Seafood Watch
Seafood Report

MONTEREY BAY AQUARIUM

Sablefish
Anoplopoma fimbria

Sablefish *(Anoplopoma fimbria),* ID #64

Illustration by Ann Caudle

West Coast Region

Final Report

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About Seafood Watch® and the Seafood Reports

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from the Internet (seafoodwatch.org) or obtained from the Seafood Watch® program by emailing seafoodwatch@mbayaq.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices", "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Fisheries Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Table of Contents

I. Executive Summary

Sablefish fisheries range from Baja, California to the Bering Sea. The species is moderately vulnerable to fishing pressure due to its moderate age at first maturity (5-6 years of age). Sablefish are managed as two stocks: Alaskan sablefish and West Coast (California-CA, Oregon-OR, Washington-WA) sablefish. The Alaskan sablefish stock is fully fished and overfishing is not occurring. Spawning stock biomass is above the $B_{35\%}$ reference point. The long-term trend in abundance is variable, but the short-term trend is up. As such, Seafood Watch® considers the Alaskan sablefish stock to be healthy and a low conservation concern. The West Coast sablefish stock is fully-fished and moderately below B_{MSY}, and overfishing is not occurring. However, the long and short-term abundance trends are down; thus, Seafood Watch® considers the status of the West Coast sablefish stock to be a moderate conservation concern.

Bycatch is a low conservation concern in the Alaskan sablefish fishery and a moderate conservation concern in the West Coast sablefish fisheries. The quantity of bycatch relative to landings is approximately 22% in the Alaskan sablefish fishery, and the trend in bycatch interaction is down. In addition, there is no evidence that bycatch is having adverse impacts on population levels in the Alaskan fishery or is substantially altering the ecosystem. In the West Coast fisheries, sablefish are caught in the fixed-gear sablefish fishery, as well as in groundfish trawl fisheries, which target other groundfish species in addition to sablefish. The amount of bycatch relative to landings in the fixed-gear sablefish fishery is 16.5%. In the West Coast groundfish trawl fishery, the amount of bycatch relative to landings is approximately 47%; however, this percentage is an estimate across all West Coast groundfish fisheries. Bycatch in the West Coast fisheries include five overfished rockfish species, spiny dogfish and some skates, which have life history characteristics that make them highly vulnerable to fishing pressure.

Bottom longlines and pots, which are known to cause moderate damage to habitats, are the primary fishing gear used in the Alaskan sablefish fishery. Scientific studies and modeling suggest that removal of sablefish in the fishery does not have adverse impact on ecosystem structure and function, and "fishing down the food web" is not occurring. Thus, Seafood Watch® considers habitat and ecosystem impacts from the Alaskan sablefish fishery to be a low conservation concern. In the West Coast sablefish fisheries, approximately 55% of the landings are caught by trawls and 40% by bottom longlines. Trawls are known to cause great damage to habitats. The West Coast sablefish fisheries occur in deep, muddy or sandy bottom areas, which are moderately resilient to fishing impacts. In addition, the fisheries occur over a moderate spatial scale, thus having less impact on habitat than a fishery occurring over a larger spatial scale. The effect of the West Coast sablefish fishery on the food web and the ecosystem are unknown. Given this information, Seafood Watch® considers the West Coast sablefish fisheries to have moderate impacts on habitats and the ecosystem. Management in both fisheries is highly effective due to robust stock assessments, regular collection of fishery-dependent and independent data, bycatch mitigation measures, and regular enforcement.

The four issues of low concern (status of stocks, bycatch, habitat and ecosystem impacts, and management effectiveness) in the Alaskan sablefish fishery result in a Seafood Watch® seafood recommendation of **Best Choice** for sablefish from the Alaskan fishery. The four issues of moderate concern (inherent vulnerability, status of stocks, bycatch, and habitat and the ecosystem impacts) in the West Coast (CA, OR, WA) sablefish fisheries result in a Seafood Watch© seafood recommendation of **Good Alternative** for sablefish from West Coast fisheries.

The U.S. North Pacific sablefish fishery (Bering Sea and Gulf of Alaska longline fishery) has been certified as sustainable to the Marine Stewardship Council (MSC) standard. The MSC is an independent non-profit organization, which has developed an environmental standard for sustainable and well-managed fisheries. It uses a product label to reward environmentally responsible fishery management and practices (http://www.msc.org/). Seafood Watch© encourages seafood buyers to ask and look for the MSC logo in fish markets and other retailers of fresh and value-added seafood products.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ **Alaska**	√ **West Coast**		
Nature of Bycatch	√ **Alaska**	√ **West Coast**		
Habitat & Ecosystem Effects	√ **Alaska**	√ **West Coast**		
Management Effectiveness	√			

About the Overall Seafood Recommendation:

- A seafood product is ranked **Avoid** if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.
- A seafood product is ranked **Good Alternative** if the five criteria "average" to yellow (Moderate Conservation Concern) OR if the "Status of Stocks" and "Management Effectiveness" criteria are both of Moderate Conservation Concern.
- A seafood product is ranked **Best Choice** if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.

Overall Seafood Recommendation:

Best Choice	**Good Alternative**	Avoid
Alaska	**West Coast (CA, OR, WA)**	

II. Introduction

Sablefish (*Anoplopoma fimbria*) are members of the Anoplopomatidae family, which includes sablefish and skillfish. They are often given the market name black cod. Sablefish are distributed from Baja, California to the Bering Sea and Japan. Adult sablefish inhabit deep waters, generally at depths of 150-1,500 m, and primarily at depths of 400-1,000 m. Juveniles live in more shallow, nearshore waters, and move into deeper waters as they age (ADF&G 2007a&b). Spawning occurs in the open ocean at depths of 300-500 m (Sigler et al. 2001). Depending on size, females can produce from 100,000 to 1 million eggs per spawn (CA DFG 2007). The eggs develop in deep waters, and larvae develop near the surface. Pelagic juveniles inhabit inshore waters for the first two years, and then begin moving offshore, reaching deep waters at 4 to 5 years of age (Sigler et al. 2001).

Sablefish are divided into two stocks: Alaskan sablefish and West Coast sablefish (CA, OR, and WA). The North Pacific Fishery Management Council (NPFMC) manages Alaskan sablefish within federal waters (3-200 miles offshore), while the Alaska Department of Fish and Game (ADF&G) manages within state waters (0-3 miles offshore). The Pacific Fishery Management Council (PFMC) manages West Coast sablefish.

The majority of the Alaskan sablefish quota is allocated for demersal longline gear, with a smaller portion allocated to pots/traps and trawl gear. The Alaskan sablefish fixed gear fishery (longlines and pots/traps) has been managed under an Individual Fishing Quota (IFQ) system since 1995, which has reduced the number of vessels, reduced crowding, gear conflicts and gear loss, and increased efficiency (NPFMC 2002). West Coast sablefish are caught in the West Coast groundfish fisheries, specifically in the limited-entry groundfish trawl fishery, nearshore fixed-gear groundfish fishery, and fixed-gear sablefish fishery. From 1900 to the 1970s, West Coast sablefish were mainly caught using hook and line. By the 1970s, more pots/traps and trawls were being used. Currently, approximately half of the quota is allocated to trawl gear and half to demersal longline gear (Figure 1).

Alaskan sablefish landings have experienced a slight decrease over the years, but remain at a historically moderate level (Figure 2). In 2005, the Alaskan sablefish fishery landed 16,942.5 metric tons (mt), equivalent to $115,874,029 (NMFS 2005a). Landings in the West Coast sablefish fishery slowly increased in the early 1900s, peaking in the mid-1970's. Landings have decreased since then, but have remained stable at a moderate level since 2000 (Figure 1). In 2005, the West Coast sablefish fishery landed 6,218.6 mt, equivalent to $20,334,570 (NMFS 2005a).

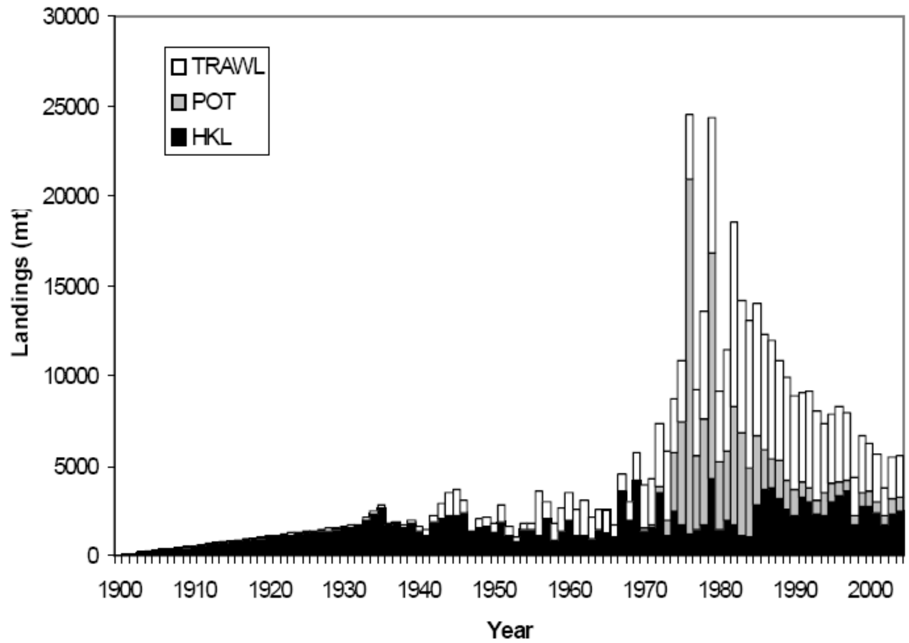

Figure 1. Landings, including foreign catch, by year and gear, of West Coast sablefish (figure from Schirripa and Colbert 2005)

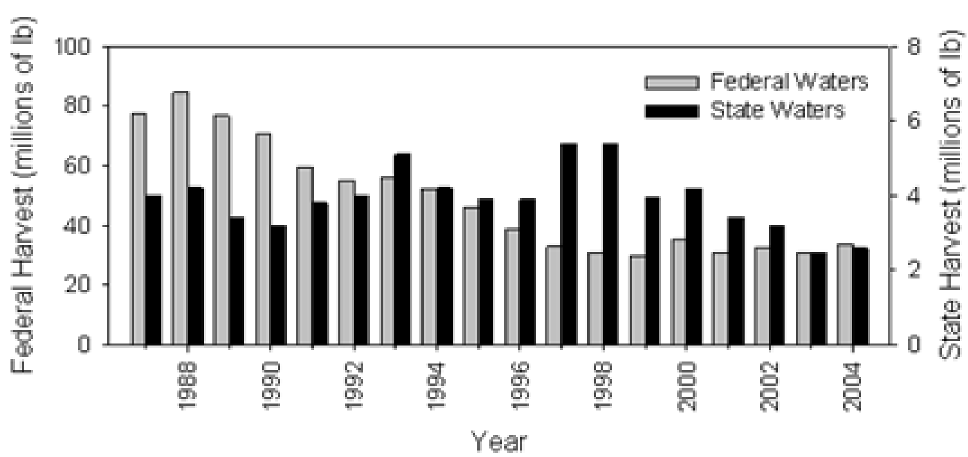

Figure 2. Sablefish landings in Alaska, 1987-2004 (figure from ADF&G 2006).

