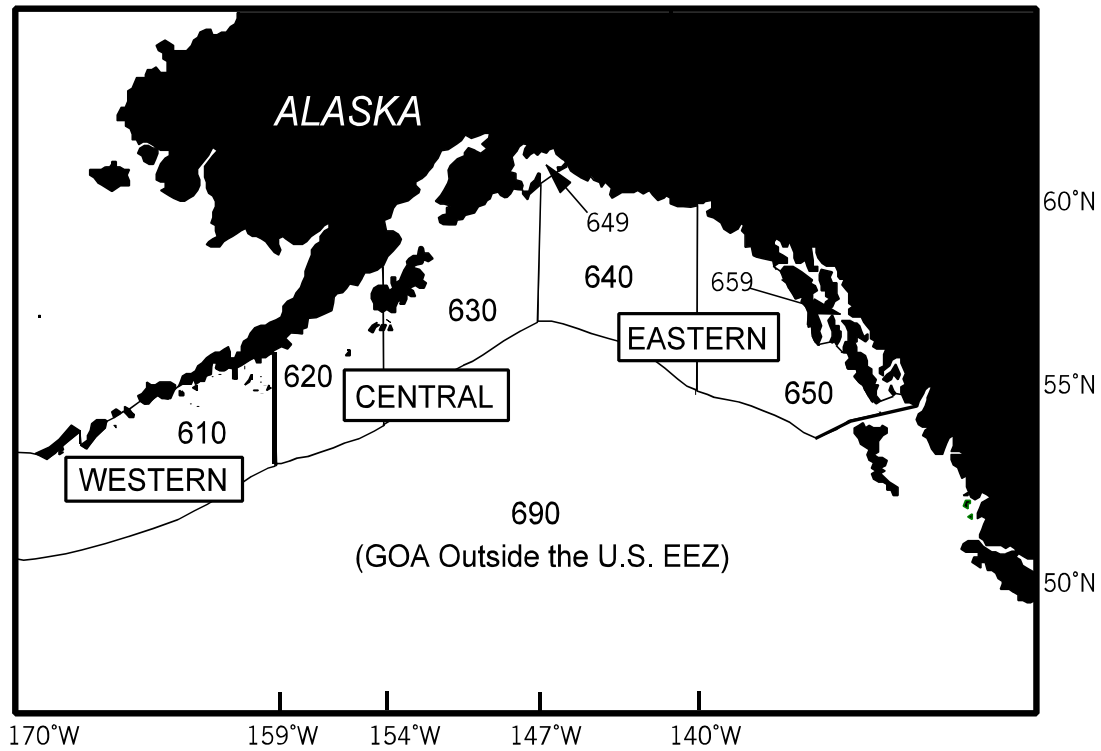


Groundfish of the Gulf of Alaska:

A Species Profile



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Acronyms and Definitions

ABC	= acceptable biological catch
BSAI	= Bering Sea/Aleutian Islands
DSR	= demersal shelf rockfish
EEZ	= exclusive economic zone
F	= instantaneous fishing mortality rate
FMP	= fishery management plan
GOA	= Gulf of Alaska
IFQ	= individual fishing quota
M	= instantaneous natural mortality rate
m	= meters
mt	= metric tons
OFL	= overfishing level
OY	= optimum yield
POP	= Pacific ocean perch
PSR	= pelagic shelf rockfish
TAC	= total allowable catch

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Walleye Pollock

Biology: Pollock (*Theragra chalcogramma*) in the Gulf of Alaska (GOA) are managed as a single stock that is separate from the Bering Sea and Aleutian Island pollock stocks. Pollock begin to recruit to the fishery at age 2 and many survive 10 years or more. Seasonal migrations occur from overwintering areas along the outer shelf to shallow waters (90-140 m) to spawn. Pollock are found throughout the water column from near the surface down to 500 m. Females reach 50% maturity at 30-34 cm (3- 4 years old) and produce about 140,000 - 300,000 pelagic eggs at this size. Spawning occurs in late winter/early spring in major spawning concentrations of pollock which have been observed in Shelikof Strait and the Shumagin Islands. Annual natural mortality of adults has been estimated to be about 25% per year ($M = 0.30$). Pollock feed on copepods, euphausiids, and fish (primarily capelin), and are in turn prey for other fish, marine mammals, and seabirds.

Stock Assessment: The primary assessment is based on an age-structured model developed for the Western and Central regulatory areas. The model incorporates fishery data and fishery independent data from triennial bottom trawl surveys, an annual hydroacoustic survey of spawning concentrations in Shelikof Strait, and age composition and catch data from the 1998 pollock fishery. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Western/Central (includes West Yakutat) pollock fall under Tier 3b of the ABC/OFL guidelines, thus the 2001 overfishing mortality rate is $F_{35\%}$ adjusted by the ratio of current female spawner biomass to $B_{40\%}$ (OFL = 117,750 mt). F_{ABC} cannot exceed the $F_{40\%}$ fishing mortality rate adjusted by the ratio of current spawner biomass to $F_{40\%}$ (0.34). B_{MSY} and F_{MSY} have not been estimated for the GOA stock. Pollock in Southeast Outside and East Yakutat areas fall into a Tier 5 assessment, where the overfishing mortality rate is equal to the natural mortality rate and F_{ABC} cannot exceed 75% of the natural mortality rate (M). Under this approach, the 2001 OFL is 6,460 mt.

Population Status: For 2001, exploitable biomass (age 3+) in the GOA was estimated at 699,000 mt. Catch specifications were the following: OFL=126,360 mt, ABC=105,810 mt (includes Western Central and Eastern Gulf ABC), TAC=95,875 mt. Pollock are of medium relative abundance and are harvested at 100% of ABC. The recommended ABC represents about a 20% increase from the projected 2001 ABC in the 1999 assessment, due to the use of new estimates of Shelikof Strait EIT survey weight-at-age to calculate spawning biomass and new fishery weight-at-age estimates to project yields. The stock is at an all-time low and is projected to decline into 2002. Most recent year classes appear to be weak, and consequently, spawner biomass is expected to decline through at least 2003.

Fishery: Major exploitable concentrations are found primarily in the Western/Central areas. Pollock catch in the Southeast Outside and East Yakutat areas never exceeded 100 mt combined during 1991-2000. Pollock are targeted by trawl gear, with 112 trawl vessels participating in the 1999 GOA pollock fishery, all delivering onshore.

Management: The pollock fishery is regulated under the GOA Groundfish FMP. In 1993, the Council apportioned 100% of GOA pollock to the inshore sector. In 1998, trawl gear was prohibited east of 140° W. longitude and 100% retention was required for pollock. In 1999, as a result of the final reasonable and prudent alternatives to mitigate the adverse impacts of the pollock fishery on Steller sea lions, NMFS established four seasonal apportionments of the pollock TAC, as opposed to the previous three. Under an emergency rule, 30% of the annual TAC in the Western/Central area is apportioned to the A season (Jan. 20-Mar. 1); 15% to the B season (Mar. 15-May 31); 30% to the C season (Aug. 20-Sept. 15); and 25% to the D season (Oct. 1-Nov. 1). A court ordered injunction on groundfish trawling within Steller sea lion critical habitat west of 144°W. longitude (in effect Aug. 8 - Nov. 30, 2000) severely limited the pollock fishery in 2000. Management measures to eliminate competition for pollock between the fishery and Steller sea lions continue to be developed as a result of a jeopardy finding in the 2000 biological opinion.

Exploitable biomass (from stock synthesis model), catch specifications and total catches (including discards) of age 2+ walleye pollock in the GOA, 1978-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1978	2,264,000	--	--	90,820
1979	2,739,000	--	--	98,510
1980	3,195,000	--	--	110,100
1981	3,854,000	--	--	139,170
1982	3,987,000	--	--	168,690
1983	3,364,000	--	--	215,570
1984	2,719,000	--	234,960	307,400
1985	2,004,000	--	293,250	284,820
1986	1,615,000	116,600	133,280	93,570
1987	1,697,000	112,000	108,000	69,540
1988	1,614,000	93,000	93,000	65,625
1989	1,465,000	75,375	72,200	78,220
1990	1,250,000	73,400	73,400	90,490
1991	1,381,000	133,400	133,400	107,500
1992	1,728,000	99,400	87,400	93,900
1993	1,582,000	160,400	114,400	108,600
1994	1,338,000	109,300	109,300	110,890
1995	1,128,000	65,360	65,360	73,250
1996	941,000	54,810	54,810	50,200
1997	1,000,000	79,980	79,980	89,800
1998	964,000	130,000	124,730	125,471
1999	767,000	100,920	100,920	93,380
2000	577,000	100,000	100,000	71,877
2001	699,000	105,810	95,875	*

Economics: In 1999, 122,220 mt of pollock was caught in the GOA, of which about 99% was retained. The rate of pollock discard was 0.4% in the pelagic trawl pollock fishery and 0.7% in the bottom trawl fishery. The onshore fleet took 100% of total harvest. Average ex-vessel price was about \$0.10/lb. Primary products produced are surimi, minced product, fillets, meal, oil and roe.

Catch History: The commercial fishery started as a foreign fishery in the early 1970s. Catches increased rapidly during the late 1970s and early 1980s. The pollock fishery experienced a short period of joint venture operations in the mid-1980s and was fully domestic by 1988.

