southeast Alaska had a complex system of owning fishing rights (Rogers 1960).

Almost immediately after Alaska was purchased from Russia, it became obvious that some form of government intervention was required to ensure conservation of fishery resources and equitable distribution of their benefits. The following year, in 1868, the U.S. Treasury Department began to send agents to Alaska to protect fur seals and to administer a lease to the Alaska Commercial Co. to harvest seals in the Pribilof Islands. As the Alaska salmon industry developed, government agents also collected taxes on processed salmon products (Fredin 1987).

In 1870, the federal government became more directly involved in fishery conservation when Congress allocated funds to investigate declining fisheries off New England. In 1871, Congress created the first federal fisheries agency, the U.S. Commission of Fish and Fisheries. The Commission's primary duty was to determine whether and to what extent marine food fishes (i.e., commercial species) had declined in abundance, and to report to Congress necessary remedial measures (Bowen 1970). Although neither fishery regulation nor fish propagation were in the Commission's charter, it recommended that state governments do the former, while the Commission conduct the latter. The fish culture work was directed primarily at northeastern marine and Great Lakes fisheries. In 1903, the Commission became the Bureau of Fisheries of the Department of Commerce and Labor. Among its duties was the responsibility to carry out the U.S. Treasury's fishery work in Alaska (Fredin 1987). Ten years later, in 1913, the department was split into the separate Departments of Commerce and Labor; the Bureau of Fisheries was lodged in the Department of Commerce.

In 1904, Theodore Roosevelt ordered the Commission to investigate the Alaska salmon fishery and recommend laws and regulations. This investigation called attention to the inadequacy of existing conservation measures. Although limiting the number of canneries was mentioned as desirable, more emphasis was given to the need for government hatcheries "to maintain the supply of fish...without curtailing production" because restrictive regulations would be unpopular with the cannery owners and difficult to enforce (Cooley 1963). Although concern over the conservation of salmon continued to be raised throughout the early 1900s, Congress expressly denied the Alaska territorial government authority to regulate fisheries, arguably due to the political influence of cannery owners who resided in states with elected congressional representatives in Washington, D.C. In 1922, two "fishery reserves" were established in which the Secretary of Commerce was authorized to issue a limited number of cannery permits. Soon after, however, Congress passed "An Act for the Protection of the Fisheries of Alaska" (the White Act), which was signed by President Calvin Coolidge in 1924. As a compromise law, the White Act averted the "reservation" system, but also declared congressional intent that not less than 50 percent of the salmon should be allowed to escape the fishery. The Act also gave the Secretary of Commerce broad powers to regulate fisheries in Alaska's territorial waters (Cooley 1963). Although salmon fisheries were the focus of the few fishery management regulations in existence during the early 1900s, two provisions that applied to groundfish were 1) a prohibition against wanton waste, and 2) an annual report to the Department of Commerce and Labor by any person engaged in catching or processing fish products (Fredin 1987). This early history of the Alaska salmon industry is important because the salmon canneries evolved into present-day groundfish processors.

Meanwhile, management of the Pacific halibut fishery took on an early international aspect. As fishermen from Canada and the U.S. conducted this fishery from northern California through Alaska shortly before World War I, fishery officials, fishermen, and dealers from both countries began to express concern about increasing amounts of gear and decreasing catch per unit of gear. Around 1913, Canadian and U.S. officials began to discuss the possibility of an international research and management agency and on March 2, 1923, the two nations ratified a halibut conservation treaty (Browning 1980). It established a four-person International Fisheries Commission, with limited regulatory powers and a principal charge to conduct research. The new Commission imposed an annual closure of the fishery from November 16 to February 15 to protect spawning halibut (Browning 1980). The treaty was renegotiated in 1930 and again in 1937 to enhance the Commission's regulatory power, and in 1953 a treaty revision changed the name to the International Pacific Halibut Commission (IPHC).

1.4.1 Post World War II Fisheries and Their Management

World War II marked a major turning point in the character of fisheries off Alaska. While the pre-war period can be characterized by a fisheries development trend from relatively small-scale fisheries to organized commercial exploitation, the post-war period by comparison was a virtual revolution in the expansion of distant water fisheries and large industrial-scale operations. In the three decades from the end of World War II to the advent of EEZ management under the Magnuson-Stevens Act (MSA), the harvest of all fisheries in the North Pacific (the area north of 30°N from Asia to North America, including the BSAI) increased from 8 million mt to 20 million mt. The greatest increases during this period came from catches of groundfish and crab in the BSAI and GOA: groundfish catches grew from relatively insignificant levels to exceed 2 million mt per year in the early 1970s (Miles *et al.* 1982).

These changes resulted from technological developments and changes in marketing and some nations' fishery policies. Advances in science and technology in developed nations sowed the seeds of conflict for exploiting living marine resources and challenged the traditional international convention of freedom of the high seas generally accepted since the late eighteenth century. The freedom of the seas convention was based on three related assumptions: 1) that waters of the high seas were not susceptible to effective occupation, 2) that the resources of the seas were inexhaustible, and 3) that any specific use of the seas would not impair or impose costs on other uses (Koers 1973). Events immediately preceding and during World War II demonstrated the error of these assumptions. For example, in 1983, Bracken provides evidence of a 55 percent decline in the catch per unit effort of sablefish and a decline in average weight from 8 pounds to 6.5 pounds off Alaska between 1937 and 1944. By the mid-1900s, such experiences from fisheries indicated the frailty of the second assumption, and the war itself demonstrated the relative utility of the first and third assumptions. To obviate the claims of other nations in the high seas adjacent to U.S. coasts, the Truman Proclamation of 1945 asserted the nation's right to adopt conservation measures in these areas and to require foreign nations to comply with those measures (Koers 1973). This unilateral claim was not effectively exercised with regard to fisheries resources until the MSA was implemented in 1977.

The complexity of the fishery management regime for groundfish fisheries grew in rough proportion to the impact of those fisheries on groundfish and related stocks. Before 1959, federal regulations focused on restricting trawl fishing gear. In 1948, minimum mesh sizes were set (5 inches in the bag; 6 inches in the wings), chain "ticklers" were prohibited, trawling was prohibited in areas of small halibut (areas closed to halibut fishing by the IPHC), and logs of fishing operations were required. In 1945 and 1946, in response to a decline in sablefish off southeastern Alaska (Section 1.3), fishing for that species was prohibited before

March 15 and after November 30. In 1947, that open season was further restricted to between May 1 and November 30 (Fredin 1987).

Until 1959, all regulations affecting the groundfish fishery off Alaska were implemented by the Bureau of Commercial Fisheries. With Alaska's 1959 achievement of statehood, state regulations began to be applied inside the 3-mile-wide territorial sea. These regulations primarily implemented licensing and reporting requirements, but they also limited the type of gear that could be used at certain times and in certain areas. For example, purse seines and pot gear were excluded in certain areas of the GOA at specified times. Off southeastern Alaska, a catch quota was established for sablefish in certain districts and time periods (NMFS 1976).

Some conservation and management measures were also implemented independently by Japan. In 1959, Japan closed an area off the north side of the Aleutian Peninsula to trawling by its groundfish vessels to prevent gear conflict with its crab fishery in that area (Fredin 1987). Although this action was taken to reduce internal conflicts, it may have had salutary effects on fish habitat. Japan also instituted an early limited access system, primarily to avoid conflicts among its many mothership and trawler fleets. In 1963, Japan limited the number of licenses issued to vessels and restricted their area of operation to ease Canadian and U.S. concerns about the impact of Japanese trawl fisheries on halibut resources. By 1967, Japan had designated the areas of operation and limited the numbers of licensed vessels in all of its groundfish fisheries in the BSAI and GOA (Fredin 1987).

Other than the limited regulations imposed by the State of Alaska, the U.S. had virtually no authority to impose restrictions beyond its territorial sea. Notwithstanding the Truman Proclamation of 1945, the U.S. did not extend its jurisdiction over fisheries beyond its 3-mile-wide territorial limit until 1966, when enactment of Public Law 89-658 extended U.S. exclusive jurisdiction of the over fisheries from 3 miles to 12 miles offshore (Miles *et al.* 1982). Although the establishment of the 9-mile contiguous fishery zone (CFZ) under this law was a forerunner to the ultimate fisheries jurisdiction claim of 200 miles ten years later, it was relatively ineffective in controlling the growth of foreign fishing capacity and groundfish harvests off the coast of Alaska. For these purposes, the U.S. relied primarily on multilateral and bilateral international agreements.

1.4.2 Multilateral Agreements

The U.S. became party to several multilateral agreements during the 1950s, but only one, the International North Pacific Fisheries Commission (INPFC), had any effect on the groundfish fisheries of the Bering Sea and GOA (Koers 1973, Miles *et al.* 1982). The INPFC involved Canada, Japan, and the U.S. in an agreement primarily to abstain from fishing on certain stocks of fish. Initially, administering the "abstention provisions" was the INPFC's most important function (Koers 1973). Under these provisions, Japan agreed to abstain from fishing for salmon, herring, and halibut of American origin or found off the coast of North America, and Canada agreed to abstain from fishing for salmon originating in U.S. rivers. The INPFC was responsible for determining whether these stocks continued to qualify for abstention and whether new stocks met criteria for abstention by one or two member nations (Koers 1973). Lacking substantial scientific information on the western migration of North American salmon, the INPFC determined that Japan would abstain from fishing for these species east of 175°W. Subsequently, knowledge was gained that North American salmon migrate west of that line and Asian salmon migrate east of that line. Japan began to lose interest in revising the abstention line in favor of Canada and the U.S. In addition, despite its responsibility to allocate catch, the

INPFC did not have a research staff, and relied instead on the fisheries data and research contributed by member governments (Miles *et al.* 1982).

This reliance on other governments' data and attendant controversy of allocating salmon, halibut, and herring based on the abstention provisions severely limited the INPFC's attention to groundfish fisheries. It virtually ignored groundfish until 1961, when the U.S. raised concern regarding Japan's large-scale groundfish fisheries in the eastern Bering Sea. In 1967, the INPFC agreed to undertake joint study of groundfish other than halibut in the northeast Pacific Ocean, and in 1968, Pacific ocean perch was the first groundfish resource assessed. The sablefish resource came under INPFC scrutiny in 1971, and a study of halibut bycatch by Japanese groundfish trawlers was initiated in 1972 (Fredin 1987). No conservation and management recommendations resulted from these studies and among other factors, the large-scale entry into the Bering Sea fisheries of non-member nations, namely the Soviet Union and South Korea, eventually eroded the INPFC's ability to act as a force in international management of these fisheries.

1.4.3 Bilateral Agreements

More success on reaching international agreement on fishery management, albeit still limited, was realized through separate agreements between the U.S. and the foreign nations with distant water fisheries off Alaska. Bilateral agreements were designed to treat five major problem areas: 1) gear conflicts, 2) access to areas subject to national jurisdiction, 3) allocation of stocks, 4) research activities and data sharing, and 5) visits aboard fishing vessels (Miles *et al.* 1982). Bilateral agreements that pertained to groundfish fisheries off Alaska were concluded between the U.S. and four other nations before 1976. Most of these agreements involved the two principal nations with distant water fisheries off Alaska, the Soviet Union and Japan, but the mid-1970s also saw agreements concluded with the South Korea and Poland. The first of these agreements were negotiated in 1964 between the U.S. and the Soviet Union and the U.S. and Japan. All of these agreements were of relatively short duration and renegotiated frequently to respond to changing conditions in the fisheries.

The first U.S.-U.S.S.R. bilateral agreement, signed in December 1964, established six areas off Kodiak Island that would be closed to Soviet trawls from July through October. The Kodiak King Crab Gear Area Agreement was designed primarily to reduce gear conflicts between the U.S. king crab fishery and Soviet trawlers in these areas off the south and western shores of Kodiak Island. The agreement was effective for three years and was extended in December 1967 without change through mid-February 1969 (Fredin 1987). In addition to resolving a gear conflict problem this agreement also addressed a crab resource allocation issue between the U.S. and the Soviet Union. The Soviet distant water fishery had conducted a king crab fishery off Alaska in the early 1960s, taking as many as 3.4 million crabs in 1961 (Naab 1971). Essentially, under this agreement, the crab resource off Kodiak Island was allocated away from Soviet fishermen, although they were permitted to continue their crab fishery in the eastern Bering Sea.

The establishment of the CFZ in 1966 gave the U.S. an important new tool in negotiating future bilateral agreements. This was reflected in the CFZ agreement between the U.S. and the Soviet Union in February 1967. The 1967 CFZ accord allowed limited Soviet fishing within the 9-mile-wide CFZ in areas off the Aleutian Islands little used by U.S. fishermen and vessel support activity in certain areas within the CFZ in return for a ban on Soviet trawling in two large areas of international waters in the GOA during the first 15 days of the Pacific halibut fishing season set by the IPHC (Fredin 1987). Again, the objective of this agreement was to reduce gear conflicts between Soviet trawlers and U.S. fixed-gear fishermen, this time

longline or setline gear used in the halibut fishery. The original 1967 CFZ accord was for one year but was later extended for another year. In 1969, it was modified and extended for two additional years, then modified again in 1971 (Naab 1971). The latest modifications introduced more measures to protect conflicts with other fisheries important to U.S. fishermen, namely king and Tanner crab, shrimp, and scallop fisheries, in addition to the halibut fishery off Alaska (Fredin 1987).

Bilateral agreements between the U.S. and Japan were very similar in scope to those between the U.S. and the Soviet Union in that they focused on reducing conflict between U.S. fixed-gear fisheries for crab and halibut and Japanese fisheries. The first U.S.–Japan bilateral agreements concluded in 1964, established an area in the eastern Bering Sea adjacent to the north side of Unimak Island that was closed to Japanese king crab fishing. The intent of this action was to reduce conflict between U.S. crab fishermen using pot gear and Japanese fishermen using tangle-net gear. In addition, the agreement set an annual Japanese production quota of 235,000 cases of canned king crab meat (Naab 1971). Based on one case containing 48 half-pound cans, this was equivalent to 5,640,000 pounds of crab meat. This agreement remained in effect through 1966. In 1966, the agreement was renegotiated to extend it for another two years, but the production quota was reduced to 185,000 cases annually. Renegotiation again in 1968, for another two years, further reduced the annual production quota to 85,000 cases of king crab meats, stipulated a new catch limit of 16 million Tanner crabs, and increased the size of the crab pot protection zone (Naab 1971). This crab pot sanctuary was part of a larger area that was already closed to Japanese trawling by unilateral action of Japan.

In May 1967, the U.S. and Japan negotiated another two-year CFZ accord similar to that previously negotiated with the Soviet Union. This agreement a) closed the same six areas off Kodiak to Japanese fishing that were closed to Soviet fishing in 1964, and b) closed the same international waters in the GOA to Japanese fishing during the first 15 days of the halibut season that were closed to Soviet vessels in 1967. A third provision of the 1967 U.S.–Japan agreement was to close to Japanese fishing vessels an area outside the CFZ south of Unimak Island. In return, Japan was allowed to fish for crab within the CFZ around the Pribilof Islands, for other species (e.g., groundfish) with certain exceptions within the CFZ along the Aleutian Islands, and for whales within the CFZ off Alaska (except for an area in the GOA) and to conduct loading and support activities within the CFZ in certain areas in the GOA. This agreement was modified in December 1970 (Fredin 1987).

The two bilateral agreements—U. S.-U.S.S.R., and U.S.-Japan—may have had marginal benefits at best for the groundfish resources in the agreed-upon closure areas. In negotiating these agreements during the 1960s and early 1970s, U.S. policy matters focused on protecting the interests of traditional U.S. domestic fisheries (e.g., salmon, shellfish, and halibut). In spite of the historic U.S. fisheries for Pacific cod and sablefish, the groundfish resources off Alaska apparently were not perceived as traditional enough or sufficiently important to U.S. domestic fisheries to warrant specific protection under the bilateral agreements. This situation changed in the early 1970s when U.S. sanctions of the growing Japanese and Soviet distant water fisheries for groundfish became difficult to maintain. For example, the total harvest of pollock in the eastern Bering Sea between 1964 and 1971, practically all of which was taken by either Japanese or Soviet vessels, increased from 175,000 tons to 1.7 million tons. Also during this period, catches of some groundfish stocks, such as Pacific ocean perch and yellowfin sole, were decreasing as fishing effort was increasing (Fredin 1987). By 1971, roughly 1,300 fishing vessels were operating in the high seas fisheries off Alaska (Naab 1971).

This increased distant water fishing effort stimulated public concerns in Alaska. Concern lead to discussions in Congress and other venues regarding the efficacy of the CFZ and the need to further extend U.S. jurisdiction over fisheries to 200 miles (Commerce Committee 1976). It was against this backdrop that U.S. negotiations with Japan in December of 1972, and with the Soviet Union in February 1973, for the first time included in the renegotiated CFZ agreements measures aimed directly at conservation of groundfish stocks. These measures were specific annual catch quotas in 1973 and 1974 for groundfish (pollock, Pacific ocean perch, and sablefish) harvests by Japanese and (flatfish) harvests by Soviet fisheries in addition to the season and area restrictions previously developed to protect the traditional domestic fisheries. These quotas reflected increased interest worldwide for extending coastal state jurisdiction over fisheries. As conservation measures, they were good first steps; however, they were initially set at levels about equal to recent years' average annual catches (Fredin 1987). While the growth of Japanese and Soviet distant water fisheries were held in check by these measures, these fisheries also were not severely constrained.

The final round of bilateral agreements with Japan and the Soviet Union was concluded in December 1974 with Japan, and in July 1975 with the Soviet Union. These agreements included more groundfish catch limits for the respective Japanese and Soviet fleets, with a slight decrease in the 1975-1976 annual pollock allocation to the Japanese mothership and trawl fisheries in the eastern Bering Sea.

The groundfish catch quotas negotiated for Japan and the Soviet Union were based almost entirely on analyses and data provided by Japan. Little or no data provided by the Soviet Union was useful for stock assessment purposes (Fredin 1987). Of less significance were bilateral agreements between the U.S. and South Korea in 1972, and the U.S. and Poland in 1975. Under these agreements South Korea agreed not to fish for salmon or halibut east of 175°W in the BSAI and the GOA (Fredin 1987). In return, South Korea was granted fishery support operations in specified areas within the CFZ. Poland likewise agreed not to conduct specialized fisheries for rockfish, sablefish, flatfish, anchovies, Pacific mackerel, herring, or shrimp in 1976 (NMFS 1976).

A notable weakness of the bilateral agreements was that the authority to enforce their provisions (i.e., time and area closures, catch quotas, etc.) generally was left to the affected nation. This generated public doubt about whether strict compliance with the provisions was being observed. In one U.S.–U.S.S.R. bilateral agreement, however, arrangements were made for visits by representatives of fishermen' organizations of the two states to the others' fishing vessels operating in the northeastern Pacific. While these visits did not constitute an official appraisal of compliance, they were important for maintaining confidence in the utility of the bilateral agreement (Miles *et al.* 1982). Another view that led fishery managers and the general public to lose faith in the ability of bilateral agreements to conserve and manage high seas fishery resources in the North Pacific was expressed by Hiroshi Kasahara in 1973:

> *"While the present international fishery management regime consists of a complex network of ad hoc arrangements, some of the largest high seas fisheries in the area which have real or potential international implications are not covered by any of the existing agreements ...Thus, in spite of the various specific agreements for fisheries in the North Pacific, well over 90 percent of the total catch comes from fisheries currently not subject to international regulation. This by itself may not be considered a serious defect . . . [however, a] real problem is the lack of mechanisms for monitoring the status of these fisheries and resources on which they are based, to predict international management problems likely to arise, and to accommodate consultations to resolve them in a timely fashion (Kasahara 1973)."*

1.5 State of the Fisheries in 1976

When the MSA was passed in 1976, groundfish fisheries were, for all practical purposes, totally foreign. Most measures were designed to lessen their impact on domestic halibut and crab fisheries. Bureau of Commercial Fisheries reports indicate that, combined, Japan, the Soviet Union, South Korea, and Taiwan landed over 1.64 million mt. The total number of foreign vessels ranged from 138 in January to 759 in June. More than 300 vessels were present each month from April to September. Japan deployed from 64 to 616 vessels, the Soviets 42 to 147, South Korea 1 to 57, and Taiwan up to 4 vessels. Japan dominated the fisheries, landing 71 percent of the total foreign catch, the Soviets 21 percent, South Korea 7 percent, and Taiwan 1 percent. United States commercial fisheries were limited mainly to red king crab in the GOA and herring, salmon, and halibut eastern Bering Sea in coastal waters. Other than sablefish and small amounts of Pacific cod, very little groundfish was taken off southeastern Alaska. The IPHC had banned all but longline gear for halibut as early as 1944.

Some areas around the Pribilof Islands were closed to prevent foreign fishing marine debris and netting from harming fur seals. In the U.S., the short-tailed albatross had been declared endangered in 1970 under the Endangered Species Act (ESA), though no protective measures had been enacted in the fisheries.

Section 2 Groundfish Fisheries Management Post-1976

All bilateral agreements had to be brought into conformance with the purposes and provisions of the MSA. Following its implementation on March 1, 1977, foreign fishing could be conducted in the new 200-nautical-mile (nm) Fishery Conservation Zone (later changed to the EEZ) only pursuant to an international treaty or a governing international fishery agreement. Governing agreements were completed with Taiwan and the Soviet Union in 1976 and with Japan, South Korea, and Poland in 1977. While these agreements allowed access to the EEZ, all foreign nations had to fish under the rules of preliminary fishery management plans (FMPs) that applied only to foreign fisheries.

Foreign fisheries off Alaska were initially managed under four FMPs, all published in the Federal Register (FR) in February 1977:

1. Trawl fisheries and herring gillnet fishery of the eastern Bering Sea and northeast Pacific.

2. Trawl fishery of the GOA.

3. Sablefish fishery of the eastern Bering Sea and northeast Pacific.

4. Snail fishery of the eastern Bering Sea.

The snail fishery was a very small Japanese fishery consisting of 21 vessels that used longline with pots along the Bering Sea shelf edge northwest of the Pribilof Islands in the mid-1970s. Snails, subsequently, were incorporated as an "unallocated species" in the 1981 BSAI groundfish plan and will not be discussed further in this section.

The balance of specificity between FMPs and their implementing regulations has changed over time. Early FMPs contained very specific management measures and harvest levels that could only be changed through a lengthy plan amendment process, which could require 18 to 24 months from problem identification to a change in management. Under the plan amendment process, changes in harvest limits often lagged behind changes in stock abundance. In addition, federal regulations often lagged behind changes in regulations for adjacent state waters, causing conflicts and confusion where stocks had to be managed as a unit throughout their range.

The description of evolution of the FMPs and their regulations that follows will emphasize five issue areas: 1) target species protection, 2) bycatch control, 3) the social and economic well-being of domestic resource users, 4) marine mammal and seabird protection, and 5) habitat protection. Table 2-1 provides an overview of major management changes. Figure 2-1 shows changes in the balance of domestic, joint venture, and foreign harvests over time.

2.1 1977 Preliminary Groundfish Fishery Management Plans

In the BSAI, optimum yields (OYs) were established for nine species or species groups: pollock, yellowfin sole, other flounders, Pacific ocean perch, sablefish, Pacific cod, herring, squid, and other species. Fishing allocations were granted to Japan, the Soviet Union, South Korea, Taiwan, and Poland. Management measures were designed to arrest the decline in abundance of overfished stocks and allow them to rebuild. For the first time in foreign fisheries off Alaska, the entire region could be closed to all fishing by a nation that had harvested its allocation of any species. This measure had never been accepted in former bilaterals. Additionally, trawling in certain areas was prohibited from December 1 to May 31 to protect spawning concentrations of pollock and flounders. Foreign vessels were required to report catch and effort, monthly and annually, and provide check-in and check-out reports by radio. All vessels were required to provide accommodations for an observer at no cost to the U.S.

The FMPs also significantly restricted the impact of foreign fisheries on domestic fisheries for halibut, crab, shrimp, and salmon. In the Bering Sea, for example, the demise of the halibut resource had been well documented over the previous ten years with combined U.S., Canadian, and Japanese setline catches in the Bering Sea; falling from a high of over 14,000 mt in 1962 to around 300 mt or less in 1973-1975 (BSAI FMP). Though it was caused partially by the directed setline fishery, it was aggravated by the enormous incidental catch of juvenile halibut by Japanese and Soviet trawlers. Japan had agreed under the bilaterals to not retain halibut caught in trawls east of 175°W except in INPFC Area D, where they were retained for a short period in the spring. The Soviets had never agreed to refrain from fishing halibut, but maintained that their vessels did not target halibut or take any as bycatch. Few observers were allowed on Soviet vessels under the bilaterals, and the Soviets were well-known for under-reporting their catches of target species and, presumably, bycatch as well.

Regional restrictions in the BSAI FMP included a ban on retention of salmon, halibut, and crabs, and no fishing at all for shrimp, which earlier had been fished nearly to extinction by foreign fleets. Foreign fishing was not allowed within 12 nm, except at certain times of the year in parts of the Aleutian Islands. Specifically to protect juvenile halibut, no trawling was allowed from December 1 through May 31 in a large area north of the Aleutian Islands and east of 170°W, which later would be called the Winter Halibut Savings Area (Figure 2-2); and in an area just south of the Pribilof Islands known as the Misty Moon Grounds. The Misty Moon Grounds was a holdover from the bilaterals, wherein foreign vessels were not allowed to trawl for seven days surrounding the U.S. and Canada halibut fishery each spring to reduce gear conflicts and disturbance to prime halibut fishing grounds. Further, the Bristol Bay Pot Sanctuary, north of the Alaska Peninsula running from the eastern boundary of the Winter Halibut Savings Area east to 160°W, was closed to trawling all year. These closures provided protection for juvenile halibut over an area of about 41,413 square nm, and a distance of about 420 nm along the northern coast of the Aleutian Islands and Alaska Peninsula. The Bristol Bay Pot Sanctuary's other main purpose was to prevent conflicts between foreign mobile trawl gear and U.S. crab pots.

Table 2-1. Brief history of fisheries management measures.

Target species	Bycatch controls	Socioeconomic benefits	Marine mammals/seabirds	Habitat
Bilaterals: pre-1977 (foreign fisheries only)				
• Foreign fishing catch quotas for eastern Bering Sea (BS) pollock/flatfish and Gulf of Alaska (GOA) Pacific Ocean perch/sablefish-self-monitored.	• Time/area closures to reduce halibut and crab bycatch. • No halibut retention in trawls. • Limited monitoring of bycatch of halibut.	• Foreign fishing time/area closures to reduce conflict with domestic fisheries for halibut and crab.	• Foreign fishing closures to protect Pribilof fur seals. • Short-tailed albatross designated endangered, 1970.	N/A.
Preliminary management plans: 1977 (foreign fisheries only)				
• Total allowable catches (TACs) and TAC-related closures in Bering Sea and Aleutian Islands (BSAI) and GOA. • Monthly/annual catch reports. • Observers. • Trawl area closures to protect spawning pollock and flounders.	• Time/area closures expanded. • No retention of halibut, crab, salmon, shrimp. • Bristol Bay Pot Sanctuary closed to trawling all year. • No herring fisheries east of 168°West (W) in BS. • Extensive trawl closures in GOA to protect halibut.	• Foreign fishing time/area closures to reduce conflict with domestic fisheries for halibut and crab.	• Recognition of direct/indirect effects of fisheries on marine mammals and seabirds.	N/A.
First fishery management plans: 1979–1982 (mainly foreign fisheries)				
1979–<u>GOA</u> Species optimum yields (OYs)/three areas: • 20 percent reserve. • OY closures. • Catch monitoring/ reporting/ observers (foreign vessels only). 1982–<u>BSAI</u> Species OYs/two areas: • Four species categories. • Objective: rebuild depleted stocks. • Monitoring/ observers (foreign vessels only). • 5 percent or 500 metric tons (mt) reserve. • TAC closures.	<u>GOA</u> Objective: Protect halibut • No retention of prohibited species catch (PSC) species. • Bottom trawl restrictions. • Domestic halibut PSC for part of year. • Expanded time/area closures. <u>BSAI</u> Objective: Rebuild halibut • Expanded time/area closures. • PSCs in separate category. • No closures for United States (U.S.) fishermen. • Foreign longline depth restrictions to protect halibut.	<u>GOA</u> • Domestic priority to groundfish. • Year-round closures to foreign fishing inside 12 miles. • three closures off southeast Alaska. • Davidson Bank closed. <u>BSAI</u> Objective: Develop U.S. fisheries • Time/area closures in Bristol Bay Pot Sanctuary, Petrel Bank, and other areas to prevent gear conflicts and grounds preemption.	• Descriptions of marine mammal and seabird issues in Fishery Management Plans.	Descriptions of habitat.

Table 2-1 (cont.). Brief history of fisheries management measures.

Target species	Bycatch controls	Socioeconomic benefits	Marine mammals/seabirds	Habitat
1983–1985 (mainly foreign and joint venture fisheries)				
Expanded catch reporting requirements for domestic vessels: • OY range in BSAI. • Annual stock assessment document in BSAI. • Directed Fishing Standards. • Species categories in BSAI/GOA. • Western and Central GOA. combined for pollock. • GOA pollock TAC reduced in response to scientific advice.	GOA • Cod total allowable level of foreign fishing (TALFF) in GOA allocated to foreign longliners to reduce trawl bycatch. • Foreigners must report bycatch. • Biodegradable panels in sablefish pots. • Southeast (east of 140°W) closed to all foreign fishing to protect halibut . • Halibut PSC raised for U.S. fishermen, but pelagic trawls exempted. • Foreigners must use off-bottom trawls all year. • Joint ventures have observers on foreign processors. • Major PSC framework in GOA. BSAI: • Chinook salmon PSC. • Also PSC on halibut, crab. • Foreign trawl restrictions in Petrel Bank. • Major policy statement for U.S. fisheries to control their bycatch.	GOA • Kodiak Gear Area closed to foreign trawls to protect. crab fishermen and gear • U.S. trawls and pots banned in eastern GOA for sablefish. • Magnuson-Stevens Act priority allocations to U.S. fishermen.	BSAI • Overall OY set low to help marine mammals and seabirds. • North Pacific Fishery Management Council (NPFMC) votes later to keep 2 million mt cap.	NPFMC prohibits discard of net and debris.

Table 2-1 (cont.). Brief history of fisheries management measures.

Target species	Bycatch controls	Socioeconomic benefits	Marine mammals/seabirds	Habitat
1986–1990 (Mainly Joint Venture and Domestic Fisheries)				
GOA • OY Range. • Reporting requirements for U.S. catcher processors. • Shelikof District to protect pollock. • Comprehensive observer program (BSAI/GOA). BSAI • Revised definitions of acceptable biological catch (ABC), threshold, overfishing definitions. • Ban pollock roe stripping (BSAI and GOA).	GOA • Type I–III closures off Kodiak. • Framework PSC in GOA. • Observer program. • 2,000 mt PSC halibut for U.S. trawlers; 750 mt for longliners. • Ban pollock roe stripping. • Maximum retainable bycatches introduced. • Full utilization policy. • Apportion halibut PSC by quarter. • Halibut excluder devices and biodegradable panels on sablefish pots. BSAI • First total closures to U.S. trawling. • Observer program. • PSC limits for halibut, crab, herring. • PSC closures. • Season delays to protect halibut. • Seasonal PSC allocations.	• Foreign fisheries end in economic exclusion zone (EEZ). • Joint ventures peak in 1987 and rapidly decline.	• NPFMC votes against raising 2 million mt OY cap in BSAI. • Walrus Island closure. • Steller sea lions listed as threatened. • Initial sea lion protections implemented. • National Marine Fisheries Service (NMFS or National Oceanic and Atmospheric Administration [NOAA] Fisheries) begins monitoring seabirds and fishing interactions.	• NOAA Fisheries policy added to Fishery Management Plan (FMP). • NPFMC approves habitat policy and committee. • Bottom trawl closures.

Table 2-1 (cont.). Brief history of fisheries management measures.

Target species	Bycatch controls	Socioeconomic benefits	Marine mammals/seabirds	Habitat
1991–1995 (Fully Domestic Fisheries)				
• New overfishing definitions. • Bogoslof District established. • Pacific ocean perch rebuilding plan. • Aleutian Islands District for Atka mackerel. • Sablefish/Halibut individual fishing quotas (IFQs).	• Biodegradable panels on all pots. • Refined pelagic trawl definition. • Hotspot authority. • Herring PSC revised. • Experimental fishing permits. • Seasonal delays to reduce bycatch. • Vessel incentive program (VIP) program. • Careful release program. • Halibut PSC based on mortality. • Salmon donation program. • Seine/gillnet ban for groundfish. • Chum salmon PSC. • Minimum mesh size in trawls. • Expanded Bering Sea closures. • Pribilof closure.	• Pollock/cod inshore-offshore. • Community development quotas (CDQs). • IFQs. • Pribilof closure. • Moratorium.	• Spectacled eider listed. • Observers on crab vessels receive seabird identification training. • Rookery/haulout closures. • Pollock allocation by area and season. • GOA pollock set low to help sea lions. • Sea lion recovery plan. • Aleutian Islands subarea – Atka mackerel. • Sea lion critical habitat designated. • Pribilof closure.	• Pribilof closure.
1996–2000+ (Fully Domestic Fisheries)				

• GOA Pacific ocean perch rebuilding plan revised.
• Overfishing definitions revised twice.
	• Red king crab PSC revised.
	• Closed nearshore areas.
	• Halibut donation program.
	• Opilio Tanner crab PSCs.
	• Bairdi Tanner crab PSCs.
	• Improved retention/utilization program.
	• Bottom trawl ban for pollock.
	• Chinook PSCs enacted and then reduced.
	• Halibut mortality avoidance pilot program.
	• Full retention of demersal shelf rockfish.
	• Forage fish ban.
		• Inshore-offshore allocations extended.
		• Atka mackerel jig allocation.
		• CDQ.
		• Moratorium.
		• License Limitation Program.
		• Cod allocations by gear type.
			• Seabird avoidance measures.
			• Take limits on short-tailed albatross.
			• More sea lion critical habitat designated.
			• Forage fish ban.
			• Extensive sea lion protective measures.
				• Essential fish habitat (EFH) guidelines.
				• EFH descriptions in FMPs.
				• Sitka Pinnacle closure.
				• Habitat area of particular concern (HAPC), Part I: no commercial fishing for sponges and corals HAPC
				  • Part II: Stakeholder process begins.
				  • Non-pelagic trawl closures.

Source: NOAA Fisheries

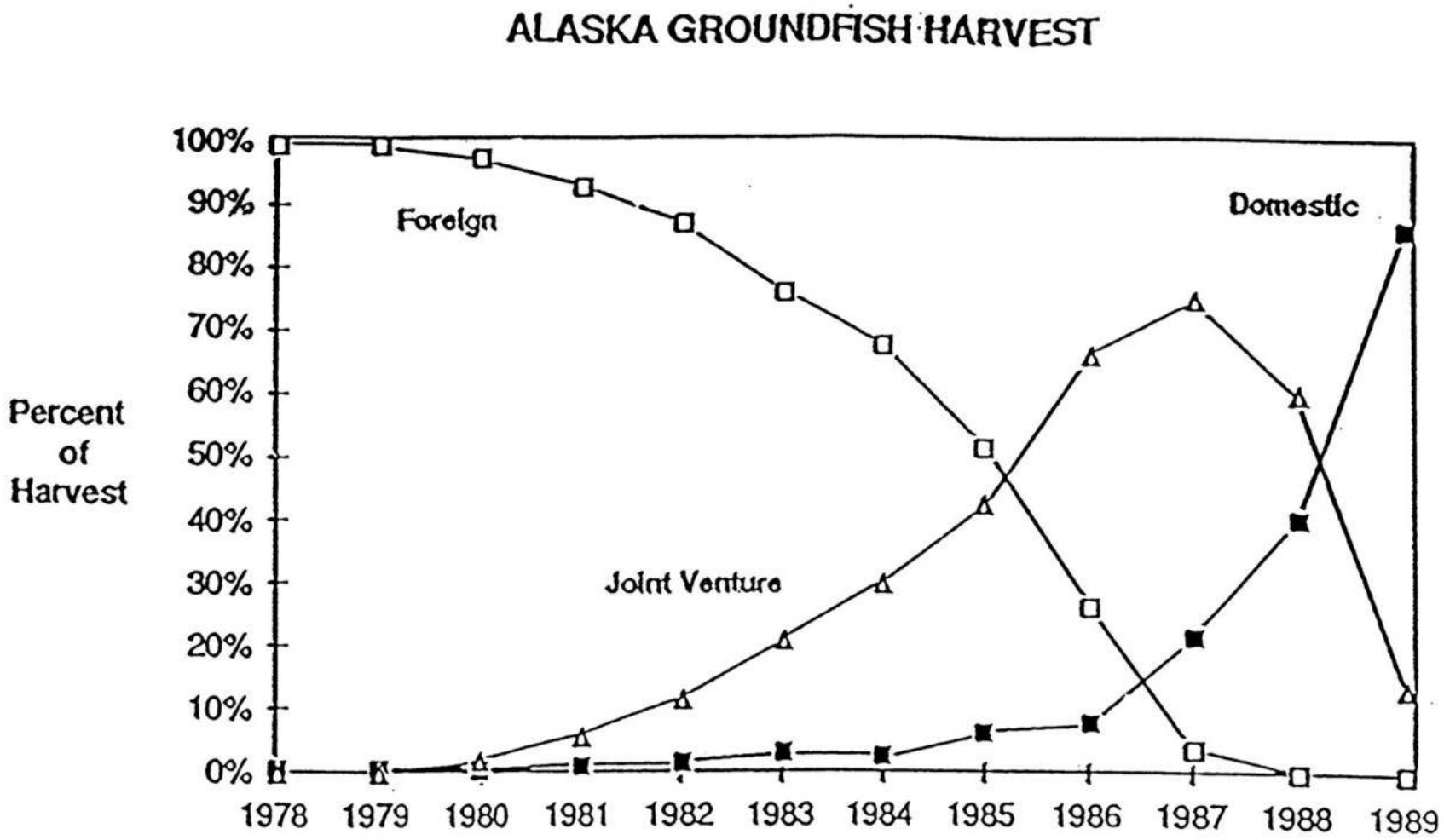

Figure 2-1. Shows changes in the balance of domestic, joint venture, and foreign harvests over time.

To prevent overexploitation of specific herring stocks important to the well-being of Native fishermen and villages, no herring fishing was allowed east of 168°W and north of 58°N. Concerns were also raised about bycatch of chinook salmon, mainly around Unimak Island, but no specific measures were placed in the FMP other than a prohibition on salmon retention in the trawl fisheries. Further, the FMP noted that impacts on marine mammals included 1) direct impacts from trawl netting, plastic wrapping bands, and other debris around their necks or bodies and 2) indirect impacts of the fisheries competing for some of the same species of fish and shellfish used as food by the northern fur seal and other marine mammals.

In 1977, GOA fisheries were also mostly foreign, although there were domestic fisheries for sablefish mainly off southeastern Alaska and emerging interest in other groundfish species, particularly off Kodiak Island. The GOA groundfish FMP set foreign catch quotas for pollock, rockfish, flounders, Pacific cod, Atka mackerel, and other species, and set aside amounts of most species for the developing U.S. fishery. U.S. management policy for the GOA, as stated in the FMP, was to 1) ensure adequate potential for development of new U.S. fisheries, 2) protect the halibut resource so it could rebuild to provide maximum sustainable yield (MSY), and 3) allow for foreign fisheries, consistent with the other two objectives. Like the BSAI FMP, the GOA FMP had similar provisions regarding the closure of foreign fisheries on quota attainment, and identical provisions for reporting, monitoring, and observer requirements.

Bycatch protections in the GOA FMP included prohibitions on retention of halibut, salmon, shrimp, herring, and creatures of the continental shelf such as crab (this category was termed Continental Shelf Fishery Resources or CSFR in the FMP). No trawling was allowed within 12 nm (except at 169°–170°W) to prevent gear conflicts and catch of inshore species. Six Kodiak Island Gear Areas were closed to foreign fishing from August 10 through May 31 to prevent conflicts with U.S. crab pots and halibut setlines. To protect emergent domestic fisheries in Dutch Harbor and Sand Point, no trawling at all was allowed in the Davidson Bank area. Other areas were closed throughout the GOA to reduce halibut bycatch. Three additional areas were closed around Kodiak Island within five days of the halibut fishery so the grounds would be undisturbed and gear conflicts with U.S. fishermen would be reduced. A rule change to the FMP in April 1978 further restricted foreign fishing by limiting the cod fishery west of 157°W and inside the 500-m isobath to longlines to reduce bycatch of other species and prevent gear conflicts during the halibut season.

The sablefish FMP regulated foreign setline fisheries from southeastern Alaska down the Pacific coast off Washington and Oregon. Foreign fisheries for GOA sablefish were prosecuted by longliners from Japan, South Korea, and Taiwan. The FMP established sablefish total allowable catches (TACs) for the BSAI, GOA, and Pacific coast. All were allocated to foreign fisheries or total allowable level of foreign fishing (TALFF) in the BSAI. In the GOA, TALFF was 19,500 mt and Domestic Annual Harvest (DAH) was 2,500 mt. There was no TALFF farther south off the Pacific coast. There were no time area restrictions in the Bering Sea, but there were various year-round and temporary closures in the Aleutian Islands. In the GOA, the foreign setline fishery had to stay outside the 500-m depth contour to reduce gear conflicts with domestic fishermen. Also, a limit was placed on the number of vessel-days a nation could fish. Sablefish management measures were merged into the groundfish FMPs, beginning with the GOA, in 1978.

While there were no direct measures controlling the impacts of the fisheries on marine mammals and seabirds, other than restrictions on operating too close to the Pribilof Islands, each of the groundfish FMPs recognized and discussed direct and indirect affects of fishing on marine mammals and seabirds.

