

**Fishery Management Report No. 21-03**

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**Prince William Sound Registration Area E  
Groundfish Fisheries Management Report, 2017–2020**

by

**Jan Rumble**

**Elisa Russ**

and

**Joe Loboy**

January 2021

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics</b>	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	$H_A$
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	$e$
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, $\chi^2$ , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient	
milliliter	mL	west	W	(multiple)	R
millimeter	mm	copyright	©	correlation coefficient	
		corporate suffixes:		(simple)	r
<b>Weights and measures (English)</b>		Company	Co.	covariance	cov
cubic feet per second	ft <sup>3</sup> /s	Corporation	Corp.	degree (angular)	°
foot	ft	Incorporated	Inc.	degrees of freedom	df
gallon	gal	Limited	Ltd.	expected value	$E$
inch	in	District of Columbia	D.C.	greater than	>
mile	mi	et alii (and others)	et al.	greater than or equal to	≥
nautical mile	nmi	et cetera (and so forth)	etc.	harvest per unit effort	HPUE
ounce	oz	exempli gratia	e.g.	less than	<
pound	lb	(for example)		less than or equal to	≤
quart	qt	Federal Information Code	FIC	logarithm (natural)	ln
yard	yd	id est (that is)	i.e.	logarithm (base 10)	log
		latitude or longitude	lat or long	logarithm (specify base)	log <sub>2</sub> , etc.
<b>Time and temperature</b>		monetary symbols		minute (angular)	'
day	d	(U.S.)	\$, ¢	not significant	NS
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	null hypothesis	$H_0$
degrees Fahrenheit	°F	registered trademark	®	percent	%
degrees kelvin	K	trademark	™	probability	P
hour	h	United States (adjective)	U.S.	probability of a type I error	
minute	min	United States of America (noun)	USA	(rejection of the null hypothesis when true)	$\alpha$
second	s	U.S.C.	United States Code	probability of a type II error	
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	(acceptance of the null hypothesis when false)	$\beta$
<b>Physics and chemistry</b>				second (angular)	"
all atomic symbols				standard deviation	SD
alternating current	AC			standard error	SE
ampere	A			variance	
calorie	cal			population	Var
direct current	DC			sample	var
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

***FISHERY MANAGEMENT REPORT NO. 21-03***

**PRINCE WILLIAM SOUND REGISTRATION AREA E GROUND FISH  
FISHERIES MANAGEMENT REPORT, 2017–2020**

by

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## ABSTRACT

The Alaska Department of Fish and Game (ADF&G) Division of Commercial Fisheries manages commercial groundfish fisheries within Prince William Sound Registration Area E (PWS) that includes territorial waters of Alaska from Cape Sucking at 144°00'W long to Cape Fairfield at 148°50.25'W long. Harvests of sablefish *Anoplopoma fimbria*, walleye pollock *Gadus chalcogrammus*, lingcod *Ophiodon elongatus*, and Pacific cod *Gadus macrocephalus* are managed by season for specific guideline harvest levels (GHL). Rockfish species (genera *Sebastes* and *Sebastolobus*) are managed collectively as bycatch to other directed fisheries. Miscellaneous groundfish species including flatfish, sharks, and skates, as well as shellfish species including octopus and squid, are also landed incidentally in the directed groundfish fisheries. ADF&G also has management authority of lingcod and black rockfish *Sebastes melanops* in federal waters of the exclusive economic zone (EEZ) from 3 nmi to 200 nmi offshore. The 2019 state-managed groundfish harvest totaled 8.0 million lb. The directed pollock trawl harvest was 6.5 million lb, 99% of the GHL. The total Pacific cod harvest from both parallel and state-waters fisheries was 0.5 million lb, the lowest since 2008 due to the decline in the Gulf of Alaska (GOA) stock, associated federal quota, and corresponding GHL. The 2019 directed sablefish harvest of 85,796 lb was 64% of the 134,000 lb GHL, with a steadily increasing trend since the lowest harvest of 16,910 lb in 2015. In 2019, the rockfish harvest retained as bycatch to other directed fisheries was 71,976 lb, well below the historical average and less than half of the GHL, primarily due to the decrease in directed Pacific cod harvest. Lingcod harvest was 26,408 lb in 2019, similar to the historical average. In 2019, walleye pollock generated the highest exvessel value of \$897,152, followed by Pacific cod at \$266,291, and sablefish at \$178,456; all groundfish harvested in PWS had a combined value of \$1.4 million.

**Key words:** Prince William Sound, Registration Area E, commercial fisheries, groundfish, management, exvessel value, annual management report (AMR), Pacific cod *Gadus macrocephalus*, walleye pollock *Gadus chalcogrammus*, *Theragra chalcogramma*, Sablefish *Anoplopoma fimbria*, lingcod *Ophiodon elongatus*, rockfish *Sebastes melanops*, squid *Beryteuthis majister*, Pacific sleeper shark *Somniosus pacificus*, salmon shark *Lamna ditropis*

## INTRODUCTION

This report describes commercial groundfish fisheries managed by Alaska Department of Fish and Game (ADF&G) in the Prince William Sound Management Area (PWS), Registration Area E, and summarizes the most recent harvest information. ADF&G manages all commercial groundfish fisheries within the territorial waters of PWS, from the shoreline to three nautical miles (nmi) offshore. For territorial waters, the Alaska Board of Fisheries (BOF) establishes management regulations and ADF&G uses its emergency order (EO) authority to adjust fishing time and area as needed (Table 1). The BOF schedules regular triennial meetings for PWS groundfish. The National Marine Fisheries Service (NMFS) manages groundfish resources in waters of the exclusive economic zone (EEZ), located from 3 nmi to 200 nmi offshore, under fishery management plans (FMP) developed by the North Pacific Fishery Management Council (NPFMC). ADF&G manages fishing for any species in the EEZ not covered under a federal FMP, including lingcod *Ophiodon elongatus*, black rockfish *Sebastes melanops*, and dark rockfish *Sebastes ciliatus*.

The State of Alaska defines groundfish as all marine finfish except Pacific halibut *Hippoglossus stenolepis*, osmerids, Pacific herring *Clupea pallasii*, and salmonids. The state-managed fisheries for rockfish *Sebastes* spp. and *Sebastolobus* spp., Pacific cod *Gadus macrocephalus*, sablefish *Anoplopoma fimbria*, walleye pollock *Gadus chalcogrammus* and *Theragra chalcogramma*, lingcod, and miscellaneous groundfish species are discussed in this management report. Harvests of black rockfish, dark rockfish, and lingcod in adjacent federal waters are also included as the state has management authority. Miscellaneous groundfish species harvested as bycatch in other directed fisheries, including sharks, skates, and flatfish are also included in this report. Other non-

groundfish bycatch in commercial groundfish fisheries, including Pacific salmon *Oncorhynchus* spp., octopus *Enteroctopus dofleini*, and squid *Beryteuthis majister*, are summarized.

Boundaries of PWS have been adjusted several times since 1996. These changes primarily affected rockfish management and are described in the rockfish section of this report. PWS currently encompasses waters of Alaska from 144° 00' W long, near Cape Suckling, to the longitude of Cape Fairfield at 148° 50.25' W long (Figure 1). The area is divided into the Inside and Outside Districts. The Inside District is waters enclosed by lines from Point Whitshed to Point Bentinck, from Cape Hinchinbrook to Zaikof Point, and from Cape Cleare to Cape Puget. The Outside District, composed of Gulf of Alaska (GOA) waters 0–3 nmi from shore, is divided into the Western and Eastern sections. The Western Section includes waters between Cape Fairfield and 147° 00' W long, and the Eastern Section includes waters between 147° 00' W long and 144° 00' W long. The BOF adopted regulations giving the commissioner authority to close fishing areas to protect endangered Steller sea lions in 2001. This action complemented NMFS closures at two locations in the Outside District. All groundfish fishing was closed within three nmi of Seal Rocks, south of Hinchinbrook Entrance, and the Wooded Islands, south of Patton Bay along outer Montague Island (Figure 2). Additionally, area regulations specify a groundfish pot closure area, to protect recovering Tanner crab *Chionecetes bairdi* populations, in waters of southeastern PWS designated by geographic coordinates and Port Gravina, except groundfish may be taken with pots as designated within Orca Bay and in waters less than 75 fathoms deep in Hinchinbrook Entrance (Figure 2; 5 AAC 28.250 (a)).

Statewide regulations require all commercial fishing vessels to register with ADF&G prior to fishing for groundfish and restrict legal gear types for groundfish to longline, pelagic trawl, hand troll, seine, mechanical jigging machine, dinglebar troll, and pots; area regulations specify additional fishery-specific registration requirements and gear restrictions. Although area regulations restricted non-pelagic trawl gear in 1997, shrimp trawl vessels may retain groundfish bycatch not to exceed 10% of the gross weight of the landed shrimp, and there is a single limited entry sablefish fishery permit that may be operated on a shrimp trawl vessel (5 AAC 28.230 (f) and (g)). Area regulations also allow groundfish bycatch taken in the salmon gillnet fishery to be retained at specified levels.

Commercial groundfish harvests are monitored inseason primarily through ADF&G fish tickets (5 AAC 39.130) with additional information from dockside sampling of the commercial harvest, dockside interviews, and log sheets for some fisheries. Dockside sampling involves the collection of biological data including species, size, sex, gonad condition, and age structures. Fishermen interviews are conducted dockside to collect information on fishing location and effort. Onboard observers may be deployed during commissioner's permit fisheries and by ADF&G request to gain additional fishery information including discarded catch. Reporting requirements specify that all groundfish retained, including harvest that is retained for personal use or used as bait at sea, must be reported on ADF&G fish tickets. ADF&G relies on accurate reporting of all fisheries removals to maintain the highest level of fisheries management.

## **ROCKFISH**

### **BACKGROUND**

There are 32 species of rockfish (genera *Sebastes* and *Sebastolobus*) in the GOA, of which 20 are commonly harvested in the commercial fishery. There is no directed fishery in PWS and rockfish

may only be retained as bycatch. Rockfish are long-lived with the oldest recorded rockfish, a rougheye rockfish *S. aleutianus* from Southeast Alaska, aged at 205 years (Munk 2001). Rockfish have a gas-filled swim bladder that allows buoyancy control. Rockfish may experience barotrauma, or injury caused by rapid decompression and expansion of gases in the swim bladder, during ascent to the surface when caught in deep water; the severity of the condition increases with depth of capture. Rockfish with barotrauma often exhibit exophthalmia, or bulging eyes, and the stomach protruding from the mouth, forced out by the overinflated swim bladder. Rockfish are unable to resubmerge when released in this condition, which results in a high mortality rate after capture, and is the reason for mandatory retention requirements in PWS. Additionally, rockfish are slow to reach sexual maturity (7 to 27 years); these and other factors make rockfish populations vulnerable to overfishing.

Rockfish are categorized into pelagic shelf (PSR), demersal shelf (DSR), slope species assemblages (all *Sebastes* genus), and thornyhead or “idiot” rockfish (*Sebastobus* genus) and are defined in regulation 5 AAC 39.975 (37), (34), (38), and (39), respectively. PSR species found in PWS include black *S. melanops*, dusky *S. variabilis*, dark *S. ciliatus*, and yellowtail *S. flavidus* rockfishes. PSR are typically associated with nearshore, rocky reef areas, may exhibit midwater schooling behavior, and are often harvested in other management areas in directed fisheries with mechanical jig and hand troll gear. There is no directed rockfish fishery in PWS and PSR harvest typically occurs on longline gear as bycatch in Pacific cod and halibut fisheries. DSR are associated with rocky reef areas but tend to be bottom dwelling and often occur at greater depths than PSR species (Bechtol 2000). Yelloweye *S. ruberrimus* and quillback *S. maliger* rockfishes are common DSR species in PWS and are usually harvested with longline gear during Pacific cod and halibut fisheries. Slope rockfish species include any rockfish not specified as either PSR or DSR, and, for the purposes of this report and PWS rockfish management, thornyhead rockfish data are included with slope species. Slope rockfish are typically found near the bottom in waters deeper than 200 meters and are most often harvested with longline gear, targeting sablefish or halibut, or with trawl gear during the pollock and sidestripe shrimp fisheries. Common slope species in PWS include rougheye and shortraker *S. borealis* rockfishes; the thornyhead rockfish species found in PWS is shortspine thornyhead *S. alascanus*.

## **STATEWIDE ROCKFISH INITIATIVE (SRI)**

Currently, there are no overarching management or assessment strategies for black or yelloweye rockfish across the GOA, although each has been identified as keystone species for PSR and DSR assemblages, respectively. ADF&G’s management of these species has been largely area- or region-specific and management has not been well coordinated across fishery divisions. Guideline harvest levels (GHLs) are used for managing commercial fisheries; however, these are applied to management areas rather than populations and are primarily based on historical levels of harvest. Sport fisheries are managed to constrain harvest levels (e.g., bag limits), but typically without an adequate understanding of how those harvest levels translate to exploitation rates of populations. Because rockfish are known to be particularly vulnerable to exploitation, and harvests have been increasing in recent years, proactive measures are needed to ensure long-term sustainability of these fisheries.

In 2017, ADF&G initiated an interdivisional, statewide initiative focused on developing long-term management and assessment strategies for these two species (Howard et al., 2019b). There have been five workshops; the goal of the workshops and future efforts is to develop long-term

collaborative management strategies that support stable populations and sustainable black and yelloweye rockfish fisheries across the GOA.

Here are some of the accomplishments of the SRI:

- 1) Published a report that describes black and yelloweye rockfish life history, rockfish fisheries in the GOA, and summarizes work of the SRI (Howard et. al, 2019a).
- 2) Published a strategic plan with a shared set of expectations and targeted timeline for goals. Also, the plan will be updated at least every five years (Howard et. al, 2019b).
- 3) Completed FishPath assessments for black and yelloweye rockfish fisheries in the GOA. FishPath is a decision support tool to guide selection of monitoring, assessment and decision rule options, particularly useful for data-limited marine fisheries.
- 4) Compiled data across fisheries in standardized formats, including sport harvest reconstruction analysis that allows for combining sport and commercial harvests in spatially appropriate reporting groups so total fishery extractions can be evaluated (operational plan will be published).
- 5) Worked to build staff capacity by holding various trainings to aid in stock assessment modeling and management strategy framework development for rockfishes.
- 6) Continued to collect biological information from sport and commercial port sampling activities to support stock assessment.
- 7) Contracted leading experts to provide continued support to staff.
- 8) Started building communications plans for sharing information with the public as well as soliciting input and engagement from stakeholders. Developed presentations and public service announcements. Organizing a webpage to highlight specifics about the SRI.
- 9) Provided support for research projects that filled key data gaps.
- 10) Developed management decision-making framework options, including a range of potential harvest level and performance metric options, for use in Management Strategy Evaluation (MSE).

The SRI will continue yelloweye and black rockfish stock assessment with the goal of having concrete results to inform the public and BOF to aid in making regulatory decisions.

## **HARVEST AND EFFORT**

### **Recent 10 years**

During the recent 3-year period (2017–2019), the average harvest of rockfish was approximately 63,000 lb, much reduced compared to the harvest between 2013 and 2016, when harvest met or exceeded the GHL of 150,000 lb for each of those years (Table 2). Effort between 2017 and 2019 ranged from 202 to 230 landings by an average of 86 vessels; the majority of rockfish bycatch was harvested by longline gear, ranging between 85% and 92% of the total harvest (Table 3). The walleye pollock pelagic trawl fishery had the second highest percentage of rockfish harvest during this period, ranging from 8% to 14% of the total, between 4,402 lb and 9,715 lb, annually (Table 3). Each of the fisheries (species/gear type) has specific associated rockfish bycatch percentage limits. In 2014, pollock trawl fishery vessels harvested the highest amount of rockfish in the history of the fishery and the pollock fishery was closed after surpassing the bycatch limit of 0.5% (67,446 lb; Table 4). Small amounts of rockfish harvested as bycatch in the shrimp trawl fishery are included with trawl gear (Table 3). Rockfish harvest by pot and jig gear has been minimal since 1998 (Table 3).

During the last 10 years (2010–2019), an average of 86 vessels harvested rockfish as bycatch in an average of 241 landings. During this same period, the average harvest for longline and trawl fisheries was 94,354 lb and 19,841 lb of rockfish, respectively (Table 3).

Between 2017 and 2019, rockfish harvest in the Inside District ranged from 46,503 lb to 54,385 lb which was much reduced from levels between 2013 and 2016 when it reached the highest levels in this bycatch fishery (since 2000, when it was created). During the last 10 years, harvest in the Outside District ranged from 7,653 lb in 2018 to 28,418 lb in 2016. Harvest and effort from the Outside District were at lower levels than the Inside District, which is the historical trend. Average participation from 2017 to 2019 for the Outside and Inside Districts was 66 and 35 vessels, respectively (Table 2).

Species composition of rockfish harvest varied among districts and by gear type. In the previous 10 years, slope rockfish was the primary assemblage of all rockfish harvested in PWS at 60% of the harvest. DSR comprised 36% of rockfish harvested and PSR were a small component at 4% (Table 5).

Black rockfish are the primary component of the PSR assemblage and harvest of this species has been relatively low for over 20 years. Black rockfish harvest was particularly low during the recent 3-year period, 2017–2019, ranging from 1,594 lb to 2,205 lb, and below the average harvest for the recent 10-year period, 2010–2019, of 2,663 lb. During recent years, black rockfish harvest peaked in 2015 at 7,756 lb, the highest harvest since 1997 (Table 5).

Yelloweye rockfish are the predominate species in the DSR assemblage. Yelloweye rockfish harvest between 2017 and 2019, ranged from 12,651 lb to 18,493 lb in 2018 and 2019, respectively, considerably lower than the recent 10-year average of 27,256 lb (Table 5). Yelloweye rockfish are caught throughout PWS and were harvested in 49 statistical areas between 2017 and 2019 (Figure 3). The highest harvest of yelloweye rockfish for the recent 10-year period, 2017–2019, occurred in 2016 at 46,665 lb; this was the highest harvest since 2000 (Table 5). Yelloweye rockfish and other DSR species are frequently harvested as bycatch to directed Pacific halibut and Pacific cod fisheries; recent reductions in Pacific cod quota directly result in lower harvest levels of these rockfish species.