The U.S. North Pacific sablefish fishery (Bering Sea and Gulf of Alaska longline fishery) has been certified as sustainable to the Marine Stewardship Council (MSC) standard). The MSC is an independent non-profit organization, which has developed an environmental standard for sustainable and well-managed fisheries. It uses a product label to reward environmentally responsible fishery management and practices (http://www.msc.org/).

Scope of the analysis and the ensuing recommendation:
This report focuses on the U.S. sablefish fisheries (California to Alaska), which account for 99.8% of sablefish sold in the U.S. market. Approximately 0.2% of sablefish sold in the U.S.

comes from British Columbia, Canada. The Canadian fishery has been evaluated by SeaChoice and listed as a **Best Choice** (http://www.seachoice.org/files/assessment/report/6/Green_Sablefish_SeaChoice.pdf).

Availability of Science

The National Marine Fisheries Service (NMFS) and ADF&G regularly conduct longline surveys to assess the health of Alaskan sablefish. Catch, effort, and length data are also available from the North Pacific Groundfish Observer Program and vessel logbooks. The Observer Program also provides data on bycatch in the fishery.

NMFS also conducts an annual, coast-wide trawl survey to determine the health of the West Coast sablefish stock. In addition, the landings sampling program and trawl logbook data provide catch-per-unit-effort (CPUE), age, and length data, and the West Coast Groundfish Observer Program (WCGOP) provides bycatch data for the West Coast sablefish fisheries.

Market Availability

Common and market names:
Sablefish is also known as black cod, butterfish, skil, skilfish, beshow, and coalfish. When used for sushi or sashimi, sablefish is commonly sold as *gindara*.

Seasonal availability:
Alaskan sablefish is available fresh from March 15 to November 15. West Coast sablefish is available fresh from April 1 to October 31 (ADF&G 2007a, NWFSC 2004). Sablefish is available frozen year-round.

Product forms:
Sablefish can be purchased on the market as filets and steaks, fresh or frozen.

Import and export sources and statistics:
Sablefish sold in the United States is primarily caught in the United States (99.8%) (NMFS 2005b). Canada provides 0.2% of sablefish sold in U.S. markets (NMFS 2005b). Within the U.S., the majority of sablefish is landed in Alaska (74%), followed by Oregon (11%), Washington (8%), and California (7%) (Figure 3).

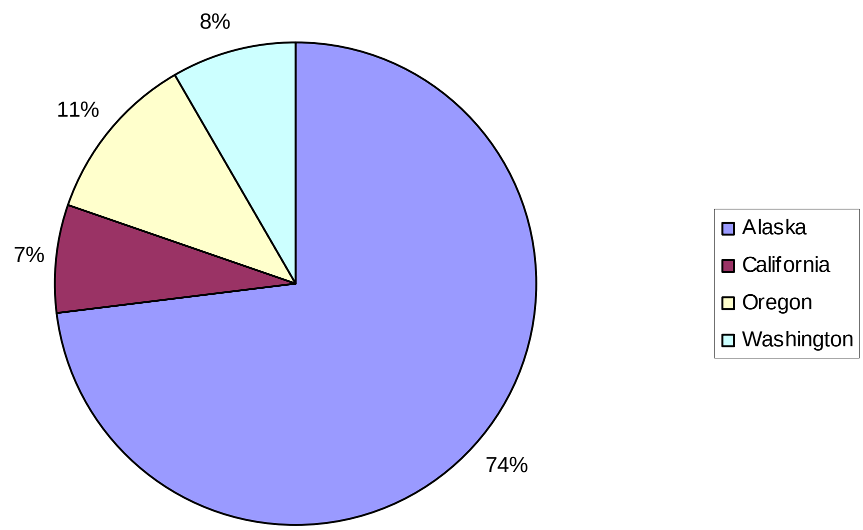

Figure 3. Sources of U.S. catch of sablefish (figure from NMFS 2005b).

III. Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species

Criterion 1: Inherent Vulnerability to Fishing Pressure

Sablefish are distributed from Baja California to the Bering Sea and Japan (Hanselman et al. 2006, Sigler et al. 2001, Fishbase 2007). The intrinsic rate of increase for sablefish is unknown. Sablefish have a moderate age at first maturity, with 50% of females reaching maturity at 6.5 years of age and 50% of males reaching maturity at 5 years of age. The fish are long-lived, regularly living over 40 years of age. The maximum age for sablefish is 94 years in Alaska and 55 years in Canada. The longest living sablefish on record was 114 years of age (Sigler et al. 2001). Sablefish have a high growth rate, with a von Bertalanffy growth coefficient (K) of approximately 0.246 for females and 0.298 for males (PFMC 2006a). Females are highly fecund, and fecundity increases with size. A 28-inch, 7-year-old female is capable of producing 100,000 eggs, while a 40-inch, 20-year-old female is capable of producing 1 million eggs (Hanselman et al. 2006).

Table 1. Life history characteristics of sablefish.

Intrinsic Rate of Increase (r)	Age at Maturity	Growth Rate	Max Age	Max Size	Fecundity	Species Range	Special Behaviors	Sources
Unknown	50% of females mature at 6.5 years of age; 50% of males mature at 5 years of age	K = 0.246 (females), 0.298 (males)	Alaska: 94 years Canada: 55 years Record: 114 years	80-85 cm	100,000 – 1 million eggs	Baja California to the Bering Sea and Japan	None	Sigler et al. 2001, Fishbase 2007, Fisheries and Oceans Canada 2007, Hanselman et al. 2006, PFMC 2006a

Synthesis
The intrinsic rate of increase for sablefish is unknown. However, sablefish have a moderate age at first maturity, with 50% of females reaching maturity at 6.5 years of age and 50% of males reaching maturity at 5 years of age. This results in sablefish being moderately vulnerable to fishing pressure.

Inherent Vulnerability Rank:

Resilient | **Moderately Vulnerable** | Highly Vulnerable

Criterion 2: Status of Wild Stocks

Alaska
Sablefish are assessed as a single stock in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) (NPFMC 2006a). The NPFMC has developed a Tier system in which reference point calculations vary based on the amount of available information. Sablefish is a Tier 3 species, which has a target fishing rate (maximum permissible fishing rate) of $F_{40\%}$ (0.092) and an overfishing level of $F_{35\%}$ (0.109). The two spawning biomass reference points are $B_{40\%}$ (123,900 tons) and $B_{35\%}$ (108,000 tons) (Figure 4). The minimum stock size threshold (MSST) or limit reference point is $B_{17.5\%}$ (half the $B_{35\%}$). If spawning biomass falls below $B_{35\%}$ then overfishing is occurring (MSC 2006; Hanselman et al. 2006).

The Alaskan sablefish stock is considered to be fully fished. Current population abundance is 95% of $B_{40\%}$ and 110% of $B_{35\%}$. Spawning biomass is not below $B_{35\%}$ (Figure 4). The harvest control rule in Alaska reduces the maximum permissible yield from 0.092 to 0.088 to prevent overfishing from occurring. The current fishing rate (0.088) relative to the overfishing level ($F_{35\%}$) is 0.81; therefore, overfishing is not occurring (Hanselman et al. 2006). NPFMC estimated the probability that spawning biomass falls below $B_{40\%}$, $B_{35\%}$, and $B_{17.5\%}$ (MSST). During the next three years, the probability of falling below $B_{17.5\%}$ is near zero, the probability of being below $B_{40\%}$ is 0.60, and the probability of falling below $B_{35\%}$ is 0.19 (Hanselman et al. 2006).

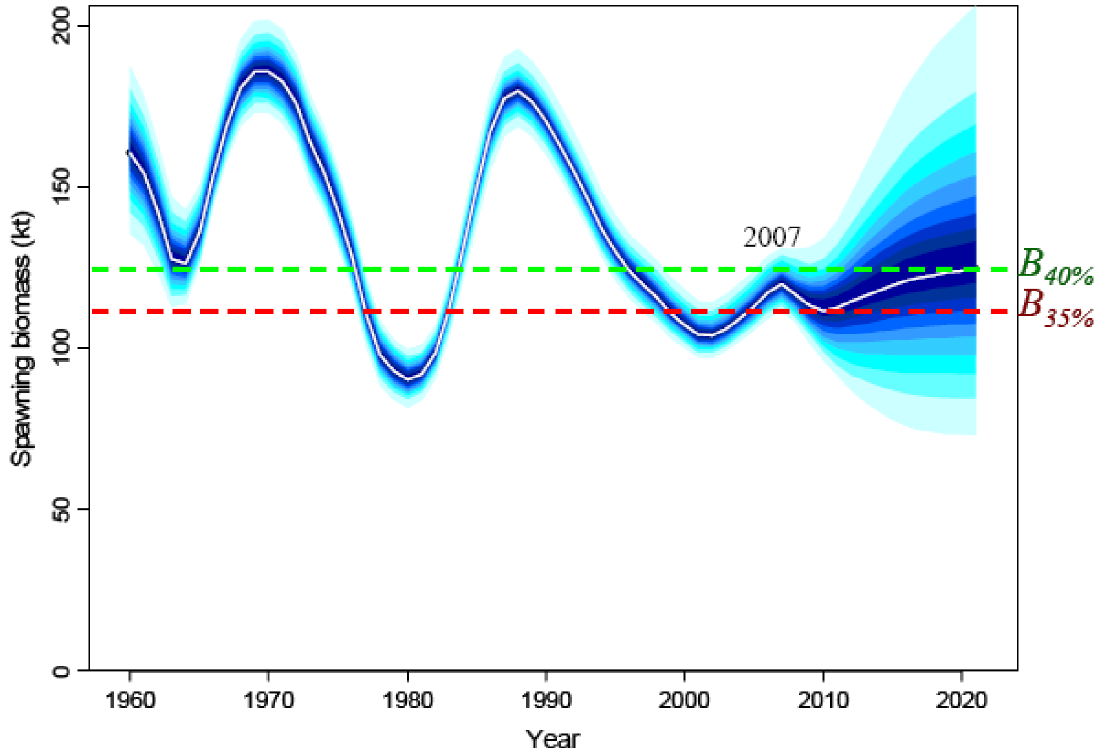

Figure 4. Estimates of female spawning biomass (thousands mt) and their uncertainty. White line is the median and shaded fills are 5% increments of the posterior probability distribution of spawning biomass based on 5,000,000 MCMC simulations. Width of shaded area is the 95% credibility interval.
(figure from Hanselman et al. 2006)