Pacific Cod

Biology: Pacific cod (*Gadus macrocephalus*), also known as grey cod, are moderately fast-growing and short-lived fish. Females reach 50% maturity of about 67 cm, corresponding to an age of about 6.7 years and are highly fecund. A 67 cm female cod will produce > 1 million eggs. Annual natural mortality of adults has been estimated to be about 0.37. In the GOA, they are most abundant in the Central area, where large schools are encountered at varying depths. Cod are demersal and concentrate on the shelf edge and upper slope (100-200 m) in the winter and spring where they overwinter and spawn from January through April and move to shallower waters (<100 m) in the summer. Cod begin to recruit to trawl fisheries at age 3, but are not fully recruited to all gear types until about age 7. Maximum age has been estimated at 19 years. Cod prey on polychaetes, amphipods, shrimp, and fish. In turn, they are eaten by halibut, sharks, seabirds, and marine mammals.

Stock Assessment: The current assessment is based on a risk-averse, length-based synthesis model. B_{MSY} and F_{MSY} estimates are not available for this stock. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. P. cod OFL is based on a Tier 3a fishing mortality rate where $F_{OFL} = F_{35\%}$ (=0.46), estimated at 91,200 mt for 2001. ABC is based on a Tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ (=0.37), resulting in a maximum permissible ABC of 76,700 mt for 2001.

Population Status: The 2001 exploitable biomass (age 3+) was estimated at 526,000 mt. The 2001 ABC was set at 67,800 mt, lower than the maximum permissible ABC, to address some of the uncertainty inherent in the model. The TAC was set at 52,110 mt. The difference between the TAC and the ABC (15,690 mt) was set aside as the guideline harvest level for State of Alaska pot and jig fisheries. Pacific cod are of medium relative abundance and are harvested at 100% of ABC. The last above average year class was spawned in 1989. Year class strengths for 1991-94 are classified as below average. Preliminary indications of the 1995 year-class indicate it may be above average. Both the stock assessment model and the 1999 bottom trawl survey suggest spawning biomass is declining; the 2001 estimate is down about 15% from last year to 93,800 mt. The estimated 2001 exploitable biomass is 526,000 mt, down about 7% from last year's estimate for 2000 and 5% from last year's projection for 2001.

Fishery: The P. cod stock is exploited by a multiple-gear fishery; primarily by trawls, and in lesser amounts by pot, longline, and jig gear. Catches by pot gear have increased in recent years, facilitated in part by comparatively low halibut bycatch rates. Participants in the 1999 fishery included 420 hook-and-line, 211 pot, and 115 trawl vessels. The 2000 fishery opened on January 1 (fixed gear) and 20 (trawl gear) and closed on March 4 in the Western and Central areas and May 28-July 4 and August 11- Oct. 1 in the Eastern area for the inshore trawl fleet. The Western area closed for the offshore fleet on Feb. 7 and went on PSC status July 31. The Central area went on bycatch status for the offshore fleet on May 28, reopened on July 4, went on bycatch status again on Aug. 11, and opened on Oct. 1. A state water fishery for pot and jig gear began in 1997, and the guideline harvest level is currently set at 25% of the federal quota in the Western area, 20% in the Kodiak and Chignik subareas of the Central area (15% in the rest of the Central area) and 25% in the Eastern area. For trawl fisheries, P. cod harvests have been constrained by halibut bycatch.

Management: The GOA P. cod fishery is regulated under the GOA Groundfish FMP. GOA and BSAI cod stocks are genetically indistinguishable, and tagging studies show that cod move between the Bering Sea and the GOA. However, the magnitude and regularity of such migrations are unknown and the stocks are managed as separate units. The FMP controls the fishery through a permit moratorium, limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, bycatch limits and rates, allocations, regulatory areas, quota reserves, record keeping and reporting requirements, and observer monitoring. In 1993, the Council apportioned 90% of GOA pollock to the inshore sector and 10% to the offshore sector. In 1998, trawl gear was prohibited east of 140° W. longitude (East Yakutat/Southeast

Exploitable biomass (from synthesis model), catch specifications, and total catches (including discards) of age 3+ Pacific cod in the GOA, 1980-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1980	799,000		60,000	35,345
1981	853,000	-	70,000	36,130
1982	887,000	-	60,000	29,465
1983	907,000	-	60,000	36,540
1984	911,000	-	60,000	23,900
1985	912,000	-	60,000	14,430
1986	928,000	-	75,000	25,010
1987	932,000	125,000	50,000	32,940
1988	934,000	99,000	80,000	33,800
1989	941,000	71,200	71,200	43,290
1990	935,000	90,000	90,000	72,520
1991	913,000	77,900	77,900	76,980
1992	888,000	63,500	63,500	80,100
1993	853,000	56,700	56,700	55,990
1994	830,000	50,400	50,400	47,990
1995	805,000	69,200	69,200	69,050
1996	760,000	65,000	65,000	68,280
1997	719,000	81,500	69,115	62,260
1998	671,000	77,900	66,060	72,320
1999	621,000	84,400	67,835	68,600
2000	560,000	76,400	59,800	54,495
2001	526,000	67,800	52,110	*

Outside subarea) and 100% retention was required for P. cod.

Economics: In 1999, 68,600 mt of P. cod was caught, of which about 98% was retained. Approximately 12,000 m were landed with hook and line gear, 19,000 mt was landed with by pot gear, and 37,000 mt was landed with trawl gear. Total ex-vessel value was \$42.7 million in 1999. Average 1999 ex-vessel price was about \$0.32/lb for fixed gear and \$0.27/lb for trawl gear. Primary products produced are headed and gutted product and fillets, and to a lesser extent salted, whole fish, roe, and mince.

Catch History: Pacific cod catches increased through most of the 1980s in response to a large year class which recruited around 1980. Historically, the majority of landings come from the Shumagin and Chirikof areas.

Deep Water Flatfish

Biology: The deep water flatfish group is comprised of Dover sole (*Microstomus pacificus*), Greenland turbot (*Reinhardtius hippoglossoides*), and deep-sea sole (*Embassichthys bathybius*). All flatfish are demersal. Dover sole are found among the soft bottom community of benthic animals at depths up to about 1400 m. Flatfish all spawn on or near the bottom at various depths. Dover sole spawn off the Oregon coast from winter to early spring. Maturity information is not available for Dover sole in the GOA, however, female Dover sole off Oregon reach 50% maturity at about 34 cm (about 6 to 9 years old). Dover sole recruit to the fishery from 7 to 10 years old and have a maximum age of about 45 years. Natural mortality is assumed to be 0.10, estimated for Dover sole off the Oregon coast. Dover sole feed on small invertebrates that live on or in the seafloor sediments. With their small-mouths, they are especially adapted to feeding on small detrital-consuming invertebrates that live within the sediment (polychaete worms and clams) or at the sediment surface (amphipods and other small crustaceans, shrimp, snails, and brittlestars).

Stock Assessment: Due to the lack of a time series of size and age data and maturity information for flatfish, no population dynamics models have been used in the assessment for this assemblage. Estimates of B_{MSY} and F_{MSY} are not available. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. For Dover sole, under Tier 5, F_{OFL} is equal to the estimate of natural mortality and $F_{abc}=0.75 M$. Greenland turbot and Deep sea sole are in Tier 6 since there are no reliable biomass estimates, so $ABC = 0.75 OFL$ and OFL is based on average catch from 1978-1995.

Population Status: The best estimate of current exploitable biomass is assumed to be the same as the survey biomass from 1999, which is 74,370 mt for Dover sole. Catch specifications for the deep water flatfish assemblage for 2001 are as follows: OFL = 6,980 mt, ABC = 5,300 mt, TAC = 5,300 mt. Relative abundance for deep water flatfish is unknown. Fishing is severely constrained by halibut bycatch limits (catch < 50 %ABC). Biomass estimates for Dover sole have a high degree of uncertainty due to the lack of deep water sampling in the triennial GOA trawl survey.

Fishery: Dover sole is the primary target species in this assemblage. Nearly all flatfish were landed by 51 trawlers in 1998. In 1998, closures occurred on March 10, April 21, and October 1 to prevent exceeding quarterly halibut bycatch limits. The 1999 deepwater flatfish fishery closed on March 24, April 25, July 21, and August 16 due to the halibut cap, and the whole GOA was closed to trawling for flatfish on October 16 due to reaching the halibut TAC.

Management: The Council divided the flatfish assemblage into four categories in 1990 because of a significant difference in halibut bycatch rates in directed fisheries for shallow and deep water flatfish species: "deep water flatfish," "shallow water flatfish," flathead sole, and arrowtooth flounder. Flathead sole was assigned a separate ABC in 1991 since it overlaps the depth distributions of the both shallow and deep water groups. In 1993, rex sole was split out of the deep water assemblage because of concerns regarding Pacific ocean perch bycatch. In the 1996 triennial trawl survey, rock sole was split into northern and southern rock sole. Due to overlapping distributions, differential harvesting of the species may occur, requiring separate management in the future. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have typically been constrained by halibut bycatch limits.

Economics: All flatfish species produced a total ex-vessel value of \$3.2 million in 1999 on landings of 24,000 mt, 10,710 mt of which was retained. Average ex-vessel price for flatfish was about \$0.12/lb. Deep water flatfish landings totaled 2,300 mt in 1999, with an approximate ex-vessel value of \$600,000. Primary products produced are whole fish, H&G, and kirmi.