During the last three years, 2017–2019, annual average exvessel rockfish values based on fish ticket reporting were at their lowest levels since 2005, averaging just under \$36,000 (Table 6). Because rockfish harvest is bycatch only, these low harvests and associated values are related to decreased directed fishing, specifically in the Pacific cod fishery. However, the reduced availability of rockfish may have had a positive effect on rockfish price; price was above average during the recent three years, averaging \$0.57/lb, above the recent 10-year average price of \$0.49/lb, and peaking at \$0.60/lb in 2018, the highest price since 2000 (Table 7).

## **Historical**

Prior to 2010, historic rockfish harvest for the Inside District ranged widely from 35,240 lb in 2003 to 489,154 lb in 1990 (Table 2). The peak harvest in 1990 was attributed to market conditions that encouraged targeting rockfish. In the Outside District, harvest ranged from 2,762 lb in 1991 to 313,489 lb in 1988 (Table 2). The majority of that record Outside District harvest in 1988 was taken by trawl gear (228,417 lb; Table 3) and was composed primarily of PSR. The relatively high harvests during those early years were attributed to misreporting during periods when the directed fishery in state waters was closed but adjacent federal waters remained open. Rockfish harvests

declined following the elimination of the federal directed rockfish fishery in 2000. Rockfish harvests have increased in recent years primarily due to the 2009 adoption of longline as a legal gear type in the state-waters Pacific cod fishery; significant increases in walleye pollock pelagic trawl fishery GHLS since 2012 have also contributed (Table 8).

Black rockfish harvests prior to 2010 ranged from 118 lb in 2002 to 57,912 lb in 1995; harvest dropped to relatively low levels after 1997. Yelloweye rockfish harvests ranged from 7,060 lb in 1989 to 66,669 lb in 2000, and in the most recent 3 years, the average harvest was 15,658 lb (Table 5).

## **MANAGEMENT AND REGULATIONS**

### **Recent**

At the 2017 BOF meeting, no proposals were adopted that related to PWS rockfish.

### **Historical**

Rockfish were not actively managed in PWS prior to 1989, and seasons remained open all year. From 1989 through 1991, rockfish seasons were set by EO to coincide with NMFS inseason adjustments for the federal Central Gulf of Alaska Regulatory Area (CGOA). Favorable market conditions, in conjunction with long seasons in adjacent federal waters, resulted in large annual PWS harvests. Following dramatic increases in rockfish harvests, the BOF adopted the *Prince William Sound Rockfish Management Plan* (5 AAC 28.265) in 1992. Original provisions of the management plan included a 150,000 lb GHL for all rockfish species, which was based on mean annual harvests (Bechtol 1992). Additional provisions included a trip limit of 3,000 lb within a 5-day period and a 20% bycatch allowance after the GHL was achieved and the directed fishery closed. The PWS rockfish directed season opening date remained January 1.

When the management plan was adopted in 1992, PWS was defined to include only that area currently described as the Inside District (Figure 1). In 1996, the management area was expanded to include waters from Cape Fairfield to Cape Suckling, and in 2000, the eastern boundary (Cape Suckling) was redefined as 144°00' W long. Additionally, in 1998, the State of Alaska accepted management authority for black and blue rockfish in adjacent federal (EEZ) waters when NPFMC passed Amendment 46 to the GOA FMP, which removed those species from the GOA FMP. Similarly, in 2008, Amendment 77 removed dark rockfish from the GOA FMP and the State of Alaska accepted management responsibility for dark rockfish in the EEZ. Although blue rockfish have limited distribution in Alaska waters and dark rockfish are a nearshore, shallow-water species rarely caught in federal waters, harvest of black rockfish from federal waters can contribute a fair amount in some years (Table 5). Despite these changes in the size of the management area, the rockfish GHL has remained unchanged.

The BOF amended the management plan in 1996 to reduce overall rockfish harvests by managing the 150,000 lb GHL for the combined directed and bycatch harvest of rockfish. Instead of closing the directed rockfish fishery when the GHL was achieved, a harvest level was targeted for the directed fishing season and once this target harvest level was reached, directed fishing was closed and the remainder of the GHL remained available for harvest in the bycatch-only fishery. However, assignment of a directed fishery harvest level proved problematic due to the uncertainty in projecting bycatch levels for other directed fisheries. In addition to the directed rockfish fishery, rockfish were taken as bycatch in fisheries for Pacific cod, halibut, sablefish, walleye pollock, and lingcod. Beginning in 1997, ADF&G used EOs to set the rockfish bycatch allowance at 10% of

the gross round weight of all delivered groundfish target species. Subsequently, ADF&G increased the rockfish bycatch level to 20% for the 1998 and 1999 PWS sablefish fisheries to accommodate demonstrated bycatch levels.

Because bycatch levels are a percentage of the targeted harvest, if GHLS increase for directed fisheries, the harvest of rockfish may also increase. This has been increasingly apparent in the harvest of rockfish in the PWS walleye pollock pelagic trawl fishery. The GHLS for this fishery reached 13.1 million lb in 2016 (Table 8), which would allow up to 65,588 lb of rockfish to be harvested as bycatch. In 2014, pollock trawl vessels harvested 67,446 lb of rockfish, exceeding the bycatch limit and closing the fishery before the pollock GHLS was reached (Table 4).

In 2000, the *Prince William Sound Rockfish Management Plan* was significantly amended by eliminating the directed rockfish fishery, requiring full retention of all rockfish, and placing bycatch levels into regulation.

Current regulations for the fishery include the following:

- 1) 150,000 lb GHLS for all rockfish species combined;
- 2) A bycatch-only fishery with mandatory full retention of all rockfish bycatch;
- 3) Bycatch allowances of 20% to sablefish, 5% to Pacific cod, and 10% to all other directed groundfish and halibut fisheries; and
- 4) Proceeds from the sale of bycatch overages paid to the State of Alaska.

## **HARVEST SAMPLING**

Consistent dockside sampling of rockfish species harvested from PWS began in 1993. ADF&G dockside sampling staff conducts interviews with fishermen to obtain fishing location and effort data, and collect biological samples for fish length, weight, sex, maturity stage, and age structures (otoliths).

Rockfish sampling opportunities have been variable without a directed rockfish fishery in PWS since 2000. All rockfish harvest is retained as bycatch to other directed fisheries. Therefore, achieving sampling goals for rockfish species can be difficult. However, due to additional sampling coverage beginning in 2013, the number of rockfish samples collected annually has increased (Table 9). Sampling goals of 550 specimens for both yelloweye and quillback rockfish were attained or nearly achieved between 2013 and 2015; however, a reduced season and decreased harvest during the PWS Pacific cod fishery in 2016 resulted in fewer sampling opportunities. The sampling goal for yelloweye rockfish was achieved again in 2019 due to concerted effort by staff to fulfill collection requests of genetics and ovaries to support the Statewide Rockfish Initiative.

Historically, slope rockfish species made up the bulk of samples in most years. Between 1993 and 2019 combined, slope rockfish (primarily shortraker and rougheye) made up 50% of all rockfish samples collected; DSR (primarily yelloweye) constituted 46% of total rockfish, and the remaining 4% was composed of PSR (primarily black). In 2019, slope rockfish were below the historical contribution at 29% of total rockfish sampled and DSR were above the historical percentage at 67% of the total. PSR samples collected in 2019 tracked with historical levels at 4% (Table 9).

Since longline became a legal gear type during the state-waters Pacific cod season in 2009, higher numbers of DSR have been harvested as bycatch. Additionally, following the implementation of federal gear sector splits in 2012 for the federal Pacific cod fishery, processors began taking

deliveries in the ports of Seward and Whittier from December through February (when halibut season is closed). With more landings occurring in Seward and Whittier in winter and early spring, additional sampling opportunities were provided, and ADF&G staff have been stationed in Seward during the Pacific cod fishery since 2013. This resulted in an increase in the annual number of DSR samples collected, and an increase in the proportion of DSR to total rockfish sampled, in recent years.

## RESEARCH

There are three fishery-independent surveys that capture or count rockfish in PWS: (1) multi-species large-mesh trawl survey, (2) sablefish longline survey, and (3) a remotely operated vehicle (ROV) survey (Byerly et al., 2015). The large-mesh trawl survey is an ongoing, primarily biennial survey in operation since 1989. The sablefish survey was conducted annually from 1996 to 2006, and the ROV surveys were conducted in 2012 and 2016.

The multi-species large-mesh trawl survey uses a 400-mesh eastern bottom trawl net. The survey occurs mainly in the eastern and southcentral portions of PWS from Valdez Arm south to Orca Bay and west to northern Montague Island. This survey provides information on numerous commercially important species (rougheye rockfish, Pacific cod, walleye pollock, sablefish, skates and various flatfish species) some of which may be used as a relative index of abundance or biomass. In addition to catch information, biological data including sex, maturity, size, and age are collected from all rockfishes and sablefish. In the history of the survey, over 99% of the rockfish caught were slope species and rougheye rockfish made up more than 97% of the total by weight (Rumble et al. 2017). This survey only covers a portion of rougheye rockfish habitat within PWS, so any catch information should be considered in this context. Rougheye rockfish catch per unit effort (CPUE) for the core station areas (Port Fidalgo, Orca Bay, and north Montague; Figure 4) that were surveyed each year peaked at 72.28 lb/nmi in 1993 and declined to 25.88 lb/nmi in 1999. CPUE increased to 44.08 lb/nmi in 2003 before decreasing again to 32.21 lb/nmi in 2005. Since 2005, CPUE has been steady but declined in 2014 to 26.89 lb/nmi and was 29.26 lb/nmi in 2015, which was below the long-term survey average of 39.77 lb/nmi (Rumble et al. 2017). Updated survey estimates are being calculated and will be reported in a future research report.

The sablefish longline survey covered depths deeper than 200 m, which shortraker and rougheye rockfish commonly occupy. Rockfish CPUE and biological data including sex, maturity, size, and age were collected for this time series. Sampling effort varied spatially throughout the years, but the northwestern portion of PWS was sampled every survey year. Therefore, data from this section has a higher potential for detecting trends in population abundance. For the northwest section, over 99% of the rockfish catch for all years combined was composed of slope species. Shortraker rockfish made up the highest percentage of the catch at 50%, rougheye rockfish made up 24%, and shortspine thornyhead rockfish made up 9%. CPUE was low for these species, with a high level of variation in most years (Rumble et al. 2017).

The 2012 ROV survey was part of a Central Region lingcod and DSR population assessment (Byerly et al., 2015). For this assessment, a series of index sites were chosen within the Inside and Outside Districts of PWS and the North Gulf District of the Cook Inlet Area. The size of the index sites ranges from 150 km<sup>2</sup> to 400 km<sup>2</sup> with 5 sites in the Central Region, 4 sites in North Gulf Coast, and 1 site in PWS. ADF&G research has surveyed 1 to 2 sites per year. After all sites are sampled once, the rotation starts again, to achieve a time series of local abundance to track changes (Rumble et al. 2017).

Index sites represent a range of harvest histories from low to high harvest and are located on rocky banks or coastlines generally separated by deeper glacial fjords. One of these sites is in southwestern PWS. It includes the passages between Bainbridge Passage and Montague Strait and extends south and west to a 150 m contour. Mechanical issues resulted in an incomplete survey, but for the restricted area that was sampled, yelloweye rockfish density was estimated at 1,697 fish/km<sup>2</sup> (CV = 30%). This density estimate was not significantly different from other areas surveyed in the Cook Inlet Area.

In 2016, an ROV survey covering most of PWS was conducted. This included both inside and outside waters, including federal waters. Analysis of this data is not yet available.

## **PACIFIC COD**

### **BACKGROUND**

Pacific cod, also known as grey cod, have been fished commercially in Alaska waters since the 19th century and currently support a large and valuable commercial fishery. This species grows quickly, up to 1.5 m in length, and reaches maturity at about 0.5 m or an age of 4–5 years in the GOA. Pacific cod have a relatively short lifespan of less than 20 years. Adult fish are demersal, living near the ocean floor, in habitats of mud, sand, and clay. Pacific cod school together, moving seasonally from deep waters (100–250 m) on the continental shelf edge and upper slope in the winter, to shallower waters (less than 100 m) in the summer with peak spawning occurring in March.

### **HARVEST AND EFFORT**

#### **Stock status**

Pacific cod abundance in the GOA and surrounding areas experienced a drastic decline in 2018 and 2019, which resulted in a 77% reduction in GHLS for the 2018 season, another 5.6 % reduction in 2019, and a GOA-wide federal fishery closure in 2020. In PWS, the state-waters GHLS was reduced from over 4.3 million lb in 2017 to 992,080 lb in 2018 and another reduction to 936,965 lb in 2019. The state-waters season was prosecuted in 2020 with a significantly reduced GHLS set at 437,425 lb, a 53.3% reduction of the 2019 GHLS (Table 10).

This reduction in Pacific cod abundance was attributed to an ocean condition called the “warm blob,” a marine heat wave that negatively affected some marine species, including Pacific cod. Pacific cod is an ectotherm, meaning that temperature directly affects its metabolism (Barbeaux et al. 2017). These warmer water temperatures occurred between 2014 and 2016; this was an unusual event due to the magnitude of the temperature increase (Bond et al. 2015).

Research has shown that Pacific cod are very sensitive to water temperature, particularly during early stages of their development. Optimal egg development occurs in slim margins of temperature, salinity, and oxygen levels (Barbeaux et al. 2017). Larval production is also driven by water temperature with cold sea surface temperatures producing higher larval abundance and higher temperatures producing less larvae (Doyle and Mier 2016). Higher temperatures increase metabolic demands of Pacific cod and the “warm blob” negatively affected primary production and reduced abundance of key zooplankton species, such as copepods and krill, which in turn deplete food sources for higher trophic levels and increased mortality (Barbeaux et al. 2017).

## Recent 10 years, 2010–2019

Longline is the dominant gear type for Pacific cod harvest in PWS in both parallel and state-waters seasons. As per the regulation, the parallel season opens on January 1, and the state-waters season for each gear type follows the corresponding parallel seasons. This was not true for 2020 because the federal season did not open and therefore there was no parallel season; a decision was made by ADF&G to open a reduced state-waters season on February 1, 2020.

During years when a federal Pacific cod season is prosecuted in the GOA, coordinated parallel seasons are opened inside state waters. The state-waters season for longline gear opens seven days following the corresponding parallel season closure. State-waters seasons for pot and jig gear open 24 hours following corresponding parallel season closures. The state-waters season GHL was relatively high between 2011 and 2017, when the allocated percentage of the Eastern Gulf of Alaska (EGOA) acceptable biological catch (ABC) jumped to the maximum of 25% after the GHL was achieved for three consecutive years and moved through step-up provisions (Table 10). Longline gear has been a legal gear type during the state-waters season since 2009. In 2012, federal gear sector allocations were implemented and season closures in the parallel season occurred by gear type which created staggered opening dates for the state-waters season.

After increasing from 2010 through 2015, Pacific cod parallel season harvest has steadily declined since 2015, from over 3.0 million lb to 75,279 lb in 2019 (Table 11). The high harvest during the parallel season in 2015 was a result of the initial parallel season remaining open until June 10.

The state-waters season longline harvest nearly doubled from 2010 to peak in 2011 at 1.6 million lb and then held relatively steady through 2014, with an average of 1.4 million lb for those four years (Table 10). Longline harvest during the state-waters season declined nearly tenfold to under 200,000 lb in 2015 leaving the 1.6 million lb GHL largely unharvested (Table 10). The low harvest for the state-waters season in 2015 corresponded with the high harvest for the parallel season and was primarily a result of the parallel season (which is tied to the federal CGOA hook-and-line season for vessels less than 50 ft) having remained open until June 10, encompassing the peak fishing time in the spring when Pacific cod congregate to spawn. Additionally, there was a diversification of the fleet into halibut and salmon activities by summer further compounding the low harvest during the state-waters season. Harvest by longline gear increased again in 2016 to over 1 million lb, although less than a quarter of the 4.8 million lb GHL was harvested; the 2016 GHL was the highest since the fishery began in 1997 (Table 10). Harvest dropped to a low level in 2017 although the GHL remained high at 4.3 million lb; 2017 longline harvest is confidential due to less than three vessels participating (Table 10). Longline harvest was 350,909 lb in 2018 and 408,778 lb in 2019, less than the half the GHLs of approximately 1 million and 0.9 million lb, respectively (Table 10). Harvest for both pot and jig gear was confidential or zero during the recent 10-year period (Table 10).

Since 2009, excluding confidential data, effort by all gear types has ranged from 7 vessels in 2020 to 38 vessels in 2012 in the state-waters season and between 15 landings in 2015 and 77 landings in 2013. Following the low effort in 2017, with confidential harvest and effort, the state-waters season during the recent three years 2018–2020 had participation between 7 and 16 vessels with between 23 and 40 landings. Since 2001, participation by pot and jig gear has been minimal (Table 10).

Total Pacific cod harvest from 2011 through 2016, from both parallel and state-waters seasons combined, represent the highest harvests on record, and peaked in 2015 at nearly 3.3 million lb

(Table 6). These high harvests had been in part due to large estimates of ABC of Pacific cod derived from stock assessments conducted by NMFS. These large NMFS estimates also provided for corresponding high GHAs allocated from the EGOA ABC, which were further increased by state regulatory step-up provisions that reached the maximum of 25% of the ABC in 2011. Additionally, beginning in 2011, longline vessels that historically had fished the parallel season in Kodiak waters transitioned to PWS and the Cook Inlet Area after requesting that buyers in Seward and Whittier open earlier in the year to take deliveries of Pacific cod. Buyers had traditionally waited until halibut season to open. In addition, management changes provided increased opportunity for longline vessels in PWS when longline became a legal gear type in the state-waters season in 2009 and federal gear sector splits were implemented in 2012. However, those trends were reversed in 2017 as total Pacific cod harvest began a precipitous decline that continued in 2018 and 2019 with the lowest harvest since 2008, resulting from historic low abundance leading to the collapse of the federal fishery.