In summary, the FMPs continued and enhanced provisions of the bilaterals. In many respects, they established the fundamental philosophy for managing the fisheries in future years as they became completely Americanized in the late 1980s. Harvest limits were set for each main species, and fishing ceased when the limit was reached. Catch reporting and observers were required. Time-area closures and non-retention of prohibited species, such as salmon, halibut, crab, and shrimp, were the main approaches to protecting non-groundfish species that were important target species for domestic fisheries. Time-area closures were also used to protect domestic fishermen from grounds preemption and gear conflicts caused by mobile foreign trawl gear.

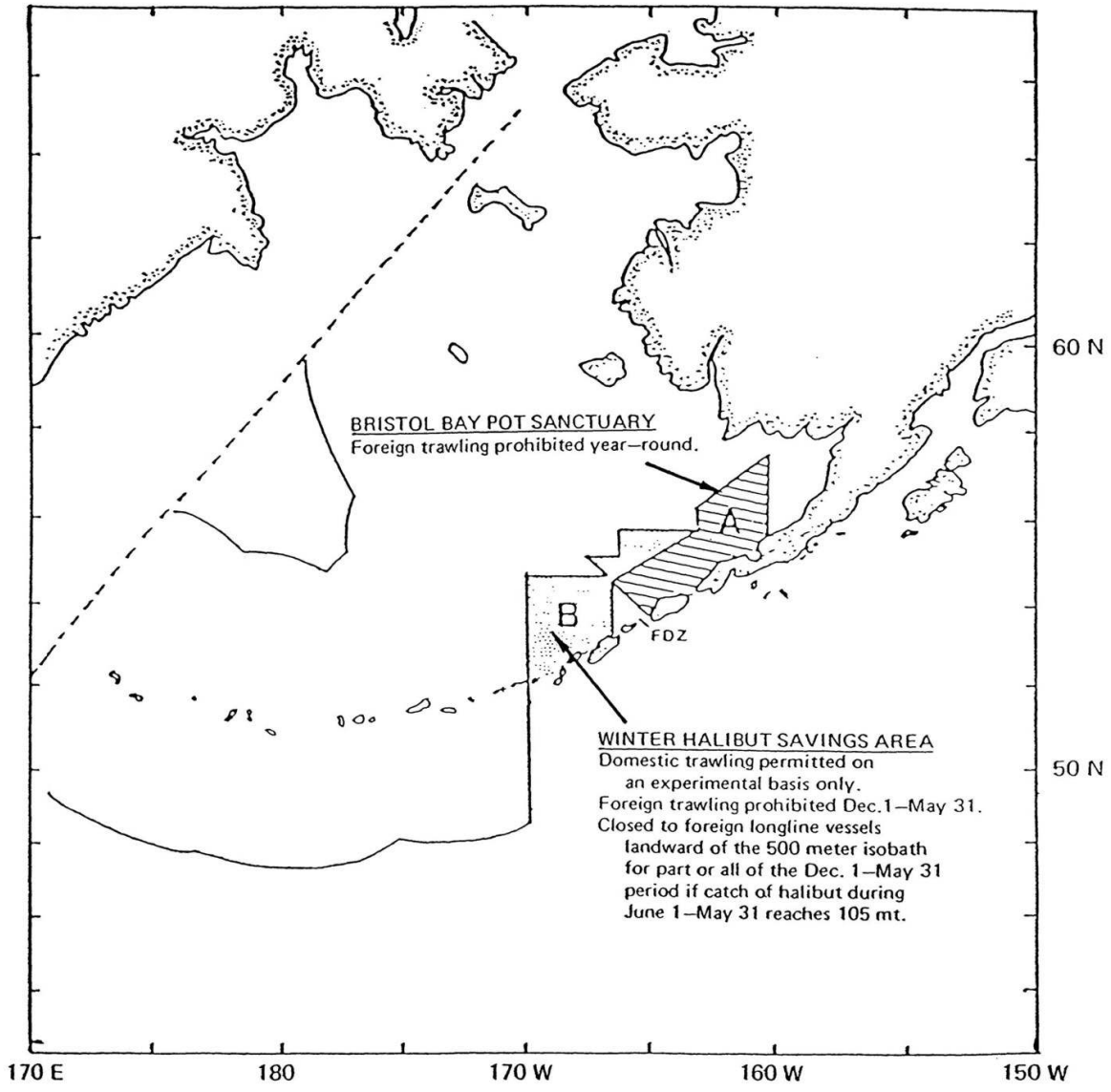

Figure 2-2. Restrictions on domestic and foreign fishing for groundfish in two areas in the eastern Bering Sea. Source: Fredin 1987.

2.2 1979–1982 Fishery Management Plans

The North Pacific Fishery Management Council (NPFMC) first convened in October 1976. One of its major tasks was to develop FMPs for the groundfish fisheries to replace the FMPs which applied only to foreign fisheries. The first FMP developed was for the GOA, implemented in January 1979; the BSAI FMP was implemented in 1982. Both plans carried forward most of the FMP management measures. Optimum yields were set for each of the main species, and species complexes and fisheries were closed when the OY was reached. The concept of a set-aside, or reserve was introduced to provide allocations to individual fisheries in season. The reserve in the GOA was 20 percent of each species. In the BSAI, the greater of 5 percent or 500 mt of each species was set aside. The OYs were distributed by management areas in both FMPs. The BSAI FMP had a specific objective to rebuild depleted groundfish stocks.

The first FMPs placed an emphasis on protecting prohibited species and the associated domestic fisheries. For example, each plan had an objective to protect halibut. The ban on retention of halibut in trawls was carried forward and some time-area closures were expanded (Figure 2-2). Bottom trawl restrictions were applied to the foreign fisheries, and depth restrictions were set on foreign longline fishing for Pacific cod in the Winter Halibut Savings Area in the eastern Bering Sea. For the first time in the GOA, domestic trawlers had a halibut prohibited species catch (PSC) cap, which, when reached, prohibited fishing with other than off-bottom trawls. No restrictions were placed on domestic fishermen in the Bering Sea other than non-retention of PSC species.

In summary, the first FMPs for groundfish were developed mainly to control the predominantly foreign fisheries, but they established the fundamental management tools that would later be used to control domestic fishing. FMP restrictions on foreign fisheries were carried over into the FMPs expanded in many cases to further two policy objectives: 1) protecting target groundfish species, and 2) protecting bycatch species and the associated domestic fisheries. A PSC limit for halibut for domestic trawlers was implemented for the first time off Alaska in the initial GOA FMP.

2.3 1982–1985 Groundfish Management

By the end of 1985, only minor foreign fisheries, harvesting pollock and Pacific cod, were being allowed in the GOA; foreign harvesting continued in the Bering Sea, but even there, foreign trawling had ended within 20 nm of the Aleutian Islands, and foreign longlining for cod was restricted to north of 55°N and west of 170°W, depending on ice conditions. Foreign harvests dropped to less than 1 million mt in 1985. In contrast, U.S.-foreign joint ventures grew rapidly through the early 1980s. They harvested about 880,000 mt in 1985, using over 100 U.S. trawlers working within some 28 different company arrangements with such countries as Japan, South Korea, Poland, the Soviet Union, Portugal, and Iceland. Completely domestic annual processing reached 105,000 mt in 1985, mostly by trawler catcher processors, also called factory trawlers. Pollock stocks in the GOA-Shelikof Straits were beginning to decline rapidly.

Target Species

The most significant change in management of target species was made in the BSAI groundfish FMP with the setting of an OY range from 1.4 to 2.0 million mt of groundfish, then using the specifications process to set TAC for each species, which, when combined, could not exceed the upper end of the OY range. A resource assessment document for the BSAI contained a full description of each stock and its current condition. Developed in 1984, it established in one document all the information needed to set the harvest levels for each groundfish species and species complex. A similar document would later be developed for the GOA groundfish fisheries (as would an OY range and TAC-setting process), which would later set the standard for the development of stock assessment and fishery evaluation documents required of all regional fishery management councils in the U.S.

Bycatch Control

The other main policy emphasis during the 1982–1985 period was on control of bycatch. By 1985, the remaining foreign fisheries were required to use off-bottom trawls year-round in the GOA, and much of the Pacific cod TALFF had been allocated to foreign longliners to reduce the bycatch that otherwise would have been incurred by trawlers. To protect halibut, southeast Alaska, east of 140°W, was closed to all foreign fishing in 1982. In the Bering Sea, a major bycatch reduction plan was established for foreign fisheries (Amendment 3) to decrease the bycatch of halibut, chinook salmon, bairdi Tanner crab, and red king crab over a five-year period.

Additional restrictions were placed on foreign fisheries, but with their directed harvest declining rapidly, management attention began to focus more on the rapidly developing joint venture fisheries and the completely domestic groundfish fisheries. Domestic groundfish fishermen could not retain PSC species, and only the PSC limit for halibut in the GOA could close on-bottom trawling. The PSC limit applied only to the western and central GOA Districts, but in 1984 it was applied to the entire GOA in response to the rapidly developing domestic trawl fisheries. Pelagic trawlers and longliners were exempted from PSC-related closures. In addition, biodegradable panels were required on all sablefish pots. Bering Sea domestic groundfish fishermen had no PSC limits, but when it passed Amendment 3, NPFMC made a major policy statement on the need for U.S. fishermen in the Bering Sea to monitor and control their bycatch. A major PSC framework for specifying PSC and allocating it to various sectors and seasons was established for the GOA and later applied to the BSAI. Observers were required on all joint venture processor vessels, and continued catch reporting on target and bycatch harvest as the foreign fisheries wound down.

Social and Economic Benefits

The priorities in the MSA require that fish be allocated first to totally domestic operations, then to joint ventures, and last to foreign directed fisheries. Therefore, when a sector of the U.S. industry established that it could harvest a certain amount, that amount had to be set aside for it; thereby creating economic benefits for domestic fishermen and communities. Two other measures that directly benefitted domestic fishermen were 1) a ban on the use of trawls and pots in the southeast Alaska sablefish fishery, leaving it for longliners, and 2) expansion of the Kodiak Island Gear Areas into one large area, bounded by the "Lechner Line," and its closure to all foreign trawling to protect the red king crab grounds.

Environmental Benefits

The NPFMC voted to prohibit the discard of nets and debris, which often caused entanglement and thus mortalities among marine mammals and other sea life.

Summary

By the end of 1985, both groundfish plans had been on-line for at least four years, and attention was increasingly focused on the rapidly growing domestic fleet, particularly trawlers working in foreign joint ventures. Conservative management of target fisheries was still the norm for both foreign and domestic fisheries, but the main policy emphasis, in terms of time and effort spent on the development of management measures, was on bycatch control.

2.4 1986–1991 Groundfish Management

During the five years between 1986 and 1991, the groundfish fisheries became totally domestic. The last years of foreign directed fishing in the BSAI and GOA were 1987 and 1986, respectively. Foreign joint ventures peaked in 1987, and their last years of operation in the Bering Sea and the GOA were 1991 and 1988, respectively. Americanization of the fishery happened more quickly than anyone had anticipated, and much of the management effort turned to determining how to restrict the impacts of the burgeoning domestic groundfish fleet on traditional fisheries for crab, halibut, salmon, and herring. Whereas the cumulative impacts of the bilaterals, the FMPs, and first FMPs in controlling bycatch had been aimed directly at the foreign fleet, managers now had to rapidly address bycatch problems caused by the domestic fleet, protect target species, and still allow for continued development of domestic fisheries.

Target Species

The basic management measures were already in place for the domestic fleet. Conservative harvest quotas (e.g., quotas set low due to uncertainty in state statutes) that had been applied to the foreign fleet were now applied to the domestic fleet. The GOA FMP was revised to incorporate an OY range and individual TACs within that range, mirroring the BSAI FMP. Overfishing definitions were also added to the BSAI FMP. The pollock stock in the western and central GOA declined significantly in 1986–1990, and NPFMC set lower harvest levels every year in response to scientific advice. The NPFMC also rebuffed several efforts to raise the OY limit in the BSAI to prolong the foreign joint venture operations. The NPFMC chose not to revise the OY limits because of concerns about the amount of groundfish taken outside the EEZ, the uncertainties in the amount of pollock and other groundfish species to support Steller sea lions, other marine mammals and seabirds, and the reliability of methodology used to determine acceptable biological catches (ABCs), among others.

The demise of the foreign directed fisheries and joint ventures left a large gap in at-sea data collection. Observers had been required on all foreign fishing and processing vessels, to cover activities and provide verification of catches. There was no observer coverage on the growing domestic fleet, despite some provisions which called for domestic vessels to take observers in certain areas when requested by National Marine Fisheries Service (NMFS or National Oceanic and Atmospheric Administration [NOAA] Fisheries). In the late 1980s, a small pilot observer program, funded partially by industry and partially by government, provided observers for a half-dozen volunteer trawlers in the BSAI and GOA. Frustrated by the lack of observer coverage and the lack of federal funding available, NPFMC voted to impose an industry-paid, comprehensive Observer Program on the domestic fleet beginning in 1990. It required 100 percent observer coverage on all vessels over 124 feet (ft) and 30 percent coverage on those between 60 ft and 124 ft. This program provided comprehensive catch verification and bycatch monitoring. It has endured over the past 10 years and is a critical component of North Pacific stock management. It provides the basis for control of target species harvest, and bycatch monitoring and interactions with marine mammals. Without the Observer Program, monitoring of deployment of the complex innovative bycatch management regimes now used in the domestic fisheries would have been difficult, if not impossible.

Bycatch Control

As noted, bycatch control in the domestic fisheries was a major policy emphasis in 1986–1990. Extensive closures were imposed on domestic trawlers around Kodiak Island and in the eastern Bering Sea to protect red king crab (Figures 2-3 and 2-4). Some closures were complete and year round; others were for parts of the year and applied just to bottom trawling. Bycatch limits were set for halibut, red king crab, and bairdi Tanner crab. At first, these limits were applied only to the joint venture flatfish fisheries, but by 1990 they were widely applied to the entire domestic fleet through a complex allocation of PSC by area, season, gear, and fishery sector, including both trawl and fixed gear. These PSCs closed down the fisheries for varying lengths of time. In 1990, a PSC limit was placed on herring for the trawl fleet. Also during 1986–1990, NPFMC and NOAA Fisheries developed the directed fishing standards that limit the amounts of a groundfish species that could be retained after the directed fishery for that species had closed. These measures allowed directed fisheries to be protected by bycatch-related closures in other directed fisheries. For example, the relatively high-bycatch fisheries for rock sole and yellowfin sole, when closed, would not impact continuation of the low-bycatch pollock fisheries. In summary, the complex program for controlling bycatch in domestic fisheries was established in 1986–1990, although it would be fine-tuned in years to come.

Social and Economic Benefits

The MSA's allocation priorities to domestic fishermen continued the favorable conditions for growth of the U.S. fishing industry off Alaska, and commensurate benefits to the communities and individuals that depended on it. Bycatch controls and time area closures to minimize grounds preemption and gear conflicts with traditional fisheries for halibut and crab also conferred economic benefits to domestic fisheries.

Environmental Benefits

Closures of groundfish fishing to protect walrus were implemented around Round Island, the Twins, and Cape Peirce from 3 to 12 miles from April 1 through September 30, beginning in 1990. That same year, NOAA Fisheries listed Steller sea lions as threatened under the ESA and implemented several measures to reduce direct impacts on them. These measures included a ban on shooting at sea lions, reductions in incidental kill quotas, and 3-mile buffer zones around principle rookeries. During those five years, NPFMC voted against raising the BSAI 2-million-mt groundfish cap, which reduced the probability of adverse impact of fishing harvests on food abundance for marine mammals and seabirds. Additionally, NOAA Fisheries began monitoring fishery interactions with seabirds and marine mammals, helped significantly by the comprehensive Observer Program.

NOAA Fisheries's policy on habitat was added to both the BSAI and GOA groundfish plans in 1986. In 1988, NPFMC approved its own habitat policy and established a habitat committee to review permit requests for significant developments that might impact fish habitat. The extensive trawl closures enacted in the BSAI and in the GOA also conferred protection on habitat.

Summary

The major new policy initiatives during 1986–1990 were control of bycatch, protection for marine mammals, and protection of habitat. Conservative management and control of target groundfish species harvests continued. The strong foundation for protecting target species had been established in the earlier period for

foreign fisheries and those measures, reinforced by the industry-paid comprehensive Observer Program beginning in 1990, were continued in the domestic fleet as it expanded.

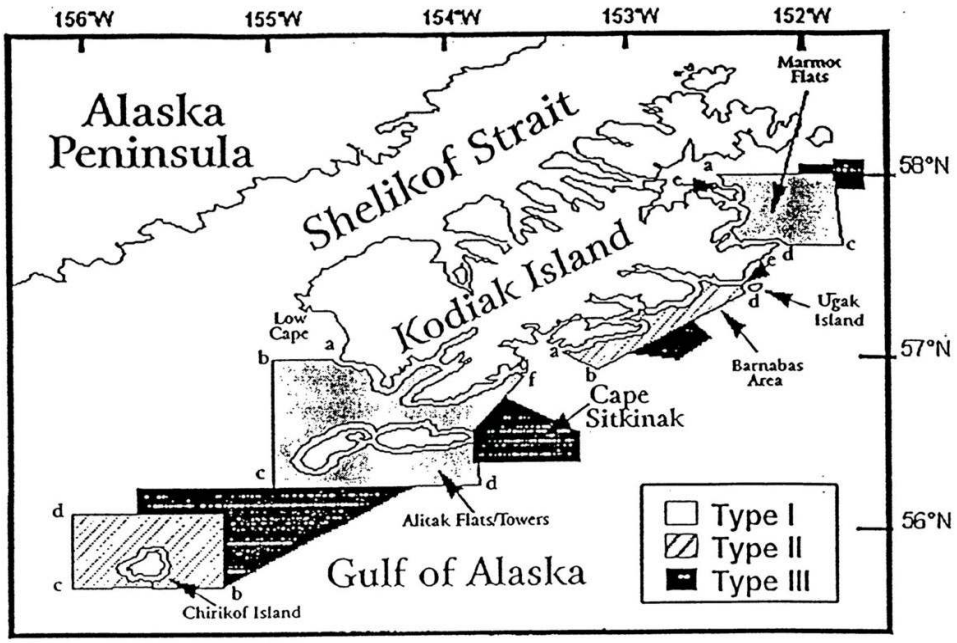

Figure 2-3. Kodiak Island non-pelagic trawl gear closures. Source: NPFMC.

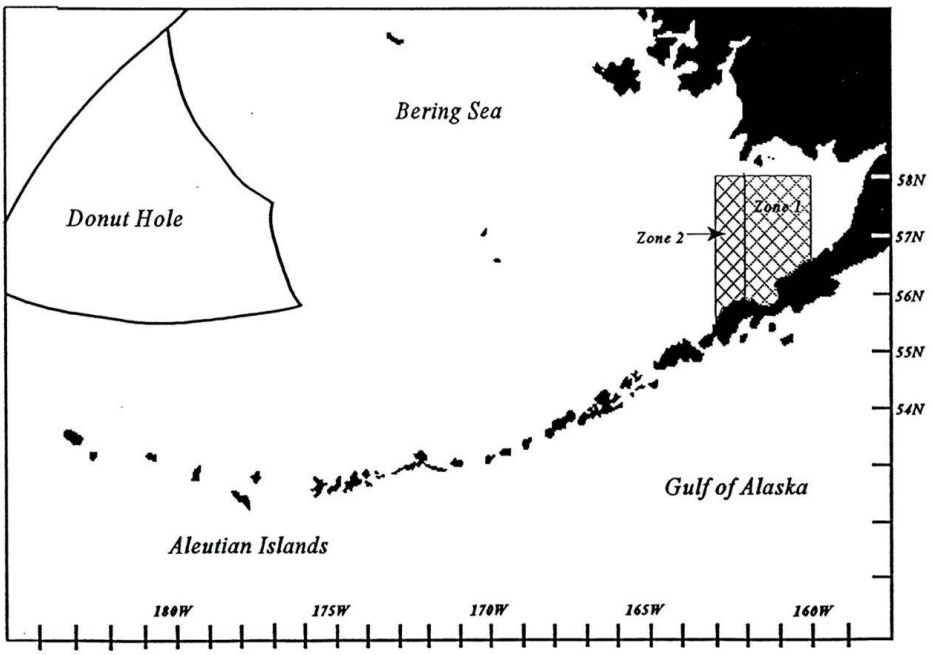

Figure 2-4. Crab and halibut protection zones. Source: NPFMC.

2.5 1991–1995 Groundfish Management

Beginning in 1991, the groundfish fisheries were fully domestic and they grew rapidly. By 1995, the groundfish fleet contained 1,545 vessels, including 1,159 vessels fishing with hook-and-line gear, 263 with pots, and 264 with trawls. Some of these vessels using more than one gear type; about 120 were catcher processors. The groundfish fleet vessels came mainly from communities in Alaska, Washington, and Oregon. Their total groundfish harvest in 1995 was approximately 2.1 million mt, with 90 percent coming from the BSAI management area. The overall catch was 65 percent pollock, 15 percent Pacific cod, 12 percent flatfish, 4 percent Atka mackerel, 2 percent rockfish, 1 percent sablefish, and lesser amounts of other species. Intense allocation disputes arose over pollock and Pacific cod. For the BSAI, actions were taken to allocate pollock and Pacific cod between the inshore and offshore processing sectors and between gear-type groups. The problem of excess fishing capacity in most sectors of the groundfish fleet began to be addressed during this period as well.

Target Species

New overfishing definitions were incorporated in the FMPs, a ban on pollock roe stripping was implemented, and the Bogoslof District in the Bering Sea was established as a separate management area for pollock. This latter measure was intended to isolate and control harvests of the component of the pollock stock that was associated with the Aleutian Basin pollock stock, which at the time was being heavily fished in central Bering Sea international waters by foreign fleets displaced from the U.S. EEZ. Additionally, the Aleutian Islands management area was partitioned into three separate areas to manage Atka mackerel and later, pollock. In the GOA, a rebuilding plan was implemented for Pacific ocean perch stocks, which had been decimated by Soviet fisheries in the 1960s and have still not recovered. These new measures were overlain on the existing conservative harvest management system.

Bycatch Control

Various restrictions were placed on the construction of groundfish gear to minimize bycatch not only of PSC species, but also of juvenile components of the groundfish stocks that had no market value, and, therefore, were discarded. For example, biodegradable panels and halibut excluder devices were required on all groundfish pots. Other restrictions included minimum mesh size in trawls, careful release mechanisms for the longline fishery, and refined definitions of pelagic trawls. Seines and gillnets were prohibited in the groundfish fisheries because of their indiscriminate bycatch. The Vessel Incentive Program was applied to the fisheries, establishing bycatch rate standards for PSC species. Hotspot authority was granted to allow NOAA Fisheries to close areas of high bycatch. A herring PSC limit was applied to the trawl fishery in the BSAI, and halibut PSC monitoring changed to a mortality basis. PSC limits were established for chum salmon in the Bering Sea and more Bering Sea areas were closed to protect red king crab. The chinook salmon bycatch donation program to food banks was approved, and a large area around the Pribilof Islands was closed to trawling for halibut and crab protection as well as other purposes.

Social and Economic Benefits

Measures enacted during this period addressed the intense competition for groundfish resources. Pollock and Pacific cod were allocated between the offshore and inshore sectors, and the Community Development Quota (CDQ) Program was established in the BSAI. Capacity problems in the groundfish and crab fisheries were addressed with a moratorium on further entry, beginning in 1995, and an Individual Fishing Quota (IFQ)

Program was implemented in 1995 for the fixed-gear sablefish and halibut fisheries. The Pribilof Islands trawling closure, described above, conferred benefits on local residents.

Environmental Benefits

The Pribilof Islands closure also provided protection for marine mammals and seabirds. The 1991–1995 period also saw broad implementation of closures to further protect the Steller sea lion. For example, NOAA Fisheries closed areas year-round to trawling within 10 miles of 37 Steller sea lion rookeries, and within 20 miles during the pollock A season (January 20–April 15) around five rookeries in the BSAI. There were comparable closures in the GOA.

To reduce competition for prey and avoid localized depletion, the pollock TAC was spread over three areas, and the amount of excess pollock that could be taken in a quarter was limited. In 1993, NPFMC reduced the GOA pollock limit significantly below the biologically safe harvest level in order to provide food for sea lions and for ecosystems needs. The pollock ABC for 1993 was 160,000 mt, but the harvest level was set at only 111,000 mt. In March 1993, NOAA Fisheries published a sea lion recovery plan and in August designated Steller sea lion critical habitat. The measures taken to protect sea lions at this time were the first pervasive restrictions on fishing fleet operations. Regarding seabirds, there were no restrictions on fisheries except for the Pribilof Island closure, but observers on crab vessels did receive training in seabird recognition.

New measures to protect habitat during this period include the aforementioned Pribilof Islands closure, and new bottom trawling closures.

Summary

During the five years from 1991 to 1995, conservative harvest strategies for groundfish species continued and the Pacific ocean perch rebuilding plan for the GOA was implemented. Allocation and fishing capacity issues were in the forefront during this period, although refinements were made to bycatch controls and PSC limits. Major new policy initiatives were implemented to protect the Steller sea lion as it became more evident that competition for prey may be significant in the long-term recovery of western Alaska sea lion populations.

2.6 1996–2000 Groundfish Management

Groundfish harvests during the second half of the 1990s were around 1.9 million mt per year. Their value surpassed all other fisheries off Alaska. In 1998, for example, groundfish harvests were valued at the ex-vessel level of $385 million, compared to shellfish, $219 million; salmon, $243 million; halibut, $94 million; and herring, $11 million. The total number of vessels active in the groundfish fishery declined from 1,545 in 1995 to 1,376 in 2001, the latest year for which such data are available. Against a backdrop of conservative harvest strategies, managers implemented additional restrictions on several groundfish gears and sectors to reduce their impacts on each other and on marine mammals, seabirds, and habitat. Spurred by the Sustainable Fisheries Act of 1996 (SFA), additional measures were implemented to reduce bycatch and waste. New PSC limits were introduced and discard of some species was banned. The 1998, American Fisheries Act (AFA) also changed the way pollock fisheries were conducted and allowed for the formation of fishing cooperatives.

Target Species

Conservative harvest strategies were continued to protect target species in the groundfish complex off Alaska. Overfishing definitions were revised in response to new SFA-mandated guidelines. The GOA rebuilding plan for Pacific ocean perch was revised, and a major new program called Improved Retention and Improved Utilization (IRIU) was approved for pollock and Pacific cod in the BSAI and the GOA. IRIU requires fishermen to land all pollock and cod harvested, including juveniles. Because there is little value in these small fish, it is hoped that fishermen will avoid areas with large juvenile catch concentrations, thus avoiding the economic costs of landing an unmarketable part of the resource. The overall intent of the program is to reduce bycatch and discard of juveniles, and thus help the stocks remain robust. Beginning in 2003, IRIU will be applied to Bering Sea yellowfin sole and rock sole and to GOA shallow water flatfish species.

Bycatch Controls

More areas in Bristol Bay were closed to trawling to protect red king crab and the red king crab PSC was revised (Figure 2-5). PSC limits were established for opilio Tanner crab and chinook salmon (Figure 2-6). The bairdi Tanner crab PSC was revised based on abundance. The pollock fisheries were restricted using off-bottom trawls, and IRIU was implemented to reduce bycatch and discards in the pollock and cod fisheries, and for several flatfish species beginning in 2003. A ban on directed fisheries for forage fish was implemented in 1998. A ban on the discard of demersal shelf rockfish in fixed-gear fisheries off southeast Alaska has been approved.

Social and Economic Benefits

Measures directly affecting the social and economic benefits in the fisheries included an extension of inshore-offshore processing allocations of cod and pollock, extension and expansion of the CDQ Program in the BSAI, a small jig gear allocation of Atka mackerel in the Aleutian Islands, and Pacific cod allocations among various gear sectors in the Bering Sea. The moratorium on new entrants into the groundfish and crab fisheries was superceded by the License Limitation Program (LLP) in 2000, and the sablefish and halibut fixed-gear fisheries continued under the 1995 IFQ program. The AFA led to a reduction in fishing capacity for pollock, and a structural change in the fishery through the introduction of cooperatives for the inshore,

mothership, and offshore fleet. These changes are still playing out in the fisheries, and cooperatives may be applied to species other than pollock.

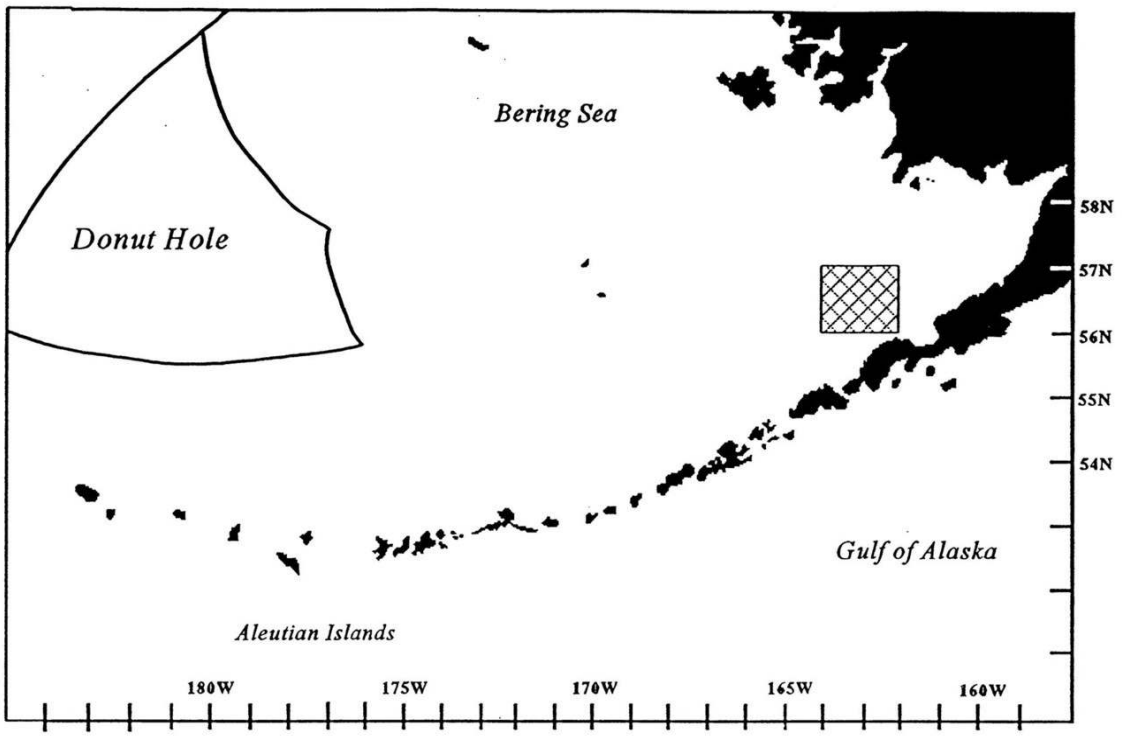

Figure 2-5. Bristol Bay red king crab savings area. Source: NPFMC.

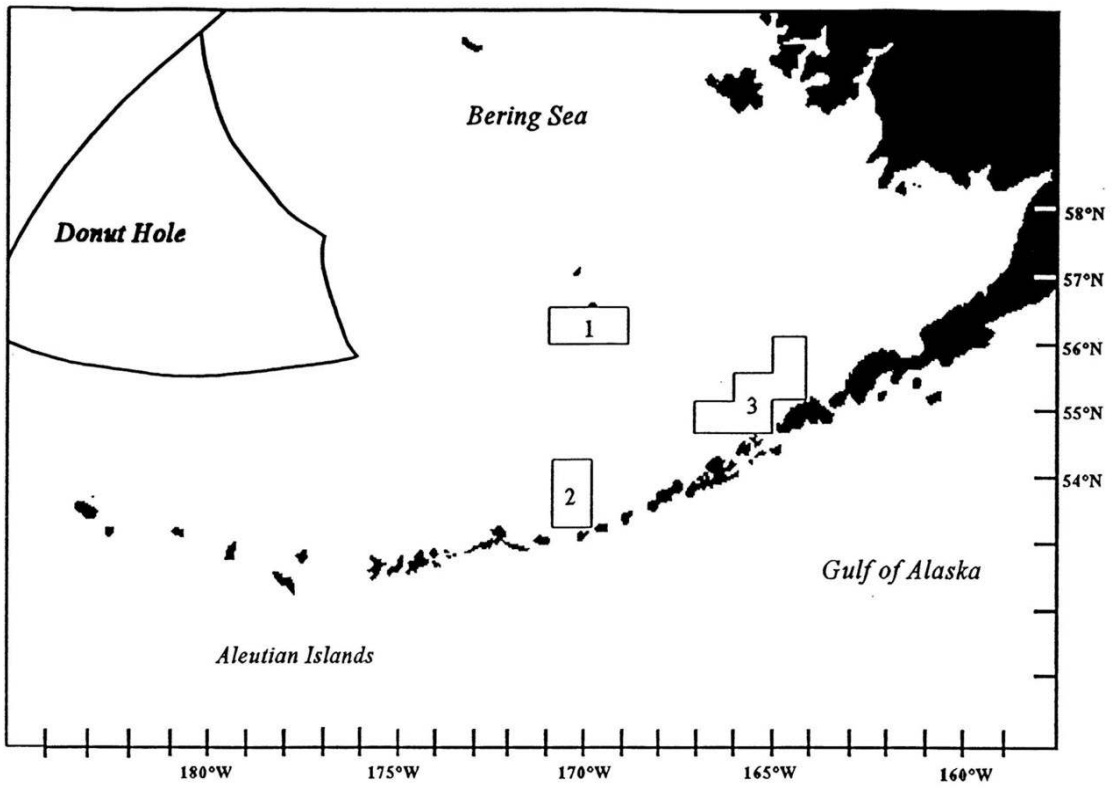

Figure 2-6. Chinook salmon savings area. Source: NPFMC.

Environmental Benefit

In May 1997, NOAA Fisheries reclassified the Steller sea lion into two distinct populations separated at 144°W. The eastern population remained listed as threatened under the ESA, but the western population was listed as endangered. This resulted in implementation of an extensive new array of fisheries restrictions, particularly on the pollock and Atka mackerel fleets. These measures were designed to spread the harvests out over time and space, to avoid localized depletion of prey for sea lions, and to greatly reduce the amount of harvest from areas designated as critical habitat for Steller sea lions. Additional rookeries and haulout areas were closed to fishing, and the entire Bogoslof and Aleutian Islands management areas were closed to pollock fishing. Further, a closure of directed fishing for forage fish was enacted to allow more prey items to be available for sea lions.

In 1997, the U.S. Fish and Wildlife Service (USFWS) concluded that the groundfish fisheries were having an effect on short-tailed albatross and established an incidental take of up to four birds during 1997 and 1998 in the longline groundfish fisheries. As a result, seabird avoidance measures were implemented in the longline fishery for groundfish and halibut: baited hooks must sink immediately, offal must be discharged aft of the hauling station, and streamer lines and avoidance gear must be used. These measures were expanded in 1999. In 2000, NOAA Fisheries issued changes to observer data collection and vessel logbook information to collect data on types of seabird avoidance measures used on each haul and their effectiveness.

Further protection was given to habitat with additional closures to bottom trawling, and the addition of identification and description of essential fish habitat to both groundfish management plans, as required by the SFA. For instance, Sitka Pinnacles Marine Reserve, an area totaling 2.5 square nm in the GOA off Cape Edgecumbe, is closed to groundfish fishing or anchoring by vessels holding a federal fisheries permit. Additionally, certain species of coral and sponges associated with habitat areas of particular concern were protected from commercial fisheries, and a stakeholder process has been initiated to further identify and protect essential fish habitat and areas of particular concern.

Summary

The major policy emphases from 1996 to 2000 have been control and reduction of the impacts of very robust groundfish fisheries on other fisheries, on marine mammals and seabirds, on habitat, and on the ecosystem as a whole. The most innovative new measure in this period was the complete ban on discards of pollock and cod, regardless of the groundfish fishery in which they were caught. Many of the new measures implemented in this period directly result from requirements of the SFA. Additionally, the AFA conferred many social and economic benefits on the pollock fisheries.

Economic and social benefits have been conferred on the industry also by the allocations of Pacific cod, continuation of the sablefish and halibut IFQ Program, continuation and expansion of the CDQ Program, and implementation of the LLP in 2000.

2.7 Current Federal Statues and Mandates

The legal basis for the federal government to conserve and manage marine fisheries in the U.S. EEZ is founded on the principle of western society known as the public trust doctrine. Because the public trust principles apply to the fisheries in the federal EEZ waters, the federal government has the responsibility to conserve those fishery resources for the overall benefit of the people of the U.S. Conservation of any biological resource, such as a fishery resource, implies imposing constraints on the use of the resource to prevent its destruction and provide for its sustained availability to current and future fisheries. Benefit implies an economic or socioeconomic objective which may not be consistent with conservation objectives. Hence, the federal public trust responsibility often is carried out by implementing management policies that reflect a fine balance between conflicting interests. Rarely does a fishery management policy maximize one particular objective–whether related to biological conservation or generation of economic wealth–over all others, except when the risk of severe depletion of a resource is at stake.

The formulation and implementation of all federal fishery management policies are guided by, and must comply with, the limitations and procedures stipulated in the body of federal statutes and executive orders (EOs) described in this section. Currently, these include 11 statutes and 6 EOs. Some of these mandates speak directly to the conservation or management of fishery resources, but most are directed at ensuring the fairness and equity of fishery management measures and that potential environmental, economic, and social effects of these mandates are considered before they are adopted. The executive branch's responsibility for compliance with these mandates resides primarily with the Secretary of Commerce and has been delegated largely to the NOAA Fisheries, one of the five agencies of the NOAA in the Department of Commerce.

2.7.1 Magnuson-Stevens Fishery Conservation and Management Act

The MSA is the principal federal statute that provides for the management of U.S. marine fisheries. Originally enacted as the Fishery Conservation and Management Act in 1976 (Public Law 94-265), this law is arguably the most significant fisheries legislation in U.S. history. It has been amended periodically since 1976; most recently in 1996, by the SFA (Public Law 104-297). The basic concepts of the MSA have not changed. They include:

- The biological conservation of a fishery resource has priority over its use;
- Conservation and management decision-making must be based on the best available scientific information, which should include social, economic, and ecological factors along with biological factors; and
- The needs of fishery resource users vary across the nation, and public participation in the policy making process should be maximized.

The MSA established ten National Standards that serve as the overarching objectives for fishery conservation and management (16 United States Code [U.S.C]. 1851, Sec. 301[a].):

"(a) IN GENERAL–Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the following national standards for fishery conservation and management:

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

(2) Conservation and management measures shall be based upon the best scientific information available.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

(4) Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (a) fair and equitable to all such fishermen; (b) reasonably calculated to promote conservation; and ©) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

(5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

(8) Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (a) provide for the sustained participation of such communities, and (b) to the extent practicable, minimize adverse economic impacts on such communities.

(9) Conservation and management measures shall, to the extent practicable, (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea."

The MSA also mandates the Secretary of Commerce to develop advisory guidelines to assist in FMP development. These guidelines serve primarily to interpret and aid compliance with the national standards (codified at 50 CFR Part 600, and most recently revised on May 1, 1998 [63 FR 24212]).

The following websites can be accessed for detailed information on the MSA:

- The Magnuson-Stevens Fishery Conservation and Management Act as amended through October 11, 1996 can be found on the NOAA Fisheries, National Marine Fisheries Service website in its entirety at http://www.nmfs.noaa.gov/sfa/magact/index.html.

- The Sustainable Fisheries Act can be found on NOAA Fisheries, National Marine Fisheries Service website in its entirety at http://www.nmfs.noaa.gov/sfa/sustainable_fishereries_act.pdf.

- 50 CFR Part 600, as revised on May 1, 1998, is available on the National Archives and Records Administration Code of Federal Regulation (CFR) website http://www.access.gpo.gov/nara/cfr/cfr-table- search.html and in its entirety at http://frwebgate1.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=42125310782+3+0+0&WAISaction=retrieve.

- 63 FR 24212 is available on the National Archives and Records Administration CFR website http://www.access.gpo/su-docs/aces/aces140.html.

2.7.2 American Fisheries Act

Next to the MSA, the AFA is the only other fisheries-specific legislation affecting how groundfish fisheries in the BSAI and, to a lesser extent, GOA are managed. The AFA, enacted in October 1998, represents the culmination of a decade-long struggle over the allocation of Alaska's most abundant fishery resource, walleye pollock in the BSAI. The AFA institutionalized a resource allocation scheme among competing onshore and offshore components of the fish processing industry.

Provisions mandated by the AFA to be in effect in 1999, were implemented through the TAC specification process and emergency interim rule-making (final specifications notice, 64 FR 12103, March 11, 1999; extended emergency interim rules, 64 FR 34743, June 29, 1999; and 64 FR 33425, June 6, 1999). Permanent federal regulations to implement provisions of the AFA required that NPFMC amend FMPs. Hence, final AFA implementing rules likely will not be in effect until 2001. For the 2000 fishing year, AFA provisions were implemented by emergency interim rules published January 5, 2000 (65 FR 380) and January 28, 2000 (65 FR 4520), and extended on June 23, 2000 (65 FR 39107) through December 24, 2000, and January 16, 2001, respectively.

Major provisions of the AFA include the following:

- Requirement of a minimum of 75 percent U.S. ownership of fishing vessels (up from majority ownership) and maximum size and horsepower limits for replacement vessels.

- Specific allocation of the BSAI directed pollock fishery TAC among the inshore component (50 percent), catcher processor vessels in the offshore component (40 percent), and motherships in the offshore component (10 percent) after first deducting 10 percent of the total TAC for the CDQ Program and an incidental catch allowance.

- Buyout of nine catcher processor vessels' future fishing privileges, financed through a combination of a grant and direct loan obligations, to be paid back by a tax of $0.006 per pound of pollock harvested by the inshore sector.