Catch History: Until 1981, flatfish was chiefly a foreign fishery targeting non-flatfish species. With the cessation of foreign fishing in 1986, joint venture fishing began to account for the majority of the catch. In 1987, the gulf-wide flatfish catch increased nearly fourfold to 10,000 mt with the joint venture fisheries accounting for nearly 73% of the gulf-wide catch. After 1988, only domestic fleets harvested flatfish. The Central area has produced the majority of the flatfish catches, with most of the harvest on the continental shelf and slope east of Kodiak Island. The fishery primarily targets on Dover sole with 72% of landings retained in 1996. Greenland turbot catch has been variable in recent years.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of deep water flatfish in the GOA, 1990-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1990	131,890	108,400	22,000	2,380
1991	131,890	50,500	15,000	10,190
1992	131,890	39,280	19,740	8,370
1993	116,570	45,530	19,740	6,110
1994	116,570	16,510	11,080	5,060
1995	116,570	14,590	11,080	2,210
1996	101,430	14,590	11,080	2,200
1997	101,430	7,170	7,170	3,620
1998	101,430	7,170	7,170	2,470
1999	78,300	6,050	6,050	2,285
2000	74,460	5,300	5,300	985
2001	74,370	5,300	5,300	*

Rex Sole

Biology: Rex sole (*Glyptocephalus zachirus*) are closely associated with the soft bottom community of benthic animals that occur in the deep water portions of submarine canyons. They are found throughout the northeastern Pacific and in the Bering Sea at depths usually less than 275 m. Rex sole feed on small invertebrates that live on or in the sea floor sediments. The small-mouthed sole is especially adapted to feeding on small detrital-consuming invertebrates that live within the sediment (polychaete worms and clams) or at the sediment surface (amphipods and other small crustaceans, shrimp, snails, and brittlestars).

Stock Assessment: The current assessment for rex sole uses the 1999 triennial trawl survey biomass to calculate ABC. Estimates of B_{MSY} and F_{MSY} are not available for this stock. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, OFL for rex sole is based on a Tier 5 fishing mortality rate where $F_{OFL} = M$ and ABC is estimated using $F = 0.75 M$.

Population Status: For 2001, the exploitable biomass of rex sole was estimated at 74,600 mt. Catch specifications were the following: OFL = 12,300 mt, ABC = 9,440 mt, TAC = 9,440 mt. Relative abundance for rex sole is unknown. Fishing is severely constrained by halibut bycatch limits (catch < 50 %ABC).

Fishery: The Central area has produced the majority of flatfish catches with most of the harvest on the continental shelf and slope east of Kodiak Island. Nearly all flatfish were landed by 51 trawlers in 1998. The flatfish resource was lightly to moderately harvested in 1999; the rex sole ABC was 29% harvested. In the 1998 deepwater fishery, closures occurred on March 10, April 21, and October 1 to prevent exceeding quarterly halibut bycatch limits. The 1999 deepwater flatfish fishery closed on March 24, April 25, July 21, and August 16 due to the halibut cap, and the whole GOA was closed to trawling for flatfish on October 16 due to reaching the halibut TAC.

Management: The rex sole fishery is regulated under the GOA Groundfish FMP. In 1993, rex sole was split out of the deep water management category because of concerns regarding the Pacific ocean perch bycatch in this target fishery. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut and crab bycatch limits.

Economics: Rex sole is a valuable target species, with 96% retained by the commercial fleet in 1999. This fishery was worth roughly \$850,000 in 1999. Primary products produced are H&G with roe-in, and to a lesser extent kirimi.

Catch History: Until 1981, flatfish was chiefly a foreign fishery targeting non-flatfish species. With the cessation of foreign fishing in 1986, joint venture fishing began to account for the majority of the catch. In 1987 the gulf-wide flatfish catch increased nearly fourfold to 10,000 mt with the joint venture fisheries accounting for nearly 73% of the gulf-wide catch. After 1988, only domestic fleets harvested flatfish.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of rex sole in the GOA, 1994-2001 (in mt).

<u>Year</u>	<u>Biomass</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
1994	89,700	11,950	10,140	3,660
1995	89,700	11,210	9,690	4,030
1996	72,300	11,210	9,690	5,850
1997	72,300	9,150	9,150	3,265
1998	72,300	9,150	9,150	3,540
1999	72,300	9,150	9,150	3,060
2000	74,600	9,440	9,440	3,600
2001	74,600	9,440	9,440	*

Shallow Water Flatfish

Biology: The shallow water flatfish group is primarily comprised of: northern rock sole (*Lepidopsetta perarcuata*), southern rock sole (*Pleuronectes bilineatus*), yellowfin sole (*Pleuronectes asper*), starry flounder (*Platichthys stellatus*), butter sole (*Pleuronectes isolepis*), English sole (*Pleuronectes vetulus*), Alaska plaice (*Pleuronectes quadrituberculatus*), and sand sole (*Psettichthys melanostictus*). All flatfish are demersal, but have varying depth ranges. Most marine occurrences of starry flounder in the trawl surveys have occurred at depths less than 150 m, but have also been harvested in rivers 120 km upstream and in the ocean to depths of 375 m. Rock sole are most abundant in the Kodiak and Shumagin areas. Spawning season, fecundity, and size at age at 50% maturity vary by species. Starry flounder spawn in late winter/early summer. Rock sole spawn from winter to spring. Rock sole attain 50% maturity at 9 years for females in the Bering sea. The maximum age of sampled rock sole was 21 years.

Although yellowfin sole are only an incidentally caught species in the GOA, they are the second most abundant demersal fish (after pollock) in Cook Inlet and are also found in Prince William Sound. They are a relatively slow growing and long-lived. They concentrate on the outer shelf in the winter, and move to very shallow waters (<30 m) to spawn and feed in the early summer. They begin to recruit to trawl fisheries at age 6, but are not fully recruited to all gear types until about age 13. Maximum age in the Bering sea for this species is 31 years. In the Bering sea, females reach 50% maturity at 30 cm (about 10.5 years old) and are highly fecund, producing 1 - 3 million eggs. Natural mortality is estimated to be 0.2. Prey includes benthic infauna and epifauna, euphausiids, and fish.

Stock Assessment: Due to the lack of a time series of size, age, and maturity data for flatfish, no population dynamics models have been used for this assemblage. Estimates of B_{MSY} and F_{MSY} are not available for this stock. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Therefore, the OFL for rock sole is based on a Tier 4 fishing mortality rate where $F_{OFL} = F_{35\%}$ and $F_{ABC} \leq F_{40\%}$. The OFLs for yellowfin and other shallow water species are based on a Tier 5 fishing mortality rate where $F_{OFL} = M$ and $F_{ABC} \leq 0.75 \times M$.

Population Status: The GOA 2001 exploitable biomass of shallow water flatfish was estimated at 299,100 mt. Catch specifications were the following: OFL = 45,330 mt, ABC = 37,860 mt, TAC = 19,400 mt. Relative abundance for shallow water flatfish is unknown. Fishing is severely constrained by halibut bycatch limits (catch < 50% ABC).

Fishery: The flatfish resource has been lightly to moderately harvested. Nearly all flatfish were landed by 51 trawlers in 1998. The Central area has produced the majority of flatfish catches, with most of the harvest on the continental shelf and slope east of Kodiak Island. Rock sole is the predominant target species in this assemblage. The 1998 shallow-water flatfish directed fishery was closed on May 2 and August 3, when the halibut bycatch limit was attained for that fishery. All trawling for 1998 was closed on October 9 for the remainder of the year. The 1999 fishery was closed on March 20 until October 1 due to the attainment of the halibut bycatch limit, and was then closed on October 16 for the rest of the year, having reached the halibut TAC.

Management: The shallow water flatfish fishery is regulated under the GOA Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: Shallow water flatfish landings totaled 2,545 mt in 1999, worth approximately \$710,000. Roughly 77% of landings were retained in 1999. Primary products produced are whole fish, H&G, and kiritimi.

Catch History: Until 1981, flatfish was chiefly a foreign fishery targeting non-flatfish species. With the cessation of foreign fishing in 1986, joint venture fishing began to account for the majority of the catch. In 1987 the gulf-wide flatfish catch increased nearly fourfold to 10,000 mt with the joint venture fisheries accounting for nearly 73% of the gulf-wide catch. After 1988, only domestic fleets harvested flatfish. The Central area has produced the majority of the flatfish catches, with the most of the harvest on the continental shelf and slope east of Kodiak Island.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of shallow water flatfish in the GOA, 1990-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1990	249,000	84,500	10,000	NA
1991	249,000	74,000	12,000	5,300
1992	249,000	50,480	11,740	8,780
1993	355,590	50,480	16,240	9,720
1994	355,590	34,420	18,630	3,890
1995	355,590	52,270	18,630	5,430
1996	315,590	52,270	18,630	9,335
1997	315,590	43,150	18,630	7,690
1998	315,590	43,150	18,630	1,750
1999	314,960	43,150	18,770	2,545
2000	299,100	37,860	19,400	6,930
2001	299,100	37,860	19,400	*

Flathead Sole

Biology: Flathead sole (*Hippoglossoides ellassodon*) are distributed from northern California northward throughout Alaska. They are most abundant at depths less than 250 m. Flathead sole spawn from February-April at depths of 50-300 m. Flathead sole are also bottom feeders but will feed on small nektonic animals such as shrimp, krill, herring, and smelt when the opportunity arises. Flathead sole attain maximum ages of 17 years for males and 21 years for females. Natural mortality is estimated at 0.2.

Stock Assessment: The current assessment for flathead sole is based on NMFS trawl survey abundance estimates. Estimates of B_{MSY} and F_{MSY} are not available for this stock. Preliminary estimates of maturity from survey data were used in a new model for flathead sole tested in 1999; these estimates may be available for the 2000 assessment and allow estimation of ABCs from the new model. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, OFL for flathead sole is based on a Tier 5 fishing mortality rate where $F_{OFL} = M$ and ABC for rex sole was estimated using $F = 0.75 M$.

Population Status: For 2001, exploitable biomass of flathead sole was 207,520 mt. Catch specifications were the following: OFL = 34,210 mt, ABC = 26,270 mt, TAC = 9,060 mt. Relative abundance for flathead sole is unknown. Fishing is severely constrained by halibut bycatch limits (catch < 50 %ABC).