The parallel and state-waters seasons have varied in length since the state-waters fishery was first established in 1997; however, federal gear sector splits have further compounded the variability in season lengths due to federal step-up and step-down provisions and also staggered closures by gear type. In 2017, longline harvest in the state-waters fishery was minimal because the parallel season was extended until June 10, with little effort and harvest following the state-waters longline opening on June 17, at which time aggregating and spawning of Pacific cod had already occurred with many fishers participating in salmon fisheries during the summer. In 2018 and 2019, the state-waters longline fishery opened concurrently with the halibut season, March 24 and March 15, respectively. Between 2017 and 2019, fishing with jig gear was open all year, 2017 for a parallel season, 2018 for a state-waters season, and 2019 split between parallel and state waters. The seasons for pot gear have been open all year between 2017 and 2019 split between a parallel and a state-waters fishery (Table 1).

Exvessel value of Pacific cod from 2017 to 2019, based on fish ticket reporting, decreased from the previous six seasons, and decreased during this time period from \$359,392 in 2017 to \$266,291 in 2019, related to the decrease in harvest (Table 6). Average Pacific cod price increased from \$0.42/lb in 2017 to \$0.57/lb in 2018 and then decreased slightly to \$0.55/lb in 2019 (Table 7).

### **Historical, through 2009**

Prior to 1997, all Pacific cod harvest occurred in parallel seasons managed concurrently with seasons set by NMFS in the CGOA. During this period, peak parallel season harvests occurred between 1990 and 1995 with a high harvest of 2.2 million lb in 1991 from 88 vessels in 234 landings. From 1996 to 2000, harvests declined to less than 1.0 million lb in all years, except 1999, when the harvest surpassed 1.3 million lb. In 2001, harvest declined to 143,641 lb, the lowest since 1989, and then declined further from 2002 to 2006, to the lowest historic levels. Harvests began to steadily increase again beginning in 2007 (Table 11).

Nearly all Pacific cod was harvested by longline gear prior to 1991. Following expansion of the pot fishery for Pacific cod in 1991, the proportion harvested by pot gear peaked in 1994 (Table 11). However, in 1998, longline gear returned as the dominant gear type accounting for the majority of the parallel season, and since 2001 longline gear has accounted for nearly 100% of the harvest (confidential data excluded) (Table 11). The decline in parallel season harvest and effort after 2000 can be attributed to a variety of factors, including shortened seasons, high exvessel prices for

halibut and sablefish, increased fixed costs, and loss of a directed yelloweye rockfish harvest opportunity in PWS.

The PWS Pacific cod state-waters season was established in 1997; total harvest between 1997 and 2008, when pot and jig gear were the only legal gear types, ranged from 0 to 418,994 lb, and effort ranged from 0 to 12 vessels (Table 10). The high GHGs between 2000 and 2002 coincided with a period of steady decline in harvest that continued with low harvest levels through 2006; most of the data are confidential due to low participation (Table 10). The disparity between harvest and GHG was the result of a decline in Pacific cod fishing effort and an increase in Pacific cod ABC in the federal EGOA.

Pot gear made up 80% or greater of the harvest and harvested up to 45% of the GHG in the early years of the state-waters season, peaking at 385,817 lb in 1998 and declining to 0 in 2001 with harvest at zero or low confidential levels during subsequent years. Jig harvest peaked in 1999 at 79,147 lb before declining to 0 in 2002. Since 2002, fewer than 3 vessels fishing with either pot or jig gear have participated annually, resulting in confidential harvests by those gear types, except for 2008 when 4 vessels harvested less than 8,000 lb. In 2009, longline became a legal gear type and the GHG was achieved in 13 days, exclusively by vessels fishing with longline gear, marking the first time the GHG was achieved since the state-waters season began. Short seasons and a fully utilized GHG continued for the next two years until harvest peaked in 2011 (Table 10).

## **MANAGEMENT AND REGULATIONS**

### **Recent 10 years**

The BOF adopted regulations related to the Pacific cod fisheries in December 2017 that were implemented in 2018. Area regulations now clearly specify that fishery-specific registrations are required for the parallel and the state-waters fishery seasons (5 AAC 28.206(d)). In addition, a general groundfish regulation was adopted that allows only one type of gear on board a vessel fishing for groundfish, with the exception of mechanical jigging machines and hand troll gear, which may be used at the same time (5 AAC 28.230 (j) and (k)).

Several regulations were adopted by the BOF related to the Pacific cod fisheries in December 2014 and implemented in 2015. PWS became a nonexclusive registration area for jig gear during the state-waters Pacific cod season, which allows jig vessels to participate in a state-waters season in both PWS and in another exclusive (or nonexclusive) registration area during the same calendar year. In addition, the regulation was rescinded that mandated the closure of the Pacific cod state-waters season for pot gear after 90% of the GHG had been harvested. Also, a regulation was adopted that provided for a combined jig and pot gear allocation initially set at 15% and the longline gear allocation set at 85%; the regulation included step-up and step-down provisions of 5% implemented the following year for the pot and jig gear GHG allocation if the allocation was or was not achieved, with a minimum of 15% and a maximum of 30% of the GHG allocated to pot and jig gear. As previously mentioned, the rockfish bycatch limit during the parallel Pacific cod season was brought in line with the rockfish bycatch limit for the state-waters season at 5% of the directed Pacific cod harvest.

### **Historical**

Historically, commercial Pacific cod seasons in PWS were managed by EO to coincide with NMFS seasons and allowable gear in the adjacent federal CGOA. This concurrent season was adopted by the BOF in November 1996 and implemented in 1997 as part of the *Prince William Sound Pacific*

*Cod Management Plan* (5 AAC 28.267) and defined as a parallel season. Similar to historical seasons, current parallel seasons are set by EO to coincide with the federal CGOA fishery for Pacific cod with respect to season dates and allowable gear types, provided those gear types are legal in state waters. There is an initial parallel season to coincide with the federal “A” season, and there may be a second parallel season to coincide with the federal “B” season. Parallel season Pacific cod harvest, as well as any Pacific cod bycatch to other directed fisheries in state waters, is accounted against the total allowable catch (TAC) set by NMFS for the EGOA. Vessel registration for parallel seasons is nonexclusive, meaning a vessel may register with ADF&G to fish a parallel season in more than 1 management area within a calendar year.

Additionally, ADF&G may open and close fishing seasons by EO at times other than those specified in the management plan; if ADF&G determines it is necessary to adapt to unanticipated openings or closures of the federal season, maintain sustained yield management, provide for orderly fisheries, or allow for a concurrent state-waters season and a federal season for Pacific cod based on inseason assessment of the fishery. This allows flexibility, and ADF&G has opened additional parallel seasons concurrent with NMFS CGOA Pacific cod federal season openings. In 2002, the BOF also adopted the federal vessel monitoring system (VMS) requirement for all parallel fisheries in order to provide more precise harvest location information and support fishery enforcement efforts to protect Steller sea lions and their habitats.

The *Prince William Sound Pacific Cod Management Plan*, implemented in 1997, established a state-waters season for vessels fishing with pot or jig gear, to open seven days after the closure of the initial parallel season. The management plan also specified that the season would close to vessels fishing with pot gear when 60% of the GHL was achieved. State-waters Pacific cod seasons were originally intended to provide Pacific cod harvest opportunity to local fleets with gear types expected to have low halibut bycatch; pot and jig were the only allowable gear types through 2008. Up until that point, the state-waters season GHL had never been achieved in PWS. That changed in 2009 when longline became a legal gear type following BOF adoption in 2008. PWS was originally designated an exclusive registration area during a state-waters season for all gear types, and still is for pot and longline gear (as noted in previous section, that changed for jig gear in 2014). For an exclusive registration area, vessels are restricted from fishing the state-waters season in both that area and another exclusive or superexclusive registration area; however, a vessel registered for the state-waters season in an exclusive registration area would be allowed to participate in a Pacific cod season in another registration area designated nonexclusive. Another regulation (5 AAC 28.232) requires that all groundfish pots be removed from the water following the closure of the parallel season, except that a vessel registered for the state-waters season may store pots as specified in a designated area 10 days prior to and 10 days following a state-waters season.

The state-waters season is managed for a GHL that is calculated annually as a fixed percentage of the ABC set by NMFS for adjacent federal waters. The PWS GHL was originally calculated as 25% of the EGOA ABC, but in 2003, the BOF reduced the allocation of the EGOA ABC for the GHL to 10% and provided for the allocation to increase to 15%, and then 25%, following years when the GHL was harvested. Providing for an incremental percentage increase was consistent with the initial structure of other state-waters Pacific cod fisheries. However, as previously noted, the GHL was not achieved until 2009, when longline became a legal gear type in the PWS state-waters season. Regulation had specified a date-certain closure of May 1 for longline gear, which was later removed (see below). The addition of longline as a legal gear type resulted in consistent

achievement of the GHL over the next 4 years and the incremental increases in percent allocation for the GHL were implemented, up to the current 25% maximum, which first took effect in 2011. Also, in 2008, the BOF expanded fishing into the Eastern Section of Outside District waters located west of Hook Point (146°15.12'W longitude).

In October of 2011, the BOF amended the *Prince William Sound Pacific Cod Management Plan*, and changes took effect in 2012, in response to new federal gear sector allocations, as follows:

- For longline gear, the parallel season coincides with the federal season in the CGOA for the less than 50 ft hook and line gear sector. The state-waters season for longline gear opens 7 days following the closure of the parallel longline season or concurrent with the individual fishing quota (IFQ) halibut season opening date, whichever occurs later.
- For pot gear, the parallel season coincides with the federal season in the CGOA for pot gear. The state-waters season for pot gear opens 24 hours following the closure of the parallel season for pot gear.
- For jig gear (mechanical or hand troll), the parallel season coincides with the federal season in the CGOA for jig gear. The state-waters season for mechanical jigging machines and hand troll gear opens 24 hours following the closure of the parallel season for jig gear.
- The closure for longline gear on May 1 was removed, and a harvest cap was set at 85% of the GHL for vessels fishing with longline gear.
  - As previously described, longline gear was allocated 85% of the GHL in 2015.
- The harvest cap for vessels fishing with pot gear was raised from 60% to 90% of the GHL.
  - As previously described, pot and jig gear were allocated a combined 15% of the GHL in 2015 with step-up and step-down provisions.

Other important elements of the management plan and related regulations that currently remain in effect include the following:

- Any state-waters season GHL remaining on September 1 may become available to all legal gear types.
- Gear restrictions of no more than 60 groundfish pots and no more than 5 mechanical jigging machines in the state-waters season.
- After October 30, ADF&G may relax gear limits and registration requirements in the state-waters season to promote full utilization of the GHL.
- In a state-waters season, Pacific cod may be taken in the waters of PWS, except those waters of the Outside District east of 146°15.12'W long (Figure 2).
- A separate 20% bycatch allowance of Pacific cod may be established by EO, in addition to any other bycatch allowance.
- During a state-waters season for Pacific cod, PWS is designated an exclusive registration area for vessels fishing with longline or pot gear, and a nonexclusive registration area for vessels fishing with jig gear. During a parallel season for Pacific cod, PWS is designated a nonexclusive registration area for longline, pot, and jig gear.
- A vessel may not participate in a state-waters season and any other Pacific cod season at the same time (on the same trip).

## HARVEST SAMPLING

Dockside sampling of Pacific cod and fishermen interviews were conducted during the PWS state-waters and parallel seasons. Pacific cod were sampled consistently, but years with low state-waters season participation led to few sampling opportunities and lower samples collected (Table 12). Dockside samplers conducted interviews with fisheries participants for information on fishing location and effort, and collected biological samples for fish length, weight, sex, and maturity stage. Age structures (otoliths) were also collected for archiving and future analysis.

Between 2017 and 2019, an average of 1,269 Pacific cod were sampled annually by vessels using longline gear in PWS directed Pacific cod fisheries (Table 12). Since 2010, sample sizes have averaged approximately 1,300 annually, with higher numbers of samples collected since 2013, primarily due to increased sampling coverage in Seward and Whittier. Since implementation of longline as a legal gear type during the state-waters season for Pacific cod in 2009, the number of landings in Seward and Whittier has increased from January through April, providing additional sampling opportunities. Following implementation of federal gear sector splits in 2012, buying operations started to open and buy Pacific cod earlier in the year; they historically had not started buying fish until halibut season opened sometime in March. These buyers had responded to requests from Pacific cod fishermen, who wanted to shift their effort from Kodiak to PWS and Cook Inlet areas to be closer to home. Since 2013, an additional ADF&G dockside sampler was hired and stationed in Seward during January through March or April, covering the peak of the Pacific cod seasons resulting in the increased sampling coverage. After March, many processors stop buying Pacific cod and fishermen also begin to drop out of the Pacific cod fishery as they prepare to enter other fisheries such as Pacific halibut and salmon.

In 2019, the majority of Pacific cod sampled came from the vicinity of Cape Puget followed by the area around Knight Island, similar to the distribution of harvest in recent years. Pacific cod sampled in 2017 and 2019 were relatively small in size compared to historical samples, although slightly larger than those collected in 2016, which were the smallest for the time series (Table 12). Samples during the 2017–2019 period averaged 64.0 cm in fork length and 3.3 kg (7.3 lb) in whole weight, just slightly smaller than the 2010–2019 average of 64.2 cm and 3.4 kg (7.5 lb), although considerably smaller than those samples collected during the early years of biological sampling. The small size in 3 of the 4 recent years (2016, 2017, and 2019) was echoed by the buyers and the fleet, who also cited difficulty finding fish; this is also reflected in lower harvest and a decrease in pounds per landing in recent years. This drop in CPUE was corroborated by harvest data that showed average pounds per landing during the parallel and state-waters seasons combined had dropped by more than half from 2016 to 2019.

Otoliths were collected from 20% of the fish sampled. Pacific cod age determination can be problematic and age accuracy has been unresolved in past years (Carlile 2005). Because Pacific cod in the GOA are managed by NMFS using length, rather than an age-structured model, otolith sampling was reduced, and collected otoliths were archived. However, recent indications of greater site fidelity in Pacific cod than previously assumed suggests further analysis and more focused assessment of state-waters Pacific cod may be warranted.

## RESEARCH

There is no ADF&G-directed research on PWS Pacific cod. Although Pacific cod are captured in Central Region multi-species trawl surveys, the survey gear and design does not lend itself to accurate abundance and biomass estimates.

Stock assessment trawl surveys have been conducted by the NMFS/Alaska Fisheries Science Center (AFSC) every two years since 2001; from 1984 through 2000, they were done every three years (Dorn et al. 2013). The survey uses a stratified random design with 49 strata that are based on depth, habitat, and management area (Martin 1997). Biomass is estimated using mean CPUE and stratum area. Commercial bottom trawlers are used to conduct the survey using standardized trawls; typically, 800 tows are completed in a survey.

The current assessment model for GOA Pacific cod uses the following information: federal and state catch data, commercial federal and state size composition, federal bottom trawl and longline Pacific cod survey information, and conditional length-at-age data for the 2010–2011 fisheries. The most recent stock assessment used Stock Synthesis version V3.30.13.10 to run all the model configurations in the analysis (Steve Barbeaux, stock assessment biologist, NOAA/NMFS, personal communication, August 31, 2020).

Although the federal Pacific cod fishery was closed for the 2020 season, the department prosecuted fisheries at a reduced level. Statewide, the GHs were based on a 35% reduction from the maximum prescribed harvest limits in regulation. This provided opportunity for limited fisheries in state waters while recognizing the need for conservative fishery management at these lower Pacific cod stock levels. For PWS, the GH was allocated<sup>1</sup> 371,811 lb for longline and 65,614 lb for jig and pot fisheries; both these fisheries opened on February 1.

## SABLEFISH

### BACKGROUND

Sablefish, also known as black cod, are a commercially important species throughout their range, and typically harvested using longline or pot gear. Sablefish are a relatively long-lived species (maximum age 94; Munk 2001), and maximum age estimated from the PWS commercial fishery is 50 years old. Adult sablefish occur in deep water ranging from 150 to 1500 m and are generally found in soft substrates, although they are caught in soft, hard, and mixed substrates.

Sablefish are a valuable commercial fish species and have the highest exvessel price per pound of all commercial groundfish species in PWS at an average of nearly \$3.40/lb over the most recent three years (2017–2019; Table 7), although the average price of \$2.08/lb in 2019 was the lowest since 2002. The PWS sablefish fishery developed in the late 1970s in response to increased sablefish value and declines in shrimp and crab fisheries (Bechtol and Morrison 1997).

There are two interesting components of the sablefish fishery that have developed in recent years. The first is that multiple permit holders have been fishing on individual vessels (Table 13). There has also been an increase in harvest from vessels fishing with pot gear beginning in 2018, but historically, the dominant gear in this fishery has been longline (Figure 5). Permit holders fishing

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<sup>1</sup> Alaska Department of Fish and Game Advisory Announcement December 17, 2019.  
<http://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1129745294.pdf>

on vessels using pot gear have had success; pots offer the benefit of avoiding whale depredation and reducing bycatch.

## **HARVEST AND EFFORT**

### **Stock Status**

There are positive indicators regarding the sablefish population in Alaska, yet stock assessment scientists are still recommending conservative harvest levels. Surveys indicate two strong year classes from 2014 and 2016; however, a sharp reduction in the 2014 year class has caused concern and uncertainty about the future of these recruitment pulses. For the 2020 season, stock assessment authors recommended a 25% increase from 2019, much reduced from the maximum Acceptable Biological Catch (ABC) because of this uncertainty. Between 2017 and 2019, these recruitment pulses were welcomed but these fish were small and plentiful; fishers and processors were trying to avoid these fish and lower prices were common. The federal ABC for GOA, and in conjunction, the PWS GHL increased from 2016 to 2019, from a GHL of 110,823 lb to 134,000 lb (Table 13). The 2020 GHL was set at 167,000 lb, the highest since 2014, which was the last year of static PWS GHLS before the GHL began to fluctuate with the corresponding change in the GOA ABC (Hanselman, et al. 2019).