- Specific naming of 20 catcher processor vessels that may participate in the (offshore) pollock fishery, 7 catcher vessels that may deliver pollock to those catcher processors, and 19 catcher vessels that may deliver pollock to motherships.

- Criteria for catcher vessels to participate in harvesting BSAI pollock in the inshore sector, and criteria for limiting the participation of onshore processing plants in the BSAI pollock fishery.

- Fishery cooperatives with limitations on the structure and participation among cooperatives involving catcher vessels and the inshore sector processing plants.

- Directions for NPFMC to develop or improve on limitations (sideboards) on the activities of AFA vessels and processors in non-pollock fisheries to prevent negative spillover effects of fishery cooperatives.

The following websites can be accessed for detailed information on the AFA:

- The American Fisheries Act can be found on the NOAA Fisheries, National Marine Fisheries Service, Alaska Region website in its entirety at http://www.fakr.noaa.gov/sustainablefisheries/afa/afa.pdf.

- 64 FR 12103, 64 FR 34743, 64 FR 33425, 65 FR 380, 65 FR 4520, and 65 FR 39107 are available on the National Archives and Records Administration CFR website http://www.access.gpo/su-docs/aces/aces140.html.

- The December 17, 2001 proposed Amendment 61 to the AFA in the FR (66 FR 65028) can be found on NOAA Fisheries, National Marine Fisheries Service, Alaska Region website at http://www.fakr.noaa.gov/prules/amd6161pr.pdf.

2.7.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is a cornerstone environmental mandate that declares a national policy to encourage productive and enjoyable harmony between man and the environment, and to promote efforts to better understand and prevent damage to ecological systems and natural resources important to the nation.

NEPA, signed into law in 1970 (42 U.S.C. 4321 *et seq.*), has two principal purposes:

1. Require federal agencies to evaluate the potential environmental effects of any major planned federal action is to ensure that public officials make well-informed decisions about the potential impacts.

2. Promote public awareness of potential impacts at the earliest planning stages of major federal actions. The Act requires federal agencies to prepare a detailed environmental evaluation for any major federal action significantly affecting the quality of the human environment.

As with the MSA, NEPA requires an assessment of both the biological and social/economic consequences of fisheries management alternatives in order to provide the public an opportunity to be involved and influence decision-making on federal actions. In short, NEPA ensures that environmental information is available to government officials and the public before decisions are made and actions are taken.

NEPA established NPFMC on Environmental Quality (CEQ) to review government policies and programs for conformity with the law. One of the CEQ's responsibilities is to advise and assist the President in preparing an annual environmental quality report, which is submitted to Congress. The CEQ is also responsible for oversight of regulations and procedures implementing NEPA, and has prepared guidance for federal agencies regarding NEPA regulations (40 CFR Part 1500). Identified processes for issue scoping, consideration of alternatives, evaluation procedures, public involvement and review, and coordination between agencies are applicable to NPFMC development of the groundfish FMPs.

The U.S. Department of Commerce, NOAA, has also prepared environmental review procedures for implementing NEPA (NOAA Administrative Order 216-6). This Order describes NOAA's policies, requirements, and procedures for complying with NEPA and the implementing regulations issued by the CEQ. The 1999 revision and update to the Administrative Order includes specific guidance regarding categorical exclusions, especially as they relate to endangered species, marine mammals, fisheries, and habitat restoration. The Order also expands on guidance for consideration of cumulative impacts and "tiering" in the environmental review of NOAA actions. This administrative order provides comprehensive and specific procedural guidance to NOAA Fisheries and NPFMC for preparing and adopting groundfish FMPs.

Federal fishery management actions subject to NEPA requirements include the approval of FMPs, FMP Amendments, and FMP implementing regulations. Such approval requires preparation of either 1) an environmental impact statement (EIS) or supplemental (S)EIS for major fishery management actions that significantly affect the quality of the human environment and documents the finding for public consideration and comment before a decision is made, or 2) an environmental assessment (EA) for fishery management actions that will not significantly affect the human environment. If an EA does not result in a finding of no significant impact, then an EIS or SEIS must be prepared. In addition to NEPA implementing regulations (40 CFR 1500-1508), NEPA compliance by fisheries management actions is guided by NOAA Administrative Order 216-6.

NEPA and the MSA requirements for schedule, format, and public participation are compatible and allow one process to fulfill both obligations. If an EIS or SEIS is prepared, however, the notice of availability of a final EIS (or SEIS) must be published at least 30 days before the Secretary of Commerce approves, disapproves, or partially approves an FMP or FMP Amendment.

The following websites can be accessed for detailed information on the NEPA:

- The National Environmental Policy Act can be found on NPFMC on Environmental Quality, NEPA website in its entirety at http://ceq.eh.doe.gov/nepa/regs/nepa/nepaeqia.htm.

- 40 CFR 1500-1508 can be found on NPFMC on Environmental Quality - Regulations for Implementing NEPA website at http://ceq.eh.doe.gov/nepa/regs/ceq/toc_ceq.htm.

- The NOAA Administrative Order 216-6 can be found on the NOAA website at http://www.rdc.noaa.gov/~nao/216-6.html.

2.7.4 Endangered Species Act

The ESA (16 U.S.C. 1531 *et seq.*), passed in 1973 and reauthorized in 1988, provides broad protection for fish and wildlife species that are listed as threatened or endangered. Provisions are made for the formal listing of species, development of recovery plans, and designation of critical habitats. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize species. Responsibilities for implementing the ESA are shared by the USFWS [freshwater fish, birds, terrestrial mammals, and plants] and NOAA Fisheries (anadromous and marine fish, marine mammals, and sea grasses). NOAA Fisheries is therefore tasked with both managing the groundfish harvest through FMPs, and ensuring that identified threatened and endangered species (e.g., the Steller sea lion) receive appropriate consideration and protection during the planning and implementation of groundfish harvests. It should be noted that compliance with ESA provisions is not subject to modification based on economic hardship. Recovery plans required under the ESA give priority to those listed species that may be affected by different economic activities.

Section 7(a)(1) of the ESA requires federal agencies to conserve endangered and threatened species; however, conservation is broadly defined. Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize or result in the destruction or adverse modification of the critical habitat of endangered or threatened species.

Under an FMP, all fishing activities must be considered; not just the specific management measures under consideration. NOAA Fisheries must conduct a formal Section 7 consultation that results in a biological opinion (BiOp) if a proposed action "may affect" or "is likely to adversely affect" endangered or threatened species or their critical habitat. If the BiOp concludes that the proposed action "is likely to jeopardize the continued existence of" threatened or endangered species, then reasonable and prudent measures are developed to minimize or mitigate the effect of the action. Once determined, the fishery management regulations must be revised to implement the reasonable and prudent measures.

The following website can be accessed for detailed information on the ESA:

- The Endangered Species Act can be found on the Legal Information Institute's United States Code Collection website in its entirety at http://www4.law.cornell.edu/uscode/16/ch35.html.

2.7.5 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 *et seq*.), as amended through 1996, establishes a federal responsibility to conserve marine mammals; management responsibility for cetaceans (whales) and pinnipeds (seals) other than walrus is vested with NOAA Fisheries. The USFWS is responsible for all other marine mammals in Alaska including sea otter, walrus, and polar bear. Congress found that certain species and population stocks of marine mammals are or may be in danger of extinction or depletion due to human activities. Congress also declared that marine mammals are resources of great international significance, and they should be protected and encouraged to develop to the greatest extent feasible commensurate with sound resource management policies.

The MMPA's primary management objective is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. The Secretary of Commerce is required to give full consideration to all factors regarding regulations applicable to the "take" of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations. If a fishery affects a marine mammal population, then the potential impacts of the fishery must be analyzed in the appropriate EA or EIS, and NPFMC or NOAA Fisheries may be requested to consider regulations to mitigate adverse impacts.

The following website can be accessed for detailed information on the MMPA:

- The Marine Mammal Protection Act can be found on the Legal Information Institute's United States Code Collection Website in its entirety at http://www4.law.cornell.edu/uscode/16/ch31.html.

2.7.6 The Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq*.) authorizes collection of fisheries data and coordination with other agencies for environmental decisions affecting living marine resources. Both formal and informal consultations, cooperative research, and data-gathering programs are routinely pursued.

The following website can be accessed for detailed information:

- The Fish and Wildlife Coordination Act can be found on the Legal Information Institute's United States Code Collection website in its entirety at http://www4.law.cornell.edu/uscode/16/h5AschI.html.

2.7.7 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 *et seq*.) was designed to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone. Section 307©) of the CZMA requires that any federal activity affecting the land or water uses or natural resources of a state's coastal zone be consistent with the state's approved coastal management program, to the maximum extent practicable.

A proposed fishery management action that requires an FMP Amendment or implementing regulations must be assessed to determine whether it directly affects the coastal zone of a state with an approved coastal zone management program. If so, NOAA Fisheries must provide the state agency having coastal zone management responsibility with a consistency determination for review at least 90 days before final NOAA Fisheries action.

The following website can be accessed for detailed information:

- The Coastal Management Act can be found on the Legal Information Institute's United States Code Collection website in its entirety at http://www4.law.cornell.edu/uscode/16/ch33.html.

2.7.8 Administrative Procedure Act

The Administrative Procedure Act (APA) (5 U.S.C. 553) requires federal agencies to give the public prior notice of rule-making and an opportunity to comment on proposed rules. General notice of proposed rule-making must be published in the FR, unless persons subject to the rule have actual notice of the rule. Proposed rules published in the FR must include reference to the legal authority under which the rule is proposed and explain the nature of the proposal including the action proposed and its intended effect, and any relevant regulatory history that provides a well-informed basis for understanding and commenting. The APA does not specify how much time the public must be given for prior notice and opportunity to comment; however, NOAA subscribes to a 30-day public comment period on proposed fishery management regulations. Exceptions to 30-day prior notice protocol include 1) proposed rules that would implement FMP Amendments, in which case the MSA indicates a 45-day period, and 2) emergency regulations, which often require immediate implementation.

Some regulations (e.g., emergency or interim) may be implemented immediately under the APA if the agency finds that prior notice and opportunity for public comment are impractical, unnecessary, or contrary to the public interest. The "good cause" reason for waiving normal public procedure must be fully explained in the FR notice. The MSA (at Section 305[c]) places further conditions and restrictions on the use of emergency or interim fishery regulations. For example, an emergency or interim fishery management measure may remain in effect for not more than 180 days and may be extended for an additional period, by notice in the FR, only once.

On August 21, 1997 (62 FR 44421), NOAA published further policy guidelines in the form of criteria and justification standards for using emergency rule authority to address marine fishery management issues. These criteria define the phrase in Section 305©) of the MSA, "an emergency exists involving any fishery," as a situation that:

1. results from recent, unforeseen events or recently discovered circumstances.

2. presents serious conservation or management problems in the fishery.

3. can be addressed through emergency regulations for which the immediate benefits outweigh the value of advanced notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under normal rule-making process (62 FR 44422).

The emergency rule guidelines also state that the normal public rule-making process may be waived in an emergency if the emergency action might be justified under one or more of the following situations:

1. Ecological – (a) to prevent overfishing as defined in an FMP, or as defined by the Secretary in the absence of an FMP, or (b) to prevent other serious damage to the fishery resource or habitat.

2. Economic–to prevent significant direct economic loss or to preserve a significant economic opportunity that otherwise might be forgone.

3. Social–to prevent significant community impacts or conflict between user groups.

4. Public health–to prevent significant adverse effects to health of participants in a fishery or to the consumers of seafood products (62 FR 44422).

Except for the emergency or interim rule provisions, a proposed rule is designed to give interested or affected persons opportunity to submit written data, views, or arguments for or against the proposed action. After the end of a 30- or 45-day comment period, the APA requires comments received to be summarized and responded to in the final rule notice. Further, the APA requires the effective date of a final rule to be no less than 30 days after publication of the final notice in the FR. This delayed effectiveness or "cooling off" period is intended to allow the affected public to become aware of and prepared to comply with the requirements of the rule. The 30-day delayed effectiveness period can be waived for a final rule only if it relieves a restriction, merely interprets an existing rule, or provides a statement of policy, or it must be made effective earlier than 30 days after publication for good cause. For fishery management regulations, the primary effect of the APA is to provide for public participation which, in combination with the MSA, NEPA, and other statutes, limits the speed with which NOAA Fisheries can implement non-emergency fishery regulations.

The following websites can be accessed for detailed information:

- The Administrative Procedure Act can be found on the Legal Information Institute's United States Code Collection website in its entirety at http://www4.law.cornell.edu/uscode/5/553.html.

- 62 FR 44421 and 62 FR 44422 are available on the National Archives and Records Administration CFRs website http://www.access.gpo/su-docs/aces/aces140.html.

2.7.9 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 *et seq*.) requires federal agencies to assess the impacts of their proposed regulations on small entities and to seek ways to minimize economic effects on small entities that would be disproportionately or unnecessarily adverse. The most recent amendments to the RFA were enacted on March 29, 1996, with the Contract with America Advancement Act of 1996 (Public Law 104-121). Title II of that law, the Small Business Regulatory Enforcement Fairness Act, amended the RFA to require federal agencies to determine whether a proposed regulatory action would have a significant economic impact on a substantial number of small entities. For a federal agency, the most significant effect of this Act is that it made compliance with the RFA judicially reviewable.

The assessment requirement of the RFA is satisfied by a regulatory flexibility analysis, which applies only to regulatory actions for which prior notice and comment is required under the APA. Hence, emergency or interim rules that waive notice and comment are not required to have regulatory flexibility analyses. Further, regulatory flexibility analyses are required only when an agency cannot certify that an action will not have a "significant economic impact" on a "substantial number of small entities."

For purposes of these analyses, small entities include: 1) small businesses which, for commercial fishing or fish processing, are firms with receipts of up to $3 million annually or up to 500 employees, respectively, 2) small non-profit organizations, and 3) small governmental jurisdictions with a population of up to 50,000 persons. For Alaska fisheries, these criteria include most fishing firms except for the large catcher processor vessels and most coastal communities except for Anchorage. NOAA Fisheries has published guidelines for RFA analysis; they include criteria for determining if the action would have a significant impact on a substantial number of small entities.

An initial regulatory flexibility analysis (IRFA) is prepared for any proposed regulatory action that meets the above criteria for having an anticipated "significant economic impact" on a "substantial number of small entities." Due to the difficulty of certifying that an action will not have significant economic impact, an IRFA is prepared routinely for most proposed fishery management measures. The IRFA usually is combined with the EA or (S)EIS document required by NEPA. However, if an action is determined to not have a "significant economic impact on a substantial number of small entities," then a statement to this effect including a factual basis for the statement, must be published in the FR and sent to the Small Business Administration.

If, following public comments on the proposed rule, the action is still considered to meet the criteria for requiring RFA analysis, then a final regulatory flexibility analysis (FRFA) must be prepared. The FRFA contains most of the same information presented in the IRFA, but must also include: 1) a summary of significant issues raised in public comment on the IRFA and the agency's response to those comments, and 2) a description of the steps the agency has taken to minimize the significant economic impacts on small entities, including a statement of factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why all other alternatives considered were rejected. Finally, the FRFA or a summary of it must be published in the FR with the final rule.

In addition, the Small Business Regulatory Enforcement Fairness Act established two new requirements on agencies that publish rules. First, for each rule or group of related rules for which an agency is required to publish an FRFA, the agency is required to publish one or more guides to assist small entities in complying with the rule. These guides, called "small entity compliance guides," must explain what a small entity is required to do to comply with the rule(s). The second new requirement directs each agency regulating the activities of small entities to establish a program for responding to inquiries from small entities concerning information on, advice about, and compliance with statutes and regulations, as well as interpreting and applying law to specific sets of facts supplied by small entities. Guidance given by an agency applying law to facts provided by a small entity may be considered as evidence of the reasonableness of any proposed fines, penalties, or damages sought against the small entity in any civil or administrative action.

The following websites can be accessed for detailed information:

- The Regulatory Flexibility Act can be found on the Legal Information Institute's United States Code Collection website in its entirety at http://www4.law.cornell.edu/uscode/5/pIch6.html.

- Public Law 104-121 (America Advancement Act of 1996) can be found on the U.S. Environmental Protection Agency (USEPA) website in its entirety at http://www.epa.gov/sbrefa/statute/publ104121.pdf.

2.7.10 Paperwork Reduction Act of 1995

Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3501 *et seq.*, and 50 CFR Part 1320) is designed "to minimize the paperwork burden for individuals, small businesses, educational and non-profit institutions, federal contractors, state, local and tribal governments, and other persons resulting from the collection of information by or for the Federal Government." In brief, this law is intended to ensure that the government is not overly burdening the public with requests for information. This is accomplished through an information collection budget (ICB). This budget for each agency is in terms of the total estimated time burden of responding to official inquiries. The President's Office of Management and Budget (OMB) oversees each agency's ICB. Agencies must annually identify and obtain clearance from OMB for new or significant revisions to reporting and recordkeeping requirements.

Procedurally, the PRA requirements constrain what, how, and how frequently information will be collected from the public affected by a rule that requires reporting (e.g., harvested fish). New collections of information must be submitted to OMB for clearance before a final rule may take effect. For each rule that requires an information collection, the agency must describe in detail what data will be collected, how it will be collected and how often, from whom it will be collected, how much time will be spent by each affected person in complying with the information requirements, why the information is necessary, and how it will be used. OMB can take 60 days to review and clear a proposed information collection; hence, to avoid delay of a rule, NOAA Fisheries tries to start the PRA review and clearance process at least 30 days before submission of a proposed rule. Information collections approved by OMB have a maximum effectiveness of three years. An extension beyond that time requires another submission for OMB clearance. Required collections of information from the public can not be enforced without being included in an approved information collection budget.

The following website can be accessed for detailed information:

- The Paperwork Reduction Act of 1995 can be found on the Legal Information Institute's United States Code Collection in its entirety at http://www4.law.cornell.edu/uscode/44/ch35.html.

2.7.11 Executive Order 12114: Environmental Effects Abroad

This EO, issued in 1979, directs agencies to consider the effects of major federal actions upon the environment of foreign nations of the "global commons." These actions include those major federal actions that result in significant environmental effects that extend outside of the geographic borders of the U.S. In some cases, an EIS may be required. The EO encourages international agreements and an exchange of information between the affected nations and the U.S.

The following website can be accessed for detailed information:

- EO 12114: Environmental Effects Abroad, can be found on NPFMC on Environmental Quality website in its entirety at http://ceq.eh.doe.gov/nepa/regs/eos/eo12114.pdf.

2.7.12 Executive Order 12630: Takings

This EO on government actions and interference with constitutionally protected property rights came into effect on March 18, 1988. This EO requires that each federal agency prepare a "takings implications assessment" for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Fishery management measures, for example, that limit fishing seasons, areas, catch quotas, the size of harvested fish, and bag limits do not appear to have any takings implications, and thus, no takings implications assessment is required. However, a takings implication assessment may need to be prepared if a fishing gear type is prohibited, for example, in such a way that a fisherman leaving the fishery would be unable to sell his investment in the gear, or if a fisherman is prohibited by federal action from exercising property rights granted by a state.

Takings issues are raised frequently in the context of limited access systems, which confer a harvesting privilege on a fisherman in the form of a permit to catch a specific amount of fish or a license to enter and participate in a fishery. Although such permits and licenses may be transferrable, and therefore increase (or decrease) in market value, they do not convey any property rights in the fishery resource (i.e., the fish). If, for conservation purposes, the federal government were to drastically reduce the amount of fish that may be harvested from a fishery for which a fisherman had a limited license or permit, thereby reducing the transfer value of that license or permit, a question is raised whether such action would have "takings implications."

The following website can be accessed for detailed information:

- EO 12630: Takings can be found on U.S. Environmental Protection Agency's website in its entirety at http://www.epa.gov/owow/wetlands/regs/eo12630.html.

2.7.13 Executive Order 12866: Regulatory Planning and Review

EO 12866, signed on September 30, 1993, and published October 4, 1993 (58 FR 51735), replaced EO 12291 and EO 12498. Its purpose, among other things, is to enhance planning and coordination with respect to new and existing regulations, and to make the regulatory process more accessible and open to the public. In addition, EO 12866 requires agencies to take a deliberative, analytical approach to rule-making, including assessment of costs and benefits of the intended regulations. For fisheries management purposes, it requires NOAA Fisheries 1) to prepare a regulatory impact review (RIR) for all regulatory actions, 2) to prepare a unified regulatory agenda twice a year to inform the public of the agency's expected regulatory actions, and 3) to conduct a periodic review of existing regulations.

The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities which would trigger the completion of an IRFA under the RFA. For this reason, the RIR is frequently combined with an EA and an IRFA in a single EA/RIR/IRFA document that satisfies the analytical requirements of NEPA, RFA, and EO 12866 for any proposed rule. Criteria for determining "significance" for EO 12866 purposes, however, are different than

those for determining significance for RFA purposes. A significant rule under EO 12866 is one that is likely to:

- Have an annual effect on the economy (of the nation) of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.

- Create serious inconsistency or otherwise interfere with an action taken or planned by another agency.

- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.

- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in EO 12866.

Fisheries management actions rarely have an annual effect on the national economy; however, OMB makes the ultimate determination of significance under this EO based in large measure on the analysis in the RIR. A recent example of a fishery management action determined to be "significant" under this EO is the regulatory action to implement provisions of the AFA in part because, at least initially, the AFA rule-making raises novel legal or policy issues arising out of legal mandates. An action determined to be significant is subject to OMB review and clearance before its publication and implementation.

An initial determination of significance, frequently without benefit of an RIR, is made for each proposed regulatory action by NOAA Fisheries through a "listing document." The listing document is a brief description of a proposed regulatory action, including a regulatory identifier number, and the expected schedule for rule-making. Listing documents are prepared by NOAA Fisheries and submitted through NOAA General Counsel and Department of Commerce Office of General Counsel to OMB. If OMB concurs in a determination of "not significant" under EO 12866, then OMB will not need to review the rule. In practice, NOAA Fisheries attempts to submit a listing document at least three months before submission of the proposed rule.

The regulatory planning function of EO 12866 is served by the unified regulatory agenda, which is prepared twice a year to inform the public of the agency's expected regulatory actions and to provide brief descriptions and timelines. In addition, a regulatory plan is prepared annually to report on the most significant regulatory actions that the agency reasonably expects to issue in proposed or final form in that fiscal year or later.

The following website can be accessed for detailed information:

- EO 12866: Regulatory Planning and Review can be found on the U.S. Environmental Protection Agency's website in its entirety at http://www.epa.gov/fedrgstr/eo/eo12866.htm.

2.7.14 Executive Order 12898: Environmental Justice

EO 12898, issued in 1994, requires that federal agencies make achieving "environmental justice" part of their mission by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low income populations in the U.S.

The following website can be accessed for detailed information:

- EO 12898: Environmental Justice can be found on the U.S. Environmental Protection Agency's website in its entirety at http://www.epa.gov/civilrights/eo12898.htm.

2.7.15 Executive Order 13084: Consultation and Coordination with Indian Tribal Governments

This EO was signed May 14, 1998, and published May 19, 1998 (63 FR 27655). Its purpose is to establish regular and meaningful consultation and collaboration with Indian tribal governments in the development of federal regulatory practices that significantly or uniquely affect their communities; to reduce the imposition on unfunded mandates on Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments. This EO requires federal agencies to have an effective process to involve and consult with representatives of Indian tribal governments in developing regulatory policies, and it prohibits regulations that impose substantial direct compliance costs on Indian tribal communities.

The following website can be accessed for detailed information:

- EO 13084: Consultation and Coordination with Indian Tribal Governments can be found on the U.S. Environmental Protection Agency's website in its entirety at: http://www.epa.gov/fedrgstr/eo/eo13084.htm.

2.7.16 Executive Order 13132: Federalism

The Federalism EO was signed August 4, 1999, and published August 10, 1999 (64 FR 43255). This EO supercedes previous federalism EOs (12612 and 13083), but supplements EOs 12372, 12866, and 12988. This EO is intended to guide federal agencies in the formulation and implementation of "policies that have federalism implications," such as regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

The EO establishes fundamental federalism principles based on the U.S. Constitution, specifies federalism policymaking criteria, and special requirements for preemption of state law. For example, a federal action that limits the policymaking discretion of a state is to be taken only where there is constitutional and statutory authority for the action and it is appropriate in light of the presence of a problem of national significance. Also, where a federal statute does not have expressed provisions for preemption of state law, such a preemption by federal rule-making may be done only when the exercise of state authority directly conflicts with the exercise of federal authority. Conflict between state and federal law is possible on fishery management issues; however, the MSA (Section 306) explicitly establishes conditions for federal preemption

of state regulations (and extension of state fishery management authority into the EEZ). This EO also requires consultation between federal and state officials and requires a federalism impact statement for rules that have federalism implications. Federalism impact statements are rarely needed for federal Alaska groundfish regulations because of close state-federal consultation provided by NPFMC process.

The following website can be accessed for detailed information:

- EO 13132: Federalism can be found the U.S. Environmental Protection Agency's website in its entirety at http://www.epa.gov/fedrgstr/eo/eo13132.htm.

2.7.17 Executive Order 13158: Marine Protected Areas

This EO, signed May 26, 2000, and published May 31, 2000 (65 FR 34909), directs the Departments of Commerce and the Interior to jointly develop a national system of marine protected areas (MPAs). The purpose of the system is to strengthen the management, protection, and conservation of existing protected areas and establish new or expanded MPAs. The MPA system is to be scientifically based, representing diverse U.S. marine ecosystems and the nation's natural and cultural resources. Establishing such a system is intended to reduce the likelihood that MPAs are harmed by federally approved or funded activities.

The following website can be accessed for detailed information:

- EO 13158: Marine Protected Areas can be found on NPFMC on Environmental Quality website in its entirety at http://ceq.eh.doe.gov/nepa/regs/eos/eo13158.html.

2.7.18 Executive Order 13186: Protection of Migratory Birds

This EO was signed January 10, 2001 and published January 17, 2001. Its purpose is to reinforce the Migratory Bid Treaty Act (16 U.S.C. 703 *et seq.*) which focuses on the conservation of migratory birds and their habitat. This EO calls for a Memorandum of Understanding on any federal action taken that may have a measurably negative effect on migratory bird populations. This Memorandum is to support the conservation intent of migratory bird by integrating bird conservation principles, measures, and practices into activities and by avoiding adverse impacts on migratory bird resources. The Secretary of the Interior is to be the overseer of this EO.

The following websites can be accessed for detailed information:

- EO 13186: Protection of Migratory Birds can be found NPFMC on Environmental Quality website in its entirety at http://ceq.eh.doe.gov/nepa/regs/eos/eo13186.html.

- The Migratory Bird Treaty Act can be found on the Legal Information Institute's United States Code Collection in its entirety at http://www4.law.cornell.edu/uscode/16/ch7schII.html.

Section 3 The Decision-Making Process

3.1 The Federal Fishery Management Process

Conservation and management policies that govern marine fisheries outside of state jurisdiction are given effect through federal regulations. These regulations are published in the FR and codified in the CFR at Title 50. General regulations governing U.S. fisheries appear at 50 CFR part 600, and regulations specifically governing the groundfish fisheries in the EEZ off Alaska appear at 50 CFR 679. Current regulations codified at these parts prescribe the existing regulatory regime for the federally managed groundfish fisheries off Alaska.

This section reviews the procedures used to develop and change the fishery conservation and management policies implemented by these federal regulations and the statutory authority and limitations that dictate these procedures. In addition, it describes five basic types of fisheries regulations and provides examples of each.

The following websites can be accessed for detailed information:

- 50 CFR Part 600, as revised on May 1, 1998, is available on the National Archives and Records Administration CFR website http://www.access.gpo.gov/nara/cfr/cfr-table-search.html.

- 50 CFR 679 is available on the National Archives and Records Administration CFR website http://www.access.gpo/gov/nara/cfr/cfr-table-search-html.

3.1.1 Federal Policymaking Under the Magnuson-Stevens Fishery Conservation & Management Act

Federal fishery management policymaking for the groundfish fisheries off Alaska begins with NPFMC. Unlike management of the nation's timber, mineral, grazing, and water resource, for which policy is dictated by the responsible agency, the U.S. Congress instituted a regional council system for marine fisheries resources. These regional councils use a formal public process that strives toward consensus-building in shaping policy, balancing competing interests, and addressing resource conservation issues. The NPFMC is one of eight regional fishery management councils (regional councils) established by Section 302(a) of the MSA. The regional councils respond to the basic concept of the MSA that the needs of fishery users vary across the nation and should be addressed at a regional level. This section describes the process by which NPFMC develops fishery management policy and proposes it for federal implementation. The other seven regional councils may use slightly different procedures to arrive at the same end. The procedures described here have evolved since NPFMC's first meeting in October 1976, and reflect its partnership with the NOAA Fisheries and the Alaska Department of Fish & Game (ADF&G) in crafting fishery management policy. In addition, these procedures reflect the Operational Guidelines published by NOAA Fisheries to assist regional councils in developing fishery management policy consistent with the MSA and other applicable laws.

FMPs provide the basis for federal regulations used to manage fisheries under regional council jurisdiction. The MSA lists the first function of the councils as follows:

> "*(1) for each fishery under its authority that requires conservation and management, [to] prepare and submit to the Secretary (A) a fishery management plan, and (B) amendments to each such plan that are necessary from time to time (and promptly, whenever changes in conservation and management measures in another fishery substantially affect the fishery for which such plan was developed) (Section 302[h]).*"

Each FMP provides a policy statement and describes goals and objectives for managing the fisheries. FMPs and FMP Amendments are developed by the regional councils, submitted to the Secretary of Commerce for review, and, if approved or partially approved, implemented by federal regulations. Once approved, the regulations are put into effect and NOAA Fisheries has responsibility of executing the day-to-day fisheries management. Enforcement of the regulations is carried out jointly by NOAA Fisheries and the U.S. Coast Guard. Disapproved and partially approved FMPs and FMP Amendments are returned by NOAA Fisheries with an explanation of the reasons for disapproval to the regional council. The regional council may then decide whether or not to revise and resubmit the FMP or FMP Amendment. Secretarial authority to approve, disapprove, or partially approve is set out in Section 304(a)(3) of the MSA. This authority has been delegated through the Under Secretary of Commerce and Administrator for Oceans and Atmosphere of the NOAA to the Assistant Administrator for Fisheries to the NOAA Fisheries Regional Administrators. This delegation may be rescinded, however, for any particular approval/disapproval decision.

An FMP or FMP Amendment may not always be implemented by federal regulations. For example, overfishing definitions may exist only in an FMP–not in regulations–as a policy guide for prompting a regional council to develop a stock rebuilding plan. Likewise, not all fishery management policy changes require an FMP or FMP Amendment. Some changes may be accomplished by a regulatory amendment that serves to reinterpret an existing FMP provision without changing it. Regulatory amendments may be developed by NPFMC or by NOAA Fisheries in consultation with NPFMC. In either case, a regulatory amendment also must be submitted for Secretarial review for consistency with the MSA and other applicable laws before it can be implemented as a final rule. For simplicity and, unless otherwise stated, the remainder of this discussion will use the term *FMP Amendment* to mean FMP, FMP Amendment, or regulatory amendment.

A regional council is not required to prepare an FMP for every fishery. FMP preparation is only required for each fishery under a regional council's authority that requires conservation and management (MSA Section 302(h)(1)). A fishery to which an FMP applies is identified as a fishery management unit, as required by National Standard 3 (MSA 301(a)(3)). The National Standards Guidelines at 50 CFR 600.320 provide guidance in specifying the fishery management unit for an FMP. In addition to specifying a fishery management unit, the MSA (Section 303(a)) requires the contents of an FMP to include 14 provisions. An additional 12 provisions are discretionary to the regional council preparing the FMP.

Proposed Action

FMP Amendments may be inspired by a variety of events, including new or triggered statutory requirements, operational need, or public recommendation. Examples of statutory requirements causing NPFMC to initiate FMP Amendments include: 1) passage of the SFA in 1996, which amended the MSA by, among other things, changing and including several new required provisions for FMPs (Section 303(a)), and 2) passage of the AFA in 1998, which fundamentally changed the management of the BSAI pollock fishery and required NPFMC to amend the BSAI Groundfish FMP. An example of an operational need causing an FMP Amendment is the need to reform the TAC-setting process to better accommodate public comment on

proposed TACs. Most FMP Amendments, however, are generated by public recommendation through an open process established by NPFMC.

The NPFMC annually solicits FMP Amendment proposals from the public (Figure 3-1). These proposals are reviewed and qualitatively ranked in terms of analytical difficulty by NPFMC's Plan Development Team. All of the amendment proposals are reviewed by NPFMC's Advisory Panel, which makes recommendations on which proposals should be considered. After hearing the recommendations and public comment on them, NPFMC selects the amendment proposals it will consider during the coming year. Typically, about 30 proposals are submitted annually; however, the number of proposals that merit serious policy consideration exceed the number of policy analyses that reasonably can be accomplished by NPFMC, NOAA Fisheries, or ADF&G staff in any one year. Hence, only the most critical proposals can be addressed.

Policy Analysis

The NPFMC's FMP Amendment cycle continues during the winter as various alternatives to the proposed fishery management action are analyzed. These analyses: 1) fulfill requirements under certain statutes and EOs; 2) provide opportunity for the public to bring information regarding the proposed and alternative actions to NPFMC's attention; and 3) help NPFMC examine the potential effects of alternative actions to their stated policy goals and objectives and make a well-reasoned decision on what amendment proposal to recommend to the Secretary of Commerce.

The principal analytical requirements are established in the NEPA and the NEPA implementing regulations. This law requires either an EIS for major federal actions or an EA for those actions that will not significantly affect the human environment. The human environment is defined by NEPA implementing regulations (40 CFR 1508.14) as including the natural and physical environment and the relationship of people with that environment. With regard to natural populations of fish, this definition recognizes that a policy change has its primary effect on the behavior of people, and through a change in human behavior, a secondary effect on the natural or physical environment of the fish. For example, a basic premise in fishery management is that humans control the growth rate and abundance of a fish stock through the regulation of fishing mortality. Allowing increased harvests of the fish stock or decreasing harvests through restrictions on catches produces socioeconomic benefits or costs, respectively, in the short-term. Because a fishery management policy change normally has interrelated economic, social, and physical environmental effects, NEPA analysis must include socioeconomic as well as biological considerations of the fishery being managed and its habitat.

Socioeconomic considerations are explicitly addressed, by EO 12866, which requires preparation of a regulatory impact review, and the Regulatory Flexibility Act which requires an analysis of the potential effects of a proposed action on "small entities." The economic questions posed by these requirements are different: the former is more concerned with broad national effects or effects on sectors of the national economy, and the latter with the potential effects on small businesses, non-profit organizations, and small governmental units. In addition, the MSA (Section 303(a)(9)) requires FMPs/amendments to include a fishery impact assessment, which assesses, specifies, and describes the likely effects of any conservation and management measures on affected fisheries participants and fishing communities, and participants in adjacent fisheries. When proposed actions primarily concern the allocation of fishing privileges or opportunities, the public's focus, and therefore the focus of the analysis, usually centers on what groups of persons would benefit or suffer as a result of implementing the amendment proposal.

A central theme of the analytical requirements of NEPA, EO 12866, and the Regulatory Flexibility Act is to require NPFMC and NOAA Fisheries to examine the potential direct and indirect effects of the proposed action and reasonable alternatives to the proposed action (including the no action alternative). The NPFMC, in choosing to recommend an amendment proposal, must explain why the chosen alternative is superior to all others and how it will likely result in net benefits to society. These analyses usually are combined in a single analytical document (referred to frequently as an EA/RIR/IRFA analysis), with separate sections dealing with biological and socioeconomic details. The combined analysis, however, is not necessarily limited to satisfying only the requirements of NEPA, EO 12866, and the Regulatory Flexibility Act. Other analyses or assessments may be combined with or prepared separately from the EA/RIR/IRFA, including a biological assessment of potential effects on endangered or threatened species, assessment of the potential effects of an action on marine mammals, a state's coastal zone management program, estimation of the paperwork burden that the amendment proposal would impose on affected individuals and businesses, essential fish habitat and fishery impact statements, and possibly a federalism impact statement. For simplicity, these analyses and assessments collectively are referred to here as the "analysis" of an FMP Amendment.

No specific time limit is imposed by law for completing of the draft analysis. Generally, NPFMC staff attempts to complete its analysis before the April meeting following the year in which NPFMC decided to address the proposal. This is not always possible, however. Especially controversial proposals, or those that have a large number of alternatives and options for analysis, may require more time than the four months typically allocated for the analytical task. A proposal that, if implemented, could have a significant impact on the human environment is required by NEPA to have an EIS or SEIS instead of an EA. In this event, "scoping" is required. Under NEPA, scoping is "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Formal scoping officially begins with publication in the FR of a notice of intent to prepare an EIS or SEIS. Depending on the nature of the proposed action, it may be a lengthy period involving numerous public hearings, or it may be fairly brief and involve no hearings and only a brief public comment period. At a minimum, however, the public comment period on the scope of issues to be addressed in the analysis should be 30 days. This additional public process, which occurs at the beginning of the analysis period, plus the greater depth of analysis in a draft EIS or SEIS, adds substantially to the overall time to plan and draft the analysis.

Amendment analyses are usually drafted by NPFMC staff biologists and economists. Some of the analyses, however, require collaboration with NOAA Fisheries and ADF&G scientists and managers, or private analysts contracted by NPFMC to prepare all or part of an analysis. Proposals made by NOAA Fisheries or ADF&G to improve the implementation of existing management policies frequently are analyzed by staff of the proposing agency.

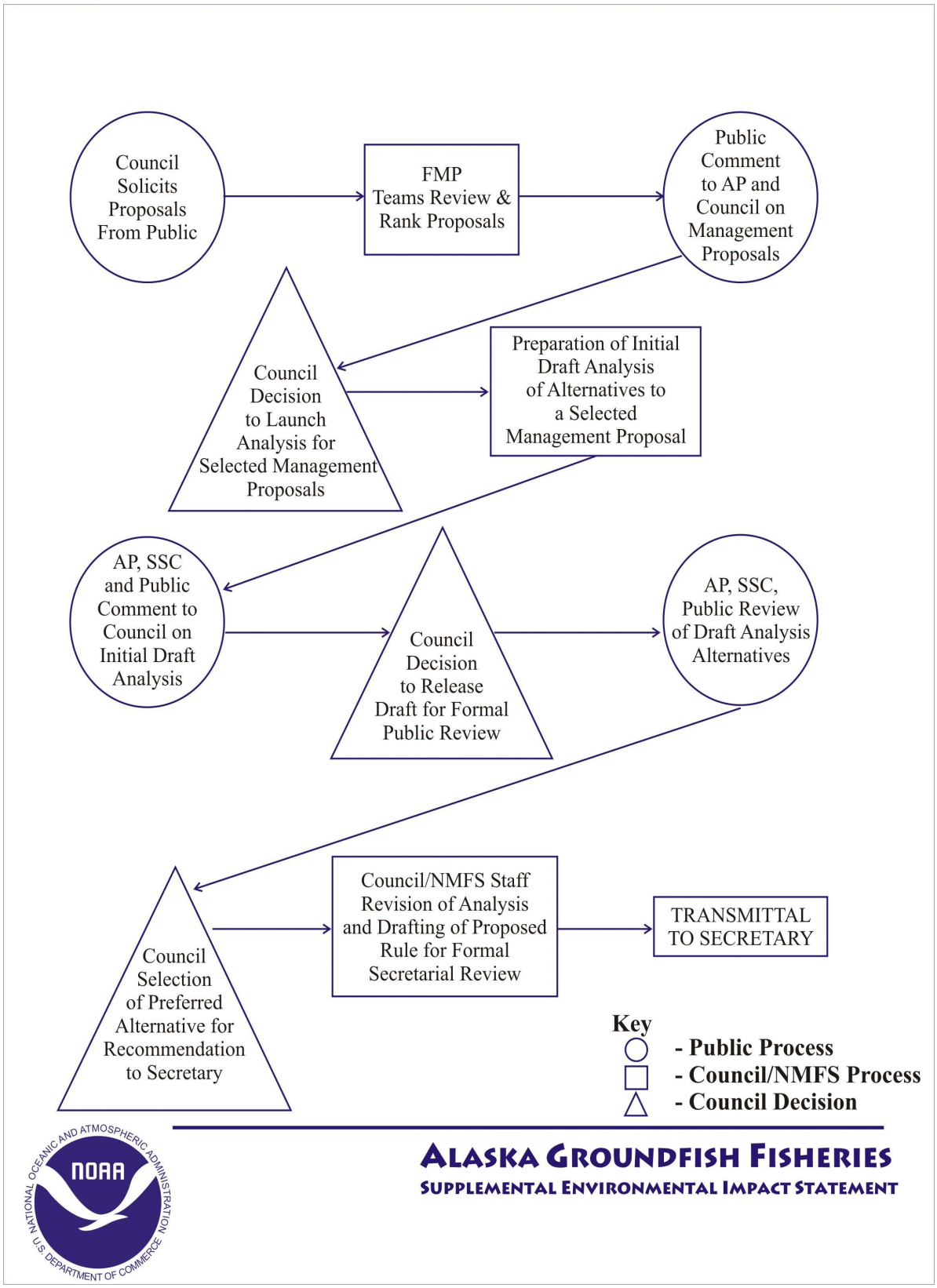

Figure 3-1. NPFMC process for developing Fishery Management Plan and regulatory amendments.