Fishery: The flatfish resource has been lightly to moderately harvested. The flatfish fisheries are often closed before they reach the target TAC due to attainment of the quarterly halibut bycatch limits. Nearly all flatfish were landed by 51 trawlers in 1998. Flathead sole are retained a majority of the time (ranging from 59% in 1991 to 83% in 1997).

Management: The flathead sole fishery is regulated under the GOA Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut bycatch limits. Flathead sole was assigned a separate ABC from the deep water complex in 1991 since it overlaps the depth distributions of the both shallow and deep water groups. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: In 1999, 900 mt of flathead sole was caught, 62% of which was retained (1991-2000 average is 72% retainment). This fishery was worth roughly \$250,000. Primary products produced are H&G with roe-in, and to a lesser extent kirimi.

Catch History: Until 1981, flatfish was chiefly a foreign fishery targeting non-flatfish species. With the cessation of foreign fishing in 1986, joint venture fishing began to account for the majority of the catch. In 1987, the gulf-wide flatfish catch increased nearly fourfold to 10,000 mt with the joint venture fisheries accounting for nearly 73% of the gulf-wide catch. After 1988, only domestic fleets harvested flatfish.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of flathead sole in the GOA, 1991-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1991	247,000	50,300	10,000	1,360
1992	247,000	48,280	10,000	2,460
1993	199,000	49,450	10,000	2,450
1994	199,000	35,850	10,000	2,550
1995	199,000	28,790	10,000	2,170
1996	206,000	28,790	9,740	3,070
1997	206,000	26,110	9,040	2,460
1998	206,000	26,110	9,040	2,670
1999	206,000	26,110	9,040	900
2000	207,500	26,270	9,060	1,550
2001	207,500	26,270	9,060	*

Arrowtooth Flounder

Biology: Arrowtooth flounder (*Atheresthes stomias*) spawn during December-February at depths of 100-360 m. Spawning of arrowtooth flounder occurs in the Gulf of Alaska from Kodiak Island to Yakutat Bay. Arrowtooth flounder are abundant over a depth range of 100-500 m. During the winter months they aggregate in the deeper portion of their range. High densities of arrowtooth flounder, as indicated from resource assessment surveys, have also been found in waters off southeastern Alaska at depths of 200-400 m. The maximum age for arrowtooth flounder is 21 years. The instantaneous rate of natural mortality is estimated at 0.2. Arrowtooth flounder are 50% mature at 47 cm (about 8.5 years) for females. The fecundity of this species is unknown. Arrowtooth flounder 15 to 30 cm feed predominantly on shrimp, euphausiids, capelin and herring, while fish over 40 cm eat mostly pollock.

Stock Assessment: The 2000 assessment for arrowtooth flounder used an age-based model run using different natural mortality values for males and females with added survey age composition data from 1984, 1987, and 1990. The 1999 survey biomass estimate and length composition was used, and catch for 1999 and 2000 was updated. Stock assessments previous to 1999 used a length-based model and the same natural mortality estimates and selectivities by length for both males and females. Arrowtooth flounder is in Tier 3a of the ABC and overfishing definitions, meaning $F_{OFL} = F_{35\%}$ and $F_{ABC} \leq F_{40\%}$. The ABC for 2001 using $F_{40\%} = 0.134$ was estimated at 148,151 mt. A separate stock assessment for arrowtooth flounder was begun in 1996.

Population Status: Arrowtooth flounder are currently the most abundant groundfish species in the Gulf of Alaska. Exploitable biomass of arrowtooth flounder was estimated to be 1,295,960 mt in 2001. Catch specifications were the following: OFL= 173,550 mt, ABC=148,150 mt, TAC=38,000 mt.

Fishery: Arrowtooth flounder are presently of limited economic importance, but tropic studies suggest they may be an important component in the GOA benthic ecosystem. Little to no effort is directed at catching this species, although commercial interest is growing. Nearly all flatfish were landed by 51 trawlers in 1998. In 2000, the trawl fishery went on bycatch status due to the halibut cap on May 13 and July 31 in the Western area, and May 13 and August 23 in the Central area. Arrowtooth are taken as bycatch by trawl and longline gear in pursuit of other highly valued species. Prior to 1996, they frequently served as "ballast" against allowable retainable bycatch of other species.

Management: Arrowtooth flounder are regulated under the GOA Groundfish FMP. They were separated from the flatfish assemblage in 1990 and managed under a separate acceptable biological catch (ABC), because of the species' present high abundance and low commercial value. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring.

Economics: Arrowtooth is a very low-valued species. In 1999, 16,200 mt of arrowtooth flounder were landed in the GOA, of which all but 4,265 mt was discarded. Average ex-vessel price was about \$0.02 per pound, for a total ex-vessel value of around \$188,000, compared with about \$20,000 in 1994. The primary product produced from arrowtooth is meal, although a process has been developed to make surimi.

Catch History: Under current fishing practices, arrowtooth flounder are mostly discarded when caught, although the percent retained has increased from 2% in 1992 to 43% in 2000. Higher catches in more recent years are a result of higher biomass levels, corresponding incidental catch in other target fisheries, and increased marketing efforts for arrowtooth meal and surimi.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of arrowtooth flounder in the GOA, 1990-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1990	1,922,000	194,600	32,000	7,705
1991	1,922,000	340,100	20,000	10,035
1992	1,922,000	303,800	25,000	15,970
1993	1,585,000	321,290	30,000	15,560
1994	1,585,000	236,240	30,000	23,560
1995	1,585,000	198,130	35,000	18,430
1996	1,640,000	198,130	35,000	22,585
1997	1,640,000	197,840	35,000	16,320
1998	2,063,000	208,340	35,000	12,975
1999	2,127,000	217,110	35,000	16,200
2000	1,572,000	145,360	35,000	22,980
2001	1,295,960	148,150	38,000	*

Sablefish

Biology: Sablefish (*Anoplopoma fimbria*), also known as black cod, is a long-lived fish, with a reported maximum age of 62 years in Alaska, 55 years in Canada. They occur over a wide range of depths, with their center of abundance at 400-1,000 m along the continental slope. Sablefish are found within gullies crossing the continental shelf like Spencer Gully. Sablefish move deeper as they age. Sablefish spawn during late winter to early spring. Female fecundity ranges from 60,000-200,000 eggs up to one million eggs for 58-71 cm to 102 cm fish. Larvae have been reported near the surface throughout the Gulf, Aleutian Islands and southeastern Bering Sea. Sizes at maturity are 52-61 cm (5 years) for males and 58-71 cm (5-7 years) for females. Sablefish growth appears to be rapid for the first 3-5 years and slows asymptotically thereafter. The current estimate of natural mortality is 0.10-0.11. Older juveniles and adults feed primarily on fishes, crustaceans, and cephalopods. Juvenile sablefish are eaten by a wide variety of finfishes, sea birds, and pinnipeds. Predators include hagfishes, sharks, Pacific cod, lingcod, Pacific halibut, and killer whales.

Stock Assessment: Sablefish are thought to belong to a single population. A combined GOA and BSAI assessment is based on an age-structured model. Estimates of B_{MSY} and F_{MSY} are not available for this stock. Relative abundance and length data from the 2000 longline survey, relative abundance and length data from the 1999 longline fishery, and length and age data from the 1999 trawl and longline surveys, respectively, were added to the assessment for 2001. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, the 2001 OFL for sablefish is based on a Tier 3b adjusted F_{OFL} ($= .15 = F_{35\%}$ adjusted), which equals 20,700 mt. Maximum permissible ABC is based on an "equilibrium adjusted" yield equivalent to $F_{40\%}$ adjusted rate (Tier 3b).

Population Status: For 2001, exploitable biomass was estimated at 188,000 mt in the GOA. Catch specifications were the following: OFL =15,720 mt, ABC =12,840 mt, TAC =12,840 mt. The sablefish stock appears low and stable, a change from previous assessments where abundance appeared low and slowing decreasing. The stock is fully exploited (100% of ABC). The stock has cycled through two peaks in 1970 and 1985 and has decreased substantially since 1988. The 1992 and 1993 year-classes are the lowest observed. Within the last five years, the gillnet surveys show that the 1995 year-class may be above average and the 1999 year-class below average. Exploitable and spawning biomass are projected to increase 3% and 4%, respectively, between 2000 and 2001. Abundance is expected to increase slowly; the size of the increase will depend on the strength of the 1997 and 1998 year classes.

Fishery: Sablefish are taken mostly by longline gear in a directed fishery (86%), and as bycatch by trawls (14%). In 1999, 13,900 mt of sablefish was caught, 92% of which was retained. Discards have occurred in the hook-and-line sablefish and trawl fisheries targeting flatfish and rockfish. An individual fishing quota (IFQ) program for the fixed gear fishery was implemented in 1995. In 1999, 897 persons held sablefish quota shares, fishing on 433 catcher vessels. The season runs from March 15-November 15, concurrent with the halibut IFQ fishery. State fisheries in Prince William Sound, Chatham Strait and Clarence Strait also land sablefish outside the IFQ program.

Management: The GOA sablefish fishery is regulated under the GOA FMP. The FMP controls the fishery through permits, an IFQ program, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. The sablefish TAC is allocated among gear types in the GOA management areas (80% of the Western and Central Area and 95% of the Eastern Area TAC to fixed gear; the remaining to trawl gear). It is on bycatch status year-round for trawl gear.

Economics: Sablefish is the highest valued groundfish resource in the GOA, worth \$70 million ex-vessel in 1999. Average ex-vessel price was about \$2.88/lb for fixed gear fisheries, and \$2.35/lb for trawl fisheries. The primary product produced is H&G for Japanese markets, with small amounts going to specialty domestic markets.