### **Recent**

In 2015, PWS sablefish harvest was at the lowest level in the history of the fishery at 16,910 lb, with effort also at historically low levels. Since then, sablefish harvest has been steadily increasing, although still well below the GHL: 40,457 lb in 2016; 73,113 lb in 2017; and 88,117 lb in 2018, the highest level since 2014. In 2019, harvest was similar to the 2018 level, although it decreased slightly to 85,796 lb. The GHL has not been fully achieved since the shared quota fishery was implemented in 2003 and had been on a steadily decreasing trend until 2015 when only 14% of the GHL was harvested. For the recent 3-year period, 2017–2019, the proportion of the GHL that has been harvested has been consistent and has averaged 64% (Table 13).

Effort in the number of vessels and landings during the recent 3-year period, 2017–2019, were similar, averaging 19 vessels with 52 landings. However, the number of participating limited-entry permit holders has shown a steadily increasing trend since the low of 24 permits fished in 2015 up to 43 and 41 in 2018 and 2019, respectively. Since the shared quota fishery was implemented in 2003, permits have been stacked on vessels, and that trend was even more pronounced during the recent 3-year period 2017–2019, with more than twice as many permits than vessels being fished in 2019 (Table 13).

Anecdotal information from fishermen indicated a higher proportion of smaller fish caught in 2019, which was reflected in average weight data from port sampling and has shown a decreasing trend since 2014; however, average weight of sablefish since 2017 has remained close to the historical average of 2.6 kg (5.7 lb; Table 14).

Exvessel value of sablefish based on fish ticket reporting bounced back after 2015 and 2016, which were the years with the two lowest values historically (\$71,462 and \$129,058, respectively). Exvessel value increased to over \$333,000 in 2017 and nearly \$307,000 in 2018 but then dropped in 2019 down to \$178,456 (Table 6). The average sablefish price per lb was the highest on record in 2017, with an average price of \$4.56/lb, but decreased in the following two years, to \$3.48/lb in 2018 and \$2.08/lb in 2019, one of the lowest values on record; this was due in part to smaller fish having less value (Table 7).

For the 2020 season, COVID-19 had an effect on permit holders' ability to safely lease vessels to harvest their sablefish quota. Permit holders are required to be present on vessels in order to harvest sablefish quotas. Vessel captains had health concerns with multiple permit holders cycling aboard their vessels. These concerns were brought to the department and the season was extended by EO to December 31, 2020, in order to provide more temporal opportunity to harvest sablefish quotas.

## **Historical**

Annual sablefish harvest and effort between 1988 and 1995, when the fishery was open access, ranged from 188,788 lb by 25 vessels in 1989 to 577,315 lb by 126 vessels in 1995. The 1995 peak in catch and effort was attributed to speculation about qualifying for the limited entry program. Between 1996 and 2002, following the implementation of the limited entry program, harvest and effort in the Inside District directed sablefish fishery ranged from 196,370 lb by 51 vessels in 1997 to 342,854 lb by 32 vessels in 2000, with a maximum effort of 69 vessels in 1996. The shared quota fishery was implemented in 2003; following this, harvest has ranged from a high of 225,002 lb by 38 vessels in 2004 to a low of 16,910 lb by 21 vessels in 2015 (Table 13).

Most sablefish harvest historically occurred in the Inside District. However, before regulations restricted the fishery to the Inside District in 1997, harvest from the Outside District was significant in some years, accounting for nearly 20% in 1993 and 1994 (Table 13). Since the shared quota fishery was implemented, harvest in the Outside District is confidential, although it has been minimal and primarily a result of trawl bycatch. Most of the Inside District fishing effort has been concentrated in a deep trench between Lone Island and the Naked Island group (Figure 1). Other harvest areas include Port Wells, Knight Island Passage, and the deeper waters of central PWS near the tanker traffic lane.

## **MANAGEMENT AND REGULATIONS**

### **Recent 5 years**

Currently, there is no directed sablefish stock assessment research being conducted in PWS. However, there have been tagging studies conducted by both NMFS and ADF&G that indicate that sablefish populations are mixed throughout the GOA, which includes PWS. In addition, NMFS has conducted biennial stock assessment surveys for sablefish in the GOA; NMFS ABC, the maximum allowable harvest level, is derived from these surveys. Beginning in 2015, the sablefish GHL was adjusted by applying the relative change each year in the NMFS GOA sablefish ABC, retroactively beginning in 1994, the year following implementation of the final yield per habitat model. Following 22 years of a static GHL at 242,000 lb, the 2015 GHL was set at 122,000 lb, nearly a 50% decrease, which was consistent with the poor fishery performance that year. Since annual adjustment of the GHL began in 2015, the GHL decreased to its historic low in 2016 of 110,823 lb, and then began to steadily rise, up to 134,000 lb in 2019 (Table 13).

Regulations adopted by the BOF in 2017 included a clarification of requirements for completing and submitting sablefish log sheets (5 AAC 28.272 (f)). Additionally, the deadline to submit log sheets to the department was shortened from 10 to 7 days following a sablefish landing, to correspond with fish ticket deadlines. The requirement of accuracy for log sheets was also adopted to aid in enforcement. The regulatory reference to only longline gear was removed because pot and jig gear are also allowable gear types; gear-specific log sheets are distributed by the department when permit holders register for the sablefish fishery.

## Historical

Between 1993 and 2014, the PWS sablefish fishery had a static GHL of 242,000 lb, based on the midpoint of a 97,000–385,900 lb guideline harvest range (GHR) derived from a yield-per-habitat model (Bechtol and Morrison 1997). Harvest and CPUE declined in the PWS sablefish fishery from 2011 to 2015 (Table 13; Figure 6), prompting ADF&G to examine other options for GHL development.

Between 1986 and 1992, the PWS sablefish fishery was managed for the midpoint of an 88,200 to 308,650 lb (40–140 mt [metric ton]) GHR. This GHR was based on a yield-per-habitat model developed for similar habitat in Clarence Strait in Southeast Alaska (Bechtol and Morrison 1997) with an estimated yield of 132 to 551 lb (0.06–0.25 mt) per square nmi. In 1993, following the improvement of bathymetric techniques, the area deemed as suitable sablefish habitat was increased by 26% and the GHR was modified to the midpoint of 97,000 to 385,900 lb (44–175 mt), or 242,000 lb, where it remained until 2015.

Prior to 1993, PWS sablefish seasons opened concurrently with sablefish seasons in federal waters of the CGOA and closed by EO when the state-waters GHL was attained. From 1993 to 1995, ADF&G staff established the duration of the fishing period based on the GHL, the projected number of participants, and past fishery performance. As effort and efficiency of the PWS fleet increased, fishing seasons became more restrictive. Seasons were composed of 1 or 2 fishing periods with total fishery duration ranging from 96 hours in 1993 to 48 hours in 1995 (Rumble et al. 2017). A season opening date of May 1 was first effective in 1997.

In 1996, the Commercial Fisheries Entry Commission (CFEC) adopted a limited entry program for the PWS sablefish fishery that established 4 vessel size classes (90 ft, 60 ft, 50 ft, and 35 ft) and 2 gear classes, fixed (longline) and net (trawl) gears. Based on the qualifying years 1991–1994, the program initially established a target of 49 permanent permits. In 2013, the adjudication process was completed for the fishery and CFEC issued 58 permanent fixed-gear permits and 1 permanent net gear permit (Rumble et al. 2017).

Despite adoption of the limited entry program, competition intensified during 1997–2002, which caused shorter season durations and gear conflicts, with tangled longlines and vessel crowding resulting in lost gear when ground lines were parted. In response to the gear conflicts and the undocumented mortality from lost gear, and to provide for conservation of the resource, the BOF adopted a shared quota approach for the PWS sablefish fishery (5 AAC 28.272) in 2003. This approach successfully lengthened the season to at least 82 days in all subsequent years and achieved a significant reduction in gear loss. Quota allocations were derived such that half of the GHL was allocated equally among registered participants and the balance of the GHL was allocated according to the permit's vessel size class: Classes A and B (90 ft and 60 ft maximum length) vessels = 18.53%; Class C (50 ft maximum length) vessels = 70.33%; and Class D (35 ft maximum length) vessels = 11.14%. These percentages were derived from average harvest by each vessel size class from 2000 through 2002.

Original regulations in the development of the limited entry program specified that permit holders were restricted in the maximum overall length of vessel they could use based on past participation (20 AAC 05.779). When the shared quota approach was adopted, ADF&G petitioned the CFEC to remove the restriction on using vessels of a larger size class while maintaining the vessel size classification for the purposes of issuing the permit and allocating the resource among permit holders. This change became effective for the 2005 season and has since allowed stakeholders to

benefit from the efficiency of being able to harvest quota from any size vessel. Other elements of the restructured fishery included possession requirements, retention of all sablefish fish tickets aboard a sablefish fishing vessel, a registration deadline, and a split fishing season. A registration deadline was set at 5:00 p.m. March 1 and registration occurred via a commissioner's permit. Season dates were March 15–May 15 and August 1–August 21. Commissioner permit stipulations included a logbook requirement and a 6-hour prior notice of landing (PNOL) requirement to allow adequate sampling of the sablefish harvest.

Killer whale *Orcinus orca* depredation on hooked sablefish during the March, April, and early May portions of the season were a negative component of the extended season. Complaints from fishery participants regarding killer whale depredation peaked during the 2005 season. To reduce the occurrences of killer whale depredation, the BOF approved a proposal in December 2005 to allow longline groundfish pot gear to be used by fixed gear permit holders in the PWS sablefish fishery (5 AAC 28.230 (i)). However, the use of longline pot gear in the fishery had been very limited, and the harvest by this gear type remained confidential due to the limited number of vessels. In time, fishery participants realized the best means to avoid killer whale depredation was to forfeit fishing opportunity during the spring season until the first week of May, when many of the killer whales depart PWS in pursuit of other available food sources. Recognizing the forfeited early season fishing opportunity, ADF&G extended the summer season 17 days to include the last week of July and the later part of August between 2006 and 2008 by EO. In December 2008, the BOF adopted a proposal amending the season dates to April 15 through August 31 to minimize killer whale depredation in early spring and maximize opportunity for fishery participants to achieve the GHL. At the same time, requiring a commissioner's permit to participate was repealed and conditions previously set under that permit registration deadline of 5:00 p.m. April 1 were formally adopted into regulation (5 AAC 28.272 and 5 AAC 28.206 (c)).

## **HARVEST SAMPLING**

Dockside sampling of sablefish from PWS was conducted in the ports of Cordova, Seward, and Whittier in 2016. Sampling operations have been conducted consistently since 1995 on PWS sablefish. Biological samples were collected for fish length, weight, sex, gonad maturity, and age (Table 14). Log sheets collected from fishermen and dockside interviews provide information on fishing location and CPUE (Figure 6).

Between 2017 and 2019, an average of 713 sablefish were sampled annually from vessels using both longline and pot gear. Sablefish fork length averaged 60.5 cm and weight averaged 2.5 kg (5.5 lb). The average length of 61.0 from 2019 samples was the same observed in 2018 and just above the 2010–2019 average of 60.9 cm (Table 14). Sablefish average length has increased since 2016, when the average size was 56.8 cm, the smallest size observed since sampling began in 1995. Small sablefish size was corroborated by buyers and the fleet in 2016, who have noted the increase in size over the past three years, which was accompanied by increased GHLs and harvest (Table 13). The predominance of small fish in 2016 was interpreted positively by fishermen in terms of potential recruitment into the fishery for future years, which may be starting to take effect, although the sablefish harvest was still only 64% of the GHL in 2019 (Figure 6).

Age structures (otoliths) from sablefish were sent to ADF&G Age Determination Unit (ADU) in Juneau for processing, and after a previous backlog, the ADU has a full complement of trained staff and sablefish age data is now current through 2019. The average annual age of sablefish between 1995 and 2019 ranged from 5 years to 8 years, with an overall average age of 6 years.

Sablefish have still been relatively young during the recent 5-year period, with an average age of 6 years in 2015 dropping to 5 years in both 2016 and 2017, then increasing back up to 6 years in 2018 and 2019 (Table 14).

Logbook data collected from fishery participants indicates sablefish CPUE in pounds per hook has improved since 2015 when it was the lowest in the time series at 0.06 lb/hook, the same year with the lowest harvest. Sablefish CPUE has increased steadily over the past 4 years, 2016–2019, to 0.44 lb/hook in 2019, above the average for this same period of 0.30 lb/hook (Figure 6).

## **RESEARCH**

Sablefish research in Central Region began in 1996 when ADF&G initiated an assessment program to develop a fishery-independent index of sablefish abundance using an annual longline survey (Bechtol and Vansant 1998; Bechtol 2001). This survey was discontinued after 2006 due to lack of funding.

A sablefish tagging survey was conducted in 2011, 2013, and 2015. Sablefish tagging results have assisted with management. To date, 1,552 sablefish were tagged, with 1,203 tagged in 2011, 318 tagged in 2013, and 31 tagged in 2015 (Rumble et al. 2017). Of those tagged in 2011, 319 (27%) were recaptured, 56 (18%) were recaptured from the 2013 marked releases, and 5 (16%) were recaptured from 2015 releases. Recapture rate in the first year for fish tagged in 2011 was 13% and 8% for fish tagged in 2013. In the first year, 94% and 81% of recaptures came from inside PWS in 2011 and 2013, respectively. The percentage of marked fish recaptured outside PWS steadily increased in subsequent years, with the majority of recaptures occurring outside of PWS after 2 years at large. Distance traveled increased with days at large through the second year but remained similar for subsequent years (Rumble et al. 2017). Of fish that were recaptured outside PWS, more moved south to Southeast Alaska and beyond than moved west (Figure 7).

## **POLLOCK**

### **BACKGROUND**

Walleye pollock grow to a maximum size of 1 m and a maximum weight of 6 kg, although they average 30–50 cm and 0.25–0.90 kg. Pollock are semipelagic schooling fish, which become increasingly demersal with age, and are relatively fast growing and short-lived. They are caught in the trawl fishery beginning at age 2 and may live to a maximum age of 22 years. Because many other species including Stellar sea lions feed on pollock, they play an important role in the ecosystem. At the same time, their survival rate is highly variable, which can potentially cause large fluctuations in pollock abundance over short periods of time.

The pollock trawl fishery in Alaskan waters is one of the largest and most valuable fisheries in the world, and the PWS directed pollock trawl fishery is the only pollock trawl fishery that is prosecuted entirely in state waters. It began in 1995, when Kodiak-based trawlers combined efforts with a Cordova processor to establish the fishery, and in 2000, the *Prince William Sound Pollock Pelagic Trawl Management Plan* was adopted into regulation (5 AAC 28.263).

### **HARVEST AND EFFORT**

#### **Recent 10 years**

Pollock harvests in the PWS directed fishery increased above historical average levels after 2011, increasing 71% from 2011 to 2012 with harvests of 3.4 million lb to 5.8 million lb, respectively.

Between 2012 and 2020, the GHL and subsequent harvest have been at historic high levels. GHLs have ranged from 5.1 million lb in 2020 to 13.1 million lb in 2016, and harvest ranged from 4.1 million lb in 2017 to 9.8 million lb in 2015. Participation in those years ranged from 8 vessels in 2017 to 22 vessels in 2019, and landings ranged from 15 in 2017 to 35 in 2015. The percentage of the GHL harvested has been 96% to 100% during the recent 3-year period, 2017–2020, which followed a low harvest of only 44% of the GHL in 2017 (Table 8).

All pollock harvest in the directed fishery occurs in the Inside District, which is split into three sections each with a harvest cap of 60% of the GHL (Figure 8). Harvest in the Hinchinbrook, Knight Island, and Bainbridge sections has varied considerably. Since 2007, the majority of harvest had been taken in the Hinchinbrook Section until fluctuating in recent years (Figure 9). During the recent 10-year period, the proportion of pollock harvested in Hinchinbrook Section averaged 57% until dropping precipitously to 4% in 2018, then increased to 27% in 2019, and climbed back to 65% in 2020. Conversely, since 2011, harvest in the Bainbridge Section was less than 1% until rising to 9% in 2017 then climbing steadily to 64% in 2019 before dropping back to 35% in 2020. Knight Island Section harvest has varied widely, and zero harvest was taken from there in 2020 (Figure 9).

The shortest pollock season during the recent 10-year period, 2011–2020, was in 2014, at only 8 days; the fishery was closed after attaining regulatory rockfish bycatch limits in the fishery prior to the GHL being achieved (Table 8). There was high effort when the season opened on January 20 in 2014. In that year, rockfish bycatch was high with a harvest of 67,466 lb or 1.29% of the directed pollock harvest, more than twice the 0.5% rockfish bycatch cap (Table 4). Rockfish bycatch harvest in the pollock fishery decreased after it peaked in 2014, and in 2017 was down to 2,552 lb (0.06%); however, it did increase to 17,436 lb in 2020 or 0.34% of the directed pollock harvest, the highest percentage since 2014 (Table 4). Other notable bycatch was the high harvest of 240,125 lb of squid caught during the fishery in 2015; after decreasing following the peak, squid bycatch again increased in 2020 up to 153,959 lb or 3.02% of the directed pollock harvest, just over the allowable level of 3.0% set by EO for the fishery (Table 4). The high level of squid in 2015 was mirrored in the NOAA/NMFS stock assessment survey and squid biomass estimates; that data is not yet available for 2020.

Except for 2014, season length ranged from 14 to 71 days during the recent 10-year period (Table 8). Season length is influenced by effort, which is often dependent on the pollock schooling up, with other fishing opportunities being a factor, and fishing often does not begin until February in many years, even though the season is open January 20.

## **Historical**

Prior to the beginning of the directed pollock trawl fishery in 1995, an average of 4,551 lb of pollock was harvested annually between 1988 and 1994. Interest and participation in the PWS directed pollock fishery has varied between 1995 and 2010 with a maximum of 11 vessels participating during the 2010 season and a confidential number of vessels (fewer than 3) during the 2001 season. Prior to 2011, harvest averaged about 3 million lb and ranged from 1.4 million lb in 2008 (39% of the GHL) to 6.3 million lb in 1995 (144% of the GHL; Table 8).

The length of the season also varied. Following the initial season that lasted 26 days when the GHL was exceeded, the season lasted approximately 1 week from 1996 to 1998. Between 1999 and 2010, season length varied between 36 days and 84 days (Table 8). Because of section harvest caps instituted in 2000, individual sections may close in advance of season closures.