NPFMC Action

The NPFMC's first action in the policymaking process, as indicated above, is to decide which (if any) of the amendment proposals should be developed, with reasonable alternatives for analysis. To make this decision, NPFMC frequently looks at what conservation or management problem would be resolved by the proposal and how important that particular problem is compared to other problems identified in other proposals. Amendments that are needed to address critical issues, such as overfishing, take precedence. In fact, the MSA (Section 304(e)(3)) requires NPFMC to prepare, within one year of being informed by NOAA Fisheries of overfishing or an overfished stock under its jurisdiction, an FMP Amendment that would end overfishing and rebuild the overfished stock. Other statutory requirements also may cause NPFMC to launch a policy change as a priority FMP Amendment. For example, a "jeopardy" determination under Endangered Species Act would require NPFMC to respond with reasonable and prudent revisions to its management regime that eliminates the jeopardy finding. Passage of the SFA in 1996, and the AFA in 1998, also prompted NPFMC to initiate FMP Amendments.

Responding to such statutory requirements for priority attention in initiating policy or management actions may severely limit the amount of staff time NPFMC allocates to analyze the amendment proposals brought by its constituency. The staff's analytical time and resources, even when augmented by NOAA Fisheries and ADF&G staff and contract analysts, is finite while the potential number and depth of amendment analyses requested far exceeds this limit. This has resulted in robust competition for NPFMC attention among various constituency groups and their amendment proposals.

After NPFMC decides to prepare an analysis of a proposed management action, its next step is to review an initial draft of the analysis to determine whether it should be released for public review and comment. In making this decision, NPFMC relies heavily on the advice it receives from its Advisory Panel and Scientific and Statistical Committee. The NPFMC also receives public testimony before making this decision, which indicates that the public has access to the initial draft analysis before the formal public comment period begins. This "public release" decision also considers whether the analysis adequately addresses a reasonable range of alternatives and options, and adequately responds to the requirements of the MSA and other applicable laws. The NPFMC may decide at this point to release the initial draft analysis for formal public review, instruct staff to make certain minor revisions before release, request major revisions and another NPFMC review before release, or suspend further action on the analysis, which would, at least temporarily, stop further development of the proposal.

If NPFMC decides to release the initial draft analysis for public review, the comment period normally is scheduled to begin at least four weeks before NPFMC's next action. The NPFMC's next action on a management proposal is to decide on its preferred alternative. The NPFMC's preferred alternative may be entirely different from the preference of the person or constituency group that originally proposed the action, or NPFMC may decide to abandon the proposal. Choosing the no action alternative, for example, would end further progress of the amendment proposal. Normally, however, NPFMC selects a preferred alternative from those in the analysis or one that is reasonably within the range of alternatives analyzed. The NPFMC takes this action after hearing again from its Advisory Panel, Scientific and Statistical Committee, and the public. If NPFMC chooses a policy alternative that is not explicitly assessed in the analysis as its preferred alternative, the analysis is revised to include the preferred alternative before it is formally submitted for review by the Secretary of Commerce.

This NPFMC process, from soliciting of amendment proposals to submitting a management recommendation for Secretarial review, is illustrated in Figure 3-1. In summary, the annual NPFMC action cycle on policy proposals is as follows:

1. During summer months proposals are solicited.

2. The NPFMC reviews and selects policy proposals at its October meeting.

3. NPFMC staff prepares the required analyses during fall/winter months.

4. Analyses undergo initial review at the April NPFMC meeting.

5. Draft analyses undergo public review in May.

6. The NPFMC adopts a preferred alternative at its June meeting.

7. The analysis is revised and rules are prepared, published, reviewed, etc., during fall months.

8. Approved FMP Amendments for succeeding fishing year are implemented.

The NPFMC deviates from this seasonal cycle of amendment proposals, analysis, and public review to respond to statutory requirements and emergency issues.

3.1.2 Federal Action on Proposed Amendments

Final Action of NPFMC and Document Preparation

The NPFMC's choice of a preferred alternative (other than the no action alternative) frequently is referred to as the "final action of NPFMC to adopt an FMP Amendment for recommendation to the Secretary of Commerce," or simply NPFMC's "final action." Although the analysis frequently needs to be revised to specify the preferred alternative and rule-making documents need to be drafted, NPFMC (i.e., the 11 voting members) rarely reviews the decision-making documents and analyses following a final vote. Instead, NPFMC relies on the work of its staff, the NOAA Fisheries staff in the Alaska Regional Office, and NOAA General Counsel, Alaska Region, to prepare the necessary documents in final form for official submission to NOAA Fisheries for Secretarial review.

The MSA (Section 304(a) and (b)) refers to the submission of a proposed FMP Amendment as a transmittal. This term is important in the regulatory process because the MSA is specific about the time allowed for Secretarial review of an FMP Amendment. Statutory deadlines for providing the public notice of an FMP Amendment proposal and for making an approval/disapproval decision are measured from the transmittal date. Hence, the sequence and timing of federal actions on proposed amendments is delineated by the MSA and other statutes. By contrast, however, the sequence and timing of NPFMC actions on proposed actions is governed primarily by its standard operating procedures. Therefore, NPFMC staff work closely with NOAA Fisheries/NOAA General Counsel staffs to make the transmitted FMP Amendment documents as structurally complete as possible, without prejudice to the particular NPFMC policy change being proposed, so that document revision and clarification after transmittal is minimized and the statutory deadlines can be adhered to as closely as possible.

The principal documents that are submitted or transmitted for Secretarial review include 1) the proposed FMP text, or text changes in the case of an FMP Amendment; 2) the draft analysis of potential environmental and socioeconomic impacts of the preferred alternative and other alternatives considered by NPFMC (the EA/RIR/IRFA and other assessments required by statutes and EOs discussed above); and 3) proposed regulations that would implement the proposed action, if it is approved. In addition to the FMP Amendment text, regional NPFMCs are required by the MSA (Section 303(c))) to simultaneously submit proposed regulations for implementing the FMP Amendment.

The proposed implementing regulations document is a draft FR notice of proposed rule-making. As such, it must conform to the form and style guidance of the Office of the FR. In addition to the actual proposed regulatory text that would amend existing CFR language, the draft proposed rule notice must include a narrative preamble that explains what action is being proposed, why it is necessary, and its legal basis. Proposed rules actions that would affect management and enforcement programs administered by NOAA Fisheries also must be carefully coordinated with those offices to ensure that the proposed requirements could be administered efficiently. For example, a new licensing or permit requirement would have to be carefully crafted so that NPFMC's proposed action, if approved, could be effectively carried out and subsequently enforced. For these reasons, NOAA Fisheries regulatory specialists in the Alaska Regional Office draft the proposed rule document in close consultation with NOAA General Counsel and NPFMC staff.

The proposed FMP text and the draft analysis also may be revised by NOAA Fisheries Alaska Region staff in consultation with NPFMC staff. Again, the purpose of such revisions is to ensure compliance with the MSA and other applicable laws and to ensure that the proposed amendment, if approved, is administratively practicable. If NOAA Fisheries finds a substantive problem in achieving NPFMC's policy goals, however, Alaska Region staff may bring this to NPFMC's attention and recommend a resolution. Also, these documents are carefully reviewed to ensure consistency among the proposed amendment text, the draft proposed rule, and the preferred alternative. NOAA Fisheries Alaska Region staff do the work of coordinating among NPFMC staff, program implementing staff, NOAA Fisheries scientists, and NOAA General Counsel to be certain that all the pertinent documents are as clear and consistent as possible before the proposed amendment is transmitted or formally submitted. At that point, the draft proposed rule and other documents are returned to NPFMC staff for final review and formal submission for Secretarial review.

Cooperation among the professional staffs of NPFMC, NOAA Fisheries Alaska Region, and NOAA General Counsel is critical to avoid rejection, for technical or procedural reasons, of an amendment proposal after official submission. Although NPFMC rarely reconsiders its final action on a policy proposal in light of the revised analysis or draft proposed implementing rules, for highly complex proposals (e.g., limited access programs) NOAA Fisheries staff may review the key elements of the draft proposed rule with NPFMC to be certain that it accurately reflects NPFMC's policy intent. Clarifications are requested when the record of NPFMC's final action is vague. Ultimately, final review by NPFMC staff affords NPFMC with a last opportunity to correct any mistakes in the three principal documents that are submitted for formal Secretarial review before the transmittal date.

Secretarial Review

A schematic representation of the procedural steps involved from NPFMC transmittal to an approval/disapproval decision is presented in Figure 3-2. Official Secretarial review of a proposed FMP Amendment is triggered by the transmittal of the FMP Amendment, analysis, and proposed rule documents.

Section 304(a)(1) of the MSA requires the Secretary of Commerce, "upon transmittal by NPFMC to the Secretary of a fishery management plan or plan amendment," to "immediately commence a review" of the FMP Amendment and to "immediately publish" a notice of availability (NOA) in the FR soliciting public comment on the proposed plan/amendment for a 60-day period beginning on the date of publication.

After receipt of the official FMP Amendment review package, and before publication of the NOA, the Secretary is first required to "immediately review" the proposed FMP Amendment to determine whether it is consistent with the MSA, including the National Standards, and other applicable law. This is essentially a cursory review to see if the policy proposal is structurally complete. If the associated analysis is missing an obvious section required by the RFA or NEPA, for example, or some other critical flaw is apparent, then NOAA Fisheries may return the FMP Amendment package to the Regional NPFMC for additional work. Rejection of an FMP Amendment submitted by NPFMC at this stage rarely occurs primarily because of the collaborative work by the Alaska Region, NOAA General Counsel, and NPFMC staffs.

The draft proposed rules, as previously mentioned, must be submitted by NPFMC at the same time the FMP Amendment is submitted for official Secretarial review. If NPFMC were proposing a regulatory amendment with no change to a FMP, only the draft proposed rule and supporting analysis would be submitted without FMP Amendment language or an NOA. The public comment period for a proposed regulation is specified in the MSA (Section 304(b)) as 15 to 60 days. As a matter of policy, NOAA Fisheries requires proposed rules that would implement FMP Amendments to be available for public comment for 45 days, and proposed rules not associated with FMP Amendments to be available for public comment for 30 days, although shorter and longer comment periods are possible.

The Secretarial decision to approve or disapprove a proposed change also is prescribed by the MSA (Section 304(a) and (b)). For an FMP Amendment, the Secretary must approve, disapprove, or partially approve the FMP Amendment within 30 days of the end of the comment period published in the NOA. If Secretarial action is not taken within this 30-day period, the FMP Amendment takes effect as if it were fully approved. This law limits the Secretary only to approve, disapprove, or partially approve a NPFMC-recommended FMP Amendment and does not allow NOAA Fisheries to substitute its judgment for that of NPFMC's or attach conditions for approval. Section 304(a)(3) states that if an FMP Amendment is disapproved or partially approved, the written notice to NPFMC must specify the applicable law with which the FMP Amendment is inconsistent, the nature of the inconsistency, and recommendations on how NPFMC could correct the inconsistency. Secretarial action on a proposed rule is similarly prescribed. For a proposed regulatory amendment, however, NOAA Fisheries is directed to make the determination of consistency with the FMP/ amendment, the MSA, and other applicable law within 15 days of "immediately" initiating an evaluation of the proposal (i.e., within 20 days of the transmittal date of NPFMC's proposed action).

If NOAA Fisheries determines that the proposed regulatory amendment is consistent, then it is published in the FR, but if the determination is negative, NOAA Fisheries must notify NPFMC in writing, specifying inconsistencies and providing revision recommendations that would make the proposed regulation consistent. An approved FMP Amendment is implemented by publication of the final rule in the FR. The preamble to a final rule must summarize and respond to comments received on the proposed FMP Amendment or proposed rule. For regulations implementing FMPs developed by NPFMC, this final rule FR notice is drafted by NOAA Fisheries Alaska Region staff. The MSA, Section 304(b)(3), requires that a final rule be published within 30 days of the end of the comment period on the proposed rule. The rule normally is not effective for an additional 30 days after it is published as required under the Administrative Procedure. This 30-day delayed effectiveness period can be waived for a final rule only if it relieves a restriction, merely interprets an existing rule, or provides a statement of policy, or it must be made effective earlier than 30 days after publication for good cause.

3.1.3 Fishery Management Regulations

Generally, fisheries management regulations govern the conduct of the fishery; for example, by limiting fishing to a certain area or to a certain time period. Fishery regulations also require reporting and recordkeeping of certain data to provide data to fishery biologists charged with developing conservative harvesting strategies, monitoring the biological and economic health of the fishery, and enforcing regulations. In addition, measures that ensure fairness for all participants in a fishery are sometimes defined in regulations; for example, requiring a fisherman to apply for a license, file a particular report, or pay certain fees. Such fairness rules also may apply to the fishery agency; for example, by requiring it to issue certain reports, specify catch limits, or make certain determinations by a certain date. Fairness rules and reporting and recordkeeping rules may be combined under an administrative category of regulations, which are essential for management operations, but are not necessarily designed to govern the potential harvesting power of individuals. Regulations designed to govern potential harvesting power include five types of restrictions that can be categorized in very general terms as “who,” “what,” “when,” “where,” and “how.” A regulatory regime for any particular fishery can be comprehensively described in terms of these five basic types of restrictions.

Who Can Participate

Until the MSA was implemented in 1977, the only restrictions on who could participate in fisheries in the EEZ were imposed by bilateral or multilateral agreements. Fishery resources beyond the territorial sea jurisdiction of any nation were considered common property and open to fishermen from all nations. Freedom of fishing on the high seas was considered a basic principle of international law of the sea. The MSA established, for the first time at the national level, a fishery resource access priority for U.S. domestic fishermen over fishermen from other countries. Section 201(d) of the MSA defined the Total Allowable Level of Foreign Fishing as that portion of the optimum yield of a fishery in the EEZ that will not be harvested by vessels of the U.S.

In the 1950s, an economic connection was made between the amount of fishing effort or capital invested in a commercial fishery and the overall cost of fishing as a result of fishery resources being considered common property (Gordon 1954). In 1978, the open access fishery problem was summarized as follows,

If there is no control over access in fisheries and if demand for a stock (or stocks) of fish is increasing, then:

- Overcapitalization is inevitable and will become worse as prices for the product increase.

- Measures to prevent depletion will either impose or lead to increased costs of fishing to the fishermen, and these costs will become greater as prices for the product increase.

- The costs of management, research, and enforcement will be borne entirely by the taxpayer (Christy 1978).

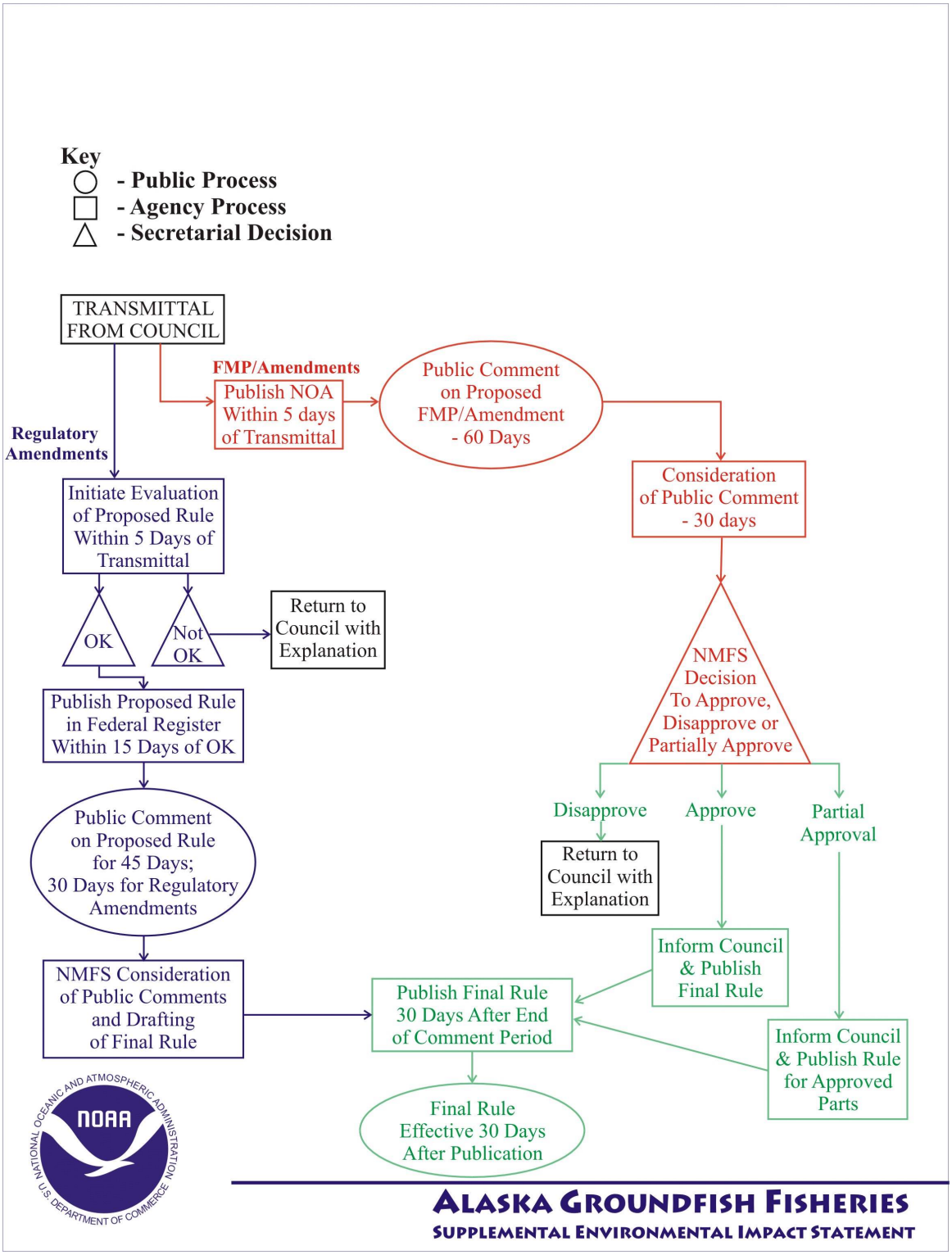

Figure 3-2. Secretarial process for review of North Pacific Fishery Management Council-proposed Fishery Management Plan and regulatory amendments.

Theoretically, the open access problem faced by managers of common property resources may be easily fixed by limiting access or, unlike most fisheries, establishing a system of property rights in the resource. Once a policy decision is made to use a limited access tool in a fishery management regime, the question quickly becomes, to whom should exclusive harvesting privileges be granted? Typically, fishermen who have traditionally and regularly participated in a fishery in the past (i.e., licensed or permitted) are included in a limited access fishery, and those who have never participated or have had insignificant involvement are not included. Early limited access programs had problems in defining these categories of participants (Ginter and Rettig 1978). Fair and defensible implementation of a limited access system requires precise and politically acceptable definitions of traditional, regular, and insignificant participation. Not surprisingly, most of the political controversy surrounding and legal contests to limited access have focused on the questions, "Who is in?" "Who is out?" and "Why?".

Under the MSA, limited access systems are discretionary, but the law provides some guidance and standards in their development. National Standard 4 (Section 301(a)(4)) states:

> *"If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.*"

Although National Standard 5 (Section 301(a)(5)) appears to foster the development of limited access systems by requiring fishery policymakers to "consider efficiency in the utilization of fishery resources," it quickly tempers that direction by requiring that conservation and management measures not have economic allocation as their sole purpose. Instead, the MSA ties a limited access to optimum yield (50 CFR 600.330). At Section 303(b)(6), the Act provides for the establishment of

> *"...a limited access system in order to achieve optimum yield if, in developing such a system, NPFMC and the Secretary take into account:*
>
> *(A) present participation in the fishery,*
> *(B) historical fishing practices in, and dependence on, the fishery,*
> *(C) the economics of the fishery,*
> *(D) the capability of fishing vessels used in the fishery to engage in other fisheries,*
> *(E) the cultural and social framework relevant to the fishery and any affected fishing communities, and*
> *(F) any other relevant considerations.*

The NPFMC has exercised this discretionary limited access authority on several occasions. In 1985, a removal of a Japanese sablefish fishery from the EEZ caused a price increase for sablefish stimulating overcapacity conditions. This prompted NPFMC to attempt a limited access policy. In December 1991, NPFMC adopted an IFQ Program for the halibut and sablefish fixed-gear fishery. An IFQ is a limited access system that involves a federal permit to harvest a specified quantity of fish derived from units representing a percentage of the TAC of a fishery. A person holding an IFQ has an exclusive harvesting privilege to catch a specified amount of fish. The IFQ Program developed by NPFMC provided for certain limited transfer of IFQ underlying units. The NPFMC's attempt at proposing a limited access policy was successful. The NPFMC submitted this policy proposal as a combined regulatory amendment with regard to halibut and an

FMP Amendment with regard to sablefish. The policy was fully approved by NOAA Fisheries on January 29, 1993, and final implementing rules were published on November 9, 1993 (58 FR 59375). A new feature of the IFQ Program is that it included a separate allocation of halibut and sablefish for a CDQ Program. By definition in the MSA (Section 3(21)), a CDQ does not include an IFQ.

Although limiting the number of vessels that can fish a given area is a powerful tool for protecting limited stocks, modern fishing technologies (i.e., computerized fish detectors and global positioning systems as well as gear improvements) often allow fishermen to harvest a large amount of fish in a short period of time. If the TAC for a given area can be caught in a matter of days, fishermen wishing to participate in that particular fishery are forced into a "race-for-fish". This is one indication that, even with limited entry, a given fishery may have an over-harvesting capacity. While the race-for-fish system is "fair" in the sense that everyone has the same opportunity to step into the race, there are significant concerns that this practice compels fishermen to work with very little sleep, heedless of weather or sea conditions, and thus leads to needlessly dangerous fishing conditions. Another argument against the race-for-fish is that it tends to swamp the capacity of fish processors when all the fish come in at the same time and leads to wasteful and inefficient use of the resource.

One way that fishery managers have responded to this situation is by developing so-called "rationalized" or "rights-based" fisheries. These controversial programs give specific individuals or communities the right to harvest a given percentage of the catch. These programs can be designed to allow individuals to catch their quota of fish over a relatively long time period. The intent is that quota holders would fish when it is safe or convenient to do so, given all other fishing restrictions. If designed properly, this individual flexibility could reduce the race-for-fish, increase the temporal and spatial distribution of fishing effort, and even out the demands on the processing/marketing sectors of the industry. The controversy arises over the contention that these programs grant private access to public resources, with all the economic benefits that accrue, to the exclusion of other citizens. Some people feel that rationalization plans have less to do with conservation or safety concerns and are really designed to preserve profitability for the select few who receive fishing rights.

Under the MSA, limited access systems are discretionary, but the law provides some guidance and standards in developing them. The NPFMC has exercised this discretionary limited access authority on several occasions.

In late 2000, Congress and the President of the United States approved the "Fishing Capacity Reduction Program for Bering Sea and Aleutian Islands Crab" (Crab Capacity Reduction Program, Public Law 106-554). The goal of this law is to reduce fishing capacity in the BSAI crab fisheries by creating a license and vessel buyback program. Congress amended this law by Public Law 107-20 and 107-177. The buyback program regulations remain under development. (See NOAA website at http://www.fakr.noaa.gov/ram/crab.htm)

Although Pacific halibut is not a groundfish governed under the MSA, under the Northern Pacific Halibut Act of 1982, NPFMC is authorized to recommend allocation measures for the halibut fishery to the Secretary of Commerce. In December 1991, NPFMC adopted an IFQ Program for the halibut and sablefish fixed-gear fishery in response to overcapacity conditions. An IFQ is a limited access system that involves a federal permit to harvest a specified percentage of the TAC of a fishery. A person holding an IFQ has an exclusive harvesting privilege to catch a specified amount of fish. A novel feature of the IFQ Program is that it included

a separate allocation of halibut and sablefish for a CDQ Program. A CDQ is an allocation of a specific amount of fish that may be harvested by a particular type of coastal community or group of communities.

In the early 1990s, NPFMC also became increasingly aware of excess harvesting capacity in the groundfish and crab fisheries under its jurisdiction. In June 1992, NPFMC again exercised its discretion to recommend a limited access policy by adopting another moratorium on the entry of new vessels into the groundfish and Bering Sea crab fisheries. The Vessel Monitoring Program (VMP) was designed to be an interim measure until a comprehensive rationalization plan could be developed and implemented. The VMP proposal was approved by NOAA Fisheries on June 29, 1995, and implemented by final rule on January 1, 1996 (final rule published August 10, 1995, 60 FR 40763, correction published September 12, 1995, 60 FR 47312). The VMP limited the ability of new participants to enter these fisheries until it was replaced by the LLP in January 2000. The LLP was adopted by NPFMC in June 1995, together with a multi-species CDQ program that included all other groundfish and crab species for which there were no CDQ allocations at that time (in addition to halibut and sablefish, NPFMC created a CDQ allocation of pollock in conjunction with its inshore-offshore allocation in 1992). The NPFMC's LLP, including the multi-species CDQ program, was approved by NOAA Fisheries on September 12, 1997, and implementing rules for the LLP were published October 1, 1998 (63 FR 52642; amended on August 6, 1999 (64 FR 42826), May 12, 2000 (65 FR 30549), and May 16, 2000 (65 FR 31103)).

Currently, participation in all fisheries for which NPFMC has an FMP is managed under limited access system. The federal regulations that implement such systems for the IFQ, CDQ, LLP, and AFA programs for the groundfish fisheries are published primarily at 50 CFR 679.4, 679.30–32, 679.40–45, and 679.60–64, which lists the qualification criteria for receiving and transferring harvesting privileges (permits or licenses) under these limited access systems and other management consideration. NOAA Fisheries Alaska Region's Restricted Access Management office administers these systems.

The following websites can be accessed for detailed information on FR documents:

- 60 FR 40763 can be found on the USEPA website in its entirety at http://www.epa.gov/fedrgstr/EPA-SPECIES/1998/November/Day-13/e30435.htm.
- 63 FR 52642 can be found on the NOAA website in its entirety at http://www.fakr.noaa.gov/frules/39-41-5LLP.pdf.
- 64 FR 42826 can be found on the NOAA website in its entirety at http://www.fakr.noaa.gov/frules/llpappl.PDF.
- 65 FR 30549 can be found on the NOAA website in its entirety at http://www.fakr.noaa.gov/frules/llpcorrection.pdf.
- 65 FR 31103 can be found on the NOAA website in its entirety at http://www.fakr.noaa.gov/frules/llpendorsement.pdf.
- 50 CFR 679 is available on the National Archives and Records Administration CFR website http://www.access.gpo/gov/nara/cfr/cfr-table-search-html.

What May Be Harvested

Regulations on what species of fish and how much of a particular species of fish may be harvested represent the most basic form of fisheries management. Such regulations focus on amounts of a regulated species and are commonly referred to as *quotas*, *catch limits*, or *bag limits*. The basic conservation premise for regulating what or how much is harvested is that fish stock abundance is inversely related to fishing mortality. That is, lower fish mortality due to fishing will produce greater abundance of the stock. A catch limit is designed to balance the harvest of the stock with the natural growth of the stock, minus the growth needed for the stock to reproduce itself. Theoretically, at the "right" catch limit, the harvest is sustainable over time. A size limit is frequently integrated in a catch limit rule. Minimum size limits are designed to allow fish to grow to sexual maturity and spawn at least once before becoming vulnerable to fishing gear. Maximum size limits may also be used to protect the largest animals because, in some species, they are the most productive.

Another harvest is that of regulation of incidentally caught species. Incidental catch, also called bycatch, is virtually inevitable in any fishery except those highly selective, low-volume fisheries such as dive fisheries for sponges, sea urchins and ornamental fish, or clam digging, in which the fisherman visually selects and captures the animal he is fishing. Other fisheries that use nets, hook gear, or traps of any kind are likely to capture or kill species other than the species being targeted.

Bycatch may not always be a species other than that being targeted. For example, there may be a market for a particular species and thus a fisherman targets that species with his fishing gear: individual fish of the species that are too small, too large, or of the wrong gender may be worthless at market. Hence, fish–regardless of whether they are the species targeted–that have little or no value to the fisherman may be considered bycatch. This bycatch is often referred to as economic bycatch. Regulatory bycatch occurs when fishermen are required to discard fish that would violate size, sex, season, area, gear, and others regulations.

Because bycatch is not likely to be zero, regulatory incentives can be provided to minimize it. For example, a bycatch limit may be imposed that, when reached, causes closure of the targeted fishery or causes closure of certain high bycatch areas. Alternatively, bycatch may be required to be retained, which imposes an economic cost on fishermen in terms of the time taken to handle the bycatch, and hold space on the fishing vessel that is used to store the bycatch. Retained bycatch, however, is an oxymoron under the MSA which defines bycatch only in terms of discarded fish, i.e., ". . . fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards" (Section 3(2)).

For the groundfish fisheries in the EEZ off Alaska, the two groundfish FMPs specify what species constitute groundfish, fishing for which is governed under the FMPs (BSAI, Section 3.1 and 13.2; GOA, Section 3.1). Prohibited species are also identified in the FMPs (BSAI, Section 13.2; GOA, Section 4.2.3) and their implementing regulations at 50 CFR 679.21(b). These species are prohibited in the groundfish fisheries because other fisheries depend on them. The prohibited species are the only non-groundfish species required (with certain exceptions) to be discarded if caught while fishing for groundfish and, therefore, are considered regulatory discards or bycatch under the MSA. The amount of groundfish that may be harvested annually is referred to in the FMPs and FMP implementing regulations as TAC. A TAC is specified for each groundfish species, and the sum of all groundfish species is restricted to a TAC range. A catch limit specified for certain prohibited species is the PSC limit. The FMP implementing regulations require NOAA Fisheries, in consultation with NPFMC, to annually establish TACs for each groundfish species based on biological condition of the stocks as well as socioeconomic considerations (50 CFR 679.20(a)). These amounts, and

some PSC limits, also are apportioned and allocated among various fishing industry components during the annual TAC-setting process as specified in the FMP implementing regulations (50 CFR 679.20–21).

The annual TAC-setting process is similar to the rule-making process for FMP Amendments in that proposed TACs for the upcoming year are published in the FR for public comment before publication of final TACs. The analytical basis for NPFMC's TAC recommendations are Stock Assessment and Fishery Evaluation (SAFE) reports, produced annually by NOAA Fisheries fishery biologists and economists and reviewed by NPFMC's FMP Teams, Science and Statistical Committee, and Advisory Panel before adoption by NPFMC. The TAC-setting process begins in September with the Plan Teams' review of preliminary stock assessment data. For public comment purposes, NPFMC recommends proposed TACs for the following fishing year at its October meeting and finalizes TACs at its December meeting. Once approved by NOAA Fisheries, the TAC amounts and their apportionments and allocations among areas, gear types, or sectors are published in the FR. Fishery closures are made by NOAA Fisheries during that fishing year to avoid exceeding the TACs.

The groundfish fishing year in both the BSAI and the GOA begins January 1. Publication of final TAC specification over one month after that date causes a logistical problem for authorizing management actions (such as closures when various seasonal or sector apportionments of a TAC are reached) before the final TACs are effective. The initial remedy for this problem was to publish interim TACs, which would be effective from January 1 until publication of the final TACs. The interim TACs are prescribed as 25 percent of the proposed TACs. This approach has been unsatisfactory in recent years, however, because the proposed TACs do not represent the best available scientific information. This information typically does not become available until November, after the stock assessment biologists have an opportunity to integrate the previous summer's biological survey data in their population dynamics models. The NPFMC recommended a revision of the TAC-setting process in 1996 (BSAI/GOA FMP Amendments 48/48), but technical difficulties pertaining to the timing and completion of analyses required by NEPA, RFA, and other statutes (Section 2.3.2 and Section 2.3.3) have delayed a regulatory amendment that would implement a revised TAC-setting process. A new draft analysis to revise the process was presented to NPFMC in June 2000 (Draft EA/RIR/IRFA For Amending the Process by Which Total Allowable Catch Specifications Are Established For Alaska Groundfish Fisheries, NOAA Fisheries, May 25, 2000).

In December 2001, an EA for the TAC Specifications for the year 2002 was issued by NOAA Fisheries. (http://www.fakr.noaa.gov/npfmc/safes/2001/2002EA.pdf). On December 20, 2001, the U.S. Department of Commerce issued a finding of no significant impact (FONSI) for the 2002 TAC Specifications EA. The TAC specifications were established "by emergency interim rule in order to manage and conserve the groundfish fisheries in the exclusive economic zone off Alaska" (U.S. Dept. of Commerce Memo, December 20, 2001). See http://www.fakr.noaa.gov/sustainablefisheries/ea/fonsi2001tac.pdf.

When and Where Harvesting May Occur

Fishing is allowed unless regulations specifically close or limit the harvesting of fish. Limitations are specified in terms of the area and time period during which they apply and regulations governing when and where fish may be harvested are nearly always linked. For example, a rule usually specifies an area in which certain restrictions apply for a specified time period or season in which certain fishing may or may not occur. An area may be closed all the time, for only certain time periods, or for only certain fishing-gear types. Alternatively, an area may be open at the beginning of a fishing year and remain open unless certain criteria are triggered during the year that cause it to close. The reasons for restricting fishing in a certain area are as varied as the types of restrictions that apply. An area may be closed to fishing for conservation reasons; for

example, protecting spawning stock of the target species or controlling the bycatch of a different species, or preventing competition between the fishery and marine mammals protected under the ESA. Fishing in certain areas also may be restricted for allocation purposes or to ensure an orderly fishery; for example, conflicts between different gear types may require prohibiting one gear type in an area for a particular period of time or fishing effort may be spread over a larger area by selectively closing smaller areas.

For the groundfish fisheries in the EEZ off Alaska, rules stipulating where and when fishing is restricted generally appear at 50 CFR 679.22–23. Regulations at 50 CFR 679.20–21, however, also provide for certain area closures when specified TAC and PSC limits are reached.

How Harvesting May Occur

Another basic fishing restriction is regulations prescribing what types of fishing gear may or may not be used to harvest certain species. Fishing gear regulations also may be specific to certain areas or seasons and often are linked with restrictions on when and where harvesting may occur. The purpose of gear restrictions may be biological conservation, socioeconomic management, or both. Some types of fishing gear are more selective than others for the species targeted. Regulations may minimize the impact of fishing gear on non-targeted species, fish habitat, and the sea bottom. Also, gear restrictions may be necessary to resolve gear conflicts or to protect the interests of fishermen who have traditionally used a particular gear type. For example, GOA FMP Amendment 14, adopted in 1985, prohibited the use of pot gear in the eastern GOA in the sablefish fishery because pots conflicted with the retrieval of hook-and-line gear, which was traditionally used in that fishery. In addition, gear restrictions are commonly used in an open access fishery to impose constraints on the harvesting efficiency of the fleet. Efficiency restrictions effectively allow for more participation in the fishery rather than less, which may be desirable to slow the pace of harvesting or to distribute the social and economic benefits of the harvest among more participants, as, for example, in a recreational fishery.

Until recently, any fishing gear could be used to harvest fish in the EEZ unless it was specifically prohibited or regulated. The 1996 amendments to the MSA (Section 305(a)) changed this approach by requiring the Secretary of Commerce to publish a list of authorized fisheries and fishing gear. Under this change, a fish, regardless of whether it was targeted for capture, may be retained only if it is taken within a listed fishery, is taken with gear authorized for that fishery, and is taken in conformance with all other applicable regulations. A final rule that lists authorized fisheries and gear types was published December 2, 1999 (64 FR 67511). Authorized gear types for the BSAI and GOA groundfish fisheries are listed in part VII of the table in 50 CFR 600.725(v). Management measures controlling the use of fishing gear for groundfish also set out in the BSAI FMP at Section 13.4.4 and in the GOA FMP at Section 4.3.1.2.3. These groundfish gear limitations are implemented by regulations at 50 CFR 679.24.

The following website can be accessed for more information:

- 64 FR 67511 can be found on the NOAA website in its entirety at http://www.nmfs.noaa.gov/sfa/022498f.pdf.

3.1.4 Groundfish Catch Monitoring and In-season Fishery Management

Groundfish fisheries in U.S. EEZ waters of the North Pacific Ocean are managed under several different programs, including the CDQ Program, the sablefish IFQ Program, the AFA pollock fishery, and the fishery that is open to all permitted vessels that have licenses under the LLP, which will be referred to as the general groundfish fishery. Catch information data used to manage these fisheries is collected from vessels and processors and from fishery observers trained by NOAA Fisheries. This section discusses permitting, recordkeeping, and reporting requirements; data used for catch estimation; and the in-season fishery management programs.

Permitting Requirements

NOAA Fisheries manages the groundfish fisheries of the BSAI and GOA in part through federal fisheries permits and federal processor permits, which are issued upon request (50 CFR 679.4). These permits authorize participants to harvest, receive, or process groundfish from the BSAI and GOA. A federal fisheries permit may be issued to a vessel that functions as a catcher vessel (greater than 60 ft length over-all [LOA]), catcher processor, mothership, tender vessel, or any combination of the four categories. Or, a vessel may be permitted as a support vessel. No vessel may fish for groundfish or receive groundfish harvested in the BSAI or GOA without a federal fisheries permit. A federal processor permit may be issued to a shoreside processor or a stationary floating processor that receives or processes groundfish. No shoreside processor or stationary floating processor may receive or process groundfish harvested in the BSAI or GOA without a federal processor permit. In 1999, moratorium permits (50 CFR 679.4(c)) were required for vessels fishing for groundfish and crab, with the objective of limiting fishing effort in BSAI and GOA fisheries. In 2000, the LLP (50 CFR 679.4(k)) replaced the vessel moratorium requirements and vessels are now required to obtain groundfish LLP licenses and crab LLP licenses. No vessel may fish in the BSAI or GOA without an LLP license. As of 2002, the requirements include:

- Catcher vessels: federal fisheries permit, LLP Permit, High Seas Fishing Compliance Act permit (for vessels fishing outside the U.S. EEZ).
- Catcher processors and motherships: federal fisheries permit, federal processor permit, LLP Permit.
- Shoreside processors: federal processor permit.
- IFQ vessels: IFQ Permit, IFQ Card.
- IFQ buyers and processors: registered buyer permit.
- Vessels and processors authorized under the AFA to harvest or process Bering Sea pollock: AFA permits.

In 2000, the LLP replaced the vessel moratorium program and qualifying vessels were issued LLP permits. LLP permits are based on the vessel catch history during the LLP qualifying period (the general qualification period was January 1, 1988 to June 27, 1992). Under the LLP, the number of vessels allowed to fish for groundfish in federal waters is limited, although the number of LLP permits still exceeds the number of vessels historically fishing in any one year. The LLP permits for groundfish include area endorsements. See

License Limitation Program Groundfish Licenses (NOAA Fisheries-RAM) for a list of License Holders as of July 11, 2002 http://www.fakr.noaa.gov/ram/daily/llp_gf.pdf.

In addition, the AFA authorized the issuance of AFA permits in the year 2000 to those catcher vessels, motherships, catcher processors, shoreside processors, and stationary floating processors qualified to harvest or process pollock in the BSAI. Inshore cooperative fishing permits also are required. The number and type of AFA permits issued are discussed under Bering Sea pollock.

All permits are issued without charge, except for the High Seas Fishing Compliance Act Permit (50 CFR 300.13), which is issued by NOAA Fisheries for fishermen fishing outside of the U.S. EEZ and requires a $50 fee. The fisheries participant must apply to NOAA Fisheries for permits, renew existing permits within appropriate time limits, and maintain the supporting documents required to demonstrate that he or she meets permit or license criteria. Appeal programs are available for applicants who believe they were falsely denied an AFA permit, IFQ permit or card, CDQ permit or card. (See Groundfish Federal Fisheries Permit or Federal Processor Permit Application and Instructions http://www.fakr.noaa.gov/ram/ffp_fpp_app_inst.pdf High Seas Fishing Compliance Permit Application http://www.fakr.noaa.gov/ram/hsfca_apn.pdf).

Source: Experimental fisheries permits (50 CFR 679.6) are issued to qualified applicants to authorize fishing for groundfish in a manner that would otherwise be prohibited and that otherwise may not be available through research or commercial fishing operations. Scientific research permits (50 CFR 600.745) are issued to qualified research agencies (generally NOAA Fisheries) under specific conditions for either fishery research vessels or fishing vessels chartered by NOAA Fisheries to fish groundfish outside the established TAC quotas. In addition, NOAA Fisheries issues permits to fishermen for high seas salmon fishing, a fishery that ADF&G monitors and manages.

Recordkeeping and Reporting Requirements

Participants issued federal fisheries permits, federal processor permits, groundfish LLP permits, and AFA permits are required to comply with recordkeeping and reporting requirements to report groundfish harvest, discard, receipt, and production (50 CFR 679.5). This enables NOAA Fisheries to collect data necessary to manage groundfish and prohibited species quotas. Reporting requirements include logbooks maintained at both the shoreside processing plant and onboard the processor vessel, as well as forms that are submitted to NOAA Fisheries.

Catcher vessels and buying stations (tender vessels and land-based buying stations) are required to record daily fishery information in logbooks. Processors (motherships, catcher processors, shoreside processors, and stationary floating processors) are required to record daily fishery information in logbooks, summarize the information on weekly production reports (WPR), and submit them to NOAA Fisheries via fax or an approved electronic reporting system. To assist NOAA Fisheries in determining fishing effort by species, processors also report the start and end of their participation in fishing operations (called check-in/check-out reports). To assist NOAA Fisheries in developing a catch history for catcher vessels delivering to motherships, each mothership must issue ADF&G fish tickets for each groundfish delivery. (See 2002 Check-in/Check-out Report for Mothership or Catcher Processor http://www.fakr.noaa.gov/rr/forms/chckmcp.pdf; 2002 Check-in/Check-out Reports for Shoreside Processor http://www.fakr.noaa.gov/rr/forms/chckss.pdf; 2002 Weekly Production Report for Mothership or Catcher Processor http://www.fakr.noaa.gov/rr/forms/wprmcp.pdf; 2002 Weekly Production Report for Shoreside Processor http://www.fakr.noaa.gov/rr/forms/wprss.pdf; 2002 Alaska Groundfish Processor Daily Report

http://www.fakr.noaa.gov/rr/forms/dpr.pdf; Alaska Department of Fish & Game Groundfish Ticket http://www.fakr.noaa.gov/rr/forms/dpr.pdf; 2002 U.S. Vessel Activity Report http://www.fakr.noaa.gov/rr/forms/var.pdf; and go to http://www.fakr.noaa.gov/rr/log.htm to see the Daily Production Logbooks for Catcher Vessel Trawl, Longline and Pot Gear, Catcher Processor Trawl, Longline and Pot Gear, Mothership, and Shoreside Processor.)