Catch History: Annual catches averaged about 1,500 mt during 1930-50, and exploitation rates remained low until the Japanese longline fleet expanded into the GOA around 1959. Catches rapidly escalated during the mid-1960s. The record all-nation catch reached 37,500 mt in 1972 and averaged about 28,000 mt during 1973-76. Evidence of declining stock abundance led to significant fishery restrictions during 1977-85, and catches were reduced substantially. Catches during 1978-83 averaged 9,200 mt, increased to 31,000 mt in 1988, and have since declined to about 13,900 mt in 1999.

Exploitable biomass (from age-structured analysis of longline survey and catch data), catch specifications and total catches (including discards) of sablefish (mt) in the GOA, 1979-2001.

Year	Biomass	ABC	TAC	Catch
1979	142,000	13,000	13,000	
1980	151,000	13,000	13,000	10,350
1981	157,000	14,350	14,350	8,540
1982	169,000	12,300	12,300	9,920
1983	222,000	9,480	9,480	8,560
1984	291,000	8,980	8,980	9,000
1985	366,000	8,980	8,980	10,230
1986	404,000	18,800	15,000	12,480
1987	383,000	25,000	20,000	21,610
1988	356,000	35,000	28,000	26,320
1989	326,000	30,900	26,000	29,900
1990	298,000	26,200	26,000	29,840
1991	265,000	22,500	22,500	26,600
1992	242,000	20,800	20,800	23,130
1993	231,000	20,900	20,900	23,380
1994	222,000	25,500	25,500	22,690
1995	192,000	21,500	21,500	21,340
1996	191,000	17,080	17,080	18,630
1997	187,000	14,520	14,520	18,200
1998	181,000	14,120	14,120	15,700
1999	179,000	12,700	12,700	15,200
2000	181,000	13,330	13,330	12,270
2001	188,000	12,840	12,840	13,570

Other Slope Rockfish

Biology: At least 30 rockfish species of the genus *Sebastes* inhabit the Gulf. Since 1988, rockfish have been divided into three management assemblages based on their habitat and distribution: slope, pelagic shelf, and demersal shelf rockfish. Slope rockfish are those species that, as adults, inhabit waters of the outer continental shelf and continental slope in depths greater than 150-200 m. In 1991, the slope assemblage was divided into three management subgroups: Pacific ocean perch (POP), shortraker/rougheye rockfish, and all other species of slope rockfish. In 1993, a fourth management subgroup, northern rockfish, was created. These subgroups were established to protect from possible overfishing. Each is now assigned an individual TAC and is profiled separately. Little information exists for the other slope assemblage. Harlequin, sharpchin, redstripe, and silverygrey rockfish are the predominant species caught in the commercial fishery. For sharpchin rockfish, size at 50% maturity is 25.5 cm, age at 50% maturity occurs at about 10 years, and $M = 0.05$. For yellowmouth rockfish, maximum age is 71 years and $M = 0.06$. Darkblotched rockfish maximum age is 48 years, and $M = 0.07$. Silvergray rockfish maximum age is 80 years, and $M = 0.01-0.07$.

Stock Assessment: Estimates of B_{MSY} and F_{MSY} are not available for this stock complex. Beginning in 1997, OFL and ABC are based on tiers defined under Amendment 44. The ABC for this group is based on a harvest rate equal to natural mortality (M) or $0.75 M$, applied to exploitable biomass. Exploitable biomass is determined from the average of the three most recent trawl surveys. Applying the definitions for ABC and OFL places sharpchin rockfish in Tier 4 where $F_{ABC} \leq F_{40\%}$, and the other species of other slope rockfish in Tier 5 where $F_{ABC} \leq 0.75M$. For sharpchin rockfish, $F_{ABC} = M = 0.05$ is less than $F_{40\%} = 0.055$. Overfishing is defined to occur at $F_{35\%}$ of 0.064 for sharpchin and $F=M$ for the other species.

Population Status: For 2001, the exploitable biomass is 102,505 mt. Catch specifications based on Tier 4 were the following: OFL = 6,390 mt, ABC = 4,900 mt, TAC = 1,010 mt. Relative abundance for other slope rockfish is unknown. Harvest is constrained by halibut bycatch and overfishing concerns for other species taken as bycatch. The ABC was distributed among the Gulf areas as follows: Western - 20 mt; Central - 740 mt; Eastern - 4,140 mt.

Fishery: The directed trawl fishery typically opens on July 1. Between half and three quarters of the catch have been discarded since 1993, after northern rockfish were separated out. Harlequin and sharpchin rockfish are small in size and of lower economic value, and there may be less incentive for fishermen to retain these species. Other slope rockfish went on bycatch status on January 1, 2001, for the Western and Central areas and was open in the Eastern area. The Western Yakutat area trawl fishery opened on July 4. The Southeast area was closed to trawl gear in 2001. The Western Yakutat and Southeast area longline fisheries went on bycatch status for other slope rockfish due to incidental catch of halibut on March 9. In the pot fishery, the West Yakutat and Southeast areas were open on January 1. The West Yakutat area was closed to all gear types on July 26 when the TAC was reached.

Management: The fishery is regulated under the GOA Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, recordkeeping and reporting requirements, and observer monitoring. Management actions include: (1) establishment of the management subgroups in 1991, which limited harvest of the more valuable species, and (2) conservative in-season management practices in which fisheries have been closed at times although unharvested TAC remained. In 1993, northern rockfish were separated from the assemblage. In 1998, trawling was prohibited east of 140° W. longitude. In 2001, a separate ABC was set for the West Yakutat area, since a small portion of the Eastern ABC has been taken recently.

Economics: Total rockfish landings were worth about \$11.5 million in 1999. Forty trawlers landed about 96% of all rockfish in 1999. Trawl gear landed 23,000 mt, of which 19,550 mt (85%) were retained. Rockfish totaling 1,000 mt were landed by 391 hook-and-line vessels, of which 850 mt (84%) were retained. Average ex-vessel price was estimated at \$0.14/lb for trawl gear and \$0.80/lb for fixed gear.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of other slope rockfish in the GOA, 1991-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1991	97,460	10,100	10,100	6,500
1992	97,460	14,060	14,060	9,150
1993	82,330	8,300	5,380	2,810
1994	82,330	8,300	2,235	1,610
1995	82,330	7,110	2,235	1,480
1996	131,330	7,110	2,020	880
1997	131,330	5,260	2,170	1,210
1998	103,710	5,260	2,170	860
1999	103,710	5,270	5,270	789
2000	102,510	4,900	4,900	577
2001	102,510	4,900	1,010	*

Catch History: Foreign, primarily Japanese, fishing dominated the fishery during 1977-84. Catches declined to a minimum in 1985 when foreign trawling was prohibited. The domestic fishery expanded each year until 1991. Overall catches of slope rockfish have continued to diminish as a result of lowered TACs. Landings for remaining species surged in 1993 when northern rockfish were removed from the subgroup. Catches have declined considerably since 1994, due in part to lower TACs. Before 1996, more than 90% of the slope rockfish trawl catch was taken by large at-sea factory trawlers. Smaller shore-based trawlers began taking sizeable catches for delivery to processing plants in Kodiak in 1996. Factory trawlers continue to take almost all the catch in the Western and Eastern areas.

Pacific Ocean Perch

Biology: Pacific Ocean perch (*Sebastes alutus*), commonly known as POP, are broadly distributed around the Northeast Pacific. POP are found over a wide range of depths but most commonly occur at 100-450 m. Adult POP migrate into deep water during fall and winter to spawn and then move to shallower depths to feed during spring and summer. Separate schools of males and females have been observed on feeding grounds at depths of 150-185 m in Unimak Pass. Spawning concentrations have been observed at depths of 350-400 m off Prince William Sound and Yakutat Bay. Adults also perform diel migrations off the sea bottom to feed. For management purposes, the Gulf of Alaska stock is considered separate from those of the Eastern Bering Sea, Aleutian, and British Columbia-California. The extent of operational sub-populations within these regions is uncertain.

The average of the adult maximum size is around 45 cm. Maximum age for POP ranges from 30 to 77 years. They are ovoviviparous, with mating occurring during September-November. Fertilization is internal and the eggs are released as larvae during March-June. Known spawning areas are southeast of the Pribilof Islands in the Bering Sea and in the Gulf of Alaska near Yakutat. Males mature at 4-13 years and females mature at 5-15 years. Mean survey ages for POP were 9.3 and 15.0 years in the Western/Central and Eastern areas, respectively. Size at 50% maturity is 36 cm and age at 50% maturity occurs at about 10 years. Estimated fecundity of females ranges from 10,000-300,000 eggs at 23-45 cm. POP are planktivorous. Small juveniles feed on calanoid copepods; large juveniles and adults feed on euphausiids. Large adults may feed on pandalid shrimps and squids. Major feeding areas are found off Unimak and Kodiak islands. Predators of POP are sablefish, Pacific halibut, and sperm whales. Estimate of natural mortality is .05.

Stock Assessment: The current POP assessment is based on an age-structured model. Estimates of B_{MSY} and F_{MSY} are not available for this stock complex. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, POP rates are based on a Tier 3b fishing mortality rate where $F_{ABC} \leq 0.067$, and the overfishing level ($F_{35\%} = 0.065$) is 15,960 mt.