Population abundance has varied since the 1960s, experiencing three valleys and two peaks (Figures 4 & 5). The decrease in abundance after the peak in 1970 was likely due to heavy fishing. The peak in 1985 was likely due to the exceptional year classes in the late 1970s (Hanselman et al. 2006). Since 1985, abundance has decreased substantially (Figure 5). Abundance decreased faster in the Eastern Bering Sea, Aleutian Islands, and western Gulf of Alaska than in the central and eastern Gulf of Alaska (Figure 6). These regional changes are probably due to the fact that small sablefish typically migrate westward, while large sablefish typically migrate eastward (Hanselman et al. 2006). Since 2000, population abundance has been increasing. The 2005 abundance is 16% higher than in 2000 (one of the record lows). NPFMC projects that abundance will remain stable because estimated year classes between and following the strong 1997 and 2000 year classes are near average (Hanselman et al. 2006).

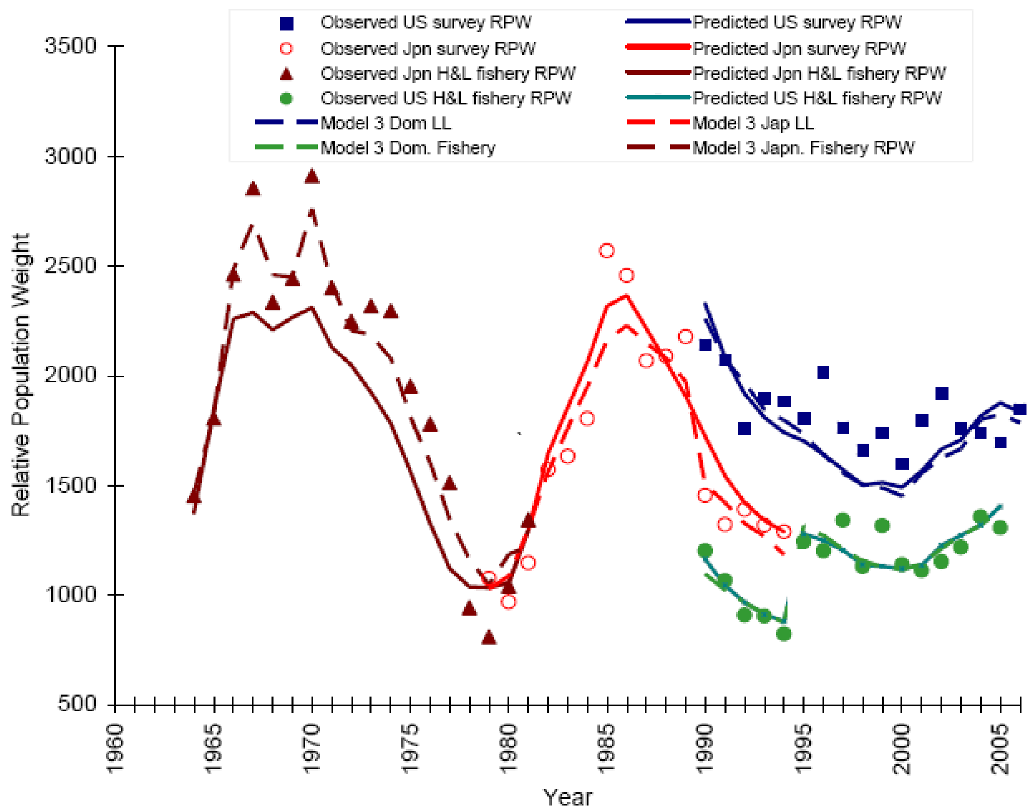

Figure 5. Observed and predicted sablefish relative abundance. Solid lines are from Model 1 while dashed lines are from Model 3 (figure from Hanselman et al. 2006).

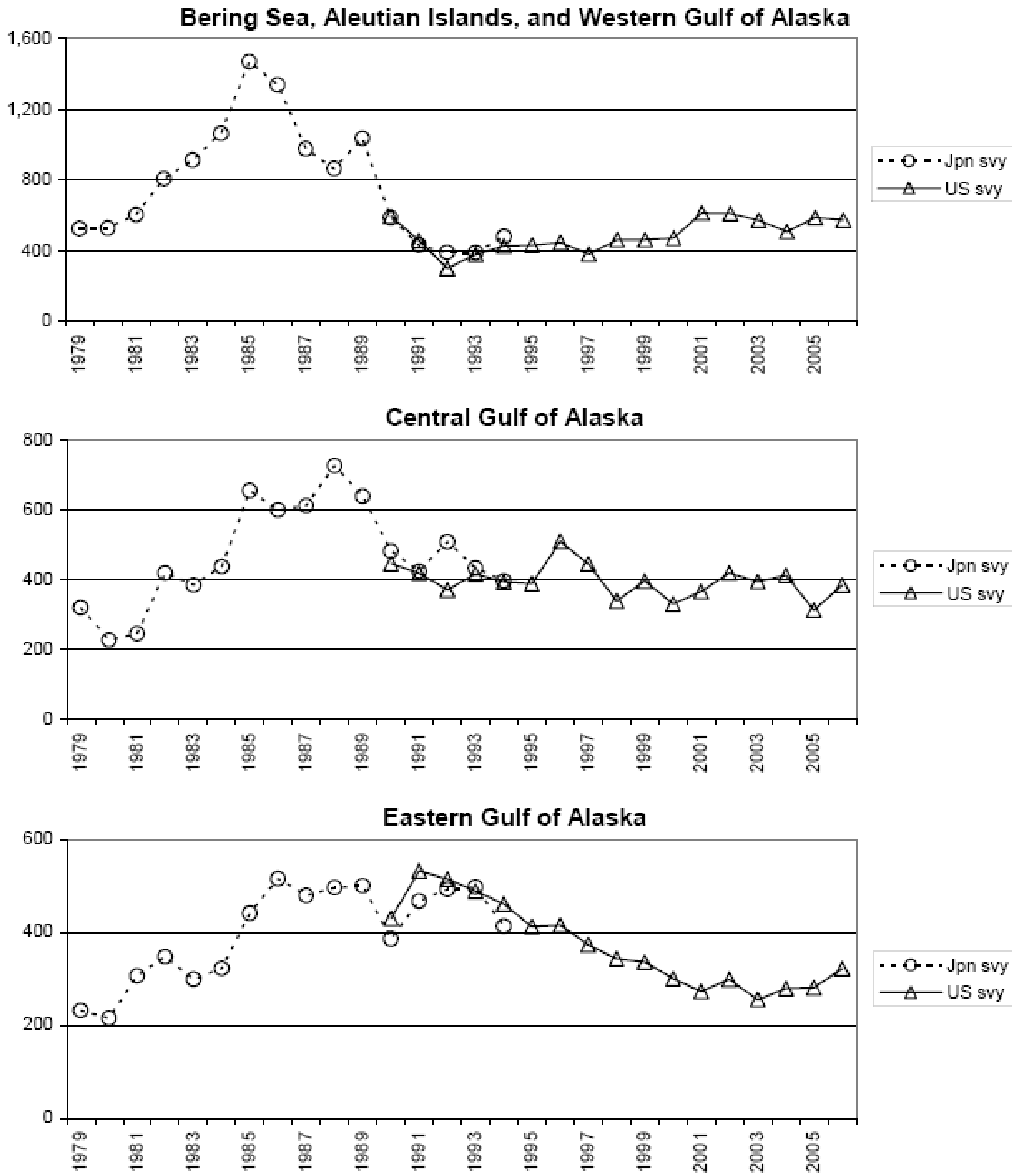

Figure 6. Relative abundance (weight) by region and survey. The two surveys are the Japan-U.S. cooperative longline survey and the domestic (U.S.) longline survey. In this plot, the values for the U.S. survey were adjusted to account for the higher efficiency of the U.S. survey gear (figure from Hanselman et al. 2006).

West Coast

For the West Coast sablefish stock, current spawning stock biomass (SSB = 75,070 mt) is 86% of B_{MSY} (40% of unfished SSB = 87,544 mt). The stock is considered to be overfished when current SSB is less than 25% of unfished biomass. The current SSB is 34% of unfished biomass;

therefore, it is not overfished. In addition, the total catch (5,687 mt) was only 68% of the allowable biological catch (8,368 mt). According to PFMC's model, the current depletion level for the year 2005 is estimated to be 34.3% (Schirripa and Colbert 2005) (Figure 7).

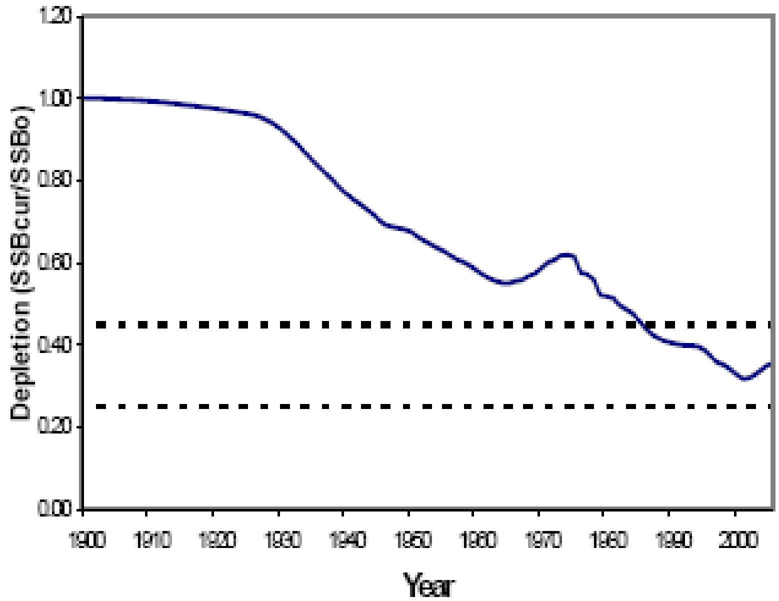

Figure 7. Estimated depletion level for sablefish from base case model. Note the top dashed line represents MSY (F45%) and the bottom dashed line represents the overfished level (figure from Schirripa and Colbert 2005).