As of September 2001, groundfish motherships and catcher processors are also required to submit a Commercial Operator's Annual Report (COAR) annually to ADF&G (66 FR 43524 and 66 FR 55123). The objectives are to gather information on exvessel and first wholesale values for state-wide finfish and shellfish products from catcher processors and motherships at sea. These data will provide means to compare value information (in dollars) of different types of species and products from all processors of fish harvested from Alaska State and Federal waters within a year and comparisons of several years through consistent yearly collection of information http://www.fakr.noaa.gov/frules/rrrcoarfr.pdf. NOTE: 66 FR 43524 and 66 FR 55123 can be found on the NOAA website in its entirety at http://www.fakr.noaa.gov/frules/rrrcoarfr.pdf and http://www.fakr.noaa.gov/frules/coarcorrection.pdf.

NOAA Fisheries administers and permits several programs in the EEZ off Alaska in addition to open-access groundfish, and for these programs, requires additional permits. Permit types, dates of creation, and initiating documentation are presented in Table 3-1. The IFQ Program (50 CFR 679.4(d)) allocates annual total catch limits for the IFQ Pacific halibut (halibut) and sablefish fisheries among individual fishermen and issues IFQ permits, IFQ cards, and IFQ registered buyer permits. The CDQ program (50 CFR 679.32(f)) is allocated a percentage of all BSAI quotas for groundfish, prohibited species, halibut, and crab. Eligible communities in western Alaska are issued halibut CDQ permits and cards. NOAA Fisheries issues AFA permits (50 CFR 679.4(l)) to qualified vessels, processors, and cooperatives for the harvest and processing of BSAI non-CDQ pollock. The Prohibited Species Donation program (50 CFR 679.26) issues salmon permits and halibut permits to tax-exempt organizations, which may then receive the PSC of salmon and halibut from vessels using trawl gear. The organizations participating in the Prohibited Species Donation program package and distribute the product to hunger relief agencies, food bank networks, or food bank distributors.

Seven types of logbooks, with instruction manuals, are provided by NOAA Fisheries to participants of the groundfish fisheries free-of-charge: catcher vessel groundfish/IFQ daily fishing logbook, catcher vessel groundfish daily fishing logbook, catcher processor groundfish/IFQ daily cumulative production logbook, catcher processor groundfish daily cumulative production logbook, mothership daily cumulative production logbook, shoreside processor daily cumulative production logbook, and buying station daily cumulative logbook. The shoreside processor daily cumulative production logbook is also available as a shoreside processor electronic logbook with daily automated data submittal to NOAA Fisheries. If using the shoreside processor electronic logbook, the processor is not required to submit WPR or quarterly logsheets to NOAA Fisheries. Shoreside processors and stationary floating processors that receive deliveries of AFA non-CDQ pollock from catcher vessels must use the shoreside processor electronic logbook. Information common to all the logbooks includes: participant identification; amount and species of harvest, discard, and product; gear type used for harvest; area of harvest; and observer information. For most logbooks and forms, the area reported is the NOAA Fisheries reporting area. For the shoreside processor electronic logbook, the area reported is the ADF&G statistical area, which is more precise than the NOAA Fisheries reporting area. NOAA Fisheries can determine the reporting area from the ADF&G statistical area. Catcher vessels and catcher processors with an IFQ permit and IFQ card for Pacific halibut or sablefish must notify NOAA Fisheries by telephone before an IFQ landing to arrange for enforcement presence. A participant with an IFQ registered buyer permit must submit an electronic landing report through a transaction terminal after an IFQ

landing and must submit a shipment report for each transfer of IFQ fish. Other reports are required if the IFQ fish leave the EEZ off Alaska or leave Alaska State waters. For new regulations see

- 2002 IFQ/CDQ Manual Landing Report http://www.fakr.noaa.gov/rr/forms/ifqlandrpt.pdf.
- 2002 IFQ/CDQ Shipment Report http://www.fakr.noaa.gov/rr/forms/ifqshiprpt.pdf.
- CDQ Catch Report and Instructions http://www.fakr.noaa.gov/cdq/02cdqcr.pdf.
- CDQ Delivery Report and Instructions http://www.fakr.noaa.gov/cdq/02cdqdr.pdf.
- 2002 Buying Station Report http://www.fakr.noaa.gov/rr/forms/bsr.pdf.
- 2002 Groundfish Product Transfer Report http://www.fakr.noaa.gov/rr/forms/ptr.pdf.

Table 3-1. Permits and programs.

Program	FMP Reference	Date
Groundfish		
Bering Sea and Aleutian Islands (BSAI)	BSAI Amendment 1	1983
Gulf of Alaska (GOA)	GOA Amendment 1	1978
High seas salmon		1978
Individual fishing quota (IFQ)		
Halibut	50 CFR 300	
Sablefish	BSAI Amendment 15 GOA Amendment 20	1993 1994
Community development quota (CDQ)		
Sablefish	BSAI Amendment 30 GOA Amendment 34	1997 1994
Groundfish and crab	BSAI Amendment 39 GOA Amendment 41	1996 1996
Groundfish Observer Program	GOA Amendment 18	1994
Moratorium		
Groundfish and crab	BSAI Amendment 23 GOA Amendment 28	1996 1995
License Limitation Program (LLP)		
Groundfish and crab	BSAI Amendment 39 GOA Amendment 41	1996 1997
King and tanner crab	BSAI Amendment 1	1989
Donated prohibited species	BSAI Amendment 50 GOA Amendment 50	1995 1996
Experimental fishing permit	GOA Amendment 22	1992

Shoreside processors and stationary floating processors that receive deliveries of groundfish or prohibited species under the CDQ program must submit a CDQ delivery report to NOAA Fisheries for each delivery. If using the shoreside processor electronic logbook, the processor is not required to submit separate CDQ delivery reports. CDQ groups must submit CDQ catch reports to NOAA Fisheries detailing the groundfish and prohibited species catch by vessels fishing for the CDQ group.

Catch Monitoring by Groundfish Observers

Regulations at 59 CFR 679.50 require groundfish observers aboard vessels equal to or greater than 60 ft LOA and at shoreside processors that process more than 500 mt of groundfish in a single monthly period. Two levels of observer coverage are established:

1. Vessels in the 60- to 124-ft LOA range and all vessels equal to or larger than 60 ft LOA using pot gear are required to carry groundfish observers during 30 percent of their fishing days. Vessels not using pot gear and that are greater than 124 ft LOA, require 100 percent observer coverage.

2. Shoreside processors that process 500–1,000 mt of groundfish in a monthly period require 30 percent observer coverage; those that process more than 1,000 mt require 100 percent coverage.

Under the new observer program, approximately of 5 percent of the Kodiak set gillnet fishery will be observed during the 2002 and 2003 salmon seasons. The objectives are to:

1. Obtain reliable estimates of incidental serious injury and mortality of marine mammals and seabirds.

2. Identify fishing methods or technology that may increase or decrease incidental serious injury or mortality.

3. Collect biological samples to support and promote scientific studies.

4. Record data on bycatch and discard levels of all species for scientific purposes.

From a letter to Kodiak setnetter permit holders, http://www.fakr.noaa.gov/protectedresources/observers/kodiaksetnetltr.pdf (this expands the observer program to small boats).

Additional observer coverage requirements are established for vessels and processors participating in management programs involving vessel-specific fishery quotas, such as the Western Alaska CDQ program or the AFA pollock fisheries.

Observers provide estimates of total catch and species composition, and species-specific biological data used in stock assessments. Observers have multiple duties, but the remainder of this section focuses on only the highest priority duties of catch weight estimation, species composition estimation, and timely inseason reporting of these data.

Observer Methods of Estimating Catch Weight

Haul-specific total catch weights are estimated by observers using one of three methods: 1) volumetric, 2) direct weight, or 3) tally. Volumetric and direct weight methods are applied primarily in trawl fisheries, while tally methods are used in hook-and-line and pot fisheries. Observers are instructed to make independent estimates of catch weight for as many hauls and sets as possible. Unverified vessel estimates of catch weight are reported by observers as official total catch (OTC) for hauls and sets where observers are unable to make an independent estimate. In 1997, observers independently estimated 72 percent of hauls and sets aboard observed vessels, accounting for 68 percent of the total reported observed OTC of 1.5 million mt. Vessel estimates were used for 7 percent of hauls and sets (10 percent of OTC by weight), and a different estimate

(proportioned delivery weight, expansion from sampled to unsampled hook-and-line sets, etc.) was used for the remaining 20 percent of hauls and sets (22 percent of OTC by weight).

Volumetric catch weight estimates have two components: 1) the measured volume of the catch and 2) the estimated density of the catch used to convert catch volume to catch weight. Observers either measure the volume of full codends before the catch is emptied, or in holding bins after it is emptied:

- In *codend volume estimation*, the observer estimates the approximate geometric shape (cylinder, elliptical solid, rectangular solid, or more complex shape) of the codend. The observer measures the total length of the codend and calculates the average height and width of the codend by measuring in several places along its length. These measurements are inserted into the appropriate geometric formula to calculate codend volume, and that volume is converted to weight using a density factor.

- In *bin volume estimation*, the observer measures the floor area of each empty holding bin on the vessel and marks height increments on the bin walls or verifies any preexisting increments. When the bins are filled, the observer measures the height of fish in the bin at four or more points and calculates average height. The known floor area of the bin is multiplied by average height of fish in the bin to calculate bin volume, and that volume is converted to weight using a density factor.

- The *density factor*, measured in weight per unit volume, is used to convert estimates of catch volume to catch weight. In pollock fisheries, the density factor prescribed by NOAA Fisheries is 0.98 metric tons per cubic meter (mt/m^3) for bin volumes and 1.02 mt/m^3 for codend volumes. Density is estimated for all other fisheries using the basket method, in which four observer baskets are filled with unsorted catch to a consistent level and weighed. The sum of the weight in the baskets divided by the sum of the known basket volumes is used as the density factor. When possible, observers are encouraged to use larger known volume containers to estimate density, but most must use baskets.

- In *direct weighing*, catch weight (excluding discards) is measured directly for catcher vessels delivering to shoreside processors, and on a subset of catcher processors equipped with in-line, motion-compensated flow scales.

The catch estimation methods used by observers vary among the vessel types, due to differences in available equipment and in fishery operations. Observers aboard catcher vessels make volumetric (usually codend) estimates of catch weight for individual hauls at sea. In some cases, this is not possible due to large codend sizes. Discard information is also collected. When the vessel delivers to a shoreside processor, the catch is weighed on scales. The observer then uses the at-sea volumetric estimates and any discard information to proportion the delivery weight back to individual haul weights. If an observer is unable to make volumetric estimates at sea, vessel estimates of individual haul weights may be used to proportion the delivery weight. In-line flow scales are installed aboard many catcher processors and can provide very accurate individual haul weights. The trawl catcher processors that fish under the AFA or the CDQ regulations are required to weigh their catches using NOAA Fisheries-inspected, in-line motion-compensated scale systems. All fish coming aboard these vessels are weighed, and these weights are reported to NOAA Fisheries. The observer also has a role in monitoring the daily testing of the scale to ensure accuracy.

Catch weight is estimated by tally methods aboard hook-and-line and pot vessels. Aboard hook-and-line vessels, observers count or estimate the total number of hooks in each set, tally the number and species caught in sampled sections of the set, estimate the average weight of individuals of each species sampled, and multiply these average species weights and numbers by the number of hooks in the entire set. Observers are instructed not to use vessel estimates of total catch aboard hook-and-line vessels because they usually do not include bycatch and dropoffs. Consequently, observer catch estimates for unsampled sets are extrapolated from similar sampled sets. Observers aboard boats fishing pots count and weigh the catch in sampled pots and estimate the total catch in a set by multiplying the sampled species numbers and average weights by the number of pots in the set. When observers do not make an independent estimate of total catch or obtain a weighed catch from a flow scale, a vessel estimate of total catch is used as OTC. Variable methods are applied on different vessels for obtaining vessel estimates of catch weight. The accuracy or precision of vessel estimates, or the effect of their incorporation into observer reported OTC, is unknown.

Observer Methods of Estimating Species Composition

Aboard all vessel types, hauls to be sampled for species composition are selected at random using the Observer Program random sampling table. One random sampling table is used for catcher vessels and one random sampling table is used for catcher processors, with a break table for catcher processors.

Observer Program guidelines on sampling selected catches for species composition require that observers collect samples from different parts of the haul and that the sample weights meet or exceed 300 kg. Observers are trained in simple random sampling techniques for haul sampling. However, there are many obstacles to executing random sampling aboard commercial fishing vessels and many observers must resort to haphazard and potentially biased sample selection methods.

Three basic approaches to collecting a species composition sample on a trawl vessel are: 1) basket sampling, 2) partial haul sampling, and 3) whole haul census. The basket sample is usually a small (minimum 300 kilograms [kg]) portion of the haul. Some form of basket sampling is incorporated in all trawler sample methods. A partial haul sample is a relatively large portion of the entire haul. A whole haul is a census of the entire haul. The sampling methods observers choose depend on the diversity and size of the catch, the shipboard setup, and their time and energy. Observers use a combination of these methods, as appropriate, to obtain the best data aboard trawlers. Aboard hook-and-line and pot vessels, observers use tally methods to sample for species composition.

The basket sample method is used to estimate species composition in a haul by weighing all target and bycatch fish. Observer baskets may or may not be used to collect the sample. For example, many basket samples on catcher vessels are obtained using a method in which the sample is collected by raising a checker bin board on deck and allowing a portion of the catch to flow in from the trawl alley, where the codend is being dumped. Other collection methods may include removing all catch from a section of a conveyor belt or an area of the deck, diverting flow from a conveyor belt, or using brailers. The basket is intended to be the object in which the sample is weighed, but, occasionally, it must be used as a selection device. Basket sampling is recommended when the catch is diverse, no species have been sorted out previous to sampling, and time or vessel cooperation does not permit a quality whole-haul or partial-haul sample.

Observers have the option to increase sample size to a partial or whole haul for individual prohibited species when target and other bycatch species are collected using a basket sample. Observers are instructed not to whole-haul sample for prohibited species at the expense of the overall species composition subsampling.

The partial-haul sampling method is used to determine species composition in a haul by counting and weighing all bycatch from a measured portion of the haul. The weight of the predominant species is determined by subtracting the total bycatch weight from the estimated partial-haul sample weight. The partial-haul sample weight is usually determined by differences in bin volume multiplied by a density factor. A subsample is used to determine predominant species average weight for extrapolation to total number. The average weight subsample is required to be a minimum of two baskets of small target species, or 50 individuals of large target species.

The main criteria for using partial-haul sampling are that the observer must be able to obtain an accurate partial-haul sample weight, and that the portion of haul sampled has less than 400 kg of bycatch that must be counted and weighed. In addition, the observer must be confident that sorting of bycatch species from the sample is thorough, that all bycatch passes the sampling point, and that sorting the partial haul does not take excessive time or affect higher priority duties.

The whole-haul census method is used to estimate species composition in a haul by counting and weighing all bycatch from the haul. The weight of the predominant species is determined by subtracting the total bycatch weight from the estimated whole-haul weight. As in partial-haul sampling, the catch is subsampled to determine the average weight of the predominant species to estimate their number. Because it is very time consuming and may interfere with higher priority observer duties, whole-haul census is typically applied only to prohibited species or other species that only rarely occur in the catch.

For observers to census a haul, there should be less than 400 kg of bycatch in the entire haul. The observer must be confident that sorting of bycatch species from the haul is thorough, that all bycatch is accessible during sorting, and that sorting does not take excessive time or affect higher priority duties.

The tally method is used to estimate species composition aboard hook-and-line and pot vessels. Sections of sets or groups of pots are selected for sampling. Aboard hook-and-line vessels, observers tally the number and species caught, released, or dropped off in sampled sections of the set and estimate the average weight of individuals of each species tallied. Similarly, observers aboard pot boats count and weigh the catch in sampled pots and estimate average weights for sampled species.

Observer Methods of Estimating Discards

Observers do not have elaborate methods for estimating discard by species. In most cases, at-sea discard information is based on the observer's best guess of percentage of each species retained. This guesstimate may be more standardized among observers on catcher vessels from which portions of hauls are discarded or all discards occur within the observer's view at one location on deck. In some rare cases, the discarded catch is retained by the vessel long enough for the observer to make a volumetric estimate of weight, or to weigh each species. The guesstimate of at-sea discard aboard catcher processors may be less standardized between observers, because discards occur simultaneously at multiple points from the deck and throughout the factory, often after the observer has taken the samples.

Observer Data Reporting Methods

Observers record catch weight and effort information from vessel logbooks and their own estimates on either Form 2US for trawlers, or Form 1US for hook-and-line vessels and pot vessels.

Observers send data to the Observer Program by various methods, depending on the level of technology available to them onboard the vessel. The Observer Program has implemented a comprehensive electronic reporting system on processing vessels and shoreside processors. This program allows the observer to send raw data which is automatically error checked and incorporated into NOAA Fisheries databases. It also allows daily communication between field observers and Observer Program staff. Currently, the program is installed on most catcher processors and shoreside processors and is working very well. Expansion of the system to catcher vessels that deliver to shoreside processors is planned.

Weekly summary reports of observer data are sent to the NOAA Fisheries Alaska Region for use in groundfish and prohibited species accounting. Daily reports are sent as needed to monitor specific fisheries.

Observer Monitoring of Processors

All processors that receive groundfish from any vessel holding a federal fisheries permit are subject to federal reporting requirements and must report all groundfish and prohibited species from all vessels and areas.

All processors subject to federal reporting requirements must maintain a daily cumulative production logbook. NOAA Fisheries issues logbooks tailored to the specific requirements of the processing mode to shoreside processors, mothership processors, and catcher processors. Daily production amounts by species and product type, and discard reports are recorded in mothership and catcher processor logbooks. Daily landing weights of fish by species, as well as daily products derived from those landings, are recorded in shoreside processors logbooks. Each day of a weekly reporting period, the daily production is recorded and added to the cumulative total for the week. At the end of the weekly reporting period, the totals are reported to NOAA Fisheries on a weekly production report and the weekly cumulative totals are reset to zero. Completed logbooks are forwarded to NOAA Fisheries Enforcement, which maintains the hard copy.

The WPR is a form on which data is recorded in a daily cumulative production logbook and transmitted to NOAA Fisheries for use in quota monitoring and statistical reporting. WPRs must be received by NOAA Fisheries no later than noon the Tuesday following the end of a weekly reporting period. The WPR contains weekly amounts of each species and product type, including discards, aggregates by federal reporting area, gear types, and whether the catch accrues to the CDQ fishery or a standard groundfish quota. Data submitted on the WPR are the only data collected on the daily cumulative production logbook that are made available in a computerized database.

Processors that receive groundfish harvested by AFA catcher vessels are required to use a NOAA Fisheries-approved electronic reporting system. Shoreside processors may choose to use a NOAA Fisheries-approved electronic logbook report to replace the daily cumulative production logbook and the paper copy of the WPR. The electronic reporting system provides information, to the species level, on each delivery of fish. It provides all the information collected by the daily cumulative production logbook and WPR, but provides more detail on catch by vessel and harvest location. These data are submitted to NOAA Fisheries daily rather than weekly.

Catch Monitoring through Vessel Monitoring System Data

A vessel monitoring system (VMS) consists of a global positioning system unit and satellite communication device configured as a tamper proof system. The VMS determines vessel location in latitude and longitude at the resolution available from the global positioning system and transmits the vessel identifier, position, and time of transmission to NOAA Fisheries. VMS data are used to monitor compliance with closed areas and to verify the location of catch when separate quotas are established inside small or irregularly shaped areas that do not correspond with the standard reporting or statistical areas.

Effective June 10, 2002, vessels authorized to participate in the directed fisheries for Pacific cod, pollock and Atka mackerel in the GOA and BSAI must have on board, and use, a VMS, while conducting directed fishing for groundfish or Pacific Halibut IFQ, regardless of where the vessel is operating as part of 2002 Steller sea lion protection measures. (See NOAA info bulletin, http://www.fakr.noaa.gov/infobulletins/permit.html.)

Groundfish Catch Estimation

Groundfish catch is estimated using information from WPRs and observer reports. These data are used differently depending on the industry component. For shoreside processors, landed weights from WPRs are used to account for the landed component of catch, and these weights are used in conjunction with observer data from catcher vessels which deliver to shoreside processors to estimate at-sea discards of groundfish. For observed catcher processors and motherships, the blend process is used. For unobserved processor vessels, the WPR provides the only source of data on groundfish catch by species. Observer data from observed vessels are used to estimate prohibited species catch for the unobserved vessels.

The accounting for catch is done for each processor, and the results summed by species, gear, and area across all processors to obtain the total catch for the fishery. Total groundfish catch from the groundfish catch accounting system is also used as the basis for computing estimates of prohibited species catch. Groundfish catch data are published in numerous regional and national reports and fishery stock assessments.

The different reports and quota monitoring processes for groundfish catch accounting vary by processing sector. The particulars of each are discussed in more detail in the following sections.

Catcher Processor and Mothership Vessels

The catcher processor and mothership fleet have a high level of observer coverage. Observers on processor vessels estimate total catch weight and collect species composition samples for a high percentage of hauls or sets. In addition to observer data, each processor submits also WPRs. Product weights are converted to equivalent round weights using product recovery rates, which are published in federal regulations. The blend process is used to select which report (observer or WPR) will be taken as the official catch estimate for the processor for a particular week.

Vessels with certified scales and two observers.

Processor vessels fishing in the AFA pollock fishery are required a) to have certified scales to weigh total catch and b) to have two NOAA Fisheries-certified observers to monitor catch at all times. The scale weight is used as the observer's official catch estimate. Because of the confidence NOAA Fisheries has in certified scale weights, data obtained from vessels equipped with scales are excluded from the blend process. NOAA Fisheries uses the observer reports of catch as the official catch estimate. Certified scales are also required on many vessels in the CDQ fishery.

Vessels without certified scales and two observers.

Estimating the catch by processor vessels without scales is done using a process commonly called the *blend process*. Total groundfish catch for all species combined is computed weekly from the WPR and from the observer report. If either report is missing, the report present is selected as the source of data for that processor during that week. If both reports are present, the blend compares the two total catch weights as follows:

- If the WPR and OTC weights are within 5 percent, the WPR is selected as the source.
- If the WPR is more than 30 percent higher than the observer total catch (for pollock fishery target) or more than 20 percent higher (all other targets), the WPR is selected as the source.
- In all other cases, the observer report is selected as the source.

The blend program then returns to the source data (observer or WPR) and copies the detailed records, showing gear type, area, and species, to the catch accounting database. Records from the WPR are identified in the blend by a source field value of W; observer records are identified by a source field value of zero.

Catcher Vessels Delivering to Shoreside Processors

Groundfish catch accounting for catcher vessels delivering to shoreside processors uses WPRs for accounting of landed catch, and uses catcher vessel observer data combined with landed catch amounts to estimate at-sea groundfish discards by catcher vessels prior to landing.

Landed catch quantity and composition.

WPRs for shoreside processors contain landed weight of catch. These data are used to estimate for the retained portion of the groundfish catch. Landings on a WPR are reported separately for each week, reporting area, and gear type. Catches under a CDQ program or research fishery are also separately identified. Landings are typically in round weight, or in a form, such as "bled only," or "headed and gutted," with a high product recovery rate. For fish landed in forms other than round, landed weights are converted to round weight using product recovery rates.

Some shoreside processors use a NOAA Fisheries-approved electronic logbook system. Electronic logbook reports contain detailed information on each landing of fish, identify the vessel making the landing, and report catch locations at the level of the Alaska groundfish statistical area.

Alaska state law requires all fish purchased to be weighed on a state-certified scale. Some fish landed, but not purchased, may not be required to be weighed on a state-certified scale, but the processors must still log and report these fish in the federal reporting system. No information is available about the accuracy of weights from state-certified scales under operational conditions. Observers at shoreside plants collect biological samples, but do not verify the accuracy or completeness of landed weights.

At-sea discards by catcher vessels delivering to shoreside processors.

Recordkeeping and reporting regulations require catcher vessel operators to report at-sea discards to the shoreside processor for inclusion on the shoreside processor WPR. NOAA Fisheries estimates at-sea discards by using observed discard rates from catcher vessels delivering to shoreside processors and extrapolating them to the total catch.

Observers on catcher vessels delivering to shoreside processors collect data on at-sea discards of groundfish. All observer data for a month, gear, and target fishery are used to calculate discard rates for each groundfish species. These discard rates are expressed as a ratio of the weight of the discarded species to the total retained groundfish weight. These discard rates are multiplied by the retained landings rates for each shoreside processor to make an estimate of total at-sea discards of groundfish.

Groundfish Total Allowable Catch Monitoring

The annual TAC for each species of groundfish may be allocated to industry components based on gear type, vessel size category, processing sector, or quota recipient class such as CDQ group or AFA Cooperative. These allocations result in a set of quotas that NOAA Fisheries must monitor. The monitoring and management programs differ depending on the regulatory program establishing the quota.

Community Development Quota Program Fishery

The CDQ program receives a percentage of each groundfish species or species group managed under the BSAI FMP and with an annual TAC. CDQ groups also receive allocations of prohibited species catch, which is called prohibited species quota (PSQ). Monitoring and management of PSQ is discussed below.

When a vessel is fishing for a particular CDQ group, the catch of groundfish is subtracted from that group's CDQ allocations. NOAA Fisheries requires the group to submit a CDQ Catch Report documenting the catch of all CDQ by all vessels fishing for it. The group is required to use one of the following sources for the catch data submitted on the CDQ Catch Report:

- Catch estimates extrapolated from observer data.
- CDQ delivery reports submitted by a shoreside processor for groundfish CDQ and PSQ delivered to the shoreside processor by a catcher vessel.
- IFQ landings report submitted by the registered buyer (either shoreside processor or custom processor) to NOAA Fisheries Enforcement for halibut CDQ only.

The use of these three different data sources is summarized in Table 3-2.

Observer data are used to monitor groundfish CDQ harvests by all catcher processors and motherships taking deliveries of unsorted codends from trawl catcher vessels. Observer data are also used to monitor harvest by catcher vessels, depending on gear type and method selected by the CDQ group for catch accounting.

For catcher processors and trawl catcher vessels delivering unsorted codends to motherships, observer data are sent by observers to the NOAA Fisheries Observer Program Office in Seattle. CDQ groups, NOAA Fisheries' Alaska Region (CDQ Program) management staff, and vessel operators obtain catch estimates based on observer data from the Observer Program Office. The CDQ groups use the estimates of total catch based on observer data to prepare a CDQ catch report for each CDQ haul or set by a catcher processor or mothership. The CDQ Program management staff subtract the catch reported from the group's CDQ allocation and use the observer data to verify the accuracy of the CDQ Catch Reports.

CDQ catch accounting for catcher vessels is more complicated than for catcher processors and motherships for a number of reasons. It is more difficult to collect species composition samples on most catcher vessels than on catcher processors. NOAA Fisheries does not require more accurate catch accounting (scales) to weigh total catch, or observer sampling stations for catcher vessels. The catch accounting requirements for catcher vessels are based on a combination of retention requirements, accounting at the shoreside processor, and the choice to use observer data for some catcher vessels.

Trawl catcher vessels are required to retain and deliver groundfish CDQ harvest to a shoreside processor, where they must be sorted by species, weighed or counted, and reported by the processor on a CDQ delivery report. Although observer data are not used to directly estimate the catch of groundfish CDQ, they are used to verify the species reported on the CDQ delivery report and to check the species weights.

For hook-and-line vessels and pot catcher vessels (non-trawl gear) 60 ft or more LOA, the CDQ group and vessel operator have two choices regarding the source for CDQ catch accounting:

- **Option 1** – They may retain all groundfish CDQ species and use the CDQ delivery report. Observer data must be used for halibut PSQ from hook-and-line vessels required to discard halibut at sea.

- **Option 2** – They may discard some groundfish CDQ species at sea, but then use observer data as source for all CDQ and PSQ. This option requires an observer sampling station with the same specifications as required for a hook-and-line catcher processor.

Option 1 is the same as required for trawl catcher vessels and Option 2 is the same as required for all catcher processors and motherships. Trawl catcher vessels were not given a choice on CDQ catch accounting methods because Option 2 would have required the use of a scale.

Sablefish Individual Fishing Quota Fishery

The sablefish TAC, after subtraction of the CDQ reserve, is allocated to trawl gear and fixed gear. The trawl gear allocation is managed under the general groundfish fishery. The fixed gear allocation is managed under an IFQ program. Permits are issued to qualified IFQ fishermen, allocating them a specific amount of sablefish quota by area and vessel size category. Individual accounts are established for each permit in the NOAA Fisheries database. Fishermen must report landed weights of sablefish using a real-time transaction processing system. The computer system converts the landed weight to round weight using standard product recovery rates, subtracts the round weight amount from the IFQ account, and prints a receipt showing the

transaction amount and remaining account balance. The computer system sums landing transactions. Account overages are electronically referred to the NOAA Fisheries Office of Law Enforcement.

Table 3-2. Source of data for Community Development Quota catch accounting by quota category, gear type, and vessel category.

Gear type/vessel category	Community development quota (CDQ) groundfish	Halibut prohibited species catch (PSC)	Crab PSC	Salmon PSC
Trawl				
Catcher processor	Obs.	Obs.	Obs.	Obs.
Mothership	Obs.	Obs.	Obs.	Obs.
Catcher vessel ≥60 feet (ft)	Del.	Obs.	Obs.	Obs.
Catcher vessel ≤60 ft	Del.	Del.	Del.	Del.
Hook-and-line				
Catcher processor	Obs.	Obs.	na	na
Catcher vessel				
≥60 ft, option 1	Del.	Obs.	na	na
≥60 ft, option 2	Obs.	Obs.	na	na
<60 ft, groundfish	Del.	Del.	na	na
<60 ft, halibut	na	na	na	na
Pot				
Catcher processor	Obs.	Obs.	na	na
Catcher vessel				
≥60 ft, option 1	Del.	na	na	na
≥60 ft, option 2	Obs.	na	na	na
<60 ft, groundfish	Del.	na	na	na

Notes: Del. – Data from the CDQ delivery report submitted by the shoreside processor reporting the weight of each species from the delivery for groundfish CDQ. The CDQ delivery report also provides the vessel operator's report of prohibited species discarded at sea from unobserved catcher vessels (<60 ft).
na – not applicable
Obs. – Estimates of total catch determined by extrapolating observer species composition data to the official total catch for each haul or set.

AFA Pollock Fishery

The pollock fishery in the BSAI is managed under regulations that implement the AFA, in addition to the MSA. The annual pollock TAC, after subtracting the CDQ reserve, and an incidental catch allowance, is allocated to three sectors– catcher processor, mothership, and inshore–that have formed cooperatives. There is one catcher processor cooperative and one Mothership cooperative. Eight inshore cooperatives have formed, each of which receives an allocation of pollock based on the historic harvest percentages of each catcher vessel in the cooperative. The history of catcher vessels not in cooperatives forms the basis of an open access quota available to vessels not in cooperatives.

Pollock caught in the directed pollock fishery count against the cooperative allocations. NOAA Fisheries considers all pollock caught by vessels using pelagic trawl gear to be directed fishing. Because regulations (50 CFR 679.24(b)(4)) prohibit directed pollock fishing with non-pelagic trawl gear, this catch is counted against the incidental catch allowance.

The pollock cooperatives actively monitor pollock harvest and cease fishing activity when their catch equals their allocation. NOAA Fisheries also monitors the pollock harvest and can close a cooperative fishery, if needed.

Separate pollock quotas have been established for the Steller Sea Lion Conservation Area (SCA) in the Bering Sea. NOAA Fisheries monitors pollock catch to ensure the pollock quota inside the SCA is not exceeded. For observed catcher vessels, the haul retrieval location is recorded by the observer to establish the catch location. Vessels with observers can fish both inside and outside the SCA during a single trip; the observer reports provide information on the amount caught inside the SCA. Vessels without observers may carry a VMS unit that provides detailed information on vessel location and speed. These vessels may fish either inside or outside the SCA during a single trip, and the VMS data are used to verify the reported fishing location. If they fish both inside and outside the SCA during a single trip, the pollock catch for the entire trip is counted against the SCA pollock quota. Catches from unobserved vessels that do not provide VMS data are counted against the SCA pollock quota as NOAA Fisheries has no way to verify the catch location. If the SCA is closed because the pollock quota is reached, the requirements to provide VMS data and to have unobserved pollock catch counted outside the SCA is removed.

Effective June 10, 2002, vessels authorized to participate in the directed fisheries for Pacific cod, pollock and Atka mackerel in the GOA and BSAI must have on board, and use, a VMS, while conducting directed fishing for groundfish or Pacific Halibut IFQ, regardless of where the vessel is operating as part of 2002 Steller sea lion protection measures(See NOAA info bulletin, http://www.fakr.noaa.gov/infobulletins/permit.html).

General Groundfish Fishery

For all groundfish fishing not under the CDQ, IFQ, and AFA Cooperative Programs, NOAA Fisheries monitors catch and issues regulatory notices to open and close specific fisheries. In some cases, catch is monitored from daily or weekly reports and the closure date is projected by extrapolating catch rates. If fishing effort is high relative to the available quota, NOAA Fisheries will estimate the length of the fishery using historic effort and catch rates, and open the fishery for a specific length of time, ranging from as little as six hours to several days.

If NOAA Fisheries determines that a groundfish allocation will be reached, a directed fishing allowance is established under regulations at 50 CFR 679.20(d)(1)(I). The directed fishing allowance is an amount less than the quota, leaving a portion to support incidental catch needs of the species in other fisheries. When the directed fishing allowance is reached, NOAA Fisheries prohibits directed fishing (50 CFR 679(d)(1)(iii)). When directed fishing is closed, fishermen may retain incidental catch of the species up to specified percentage limits (50 CFR 679.20(e)), allowing limited retention of the species but greatly reducing the catch rate.

When a quota is reached, NOAA Fisheries prohibits further retention of the species (50 CFR 679.20(d)(2)). If catch amounts reach the level defined as overfishing, NOAA Fisheries can take actions to restrict other fisheries (50 CFR 679.20(d)(3)).

Most groundfish quotas are for areas that correspond with NOAA Fisheries statistical areas or FMP areas. For these quotas, the location of catch is determined by the reported catch location or the observed haul location. When catch quotas are established for small areas, for example, the Atka mackerel quotas in the Aleutian Island Steller sea lion critical habitat, NOAA Fisheries cannot monitor the quotas based on the reporting areas or observer data. In small areas, vessels can set and retrieve gear outside the area, but fish inside the area. NOAA Fisheries has adopted two strategies to monitor quotas for these small areas.

One strategy is to treat the critical habitat quota as a limit within the overall area quota. NOAA Fisheries monitors the overall area catch, and when the critical habitat quota is reached, NOAA Fisheries closes critical habitat. This method is very effective in controlling the catch inside critical habitat. Because all catch from the larger area is initially counted against the critical habitat quota, it tends to result in vessels fishing inside critical habitat first, which may cause concerns about temporal concentration of the catch in critical habitat, even though the catch amount is well-controlled.

Another strategy is to utilize VMS data in conjunction with observer data to monitor the vessel location during the time between gear set and retrieval. This method allows assignment of catch from a specific haul or set as inside or outside critical habitat. If any portion of the haul or set occurs inside critical habitat, the catch is counted as coming from inside critical habitat.

Prohibited Species Catch Estimation

Several fish and shellfish species are prohibited in North Pacific groundfish fisheries. These include all species of salmon, steelhead, Pacific halibut, Pacific herring, and crabs. Prohibited species must be returned to the sea as soon as possible after they are caught. One exception is the Prohibited Species Donation Program, a program to retain and donate salmon to food banks. Unlike halibut and crab, salmon caught with trawl gear suffer nearly 100 percent mortality. Regulations implementing this program are separate from a regulation that requires all salmon be retained until counted by an observer.

Observers were first deployed in the domestic groundfish fishery in 1990 to collect information on groundfish catch, PSC, and other biological data. Observer coverage is based on vessel length; vessels 125 ft LOA or longer carry an observer 100 percent of the time and vessels from 60–124 ft LOA carry an observer 30 percent of the time. Vessels smaller than 60 ft do not carry observers. The salmon set gillnets of Kodiak will be carrying observers in the summer of 2002 and 2003. Actual observer coverage varies widely by fishery; the pollock fishery, conducted by large vessels, has very high coverage while the hook-and-line fishery for demersal shelf rockfish, which involves small vessels, has little or no observer coverage.

The NOAA Fisheries Observer Program sends PSC data weekly to the Sustainable Fisheries Division of NOAA Fisheries Alaska Region. These data contain the official total catch, weight of sampled hauls, and numbers and weights for each prohibited species, aggregated by unique combinations of vessel, week, reporting area, and gear. NOAA Fisheries Alaska Region assigns a target fishery to the record based on the groundfish catch composition. For catcher vessel observer reports, both the vessel and the processor are identified.

Prohibited Species Catch Rates

Prohibited species catch rates are calculated by dividing the sum of the weights or counts of PSC in a set of observer data by the sum of the weight of groundfish in the dataset. For rates from observed vessels that will be applied to unobserved vessels, a minimum of three different weekly observer reports is required before an average rate is used. For some rates, this threshold is set at a higher number.

PSC rates for observed catcher processor and mothership vessels.

Prohibited species catch rates for a catcher processor or mothership that carries an observer during a weekly reporting period are computed using data reported by that observer. A catch rate, for each prohibited species is computed from observer sampling data as a ratio of weight (halibut and herring) or numbers (crab and salmon) per metric ton of groundfish.

PSC rates for catcher vessels delivering to shoreside processors.

All observer data for a target fishery, gear type, and reporting area from a three-week period of observed catcher vessels that deliver to shoreside processors are combined to generate an average rate, which is applied to groundfish catch from shoreside processors. In order to prevent application of a small number of observer reports to a large amount of groundfish harvest, these three-week average rates are used only if there are at least ten applicable observer reports. If the shoreside-specific rate is not available, this combined average rate is used. If current year observer reports are not available, a rate is used based on prior year observer data. Finally, if no current or prior year data exist for the particular reporting area, a rate based on the average of current year data for the same management area, gear, and target fishery is applied.

PSC rates for unobserved processor vessels.

PSC estimation procedures for unobserved processor vessels are identical to those used for shoreside processors, except that the first rate applied is based on an average of observer reports from the same processing mode. If at least ten observer reports are available over a three-week period, the rate used for an unobserved catcher processor will be calculated from data collected by observers on catcher processors. Likewise, the rate used for an unobserved mothership will be calculated from data collected by mothership observers.

Computation of Prohibited Species Catch

Once the PSC has been estimated, the PSC rate estimates are calculated by multiplying each prohibited species rate times the total groundfish weight for the processor from the groundfish catch accounting system. For PSC limits, which are expressed in terms of mortality, the PSC amount is multiplied by the mortality rate to obtain an estimate of mortality. The following factors used to estimate PSC rates are provided to identify how the catch rates are applied to groundfish catch from the groundfish catch accounting system.

- For the "processor-specific" rate, the factors used are week, permit number, reporting area, and gear.

- For the three-week average rates, the factors are week, reporting area, gear, and target. Four different types of three-week average rates are: 1) average of all observer data for a particular factor, 2) average of shore-delivering catcher vessel data, 3) average of mothership-delivering catcher vessel data, and 4) average of catcher processor data.

- For rates based on data from prior years, the factors used are reporting area, gear, and target.

- For BSAI and GOA annual average rates, the factors used are gear and target.

Observer coverage levels are higher in the BSAI than in the GOA because coverage is based on vessel size. The BSAI has a higher proportion of large vessels; as a consequence, more processor-specific rates are used in the BSAI, and more average rates are used in the GOA.

Prohibited Species Catch Limit Monitoring

Annual PSC limits for some species are specified under 50 CFR 679.21, or through the annual specification process. To create PSC quotas, PSC limits may be further allocated to fishery categories, gear groups, or seasons.

General Groundfish Fishery

NOAA Fisheries monitors PSC quotas for the general groundfish fishery using the PSC estimates described above. When NOAA Fisheries determines that a PSC quota will be reached, a notice closing the fishery is published in the FR. Authority for PSC closures is under 50 CFR 679.21. Reaching a PSC quota can result in closure of an area or a season, even if groundfish quotas remain unharvested.

Community Development Quota Program Fishery

The CDQ Program receives an allocated 7.5 percent of the PSC limits for halibut, red king crab, bairdi Tanner crab, opilio Tanner crab (snow crab), chinook salmon, and non-chinook salmon (all other salmon species) in the BSAI. These allocations are called PSQs.

Whether the catch of a prohibited species accrues against the CDQ group's PSQ allocations depends on the gear used to catch the prohibited species and, in some cases, on the date or area of the bycatch. Table 3-3 summarizes the regulations for accrual of prohibited species bycatch against PSQs for CDQ fisheries. Halibut accrues against the PSQ when caught with trawl or hook-and-line gear anywhere in the BSAI at any time of the year. Based on NPFMC recommendation, pot and jig gear are annually exempt from the BSAI halibut PSC limit. The justification for this exemption is that only small amounts of halibut are caught by these gear types. This exemption is not a permanent regulation, but is published in the FR each year with the groundfish TAC amounts.

Although crab and salmon are always prohibited species in any groundfish fishery, they accrue against the PSQ only when caught with trawl gear. In addition, crab and non-chinook salmon count against the PSQ only when caught in certain areas and, in the case of salmon, only when caught during certain times of the year.