For all years since the directed fishery began, the proportion of pollock harvested in the Hinchinbrook Section averaged 43%, with Knight Island Section producing 26% and Bainbridge Section producing 31% of the harvest. In the early years of the directed fishery, 1995 through 2000, the majority of harvest came from Bainbridge Section, and then switched to Hinchinbrook Section for most years beginning in 2002 through 2017; Knight Island Section never had the majority of harvest in any given year (Figure 9).

## **MANAGEMENT AND REGULATIONS**

### **Recent 3 years**

There were no new pollock regulations adopted at the 2017 BOF meeting.

### **Historical**

The directed pollock pelagic trawl fishery GHL is deducted from the combined federal Western, Central, and West Yakutat GOA Regulatory Areas (W/C/WYAK) ABCs and has ranged from 2.0 million lb in 2004 and 2005 to 13.1 million lb in 2016 (Table 8). ADF&G used several different approaches to determine the GHL through the years, including 1) applying 8–10% harvest rates to biomass estimates derived from ADF&G’s summer bottom trawl assessment surveys, 2) using derivations from a spring acoustic survey biomass estimate, 3) mirroring relative annual changes in harvest levels in federal waters of the GOA, and 4) applying the Tier 5 (NPFMC 2020) approach similar to that used by the NPFMC to establish the ABC for some groundfish species. Starting with the 2013 season, ADF&G and the NPFMC Groundfish Plan Team agreed to calculate the PWS directed pollock trawl fishery GHL as 2.5% of the W/C/WYAK ABC. This percentage was the midpoint between the 2001–2010 average of GHL percent of the W/C/WYAK ABC (2.44%) and the 1996 and 2012 level (2.55%). ADF&G has reserved a percentage of the calculated GHL for a test fishery. Test fisheries were conducted in all years except 2006, 2008, 2012, 2014, 2015 and 2017; test fishery revenues were used to fund PWS commercial fishery management, including groundfish stock assessment and inseason pollock catch sampling.

The fishery has an annual registration deadline of January 13 (5 AAC 28.206), and the season opens at 12:00 noon on January 20. There is a regulatory closure date of March 31 in order to avoid herring bycatch. The fishery occurs in the Inside District, which is further divided into 3 sections: Bainbridge, Knight Island, and Hinchinbrook (Figure 8), described in 5 AAC 28.263 (a), and no more than 60% of the GHL may be taken from any one of these sections. In 2002, when there was a dramatic increase in bycatch rates for all species (Table 4), committee meetings at the BOF determined that ADF&G would encourage cleaner fishing practices by instituting bycatch limits; bycatch is restricted to no more than 5% of the total round weight of pollock harvested, and ADF&G further manages bycatch by apportioning the percentage among the following species groups by EO: rockfish (0.5%), salmon (0.04%), shark (0.96%), squid (3.0%), and other species (0.5%). In 2014, the rockfish bycatch limit of 0.5% during the directed pollock pelagic trawl fishery was adopted into regulation by BOF.

Inseason management during the PWS directed pollock fishery is intensive, with close contact between the fleet and managers with attention to the 60% section harvest limit and bycatch limits. ADF&G management requirements include mandatory check-in and check-out procedures before fishing in or leaving a management section, as well as recording fishing information in log sheets. The majority of the fleet transits from Kodiak, which increases the lead time necessary to make management decisions. Trip limits of 300,000 lb are established in regulation (5 AAC 28.073) and

are an important management tool to control the rate of harvest in the fishery. Historically, vessels have often achieved this harvest trip limit in less than 12 hours of fishing time.

Although bycatch in this fishery is low relative to other groundfish fisheries, bycatch rates have sometimes warranted management measures. The amount of bycatch is estimated by fishery participants and communicated to ADF&G during the fishery. Pollock harvest is often estimated on fish tickets at the time of landing with bycatch requiring additional time to process and those species and weights may not be initially reported. At times, full accounting of bycatch may not be available for multiple days or even until after the closure, when all fish ticket data are processed. Inseason estimates are often different than the actual bycatch reported on the fish tickets. Rockfish caught as bycatch during this fishery accrue to the rockfish GHL of 150,000 lb for that bycatch-only fishery. Because rockfish bycatch levels are a percentage of the directed harvest, as pollock GHGs increase, rockfish bycatch allowances increase, and rockfish harvested in this fishery may be a significant proportion of the rockfish GHG (Table 4).

Examples of fishery closures due to bycatch limits being achieved include the following:

- In 2008, 38% of the 2008 GHG was harvested due to closure of the fishery when the rockfish bycatch cap was exceeded; the Hinchinbrook Section was closed on March 7, and the remaining sections (Knight Island and Bainbridge) closed on March 17.
- In 2009, the fishery was closed before the GHG was achieved because both the miscellaneous finfish and rockfish bycatch caps were exceeded; the Hinchinbrook Section was closed on February 11 and the remaining sections closed on March 21 with 90% of the GHG harvested.
- In 2014, the fishery was closed before the GHG was achieved when the rockfish bycatch cap was exceeded; all sections were closed on January 27, and 61% of the GHG was harvested.

In recent seasons, ADF&G has worked with the fleet to rotate vessels through PWS and limit the number of vessels fishing at a given time, with the goal of minimizing bycatch harvest and targeting the GHG closely. This has been effective; no regulatory action has occurred due to excessive bycatch following the 2014 closure.

## **HARVEST SAMPLING**

Dockside sampling of walleye pollock from the PWS trawl fleet has been conducted since 1995 (Table 15). This required ADF&G staff to travel from Homer and Seward to achieve sampling objectives. All sampling operations were conducted in the port of Kodiak in 2020, as there was no buyer in Seward and therefore all vessels delivered in Kodiak. Biological samples collected from pollock included fish length, weight, sex, gonad maturity, and age structures (otoliths) to determine age. Logbook data provided information on fishing location and effort. An ADF&G onboard observer was deployed during the one preseason test fishery trip in 2020 to collect additional samples and obtain information on fishing activity, gear deployment, and bycatch. The first test fishery trip had poor fishing as did initial trips during the regular fishery in late January, which resulted in most fishing occurring mid- to late February. It took three additional test fishery trips postseason to harvest the remaining test fishery allotment.

In 2020, ADF&G staff sampled 1,600 pollock for length and, of those, 800 fish were sampled for all biological data. Pollock had an average fork length of 48.0 cm and an average weight of 0.8 kg (1.8 lb) in 2020. Between 2017 and 2019, an average of 1,757 pollock were sampled with an

average fork length of 44.8 cm and 0.8 kg (1.8 lb), considerably smaller than the 2010–2019 average of 48.1 cm in length and 1.0 kg (2.0 lb), and well below the size of fish sampled during early years of biological sampling (1995–1998). However, sampled pollock have been steadily increasing in size following a historic low in 2017 when average length was 42.4 cm and weight was 0.6 kg (1.3 lb). Pollock size trends indicated that fish condition was still relatively poor in recent years, with a low weight-to-length ratio. Low fish weight and low female percentage was a concern of buyers and the fleet in 2016 and 2017, and no payment was made by some processors to vessels for fish under 0.8 kg, resulting in less effort and GHs not being achieved (Table 8). Although small size was still a concern in 2020, effort was more typical and GHs were nearly or fully achieved from 2018 to 2020. The sex ratio in 2020 pollock samples was 37% female, slightly above the 2017–2019 and 2010–2019 averages (Table 15).

The age structures collected from pollock are otoliths (ear bones) and age reading occurs at the ADF&G laboratory in Homer. Processing of age data are not yet complete for 2016 through 2020. The average age of walleye pollock from 1996 to 2015 ranged from 4 years to 8 years and averaged 6 years (Table 15).

## **RESEARCH**

NMFS conducts a stock assessment of pollock every year with a variety of sources of data included to estimate abundance. For 2017–2019 assessments, information included in the assessment model included: federal fishery total catch and catch at age, Shelikof Strait acoustic survey biomass and age composition, NMFS bottom trawl survey biomass and length composition, ADF&G crab/groundfish trawl survey biomass and age composition, and summer acoustic survey biomass and length composition (Dorn et al. 2019, Dorn et al. 2018, Dorn et al. 2017). In this time period, there have been contrasting trends in the survey abundance indices which has caused uncertainty and poor model fits. Besides the model estimates, other factors have been used to make harvest recommendations including population dynamics considerations (age composition) and environmental/ecosystem considerations. These abundance estimates and recommended ABCs are used to derive annual GHs. Between 2017 and 2020, pollock ABCs for the GOA have decreased steadily (excluding Southeast Outside) from 203,769 mt in 2017 to 108,494 mt in 2020, a decrease of ~50%.

There is no directed ADF&G research on PWS pollock, but pollock are caught in Central Region multi-species trawl surveys, which are designed to target and assess Tanner crab. Survey estimates for pollock from these surveys are highly variable and not an accurate tool for assessing pollock; therefore, the survey is unable to provide abundance and biomass estimates for the pollock population in PWS but CPUE estimates can be examined for trends and may provide an index.

Pollock CPUE estimates from the ADF&G large-mesh trawl survey are available for 1994 to 2015. Estimated CPUE increased for the first 3 years pollock were accounted for in the survey to a peak of 150.19 lb/nmi in 1997 for the time series. Pollock CPUE then dropped dramatically in 1999 to 28.82 lb/nmi and remained below average through 2003. CPUE estimates were above average in 4 out of the next 5 surveys from 2005 to 2013 with a high of 94.41 lb/nmi in 2009. CPUE declined after 2009 dropping to very low levels of approximately 19.70 lb/nmi in 2014 and 2015 (Rumble et al. 2017). More recent estimates will be published in a future research report.

# LINGCOD

## BACKGROUND

Lingcod belong to the greenling (Hexagrammidae) family. Male lingcod begin to sexually mature at age 2 and 50 cm length, whereas female lingcod begin to mature around 3–5 years of age and 60–76 cm length. Lingcod can reach sizes of 38 kg and 1.5 m; females exhibit a faster growth rate and grow larger than males with a maximum reported age of 25 years (Munk 2001). Adult male lingcod do not generally move far from where they are born and engage in guarding the “nests”, where female lingcod deposited eggs, for 8–10 weeks during winter and early spring. An unguarded nest can be destroyed within 48 hours by predators. Because of these behaviors, this species is highly susceptible to overfishing.

## HARVEST AND EFFORT

### Recent

Lingcod harvest in PWS occurs in a directed lingcod fishery and as bycatch to other groundfish fisheries. Retention of lingcod is allowed beginning on July 1 and the state has authority to manage lingcod in both state and federal waters. The total lingcod harvest between 2017 and 2019, directed and bycatch combined, including federal waters, ranged from 12,622 lb to 29,554 lb with 22 to 38 vessels participating and an average of 51 landings annually. Lingcod harvest in 2018 and 2019 was close to the 10-year average (2010–2019) of approximately 29,000 lb; however, the 2017 harvest was 12,622 lb, the lowest level since 1999. Generally, most of the harvest of lingcod occurs in federal waters of PWS, and between 2017 and 2019, the federal waters harvest averaged 56% of the total harvest (Table 16).

Directed harvest for lingcod in the Inside District of PWS (Figure 1) from 2017 to 2019 ranged from 0 lb in 2017 to 5,596 lb in 2019. Directed harvest in the Outside District (including federal waters) during the same period has been higher, ranging from 2,583 lb in 2019 to 15,686 lb in 2018. Bycatch harvest of lingcod during the recent 3-year period in the Inside District ranged from 460 lb in 2017 to 3,574 lb in 2018 and has also been higher in the Outside District ranging from 6,140 lb in 2017 to 16,437 lb in 2019 (Table 17).

During the recent 3 years (2017–2019), an average of 52% of all harvested lingcod was landed as bycatch to other halibut and groundfish fisheries, which is similar to the recent 10-year average of 50%. However, the percentage of lingcod harvested as bycatch fluctuated considerably during the recent three years, ranging from 36% in 2018 to 69% in 2019. During the recent three years, lingcod harvest from the Inside District directed fishery was lower than harvest from the Outside District. For the recent 10-year period (2010–2019), the majority of lingcod harvest from the Inside District was in the directed fishery (Table 17).

Exvessel value of lingcod based on fish ticket reporting was \$33,988 in 2018 and \$28,785 in 2019, the highest since 2012; both years were above the 2010–2019 average value of \$26,331 (Table 6). Average lingcod price per lb in the last three years has averaged \$1.10, ranging from \$1.05 in 2017 to \$1.15 in 2018, and above the 10-year average of \$0.94 (Table 7).

### Historical

Since 1988, lingcod harvest and effort varied, from a low of 9,344 lb by 16 vessels with 18 landings in 1999, to a high harvest of 110,208 lb by 36 vessels with 49 landings in 1995, and a high effort

of 89 landings from 42 vessels with a harvest of 72,472 lb in 2009. In the Inside District of PWS, lingcod harvest peaked in 1997 at 22,890 lb with the second highest harvest of 20,244 lb in 1991; however, in most years harvest was less than 7,000 lb. In the state waters of the Outside District, harvest peaked at 18,796 lb in 2001, although in most years it was also less than 7,000 lb. The majority of the harvest in most years occurred in adjacent federal waters of the EEZ; harvest in these waters peaked at 107,319 lb in 1995 with a low of 2,509 lb in 1999 and has been highly variable annually (Table 16).

Historically, the PWS lingcod fishery was a bycatch fishery composed of many small landings by predominantly jig (mechanical and hand troll) and longline gear. Since 2003, longline has been the dominant gear type harvesting lingcod, although some landings still occur by jig, pot, and trawl gear (Figure 10).

## **MANAGEMENT AND REGULATIONS**

### **Recent**

At the 2017 PWS Finfish BOF meeting, a regulation was adopted that specified the bycatch allowance for lingcod in PWS is measured as round weight.

### **Historical**

ADF&G manages lingcod harvest in both state and federal waters. The regulatory season from July 1 to December 31 exists to protect spawning and nest-guarding lingcod during the first half of the year. A minimum size requirement of 35 inches overall, or 28 inches measured from the front of the dorsal fin to the tip of the tail, is intended to allow at least one spawning opportunity for a lingcod prior to being susceptible to harvest (5 AAC 28.270 (a)).

Beginning in 1998, ADF&G established a lingcod fishery GHL calculated as 50% of the most recent (1986–1995) 10-year average harvest. In 2000, ADF&G increased the GHL to 75% of the average for those years, consistent with the most conservative alternative used by the NPFMC when considering fisheries with little data on abundance or stock structure. This resulted in a 5,500-lb GHL for the Inside District and a 19,000-lb GHL for the Outside District and adjacent federal waters. Since 2008, the GHL has been set at 7,300 lb for the Inside District and 25,300 lb for the Outside District and adjacent federal waters, or 100% of the historical harvest (Table 17).

The BOF adopted a regulation in 2008 allowing retention of lingcod as bycatch to other directed fisheries up to 20% by weight of the directed finfish species on board a vessel, both during and after the closure of the directed lingcod season (5 AAC 28.210(c)(2)). Retention of lingcod following the closure of the directed fishery in 2009 resulted in the second highest recorded lingcod harvest of 72,472 lb, which included the highest lingcod bycatch harvest of 52,087 lb (Tables 16 and 17). However, harvest of lingcod has declined in subsequent years. No lingcod retention is allowed before July 1, and mortality of released lingcod is believed to be low (Albin and Karpov 1998).

To facilitate biological sampling objectives, the BOF adopted a regulation in 2003 (5 AAC 28.270 (c)) that provides ADF&G with EO authority to require that all lingcod be delivered with the head attached, and with the vent and area 1.0 inch forward of the vent intact as proof of sex. An EO has been issued annually since 2003 to allow ADF&G greater opportunity to achieve necessary sample sizes and collect a more robust data set that includes information on sex.

## HARVEST SAMPLING

Dockside sampling of lingcod from PWS was conducted in the ports of Cordova and Seward in 2019. Although there has been some sporadic sampling of lingcod dating back to 1993, sampling operations have been conducted consistently since 2003 on PWS lingcod. Sampling efforts have improved because ADF&G has issued an EO annually that requires lingcod to be landed with head on and vent intact since 2003. Biological samples were collected for fish length, weight, sex, gonad maturity, and age, and dockside interviews were conducted for information on fishing location and effort.

Between 2017 and 2019, 238 lingcod were sampled from vessels using longline and jig gear, with an average fork length of 108.5 cm and an average whole weight of 13.3 kg (29.3 lb; Table 18). The average size of lingcod during the recent 3-year period was slightly below the 2010–2019 average. Between 2011 and 2018, lingcod had the highest average lengths since sampling began, peaking in 2014 at 110.9 cm, with average weights following the same trend (Table 18). The larger size of lingcod in those recent years may be partly attributed to higher proportions of females in samples collected, peaking in 2013 at 98% (Table 18). In 2019, the proportion of females fell to the lowest historical level at 66%, well below the 2010–2019 average of 89%; prior to that, the lowest percentage of females had been 79% in 2003, the first year of consistent sampling (Table 18). Lingcod must be 35 inches (89 cm) in total length to be retained, and the fact that female lingcod grow to a larger size than males (Jagiello 1990 and Gordon 1994) results in a higher proportion of females being harvested in the fishery.

Otoliths are the current age structures collected from lingcod to determine age. Prior to 2006, fin rays were the age structure used to age lingcod. An experiment comparing ages estimated from otoliths and fin ray sections was conducted between 2001 and 2005 at the Homer lab, and analysis produced comparable results. Less labor is required to process otoliths versus fin rays, and therefore the decision was made in 2006 to switch to otoliths as the preferred age structure for all lingcod age determination in Central Region (PWS and Cook Inlet Areas) from the commercial fishery. However, ADF&G staff continue to use fin rays to assess lingcod age from the sport fishery. Otoliths from lingcod were sent to the ADU laboratory for processing, and age data are not available for 2017–2019 at this time. The average age of lingcod for between 2003 and 2016 ranged from 14 to 17 years, with an average age for 2010–2019 of 16 years (Table 18).