Population Status: Estimated spawning biomass in 2001 is 95,760 mt and exploitable biomass is 211,160 mt. Catch specifications based on Tier 3b are ABC = 13,510 mt and TAC = 13,510 mt. POP are at low relative abundance and are constrained in some areas by halibut bycatch and overfishing concerns for other species taken as bycatch. A rebuilding plan was implemented in 1995, and the stock was considered rebuilt in 1997. POP ranged up to 78 years in survey samples, but the mean population age was 10 years during 1987-90. Relatively strong recent year-classes appear to have contributed to increased abundance.

Fishery: The directed trawl fishery opens on July 1. POP are caught exclusively with trawl gear, and have been taken primarily by catcher/processors in a directed fishery, although shore-based trawlers accounted for 41% of the catch in the Central area in 1999 and 32% in 1998. Discard rates for POP are very low, 14% in 1999 compared with a peak of 79% in 1993. In 1999, the Western area fishery was on bycatch status starting July 20, and then on prohibited status from September 8 - December 31. In the Central area, the fishery was on bycatch status from July 11-August 6, then again from August 8-December 31, and then on prohibited status starting September 3. In West Yakutat, the fishery was on bycatch status from July 19-December 31.

Management: The GOA FMP regulates this fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements in 1991, and observer monitoring. In 1991, POP and shortraker/rougheye rockfish were separated from the slope rockfish assemblage to prevent possible overfishing. A reduction in TACs to promote stock rebuilding was successful after three years. In 1998, trawling was prohibited east of 140° W. longitude.

Economics: Economic information for rockfish is not broken out by subgroup. This data is provided for total rockfish landings in the profile for other slope rockfish.

Catch History: A foreign POP trawl fishery began in the early 1960s. This fishery developed rapidly, with massive efforts by the Soviet and Japanese fleets. Catches peaked in 1965 with landings of 350,000 mt. This apparent overfishing resulted in a precipitous decline in catches in the late 1960s. Catches continued to decline in the 1970s, and by 1978 were only 8,000 mt. Landings declined again to very low levels in the early 1990s, but have recovered under the rebuilding plan.

Exploitable biomass (from the stock synthesis model), catch specifications and total catches (including discards) of POP in the GOA, 1991-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1991	125,081	5,800	5,800	6,631
1992	172,085	5,730	5,200	6,159
1993	206,210	3,378	2,560	2,060
1994	235,487	3,030	2,550	1,853
1995	252,412	6,530	5,630	5,742
1996	279,431	8,060	6,960	8,378
1997	301,084	12,990	9,190	9,531
1998	243,170	12,820	10,780	8,961
1999	228,190	13,120	12,590	10,472
2000	200,310	13,020	13,020	10,106
2001	211,160	13,510	13,510	*

Shortraker/Rougheye Rockfish

Biology: As with most rockfish, shortraker (*Sebastes borealis*) and rougheye (*S. aleutianus*) rockfish are slow growing and long-lived. They inhabit waters of the outer continental shelf and continental slope. Shortraker rockfish are consistently most abundant in the Yakutat area, and rougheye rockfish, except during 1992-95, are most abundant in the Southeastern area. Estimates of maximum age of shortraker rockfish is 120 years and estimates for rougheye rockfish are 95 and 140 years. The estimate of M for rougheye rockfish is 0.025; there is no estimate of M or Z for shortraker rockfish, but a ratio of maximum age of rougheye to shortraker (140/120) multiplied by 0.025 was used to estimate $M = 0.03$.

Stock Assessment: Estimates of B_{MSY} and F_{MSY} are not available for this stock complex. Applying the new definitions for ABC and OFL based on Amendment 44 places shortraker rockfish in Tier 5 where $F_{ABC} \leq 0.75M$. Thus, the recommended F_{ABC} for shortraker rockfish is 0.023. Applying Tier 4 to rougheye rockfish ($F_{ABC} \leq F_{40\%}$) results in an $F_{ABC} = M = 0.025$.

Population Status: Applying the F_{ABC} rates to the estimates of exploitable biomass of 22,411 mt for shortraker rockfish and 48,404 mt for rougheye rockfish results in ABCs of 517 mt for shortraker rockfish and 1,210 mt for rougheye rockfish and a recommended ABC for the subgroup of 1,730 mt. The 2001 TAC is set equal to ABC. Total exploitable biomass in 2001 for this group is 70,885 mt. Overfishing is defined to occur at the harvest rate set equal to $F_{35\%} = 0.038$ for rougheye rockfish. The $F = M$ rate of 0.03 is used to define the overfishing level for shortraker rockfish because data are not available to determine $F_{35\%}$ for shortraker rockfish. The overfishing catch limit equals 2,510 mt for the shortraker/rougheye subgroup. The relative abundance for this complex is unknown and the population is highly exploited. Roughly 17.5 - 26.3% during 1993-96 of the rougheye rockfish population was <30 cm in length, suggesting a moderate level of recruitment. Mean survey lengths for rougheye rockfish were 37.4 and 36.6 cm in 1993 and 1996.

Fishery: Historically, bottom trawls have accounted for nearly all the reported commercial harvest. The directed trawl fishery opens on July 1. Since 1993, longline catches have ranged from 30-48% of the total Gulf-wide harvest of shortraker/rougheye in the directed fishery and as bycatch in the sablefish and halibut longline fisheries. The entire TAC is needed for bycatch in other directed hook-and-line fisheries. Shortraker rockfish have dominated the commercial catch of this subgroup, especially since 1993. Discards of shortraker/rougheye rockfish have been low to moderate over the years, dropping from a peak of 45% in 1994 to 22% in 1997 and 30% in 1999. The fishery was placed on bycatch status for all areas of the Gulf on January 1, 2000. It went on prohibited status on September 8 and October 1 in the Western and Eastern areas, respectively, upon attainment of the TAC.

Management: The fishery is regulated under the GOA Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements in 1991, and observer monitoring. Management actions include: (1) establishment of the management subgroups in 1991, which limited harvest of the more desired species, and (2) conservative in-season management practices in which fisheries have sometimes been closed although substantial unharvested TAC remained. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: Economic information for rockfish are not broken out by subgroup. This information is provided for total rockfish landings in the profile for other slope rockfish.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of shortraker/rougheye in the GOA, 1991-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1991	48,900	2,000	2,000	700
1992	48,900	1,960	1,960	2,165
1993	82,400	1,960	1,765	1,930
1994	82,400	1,960	1,960	1,830
1995	82,400	1,910	1,910	2,250
1996	64,900	1,910	1,910	1,660
1997	64,900	1,590	1,590	1,610
1998	64,900	1,590	1,590	1,734
1999	65,400	1,590	1,590	1,310
2000	70,900	1,730	1,730	1,625
2001	70,900	1,730	1,730	*

Catch History: The shortraker/rougheye fishery was separated from the slope rockfish fishery in 1991. Landings since then have been low and relatively stable, and are harvested primarily in a directed fixed gear fishery and as bycatch in other trawl fisheries.

Northern Rockfish

Biology: As with most rockfish, northern rockfish (*Sebastes polyspinus*) are slow growing and long-lived. Maximum age for northern rockfish is estimated at 49 years. Mean age of northern rockfish was roughly 15 years for 1987-93. Size at 50% maturity is 36 cm and age at 50% maturity occurs at about 12.8 years.

Stock Assessment: For the first time, in 2001, the stock assessment for this species is based on an age-structured model. The projected current spawning biomass in 2001 is 39,090 mt. $B_{40\%}$ is determined from the average recruitment of the 1977-94 year classes. Since B_{2001} is $> B_{40\%}$, the computation in Tier 3a is used to determine the maximum value of F_{ABC} . Thus $F_{ABC} \leq F_{40\%} = 0.055$, which results in a maximum allowable ABC of 4,880 mt.

Population Status: Applying the $F_{40\%}$ rate to the estimated exploitable biomass (93,850 mt) results in an ABC of 4,880 mt for 2001. The TAC is set equal to ABC. Overfishing under Tier 3a is defined to occur at $F_{35\%} = 0.065$ for northern rockfish, resulting in an overfishing limit of 5,780 mt. There is relative uncertainty in the biomass estimate, catch history, and life history parameters for northern rockfish. The declining stock trend and the weakness of recent recruitment estimates identified by the age structured model indicates that caution is warranted for management of this stock. The population is typically exploited at 50-90% of ABC.

Fishery: Historically, bottom trawls have accounted for nearly all the commercial harvest. The trawl fishery opens on July 1. Northern rockfish were placed on bycatch status in all areas of the Gulf on January 1. The trawl fishery opened in the Western and Central areas on July 4, and was placed on bycatch status on July 26 and July 24, respectively. Discards of northern rockfish generally have been low to moderate over the years, with a high of 28% in 1997 and a low of 10% in 2000.

Management: The GOA Groundfish FMP regulates the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, recordkeeping and reporting requirements, and observer monitoring. Management actions include: (1) establishment of the management subgroups in 1991, which limited harvest of the more desired species and (2) conservative in-season management practices in which fisheries have sometimes been closed although substantial unharvested TAC remained. Northern rockfish were separated from the other slope rockfish assemblage in 1993. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: Economic information for rockfish are not broken out by subgroup. This information is provided for total rockfish landings in the profile for other slope rockfish.

Catch History: The northern rockfish fishery was separated from the slope rockfish fishery in 1993 to prevent overfishing. ABCs and TACs have declined slightly, while landings have declined by less than half. Northern rockfish are caught in a directed fixed gear fishery and as bycatch in other trawl fisheries. Shore-based vessels accounted for 66% of the 1999 northern rockfish catch.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of northern rockfish in the GOA, 1993-2001 (in mt).