The same data sources discussed above and summarized in Table 3-3 for use in monitoring CDQ groundfish catch are used for monitoring PSQ. For trawl catcher vessels, salmon PSQ must be retained and delivered to a shoreside processor, where they must be sorted by species, weighed or counted, and reported to NOAA Fisheries by the shoreside processor on a CDQ delivery report. Although observer data are not used directly to estimate salmon PSQ, they are used to verify the species reported on the CDQ delivery report and to check the species weights. Because halibut and crab are required to be discarded at sea, observer estimates of halibut PSQ and crab PSQ are used as the basis for subtracting bycatch amounts from the CDQ group's PSQ allocations.

Halibut discarded by vessels using pot or jig gear does not count against the BSAI halibut PSC limit, and also does not count against a CDQ group's halibut PSQ. Because vessels less than 60 ft LOA are unobserved, NOAA Fisheries requires the vessel operator to report discards on the CDQ Delivery Report. It is impossible to verify the accuracy of these reports.

Table 3-3. Regulations regarding accrual of prohibited species bycatch against prohibited species quotas in the Community Development Quota fisheries, by species, gear, area, season, and target fishery.

	Halibut	Red king crab	Bairdi Tanner crab	Opilio Tanner crab	Chinook salmon	Non-chinook salmon
Gear	Trawl or hook-and-line only (not pot or jig).	Trawl.	Trawl.	Trawl.	Trawl.	Trawl.
Area	All Bering Sea and Aleutian Islands (BSAI).	Zone 1 only.	Separate prohibited species catch (PSC) for Zone 1 and Zone 2.	Opilio Tanner crab bycatch limitation zone (COBLZ).	All BSAI.	Catcher vessel operational area (CVOA).
Time/Season	All year.	All year.	All year.	All year.	Jan. 15 - Apr. 15.	Aug. 15 - Oct. 14.
Target fisheries	All.	All trawl.	All trawl.	All trawl.	All trawl.	All trawl.

Section 4 Fishery Management Tools

4.1 Stock Assessments for Alaska Groundfish Stocks

The Alaska Fisheries Science Center (AFSC) is responsible for BSAI and GOA groundfish assessments. Early assessments were in response to a perceived need of U.S. fishery scientists to gain management control and influence over expanding foreign fisheries on Alaska's groundfish. Initial efforts were directed at monitoring the foreign catch levels through bilateral agreements for the exchange of catch statistics and international cooperative program to conduct independent fishery resource surveys. The MSA gave the NOAA Fisheries authority to regulate foreign and domestic fisheries within the U.S. EEZ. The MSA marks the beginning of NOAA Fisheries' data collection of fisheries information to generate stock assessments of major groundfish resources. Stock assessments are updated annually. Reports are prepared and reviewed by AFSC scientists, the ADF&G, and the University of Alaska Fairbanks, with support of NPFMC BSAI and GOA groundfish plan teams.

Stock assessment analysis is a way to estimate how many fish are in a specific geographic ocean area or fishing ground and to predict how these fish populations will respond to harvesting. Scientists use resource survey and fishery information in mathematical calculations to estimate how many fish are in a specific management area. Life history information is used to estimate how many fish can be caught in a fishing season without impacting future stocks and while accounting for natural mortality (*M*), including removals by predators. Fishery managers use the biomass and fishing rate information to determine the allowable amount of fish that can be caught during an upcoming fishing season. (These limits will be discussed further in section A.4.2.) Managers weigh economic and social considerations, with biological and ecological concerns. But, scientists are primarily concerned with biological limits and stock production variability. The assessments are reviewed by NPFMC's groundfish plan teams, composed of biologists, economists, and mathematicians from government agencies and academia. The plan teams compile the individual species assessments into an annual SAFE document, which contains information on historical catch trends, biomass estimates, preliminary ABC estimates, harvest impact assessments, and alternative harvesting strategies. The plan teams' recommendations are passed on to NPFMC and its advisory committees.

4.1.1 Stock Assessment Modeling

Three analytical assessment methods are typically used for Alaska groundfish: 1) index methods, 2) stock synthesis, and 3) Automatic Differentiation (AD) model builder. The simplest assessment is an index of population size or biomass based primarily on resource surveys. A number of survey methods have been developed to estimate abundance or biomass of a fish stock. The survey method selected is usually designed to target one or more stocks in a specific area. The exact survey method may differ among fishing grounds and target stocks. However, scientists are careful to maintain standard sampling methods to ensure consistency and comparability of data over time by following consistent protocols and deploying standardized sampling gear. Fish abundance or biomass estimates are derived by multiplying the average catch rate by the size of the survey area. The results can be either expressed as an index of abundance or estimate of stock biomass in metric tons. Stock assessments may be based on the most recent survey or on an average of survey estimates over time. The latter approach is somewhat limited because it does not typically precisely forecast trends in abundance, particularly when surveys occur infrequently. Furthermore, survey biomass estimates can be biased or inaccurate if the sampling gear is not efficient in capturing all the fish at sampling stations, if fish for some reason avoid a particular habitat being sampled or if a significant

portion of the stock is outside the survey area. Thus in many cases, a survey biomass estimate may be a conservative estimate. The more frequent the surveys, the longer the time series of index of abundance or biomass, and the better scientists are at judging a survey's ability to track true trends in stock magnitude.

Assessment methods can be greatly improved if annual catch data and age composition from fisheries and resource surveys are available. For the Alaska groundfish fisheries, catch quantities are monitored by a program that includes at-sea observers and sampling for shoreside landings. Roughly 30,000 observer days (equivalent to 114 full-time employees) are expended annually to collect catch data from the Alaska groundfish fisheries. All vessels capable of hosting an observer may be required to do so at the vessel's expense. The recreational harvest of groundfish in Alaskan waters is a minor component of the total catch.

Observers collect biological data, such as otoliths (ear bones, which grow in layers like tree rings), length frequencies, stomach samples, and maturity stage for a variety of species. Age composition estimates come from otolith samples collected during resource surveys. The age data are combined with the (typically) large sample of fish lengths measured from fleet catches and resource surveys. The appearance of small, younger fish provide data to forecast the strength of incoming year (all fishes born in a particular year). The survival and growth of the eggs, larvae, and juvenile fish are highly variable, due to natural conditions and the variability of the marine environment. Recruitment is the principal component of the variability of a fish stock's annual production. As a result, interannual variability in recruitment is a major source of uncertainty in projecting stock trends. Therefore, the ability to determine the age-structure of a fish population for the time series of the fishery is critical in accurate assessment of a stock, particularly if it has undergone major swings in abundance.

With a time series of age composition data, scientists can employ complex population models, such as Stock Synthesis and AD model builder software, to apply biological characteristics and the dynamics of fish populations to estimate population trends over time, sustainable harvest rates, and biomass levels. For most Alaska groundfish, spawning is seasonal, so that all fish in a particular year-class will have been born within a month or two of each other. Stock Synthesis and AD model builder are age-structured models, meaning that they keep track of each year-class as it ages, enters the fishery, and eventually dies out. Recruitment begins when a year-class is captured by fishing gear. For example, the relatively strong 1994 year-class of pollock in the GOA "recruited" to the fishery in 1996 at age two; in 1999, at age five, it was 36 percent of the total pollock catch. Being able to keep track of year-classes improves abundance estimates and allows scientists to better predict short-term trends.

The Stock Synthesis computer model is used for many Alaska groundfish assessments. This program was developed as a tool for incorporating complex fishery and survey data in a single framework (Methot 1990). Stock synthesis requires fewer assumptions about data than earlier age-structured methods. Quantities in the model that are uncertain are estimated using appropriate statistical methods. The key philosophy is to treat observations as random quantities about some true underlying values.

One way to think about how the program is designed is to imagine trying to say something about a stock of fish before looking at any data. Given that the species of fish is known, along with some general biological characteristics, it is possible to synthesize the abundance of that stock given some crude approximations. The essence of the initial dataless or synthesized population model can be illustrated in the following example.

First, assume that the fishery had average catches of about 500 mt for the past 10 years, then assume that, in year 10, the harvest represented about 10 percent of the total stock. Given some assumptions about the natural mortality rate and the average weight at age, the abundance trend can be sketched. The calculation used to construct population numbers is complete, but observed catch and survey data and values for various biological parameters must be incorporated to add realism to this synthesized stock. First, biological guesses such as average weights at age are replaced with estimates based on real data. Similarly, information on longevity and reproductive output of the species is incorporated to estimate the natural mortality rate. Information about gear type and surveys provide background on the selectivity patterns to be expected. Running the model, at this point, improves the realism and scales the population values in general terms. Further refinements occur as age or size composition data are added, which provide critical information on the variability of year-class strengths and historical pattern of age structure of the population. The computer model can then be tuned–optimization–by adjusting the several hundred parameter values using a maximizing algorithm until the simulation results become most consistent with the observations.

AD model builder is a new modeling environment for developing and fitting complex statistical models (Fournier 1998). It is more flexible than Stock Synthesis because almost any kind of population model can be written in computer code and fit using available data. Most applications of AD model builder to Alaska groundfish are age-structured models, which are similar to but have advantages over Stock Synthesis. First, the optimization routine in AD model builder takes advantage of recent methodological advances in computer science. AD model builder also provides a suite of statistical tools for evaluating uncertainty.

Finally, because the modeling environment is open-ended, the analyst can tailor the assessment model to the unique characteristics of the stock and the available information. It is anticipated that more age-structured assessments will use AD model builder to assess future Alaska groundfish stocks.

One of NOAA Fisheries' primary long-term objectives is to reduce uncertainty in stock assessments. Moving from an assessment based on a biomass index, or an aggregate biomass model, to an age-structured assessment is a positive step towards achieving this objective. In 1990, four Alaska groundfish assessments were based on age-structured models. In 1999, 18 assessments were based on age-structured models, and 19 were based on survey index (Table 4-1). Further refinements may further reduce uncertainty, but only moderate gains can be expected. The real strength of these modern assessment methods lies in their ability to realistically model the uncertainty inherent in the assessment processes. Ironically, this may make uncertainty appear to increase. For example, earlier assessment typically provided only a point estimate of current stock size.

Using AD model builder, it is possible to obtain confidence limits for current stock size that reflect the uncertainty in the input parameters and how well the model fits the data. These confidence limits may be rather large for many groundfish stocks.

For the BSAI, scientists contribute to annual groundfish assessment reports for 16 stocks and 6 multi-species groups, including walleye pollock (3 areas), Pacific cod, Atka mackerel, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, other flatfish, Pacific ocean perch (2 areas), sharpchin/northern rockfish, shortraker/rougheye rockfish, other red rockfish, other rockfish (2 areas), sablefish, squid, and other species. For the GOA, 15 assessments are updated annually, including walleye pollock (2 areas), Pacific cod, thornyhead rockfish, Pacific ocean perch, shortraker/rougheye rockfish, northern rockfish, demersal shelf rockfish, pelagic shelf rockfish, other rockfish, arrowtooth flounder, rex sole, shallowwater flatfish, sablefish, and other species. The stocks or stock complexes assessed for each plan

are the most valuable species, accounting for a high percentage of catch. Periodically, new species or species groups are added to the list. Often, models are modified substantially to accommodate new information and modeling improvements. The addition of another year of data also improves certainty of the model estimates of stock abundance and recruitment for prior years.

Table 4-1. Methods used to update annual stock assessments for Alaska groundfish, 1999.

Species	Area	Assessment method
Walleye pollock	Bering Sea and Aleutian Islands (BSAI)	AD Model Builder
	Aleutian Islands	Survey Index
	Bogoslof	Survey Index
	Gulf of Alaska (GOA)	AD Model Builder
	Southeast	Survey Index
Pacific cod	BSAI	Stock Synthesis
	GOA	Stock Synthesis
Sablefish	BSAI and GOA	AD Model Builder
Atka mackerel	Aleutian Islands	Stock Synthesis
Yellowfin sole	BSAI	AD Model Builder
Rock sole	BSAI	AD Model Builder
Greenland turbot	BSAI	Stock Synthesis
Arrowtooth flounder	BSAI	Stock Synthesis
	GOA	AD Model Builder
Flathead sole	BSAI	Stock Synthesis
	GOA	AD Model Builder
Alaska plaice	BSAI	AD Model Builders
Other flatfish	BSAI	Stock Index
Pacific Ocean perch	BSAI	Stock Synthesis
	Aleutian Islands	Stock Synthesis
	GOA	Stock Synthesis
Other red rockfish	BSAI	Survey Index
Sharpchin/northern	Aleutian Islands	Survey Index
Northern rockfish	GOA	Survey Index
Shortraker/rougheye	Aleutian Islands	Survey Index
	GOA	Survey Index
Other rockfish	BSAI	Survey Index
	Aleutian Islands	Survey Index
	GOA	Survey Index
Squid	BSAI	Survey Index
Other species	BSAI	Survey Index
Deepwater flatfish	GOA	Survey Index
Rex sole	GOA	Survey Index
Shallow water flatfish	GOA	Survey Index
Pelagic shelf rockfish	GOA	Survey Index
Thornyhead rockfish	GOA	AD Model Builder
Demersal shelf rockfish	GOA	Survey Index
Total by assessment method		
Stock synthesis	9	
Ad model builder	9	
Survey index	19	

4.1.2 Independent Resource Surveys

Measuring fish stock abundance or biomass in the ocean is not easy. Unlike trees, fish cannot simply be counted because they are out of sight, below the water surface. Counting is further complicated because fish move around and may migrate extensively over relatively short time periods. For oceanic fish stocks, the survey sampling method is the only feasible option for estimating fish abundance independent of the fishery.

The AFSC has several different surveying methods for the BSAI and GOA areas, including area-swept bottom trawl surveys for shellfish and bottomfish stocks, acoustic echo-integration/trawl surveys for the dominant semipelagic stocks such as pollock, and longline surveys for measuring relative abundance of valuable bottom species than inhabit the deeper waters of the upper portion of the continental slope. Each survey has unique strengths and weaknesses for estimating abundance depending on the fish's social behavior, preferred habitat, location in the water column or proximity to the sea floor, swimming ability, attraction to bait, and other such variables. For example, the bottom trawl survey can do a good job of estimating rock sole biomass, but will do a poorer job with midwater or pelagic species such as herring and squid. Fish without air bladders or fish that live on the sea floor, are very difficult to detect by acoustic survey systems.

The NOAA Fisheries survey strategy for Alaska groundfish resources was formulated in the mid-1970s but not fully implemented until 1984. The comprehensive survey strategy consists of a suite of annual and triennial bottom trawl and acoustic surveys alternating among the eastern Bering Sea, Aleutian Islands, GOA, and the West Coast regions. Annual surveys have been conducted for the crab and groundfish stocks in the Bering Sea, spawning pollock in Shelikof Strait of the GOA and Bogoslof Island area of the Bering Sea, and sablefish in the GOA. In recent years, an area of approximately 600,000 square kilometer (km) has been sampled annually with as many as 1,400 stations on the NOAA Fisheries bottom trawl surveys. The winter and summer acoustic surveys cover about 15,000 km of tracklines annually. The annual Alaska sablefish longline survey covers about 95,000 square km and fishes 16 km of longline per station over a depth range of about 660 to 3,960 ft at about 90 stations.

The history of NOAA Fisheries groundfish research off Alaska began with the Bureau of Commercial Fisheries exploratory fishing research groups in the late 1950s. They are accredited with the development of the area-swept method for estimating bottomfish abundance in the northeast Pacific Ocean. Most of the AFSC's standardization for trawl designs, gear deployment, on-deck catch sampling procedures, and data analysis were initiated by this group. The trawl survey of the eastern Bering Sea shelf area for estimating the abundance of red king crab was started in the late 1960s by NOAA Fisheries scientists from the Auke Bay Laboratory; it was not until 1975 that the current standard grid survey was implemented to measure the abundance of crab and groundfish. The survey has been conducted annually since 1979.

The original survey gear was a 400 Eastern otter trawl, a two-seam trawl designed to catch flatfish. This trawl is made with 4- and 3.5-inch nylon webbing. This net was enlarged in the early 1980s to more closely match the horsepower of survey vessels. Both trawls were fished with a footrope made of a single steel cable wrapped with rope and rubber hose and attached to chain tied to the front edge of the bottom of the net. This footrope design was chosen because it effectively fishes the organisms living on the seafloor, particularly on the relatively smooth bottom of the eastern Bering Sea. The trawl net was spread with standard (9 ft by 6 ft) V doors. The modified net has a 103.6 ft long footrope and fishes with an opening about 56 ft wide and 8 ft high.

The time series for the triennial bottom trawl surveys over the continental shelf began in 1977 for the West Coast off Washington, Oregon, and California; 1980 for the Aleutian Islands; and 1984 for the GOA. The standard trawl for these surveys was initially a four-seam, high-rise net made with 5-in nylon webbing and was referred to as the *nylon Nor'eastern trawl*. An upgraded net included replacing the nylon webbing with 5-in polyethylene webbing and replacing the net wings with a cut away wing design. This modification is referred to as the *poly Nor'eastern trawl*. Following a rigorous experimental design, the two nets were compared over 1986 and 1987 and no significant differences were found. The *poly Nor'eastern trawl* fishes with an average width opening of 52.8 ft and a height of 24.75 ft. The footrope design of both nets is roller gear design made with 14-in bobbins. Each net is spread by standard V doors. The codends of all the NOAA Fisheries survey trawls are fitted with a 1.25-in mesh liner to retain small or juvenile fish. All survey nets are built and refurbished to strict standards by a team of AFSC's gear specialists. Also, for a particular survey, identical fishing gear is used at each station each year. Survey gear is generally designed to catch a wide range of fish sizes so surveys provide a consistent sample of fish and provide information on prerecruit-sized fish that would otherwise not be available for stock assessment. Survey stations are either laid out in a systematic pattern over the fishing grounds or in a stratified random pattern. The area-swept estimate of biomass is derived from the average of the catch rates for all survey stations, multiplied by the geographic area of the survey. The catch rate for a station is the ratio of catch for a species, divided by the area fished. The area fished is determined by the width of the net spread multiplied by length of the tow when the net is in contact with the seafloor.

The Bering Sea bottom trawl survey is conducted annually starting as early as late May and continuing to August. The survey is based on a grid of fixed, equally spaced, survey stations that allow for sampling across all habitat types. Each station is located approximately 20 nm apart, giving a sampling intensity of one station for every 383 square nm (Figure 4-1). Since 1993, the same two commercial fishing trawlers, identical sister ships, have been chartered to carry out the 65-day survey. The survey samples approximately 400 trawl stations over 460,000 square km inside the 660-ft depth contour. The catch from each tow is sorted by species, then weighed and counted for total values. Each species component is sampled for sex composition, individual lengths and weights, and, as needed, biological samples such as Greenland turbot, arrowtooth flounder, Kamchatka flounder, and Pacific halibut.

The bottom trawl survey along the Aleutian Islands from 165°W to 170°30' E has been conducted triennially from June to early August from 1980 to 1986 and from 1991 to present time by two fishing vessels. On the first three surveys, the Japanese fisheries agency provided one vessel and the other was either a NOAA ship or fishing vessel chartered by NOAA Fisheries. The U.S. vessels used the standard *Nor'eastern* survey trawl; the Japanese vessel supplied its own trawl gear. The survey followed a stratified, random station pattern, with just under 500 stations, covering the continental shelf and slope from 16 meter (m) inshore depth out to a depth of 1,650 m for a total area of 66,900 square km (Figure 4-2). Since 1991, the survey has been conducted by two chartered U.S. fishing vessels for about 120 to 130 days. Starting with the 1997 survey, the standard 30-minute tow was reduced to 15 minutes to increase the number of possible stations and reduce the quantity of fish caught per tow closer to 1 mt on average. Over 100 species of fish and vertebrates were identified in the survey catch.

The area for the GOA triennial survey is just under 320,000 square km, including the upper slope. The offshore extent of the survey has varied by survey year, depending on survey objectives and fishing depth limits of the chartered vessels (Figure 4-3). Starting with the 1996 survey, the standard trawl tow was reduced from 30 minutes to 15 minutes. About 140 species of fish and 200 species of invertebrates were identified in the survey catches. Survey results are summarized for 30 fish species, including arrowtooth flounder,

Pacific ocean perch, walleye pollock, Pacific cod, Pacific halibut, flathead sole, southern rock sole, northern rock sole, rex sole, Dover sole, yellowfin sole, Alaska plaice, starry flounder, English sole, butter sole, Atka mackerel, sablefish, northern rockfish, rougheye rockfish, light dusky rockfish, dark dusky rockfish, sharpchin rockfish, shortraker rockfish, shortspine thornyhead, redstripe rockfish, silvergray rockfish, harlequin rockfish, redbanded rockfish, yellowmouth rockfish, and rosethorn rockfish.

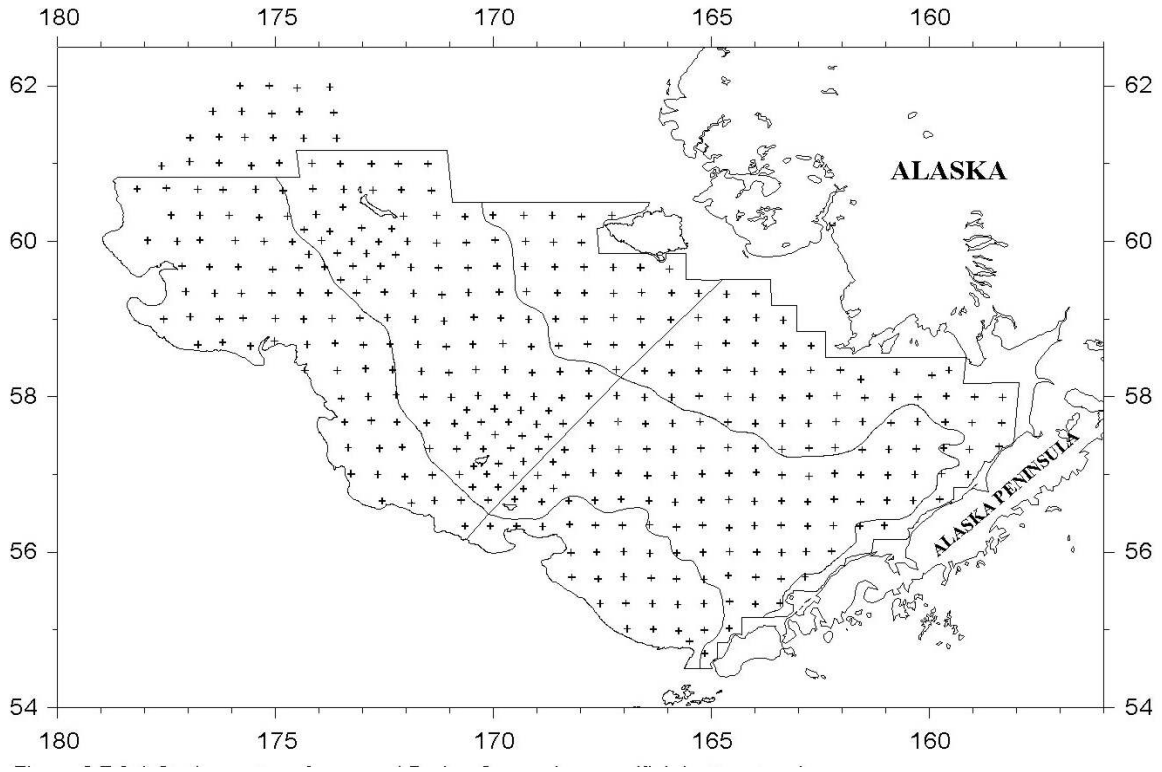

Figure 4-1. Station pattern for annual Bering Sea crab–groundfish bottom trawl survey. Source: NOAA Fisheries.

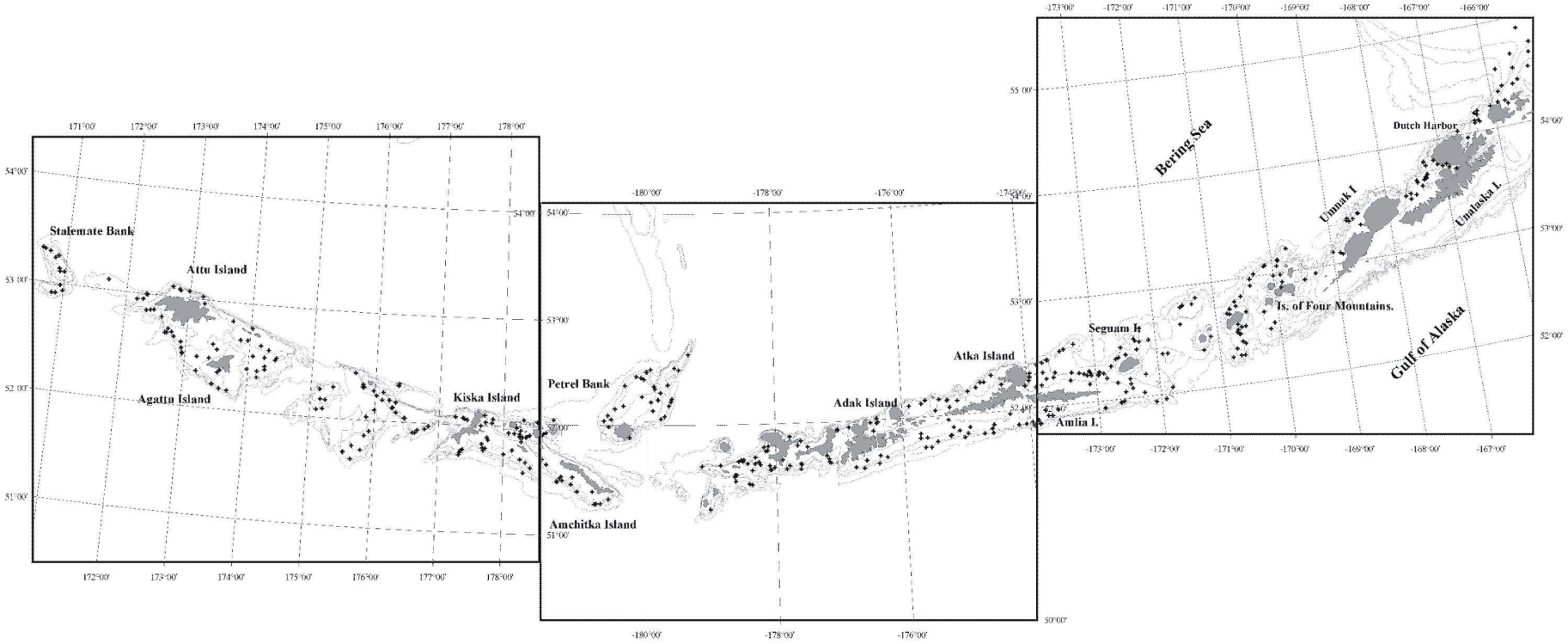

Figure 4-2. Aleutian Islands bottom trawl survey station locations. Source: NOAA Fisheries.

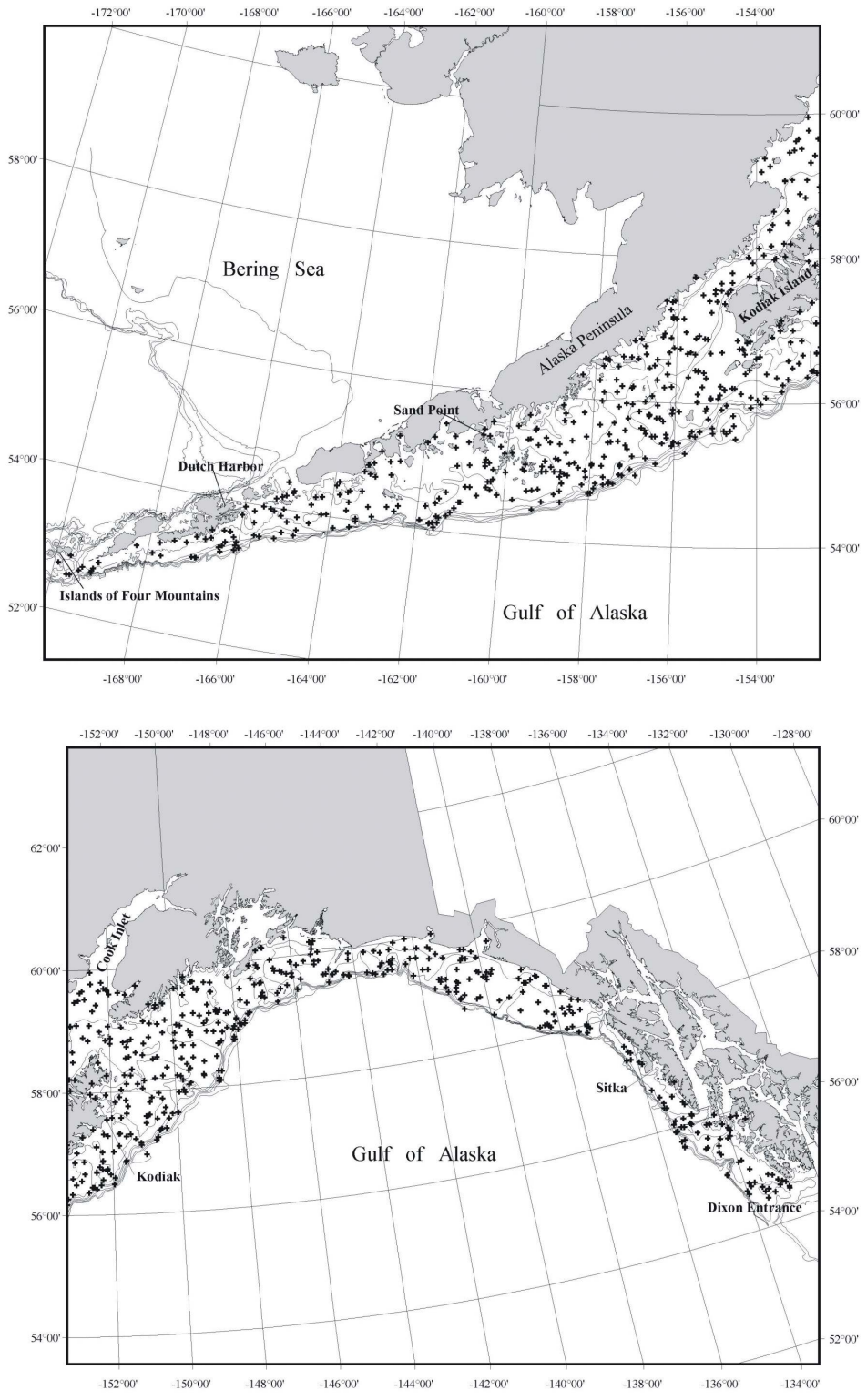

Figure 4-3. Gulf of Alaska bottom trawl survey station locations. Source: NOAA Fisheries.

Beginning with the 1999 GOA survey, AFSC initiated a new survey strategy to increase the frequency of the survey schedule from triennial to biennial (Table 4-2). This new schedule continues the annual eastern Bering Sea bottom trawl survey for crab and groundfish. The summer bottom trawl survey is expanded to include a biennial shelf survey alternating between the GOA and the Aleutian Islands, a biennial slope survey alternating between the GOA and the eastern Bering Sea, and a biennial acoustic summer survey targeting on walleye pollock alternating between the eastern Bering Sea and the GOA. Full implementation of this new schedule depends in part on transferring AFSC survey responsibility for the west coast groundfish resources to the Northwest Fisheries Science Center. Currently, the centers are preparing for the transition of responsibilities to be completed by the end of the 2001 triennial cycle. Additional research is under way to further quantify the various sources of bias in the standard bottom trawl tows resulting from fish being herded by the trawl doors into the path of the capture net, the avoidance of fish to escape capture in front of the oncoming trawl, or the escape of fish through the trawl meshes. Although this is a new line of research, considerable progress is being made each year.

In the mid-1960s, a program was initiated at the University of Washington with the support of Washington Sea Grant to develop acoustic technology and survey methods to measure fish abundance. A prototype echo-sounder and echo-integration system was first used by NOAA Fisheries in the mid-1970s to measure the off-bottom (pelagic) component of the west coast Pacific whiting population. Based on the success of this research, standard surveys were designed to assess whiting in 1977 and Bering Sea pollock in 1979 as part of the summer triennial survey (see Figure 4-4 for a survey pattern example). In 1981, a winter acoustic survey was initiated to measure the spawning pollock abundance aggregated in Shelikof Strait. The winter survey was expanded in 1988 to assess spawning pollock concentrated in the Bogoslof Island area. Both surveys have been continued on an annual schedule. In the late 1980s, AFSC invested in second-generation echo-sounder and echo-integration technology. This new system was installed on the NOAA ship *Miller Freeman,* which has served as the principal vessel for AFSC acoustic surveys since then. This new equipment greatly improved the quality and accuracy of acoustic survey data and the capability to calibrate the system and to measure target strength (the acoustic reflectivity of an individual fish used to convert the magnitude of the acoustic echos from fish in the water column to fish density). The quality of the acoustic data was further enhanced by mounting the transducer on the *Miller Freeman*'s centerboard. This amidship location is forward of the noise field generated by propeller cavitation and away from any disturbances created by the air bubbles in the water flow over the ship's hull. This new system greatly enhanced the acoustic data and the capability of an acoustic survey to detect deeper and lower densities of fish. Although the *Miller Freeman* is the primary vessel used by the AFSC acoustic surveys, U.S. scientists frequently conduct surveys in cooperation with research vessels from foreign fisheries agencies. The current AFSC policy when undertaking cooperative acoustic surveys is to conduct a one- to three-day side-by-side survey to estimate intership calibration factors to provide a way to combine results from both vessels into one biomass estimate.

The successful application of acoustic survey technology to assess abundance of midwater, semipelagic marine fish resources requires that target species be the dominant species in the water column. This requirement reduces the problem of signal contamination from other species. In addition, the acoustic system must be routinely calibrated during the course of the survey and in situ target strength measurements must be collected from single individual fish targets of known species, size, and depth. Current acoustic systems cannot determine fish species or fish size, consequently a major component of an acoustic survey is sampling targets with bottom or midwater trawls. The trawl catches are critical for identifying species and collecting biological data (e.g., size, sex, age, maturity, and food habits).

Additional research efforts are needed to collect target strength data for all target species and to understand the effect of vessel and gear noise on the behavior of pollock sampled during acoustic surveys and bottomfishes from area-swept bottom trawl surveys. Statistical research continues to improve survey design so that the survey variance is minimized, considering fish schooling patterns, transect spacing, and continuous collection of acoustic data along the transects. Researchers are assessing the impact of vessel and gear noise on the AFSC acoustic survey for pollock using the *Miller Freeman*. Fish aggregations have been observed to change location and density as a vessel passes or a trawl net approaches. Fish avoidance could create a considerable bias in acoustic estimates of stock biomass, the composition of midwater trawl catches, and even in the catch rates from bottom trawl surveys. The biggest gains in the AFSC acoustic survey strategy will come from increasing the frequency of surveys in the eastern Bering Sea from triennial to biennial, alternating between the Bering Sea and the GOA. The new biennial schedule includes a new summer pollock survey to be conducted synoptically with the new biennial bottom trawl survey (Table 4-3). Currently, there is no summer acoustic survey in the GOA. The implementation of this summer survey in the GOA is hampered by the responsibility of the AFSC to also conduct acoustic surveys for Pacific whiting off the west coast.

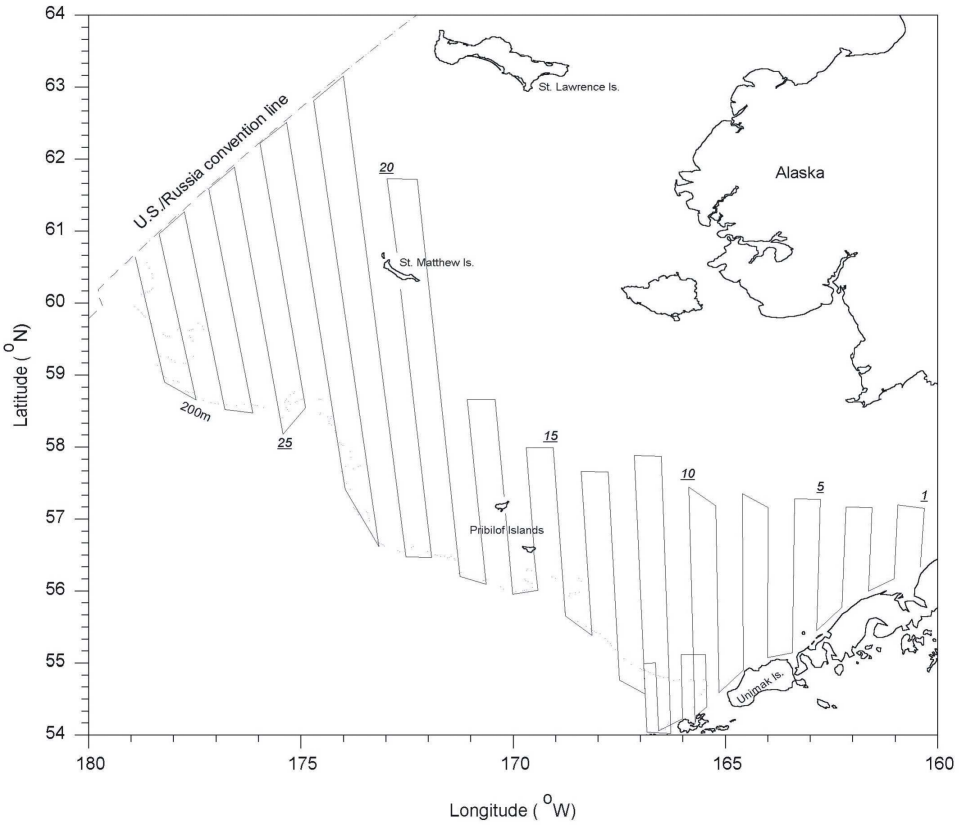

Figure 4-4. Example of a summer acoustic-midwater trawl survey pattern for pollock, eastern Bering Sea. Source NOAA Fisheries.

A preliminary survey effort is needed to determine the feasibility of using acoustic surveys in the GOA during the summer because of the potentially high diversity of other fish and invertebrate species, which could contaminate pollock echos. The Bering Sea survey should be expanded into Russian waters because the Russian fishery has increased in the area immediately to the west of the U.S. EEZ. This survey expansion into Russian waters is critical because pollock stocks are transboundary. Efforts in recent years to expand the survey have failed because the Russian government has refused to grant the *Miller Freeman* permission to enter its waters.

In 1979, Japanese scientists from the National Research Institute of Far Seas Fisheries and AFSC scientists initiated a cooperative longline survey of the groundfish resources of the GOA upper continental slope. Sablefish inhabit the upper slope over a broad depth range extending out beyond 1,000 m. This survey developed into the principal method for measuring sablefish abundance in Alaska. After Japanese scientists withdrew from the cooperative survey, the AFSC initiated a second longline survey using U.S. fishing vessels and gear and a nearly identical survey design (Figure 4-5). A private Japanese fishing company agreed to continue the survey to ensure calibration so the times series for the two surveys could be linked. The two surveys were conducted together, with two vessels surveying the same stations just a few days apart. Design specifications were identical for the two surveys, including skate length, number of hooks per skate, distance between hooks, total number of skates fished per station, and type of bait. The primary difference was the style of hooks. Both surveys were conducted for seven years, 1988–1994, to establish comparative data sets. Subsequent analysis of the paired, observed catch rates showed a nearly identical relationship for the last five years. This consistency in catch rates provided the basis for adjusting the catch rates from the original survey to be comparable to the new U.S. survey, thereby forming one time series of abundance index of 21 years long. This survey is the primary data source for tracking trends in sablefish abundance, and it is used to allocate harvest quotas among fishery management areas. The early U.S. longline survey was restricted to the GOA management areas. In recent years, the survey was lengthened to include the Aleutian Islands area, and in alternate years, the eastern Bering Sea slope region.

Alaska groundfish stock assessment analyses have been ongoing for about 25 years. Increasingly more sophisticated over time, a number of these assessments are now based on complex age-structured models supported by high-speed desktop computers. These models depend on data collected by NOAA Fisheries North Pacific Groundfish Observer Program and groundfish resource assessment surveys. The groundfish surveys conducted off Alaska are probably the most extensive survey effort implemented by a single government agency anywhere in the world. The survey strategy is currently being expanded to an annual/biennial cycle, which will greatly increase the pollock stock monitoring in the eastern Bering Sea, GOA, and Aleutian Islands groundfish stocks. The increased age composition data from expanded surveys will also improve stock assessments and forecasts, particularly for the younger incoming year-classes. Data collection management and observer and resource survey data has been enhanced by modern computer technology, which has expedited the availability of fishery catch data to allow in-season management of harvest quotas and of survey results to within 1 to 3 months. Both survey and catch data now become available in time to incorporate into annual stock assessment updates used to set ABCs for the upcoming fishing season. Furthermore, survey sample sizes are sufficient to provide coefficients of variation for the abundant stocks, which range from about 8 to 12 percent for many flatfish stocks and 20 to 40 percent for most rockfish species. The biennial survey cycle will further increase the overall precision in biomass time series by 20 to 30 percent (Table 4-2). These surveys also provide the best database for identifying essential fish habitat, interspecific interactions, and biodiversity of marine ecosystems.