Sablefish SSB has steadily declined since 1900 (Figure 8). Two strong year classes occurred in 1999 and 2000, but this level of recruitment did not continue during 2001-2005. PFMC projects a short-term increase in biomass, followed by a continued decline. The size/sex/age distribution of the stock is functionally normal (Schirripa 2007).

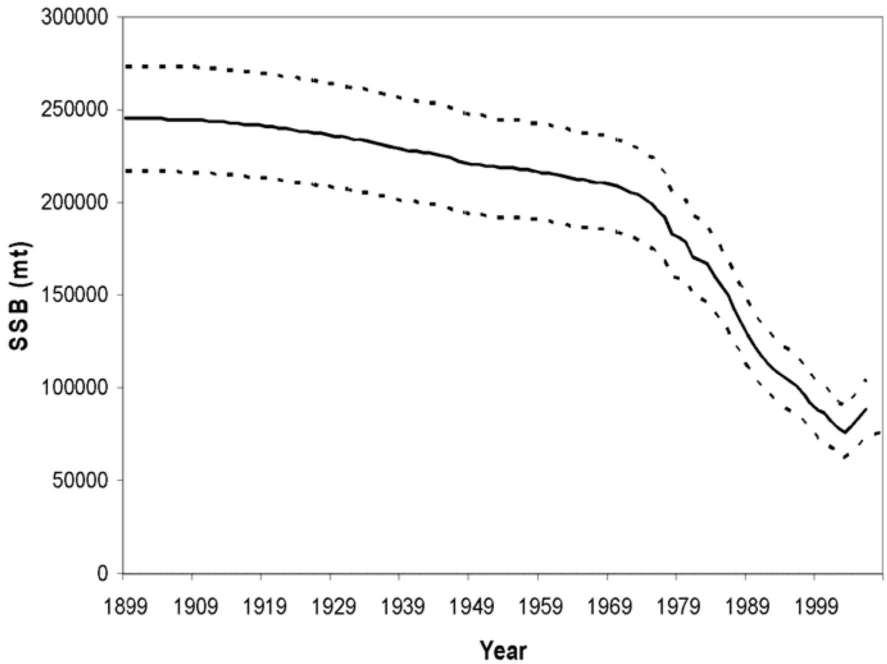

Figure 8. Estimated spawning stock biomass with approximate 95% confidence intervals (figure from Schirripa 2007).

Table 2. Stock status of sablefish.

Stock	Status	B/B_{MSY}	Occurrence of Overfishing	F/F_{MSY}	Abundance Trends/ CPUE	Age/Size/ Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Alaska	Fully fished	B40%: 118,800t/ 123,900t = 95% B35%: 108,000t/ 123,900t = 110%	Overfishing is not occurring	.088/.109 = .81	Long-term: variable Short-term: increase	Normal	Low	Hanselman et al. 2006	Low
West Coast (WA, OR, CA)	Fully fished	75,070mt/ 87,544mt = 86%	Overfishing is not occurring	5,687mt/ 8,368mt = .68	Long-term: decline Short-term: decline	Normal	Low	Schirripa and Colbert 2005, Hastie and Bellman 2006	Moderate

Synthesis

Alaska

The Alaskan sablefish stock is considered to be fully fished. Population abundance has varied since the 1960s, experiencing three valleys and two peaks. Since 2000, population abundance has been increasing. Current population abundance is 95% of $B_{40\%}$ and 110% of $B_{35\%}$. Spawning stock biomass is not below $B_{35\%}$, and the current fishing rate (0.088) relative to the overfishing level ($F_{35\%}$) is 0.81; therefore, overfishing is not occurring. The size/sex/age distribution is functionally normal. Given this information, Seafood Watch® considers the Alaskan sablefish stock to be healthy.

West Coast
Current spawning stock biomass is 86% of B_{MSY}. The current SSB is greater than 25% of unfished biomass (34%), and the total catch in 2005 was only 68% of the allowable biological catch; therefore, the stock is not overfished and overfishing is not occurring. However, SSB has steadily declined since 1900. Due to strong year classes in 1999 and 2000, PFMC projects a short-term increase, followed by a continued decline. The size/sex/age distribution of the stock is functionally normal. Given this information, Seafood Watch® considers the status of the West Coast (CA, OR, WA) sablefish stock to be a moderate conservation concern.

Status of Wild Stocks Rank:

Healthy	**Moderate/Rebuilding**	Poor	Critical
Alaska	**West Coast (CA, WA, OR)**		

<u>Criterion 3: Nature and Extent of Bycatch</u>

Seafood Watch® defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for and managed in some way.

Alaska
Bycatch in the Alaskan sablefish fishery includes small, immature sablefish and a variety of non-target species. The capture of non-target species is monitored by the North Pacific Groundfish Observer Program. Observer coverage in the sablefish fishery is only slightly over 20%, but is enough to provide a quantitative estimate of bycatch (MSC 2006). In 2005, the amount of discarded catch of sablefish relative to sablefish landings equaled 1%. Discards of non-target species relative to sablefish landings equaled approximately 21% (Table 3).

The non-target species caught most often in the Alaskan sablefish fishery is grenadier. This species has high population abundance, well above the overfishing level, in the Gulf of Alaska, Bering Sea, and Aleutian Islands (Clausen 2007); therefore, bycatch of this species is not a high conservation concern.

Under the current IFQ system, the Alaskan sablefish longline fishery has likely reduced discards of all non-target species because of the slower pace of the fishery and the incentive to maximize value from the catch. In addition, catch of immature fish has decreased and the probability of a fish reproducing at least once has increased. Spawning potential of sablefish has increased 9% for the IFQ fishery (MSC 2006).

Table 3. Catch of non-target species relative to sablefish landings in Alaska (data from NPFMC 2006a).

2005 Sablefish Landings (mt)	Non-target Species	Non-target Catch (mt)	Percent Non-target Catch Relative to Sablefish Landings
16942.5	birds	0.12	0.00%
	brittle stars	0.18	0.00%
	corals	0.31	0.00%
	eelpouts	1.32	0.01%
	grenadier	3232.75	19.08%
	sculpin	3.53	0.02%
	octopus	0.12	0.00%
	anemone	0.23	0.00%
	sea star	1.4	0.01%
	shark	19.1	0.11%
	sleeper	10.48	0.06%
	salmon	0.23	0.00%
	dogfish	8.4	0.05%
	skate	96.89	0.57%
	big	2.44	0.01%
	longnose	11.77	0.07%
	other	82.68	0.49%
	snails	2.92	0.02%
	sponge	0.65	0.00%
			20.51%

Bycatch in the Alaskan longline sablefish fishery also includes seabirds, such as short-tailed albatross and Laysan albatross, both classified as vulnerable to extinction by the IUCN, and black-footed albatross, which is classified as endangered by the IUCN (IUCN 2006). Longlines attract scavenging seabirds that attempt to eat bait off hooks as they are released from the vessels, and sometimes the seabirds swallow the hook in addition to the bait and are then pulled under the surface and drowned. Seabirds can also drown when they become entangled in the fishing lines. In Alaska's demersal longline fisheries, 10,000-27,000 seabirds were hooked each year prior to the implementation of streamer lines, a seabird bycatch reduction device that scares seabirds away from longlines (Melvin et al. 2001). Since most scavenging seabirds are long-lived and have low fecundity, the mortality of these birds in the demersal longline fisheries can have substantial adverse impacts on their populations (Lewison and Crowder 2003 as cited in MSC 2006). Bycatch of the short-tailed albatross receives the most attention in the demersal longline fisheries due to its endangered status (Melvin et al. 2001).

Streamer lines, developed by the Japanese, have proven to be the most cost-effective solution to reducing seabird bycatch in the demersal longline fisheries (Figure 9). Two main lines are positioned on each side of the longline and extend behind the boat, with floats attached to the ends. Brightly colored streamer lines are attached to the groundlines. The bright colors and the flapping of the lines scare seabirds away from the baited hooks (Morgan and Chuenpagdee 2003). The Washington Sea Grant Program conducted a 2-year study of possible seabird mitigation strategies in two major Alaskan demersal longline fisheries: the Gulf of Alaska/Aleutian Islands fishery for sablefish/halibut; and the Bering Sea catcher-processor longline fishery for Pacific cod. In 2000, paired streamer lines completely eliminated albatross and northern fulmar bycatch in these two fisheries. Single streamer lines were slightly less effective than paired streamer lines, reducing seabird bycatch by 96% and 71% in the sablefish/halibut and cod fisheries, respectively (Melvin et al. 2001).