<u>Year</u>	<u>Biomass</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
1993	76,800	5,760	5,760	4,825
1994	76,800	5,760	5,760	5,970
1995	76,800	5,270	5,270	5,635
1996	84,900	5,270	5,270	3,345
1997	84,900	5,000	5,000	2,945
1998	83,900	5,000	5,000	3,050
1999	83,900	4,990	4,990	5,400
2000	85,400	5,120	5,120	3,400
2001	93,850	4,880	4,880	*

Pelagic Shelf Rockfish

Biology: The pelagic shelf rockfish (PSR) assemblage in the Gulf includes three species: dusky (*Sebastes ciliatus*), widow (*S. entomelas*), and yellowtail rockfish (*S. flavidus*). This assemblage was separated from slope rockfish in 1988. PSR are defined as those species of *Sebastes* that inhabit waters of the continental shelf of the Gulf, and that typically exhibit a midwater, schooling behavior. Dusky rockfish were separated into “light” and “dark” varieties only in the 1996 and 1999 surveys. Gulfwide, light dusky rockfish is the most important species in the assemblage; dark dusky, widow, and yellowtail rockfish are minor species. The dusky rockfish natural mortality rate of 0.09 is an indication that this species is faster-growing and shorter-lived than most other rockfish. The maximum age for dusky rockfish is 49 years; one specimen was aged to 59 years. Dusky rockfish appear to recruit at age 7 to the commercial fishery. Data on size at 50% maturity for females is estimated to be 42.8 cm or 13 years; there is no information on size at maturity for males. Dusky and yellowtail rockfish may be a latent, under-utilized resource in nearshore waters of Southeastern Alaska.

Stock Assessment: Estimates of B_{MSY} and F_{MSY} are not available for this assemblage. Applying the new definitions for ABC and OFL, based on Amendment 44, places pelagic shelf rockfish in Tier 4. An $F=M=0.09$, which is more conservative than $F_{40\%} = 0.11$, was used to assess dusky rockfish (the only assessed species in the assemblage). The reduction strategy is used due to concern over the reliability of biomass estimates and the estimates of $B_{40\%}$.

Population Status: The PSR exploitable biomass for 2001 is 66,443 mt. Using an $F=M$ strategy results in an ABC of 5,980 mt. Under a Tier 4 assessment and the Amendment 56 overfishing definitions, $F_{OFL} = F_{35\%} = 0.136$, resulting in a Gulf-wide OFL of 9,036 mt. The relative abundance for this complex is unknown and the population is exploited at 50-90% of ABC. Dusky rockfish recruitment is a relatively infrequent event. An estimated 92% of the population in 1996 was greater than or equal to 40 cm in length.

Fishery: The directed trawl fishery opens on July 1. During 1988-95, almost all the PSR trawl catch (>95%) was taken by large, at-sea factory trawlers. Smaller shore-based trawlers began taking a sizeable portion of the catch in the Central area in 1996 and 1997 for delivery to processing plants in Kodiak. Since 1991, PSR have also been harvested by jig and longline gear, mostly near Kodiak and along the south shore of the Kenai Peninsula. In 2000, the Central and West Yakutat area fisheries opened on July 4 and went on bycatch status on July 26. The Western area went on bycatch status on August 23, and reopened October 1. Discard rates in the trawl fishery have been relatively low, with a high of 11% in 1996 and a low of 3% in 2000.

Management: The GOA Groundfish FMP regulates the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, recordkeeping and reporting requirements, and observer monitoring. Management actions include: (1) establishment of the slope, PSR, and demersal shelf rockfish management subgroups in 1988, which limited harvest of the more desired species, and (2) conservative in-season management practices in which fisheries have sometimes been closed although substantial TAC remained unharvested. In 1997, black rockfish (*S. melanops*) and blue rockfish (*S. mystinus*) were separated into a “nearshore” component of PSR and managed under a separate ABC and TAC in the Central area, where a jig fishery for black rockfish occurs. In 1998, these two species were removed from the FMP, and are now managed by the State of Alaska. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: Economic information for rockfish are not broken out by subgroup. This information is provided for total rockfish landings in the profile for other slope rockfish.

Catch History: Gulfwide PSR catches generally increased after the management groups were separated in 1988 to a maximum in 1992. Since then, catches have declined mostly due to in-season management regulations. In 1997, the Central and Eastern area were both closed with a substantial amount of unharvested TAC remaining. These closures occurred to avoid TAC overruns, and also to prevent bycatch of POP. In recent years, the harvest has come closer to reaching the TAC.

Exploitable biomass (from triennial trawl surveys), catch specifications and total catches (including discards) of pelagic shelf rockfish in the GOA, 1990-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1988	83,000	3,300	3,300	1,090
1989	83,000	6,600	6,600	1,740
1990	30,000	8,200	8,200	1,650
1991	30,000	4,800	4,800	1,773
1992	30,000	6,890	6,890	3,163
1993	59,000	6,740	6,740	3,041
1994	59,000	6,890	6,890	2,610
1995	59,000	5,190	5,190	2,342
1996	78,000	5,190	5,190	1,834
1997	78,000	5,140	5,140	2,280
1998	55,580	5,260	5,260	2,548
1999	54,220	4,880	4,880	4,659
2000	66,443	5,980	5,980	3,727
2001	66,443	5,980	5,980	*

Demersal Shelf Rockfish

Biology: The demersal shelf rockfishes (DSR) assemblage is comprised of seven species of shallow, nearshore, bottom-dwelling rockfishes: canary rockfish (*Sebastes pinniger*), China rockfish (*S. nebulosus*), copper rockfish (*S. caurinus*), quillback rockfish (*S. maliger*), rosethorn rockfish (*S. helvomaculatus*), tiger rockfish (*S. nigrocinctus*), and yelloweye rockfish (*S. ruberrimus*). Yelloweye and quillback rockfish account for 90% and 8% of all DSR landings, respectively. DSR exhibit slow growth and extreme longevity. They are viviparous, with parturition occurring from February through September with the majority of species extruding larvae in winter and spring. Yelloweye rockfish extrude larvae over an extended time period, with the peak period of parturition occurring in April and May. Estimated length and age at 50% maturity for yelloweye in Southeast Outside are 45-52 cm and 21+ years for females and 50-57 cm and 23+ years for males. Individual growth levels off at about age 30.

Stock Assessment: Density is estimated using line transect techniques in the Eastern Gulf. ABC/TAC recommendations for the entire assemblage are keyed to adult yelloweye biomass. The 2000 assessment estimated exploitable biomass at about 40% less than the 1999 estimate, due mainly to revised estimates of rock habitat by management area. The exploitable biomass estimate is based on the sum of the lower 90% confidence interval of biomass; the model was updated in 2000 using these new estimates. The 2001 exploitable biomass estimate in Southeast Outside is 14,693 mt, 3% less than the 2000 estimate.

Population Status: The 2001 ABC is 330 mt, determined by applying $F=M=0.02$ to the estimated biomass and adjusting for the 10% of other DSR species. This rate is more conservative than the $F_{40\%}$ rate that would be obtained by using Tier 4 under the new definitions for setting ABC, as $F_{40\%} = 0.025$. The TAC is set equal to the ABC. The overfishing level for DSR was set at $F_{30\%} = 0.0279 = 410$ mt. The relative abundance for this complex is unknown.

Fishery: A directed longline fishery occurs in the Southeast Outside District and the internal State waters of Southeast Alaska. Much of the catch occurs as bycatch in the halibut longline fishery. DSR may only be taken in directed fisheries by longline gear; trawl fisheries are limited to bycatch only. Discard rates in the trawl fishery have been relatively low. DSR mortality during the halibut longline fishery was estimated to be about 114 mt in 1999, using a 10% bycatch mortality in Area 2C and 7% in Area 3A, which accounted for 31% of the total DSR landings. The allowable bycatch limit in the halibut fishery is 10% of the halibut weight.

Management: Prior to 1987, this complex was grouped with the "other rockfish" complex in the GOA FMP. In 1987, the complex was split into three components for management purposes in the eastern Gulf. The DSR assemblage was recognized as an FMP assemblage only east of 137° W. longitude. In 1992, DSR was recognized in East Yakutat and management of DSR extended westward to 140° W. longitude (Southeast Outside). Southeast Outside is comprised of four management areas, and DSR are managed jointly by the State of Alaska (ADF&G) and NMFS. Two internal state water subdistricts are managed entirely by ADF&G and are not included in this stock assessment. The FMP controls the fishery through permits, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, recordkeeping and reporting requirements, and observer monitoring. DSR were excluded from the Council license limitation program since the State has initiated an analysis for a separate DSR license limitation program. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude.

Economics: Economic information for rockfish are not broken out by subgroup. This information is provided for total rockfish landings in the profile for other slope rockfish.

Catch History: DSR have been landed incidental to other groundfish and halibut fisheries in SEO since the turn of the century. Some bycatch was also landed by foreign longline and trawl vessels targeting slope rockfish in the Eastern Gulf from the 1960s through the mid-1970s. Beginning in 1979, a small, shore-based rockfish fishery began in Southeast, targeting primarily the nearshore, bottom-dwelling component of the rockfish complex. The directed DSR catch in SEO increased from 106 mt in 1982 to a peak of 900 mt in 1993, and down to 230 mt in 2000. Directed fishery landings have been constrained by other fishery management actions. Since 1992, there has been a separate PSC for the DSR fishery.