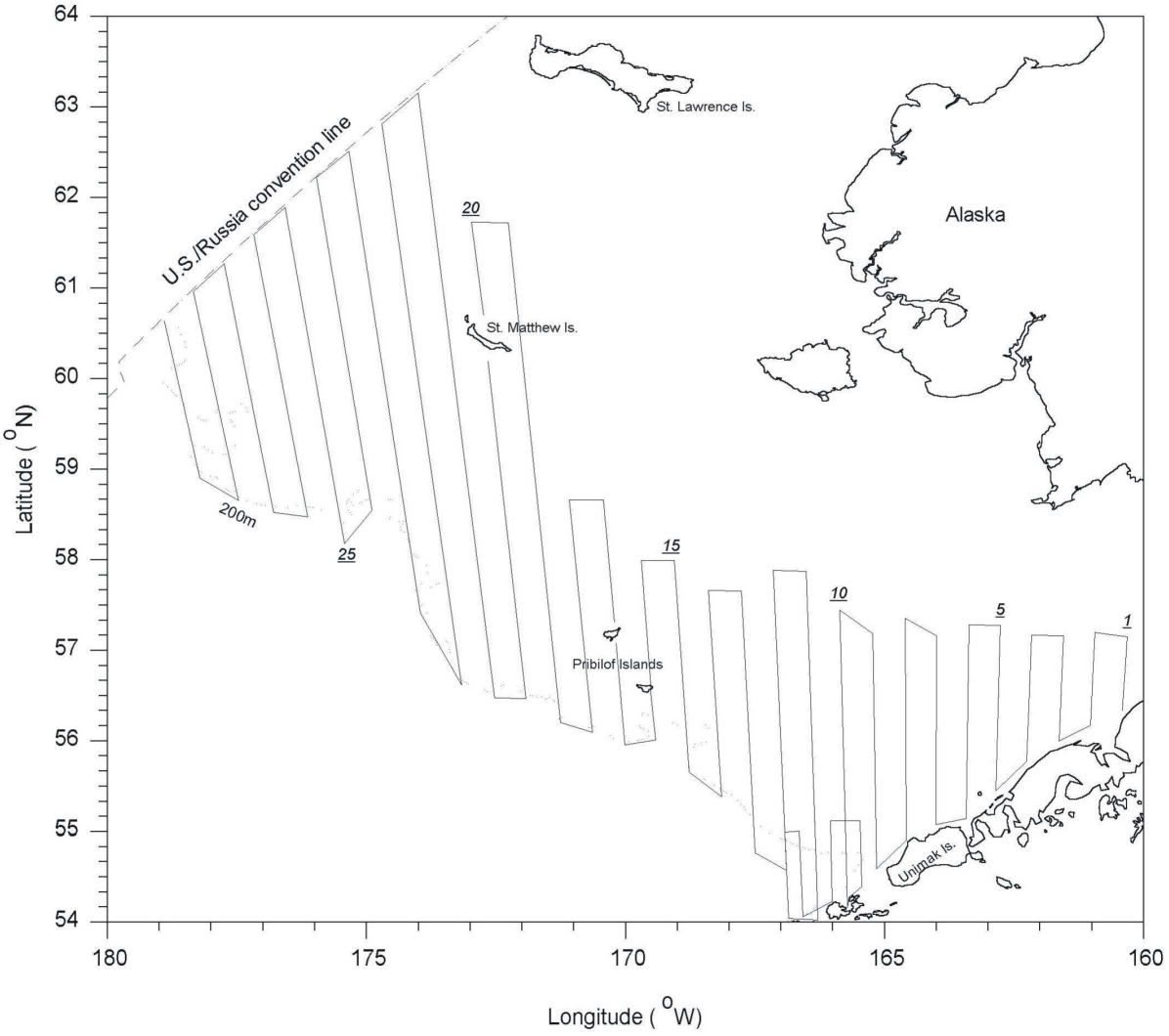

Figure 4-5. Sablefish longline survey station locations for eastern Bering Sea, Aleutian Islands (eastern half), and Gulf of Alaska management areas. Source: NOAA Fisheries.

Table 4-2. Stock assessment survey strategy for the Gulf of Alaska and Bering Sea and Aleutian Islands groundfish resources based on the 1999–2000 biennial cycle.

Survey	Season	Frequency	Number of vessels	Area (square kilometers)	Number of stations or trackline (kilometers)	Days at sea
Bottom trawl surveys						
Bering Sea shelf	Summer	Annual	2	463,000	400	135
Bering Sea slope	Summer	Biennial	1	25,000	100	35
Aleutian Islands shelf	Summer	Biennial	2	66,900	476	140
Gulf of Alaska shelf and slope	Summer	Biennial	3	320,000	870	220
Longline surveys						
Gulf of Alaska slope	Summer	Annual	1	55,500	74	83
Bering Sea slope	Summer	Biennial	1	17,400	16	18
Aleutian Islands slope	Summer	Biennial	1	24,600	14	18
Acoustic surveys						
Bering Sea pollock	Summer	Annual	1	340,000	10,200	60
Bogoslof pollock	Winter	Annual	1	31,000	2,300	11
Shelikof pollock	Winter	Annual	1	38,000	1,700	15

Non-Target Species Surveys and Data Collection Programs

There is no way to assess whether there have been trends in catch per unit effort for individual non-target species over the course of the fisheries or whether there have bene trends in the size or age composition of a particular non-target species caught by fisheries, each of which could be important indicators of population status. Nevertheless, the information on non-target species catch quantity and location collected by observers is integral to all of the following analyses.

4.2 Derivation of Overfishing Level and Acceptable Biological Catch

The overfishing level (OFL) for a stock is the fishing mortality rate that reduces the level of spawning biomass per recruit to some percentage of the original, pristine level. In contrast, ABC is the calculated level of the sustainable harvest of a stock. Values for the OFL and ABC are developed according to definitions prescribed by Amendments 56/56 to the BSAI and GOA Groundfish FMPs (see Appendices C and D). These definitions are governed by the MSA and the National Standard Guidelines. The most recent revision of the National Standard Guidelines was published May 1, 1998, reflecting changes resulting from passage of the SFA on October 11, 1996. Two pieces of relevant statutory language are:

- Section 3(29) of the MSA defines overfishing as "a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the MSY (i.e., the largest average catch or yield that can continuously be taken under existing environmental conditions) on a continuing basis."

- Section 303(1)(10) of the MSA mandates that all FMPs "specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which NPFMC or the Secretary has determined is approaching an overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery."

The National Standard Guidelines interpret the above mandate as requiring that each FMP specify, to the maximum extent possible, a pair of objective and measurable "status determination criteria" for each stock or stock complex covered by that FMP. One of these criteria is the maximum fishing mortality threshold (MFMT), equivalent to OFL in the BSAI and GOA Groundfish FMPs. Exceeding the MFMT for a period of one year or more constitutes overfishing. The other status determination criterion is the minimum stock size threshold (MSST), which is covered in Section 4.4.

The National Standard Guidelines also draw a distinction between limit reference points, such as OFL which management seeks to *avoid*, and target reference points, such as OY, which management seeks to *achieve* (ABC is another example of a target reference point). OY is the amount of fish that will 1) provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, 2) is prescribed as such on the basis of MSY from the fishery, and 3) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY. The National Standard Guidelines endorse a precautionary approach to setting target reference points, an approach characterized by three features:

1. Target reference points, such as OY, should be set safely below limit reference points, such as the fishing mortality rate (F) or level defined by the status determination criteria.

2. A stock that is below its MSY level should be harvested at a lower rate than if the stock were above its MSY level.

3. Criteria used to set target catch levels should be explicitly risk-averse, so that greater uncertainty regarding the status or productive capacity of a stock corresponds to greater caution in setting target catch levels.

The National Standard Guidelines' characterization of a precautionary approach was modeled upon the definitions of OFL and ABC found in the then-current BSAI and GOA Groundfish FMPs. The NPFMC approved modifications to these definitions in June 1998 for the purpose of bringing them into compliance with changes mandated by passage of the SFA.

4.2.1 Acceptable Biological Catch

Acceptable biological catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described under Section 4.2.2.

4.2.2 Overfishing

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate (e.g., OFL or MFMT). The OFL and ABC are calculated through a set of six tiers. These tiers organize each stock according to data availability and are arranged in descending order, the first tier being the most data-rich.

The data-rich category (Tier 1) usually include reliable estimates of MSY-related quantities, current stock size, the constant fishing mortality rate which results in the MSY (F_{MSY}) and the corresponding average spawning biomass (B_{MSY}). The stock assessments may be advanced and take uncertainty into account. The NPFMC's Science and Statistical Committee (SSC) will have final authority for determining whether a given item of information is "reliable" for the purpose of this definition, and may use either objective or subjective criteria for such determinations.

In cases where stock data are unavailable or inaccurate, MSY control rules may be used. These rules give management some flexibility and control when reliable fishing mortality rates and/or average spawning biomass information is unavailable. MSY control rules are used to set the criteria for determining whether a stock is being overfished or the stock is in a overfished condition, and enable the use of proxies. Proxies are established according to the National Standard Guidelines and the NOAA technical guidance report (Restrepo *et al.* 1998).

Tier 1 ABC and OFL values are calculated according the mean of the probability density function (pdf) (the statistical distribution of F_{MSY}). For Tiers 1-3, the coefficient *a* is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information.

Data-moderate cases may include unreliable or limited MSY-related quantities, incomplete life history, and inconsistent data or recruitment, but reliable estimates of current stock size (B) and all necessary life history and fishery parameters. For Tiers 2- 4, a designation of the form "$F_{X\%}$" ($F_{\%SPR}$) refers to the fishing mortality rate (F) associated with a stable level of spawning per recruit which is equal to a percentage of the level of spawning per recruit at equilibrium when no fishing has taken place. By way of the MSY control rule, these fishing mortality rates act as proxies to the Tier 1 definitions (mean of pdf), and have been developed to achieve approximately the same results. The fishing mortality rates differ among tiers (2-4), and are chosen based on the information available. $F_{20\%}$ has been used to calculate thresholds for well-known stocks with high resilience and $F_{30\%}$ for less well-known stocks with relatively high resilience. $F_{35\%}$ has been advocated

for stocks with average resilience and $F_{50\%}$ to $F_{60\%}$ may serve as proxies for stocks with very low productivity. However, much of the work on $F_{\%SPR}$ may not be a viable assumption for long-lived species and those with low reproductive output. The OFL definitions for Tiers 1-3 are equivalent to MSY control rules based on constant fishing mortality when stocks are above reference levels, but are substantially more conservative than an MSY control rule based on constant fishing mortality when stocks are below reference levels. Tier 4 OFL definition is equivalent to MSY control rule based on constant fishing mortality.

Data-poor cases lack much of the essential information including current stock size, fishing mortality rates, and life history information. Stock assessment data is incomplete, and measurements of uncertainty may be qualitative rather than quantitative. For Tiers 5 and 6, ABC and OFL are calculated according to *M* and reliable historical catch data. The OFL definitions in Tier 5 are equivalent to MSY control rule based on constant fishing mortality, while Tier 6 OFL definitions are equivalent to MSY control rule based on constant catch.

Equations Used to Derive OFL and ABC in the Respective Tiers

1. *Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.*
   - *1a. Stock status: $B/B_{MSY} > 1$*
     $F_{OFL} = m_A$, the arithmetic mean of the pdf
     $F_{ABC} \le m_H$, the harmonic mean of the pdf
   - *1b. Stock status: $a < B/B_{MSY} \le 1$*
     $F_{OFL} = m_A \times (B/B_{MSY} - a)/(1 - a)$
     $F_{ABC} \le m_H \times (B/B_{MSY} - a)/(1 - a)$
   - *1c. Stock status: $B/B_{MSY} \le a$*
     $F_{OFL} = 0$
     $F_{ABC} = 0$
2. *Information available: Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.*
   - *2a. Stock status: $B/B_{MSY} > 1$*
     $F_{OFL} = F_{MSY}$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%})$
   - *2b. Stock status: $a < B/B_{MSY} \le 1$*
     $F_{OFL} = F_{MSY} \times (B/B_{MSY} - a)/(1 - a)$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - a)/(1 - a)$
   - *2c. Stock status: $B/B_{MSY} \le a$*
     $F_{OFL} = 0$
     $F_{ABC} = 0$
3. *Information available: Reliable point estimates of B, $_{40\%}$, $F_{35\%}$, and $F_{40\%}$.*
   - *3a. Stock status: $B/_{40\%} > 1$*
     $F_{OFL} = F_{35\%}$
     $F_{ABC} \le F_{40\%}$
   - *3b. Stock status: $a < B/_{40\%} \le 1$*
     $F_{OFL} = F_{35\%} \times (B/_{40\%} - a)/(1 - a)$
     $F_{ABC} \le F_{40\%} \times (B/_{40\%} - a)/(1 - a)$
   - *3c. Stock status: $B/_{40\%} \le a$*
     $F_{OFL} = 0$
     $F_{ABC} = 0$

4. *Information available: Reliable point estimates of B, $F_{35\%,}$ and $F_{40\%}$.*

   $F_{OFL} = F_{35\%}$

   $F_{ABC} \leq F_{40\%}$

5. *Information available: Reliable point estimates of B and natural mortality rate M.*

   $F_{OFL} = M$

   $F_{ABC} \leq 0.75 \times M$

6. *Information available: Reliable catch history from 1978 through 1995.*

   OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information

   $ABC \leq 0.75 \times OFL$

4.3 Specification of Total Allowable Catch

The FMPs divide the fish species likely to be taken in the groundfish fishery into four categories. The OY is applied to all categories except the "prohibited species" category. OY is the amount of fish that will 1) provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, 2) is prescribed as such on the basis of MSY from the fishery, and 3) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY.

- **Target Species**. Those species that are commercially important and for which a sufficient database exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, other flatfish, sablefish, Pacific ocean perch, other rockfish, Atka mackerel, and squid.

- **Other Species**. Species groups that are currently of little economic value and not generally targeted. This category contains species with economic potential or which are important ecosystem components, but sufficient data are lacking to manage each separately. Accordingly, a single TAC applies to this category as a whole. Catch of this category as a whole must be recorded and reported.

- **Non-specified Species**. Those species and species groups of no current economic value taken by the groundfish fishery only as incidental catch. Virtually no data exist that would allow population assessments. No record of catch is necessary. The TAC for this category is the amount that is taken incidentally while fishing for target and other species, whether retained or discarded.

- **Prohibited Species**. Those species and species groups whose catch must be returned to the sea with minimum injury, except when their retention is authorized by other applicable law. Groundfish species and species groups for which the quotas have been achieved are treated in the same manner as prohibited species.

The NPFMC may set a maximum catch quota, the TAC, for target and other species, either by individual species or groups of species. The groupings are based on commercial importance of a species or species group and whether sufficient biological information is available to manage a species or species group on its own biological merits. Catch specifications are made for each managed species or species group, and in some cases, by species and subarea. Because both BSAI and GOA FMPs have OY ranges for the aggregate groundfish target species, any of the target species assemblages can be assembled/disassembled during the annual TAC-setting process. Over the years, NPFMC has done such disassembling several times. For example, in the BSAI, arrowtooth flounder were combined with Greenland turbot, but broken out separately in 1986. Rock sole were combined with "other flatfish" but broken out separately in 1989. Red rockfish were combined with "rockfish" but broken out separately in 1991, and further broken out into sharpchin/northern and shortraker/rougheye rockfish in a subsequent year. Such disassembling can only occur with the target species category. The "other species" category requires an FMP Amendment to break out a species and make it a target species category, as does the non-specified species category. An FMP Amendment would be required to make a non-specified species a target species.

For example, in 1999, FMP Amendments 63/63 were initiated to remove the shark and skate species groups from other species in both the BSAI and GOA to better protect these vulnerable, long-lived species (NPFMC 1999). Based on the 1999 stock assessments for other species, the Plan Teams recommended that all other species be considered in an expanded FMP Amendment to establish TACs at the species group level. While this amendment was being revised, NPFMC recommended to NOAA Fisheries that other species be placed on bycatch only status to prevent a directed fishery from developing in the interim. NOAA Fisheries determined that it did not have regulatory authority for such an action; therefore, aggregate other species TACs remain in place in the BSAI and the GOA despite efforts to limit directed fisheries and develop more protective management within this category. Final action on the revised plan amendments to set other species as bycatch only and to re-define the GOA TAC setting process will be scheduled in 2001.

The TAC specifications define upper harvest limits, or fishery removals, for the next fishing year. The sum of the TAC specifications is important because the FMPs specify the upper and lower ceilings for total TAC in each management area. In the BSAI, the lower limit is 1.4 million mt and the upper limit is 2 million mt (50 CFR 679.20(a)(1)(I)). In the GOA, the lower limit is 116,000 mt and the upper limit is 800,000 mt (50 CFR 679.20(a)(1)(ii)).

Suballocations of TAC are made for biological and socioeconomic reasons according to percentage formulas established through FMP Amendments. For particular target fisheries, TAC specifications are further allocated within management areas (eastern, central, and western Aleutian Islands; Bering Sea; western, central, and eastern GOA) among management programs (open access or CDQ Program), processing components (inshore or offshore), specific gear types (trawl, non-trawl, hook-and-line, pot, jig), and seasons according to regulations 50 CFR 679.20, 50 CFR 679.23, and 50 CFR 679.31.

Suballocations of TAC to the various gear groups, management areas, and seasons are made according to regulation driven formulas or, for discretionary allocations, according to Secretary of Commerce-approved specifications. NOAA Fisheries uses in-season management authority to open and close the fisheries (50 CFR 679.25). The entire TAC amount is available to the domestic fishery (50 CFR 679.20). The gear authorized in the federally managed groundfish fisheries off Alaska includes trawl gear, fixed-gear, longline gear, pot gear, and non-trawl gear (50 CFR 679.2).

Fishing areas correspond to the defined regulatory areas within the fishery management units. The BSAI is divided into 16 reporting areas (Figure 4-6), some of which are combined for TAC specification purposes. The Aleutian Islands group comprises regulatory Areas 541, 542, and 543. Referred to individually, 541 represents the eastern Aleutian Islands, 542 the central Aleutian Islands, and 543 the western Aleutian Islands. The GOA is divided into seven reporting areas (Figure 4-7): the western Gulf is Area 610, the central Gulf includes Areas 620 and 630, and the eastern Gulf includes Areas 640 and 650. Area 649 is state waters in Prince William Sound: Area 659 is state waters in southeast Alaska.

Fisheries are opened and closed by regulatory announcement. Closures are made when in-season information indicates the apportioned TAC or available PSC has been or will soon be reached, or at the end of the specified season if the particular TAC has not been taken (50 CFR 679.25).

4.3.1 Annual Promulgation of TAC

Establishing harvest specification rules is required for federal groundfish fisheries to run from one fishing year to the next. Specifying TAC and PSC limits follows the fishery regulation rule-making process. To conform with rule-making requirements, particularly those originating from the Administrative Procedures Act concerning standards for prior public review and input, three separate rules are published per management area, per year. The publications are first, proposed specifications, then interim specifications, and finally, final specifications. This three-part process has been in place, with various refinements, since implementation of the FMPs. The process is summarized in Table 4-3.

Proposed Specifications

Proposed ABC, TAC, and PSC[1] specifications are recommended by NPFMC at its October meeting and published in the FR for public review and comment. The recommendations are based on the preliminary Stock Assessment and Fishery Evaluation reports prepared by NPFMC's BSAI and GOA Plan Teams during and subsequent to their September meetings. Any new data on stock levels obtained from the previous summer's surveys are generally not yet in a useable form; therefore, the proposed specifications are based on previous year's data. Preliminary Stock Assessment and Fishery Evaluation reports are incorporated into the environmental analysis accompanying the proposed specifications rule. The Plan Teams' meetings and NPFMC meeting are open public meetings. The NPFMC also solicits public comment on the proposed TAC specifications during its October meeting.

Drafting, review, clearance, and FR publication of proposed ABCs, TACs, and PSC limits takes approximately two months. In 1999, for example, NPFMC met and recommended proposed year 2000 specifications on October 17, 1999, and the proposed specifications were published December 13, 1999. December 13, 1999 was the first day of the 30-day public comment period required under Administrative Procedures Act.

[1]BSAI crab and herring and GOA halibut only; BSAI PSC limits for halibut and salmon are established in regulations (50 CFR 679.21.)

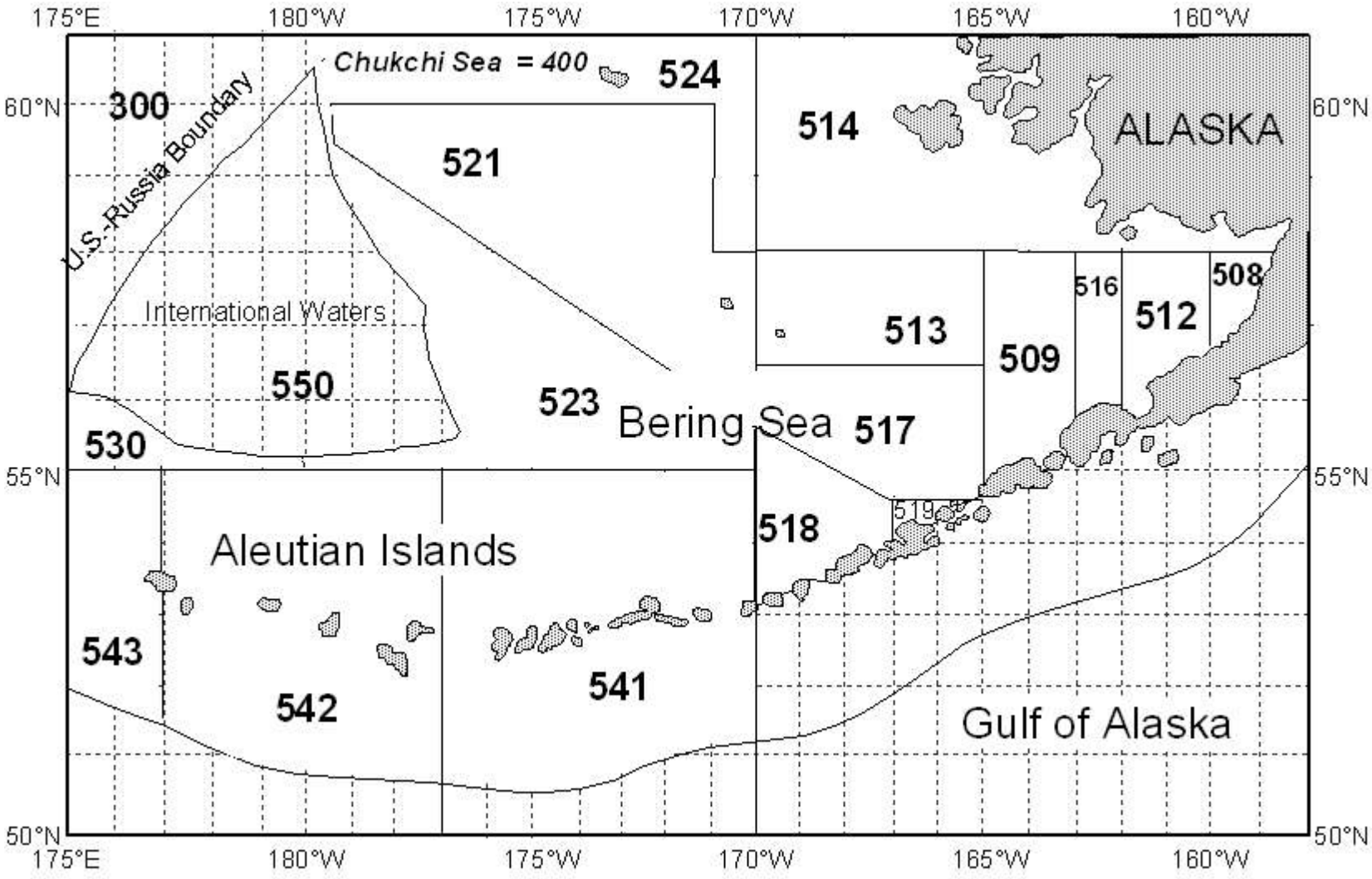

Figure 4-6. Bering Sea and Aleutian Islands statistical and reporting areas. Source: NOAA Fisheries.

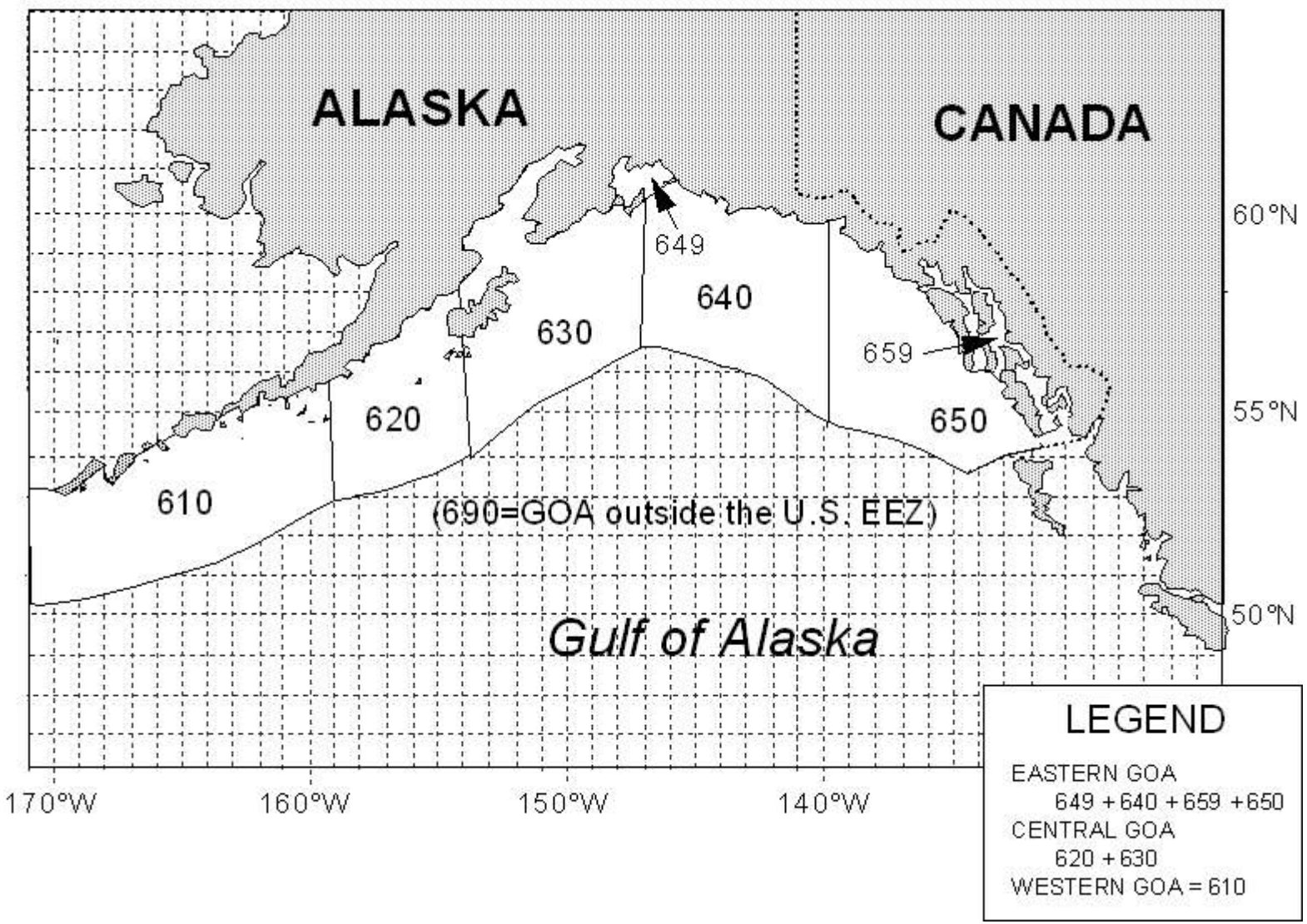

Figure 4-7. Gulf of Alaska statistical and reporting areas. Source: NOAA Fisheries.

Table 4-3. Steps and time line for annual total allowable catch specifications and prohibited species catch limit rules.

Month	Step in the process
September	Stock assessment authors provide Groundfish Plan Teams with proposed acceptable biological catch (ABC) recommendations. Groundfish Plan Teams provide scientific and statistical committee (SSC), advisory panel (AP), and North Pacific Fishery Management Council (NPFMC) proposed ABC recommendations.
October	NPFMC recommends proposed ABC, total allowable catch (TAC) specifications, and prohibited species catch (PSC) limits.
November	Specifications are published as proposed rule.
December	Interim specifications are published as a final rule. Groundfish Plan Teams provide final ABC recommendations. NPFMC recommends final ABC, TAC specifications, and PSC limits.
January	Non-trawl groundfish fisheries open January 1, and trawl fisheries open January 20 under interim specifications.
February-March	Final specification are published as final rule and replace interim specifications.

Interim Specifications

Interim TAC specifications are mathematical determinations authorizing one-fourth of each proposed interim TAC and apportionment thereof, one-fourth of each PSC allowance and the first seasonal allowance of BSAI and GOA pollock and BSAI Atka mackerel to be in effect on January 1 on an interim basis and to remain in effect until superceded by final specifications. NOAA Fisheries publishes the interim specifications in the FR as soon as practicable after the October NPFMC meeting. In 1999, for example, the year 2000 interim TAC specifications were published January 3, 2000. Retention of sablefish with fixed gear is not currently authorized under interim specifications. Further, existing regulations do not provide for an interim specification for the CDQ non-trawl sablefish reserve or for an interim specification for sablefish managed under the IFQ program.

Final Specifications

Final TAC and PSC specifications are recommended by NPFMC at its December meeting. The recommendations are based on Stock Assessment Fishery Evaluation reports prepared by NPFMC's BSAI and GOA Groundfish Plan Teams during and subsequent to their November meetings. Final Stock Assessment Fishery Evaluation reports are incorporated into the environmental analysis accompanying the final rule (NMFS 1999). The Groundfish Plan Team meetings and NPFMC meetings are open public meetings. The NPFMC solicits public comment on the proposed TAC specifications during its December meeting. Finalizing specifications takes approximately two months. For example for year 2000 final specifications, NPFMC met December 7 through 12, 1999, and recommended final TAC specifications and PSC limits that were published in the FR February 18, 2000.

While the above is an accurate description of the TAC-setting process to date, it is known to have flaws. The proposed specifications are outdated by the time they are published and the public has a formal opportunity to comment on them.

The NPFMC recommended a revision of the TAC-setting process in 1996 (BSAI/GOA FMP Amendments 48/48), but technical difficulties pertaining to the timing and completion of analyses required by NEPA, RFA, and other statutes have delayed a regulatory amendment that would implement a revised TAC-setting process. A new draft analysis to revise the process was presented to NPFMC in June 2000 (Draft EA/RIR/IRFA For Amending the Process by Which TAC Specifications Are Established For Alaska Groundfish Fisheries, NOAA Fisheries, May 25, 2000). If approved, a revised TAC-setting process for the 2002 fishing year would likely not be in effect until 2001.

4.3.2 Stock Assessment Information

The flow of new target species stock assessment information through the process starts when the AFSC stock assessment authors make ABC and OFL recommendations. For most species and species groups, the timing of new survey information that would lead to new calculations of ABC and OFL is after deadlines for the preliminary Stock Assessment Fishery Evaluation. The information is first available to the Plan Teams at their November meetings and, therefore included in the final Stock Assessment Fishery Evaluation. For species and species groups not receiving new stock survey information, the prior year's ABC and OFL recommendations are documented in the preliminary and final Stock Assessment Fishery Evaluation reports.

4.3.3 Role of Plan Teams, Scientific and Statistical Committee, Advisory Panel, and North Pacific Fishery Management Council, and the Secretary of Commerce in Total Allowable Catch Specifications

The role of NPFMC-appointed Groundfish Plan Teams is to make ABC and OFL recommendations, which may be different from that of the stock assessment author. These recommendations are also documented in the Stock Assessment Fishery Evaluation reports.

The role of NPFMC's Scientific and Statistical Committee is to make proposed ABC and OFL recommendations at the October NPFMC meeting and final recommendations at the December NPFMC meeting. These recommendations are documented in NPFMC meeting minutes.

The role of NPFMC's Advisory Panel is to recommend TAC specifications and PSC limits to NPFMC. The Advisory Panel's TAC recommendations must acknowledge the Plan Teams' and Science and Statistical Committee's ABC recommendations to ensure their recommended TAC is not higher than an ABC recommendation.

The NPFMC makes the last run at determining ABC and recommending proposed and final TAC specifications and PSC limits. The proposed specifications are made at the October meeting and the final specifications at the December meeting. NPFMC action taken during public meetings, is informed through the Stock Assessment Fishery Evaluation reports, which are part of an environmental analysis prepared according to National Environmental Policy Act regulations.

Since 1991, an environmental assessment has been prepared each year on TAC specifications. The environmental assessment is used in the decision-making process and accompanies the specification rules through regulatory review and filing with the Office of the FR.

NOAA Fisheries packages NPFMC recommendations into proposed or final rule specification documents and forwards them to the Secretary of Commerce for approval. Secretarial approval of final specifications usually occurs by March.

Because some fisheries would be under way before the final specifications approval, an interim specifications rule is published on or before January 1 by the Secretary of Commerce. The interim specifications implement one-fourth of the proposed TAC specifications and apportionments thereof toward fisheries occurring in the first quarter of the calendar year (50 CFR 679.20(c)(2)). Upon approval, the new TAC specifications replace the preliminary TAC specifications (50 CFR 679.20(c)(3)).

4.4 Derivation of Minimum Stock Size Threshold

The National Standards Guidelines require that each FMP specify, to the maximum extent possible, objective and measurable status determination criteria for each stock or stock complex covered by the FMP, provide an analysis of how the status determination criteria were chosen, and describe how they relate to reproductive potential. One such criterion is the MFMT, equivalent to OFL in the BSAI and GOA Groundfish FMPs. Exceeding the MFMT for a period of one year or more constitutes *overfishing*. The second status determination criterion is the MSST, which has no equivalent in the BSAI and GOA Groundfish FMPs. If a stock falls below its MSST, it is considered *overfished*.

Although MSSTs are not specified by the BSAI and GOA Groundfish FMPs, the fact that their use is required by the National Standard Guidelines resulted in their becoming a standard component of the Stock Assessment Fishery Evaluation reports prepared in 1999 for the 2000 fishery[2]. To evaluate stocks with respect to their minimum stock size thresholds, the 1999 SAFE Reports contained two sets of projections for each stock managed under Tiers 1, 2, or 3 of Amendments 56/56. The two sets of projections were distinguished by the harvest scenario assumed (see the following). For each harvest scenario, the projections began with the vector of 1999 numbers at age estimated in the respective assessment. This vector was then projected forward to the beginning of 2000 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total catch for 1999. In each subsequent year, the projected fishing mortality rate was prescribed on the basis of the spawning biomass in that year and the respective harvest scenario. In each year, projected recruitment was drawn from a distribution whose parameters consisted of maximum likelihood estimates determined from the time series of recruitments estimated in the assessment. Because an environmental regime shift appears to have occurred around 1977 (see Section 3 for more information), only year-classes spawned after 1976 were included in this time series. Projected spawning biomass was computed in each year based on the time of peak spawning and the maturity and weight schedules described in the assessment. Total catch was assumed to equal the catch associated with the respective harvest scenario in all years. This projection scheme was run 1,000 times to obtain distributions of possible future stock sizes, fishing mortality rates, and catches.

The harvest scenarios used in the two sets of projections were as follows (maximum F_{ABC} refers to the maximum permissible value of F_{ABC} under Amendment 56): (For information regarding the derivation of OFL and ABC, see Section 4.2)

- *Scenario 1*: In all future years, F is set equal to F_{OFL}.
- *Scenario 2*: In 2000 and 2001, F is set equal to *max* F_{ABC}, and in all subsequent years, F is set equal to F_{OFL}.

[2]The proxy for MSSTs as described in the FR notice announcing the approval of Amendments 56/56 proved unworkable and NOAA Fisheries relied on the procedure described in this section for specifying MSSTs for the 2000 fishing year.

Harvest scenarios 1 and 2 were used to determine the status of each stock with respect to its MSST as follows (for Tier 3 stocks, the MSY level is defined as $_{35\%}$):

- Is the stock overfished? This depends on the stock's estimated spawning biomass in 2000:
  - If spawning biomass for 2000 is estimated to be below ½ B_{MSY}, the stock is below its MSST
  - If spawning biomass for 2000 is estimated to be above B_{MSY}, the stock is above its MSST
  - If spawning biomass for 2000 is estimated to be above ½ B_{MSY} but below B_{MSY}, the stock's status relative to MSST is determined by referring to harvest scenario #1. If the mean spawning biomass for 2010 is below B_{MSY}, the stock is below its MSST. Otherwise, the stock is above its MSST

- Is the stock approaching an overfished condition?

  This is determined by referring to harvest scenario #2:
  - If the mean spawning biomass for 2002 is below ½ B_{MSY}, the stock is approaching an overfished condition
  - If the mean spawning biomass for 2002 is above B_{MSY}, the stock is not approaching an overfished condition
  - If the mean spawning biomass for 2002 is above ½ B_{MSY} but below B_{MSY}, the determination depends on the mean spawning biomass for 2012. If the mean spawning biomass for 2012 is below B_{MSY}, the stock is approaching an overfished condition. Otherwise, the stock is not approaching an overfished condition

It is currently considered impossible to evaluate the status of stocks in Tiers 4 through 6 with respect to their MSSTs because stocks qualify for management under these tiers only if reference stock levels (such as MSST) cannot be reliably estimated.

Section 5 Groundfish Fishery Descriptions

5.1 Pollock

The pollock fishery is a single species target fishery. Directed fishing for pollock is conducted entirely with trawl gear. Most of the pollock is harvested by vessels using pelagic (or midwater) trawl gear, a much smaller amount is harvested by vessels using by bottom (non-pelagic) trawl gear. Other gear types incidentally take pollock in other fisheries in relatively small amounts.

BSAI

In 2002, almost 1,500,000 mt of pollock were harvested in the eastern Bering Sea (assuming that the full TAC was taken) and about 1,000 mt (as of Oct 19, 2002) in the Aleutian Islands (NPFMC 2002a). In 2001, about 1,390,000 mt were harvested in the BSAI by 104 catcher vessels and 16 catcher processors. (Hiatt *et al.* 2002, Economic Status of the Groundfish Fisheries off Alaska 2001, Appendix D of NPFMC 2002a). Of this catch, over 1,330,000 mt of pollock were taken by pelagic trawls in the directed fishery with about 16,000 mt taken by bottom trawls in the BSAI (Hiatt *et al.* 2002). In that same period, an additional 138,000 mt of pollock was taken as incidental catch in other directed groundfish fisheries, mostly by vessels using trawl gear targeting yellowfin sole (16,000 mt).

Bycatch of non-targeted species in the directed pollock fishery using pelagic trawl gear is comparatively low by weight of the targeted pollock. Prohibited species may not be retained, unless they are donated to charitable food banks (50 CFR 679.26). The incidental catch of other groundfish species and prohibited species catch by vessels using pelagic and bottom trawl targeting pollock in 2001 is presented in the Hiatt *et al.*(2002). Incidental catch of salmon is highest in the pollock fishery with about 85,000 salmon (about 31,000 of which are chinook) taken . Bycatch of other prohibited species such as halibut (51 mt in the bottom trawl pollock fisheries and 164 mt in the pelagic fisheries), herring (2 mt in the bottom trawl and 224 mt in pelagic) and crab (king, bairdi, and tanner; about 50,000 ind. total), has been documented for 2001.

The pattern of the modern pollock fishery in the BSAI is to focus on a winter, spawning-aggregation fishery. This is termed the "A" fishery with an opening on January 20th. This season lasts about 4-6 weeks depending on the catch rates. Since 1992, the "B" season (typically September-October) fishery has been conducted to a greater extent west of 170˚W longitude than previously (Ianelli *et al.* 1998). Fishing is closed for pollock in all areas from November 1 to January 20. Fishing is also closed around designated rookeries and haulouts out to 20 nm in the Bering Sea. The Bering Sea pollock TAC is allocated 40 percent to the combined A/B seasons and 60 percent to the combined C/D seasons. Half of the 40 percent allocation to the A/B season (i.e., 20 percent) can be taken inside the SCA during the combined A and B seasons, with 15 percent allocated to the A and 5 percent to the B. The 60 percent TAC allocation to the C/D season is similarly apportioned by area inside and outside the SCA, except that a maximum of 4.5 percent.

In addition to these allocations, under the AFA, 10 percent of the Bering Sea annual pollock TAC is allocated to the CDQ sector, 5 percent of the remainder is removed for bycatch allowance in other fisheries, and the remainder is subdivided among catcher processors (40 percent), motherships (10 percent), and the inshore sector (50 percent). To prevent competition among sectors, the allocation of pollock TAC to each sector is managed by season and area.

Disentangling the specific changes in the temporal and spatial dispersion of the eastern Bering Sea pollock fishery resulting from Steller Sea Lion Protection Measures and from implementation of the AFA is difficult. An example of the allocation of Bering Sea pollock under the AFA is shown in Table 5-1 using a hypothetical allocation of a 1 million mt pollock TAC for the Bering Sea subarea and the percentage formulas contained in the AFA. Within the sectors, the catcher processors and inshore and offshore catcher vessels have formed pollock fishery cooperatives that contribute to rationalizing the fishery by reducing the pace of harvest, increasing the fishing seasons, and facilitating overall management of the fishery.

GOA

The fishery for pollock in the GOA is entirely shore-based with about 90 percent of the catch taken using pelagic trawls. During winter, fishing effort usually targets pre-spawning aggregations in Shelikof Strait and near the Shumagin Islands . Fishing areas in summer are less predictable, but fishing typically occurs on the east side of Kodiak Island and in nearshore waters along the Alaska Peninsula.

In 2002, over 53,000 mt of pollock were harvested in the GOA (assuming that the full TAC was taken) (NPFMC 2002a). In 2001, the most recent year for which vessel data is available, about 70,000 mt of pollock were taken by 83 catcher vessels and no catcher processors in the GOA (Hiatt *et al.* 2002). Of this catch, about 42,000 mt of pollock were taken by pelagic trawls in the directed fishery with about 27,000 mt taken by bottom trawls in the BSAI (Hiatt *et al.* 2002). In that same period, an additional 2,400 mt of pollock was taken as incidental catch in other directed trawl groundfish fisheries.