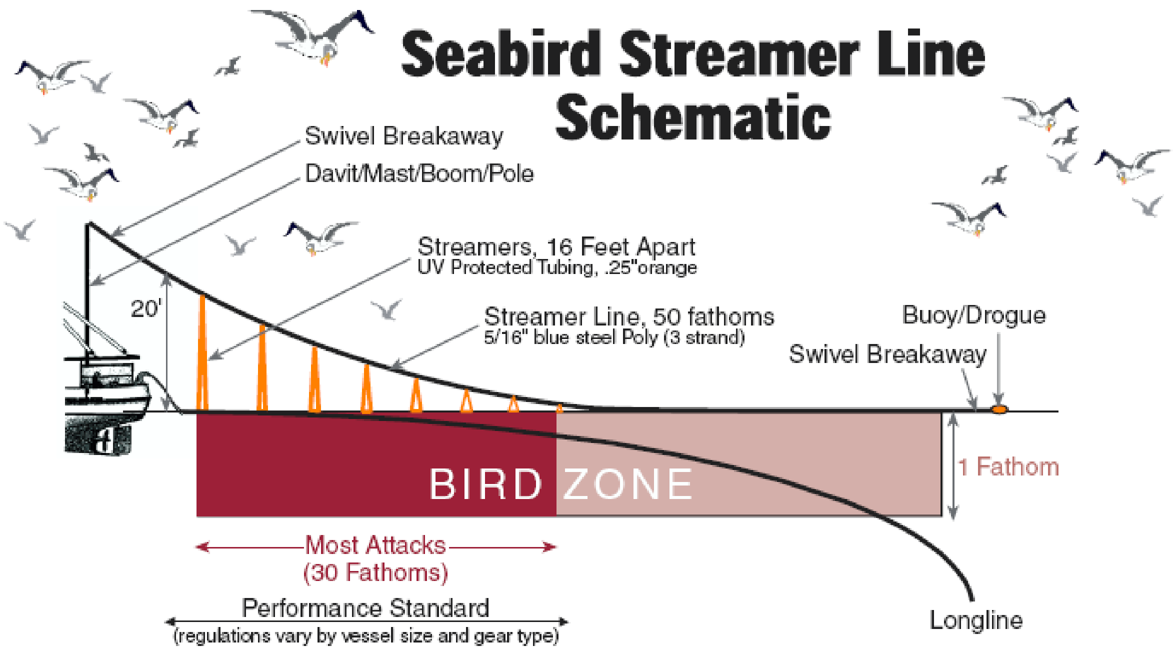

Figure 9: Schematic of seabird streamer lines (figure from Melvin 2002).

Killer whales and sperm whales also sometimes interact with groundfish longline fisheries in Alaska. From 1993-1997, one killer whale died in the Bering Sea/Aleutian Islands (BSAI) groundfish longline fisheries, which includes miscellaneous finfish and sablefish fisheries. This resulted in a mean annual mortality rate of 0.2. Killer whales are not listed as "depleted" under the Marine Mammal Protection Act (MMPA) or listed as "threatened" or "endangered" under the Endangered Species Act (ESA) (NOAA Fisheries 1999). Because the annual mortality rate is very low and spread across all BSAI groundfish longline fisheries, and killer whales are not endangered or threatened, mortality of killer whales in the sablefish fishery is at present a low conservation concern. From 2000-2004, one sperm whale death occurred in the Gulf of Alaska sablefish longline fishery. This resulted in a mean annual mortality rate of 0.45. Sperm whales are listed as "endangered" under the ESA and "depleted" under the MMPA. However, on the basis of total abundance, current distribution, and regulatory measures that are currently in place, it is unlikely that this stock is in danger of extinction (Angliss and Outlaw 2006). Given the low annual mortality rate and sperm whale current abundance and distribution, mortality of sperm whales in the sablefish fishery is a low conservation concern.

West Coast

West Coast sablefish are caught in the West Coast Groundfish fisheries, specifically in the limited-entry groundfish trawl and fixed-gear sablefish fisheries. In 2001, the National Marine Fisheries Service (NMFS) initiated the mandatory West Coast Groundfish Observer Program (WCGOP), and the first observers were placed aboard vessels in August 2001. The program collects bycatch data on commercial vessels that catch groundfish off the U.S. West Coast (NWFSC 2006a; Hastie and Bellman 2006).

In the 2005 West Coast commercial groundfish trawl fishery, the percent of total discards (sablefish + non-target species) relative to landings equaled 47% (Table 4). It should be noted that this percentage is the total percent of discards across the West Coast commercial groundfish trawl fishery, which targets other groundfish species in addition to sablefish. Therefore, these percentages are the maximum amount of discards. The percent of total discards relative to landings in the 2005 fixed-gear sablefish fishery equaled 16.5% (Table 5) (Hastie and Bellman 2006).

Discards in the West Coast sablefish fisheries include eight rebuilding species, five of which are overfished: widow rockfish, yelloweye rockfish, boccacio, cowcod, and darkblotched rockfish (highlighted in blue in Tables 4 and 5). Management measures are in place, however, to reduce bycatch and mortality of these species. Spiny dogfish and some skates are also caught and discarded. Bycatch of these species may impact their population levels, because their life history characteristics of long lifespan, slow growth, and low fecundity make them highly vulnerable to fishing mortality. It is unknown if discards of species caught as bycatch in West Coast sablefish fisheries are altering the ecosystem.

Table 4. Estimated percent discard mortality relative to landings in the West Coast groundfish trawl fishery during 2005. The 2005 total estimated West Coast non-whiting commercial groundfish trawl landings were approximately 19,134 mt. Overfished species are highlighted in blue (data from Hastie and Bellman 2006).

Discarded species	Amount of discards (mt)	Percent discard relative to west coast non-whiting commercial groundfish trawl landings
Other groundfish	1,524	7.97%
Arrowtooth flounder	1,397	7.31%
Spiny dogfish	1,067	5.58%
Pacific hake/whiting	822	4.30%
Other flatfish	731	3.82%
Dover sole	656	3.43%
Longnose skate	637	3.33%
Sablefish	524	
mortality*	262	1.37%
Lingcod	383	
mortality*	192	1.00%
English sole	302	1.58%
Dungeness crab	254	1.33%
Tanner crab	252	1.32%
Splitnose rockfish	144	0.75%
Unspecified skate	138	0.72%
Shortspine thornyhead	133	0.70%
Big skate	111	0.58%
Longspine thornyhead	92	0.48%
Other shelf rockfish	81	0.42%
Petrale sole	55	0.29%
Chilipepper rockfish	52	0.27%
Yellowtail rockfish	29	0.15%
Boccacio	27.7	0.14%
Other slope rockfish	27	0.14%
Darkblotched rockfish	23.7	0.12%
Canary rockfish	21.6	0.11%
Pacific ocean perch	10.8	0.06%
Pacific cod	4	0.02%
Widow rockfish	3.3	0.02%
Blackgill rockfish	2	0.01%
Cowcod	1.4	0.01%
Black rockfish	1	0.01%
Shortbelly rockfish	1	0.01%
Yelloweye rockfish	0.6	0.00%
Other nearshore rockfish	0	0.00%
Total	**8,427.3**	**47.35%**

* The PFMC's Groundfish Management Team assumes a rate of mortality for discarded sablefish and lingcod in the trawl fishery to be 50%.

Table 5. Estimated percent discard mortality relative to landings in the West Coast fixed gear sablefish fishery during 2005. The 2005 total estimated West Coast fixed-gear sablefish landings were 3,069 mt. Overfished species are highlighted in blue (data from Hastie and Bellman 2006).

Discarded species	Amount of discards (mt)	Percent discard relative to west coast fixed-gear sablefish landings
Sablefish	421	
mortality*	84	2.74%
Spiny dogfish	149.6	4.87%
Arrowtooth flounder	82.6	2.69%
Longnose skate	54.3	1.77%
Big skate	45.4	1.48%
Unspecified skate	19	0.62%
Other slope rockfish	17.7	0.58%
Other shelf rockfish	14.2	0.46%
Lingcod	10.5	0.34%
Other groundfish	8.8	0.29%
Tanner crab	8.7	0.28%
Dover sole	3.7	0.12%
Pacific cod	2.3	0.07%
Dungeness crab	1.2	0.04%
Shortspine thornyhead	1.1	0.04%
Widow rockfish	0.8	0.03%
Yelloweye rockfish	0.8	0.03%
Darkblotched rockfish	0.6	0.02%
Pacific whiting/hake	0.6	0.02%
Yellowtail rockfish	0.4	0.01%
Blackgill rockfish	0.4	0.01%
Pacific ocean perch	0.3	0.01%
Longspine thornyhead	0.1	0.00%
Canary rockfish	0	0.00%
Bocaccio rockfish	0	0.00%
Cowcod rockfish	0	0.00%
Petrale sole	0	0.00%
English sole	0	0.00%
Other flatfish	0	0.00%
Chilipepper rockfish	0	0.00%
Splitnose rockfish	0	0.00%
Total	**507.1**	**16.52%**

* The PFMC's Groundfish Management Team assumes a rate of mortality for discarded sablefish in the fixed-gear fishery to be 20%.

Synthesis

Alaska

The quantity of bycatch relative to sablefish landings in the Alaskan fishery is approximately 20.5%. This bycatch includes small sablefish and a variety of non-target species, particularly grenadier. Under the IFQ system, the fishery has likely reduced discards of non-target species because of the slower pace of the fishery and the incentive to maximize value from the catch.

Seabirds have also historically interacted with the Alaska longline fishery; however, the trend in seabird bycatch has been decreasing due to widespread use of seabird mitigation measures (i.e., streamer lines). There is no evidence that bycatch in the fishery is having an adverse impact on population levels or substantially altering the ecosystem. Given this information, Seafood Watch® deems bycatch in the Alaskan sablefish fishery a low conservation concern.

West Coast

The quantity of bycatch relative to landings in the West Coast groundfish trawl fishery is estimated to be approximately 47%. It should be noted that this fishery targets other groundfish species in addition to sablefish. As such, this percentage is the maximum amount of bycatch caught as a result of the West Coast groundfish trawl fishery targeting sablefish. In addition, the quantity of bycatch relative to landings in the fixed-gear sablefish fishery is estimated to be approximately 16.5%. The total estimated amount of bycatch for the trawl and fixed-gear fisheries combined is approximately 63.5%. Bycatch in these fisheries include five overfished species, spiny dogfish, and some skates, which have life history characteristics that make them highly vulnerable to fishing pressure. Given the moderate amount of bycatch, and the highly vulnerable species that are caught as bycatch, Seafood Watch® deems bycatch in the West Coast sablefish fishery a moderate conservation concern.

Nature of Bycatch Rank:

Low	**Moderate**	High	Critical
Alaska	**West Coast (CA, OR, WA)**		

Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems[1]

Sablefish are caught with fixed gear (bottom long-lines or pots) or trawls. In Alaska, the sablefish quota is allocated by gear type, with the majority of the overall quota allocated to fixed gear. In the Western Gulf of Alaska, 80% is allocated to fixed gear (including pots) and 20% to trawls; in the Eastern Gulf of Alaska, 95% is allocated to fixed gear and 5% to trawls; in the Eastern Bering Sea, 50% is allocated to fixed gear and 50% to trawls; and in the Aleutian Islands, 75% is allocated to fixed gear and 25% to trawls (Hanselman et al. 2006). In the West Coast sablefish fishery (WA, OR, and CA), approximately 55% of sablefish landings are caught by trawls, 40% by longlines, and 5% by pots (Schirripa and Colbert 2005).