## RESEARCH

An ROV survey (Byerly et al. 2015) was conducted in 2012 to estimate lingcod and DSR density and local abundance in the southwestern portion of PWS (see Rockfish section above). Mechanical issues resulted in an incomplete survey, but for the restricted area that was sampled, lingcod density was estimated at 2,889 fish/km<sup>2</sup>. This density estimate was not significantly different from that in other areas sampled in the Cook Inlet Area, although the PWS estimate had lower precision. Based on stereo video measurements, 57% of lingcod observed were estimated to be of legal size. In 2016, an ROV survey covering most of PWS was conducted in both inside and outside waters, including federal waters. Analyses require comprehensive video review and data is not yet available.

Very few lingcod are captured in the large-mesh trawl survey or in the sablefish longline survey (likely because these surveys are conducted deeper than lingcod typically occur), and as such, those data are of little use for assessment purposes.

# MISCELLANEOUS GROUND FISH

## SKATES

### BACKGROUND

Skates are not specified in PWS groundfish fishery regulations and are therefore classified as a miscellaneous groundfish. A directed fishery for big (*Raja binoculata*) and longnose (*Raja rhina*) skates occurred in PWS during 2009 and 2010 following the ADF&G's receipt of a capital budget management increment but was discontinued. Big and longnose skates are the two most frequently landed skate species in PWS. The majority of the skate harvest occurs as bycatch in the state-waters Pacific cod fishery, although skates are also harvested in all directed longline groundfish fisheries. Both of these species are long lived, have slow growth rates, and mature late in life, making them vulnerable to overfishing. The directed skate fishery was discontinued for several reasons, including the lack of comprehensive stock assessment data, relative catch and composition of skate species, halibut bycatch in the directed skate fishery, other skate harvest opportunities, and cost of management.

### HARVEST AND EFFORT

#### Recent

During the last three years, 2017–2019, skate harvest has decreased to lower levels; reduced Pacific cod abundance and GHLS has led to less bycatch, including skates. The harvest ranged from 19,752 lb in 2019 to 39,831 lb in 2017, much lower than the previous eight years. Skates had an exvessel value of \$8,566 in 2018, and \$5,728 in 2019, the lowest levels since 2008; price per pound was also low at \$0.27/lb and \$0.29/lb, respectively, and was below the recent 10-year average (2010–2019) of \$0.35/lb (Tables 6 and 7).

From 2010 to 2016, skate harvested as bycatch in PWS ranged from 92,488 lb in 2016 to 268,440 lb in 2015 (Table 6). Following the closure of the directed fishery, the harvest of skates as bycatch was similar to levels harvested when the directed fishery was open in 2009 and 2010, mainly due to the continued interest of buyers, until the declines over the recent three years; these lower skate harvests may be partly attributed to declines in directed Pacific cod fisheries and the associated bycatch being harvested.

#### Historical

Skates were open to directed fishing until 1998, although harvest levels remained low. As a market for skates was developed and with the advent of the PWS state-waters Pacific cod fishery opening to longline gear in 2009, harvest of skates as bycatch within PWS increased (Table 6).

In the directed skate fishery in 2009, 9 vessels harvested 258,389 lb in 17 landings. Landings of big skate ranged from 1,067 lb to 26,718 lb in the Inside District, and from 604 lb to 20,903 lb in the Outside District. The largest landing of big skate in the Inside District exceeded the Inside District GHLS (20,000 lb), and several big skate landings of approximately 19,000 lb in the Outside District caused the harvest to exceed the Outside District GHLS (30,000 lb). The directed season for big skate closed on March 29 in the Inside District and on April 2 in the Outside District. Landings of longnose skate ranged from 424 lb to 15,274 lb, and the season within both the Inside and Outside districts remained open through April 30 (Wessel et al. 2014).

In the 2010 directed skate fishery, 6 vessels harvested 104,509 lb in 16 landings. Landings of big skate were restricted by a 2,500 lb trip limit, to avoid exceeding the skate GHL as occurred in 2009. The directed season for big skate closed on March 21 in the Inside District and on April 30 in the Outside District. Landings of longnose skate in 2010 ranged from 738 lb to 15,793 lb, and the season in the Inside and Outside districts remained open through April 30. Effort and harvest in the 2010 skate fishery declined as a result of the 2,500 lb big skate trip limit and other skate harvest opportunities; vessels targeting Pacific cod in the federal EGOA were allowed to retain skate at a bycatch allowance of 20%, which resulted in greater amounts of big skate than could be retained under trip limits in the directed state-waters fishery (Wessel et al., 2014).

## **MANAGEMENT AND REGULATIONS**

Seasons for miscellaneous groundfish were historically set by EO to coincide with seasons set by NMFS in the adjacent federal waters of the EEZ. However, BOF actions in 1998 and in 2000 made two significant changes to management of miscellaneous groundfish. The 1998 action closed directed fishing for sharks and established a commissioner's permit requirement to target skates (5 AAC 28.084 and 5 AAC 28.083). These actions were consistent with the lack of information on stock size necessary to conduct a sustainable fishery. After this regulatory addition, ADF&G issued no PWS skate permits until 2009. In 2000, the BOF adopted into regulation a miscellaneous groundfish commissioner's permit requirement (5 AAC 28.220(c)) for PWS. This provided a mechanism for developing fisheries and provided ADF&G a flexible tool to ensure adequate data collection and manageability. In 2003, when NMFS adopted a bycatch-only fishery for skates, ADF&G adopted a similar approach, except for the 2009 and 2010 commissioner's permit fishery that resulted from stakeholder interest.

The directed skate fishery in 2009 and 2010 was managed under a commissioner's permit, described in regulation (5 AAC 28.083), which stipulated GHLs by species, season, fishing area, log sheets, catch reporting, prior notice of departure and landing, and accommodation of an ADF&G observer. In 2010, the permit also stipulated a big skate trip limit of 2,500 lb per 2-day period to slow the pace of harvest because the GHL had been exceeded the previous year.

GHs for the directed fishery were set independently for longnose and big skate for the PWS Inside and Outside districts using estimates of skate abundance derived from PWS Inside District trawl survey data and applying an exploitation rate taken from the most recent 5-year average of the federal Bering Sea/Aleutian Islands model. Because survey data were lacking for the Outside District, big and longnose skate GHs were set based upon Inside District survey data expanded to account for an Outside District fishing area that was 50% larger than the Inside District fishing area. For longnose skate, a harvest rate of 0.034% (2009) and 0.045% (2010) was used, whereas for big skate, the 0.034% harvest rate was applied for both years. This approach resulted in Inside District GHs of 20,000 lb for big skate and 100,000 lb (110,000 lb in 2010) for longnose skate. Resulting GHs in the Outside District were 30,000 lb for big skate and 150,000 lb (155,000 lb in 2010) for longnose skate (Rumble et al. 2017).

ADF&G has not issued skate permits since 2010 for several reasons: lack of comprehensive stock assessment data, relative catch and composition of skate species, halibut bycatch in the directed skate fishery, and other existing skate harvest opportunities.

Concern over skate abundance levels derived from NMFS stock assessment surveys in recent years resulted in a reduction in maximum retainable amounts (MRA) from 20% to 5% for skate bycatch in federal waters fisheries in 2016, reacting to concerns about the skate population stock

assessment information and of vessels “topping off” their harvest with maximum allowed bycatch. Additionally, the CGOA TAC was achieved for big skate in 2013 through 2016, and big skate was closed to retention in federal waters adjacent to PWS. ADF&G closed big skate in state waters of PWS in those years to mirror the NMFS action as there was no GHM set for skate species. The PWS allowable bycatch level of skate species in aggregate had been reduced by EO from 20% to 15% in 2014 due to a conservation concern. Following suit after the recent federal action, ADF&G reduced allowable skate bycatch levels in PWS by EO to 5% since 2016.

Stock assessment is conducted by NOAA/NMFS each year and separate ABCs are generated for big skate, longnose skate, and “other” skates. All GOA skates are managed under Tier 5 (NPFMC 2020), where the ABC and overfishing levels (OFL) are based on survey biomass estimates and mortality rate.

## **HARVEST SAMPLING AND RESEARCH**

Currently, there is no dockside sampling effort on skate species.

During the directed skate fishery in 2009 and 2010, both big and longnose skates were sampled for total length, disc width, weight, sex, gonad maturity, and age (vertebrae collected as age structures). For both years combined, big skate had an average weight of 16.6 kg (36.6 lb), average length of 123.6 cm, and average age of 7 years, and the sex ratio was 74% female (Rumble et al. 2017). Female percentage increased between 2009 and 2010. Longnose skate had an average weight of 10.0 kg (22.0 lb), average length of 116.9 cm, average age of 11 years, and the sex ratio was 44% female. Measurements of longnose skate were similar for both years.

Skates are captured in multispecies trawl surveys. Skate survey information has been used to estimate biomass and establish commercial harvest levels in PWS, but the data lacked strength due to the poor gear efficiency for capturing these species. The relative abundance of longnose and big skates captured by the trawl survey differed substantially from that captured in the commercial fishery. To address this discrepancy, shallow stations were added in an attempt to better sample presumed big skate habitat. Despite this, relative abundance was similar to previous surveys. The discrepancy in relative abundance of these species between survey and directed commercial fishery may be explained by seasonal movement patterns.

Estimates of pounds per nautical mile towed for big and longnose skate had been generated from 1999 through 2016 from the PWS large-mesh trawl survey (Rumble et al. 2017). CPUE for longnose skate had remained consistent between 2014 and 2016, and similar to the long-term average of 88.0 lb/nmi. Big skate CPUE had been increasing after reaching its lowest level of 0.9 lb/nmi in 2007 and was at its highest point in 2015 of 33.9 lb/nmi.

Biological data are collected on all skate mortalities from surveys, and ADF&G collaborated on a big skate satellite tagging and tag and recapture research project with a graduate student at the University of Alaska, Fairbanks, to examine skate movements within PWS and the GOA (Farrugia et al., 2016).

## **OTHER SPECIES**

### **BACKGROUND**

Other miscellaneous groundfish, including numerous species of flatfish, and sharks are landed incidentally to PWS groundfish fisheries and have been targeted only sporadically (Table 19).

Octopus and squid are also landed incidental to PWS groundfish fisheries; although they are considered shellfish under state regulation, they fall under the “other” groundfish category in federal regulation. Many of these species are discarded at sea during other directed fisheries, and although discards at sea are often not reported, amounts reported on fish tickets are included here to provide an indication of relative catch.

## **HARVEST AND EFFORT**

Although much of the miscellaneous groundfish catch in commercial fisheries (with the exception of skate) is discarded at sea and is probably largely undocumented, some abundance information is available from observer coverage in the pollock trawl and shrimp trawl fisheries, as well as other agency stock assessment survey data and CPUE from the ADF&G large-mesh trawl survey (Rumble et al. 2017). An indication of incidental catch in longline fisheries has also been provided by ADF&G’s longline survey. Shark bycatch, particularly Pacific sleeper shark *Somniosus pacificus* in longline and trawl fisheries, has been reported to be significant (Table 19). Similarly, there is an incidental catch of salmon sharks *Lamna ditropis* during salmon seine fisheries. Squid has been a significant bycatch component in the pollock trawl fishery in some years (Table 4).

## **MANAGEMENT AND REGULATIONS**

There are no directed fisheries for miscellaneous groundfish within PWS and harvest occurs as bycatch to other directed groundfish and halibut fisheries. Bycatch limits are set in accordance with 5 AAC 28.070 and allow retention of a bycatch species up to 20% by weight of the directed species on board a vessel. Prior to 2014, bycatch limits in PWS were managed under a 20% aggregate allowance or cap for all species, meaning that the weight of all bycatch species combined could be up to 20% by weight of the directed species on board the vessel. In 2014, ADF&G began issuing an EO each year that set individual species or aggregate species bycatch allowances; miscellaneous groundfish species bycatch limits were set at 15% for shark species in aggregate, and 20% for all other groundfish species (not specified in the EO) in aggregate.

Although octopus is a miscellaneous shellfish species, octopus may be retained in groundfish fisheries. ADF&G manages octopus as a bycatch-only fishery under *Registration Area E Octopus Management Plan* (5 AAC 38.217). This plan, adopted by the BOF in 2012, specifies a GHR of 0–35,000 lb and a bycatch limit of 20% to directed groundfish and halibut fisheries or 35% to directed shrimp fisheries.

## **HARVEST SAMPLING AND RESEARCH**

There have been no other samples collected to date of miscellaneous groundfish from commercial fisheries in PWS. All of the species listed under miscellaneous groundfish (flatfish, sharks, skates) are captured in various PWS surveys; the survey gear and design does not lend itself to quality abundance estimates for sharks, although CPUE is estimated for spiny dogfish and other various groundfish species and smelt caught in the large-mesh trawl survey including flatfish and sculpin (Rumble et al. 2017).

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## **TABLES AND FIGURES**

Table 1.—Groundfish emergency orders issued for Prince William Sound Registration Area E, 2017–2019.

Fishery	Emergency order	Effective date	Explanation
2017 Calendar year			
Global bycatch	2-GF-E-01-17	1/1/2017	Set groundfish bycatch limits.
Pacific cod	2-GF-E-02-17	1/1/2017	Opens parallel season concurrent with federal Central Gulf of Alaska Area.
Pollock	2-GF-E-03-17	1/20/2017	Sets bycatch limits for directed pollock pelagic trawl fishery.
Pacific cod	2-GF-E-04-17	2/23/2017	Closes parallel season to vessels fishing with pot gear 12:00 noon February 23 and opens state-waters season to vessels fishing with pot gear effective 12:00 noon February 24.
Pacific cod	2-GF-E-05-17	4/6/2017	Closes the state-waters season with pot gear 12:00 noon April 6 and immediately opens the parallel season to vessels fishing with pot gear.
Pacific cod	2-GF-E-06-17	6/10/2017	Closes parallel season to vessel fishing with pot and longline gear 12:00 noon June 10 and opens state-waters season to vessels fishing with pot gear effective 12:00 noon June 10 and opens a state-waters season to vessels fishing with longline gear effective 12:00 noon June 17.
Lingcod	2-GF-E-07-17	7/1/2017	Requires all lingcod taken in the PWS Area to be landed with the head on and evidence of sex retained.
Pacific cod	2-GF-E-08-17	9/1/2017	Closes the state-waters season to vessels fishing with pot and longline gear 12:00 noon September 1 and immediately opens the parallel season to vessels fishing with pot or longline gear.
2018 Calendar year			
Global bycatch	2-GF-E-01-18	1/1/2018	Set groundfish bycatch limits.
Pacific cod	2-GF-E-02-18	1/1/2018	Opens parallel season concurrent with federal Central Gulf of Alaska Area.
Pollock	2-GF-E-03-18	1/20/2018	Sets bycatch limits for pollock pelagic trawl fishery.
Pacific cod	2-GF-E-04-18	1/1/2018	Closes parallel season to vessels fishing with jig gear 12:00 noon December 31, 2017 and immediately opens state-waters season to vessels fishing with jig gear effective 12:01 noon January 1, 2018.
Pacific cod	2-GF-E-05-18	2/14/2018	Closes parallel season to vessels fishing with pot gear 12:00 noon February 14 and opens state-waters season to vessels fishing with pot gear effective 12:00 noon February 15.
Pacific cod	2-GF-E-06-18	3/2/2018	Closes parallel season to vessels fishing with longline gear 12:00 noon March 2 and opens state-waters season to vessels fishing with longline gear 12:00 noon March 24.
Pollock	2-GF-E-07-18	3/2/2018	Closes directed fishing for pollock with pelagic trawl 1:00 p.m. March 2.
Lingcod	2-GF-E-08-18	7/1/2018	Requires all lingcod taken in the PWS Area to be landed with the head on and evidence of sex retained.
Pacific cod	2-GF-E-09-18	9/1/2018	Closes state-waters season to vessels fishing with pot and longline gear 12:00 noon September 1 and immediately opens a parallel season to vessels fishing with pot and longline gear.

-continued-

Table 1.–Page 2 of 2.

Fishery	Emergency order	Effective date	Explanation
2019 Calendar year			
Global bycatch	2-GF-E-01-19	1/1/2019	Set groundfish bycatch limits.
Pollock	2-GF-E-02-19	1/20/2019	Sets bycatch limits for pollock pelagic trawl fishery.
Pacific cod	2-GF-E-03-19	1/1/2019	Opens parallel season concurrent with federal Central Gulf of Alaska Area.
Pacific cod	2-GF-E-04-19	1/27/2019	Closes parallel season to vessel fishing with pot gear 12:00 noon January 27 and opens state-waters season to vessels fishing with pot gear effective 12:00 noon January 28.
Pacific cod	2-GF-E-05-19	2/7/2019	Closes parallel season to vessels fishing with longline gear 12:00 noon February 7 and opens state-waters season to vessels fishing with longline gear 12:00 noon March 15.
Pollock	2-GF-E-06-19	2/12/2019	Closes directed fishing with pelagic trawl gear in Bainbridge Section of PWS 12:00 noon February 12.
Pollock	2-GF-E-07-19	2/13/2019	Closes directed fishing with pelagic trawl gear in PWS 12:00 noon February 13.
Pacific cod	2-GF-E-08-19	3/12/2019	Closes the parallel season to vessels fishing with jig gear 12:00 noon March 12 and opens state-waters season to vessels fishing with jig gear 12:00 noon March 13.
Lingcod	2-GF-E-09-19	7/1/2019	Requires all lingcod taken in the PWS Area to be landed with the head on and evidence of sex retained.
Pacific cod	2-GF-E-10-19	9/1/2019	Closes the state-waters season to vessels fishing with pot and longline gear 12:00 noon September 1 and immediately opens the parallel season to vessels fishing with pot gear.
Pacific cod	2-GF-E-11-16	10/03/2019	Closes parallel season to vessels fishing with longline gear 12:00 noon October 3 and immediately opens state-waters season to vessels fishing with longline gear.

Table 2.—Prince William Sound Area commercial rockfish harvest and effort from the Inside and Outside Districts including black and dark rockfish from federal waters, 1988–2019.