Exploitable biomass (from line transect surveys), catch specifications and total catches (including discards) of demersal shelf rockfish (mt) in the GOA, 1994-2001.				
Year	Biomass	ABC	TAC	Reported Catch
1994	30,450	960	960	440
1995	20,190	580	580	280
1996	29,290	950	950	435
1997	29,290	950	950	380
1998	25,030	560	560	360
1999	25,031	560	560	350
2000	15,100	340	340	230
2001	14,695	330	330	*

Thornyhead Rockfish

Biology: The thornyhead rockfish assemblage consists of two species: shortspine (*Sebastolobus alascanus*) and longspine (*Sebastolobus altivelis*) thornyheads. They inhabit the outer shelf and slope region throughout the northeastern Pacific and Bering Sea. Thornyheads are a deepwater demersal fish, inhabiting the continental shelf edge and slope, seldom swimming far off the bottom. Unlike rockfish of the genus *Sebastes*, they do not generally form large schools. Shortspine inhabit depths of 90-1,460 m and the longspine inhabit depths of 370-1,600 m. Shortspine thornyheads are the most abundant of the two species; longspine have rarely occurred in resource assessment survey catches. Female thornyheads release a mass of eggs that are held together by a gelatinous material. This gelatinous mass rises to the surface where it becomes free-floating. It is not known if fertilization occurs internally or at the time the eggs are released. Shortspine thornyheads account for about 90% of the other rockfish complex biomass. Little is known about this species in the GOA. Females reach 50% maturity at about 22 cm. Maximum life span is about 60 years, but some individuals may be 100 years or older. Annual natural mortality of adults has been estimated to be about 5% ($M = 0.07$). Recruitment to longline fisheries starts at age 15, fully recruited at age 30. Recruitment to trawl fisheries occurs at smaller sizes reflecting the shallower depths where these fisheries typically occur. The shortspine population structure is not well defined. Thornyheads in the GOA have been managed as a single stock since 1980.

Stock Assessment: The current assessment for thornyheads is a sized based, age-structured model. B_{MSY} and F_{MSY} have not been estimated for this stock. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, OFL is based on a Tier 3a fishing mortality rate where $F_{OFL} = F_{35\%} = 0.092$. ABC is based on a Tier 3a harvest strategy where $F_{ABC} = 0.077$.

Population Status: The 2001 estimate of exploitable biomass for thornyheads is 52,100 mt. Assuming average recruitment when fished at the $F_{40\%}$ rate, thornyheads are expected to decline. The 2001 catch specifications are as follows: OFL = 2,770 mt, ABC = 2,310 mt, TAC = 2,310 mt. The abundance of this complex is relatively high and recent harvests have been between 50-90% of the ABC. Due to the long-lived nature of this species, the overall harvest rate recommendation is at about 4% of the total age 5+ biomass.

Fishery: Thornyheads are commonly taken as bycatch by bottom trawl and longline gear. They are one of the most valuable rockfish species, with most of the domestic harvest exported to Japan. The greatest foreign-reported harvest activities for thornyheads in the Gulf occurred during 1979-83. In 1985, the U.S. catch surpassed the foreign catch for the first time. U.S. catches peaked in 1989 with a total removal of 3,080 mt. The directed fishery for sablefish harvested the largest amount of thornyheads in 1994-1995, followed by rockfish, rex sole and other flatfish fisheries.

Management: The fishery is regulated under the GOA Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas, seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting, and observer monitoring. In 1998, trawling was prohibited in the Eastern area east of 140° W. longitude. The TAC is reserved for bycatch in other directed fisheries.

Economics: Economic information for rockfish are not broken out by subgroup. Information is provided for total rockfish landings in the profile for other slope rockfish.

Exploitable biomass (from sized based, age-structured model), catch specifications and total catches (including discards) of age 5+ thornyhead rockfish in the GOA, 1990-2001 (in mt).

Year	Biomass	ABC	TAC	Catch
1984	58,330	3,750	3,750	210
1985	58,930	3,750	3,750	80
1986	59,750	3,750	3,750	860
1987	59,880	3,750	3,750	1,960
1988	58,990	3,750	3,750	2,790
1989	57,680	3,750	3,750	3,050
1990	56,080	3,800	3,800	1,650
1991	55,280	1,800	1,400	2,020
1992	54,800	1,800	1,800	2,020
1993	53,780	1,180	1,060	1,370
1994	53,410	1,180	1,180	1,320
1995	53,130	1,900	1,900	1,110
1996	52,660	1,560	1,250	1,100
1997	52,270	1,700	1,700	1,240
1998	52,270	2,000	2,000	1,410
1999	53,200	1,990	1,990	1,280
2000	53,200	2,360	2,360	1,310
2001	52,100	2,310	2,310	*

Catch History: Thornyheads have been harvested since the late 19th century, when commercial trawling by U.S. and Canadian fishermen began. In the mid-1960s Soviet fleets arrived in the eastern Gulf, where they were soon joined by vessels from Japan and the Republic of Korea. Catches of thornyheads in the Gulf declined markedly in 1984 and 1985, due primarily to restrictions on foreign fishing imposed by U.S. management policies. The greatest foreign-reported harvest of thornyheads in the GOA occurred during 1979-83. In 1985, the U.S. catch surpassed the foreign catch for the first time. U.S. catches of thornyheads continued to increase, reaching a peak in 1989 with a total removal of 3,080 mt. Catches have since averaged about 1,240 mt during the period 1995-2000.

Atka Mackerel

Biology: Atka mackerel (*Pleurogrammus monopterygius*) is a schooling, semi-demersal species distributed from the east coast of the Kamchatka Peninsula, throughout the Komandorskiye and Aleutian Islands, north to the Pribilof Islands in the eastern Bering Sea, and eastward through the GOA to southeast Alaska. Their center of abundance is in the Aleutian Islands. An Atka mackerel population existed in the GOA primarily in the Kodiak, Chirikof, and Shumagin areas and supported a large foreign fishery through the early 1980s. By the mid-1980s, this fishery and presumably the population, had all but disappeared. Recently, Atka mackerel have been detected by the summer trawl surveys only in the Shumagin (Western) area of the GOA. Genetic information suggests that the Aleutian Island and Gulf populations could be managed as a single stock, however, there are significant differences in population size, distribution, recruitment patterns, and resilience to fishing. Atka mackerel abundance in the Gulf may be dependent on strong recruitment from the Aleutian Islands population. Atka mackerel begin to recruit to the fishery at age 2 and may survive to 15 years, however most of the population is less than 10 years old. Annual natural mortality of adults has been estimated to be 25% ($M = 0.30$). Females reach 50% maturity at about 38 cm or 3.6 years old. Atka mackerel migrate from the shelf edge to shallow coastal waters to spawn. Spawning occurs in July to October on restricted shelf areas with suitable bottom characteristics. Eggs are adhesive and deposited in rock crevices. These nests are guarded by the males until hatching, which occurs about 40–45 days later. Atka mackerel eat copepods and euphausiids, and in turn are prey for other fish, seabirds, Steller sea lions, and other marine mammals.

Stock Assessment: Schooling behavior, patchy distribution, and habitat preference make Atka mackerel a difficult species to sample with standard trawl survey gear. Thus, the existing GOA bottom trawl survey data has limited utility for either absolute abundance estimates or indices for Atka mackerel. Estimates of B_{MSY} and F_{MSY} are not available. Beginning in 1997, OFL and ABC rates are based on tiers defined under Amendment 44. Under this definition, OFL for Atka mackerel is based on Tier 6 and is set equal to the average catch from 1978–1995. In line with a conservative harvest policy, the Atka mackerel fishery is a bycatch only fishery. The ABC is set at a level sufficient to satisfy bycatch needs in other fisheries.

Population Status: Since 1997, an estimate of exploitable biomass could not be determined from trawl survey data due to extreme catch variances. Using Tier 6 criteria, the 2000 overfishing level is 6,200 mt. The ABC is 600 mt. Atka mackerel are considered to be at a low level of relative abundance and exploitation. There may be some evidence of localized depletion; this species has exhibited vulnerability to fishing pressure in the past. The dramatic decline of the Atka mackerel fishery in the Gulf of Alaska suggests that the area may be the edge of the species' range and be populated only during periods when recruitment, possibly as juveniles, from the Aleutian portion of the range is strong.

Fishery: Decreased Atka mackerel abundance may be due to a westward shift in their distribution, excessive fishing mortality, or successive years of poor recruitment. The population consists mostly of large fish. The lack of catches in the Eastern and Central areas indicates stocks are not sufficiently abundant to support a commercial fishery, although small amounts are caught incidentally in other target fisheries. Schooling behavior makes the species vulnerable to targeted fishing with bottom trawls. Due to low availability, industry showed little interest in targeting this species, and the presence of Atka mackerel in the Western area resulted in a target species category beginning with the 1994 fishing year. Since 1997, Atka mackerel has been a bycatch fishery only.

Management: The Atka mackerel fishery is regulated under the GOA Groundfish FMP. It was added to the "other species" category in 1988 due to low abundance, and separated from "other species" in 1994 after four years of targeted catch, primarily from the Western Gulf. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring.

Economics: In 1999, 170 mt of Atka mackerel was caught as trawl bycatch in the Gulf, about 94% of which was retained. In 1996, average ex-vessel value totaled about \$400,000; price and catch has since declined and in 1999 the catch was valued at about \$77,000. Primary products are H&G and whole fish.

Catch specifications and total catches (including discards) of Atka mackerel in the GOA, 1994–2001 (in mt).

<u>Year</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
1994	4,800	3,500	3,540
1995	3,240	3,240	700
1996	3,240	3,240	1,580
1997	1,000	1,000	330
1998	600	600	320
1999	600	600	260
2000	600	600	170
2001	600	600	*

Catch History: Atka mackerel stocks supported a targeted foreign fishery in the Central area in the 1970s through the early 1980s, under joint venture operations. Catches peaked in 1975 at about 27,000 mt and dropped to almost nothing in 1986. All landings since then have been taken by the domestic fishery. Except for in the Western area, abundance has declined to negligible quantities.