Habitat Effects

The extent of fishing gear impacts on habitat and the ecosystem depends on the spatial scale of the fishery and the type of habitat where fishing occurs (Morgan and Chuenpagdee 2003). The

[1] A portion of this section was taken verbatim from the Seafood Watch Atlantic Flatfishes Report written by Melissa Mahoney Stevens and the Seafood Watch Wild-caught Coldwater Shrimp Report written by Santi Roberts. The Atlantic Flatfishes report is available at:
http://www.mbayaq.org/cr/cr_seafoodwatch/content/media/MBA_SeafoodWatch_AtlanticFlounderReport.pdf
The Wild-caught Coldwater Shrimp Report is available at:
http://www.mbayaq.org/cr/cr_seafoodwatch/content/media/MBA_SeafoodWatch_ColdwaterShrimpReport.pdf

sablefish fishery covers a moderate geographic scale, occurring in the Pacific Ocean from Alaska to California; thus, the fishery has less impact on habitats and ecosystems than one occurring in multiple ocean basins. The preferred habitat of sablefish is deep, muddy or sandy bottom areas, which are known to be moderately resilient to fishing (Morgan and Chuenpagdee 2003; HMSC 2003). Soft sediments are less likely to be impacted than hard structures that rise above the seafloor, such as coral (Quandt 1999).

A 2002 study by the National Research Council (NRC) emphasized the potential of fishing rationalization[2] to decrease fishing effects on essential fish habitat (EFH). Rationalization should reduce the overall number of hours of bottom contact, thus, reducing habitat impacts. The Alaskan halibut/sablefish fisheries have been rationalized by implementation of an Individual Fishing Quota (IFQ) program. The fast pace of the fishery significantly decreased under rationalization. The slower paced fishery and longer fishing seasons should result in less fishing of marginal areas where habitat impacts might occur, a reduction in lost gear and bycatch, and a decrease in the disruption of stock structure and behavior (NPFMC 2006b).

Bottom longlines

Bottom longline gear consists of short lines (gangions), each with a baited hook, attached to a long stationary line (groundline). Weights are added to the lines so that they rest on or slightly above the seafloor. The lines are marked with buoys at the surface. Bottom longlines are usually left to soak from several hours to several days.

Bottom longlines are known to have moderate impacts on habitats and ecosystems (Figure 10). They are substantially less damaging than bottom trawls or dredges because they are a fixed gear, so although they are bottom gear, they have contact with a substantially smaller area of the seafloor than these more mobile gears (Morgan and Chuenpagdee 2003).

[2] Fishery rationalization programs are implemented to optimize fisheries by controlling access and effort (e.g., limited entry, individual quotas, cooperatives).

Figure 5 Experts' Impact Rating, Survey Severity Ranking, and Policy Implications

GEAR CLASS	HABITAT IMPACTS Physical	Biological	BYCATCH Shellfish & crabs	Finfish	Sharks	Marine mammals	Sea birds & turtles	MANAGEMENT CATEGORY (Policy responses)
Trawls – bottom	5	5	3	5	2	2	2	HIGH IMPACT (Very Stringent)
Gillnets – bottom	3	2	1	4	3	4	3	
Dredges	5	5	4	2	1	1	1	
Gillnets – midwater	1	1	1	4	4	5	5	
Pots and traps	3	2	4	2	1	3	1	MEDIUM IMPACT (Moderately Stringent)
Longlines – pelagic	1	1	1	3	4	3	5	
Longlines – bottom	2	2	1	4	3	1	2	
Trawls – midwater	1	1	1	3	2	2	2	LOW IMPACT (Least Stringent)
Purse seines	1	1	1	2	2	3	2	
Hook and line	1	1	1	2	3	1	2	

KEY: 5 VERY HIGH IMPACT 4 HIGH IMPACT 3 MEDIUM IMPACT 2 LOW IMPACT 1 VERY LOW IMPACT

Figure 10. Experts' Impact Rating, Survey Severity Ranking, and Policy Implications. Note the "medium impact" of pots and traps and bottom longlines, and the "high impact" of bottom trawls (figure from Morgan and Chuenpagdee 2003).

The bycatch observer program in the Alaskan groundfish longline fishery has shown that the bottom longlines bring up a small amount of corals (Livingston 2001 & 2003 as cited in MSC 2006), and this bycatch of corals is likely to be particularly associated with the sablefish longline fishery since it occurs in deeper waters. However, the frequency of coral bycatch is low, suggesting that the impact of the fishery on habitat is small. Bycatch of all habitat areas of particular concern (HAPC) biota (seapens/whips, sponges, anemones, tunicates and coral) comprises about 5% of total non-target species caught in all Bering Sea/Aleutian Islands groundfish fisheries combined and less than 0.5% of total non-target species caught in all of the Gulf of Alaska groundfish fisheries (Figure 11) (NPFMC 2006d, MSC 2006).

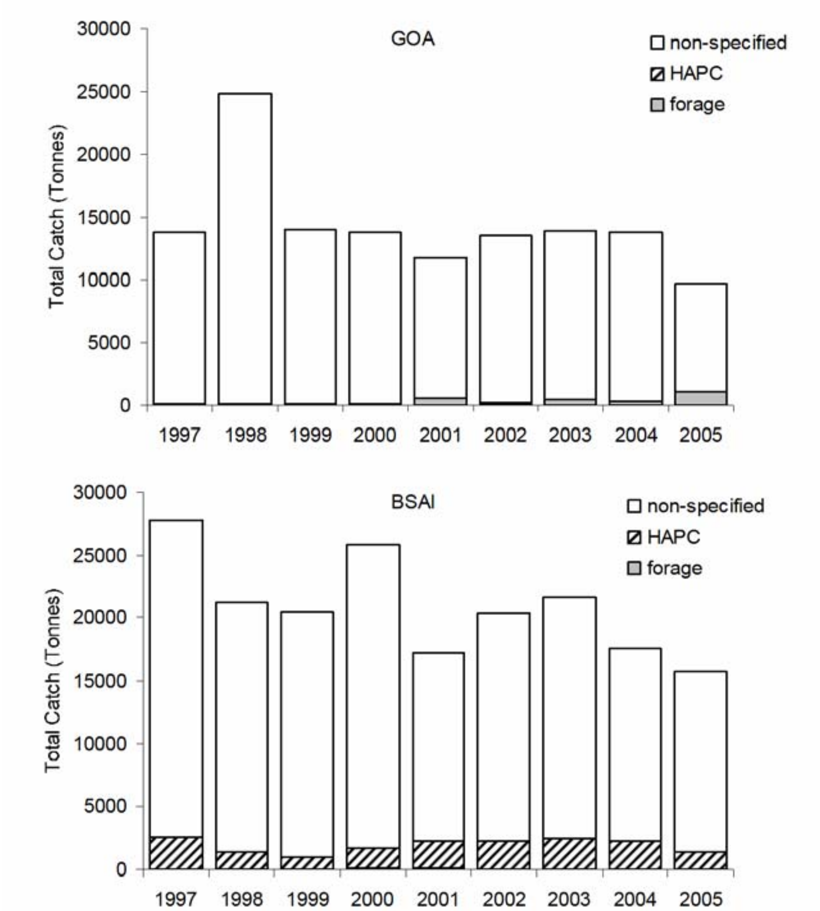

Figure 11. Total catch of non-target species (tons) in the BSAI and GOA areas by groundfish fisheries (figure from NPFMC 2006d).

Pots

Pots are known to have moderate impacts on habitats and ecosystems (Figure 10). Similar to bottom longlines, pots are considerably less damaging than trawls or dredges because they are not mobile, so although they are bottom gear, they have contact with a substantially smaller area of the seafloor than these more mobile gears. Pots can affect habitat, however, because they do not necessarily remain stable on the seafloor. Pots bounce off the seafloor in the presence of large swells, and get dragged across the seafloor when being removed, especially during a storm or if pots are stuck in the sand (Morgan and Chuenpagdee 2003).

Eno et al. (2001) studied the effects of pots set over a wide range of sediment types. They observed that mud communities fully recovered from pot impact within 72-144 hours of pot removal. Hauling the pots along the bottom during pot removal left a track in the sediments, but biological abundance within the area was not affected. It is important to note that this conclusion is based on the physical manifestation of pot disturbance, but not on a solid understanding of changes in infaunal organisms (NFMS 2004).

The setting and retrieval of pots are thought to have larger impacts on the hard, rocky bottom areas, such as in certain areas of the Alaskan sablefish fishery. These hard bottom areas are home to attached invertebrates, including corals, sponges, and sea stars, which provide food and shelter for crabs and fish. Corals are more vulnerable to adverse impacts from fishing gear than sand and mud bottom habitat (Barnette 2001). Once damaged, recovery of corals may take decades or longer (Roberts and Hirshfield 2004). Damage is inflicted where the pots rest directly on the corals, but also during hauling if the gear is not hauled directly up, and instead is dragged for some distance over the seabed (Appledorn et al. 2000).

Trawls

Trawls are mobile fishing gear in which a large, cone-shaped net is towed behind a vessel. The net is held open by a beam, or by the force of water pressure against the trawl doors. Each door can weigh thousands of pounds. The net is attached to the doors by a weighted bridle that connects to a bottom foot rope and a buoyed head rope (Morgan and Chuenpagdee 2003).

Bottom trawling is generally recognized as having high impacts on habitats and ecosystems (Figure 10). Trawling impacts sea-floor communities by scraping the ocean bottom causing: 1) sediment re-suspension (turbidity) and smoothing; 2) removal and/or damage to non-target species; and 3) destruction of three-dimensional habitat (biotic and abiotic) (Auster and Langton 1999). Several studies on the effects of bottom trawling have focused on the heavily trawled fishing grounds in the northwest Atlantic (Collie et al. 1997; Collie et al. 2000). Pereira et al. (1999), for example, conducted an experimental trawl study on the Grand Banks off Newfoundland and reported that “otter trawling on a sandy bottom ecosystem can produce detectable changes on both benthic habitat and communities, in particular a significant reduction in the biomass of large epibenthic fauna”. At a workshop to assess the effects of fishing gear on marine habitats off the northeastern U.S., experts concluded that the “greatest impacts from otter trawls occur in low and high energy gravel habitats and in hard clay outcroppings” (NOAA 2002b, p. 24). Based on the results of this and other studies, it is apparent that bottom trawling may alter the surrounding ecosystem, as well as reduce survival of the target species, by reducing or altering available habitat and food resources.