Year	Inside District			Outside District			Total harvest (lb)
	Vessels	Landings	Harvest (lb)	Vessels	Landings	Harvest (lb)	
1988	64	170	113,253	18	25	313,489	426,742
1989	35	95	93,307	7	8	25,125	118,431
1990	93	391	489,154	10	11	17,314	506,468
1991	88	239	153,889	6	6	2,762	156,650
1992	106	275	178,621	16	24	12,882	191,503
1993	67	183	81,095	20	33	27,478	108,573
1994	65	160	97,710	31	51	104,670	202,380
1995	122	211	153,107	35	60	156,839	309,946
1996	86	208	108,372	31	50	76,315	184,686
1997	90	234	136,593	26	36	29,245	165,838
1998	80	198	100,120	13	23	8,914	109,034
1999	81	214	60,539	21	31	11,447	71,987
2000	97	260	111,171	18	31	10,749	121,919
2001	94	205	60,597	17	37	13,485	74,082
2002	81	161	67,242	13	26	7,369	74,612
2003	72	168	35,240	30	58	12,751	47,990
2004	61	149	40,582	23	47	12,219	52,801
2005	72	166	47,528	17	47	13,322	60,850
2006	91	167	61,095	22	51	15,176	76,271
2007	59	165	66,322	25	57	15,282	81,604
2008	60	162	92,166	18	47	14,419	106,585
2009	71	212	96,538	37	68	21,657	118,196
2010	71	212	89,962	32	55	14,938	104,900
2011	66	188	96,511	32	53	22,244	118,755
2012	73	191	90,721	36	60	23,155	113,877
2013	76	238	134,878	28	50	14,586	149,464
2014	71	172	143,978	32	46	13,573	157,551
2015	63	235	126,623	25	51	25,505	152,128
2016	72	219	133,175	29	52	28,418	161,593
2017	50	160	46,503	29	50	13,211	59,714
2018	73	183	48,888	30	42	7,653	56,541
2019	74	173	54,385	46	78	17,591	71,976
Average							
2010–2019	69	197	96,562	32	54	18,087	114,650
2017–2019	66	172	49,925	35	57	12,818	62,743

Table 3.—Prince William Sound Area commercial rockfish harvest by gear type, including black and dark rockfish from federal waters, 1988–2019.

Year	Vessels	Landings	Harvest (lb)					
			Jig	Trawl	Trawl %	Longline	Longline %	Pots
1988	80	195	54,097	228,417	54%	144,228	34%	0
1989	39	103	<sup>a</sup>	997	1%	104,633	99%	0
1990	96	402	30,088	20,238	4%	455,789	90%	<sup>a</sup>
1991	89	247	15,624	11,162	7%	129,864	83%	0
1992	114	299	9,946	28,510	15%	152,945	80%	<sup>a</sup>
1993	80	209	13,905	12,610	12%	81,978	76%	<sup>a</sup>
1994	92	211	94,588	<sup>a</sup>		104,799	53%	<sup>a</sup>
1995	148	284	168,777	267	0%	127,616	43%	<sup>a</sup>
1996	99	257	57,103	3,507	2%	124,077	67%	0
1997	106	266	34,047	1,294	1%	130,141	79%	<sup>a</sup>
1998	88	220	2,903	1,079	1%	104,889	96%	<sup>a</sup>
1999	92	244	1,130	1,951	3%	68,906	96%	0
2000	100	284	2,401	2,061	2%	117,210	96%	247
2001	101	233	1,165	4,495	6%	68,400	92%	<sup>a</sup>
2002	87	190	0	30,553	41%	44,059	59%	0
2003	89	243	256	4,752	10%	42,982	90%	0
2004	71	197	283	3,735	7%	48,783	92%	0
2005	80	206	<sup>a</sup>	8,863	15%	51,547	85%	0
2006	72	226	1,008	12,391	16%	62,866	82%	<sup>a</sup>
2007	73	213	1,215	10,970	13%	69,419	85%	0
2008	71	207	<sup>a</sup>	21,656	20%	85,113	80%	0
2009	88	256	<sup>a</sup>	22,359	19%	95,663	81%	<sup>a</sup>
2010	87	262	<sup>a</sup>	6,500	6%	98,117	94%	<sup>a</sup>
2011	81	232	<sup>a</sup>	8,113	7%	110,497	93%	<sup>a</sup>
2012	94	245	881	18,054	16%	94,587	83%	<sup>a</sup>
2013	85	278	<sup>a</sup>	29,680	20%	119,561	80%	<sup>a</sup>
2014	90	211	0	69,132	44%	88,419	56%	0
2015	79	280	0	23,293	15%	128,835	85%	0
2016	87	265	966	25,110	16%	135,436	84%	<sup>a</sup>
2017	66	202	433	4,413	7%	54,859	92%	<sup>a</sup>
2018	91	203	129	4,402	8%	51,920	92%	0
2019	100	230	865	9,715	14%	61,307	85%	<sup>a</sup>
Average								
2010–2019	86	241	468	19,841	15%	94,354	84%	0
2017–2019	86	212	476	6,177	10%	56,029	90%	0

Note: Small amounts of rockfish harvested as bycatch in the shrimp trawl fishery are included with trawl gear.

<sup>a</sup> Confidential data due to fewer than three participants.

Table 4.–Prince William Sound Area directed pollock fishery harvest and bycatch by species or species group, in lb and as a percentage of the directed pollock harvest, 1995–2020.

Year	Pollock harvest (lb)	Reported bycatch <sup>a,b</sup>										Total bycatch	
		Rockfish		Salmon		Shark		Squid		Other			
		lb	%	lb	%	lb	%	lb	%	lb	%	lb	%
1995	6,325,575	67	0.00%	76	0.00%	378	0.01%	1,346	0.02%	5,135	0.08%	7,002	0.11%
1996	3,265,740	0	0.00%	0	0.00%	2,724	0.08%	437	0.01%	3,836	0.12%	6,997	0.21%
1997	4,319,707	12	0.00%	42	0.00%	648	0.02%	17,016	0.39%	2,076	0.05%	19,794	0.46%
1998	4,013,725	10	0.00%	285	0.01%	7,825	0.19%	21,663	0.54%	11,909	0.30%	41,692	1.04%
1999	4,673,074	260	0.01%	2,088	0.04%	14,022	0.30%	5,968	0.13%	2,727	0.06%	25,065	0.54%
2000	2,256,504	1,368	0.06%	535	0.02%	2,024	0.09%	5,487	0.24%	974	0.04%	10,388	0.46%
2001 <sup>c</sup>													
2002	2,364,143	28,993	1.23%	1,262	0.05%	52,480	2.22%	179,933	7.61%	3,431	0.15%	266,099	11.26%
2003 <sup>d</sup>	2,421,772	3,824	0.16%	189	0.01%	7,254	0.30%	20,417	0.84%	8,319	0.34%	40,003	1.65%
2004	1,928,458	2,086	0.11%	151	0.01%	3,148	0.16%	10,890	0.56%	3,848	0.20%	20,123	1.04%
2005	1,677,157	8,289	0.49%	775	0.05%	11,483	0.68%	6,044	0.36%	9,841	0.59%	36,432	2.17%
2006	3,486,499	11,303	0.32%	635	0.02%	3,461	0.10%	31,813	0.91%	17,846	0.51%	65,058	1.87%
2007	2,339,978	10,262	0.44%	836	0.04%	2,650	0.11%	11,155	0.48%	2,233	0.10%	27,136	1.16%
2008 <sup>e</sup>	1,395,933	20,790	1.49%	48	0.00%	1,550	0.11%	30,619	2.19%	1,066	0.08%	54,073	3.87%
2009 <sup>e</sup>	3,249,441	21,093	0.65%	142	0.00%	19,101	0.59%	15,747	0.48%	14,115	0.43%	70,199	2.16%
2010	3,662,919	3,594	0.10%	223	0.01%	3,133	0.09%	17,052	0.47%	21,854	0.60%	45,856	1.25%
2011	3,377,325	5,290	0.16%	50	0.00%	411	0.01%	15,006	0.44%	2,410	0.07%	23,167	0.69%
2012	5,785,295	16,904	0.29%	1,431	0.02%	1,810	0.03%	8,123	0.14%	12,682	0.22%	40,950	0.71%
2013	5,779,241	27,824	0.48%	61	0.00%	3,230	0.06%	86,116	1.49%	3,401	0.06%	120,632	2.09%
2014 <sup>e</sup>	5,220,121	67,446	1.29%	260	0.00%	526	0.01%	171,946	3.29%	24,322	0.47%	264,500	5.07%
2015	9,818,616	20,785	0.21%	442	0.00%	889	0.01%	240,125	2.45%	7,337	0.07%	269,578	2.75%
2016	8,573,163	21,992	0.26%	1,067	0.01%	2,720	0.03%	41,993	0.49%	12,286	0.14%	80,058	0.93%
2017	4,143,533	2,552	0.06%	177	0.00%	117	0.00%	259	0.01%	2,857	0.07%	5,962	0.14%
2018	6,802,350	3,437	0.05%	1,172	0.02%	477	0.01%	1,732	0.03%	20,421	0.30%	27,239	0.40%
2019	6,539,859	6,995	0.11%	258	0.00%	679	0.01%	31,744	0.49%	5,358	0.08%	45,034	0.69%
2020	5,090,676	17,436	0.34%	2,240	0.04%	10,357	0.20%	153,959	3.02%	2,562	0.05%	186,554	3.66%

<sup>a</sup> Includes discards at sea.

<sup>b</sup> Test fish not included.

<sup>c</sup> Confidential data due to fewer than three participants.

<sup>d</sup> Total bycatch cap of 5% implemented with species group caps.

<sup>e</sup> Rockfish bycatch cap reached and season closed.

Table 5.—Prince William Sound Area commercial rockfish harvest by species assemblage, including black and yelloweye rockfish harvest, 1988–2019.

Year	Pelagic Shelf Rockfish <sup>a</sup> (PSR)			Demersal Shelf Rockfish (DSR)			Slope Rockfish <sup>b</sup>		Total harvest (lb)
	Black Rockfish harvest (lb)	PSR harvest (lb)	PSR percent of total	Yelloweye Rockfish harvest (lb)	DSR harvest (lb)	DSR percent of total	Slope Rockfish harvest (lb)	Slope Rockfish percent of total	
1988	32,605	312,178	73%	27,495	27,733	6%	86,831	20%	426,742
1989	6,971	21,471	18%	7,060	17,574	15%	79,387	67%	118,431
1990	8,036	26,887	5%	22,753	24,256	5%	455,326	90%	506,468
1991	12,775	26,147	17%	11,425	31,893	20%	98,611	63%	156,650
1992	5,129	51,622	27%	14,799	42,944	22%	96,937	51%	191,503
1993	7,732	27,652	25%	13,083	14,257	13%	66,664	61%	108,573
1994	27,334	118,178	58%	20,396	23,248	11%	60,953	30%	202,380
1995	57,912	183,569	59%	27,973	30,459	10%	95,919	31%	309,946
1996	16,211	71,507	39%	41,842	53,718	29%	59,461	32%	184,686
1997	30,011	37,915	23%	34,300	41,403	25%	86,520	52%	165,838
1998	1,545	4,290	4%	56,033	57,038	52%	47,707	44%	109,034
1999	1,586	3,164	4%	39,846	43,394	60%	25,428	35%	71,987
2000	1,201	3,103	3%	66,669	72,743	60%	46,074	38%	121,919
2001	870	2,195	3%	29,768	31,212	42%	40,675	55%	74,082
2002	118	510	1%	14,213	14,647	20%	59,454	80%	74,612
2003	1,026	2,011	4%	22,050	22,945	48%	23,034	48%	47,990
2004	531	2,028	4%	21,942	23,764	45%	27,009	51%	52,801
2005	430	1,134	2%	19,148	21,291	35%	38,425	63%	60,850
2006	352	1,733	2%	20,376	22,482	29%	52,056	68%	76,271
2007	913	1,815	2%	22,432	24,128	30%	55,661	68%	81,604
2008	475	643	1%	21,813	23,907	22%	82,035	77%	106,585
2009	649	1,073	1%	28,815	32,242	27%	84,881	72%	118,196
2010	847	1,287	1%	22,794	25,192	24%	78,422	75%	104,900
2011	2,206	3,306	3%	36,629	47,060	40%	68,389	58%	118,755
2012	2,485	3,836	3%	27,343	38,423	34%	71,617	63%	113,877
2013	487	984	1%	37,402	50,420	34%	98,060	66%	149,464
2014	856	3,654	2%	16,927	31,444	20%	122,453	78%	157,551
2015	7,756	8,548	6%	37,828	60,200	40%	83,380	55%	152,128
2016	6,483	7,458	5%	46,665	94,841	59%	59,294	37%	161,593
2017	1,594	3,123	5%	15,832	26,846	45%	29,744	50%	59,714
2018	1,715	2,496	4%	12,651	17,860	32%	36,184	64%	56,541
2019	2,205	4,176	6%	18,493	27,077	38%	40,722	57%	71,976
Average									
2010–2019	2,663	3,887	4%	27,256	41,936	36%	68,826	60%	114,650
2017–2019	1,838	3,265	5%	15,658	23,928	38%	35,550	57%	62,744

<sup>a</sup> Includes black and dark rockfish from federal waters.

<sup>b</sup> Includes thornyhead rockfish.

Table 6.—Prince William Sound Area state-managed groundfish harvest, in whole pounds, and exvessel value, 1988–2019.

Year	Lingcod		Pacific cod		Pollock		Rockfish		Sablefish		Skate		Total value
	lb	Value	lb	Value	lb	Value	lb	Value	lb	Value	lb	Value	
1988	26,952	\$9,903	330,718	\$93,884	1,548	\$124	426,742	\$136,172	247,374	\$240,816	11,770	\$4,325	\$485,224
1989	21,710	\$6,963	71,845	\$15,845	1,558	\$208	118,431	\$38,590	188,788	\$150,328	614	\$61	\$211,965
1990	42,899	\$15,313	1,203,118	\$308,337	8,102	\$1,186	506,468	\$181,954	216,414	\$142,270	–	\$0	\$649,060
1991	32,851	\$13,414	2,227,204	\$613,631	272	\$0	156,650	\$57,011	350,633	\$309,556	132	\$13	\$993,624
1992	25,941	\$8,284	1,953,917	\$447,806	8,932	\$2,494	191,503	\$62,299	465,856	\$425,451	18	\$2	\$946,335
1993	66,781	\$25,457	1,277,033	\$234,624	5,633	\$1,259	108,573	\$37,687	391,546	\$384,011	815	\$245	\$683,284
1994	44,007	\$14,268	1,901,272	\$355,835	5,811	\$2,326	202,380	\$81,814	341,059	\$414,942	–	\$0	\$869,183
1995	110,208	\$39,417	1,595,736	\$383,379	6,550,820	\$657,862	309,946	\$190,608	577,315	\$1,307,861	1,713	\$206	\$2,579,334
1996	28,753	\$11,504	854,037	\$193,448	3,694,216	\$341,613	184,686	\$107,998	291,396	\$539,122	26,667	\$3,958	\$1,197,643
1997	38,198	\$15,536	1,122,769	\$290,724	4,866,014	\$464,000	165,838	\$92,651	208,370	\$481,795	37,256	\$3,361	\$1,348,067
1998	11,096	\$4,222	1,097,669	\$267,898	4,648,156	\$380,356	109,034	\$72,677	244,695	\$417,105	44,790	\$4,703	\$1,146,961
1999	9,344	\$6,537	1,724,844	\$583,008	5,175,725	\$503,414	71,987	\$41,553	213,907	\$384,072	842	\$343	\$1,518,927
2000	23,855	\$16,695	1,027,105	\$390,581	2,631,273	\$210,759	121,919	\$87,268	356,513	\$805,878	323	\$226	\$1,511,406
2001	26,812	\$24,415	170,673	\$60,788	3,509,669	\$243,770	74,082	\$30,204	323,908	\$605,782	243	\$109	\$965,068
2002	20,170	\$18,060	17,831	\$4,832	2,541,214	\$183,793	74,612	\$30,350	328,618	\$626,551	691	\$139	\$863,724
2003	24,235	\$17,563	317,530	\$105,881	2,476,588	\$165,206	47,990	\$23,901	223,846	\$515,869	882	\$117	\$828,538
2004	30,292	\$22,828	332,976	\$154,385	2,329,685	\$147,682	52,801	\$22,450	234,996	\$498,766	283	\$35	\$846,146
2005	24,244	\$17,326	132,816	\$59,441	1,995,145	\$279,195	60,850	\$32,957	227,079	\$496,893	84,013	\$10,082	\$895,893
2006	28,084	\$25,741	47,046	\$21,124	3,487,089	\$418,341	76,271	\$36,930	195,562	\$458,012	89	\$11	\$960,159
2007	30,695	\$25,938	426,100	\$207,005	2,599,889	\$302,968	81,604	\$41,083	199,213	\$491,685	37	\$11	\$1,068,690
2008	40,601	\$35,392	74,120	\$43,587	1,395,938	\$213,194	106,585	\$48,593	206,888	\$615,881	9,449	\$3,609	\$960,256
2009	72,472	\$63,941	871,267	\$302,556	3,550,868	\$559,941	118,196	\$56,621	219,438	\$661,274	328,636	\$119,248	\$1,763,580
2010	54,925	\$43,113	914,252	\$257,899	3,979,866	\$698,079	104,900	\$48,613	212,229	\$717,616	212,347	\$61,888	\$1,827,207
2011	45,810	\$34,750	1,955,057	\$705,365	3,730,616	\$536,549	118,755	\$51,170	222,099	\$943,681	201,012	\$68,305	\$2,339,820
2012	40,485	\$37,990	1,819,433	\$659,315	5,785,463	\$934,350	113,877	\$52,171	203,824	\$659,338	146,572	\$61,652	\$2,404,817
2013	30,331	\$24,008	2,081,526	\$578,538	6,271,391	\$974,472	149,464	\$69,796	155,488	\$428,739	237,656	\$93,743	\$2,169,296
2014	15,871	\$15,553	2,176,690	\$740,075	5,221,217	\$678,758	157,551	\$70,898	96,726	\$331,770	120,304	\$48,122	\$1,885,176
2015	20,364	\$19,753	3,275,208	\$1,143,048	9,822,290	\$1,080,452	152,128	\$59,330	16,910	\$71,462	268,440	\$110,329	\$2,484,373
2016	14,093	\$12,120	2,287,439	\$727,406	9,366,410	\$749,313	161,593	\$77,565	40,457	\$129,058	92,488	\$32,093	\$1,727,554
2017	12,622	\$13,253	855,695	\$359,392	4,146,557	\$207,328	59,714	\$32,843	73,113	\$333,395	39,831	\$15,136	\$961,346
2018	29,554	\$33,988	591,275	\$337,027	7,730,348	\$850,338	56,541	\$33,924	88,117	\$306,647	31,726	\$8,566	\$1,570,490
2019	26,408	\$28,785	484,166	\$266,291	7,476,268	\$897,152	71,976	\$41,026	85,796	\$178,456	19,752	\$5,728	\$1,417,438
Average													
2010–2019	29,046	\$26,331	1,644,074	\$577,436	6,353,043	\$760,679	114,650	\$53,734	119,476	\$410,016	137,013	\$50,556	\$1,878,752
2017–2019	22,861	\$25,342	643,715	\$320,903	6,451,058	\$651,606	62,743	\$35,931	82,342	\$272,833	30,436	\$9,810	\$1,316,425

Note: Exvessel value is based on price per whole pounds on records that returned a dollar value and applied to all harvest. En dashes indicate that no applicable harvest occurred.