Since 1992, the GOA pollock TAC has been apportioned spatially and temporally to reduce impacts on Steller sea lions. The Steller Sea Lion Protection Measures implemented in 2001 establish four seasons in the Central and Western GOA beginning January 20, March 10, August 25, and October 1, with 25 percent of the total TAC allocated to each season. In addition, a new harvest control rule was implemented that requires a cession of fishing when spawning biomass declines below 20 percent of unfished stock biomass.

Bycatch of non-targeted species in the directed pollock fishery using pelagic trawl gear is comparatively low by weight of the targeted pollock. Prohibited species may not be retained, unless they are donated to charitable food banks (50 CFR 679.26). The incidental catch of other groundfish species and prohibited species catch by vessels using pelagic and bottom trawl targeting pollock in 2001 is presented in the Hiatt *et al.*(2002). Bycatch of salmon is highest in the pollock fishery with about 12,000 salmon (about 10,000 of which are chinook) taken . Bycatch of other prohibited species such as halibut (72 mt in the bottom trawl pollock fisheries and 16 mt in the pelagic fisheries), herring (4 mt in the bottom trawl and 3 mt in pelagic) and bairdi crab (about 9,000 ind. and 6,000 ind. in the bottom and pelagic trawl fisheries respectively), has been documented for 2001.

Table 5-1. Sector-specific Bering Sea subarea pollock total allowable catch allocation procedures using a hypothetical Bering Sea subarea pollock total allowable catch of 1 million metric tons.

Allocation of Bering Sea subarea pollock total allowable catches (TACs) under Alternative 2	Hypothetical allocations (metric tons)	% of Bering Sea and Aleutian Islands (BSAI)
Step 1: Establish TAC for the Bering Sea Subarea. Separate TACs are established for the Bering Sea Subarea and Aleutian Islands Subarea. In this hypothetical example, the Bering Sea Subarea pollock TAC is set at 1 million mt.	1,000,000	100
Step 2: Allocate 10 Percent of TAC to community development quota (CDQ). Under the AFA, 10 percent of the Bering Sea and Aleutian Islands Subarea TACs are allocated to the Western Alaska CDQ program.	100,000	10
Step 3: Establish incidental catch allowance (ICA). Establish an ICA to account for incidental catch of pollock in other groundfish fisheries. Approximately 5 percent in recent years.	50,000	5
Step 4: Establish directed fishing allowance (DFA). Establish the DFA for the pollock target fisheries. The DFA is the TAC minus the CDQ and ICA amounts.	850,000	85
Step 5: Allocate 40 Percent of DFA to catcher processor sector. Under the AFA, the catcher processor sector is allocated 40 percent of the DFA. In addition, not less than 8.5 percent of the catcher processor sector DFA is allocated to catcher vessels delivering to catcher processors, and the unlisted AFA catcher processors are limited in the aggregate to 0.5 percent of the catcher processor sector DFA.		
Catcher processor sector DFA (40 percent)	340,000	34
Catcher processor sector catcher vessel set-aside (8.5 percent)	28,900	2.89
Unlisted AFA catcher processors (0.5 percent)	1,700	0.17
Step 6: Allocate 10 Percent of DFA to mothership sector. Under the American Fisheries Act (AFA), the mothership sector is allocated 10 percent of the DFA.	85,000	8.5
Step 7: Allocate 50 Percent of DFA to inshore sector. Under the AFA, the inshore sector is allocated 50 percent of the DFA. The inshore sector allocation is further divided into allocations to individual inshore catcher vessel cooperatives and to the open access inshore sector, which is composed of AFA inshore catcher vessels not in cooperatives.	425,000	42.5
Step 8: Allocate to inshore cooperatives. Under the AFA, any inshore catcher vessel cooperative that is composed of at least 80 percent of the vessels that delivered the majority of their pollock to a particular inshore processor and that has agreed to deliver at least 90 percent of its pollock to that same inshore processor is eligible for a suballocation of the inshore sector DFA. The cooperative's allocation is a percentage of the inshore sector DFA that is equal to the aggregate catch histories of the member vessels from 1995 to 1997, relative to total inshore landings during that same period. Up to eight inshore catcher vessel cooperatives may form under the AFA to match the eight AFA inshore processors. In this example, it is assumed that vessels representing 95 percent of the 1995–1997 inshore catch history have joined cooperatives.	398,884	39.9
Step 9: Allocate to inshore open access fishery. Under the AFA, vessels that do not join inshore catcher vessel cooperatives are eligible to fish in the open access sector of the inshore pollock fishery. The open access sector allocation is equal to the inshore DFA minus the aggregate allocation of pollock to cooperatives.	26,116	2.6

5.2 Pacific Cod

BSAI - Trawl

In the BSAI, the Pacific cod fishery attracts a broad group of participants. Small catcher vessels and large catcher processors target Pacific cod with a variety of different gear types. While most of the Pacific cod harvest is conducted by vessels using fixed-gear comprised of hook and longlines, pots, and jig gear, in 2001, the most recent year for which data is available, 21 trawl catcher processors and 66 trawl catcher vessels harvested Pacific cod in the BSAI (Hiatt *et al.* 2002). In 2001, these vessels harvested about 35,000 mt. Through August 2002, about 46,000 mt had been harvested by trawl gear in the directed fishery (NPFMC 2002a). In 2001, about 19,000 mt of Pacific cod were taken incidentally in the other groundfish trawl fisheries. The majority of Pacific cod harvested by trawl gear is taken in shallow waters on the eastern Bering Sea shelf.

Under regulations at 50 CFR 679.20(b)(1)(iii), 7.5 percent of the annual Pacific cod TAC is allocated to the CDQ fishery. The non-CDQ Pacific cod TAC is split into three gear allocations; trawl, fixed gear (hook-and-line and pots), and jig. Regulations at 50 CFR 679.20 (a)(7)(I) allocate 47 percent to trawl gear (split 50:50 between catcher vessels and catcher processors), 51 percent to fixed gear, and 2 percent to jig gear.

The bycatch of other groundfish species and prohibited species catch by vessels using trawl gear targeting Pacific cod in 2001 in the BSAI is presented in Hiatt *et al.*(2002). Bycatch of halibut was about 590 mt in 2001. Bycatch of other prohibited species such as herring (5 mt), king crab (about 2,000 ind) and salmon (about 5,000 ind. chinook and other combined) is quite low in the Pacific cod trawl fishery. Incidental catch of bairdi and other tanner crabs of about 66,000 and 30,000 individuals, respectively, has been documented for 2001.

The most common Pacific cod products for at-sea processors are headed and gutted fish and fillets. The most common products for shoreside processors are salted cod, fillets, and fish meal. The trawl fishery for Pacific cod opens by regulation on January 20 (50 CFR 679.23(c)) and closes when either the Pacific cod TAC or the halibut mortality bycatch allowance for the trawl fishery is reached.

BSAI - Fixed Gear

In 2001, 72 catcher vessels and 42 catcher processors targeted Pacific cod with hook-and-line gear. In addition, 70 catcher vessels and 6 catcher processors used pot gear to target Pacific cod. In that year hook and line vessel harvested about 100,000 mt of Pacific cod while pot fisherman took about 16,000 mt. In 2002, TACs were set at about 62,000 mt for hook and line and about 11,000 mt for pot gear. In 2001, about 19,000 mt of Pacific cod were taken incidentally in the other groundfish trawl fisheries.

Under regulations at 50 CFR 679.20(b)(1)(iii), 7.5 percent of the annual Pacific cod TAC is allocated to the CDQ fishery. In 2000, NOAA Fisheries approved Amendment 64 to the BSAI groundfish fishery, which authorizes a further apportionment of the 51 percent fixed-gear allocation among vessels using hook-and-line or pot gear. Amendment 64 establishes the following apportionment of the fixed-gear allocation after deducting incidental catch of Pacific cod in other groundfish fixed-gear fisheries:

- 80 percent to hook-and-line catcher processors.
- 0.3 percent to hook-and-line catcher vessels.
- 18.3 percent to pot vessels.
- 1.4 percent to hook-and-line or pot vessels less than 60 ft.

Regulations at 50 CFR 679.20 (a)(7)(iv) split the fixed gear cod TAC into three seasonal allocations: January 1, May 1, and September 1.

The incidental catch of other groundfish species and prohibited species catch by vessels using hook and line gear targeting Pacific cod in 2001 is presented in Hiatt *et al.*(2002). Bycatch of halibut was about 776 mt in 2001. Incidental catch of other prohibited species included king crab (about 26,000 individuals) and bairdi and other tanner crabs (about 103,000 individuals). The Pacific cod pot fisheries in 2001 took about 2 mt of halibut, about 12,000 king crabs, and about 192,000 bairdi and other tanner crabs. As expected, there were no incidental catches of herring or salmon by the hook-and-line or pot fisheries for Pacific cod.

Hook-and-line harvested cod are mostly taken along the slope of the continental shelf break and along the Aleutian Islands. Pacific cod harvested by pot gear is taken along the slope as well as north and west of Unimak Island and adjacent to the Aleutian Islands. The most common Pacific cod products for at-sea processors are headed and gutted fish and fillets. The most common products for shoreside processors are salted cod, fillets, and fish meal.

GOA - Trawl

After pollock, Pacific cod is the largest volume fishery in the GOA. In 2001, 95 catcher vessels and 6 catcher processors harvested about 20,000 mt in the directed fishery. Also during that year, about 5,000 mt were taken as incidental catch in other directed groundfish trawl fisheries. As of August 2002, 18,500 mt had been taken by trawl. The percentage of the total TACs for Pacific cod harvested by trawl gear in the GOA has declined in recent years as additional vessels using fixed gear have entered the fishery. The federal Pacific cod TACs are not allocated by gear type in the GOA harvests, by all gear types are deducted from a shared TAC established for each management area.

The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in state waters. Since the beginning of a separately managed Pacific cod fishery by the State of Alaska in 1998, the federally managed TACs have been adjusted downward from ABC levels by the amount of guideline harvest levels (GHLs) established by the state. Trawl vessels of all sizes target Pacific cod, and the fishery attracts the greatest number of trawl vessels participating in the groundfish fisheries (Hiatt *et al.* 2002). In recent years, 20 percent of the annual TACs were held in reserve until after the principal directed fisheries closed as a management buffer to prevent exceeding the annual TACs and to provide greater assurance that incidental catch of Pacific cod may be retained throughout the fishing year. In the GOA, the Pacific cod TACs are allocated 90 percent to vessels targeting Pacific cod for processing by the inshore component and 10 percent to vessels targeting Pacific cod for processing by the offshore component.

Pacific cod is also included in the improved retention and utilization regulations at 50 CFR 679.27. The most common primary products are skinless, boneless fillets. Processors who have no filleting machinery process headed and gutted fish. A wide variety of ancillary products may also be produced, including roe, milt, trimmings that can be processed into surimi, collars, stomachs, heads, fish meal, and oil.

The Pacific cod trawl fishery has the highest prohibited species catch of halibut and bairdi Tanner crab of all GOA trawl fisheries (Hiatt *et al.* 2002). In 2001, this amounted to 746 mt of halibut and about 47,000 individual bairdi crabs.

GOA - Hook and Line Gear

The Pacific cod hook-and-line fishery in the GOA is second to sablefish in both volume and value. In 2001, the hook-and-line gear harvest was about 10,000 mt taken by 427 catcher vessels and 13 catcher processors. About 200 mt of Pacific cod were taken as incidental catch in Sablefish hook and line fishery. The catch of prohibited species in the Pacific cod hook-and-line fishery is extremely minimal, with only about other tanner crabs taken in 2001. In 2002, about 12,000 mt had been harvested as of August. The Pacific cod TACs are not allocated by gear type in the GOA; harvests by all gear types are deducted from a shared TAC established for each management area. The Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in state waters.

In recent years, 20 percent of the annual TACs have been held in reserve until after the principal directed fisheries close as a management buffer to prevent exceeding the annual TACs and to provide greater assurance that incidental catch of Pacific cod may be retained throughout the fishing year. Pacific cod is also included in the IRIU Program regulations (50 CFR 679.27). The most common primary products are skinless, boneless fillets and, for processors without fillet machinery, headed and gutted fish. A wide variety of ancillary products may also be produced, including roe, milt, trimmings processed into surimi, collars, stomachs, heads, fish meal, and oil.

GOA - Pot Gear

Only single buoyed pots may be fished in the GOA. Fishing for groundfish using pot gear is almost entirely limited to targeting Pacific cod in the GOA. Following the implementation of the moratorium program in 1995, the establishment of a state waters Pacific cod fishery in 1998, and the LLP in 2000, most new entrants are limited to fishing within state waters during both the federal and subsequent state water openings. In 2001, the pot gear harvest of Pacific cod in the federal fisheries was about 7,000 mt taken by 150 catcher vessels and 4 catcher processors. As of August 2002, almost 15,000 mt of Pacific cod had been harvested by pot gear in the GOA.

The federal Pacific cod TACs in the GOA are affected by a developing Pacific cod fishery in state waters. Since the beginning of a separately managed Pacific cod fishery by the State of Alaska in 1998, the federally managed TACs have been adjusted downward from ABC levels by the amount of GHLs established by the state. In 2001 and 2002, TAC was set at 23 percent below ABC to accommodate the state hook-and-line fishery. In the state waters fisheries in the GOA, the Pacific cod GHLs are allocated by gear type (between pot and jig) and vessel size (5 AAC 28.276, .367, .467, .537, and .577).

The net effect is that the amount of Pacific cod harvested by vessels using pot gear has increased in recent years. Pot gear vessels of all sizes target Pacific cod. The most common primary products are skinless, boneless fillets, and for processors without fillet machinery, headed and gutted fish. A wide variety of ancillary products may also be produced, including roe, milt, trimmings processed into surimi, collars, stomachs, heads, fish meal, and oil. Bycatch of other groundfish species and prohibited species catch by vessels using pot gear targeting Pacific cod is presented in Hiatt *et al.* (2002). Bycatch of other groundfish species is very low for pot gear targeting Pacific cod with only abut 200 mt of octopus from the other species assemblage taken in 2001. However, pot gear has the highest bycatch of crab in the GOA. In 2001, pot gear incidental catch of bairdi Tanner crab in the GOA Pacific cod fishery was almost 70,000 individuals. By regulation (50 CFR 679.2) the circumference of the tunnel entrance is limited to 36 in. and a biodegradable panel must be installed to reduce bycatch. In recent years bycatch of halibut has been low (5 mt in 2001) and pot gear has been exempted in the GOA from halibut prohibited species catch limitations.

Jig Gear

Jig gear is used to target primarily Pacific cod and rockfish in the GOA. Catches of Pacific cod by vessels using jig gear in the federally managed fishery was about 150 mt in 2001. Vessels using jigging gear are more active in the state-managed Pacific cod and black rockfish fisheries than in the federally managed fisheries. In state waters, Pacific cod fisheries GHL allocations have been made to vessels using jig gear; however, these allocations have not yet been fully utilized. The use of jig gear is especially attractive to owners of small-sized vessels. The gear is relatively inexpensive and can fished from small vessels with minimum crew. Primary and ancillary products from jig-caught Pacific cod are the same as from catches by other gear types. The vast majority of vessels using jig gear are under 60 ft LOA and are exempt from federal observer, recordkeeping, and reporting requirements. In recent years, jig gear, and pot gear, in the GOA have been exempted from halibut prohibited species catch limitations. While the amount of incidental catch of halibut by vessels using jig gear is unknown, it is assumed to be low. Bycatch rates and attendant mortality rates are also relatively low.

5.3 Atka Mackerel

The directed Atka mackerel fishery is a bottom trawl fishery that occurs off the continental shelf in the EBS and in the passes between the islands of the central and western Aleutians. As of October 12, 2002, about 42,000 mt of Atka mackerel had been harvested (TAC set a 49,000 mt). The most common Atka mackerel products are headed and gutted (eastern cut) and whole frozen fish (destined for processing).

In 2001, 12 trawl catcher processors and no catcher vessels harvested Atka mackerel in the BSAI (Hiatt *et al.* 2001). These vessels harvested approximately 60,000 mt of Atka mackerel in the directed fishery. An additional 1,500 mt of Atka mackerel was incidentally caught in the other groundfish trawl fisheries. Also in 2001, the directed Atka mackerel fishery incidentally caught about 11,000 mt of other groundfish species, the majority of which consisted of rockfish and Pacific cod (about 8,000 mt and 2,000 mt, respectively). Bycatch of prohibited species in the BSAI trawl Atka mackerel fishery in 2001 consisted mostly of halibut (61 mt), and a small amount of bairdi crabs (2,000 individuals).

In 1998, 1 percent of the BSAI Atka mackerel TAC was allocated to vessels using jig gear. Beginning in 1999, the non-jig portion of the Atka mackerel annual TAC is divided equally into two seasons, with 50 percent of the TAC available in the A season and 50 percent in the B season. Under regulations at 50 CFR 679.20 (a)(8)(ii)(A), the A season begins on January 20 and remains open until the seasonal allocation is harvested or until April 15, when it closes. The B season opens September 1 and remains open until the seasonal allocation is harvested or until November 1, when it closes.

Since 1994, the Atka mackerel quota has been split in the annual final specifications into three separate area allocations based on the most recent biomass estimates. The three areas are the Bering Sea/eastern Aleutian Islands (Bering Sea and Area 541), the central Aleutian Islands (Area 542), and the western Aleutian Islands (Area 543). In 1999, Area 542 and Area 543 were further split into critical habitat and non-critical habitat areas due to Steller sea lion concerns (CFR 679.22(a)(8)(iii), Tables 1 and 2, and Figure 4 of 50 CFR 226). In Area 542 of the central Aleutian Islands 80 percent of the Atka mackerel seasonal TAC was allowed to be harvested within the critical habitat area. In the western Aleutian Islands (Area 543), the critical habitat allocation was 65 percent of the seasonal TAC.

Once the critical habitat percentage of Atka mackerel is harvested, all trawl fisheries are prohibited inside critical habitat until the remaining seasonal allocation is harvested outside the critical habitat area. At that point, the Atka mackerel fishery closes and other trawl fisheries can take place inside the critical habitat area.

5.4 Rock Sole, Flathead Sole, Deepwater Flatfish, Shallow Water Flatfish, Rex Sole, and Other Flatfish

BSAI

In the BSAI, the rock sole, flathead sole, and other flatfish fisheries are almost exclusively prosecuted by catcher processors using bottom trawl gear. Although the fisheries are open to other vessel categories and gear types, very few rock sole, flathead sole, other flatfish are harvested by other types of vessels. In 2001, 26 trawl catcher processors targeted rock sole, flathead sole, and other flatfish in the BSAI. In 2001, the directed fishery for flathead sole harvested about 10,000 mt with an additional 7,500 mt of these fish harvested incidentally in the other BSAI groundfish trawl fisheries. The directed fishery for rock sole harvested about 15,000 mt in 2001, with an additional 13,000 mt harvested incidentally. In 2002, the catch of rock sole in the BSAI was about 40,000 mt and the catch of flathead sole was about 15,000 mt (both current through November 12, 2002).

Flathead sole fisheries also incidentally catch pollock (about 4,500 mt in 2001), Pacific cod (2,800 mt in 2001), rock sole (1,900 mt in 2001), and yellowfin sole (2,900 mt in 2001). Bycatch of bairdi and other tanner crabs is relatively high in the flathead sole fishery (almost 300,000 bairdi crabs, over 475,000 other tanner crabs in 2001). Other prohibited species bycaught in the 2001 flathead sole BSAI trawl fishery included about 360 mt of halibut, about 10 mt of herring, about 1,200 king crab individuals, and a small amount of salmon (fewer than 1,500 individuals, chinook and other salmon combined).

The rock sole fisheries in 2001 also caught several species of groundfish incidentally: pollock and yellowfin about 5,000 mt each, pacific cod about 4,000 mt, and flathead sole about 1,000 mt. The rock sole fishery also has a fairly high bycatch rate for bairdi and other tanner crabs (almost 270,000 individuals of each category in 2001). Almost 820 mt of halibut were caught in the rock sole fishery along with about 13 mt of herring and nearly 30,000 red king crab and other king crab combined. As expected, very few salmon (less than 3,000 chinook and other salmon combined) were caught by rock sole directed fisheries in 2001.

Outside of the high-value rock sole roe fishery in the spring, the rock sole, flathead sole, and other flatfish category is used as a fill-in when more valuable target species are not available. The most common rock sole and flathead sole products are headed and gutted fish (with and without roe) and fish meal. The most common products for other flatfish are whole frozen fish and fish meal.

Vessels participating in these fisheries generally fish for rock sole during the roe season until the first seasonal halibut bycatch cap is reached. Generally, after the rock sole roe fishery closes, these vessels shifted to several different targets; notably Atka mackerel, yellowfin sole, and Pacific cod. Vessels also can go into the GOA to fish for rex sole.

In the BSAI, most of the rock sole, flathead sole, and other flatfish fisheries occur on the continental shelf in the eastern Bering Sea in water shallower than 200 m. Some effort follows the contour of the shelf to the northwest and extends as far north as Zhemchug Canyon. Very few rock sole, flathead sole, and other flatfish are taken in the Aleutian Islands due to the limited shallow water areas present.

GOA

Deepwater flatfish, rex sole, and flathead sole are targeted exclusively with bottom trawl gear in the GOA. Most shorebased catcher vessels targeting these species are homeported in, and deliver to, processing plants in Kodiak. Small sized (less than 125 ft length overall [LOA]) trawler catcher processors also target these species. These species are particularly attractive to smaller sized catcher processors because the low average daily catch amounts of high-value targets, such as rex sole, are well-suited to low-volume processing capacity. These targets are made additionally attractive by the larger amounts of highly valuable species closed to directed fishing that may be retained as bycatch. In 2001, 41 catcher vessels and 11 catcher processors targeted flatfish in the GOA. These vessels caught a total of 3,400 mt of flathead sole, rex sole, and deepwater flatfish, combined, with an additional 1,500 mt caught by other groundfish fisheries such as the pollock and Pacific cod trawl fisheries. In 2002, the combined catch was about 5,500 mt.

The rex sole fisheries catch a fairly large amount of halibut as bycatch (252 mt in 2001) with the flathead sole and deepwater flatfish fisheries also catching halibut at the rate of 70 and 44 mt, respectively. For example, in 2002 the deepwater flatfish and rex sole fisheries were closed in each quarter on May 24, August trawling for flatfish on October 13 due to reaching the halibut bycatch limit. The only other substantial bycatch is that of bairdi crab in the flathead sole fishery (about 42,00 individuals in 2001).

Target fishery is defined by the dominant species, that is, when deepwater flatfish, rex sole or flathead sole comprise the largest portion of an observed haul's catch. Deepwater flatfish, rex sole, and flathead sole are most often fished at depths greater than 80 fathoms, where valuable species on bycatch status, such as sablefish, thornyhead, shortraker, and rougheye rockfish, may be incidentally taken. For many vessels, the value of groundfish species retained as bycatch exceeds the value of targeted species retained. The most common primary products are skinless, boneless fillets; headed and gutted fish; and whole fish. The most common ancillary products are roe, fish meal, and oil.

Shallow water flatfish, as a target, includes all other species of flatfish for which a separate TAC is not established. These species are targeted exclusively with bottom trawl gear. This target fishery is defined by the dominant species; that is, when shallow water flatfish comprise the largest portion of an observed haul's catch. In 2001, directed fisheries for shallow water flats harvested about 3,400 mt of this species, with an additional 3,000 mt taken in the other flatfish and groundfish fisheries. Bycatch of halibut is high in the shallow water flatfish fishery with almost 490 mt taken in 2001. The 2002 shallow water flatfish fishery was closed on May 15, August 5, and October 13 due to attainment of the halibut bycatch limit.

Shallow water flatfish are targeted mostly by medium-sized shorebased catcher vessels homeported in and delivering to Kodiak. Rock sole and butter sole comprise the majority of the catch in this target fishery. The most valuable species is rock sole bearing roe. The most common primary and ancillary products are similar to the deeper water flatfish fisheries described previously.

5.5 Yellowfin Sole

The yellowfin sole fishery takes place in the relatively shallow waters of the eastern Bering Sea shelf. And is primarily caught by catcher processors using bottom trawl gear. Vessels begin to target yellowfin sole after the rock sole roe fishery closes in the early spring. In recent years, yellowfin sole seasons have been longer than any other major groundfish fishery in the BSAI; in some years, the fishery never officially closes. This is due to large annual TACs and a relatively low value for yellowfin sole products. In 2001, 54,000 mt of yellowfin were taken in the directed fishery, with an additional 10,000 mt taken incidentally in the other groundfish fisheries.

Bycatch of halibut and tanner crabs is high in the yellowfin fishery and often constrains the fishery. In 2001 over 1,000 mt of halibut, 32,000 red king crabs, 324,000 bairdi crabs and 1,000,000 other tanner crabs were taken. And in 2002, the yellowfin sole harvest was constrained by two seasonal closures due to the attainment of halibut PSC limits: from May 11-May 21 and from June 15-June 30. In addition zone 1 was closed on May 21 for the remainder of 2002 to prevent exceeding the 2002 bycatch allowance of red king crab specified for the yellowfin sole target fishery.

The most common yellowfin sole products for catcher processors were headed and gutted (eastern cut) fish and whole frozen fish. Shoreside processors made a small amount of surimi in 1999.

5.6 Greenland Turbot

Greenland turbot are harvested by hook-and-line gear in the Bering Sea from Unimak Island along the continental shelf break to above Zhemchug Canyon. They are large flatfish harvested in relatively deepwater (beyond 200 m) off the BSAI continental slope, and also along the Aleutian Islands chain. The major portion of the harvest is taken by hook-and-line catcher processors although a small amount is taken by bottom trawl. In 2001, hook and line vessels harvested about 3,000 mt of Greenland turbot, while trawl vessels took only about 400 mt. Greenland turbot are also taken as incidental bycatch in trawl fisheries, most notably those targeting flatfish and rockfish species in the Bering Sea (about 1,500 mt in 2001).

Separate TACs for Greenland turbot are specified for the Bering Sea Subarea and the Aleutian Islands Subarea. In recent years, vessels using hook-and-line gear to target Greenland turbot (as well as sablefish) have experienced a problem with killer whales, which strip the fish off the hooks as the gear is retrieved. In some areas and years, the killer whale problem has been severe enough that vessels stopped fishing and left the grounds. Although pot gear may alleviate predation by killer whales, longline pot gear is not authorized for the Bering Sea fishery and single pot gear is not deemed economically viable. Anecdotal information from vessel operators indicated that the killer whale problem, as well as poor flesh quality, made fishing for Greenland turbot unprofitable. The most common Greenland turbot product was headed and gutted, with the tail removed.

The opening date of the Greenland turbot fishery is May 1 (50 CFR 679.23(e)(1)). This opening date was implemented to reduce halibut bycatch rates in late winter and early spring months. In 2001, turbot fisheries took about 16 mt of halibut, 8,000 other tanner crabs, and about 2,000 bairdi crabs.

5.7 Arrowtooth Flounder

Arrowtooth flounder is harvested exclusively with bottom trawl gear in the BSAI and GOA. The flesh rapidly loses it texture due to enzyme activity. For this reason, when retained by catcher processors, it is immediately processed or, when targeted by shorebased catcher vessels, delivered to the processing plant within 24 hours. When retained, the most common products are surimi, fillets, whole fish, and meal. The most common ancillary products are fish meal and oil.

In 2001 in the BSAI, 14,000 mt of arrowtooth flounder were taken by groundfish trawl and fixed gear fisheries. In the GOA in 2001, almost 20,000 mt were taken. The GOA catch through October 5, 2002 was 19,000 mt. Under current fishing practices, arrowtooth flounder are mostly discarded when caught, although the percent retained has increased from below 10 percent in the early 1990s to 49 percent in 2002 (NPFMC 2002a and 2002b).

5.8 Rockfish

BSAI

Thirty five species of rockfish (genus *Sebastes* and *Sebatolobus*) occur in the BSAI of which eight are commercially important. In recent years, the only BSAI rockfish species open for directed fisheries has been the Pacific ocean perch complex which includes Pacific ocean perch, sharpchin, northern, shortraker, and rougheye rockfish. In 2001, Pacific ocean perch in the eastern Bering Sea/Aleutian Islands was assessed and managed as a single stock. Standardizing and partitioning total groundfish effort into effort directed solely toward Pacific ocean perch is extremely difficult. However, the November 2002 SAFE Report reports that in 2001, nearly 9,000 mt of Pacific ocean perch were removed from the BSAI. Through September 7, 2002, Pacific ocean perch removals totaled over 9,700 mt. The most common rockfish products are headed and gutted (eastern cut) and whole frozen fish.

Prior to 2001, harvests of sharpchin, northern, shortraker, and rougheye rockfish were managed in the eastern Bering Sea as the other red rockfish (ORR) complex, while in the Aleutian Islands, they were split into the sharpchin/norther (SCNO) and shortraker/rougheye (SRRE) complexes. In 2001, over 6,000 mt of rockfish in the SCNO complex were harvested in the eastern Bering Sea and Aleutian Islands, with nearly 98 percent caught in the Aleutians. That same year, only about 750 mt of the SRRE complex was taken in the BSAI, with almost 95 percent of the total taken in the Aleutian islands. Beginning in 2002, the sharpchin rockfish were removed from the SCNO, leaving northern rock fish to be managed with single-species catch levels. Estimated removals through September 7, 2002 for northern rockfish were almost 2,100 mt with 95 percent taken in the Aleutian Islands. For the SRRE complex over the dame time period, removals were about 550 mt, with 83 percent taken in the Aleutian Islands.

The Other Rockfish complex includes the 29 species of *Sebastes* and *Sebastolobus* not managed in the groups described above. These species have been observed at least once in the BSAI surveys and/or have occurred in at least 1 percent of the hauls where species from the ORR have been caught. The tow most abundant species in this complex are light dusky rockfish and shortspine thornyheads. In 2001, nearly 900 mt of other rockfish were harvested in the BSAI with about 67 percent taken in the Aleutian Islands. Through September 21, 2002, catch of other rockfish totaled about 850 mt with about 57 percent of the catch occurring in the Aleutian Islands.

In the BSAI, directed fisheries for these are mostly conducted by catcher processors using bottom trawl gear and hook and line catcher vessels. For example, in 2001, 8 trawl catcher processors and only one catcher vessel using bottom trawl gear harvested rockfish, while and 15 hook and line catcher vessels and only two fixed gear catcher processors conducted the fishery in the BSAI. Prohibited species caught as bycatch in the rockfish trawl fisheries include halibut (55 mt in 2001), and other king crab (4,700 individuals in 2001).

GOA

GOA rockfish include all species of the genera *Sebastes* and *Sebastalobus*. Since 1988, the NPFMC has divided these species into three management groups: demersal shelf rockfish, pelagic shelf rockfish, and slope rockfish. The slope rockfish group is dominated by one species Pacific ocean perch which historically has provided most of the past commercial catch. Separate TACs are established for Pacific ocean perch,

northern rockfish, pelagic shelf rockfish, other slope rockfish, shortraker and rougheye rockfish, thornyheads, and demersal shelf rockfish in the southeast Outside District.

Bottom trawl gear is mostly used to target the most abundant species: Pacific ocean perch, northern, and pelagic shelf rockfish. Pelagic trawl gear has also been successfully used to target Pacific ocean perch. In recent years, the number of participants has increased to include medium-sized shorebased trawlers as well as medium- to large-sized catcher processors. In 2001, 33 catcher vessels and 12 catcher processors targeted rockfish using trawl gear in the GOA. Also in 2001, 418 hook and line catcher vessels and 3 catcher processors prosecuted the fishery. Through October 5, 2002, harvests in the GOA rockfish fisheries amounted to just over 3,000 mt of northern rockfish, 3,300 mt of pelagic shelf rockfish, nearly 12,000 mt of Pacific ocean perch, and 700 mt of other slope rockfish. Additionally, 70 mt of demersal shelf rockfish, 1,200 mt of SRRE rockfish, and 1,500 mt of thornyhead rockfish were taken through October 5, 2002. The most common primary products are skinless, boneless fillets; headed and gutted fish; and whole fish. The most common ancillary products are fish meal and oil.

Most of the rockfish harvested by hook-and-line gear in the GOA is taken as incidental catch in the directed sablefish fishery. In 2001, more fish were taken as bycatch in the hook-and-line sable fish fishery (1,400 mt) as compared to the directed rockfish hook and line fisheries (1,000 mt). Thornyhead, shortraker, and rougheye rockfish (e.g., deepwater rockfish) are commonly found along the continental slope at depths where sablefish are frequently harvested. Prohibited species caught as bycatch in the 2001 rockfish fisheries included: halibut (390 mt), and bairdi crab (nearly 3,000 individuals).

5.9 Sablefish

Sablefish are harvested in relatively deepwater along the continental slope (100–1,000 m) and along the Aleutian Islands. Since 1996 directed fisheries for sablefish have only been open to vessels using hook-and-line and pot gear in the BSAI. Only hook-and-line gear and jig gear are permitted to target sablefish under the IFQ management program in the GOA (50 CFR 679.42(b)(1)). The use of pot gear to target sablefish is prohibited in the GOA (50 CFR 679.24(c)(2)(B) and (3)).

In 1995, sablefish (as well as Pacific halibut) became a closed fishery based on historical participation. An IFQ program was implemented which assigns quota shares on an annual basis to authorized fishermen (50 CFR 679(d)). The directed sablefish fishery is open only to IFQ shareholders who use fixed gear (hook-and-line or pot gear).

Five state fisheries also land sablefish outside of the IFQ program and are . For federal and state fisheries combined, the total number of longline vessel targeting sablefish in 2001 was 438 (NPFMC 2002a). In 2001 these vessels harvested about 12,000 mt of sablefish, 92 percent of which was taken in the GOA. Small amounts of sable fish are taken incidentally in the other groundfish fisheries, totally about 2,000 mt in the BSAI and GOA combined in 2001. A small amount of prohibited species have been historically taken as bycatch in the sablefish fisheries. For example, the hook-and-line fishery only took less than 100 tanner crabs as bycatch in 2001, and the 2001 pot fishery for sablefish took about 4 mt of halibut, less than 1,000 king crab, and about 300 other tanner crabs (Hiatt *et al.*2002).

Under the IFQ Program, individual fishermen have a known amount of sablefish that they are allowed to harvest within a specified area and year. As a consequence, sablefish operations are slightly more structured than open access fisheries, and individuals are more able to plan their sablefish harvest to maximize logistical and financial returns. IFQ sablefish can be targeted in a directed fishery, or they can be harvested in conjunction with other fisheries in a "mixed" fishery. One common BSAI mixed fishery is Greenland turbot and sablefish. The vessel will target Greenland turbot and take whatever sablefish are harvested along with the turbot. It should be noted that gear types other than hook-and-line are allowed to retain sablefish as long as the amount does not exceed the legal maximum retainable bycatch limit. Hook-and-line vessels without IFQ are required to discard any sablefish harvested.

Sablefish are similar to Greenland turbot in that killer whales will congregate and strip sablefish from longline gear as it is being retrieved. The most common sablefish product is headed and gutted (eastern cut). The IFQ sablefish fishery opens concurrent with the IFQ Pacific halibut fishery. The season dates are specified annually and typically open on March 15 and close on November 15 (50 CFR 679.23(g)(1)).

5.10 Other Species Fisheries

The other species category in includes squid, sculpin, skate, shark, and octopus. With the exception of octopus, there are no directed commercial fisheries for these species, but they are taken as incidental bycatch in the trawl and hook-and-line fisheries.

Since 1993, four vessels have registered with the ADF&G to fish octopus with pot gear in the Bering Sea. To date, the fishery has not generated enough money to make it attractive. An unknown number of octopus are also taken by pot vessels during crab fisheries and used as bait.

Skate, sculpin, and shark are commonly taken in GOA bottom trawl fisheries. Almost all other species incidental catch is discarded or used to make fish meal and oil. Each year, about 2,000 mt of skate is retained from the bottom trawl and hook-and-line fisheries combined. The primary products are skate wings and whole skates, fish meal, and oil.

Section 6 Literature Cited

Bowen, J.T. (1970). "A History of Fish Culture as Related to the Development of Fishery Programs". A Century of Fisheries in North America, N.G. Benson (ed.), American Fisheries Society, pp. 71-93.

Bracken, B.E. (1983). "A History of the U.S. Sablefish Fishery in the Gulf of Alaska, 1906-1982". Alaska Sea Grant, 83-8, University of Alaska. pp. 41-47.

Browning, R.J. (1980). "Fisheries of the North Pacific: History, Species, Gear and Processes". Alaska Northwest Publishing Company, Anchorage, AK. 423 pp.

Chitwood, P.E. (1969). "Japanese, Soviet, and South Korean Fisheries off Alaska, Development and History through 1996". U.S. Fish and Wildlife Service Circular 310, U.S. Department of the Interior, Washington, DC, pp. 34.

Christy, Jr., F.T. (1978). "The Costs of Uncontrolled Access in Fisheries". In Limited Entry as a Fishery Management Tool, R.B. Rettig and J.J.C Ginter (eds.), University of Washington Press, Seattle, WA, pp. 201-210.

Commerce Committee. (1976). "A Legislative History of the Fishery Conservation and Management Act of 1976". U.S. Government Printing Office, Washington, DC. 1176 pp.

Cooley, R.A. (1963). "Politics and Conservation, the Decline of the Alaska Salmon". Harper & Row, Publication. 230 pp.

Fishery Agency of Japan. (1976). "Japanese Fisheries in the Eastern Bering Sea and Northeastern Pacific Ocean". Fishery Agency of Japan. 37 pp.

Fournier, D. (1998). "AD Model Builder". Computer programming template for the development and parameter estimation of non-linear models. Otter Research Ltd. Information available on-line: http://www.fisheries.org/cus/ad_model_builder.htm

Fredin, R.A. (1987). "History of Regulation of Alaskan Groundfish Fisheries". NWAFC Processed Report, 87-07, U.S. DOC, NOAA, NMFS, Seattle, WA. pp. 63.

Ginter, J.J.C. and R.B. Rettig. (1978). "Limited Entry Revisted". In Limited Entry as a Fishery Management Tool, R.B. Rettig and J.J.C Ginter (eds.), University of Washington Press, Seattle, WA, pp. 157-172.

Gordon, H.S. (1954). The Economic Theory of Common Property Resource. *Journal of Political Economy*, 62 (April), pp. 124-142.

Hiatt, T., R. Felthoven, and J. Terry. (2002). "Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea and Aleutian Island Area: Economic Status of the Groundfish Fisheries off Alaska, 2001." Resource Ecology and Fisheries Management Division, Alaska Fisheries Science Center, NMFS.

Ianelli , J.N., Fritz, L., Honkalehto, T., Williamson, N., and Walters, G. (1998). "Bering Sea-Aleutian Islands Walleye Pollock Assessment for 1999." In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands regions. NPFMC, Anchorage, AK, Section 1:1-79.

Kasahara, H. (1973). Management of Fisheries in the North Pacific. *Journal of the Fisheries Research Board of Canada*, 30(12), pp. 2355.

Koers, A.W. (1973). "International Regulation of Marine Fisheries, A Study of Regional Fisheries Organizations". Fishing News (Books) Ltd., London. 368 pp.

Kravanja, M.A. (1976). "The Soviet Fishing Industry: A Review".

Methot, R.D. (1990). "Synthesis model: An adaptable framework for analysis of diverse stock assessment data". International North Pacific Fisheries Commission Bulletin, 50, International North Pacific Fisheries Commission, 6640 Northwest Marine Drive, Vancouver, BC, Canada V6T 1X2, pp. 259-277.

Miles, E., S. Gibbs, D. Fluharty, C. Dawson, and D. Teeter. (1982). "The Management of Marine Regions: The North Pacific". University of California Press, Berkeley, CA. 656 pp.

Naab, R.C. (1971). "The Growing Role of International Agreements in Alaska Fisheries". Commercial Fisheries Review, 33(9), pp. 27-40.

National Marine Fisheries Service (NMFS). (1976)."Draft Environmental Impact Statement for Preliminary Fishery Management Plan for the Trawl Fishery of the Gulf of Alaska."DOC, NOAA, NMFS. pp.109.

NMFS. (1999). "Environmental Assessment for 2000 Groundfish Total Allowable Catch Specifications Implemented under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area and Groundfish Fishery of the Gulf of Alaska Area". U.S. DOC, NOAA, NMFS, P.O. Box 21668, Juneau, AK 99802-1668.

North Pacific Fishery Management Plan (NPFMC). (1978). "Fishery Management Plan and Final Environmental Impact Statement for the Gulf of Alaska Groundfish During 1978". NPFMC, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501-2252.

NPFMC. (1981). "Fishery Management Plan and Final Environmental Impact Statement for the Groundfish of the Bering Sea and Aleutian Islands Area". NPFMC, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501-2252.pp.97.

NPFMC. (1999). "Draft Environmental Assessment Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Amendments 63/63 to the Fishery Management Plans for the Groundfish Fisheries of the Bering Sea/Aleutian Islands and Gulf of Alaska to Revise Management of Sharks and Skates." NPFMC, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501-2252.

NPFMC. (2002a)."Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region for 2003." Compiled by the Plan Team for the Bering Sea/Aleutian Islands Groundfish Fisheries, ed., NPFMC, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501-2252.

NPFMC. (2002b)."Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska Region for 2003." Compiled by the Plan Team for the Gulf of Alaska Groundfish Fisheries, ed., NPFMC, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501-2252.

Pruter, A.T. (1976). "Soviet fisheries for bottomfish and herring off the Pacific and Bering Sea Coasts of the U.S.". Paper 1225, Marine Fisheries Review, pp. 1-15.

Restrepo, V.R., G.G. Thompson, P.M. Mace, W.L. Gabriel, L.L. Lowe, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P.R. Wade, and J.F. Witzig. (1998). "Techincal guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31.

Rogers, G.W. (1960). "Alaska in Transition, the Southeast Region". John Hopkins Press, Baltimore, MD.