In a review of fishing effects, Collie et al. (2000) found that fauna associated with sandy (coarser) sediments were less affected by trawl disturbance than those in soft, muddy (biogenic) sediments. Recovery rates appear to be slower in muddy and structurally complex habitats, while mobile sandy sediment communities can withstand 2-3 trawl passes per year without significant adverse change to physical structure or biota (Collie et al. 2000).

Ecosystem Effects

Alaska

The Alaska Fisheries Science Center (AFSC) conducted a study to determine whether North Pacific fisheries (of which Alaskan sablefish is a part) were “fishing-down” the food web. They determined total catch, trophic level of the catch, and Pauly’s Fishery is Balanced (FIB) index in the Eastern Bering Sea (EBS), Aleutian Islands (AI), and Gulf of Alaska (GOA). AFSC showed alternation of similar trophic level species rather than a removal of top-level predators and subsequently, targeting of lower trophic level species. The stability of the trophic level of catches in the EBS, AI, and GOA also indicate that “fishing-down” the food web is not occurring in fisheries in these areas (Figure 12). These results are consistent with the Livingston et al. (1999) analysis that showed no “fishing-down” effect in the EBS (NPMFC 2007).

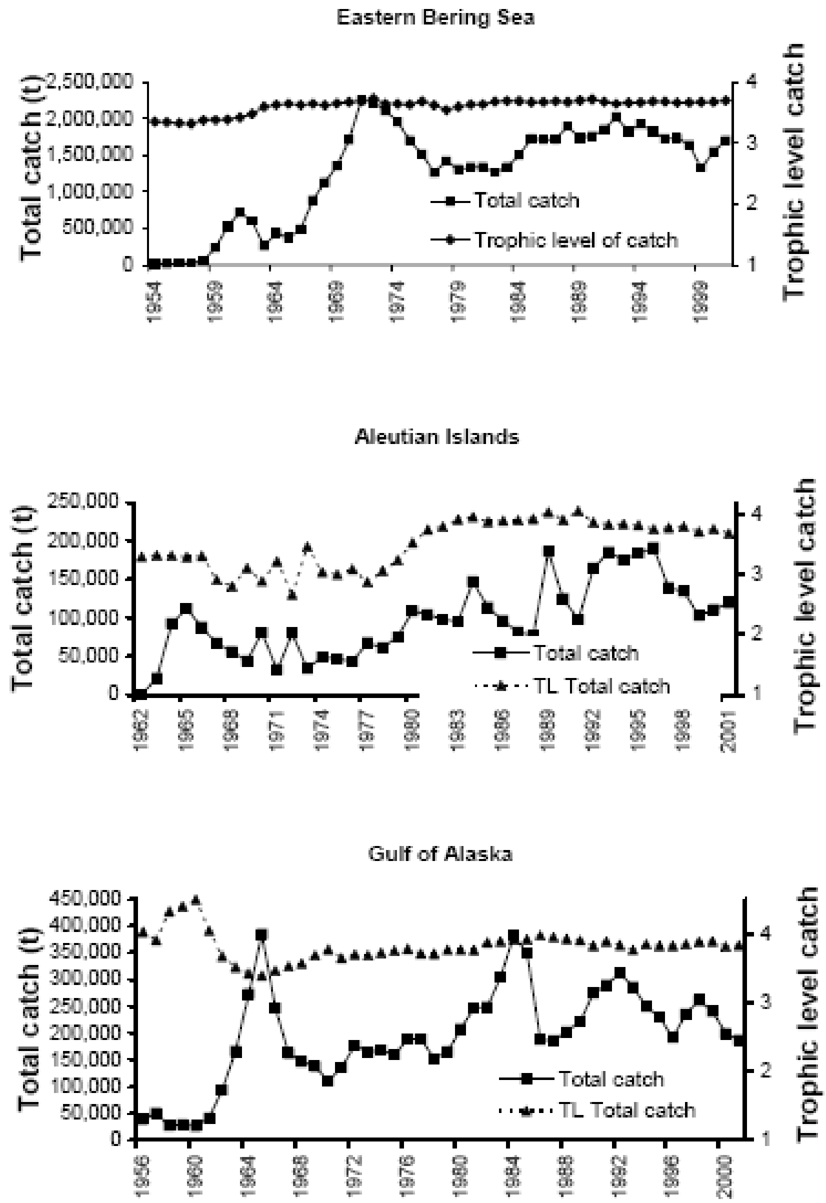

Figure 12. Total catch (groundfish, herring, shellfish, and halibut) and trophic level of total catch in the EBS, AI, and GOA through 2001 (figure from NPFMC 2007).

There is no evidence to suggest that removal of sablefish at the present fishing rate has an adverse impact on ecosystem structure or function in Alaskan fisheries. Ecosim and Ecopath[3] models support this conclusion (MSC 2006).

West Coast

Currently, it is unknown if the West Coast sablefish fishery does or does not substantially disrupt the food web or change the state of the ecosystem. The West Coast marine ecosystem differs

[3] Ecosim and Ecopath are ecological/ecosystem modeling software programs.

from that off the coast of Alaska. As such, we cannot assume that the West Coast sablefish fishery has the same level of ecosystem effects as the Alaskan sablefish fishery.

Synthesis
Alaska
Bottom longlines and pots, which are known to cause moderate damage to habitats, are the primary fishing gear used in the Alaskan sablefish fishery. The fishery occurs over a moderate spatial scale, in deep muddy or sandy bottom habitats, which are moderately resilient to fishing. Scientific studies and modeling also suggest that removal of sablefish does not have adverse impact on ecosystem structure and function in Alaska, and “fishing-down” the food web is not occurring. Thus, Seafood Watch® considers the effects of the Alaskan sablefish fishery’s practices on habitat and the ecosystem to be benign.

West Coast
In the West Coast sablefish fishery, approximately 55% of landings are caught by trawls and 40% by bottom longlines. Trawls are known to cause considerable damage to habitats, while bottom longlines are known to cause moderate damage. The fishery occurs over a moderate spatial scale, in deep muddy or sandy bottom habitats, which are moderately resilient to fishing. The effect of the West Coast sablefish fishery on the food web and the ecosystem are unknown. Given this information, Seafood Watch® considers the West Coast Sablefish fishery to have moderate impacts on habitat and the ecosystem.

Effect of Fishing Practices Rank:

Benign	**Moderate**	Severe	Critical
Alaska	**West Coast (CA, OR, WA)**		

Criterion 5: Effectiveness of the Management Regime

Alaska
The Alaskan sablefish fisheries are managed by the North Pacific Fishery Management Council (NPFMC) in federal waters (3-200 miles offshore) and the Alaska Department of Fish and Game (ADF&G) in state waters (0-3 miles offshore). The vast majority (~90%) of the fishery occurs in federal waters. The state fisheries occur in the Aleutian Islands (Westward Region), Prince William Sound (Central Region), and Chatham and Clarence Straits (Southeast Region) (ADF&G 2007a). Alaska sablefish is managed under Amendment 20 to the Gulf of Alaska (GOA) Fishery Management Plan (FMP) and Amendment 15 to the Bering Sea/Aleutian Islands (BSAI) FMP (Hanselman et al. 2006). The FMPs control the sablefish fisheries through permits and limited entry, catch quotas, seasons, gear restrictions, closed areas, bycatch limits, allocations, recordkeeping requirements, and observer monitoring (Witherell 2000).

In 1982, the sablefish longline fishery in federal waters began expanding in the GOA, and by 1988, all sablefish caught, except minor venture catches, were taken in the GOA longline fishery. As a result, the year-round season in the GOA began to shorten. By the late 1980s, the average season length decreased to one-two months and in some areas was as short as 10 days. In 1995, the Individual Fishing Quota (IFQ) program was implemented for fixed gear (longlines and pots) sablefish fisheries in both the GOA and BSAI. The season now runs for 8 ½ months, from March 1 to November 15 (ADF&G 2007a).

The state-managed sablefish fisheries in the Southeast Region (Chatham and Clarence Straits) are managed under a shared quota system. All permit holders receive an equal share of the annual quota. The Chatham Strait fishery uses only longlines, while the Clarence Straits fishery uses mostly longlines but also some pots (ADF&G 2007a). Other state-managed sablefish fisheries include a limited entry fishery in Prince William Sound and open access fisheries in the Cook Inlet and Aleutian Island areas. All have set Guideline Harvest Levels (GHLs) (ADF&G 2007a).

The Alaskan sablefish stocks are regularly assessed by longline surveys. In addition, Alaska uses data from the biennial NMFS groundfish trawl surveys to monitor abundance and recruitment (Dana Hanselman, Pers. Comm.). Catch, effort, and length data are also obtained from the North Pacific Groundfish Observer Program and vessel logbooks. The observer program and logbook reports also ensure that regulations are being enforced. Sablefish abundance in Alaska has experienced peaks and valleys over time. When abundance has declined, management has responded by substantially restricting allowable catches to increase abundance levels and avoid future declines.

Management has successfully reduced bycatch in the Alaskan sablefish fishery. Since implementation of the IFQ program in the Alaskan sablefish longline fishery, bycatch has decreased. Under the IFQ program, each fisherman has an allotted amount of the overall quota, ending the “race for fish”. Fishermen also keep non-targeted catch of lower value, which were discarded in the open access fishery (MSC 2006). Landings of immature fish have decreased under the IFQ program, improving the chance that fish will have at least one opportunity to reproduce. Spawning potential of sablefish has increased 9% in the IFQ fishery (MSC 2006). In 2004, NPFMC implemented regulations that require all vessels in Alaskan longline fisheries for groundfish and Pacific halibut to use single streamer or paired streamer lines while setting longline gear (Melvin et al. 2002). Paired streamer lines have completely eliminated bycatch of Laysan albatross and northern fulmars. Single streamer lines have reduced seabird bycatch by 96% (Melvin et al. 2001).

West Coast

Sablefish fisheries off the coasts of CA, OR, and WA are managed by the Pacific Fishery Management Council (PFMC) as a single stock (Henry and Pearson 2001). The fishery is referred to as the West Coast sablefish fishery, which includes the limited entry trawl fishery (bottom and pelagic trawl gear), limited entry fixed gear fishery (longlines and pots/traps only), and open access fishery. Trawl gear may not be used in the open access fishery (PFMC 2006b). Sablefish are caught in the limited entry DTS Complex fishery, which catches Dover sole, thornyhead rockfish, and sablefish.

In the West Coast sablefish fishery, approximately 90% of the commercial sablefish optimal yield is allocated to the limited entry fishery (58% to the trawl sector and 42% to the fixed gear sector), and approximately 9% is allocated to the open access fishery. The limited entry fixed gear fishery is divided at 36°N latitude with separate optimal yields for the northern and southern fisheries. In 1997, NMFS implemented the sablefish endorsement program. Limited entry permit holders could be eligible for sablefish endorsements based on their permit history. Initially, each sablefish endorsement holder had an equal allocation. This inequitable allocation system was soon replaced with a three tier system. Under the tier system, sablefish endorsement holders were placed into one of three tiers based on their permit histories (PFMC 2001).

The PFMC sets trip limits for the limited entry sablefish fisheries and the open access fisheries. Trip limits vary by fishery. In the limited entry DTS Complex fishery, the cumulative trip limit from January through February is 59,000 pounds, of which not more than 1,500 pounds may be sablefish. From March through April, the cumulative trip limit is 37,000 pounds, of which not more than 5,000 pounds may be sablefish caught by trawls and not more than 1,500 pounds may be sablefish caught by fixed gear. In the limited entry sablefish trawl fishery, no more than 500 pounds of sablefish per trip may be smaller than 22 inches (with head on). In the limited entry sablefish fixed gear fishery, the daily trip limit is 300 pounds, not to exceed 1,500 pounds in any two-month calendar period. The daily trip limit in the open access fishery is 300 pounds, not to exceed 600 pounds in any two-month calendar period (WSR 1998)

NMFS regularly collects fishery-dependent and independent data. NMFS conducts an annual coast-wide groundfish trawl survey. In addition, the landings sampling program and trawl logbook data provide catch-per-unit-effort (CPUE), age, and length data (Henry and Pearson 2001). This information has helped PFMC maintain productivity of the West Coast sablefish stock over time. The stock has never reached an overfished status.

The logbook reports and the West Coast Groundfish Observer Program (WCGOP) provide enforcement of the fisheries' regulations. The WCGOP requires all groundfish vessels in U.S. federal waters to carry an observer when notified to do so by NMFS or its designated agent. State rule-making has extended this requirement to California and Oregon vessels fishing within state waters. Observers are stationed along the West Coast from Bellingham, Washington to San Diego, California (NWFSC 2006b).

NMFS and PFMC have implemented bycatch minimization requirements for the entire West Coast groundfish fisheries, including the sablefish fishery (61 FR 128). These measures include limits on the incidental catch of overfished species, such as canary rockfish and yelloweye rockfish. Under the WCGOP, all vessels are required to have an observer onboard for monitoring and recording bycatch. Another bycatch minimization measure is the implementation of numerous closed areas to reduce the incidental catch of overfished species. These closed areas not only protect particular groundfish species, but also protect groundfish habitat. Commercial trawl closed areas include trawl rockfish conservation areas, cowcod conservation areas, Farallon Island closed areas, essential fish habitat conservation areas, and the Cordell Banks closed area. Commercial non-trawl closed areas include non-trawl rockfish conservation areas, cowcod conservation areas, Farallon Islands closed areas, essential fish habitat conservation areas, yelloweye rockfish conservation areas, and the Cordell Banks closed area (NMFS 2006a; NMFS 2007a).

Table 6. Commercial harvest management measures for the sablefish fishery.

Management Jurisdictions & Agencies	Total Allowable Landings	Size Limit	Gear Restrictions	Trip Limits	Area Closures	Sources
NPFMC, ADF&G	GOA (2007): 14,840 mt BS (2007): 2,580 mt AI (2007): 2,620 mt	None	State-managed: Chatham Strait restricted to longlines; Clarence Strait restricted to longlines and pots; Prince William Sound restricted to longlines and one bottom trawl vessel; in BSAI, longline, pot, jig, and hand troll are legal. Federally-managed: longlines and bycatch in trawls in GOA; trawls, longlines, and pots in BSAI.	Cook Inlet	No sablefish retention in state waters off Southeast Alaska and Yakutat	NMFS 2006b; Witherell 2000; Woodby et al. 2005
PFMC	Average of 7,800 mt per year since 1993	22 inches total length or 15.5 inches headed	Trawl gear and non-trawl gear (limited entry or open access longline and pot or trap, open access hook-and-line, gillnet, set net, trammel net and spear) allowed	Limited Entry Fixed Gear, Limited Entry Trawl Gear, and Open Access Gears Daily Trip Limit (DTL) Fisheries	Trawl and non-trawl rockfish conservation areas, cowcod conservation areas, yelloweye rockfish conservation areas, essential fish habitat conservation areas, Cordell Banks closed area, Farallon Islands closed areas	65 FR 174, 50 CFR Part 660.382-.383; NMFS 2007a&b; PFMC 2001

Synthesis

Alaska

NMFS and ADF&G regularly conduct longline surveys to assess the health of Alaskan sablefish. Catch, effort, and length data are also available from the North Pacific Groundfish Observer Program and vessel logbooks. The observer program and logbook reports also provide enforcement of the fisheries' regulations. Sablefish abundance in Alaska has experienced some declines over the past 40 years, but management has responded quickly by substantially reducing allowable catches. Bycatch of seabirds in the Alaskan longline fishery is the main bycatch concern within Alaskan sablefish fisheries. However, since the implementation of regulations requiring the use of streamer lines when setting longline gear, seabird bycatch has been almost eliminated. The implementation of the IFQ program has also decreased bycatch in Alaskan sablefish longline fishery. Given these progressive measures, Seafood Watch® considers management of the Alaskan sablefish fisheries to be highly effective.

West Coast

NMFS conducts an annual coast-wide trawl survey to determine the health of the West Coast sablefish stock. In addition, the landings sampling program and trawl logbook data provide CPUE, age, and length data. This information has helped PFMC maintain productivity of the

West Coast sablefish stock over time. NFMS and PFMC have implemented bycatch minimization requirements for the entire West Coast groundfish fishery, including the sablefish fishery. These include bycatch limits on overfished species and a variety of closed areas, which have also protected groundfish habitat. The WCGOP (which requires all groundfish vessels in federal waters to carry an observer), logbook reports, and dockside monitoring provide enforcement of the fishery's regulations. Given these strong measures, Seafood Watch® also considers management of the West Coast (CA, OR, WA) sablefish fisheries to be highly effective.

Effectiveness of Management Rank:

Highly Effective	Moderately Effective	Ineffective	Critical
Alaska and West Coast (CA, OR, WA)			

IV. Overall Evaluation and Seafood Recommendation

Sablefish are moderately vulnerable to fishing pressure due to their moderate age at first maturity (5-6 years of age). The Alaskan sablefish spawning stock biomass is above the $B_{35\%}$ reference point and the short-term trend is up, making the status of the Alaskan sablefish stock a low conservation concern. The West Coast sablefish stock is fully-fished and moderately below B_{MSY}, and overfishing is not occurring. However, the long and short-term abundance trends are down. Thus, Seafood Watch® considers the status of the West Coast sablefish stock a moderate conservation concern.

A moderate amount of bycatch relative to landings (20.5%), a decreasing trend in bycatch interactions, and the lack of population and ecosystem impacts from bycatch result in the Alaskan sablefish fishery receiving a bycatch ranking of low conservation concern. In the West Coast sablefish fisheries, the moderate amount of bycatch relative to landings (~63.5%) and the composition of bycatch species (overfished and highly vulnerable species) makes bycatch a moderate conservation concern in these fisheries.

Bottom longlines and pots, which are known to cause moderate damage to habitats, are the primary fishing gear used in the Alaskan sablefish fishery. Scientific studies and modeling suggest that removal of sablefish in the fishery does not have an adverse impact on ecosystem structure and function, and "fishing-down" the food web is not occurring. Thus, Seafood Watch® considers habitat and ecosystem impacts from the Alaskan sablefish fishery to be a low conservation concern. The West Coast sablefish fisheries use trawls in addition to bottom longlines; trawls are known to cause great damage to habitats. However, the West Coast sablefish fisheries occur over a moderate spatial scale and in deep, muddy or sandy bottom areas, which are moderately resilient to fishing. As such, Seafood Watch® considers the West Coast sablefish fisheries to have moderate impacts on habitats and the ecosystem. Management in both fisheries is highly effective due to robust stock assessments, regular collection of fishery-dependent and independent data, bycatch mitigation measures, and regular enforcement.

The four issues of low concern (status of stocks, bycatch, habitat and ecosystem impacts, and management effectiveness) in the Alaskan sablefish fishery result in a Seafood Watch® overall recommendation of **Best Choice**. The four issues of moderate concern (inherent vulnerability, status of stocks, bycatch, and habitat and the ecosystem impacts) in the West Coast (CA, OR, WA) sablefish fisheries result in a Seafood Watch® overall recommendation of **Good Alternative**.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ **Alaska**	√ **West Coast**		
Nature of Bycatch	√ **Alaska**	√ **West Coast**		
Habitat & Ecosystem Effects	√ **Alaska**	√ **West Coast**		
Management Effectiveness	√			

Overall Seafood Recommendation:

Best Choice

Alaska

Good Alternative

West Coast (CA, OR, WA)

Avoid

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Supplemental Information

Consumption advice on the Seafood Watch® pocket guides is provided by Environmental Defense. Environmental Defense applies the same risk-based methodology as the U.S. Environmental Protection Agency (EPA) to data from government studies and papers published in scientific journals. Environmental Defense has issued a consumption advisory for sablefish for children under 12 years of age due to elevated mercury levels. Consumption of sablefish should be limited to two meals per month for children ages 0-6, and three meals per month for children ages 6-12. A meal size is considered to be 3 ounces (a little less than ¼ pound of fish before cooking). There is no consumption advisory for men or women of childbearing age. More detailed information about the Environmental Defense advisory can be found at http://www.oceansalive.org/eat.cfm?subnav=fishpage&group=Sablefish.

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