Table 7.—Prince William Sound Area state-managed groundfish average price per pound, 1988–2019.

Year	Average price per pound					
	Lingcod	Pacific cod	Pollock	Rockfish	Sablefish	Skate
1988	\$0.37	\$0.28	\$0.08	\$0.32	\$0.97	\$0.37
1989	\$0.32	\$0.22	\$0.13	\$0.33	\$0.80	\$0.10
1990	\$0.36	\$0.26	\$0.15	\$0.36	\$0.66	–
1991	\$0.41	\$0.28	\$0.00	\$0.36	\$0.88	\$0.10
1992	\$0.32	\$0.23	\$0.28	\$0.33	\$0.91	\$0.10
1993	\$0.38	\$0.18	\$0.22	\$0.35	\$0.98	\$0.30
1994	\$0.32	\$0.19	\$0.40	\$0.40	\$1.22	–
1995	\$0.36	\$0.24	\$0.10	\$0.61	\$2.27	\$0.12
1996	\$0.40	\$0.23	\$0.09	\$0.58	\$1.85	\$0.15
1997	\$0.41	\$0.26	\$0.10	\$0.56	\$2.31	\$0.09
1998	\$0.38	\$0.24	\$0.08	\$0.67	\$1.70	\$0.10
1999	\$0.70	\$0.34	\$0.10	\$0.58	\$1.80	\$0.41
2000	\$0.70	\$0.38	\$0.08	\$0.72	\$2.26	\$0.70
2001	\$0.91	\$0.36	\$0.07	\$0.41	\$1.87	\$0.45
2002	\$0.90	\$0.27	\$0.07	\$0.41	\$1.91	\$0.20
2003	\$0.72	\$0.33	\$0.07	\$0.50	\$2.30	\$0.13
2004	\$0.75	\$0.46	\$0.06	\$0.43	\$2.12	\$0.13
2005	\$0.71	\$0.45	\$0.14	\$0.54	\$2.19	\$0.12
2006	\$0.92	\$0.45	\$0.12	\$0.48	\$2.34	\$0.12
2007	\$0.85	\$0.49	\$0.12	\$0.50	\$2.47	\$0.31
2008	\$0.87	\$0.59	\$0.15	\$0.46	\$2.98	\$0.38
2009	\$0.88	\$0.35	\$0.16	\$0.48	\$3.01	\$0.36
2010	\$0.78	\$0.28	\$0.18	\$0.46	\$3.38	\$0.29
2011	\$0.76	\$0.36	\$0.14	\$0.43	\$4.25	\$0.34
2012	\$0.94	\$0.36	\$0.16	\$0.46	\$3.23	\$0.42
2013	\$0.79	\$0.28	\$0.16	\$0.47	\$2.76	\$0.39
2014	\$0.98	\$0.34	\$0.13	\$0.45	\$3.43	\$0.40
2015	\$0.97	\$0.35	\$0.11	\$0.39	\$4.23	\$0.41
2016	\$0.86	\$0.32	\$0.08	\$0.48	\$3.19	\$0.35
2017	\$1.05	\$0.42	\$0.05	\$0.55	\$4.56	\$0.38
2018	\$1.15	\$0.57	\$0.11	\$0.60	\$3.48	\$0.27
2019	\$1.09	\$0.55	\$0.12	\$0.57	\$2.08	\$0.29
Average						
2010–2019	\$0.94	\$0.38	\$0.12	\$0.49	\$3.46	\$0.35
2017–2019	\$1.10	\$0.51	\$0.09	\$0.57	\$3.37	\$0.31

Note: En dashes indicate that no applicable harvest occurred.

Table 8.—Prince William Sound Area pollock harvest and effort by gear type, directed trawl fishery harvest, effort, guideline harvest level (GHL), and season length, 1988–2020.

Year	Vessels	Landings	Harvest (lb)		Total	GHL <sup>d</sup> (million lb)	Harvest % of GHL <sup>d</sup>	Season length (days)	
			Pelagic trawl gear	Other gear <sup>a</sup>					
1988	b	b	b	1,548	1,548				
1989	6	9	919	639	1,558				
1990	8	14	6,588	1,514	8,102				
1991	5	7	0	272	272				
1992	15	23	6,341	2,591	8,932				
1993	3	7	5,442	191	5,633				
1994	5	7	0	5,811	5,811				
Average 1988–1994	6	10	2,756	1,795	4,551				
<b>Directed trawl fishery begins in 1995</b>									
Year	Directed fishery vessels	Directed fishery landings	Directed harvest	Other gear <sup>a</sup>	Test fishery <sup>c</sup>	Total harvest	GHL <sup>d</sup> (million lb)	Harvest % of GHL <sup>d</sup>	Season length (days)
1995	9	35	6,325,575	10,220	215,025	6,550,820	2.1–4.4	144%	26
1996	11	24	3,265,740	7,905	420,571	3,694,216	3.1	105%	5
1997	10	31	4,319,707	7,184	539,123	4,866,014	3.9	111%	8
1998	11	29	4,013,725	2,680	631,751	4,648,156	3.9	103%	7
1999	6	38	4,673,074	11,890	490,761	5,175,725	4.6	102%	36
2000 <sup>e</sup>	4	20	2,256,504	8,045	366,724	2,631,273	3.1	73%	70
2001	b	b	b	b	381,502	3,509,669	3.1	100%	64
2002	3	22	2,364,143	68	177,003	2,541,214	3.8	62%	70
2003 <sup>f</sup>	3	17	2,421,772	1,221	53,595	2,476,588	3.8	64%	84
2004	3	9	1,928,458	824	400,403	2,329,685	2.0	96%	68
2005	6	8	1,677,157	805	317,183	1,995,145	2.0	84%	48
2006	8	15	3,486,499	590	0	3,487,089	3.6	97%	58
2007	5	12	2,339,978	756	259,155	2,599,889	3.6	65%	69
2008 <sup>g</sup>	5	7	1,395,933	5	0	1,395,938	3.6	39%	56
2009 <sup>g</sup>	8	14	3,249,441	<sup>d</sup>	300,806	3,550,268	3.6	90%	60
2010	11	15	3,662,919	5,094	311,853	3,979,866	3.6	102%	42
2011	7	13	3,377,325	13,608	339,683	3,730,616	3.6	94%	17
2012	9	21	5,785,295	168	0	5,785,463	6.1	95%	24
2013	14	23	5,779,241	3,484	496,856	6,271,391	5.8	99%	14
2014 <sup>g</sup>	19	22	5,220,121	1,096	0	5,221,217	8.6	61%	8
2015	17	35	9,818,616	3,674	0	9,822,290	9.3	99%	16
2016	10	33	8,573,163	13,268	779,979	9,366,410	13.1	72%	71
2017	8	15	4,143,533	3,024	0	4,146,557	9.4	44%	71
2018	16	28	6,802,350	1,932	926,066	7,730,348	7.1	96%	42
2019	22	28	6,539,859	1,295	935,114	7,476,268	6.6	99%	24
2020 <sup>h</sup>	14	23	5,090,676	<sup>h</sup>	928,792	6,019,468	5.1	100%	41
Average									
2011–2020	14	24	6,113,018	4,617	439,830	6,557,003	7.5	86%	33
2018–2020	17	26	6,144,295	1,613	929,991	7,075,361	6.3	98%	36

<sup>a</sup> Includes jig, pot, and longline harvest from the Inside and Outside Districts.

<sup>b</sup> Confidential data due to fewer than three participants.

<sup>c</sup> Fish landed and sold under the ADF&G's program receipts authority are listed as "test fishery" and not included in vessels or landings.

<sup>d</sup> GHL does not include test fishery harvest.

<sup>e</sup> Pollock harvest sections were created in 2000.

<sup>f</sup> Total bycatch cap of 5% implemented with species group caps.

<sup>g</sup> Rockfish bycatch cap reached and season closed.

<sup>h</sup> Pollock trawl harvest preliminary from 2020; harvest by other gear not complete at time of report.

Table 9.—Species composition of sampled rockfish, grouped by rockfish assemblage, including number sampled (*n*) and proportion, from commercially harvested rockfish in the Prince William Sound Area, 1993–2019.

Year	Slope rockfish						Demersal shelf rockfish (DSR)						Pelagic shelf rockfish (PSR) <sup>c</sup>		Total samples
	Rougheye		Shortraker		Total slope <sup>a</sup>		Yelloweye		Quillback		Total DSR <sup>b</sup>		<i>n</i>	%	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%			
1993	158	36%	226	51%	405	91%	23	5%	1	0%	38	9%	2	0%	445
1994	111	34%	102	31%	229	71%	52	16%	41	13%	95	29%	0	0%	324
1995	0	0%	0	0%	0	0%	29	18%	0	0	29	18%	134	82%	163
1996	1	1%	82	73%	112	100%	0	0%	0	0	0	0%	0	0%	112
1997	31	16%	71	38%	189	100%	0	0%	0	0	0	0%	0	0%	189
1998	90	8%	198	18%	375	35%	602	56%	96	9%	699	65%	6	1%	1,080
1999	70	19%	221	61%	350	97%	10	3%	0	0%	10	3%	0	0%	360
2000	97	23%	224	53%	415	99%	4	1%	0	0%	4	1%	1	0%	420
2001	96	26%	61	16%	171	46%	186	50%	0	0%	192	52%	8	2%	371
2002	92	21%	300	68%	397	90%	45	10%	0	0%	45	10%	0	0%	442
2003	10	4%	88	31%	121	43%	133	47%	23	8%	156	56%	4	1%	281
2004	29	13%	158	69%	212	93%	15	7%	1	0%	16	7%	0	0%	228
2005	38	35%	51	46%	107	97%	0	0%	0	0%	0	0%	3	3%	110
2006	30	21%	32	22%	79	55%	44	31%	18	13%	62	43%	2	1%	143
2007	59	15%	112	29%	218	57%	135	35%	24	6%	162	43%	0	0%	381
2008	32	10%	59	19%	132	43%	142	46%	17	5%	172	55%	6	2%	310
2009	165	29%	146	25%	456	79%	56	10%	47	8%	113	20%	7	1%	576
2010	71	20%	113	32%	298	86%	4	1%	35	10%	50	14%	0	0%	348
2011	168	18%	278	29%	717	75%	121	13%	79	8%	209	22%	33	3%	959
2012	201	22%	234	25%	488	53%	170	18%	191	21%	395	43%	46	5%	929
2013	167	9%	330	17%	652	34%	592	30%	618	32%	1,232	63%	58	3%	1,942
2014	237	11%	487	22%	960	44%	536	25%	546	25%	1,153	53%	65	3%	2,178
2015	366	20%	197	11%	690	37%	598	32%	477	26%	1,113	60%	64	3%	1,867
2016	191	12%	375	23%	673	42%	397	24%	324	20%	789	49%	159	10%	1,621
2017	226	19%	139	12%	474	40%	482	40%	158	13%	685	57%	35	3%	1,194
2018	391	28%	167	12%	673	49%	376	27%	193	14%	626	46%	76	6%	1,375
2019	174	11%	161	10%	473	29%	593	36%	411	25%	1,087	67%	66	4%	1,626
Total	3,301	17%	4,612	23%	10,066	50%	5,345	27%	3,300	17%	9,132	46%	775	4%	19,974

<sup>a</sup> Total slope includes rougheye, shortraker, redbanded, thornyhead, silvergray, darkblotched, redstripe, sharpchin, Pacific Ocean perch, and unidentified slope rockfish species.

<sup>b</sup> Total demersal shelf rockfish (DSR) also includes yelloweye, quillback, canary, china, copper, and tiger rockfish.

<sup>c</sup> Pelagic shelf rockfish (PSR) includes black (primarily), dusky, dark, and yellowtail rockfish.

Table 10.—Prince William Sound Area state-waters Pacific cod season annual effort, guideline harvest level (GHL), and harvest by gear type, 1997–2019, with preliminary data for 2020.

Year	Vessels	Landings	GHL (lb)	% of GHL harvested	Harvest (lb)			Total <sup>b</sup>
					Longline	Pot	Jig <sup>a</sup>	
1997	9	36	881,849	23%		192,142	8,378	200,520
1998	9	33	859,803	49%		385,817	33,177	418,994
1999	7	27	931,453	42%		314,987	79,147	394,134
2000	12	36	2,948,683	10%		268,765	22,377	291,142
2001	3	3	2,617,989	0%		0	228	228
2002	0	0	1,904,243	0%		0	0	0
2003	c	c	705,479	43%		c	0	c
2004	c	c	970,034	33%		c	0	c
2005	c	c	896,620	14%		c	0	c
2006	c	c	910,730	3%		c	c	c
2007	3	20	910,730	38%		c	c	345,684
2008	4	6	586,430	1%		0	7,557	7,557
2009 <sup>d</sup>	19	37	487,663	145%	704,866	0	0	704,866
2010	24	45	784,735	105%	822,747	c	0	c
2011	25	63	1,435,209	111%	1,594,590	0	0	1,594,590
2012 <sup>e</sup>	38	70	1,448,437	96%	1,395,483	0	c	c
2013	25	77	1,781,335	72%	1,275,245	0	0	1,275,245
2014	30	61	1,463,318	95%	1,384,749	0	0	1,384,749
2015	9	15	1,558,668	15%	193,352	0	c	c
2016	29	76	4,841,902	22%	1,061,974	0	c	c
2017	c	c	4,338,146	c	c	0	0	c
2018	16	36	992,080	35%	350,909	0	0	350,909
2019	15	40	936,965	44%	408,778	0	0	408,778
2020 <sup>f</sup>	7	23	437,425	97%	426,119	0	c	c
Average								
2010–2019	23	54	1,958,080	69%	943,092	g	g	g
2017–2019	16	38	2,089,064	39%	379,843	g	g	g

<sup>a</sup> Includes mechanical jig and hand troll.

<sup>b</sup> Total harvest does not include confidential data.

<sup>c</sup> Confidential data due to limited number of participants.

<sup>d</sup> Longline became an allowable gear type for the Prince William Sound Area state-waters season.

<sup>e</sup> Regulatory change implemented to close season to longline gear when 85% of GHL attained.

<sup>f</sup> Preliminary effort and harvest data through July 31, 2020.

<sup>g</sup> Not provided due to multiple years of confidential data or no harvest.

Table 11.—Prince William Sound Area parallel Pacific cod season annual effort and harvest by gear type, 1988–2020.

Year	Vessels	Landings	Harvest (lb) <sup>a</sup>				Total <sup>d</sup>	% Longline
			Other <sup>b</sup>	Longline	Pot	Jig <sup>c</sup>		
1988	39	87	0	330,718	0	0	330,718	100%
1989	23	45	<sup>e</sup>	71,845	<sup>e</sup>	<sup>e</sup>	71,845	100%
1990	84	307	<sup>e</sup>	1,203,118	<sup>e</sup>	<sup>e</sup>	1,203,118	100%
1991	88	234	17,074	1,248,218	961,912	<sup>e</sup>	2,227,204	56%
1992	140	524	<sup>e</sup>	1,359,176	594,741	<sup>e</sup>	1,953,917	70%
1993	57	205	<sup>e</sup>	810,831	466,202	<sup>e</sup>	1,277,033	63%
1994	46	197	0	316,550	1,584,722	<sup>e</sup>	1,901,272	17%
1995	75	205	24,539	359,765	1,204,450	6,982	1,595,736	23%
1996	50	135	218,170	214,021	420,183	1,663	854,037	25%
1997	60	172	1,506	334,086	582,324	4,333	922,249	36%
1998	50	150	5,879	534,553	138,243	0	678,675	79%
1999	54	196	1,909	687,169	641,523	<sup>e</sup>	1,330,601	52%
2000	58	175	<sup>e</sup>	403,230	332,310	0	735,540	55%
2001	23	63	<sup>e</sup>	143,641	<sup>e</sup>	<sup>e</sup>	143,641	100%
2002	22	51	<sup>e</sup>	17,700	0	0	17,700	100%
2003	26	45	234	14,051	<sup>e</sup>	<sup>e</sup>	14,285	98%
2004	17	45	<sup>e</sup>	13,247	0	0	13,247	100%
2005	24	38	221	11,073	0	0	11,294	98%
2006	30	59	587	18,407	0	0	18,988	97%
2007	31	82	<sup>e</sup>	64,807	<sup>e</sup>	<sup>e</sup>	64,807	100%
2008	35	78	0	66,563	0	0	66,563	100%
2009	41	90	<sup>e</sup>	166,190	0	0	166,190	100%
2010	40	93	326	88,700	0	0	89,026	100%
2011	39	93	345	359,402	<sup>e</sup>	<sup>e</sup>	359,747	100%
2012	32	82	1,963	420,544	<sup>e</sup>	<sup>e</sup>	422,507	100%
2013	32	92	182	806,281	<sup>e</sup>	<sup>e</sup>	806,463	100%
2014	33	82	415	791,448	<sup>e</sup>	<sup>e</sup>	791,863	100%
2015	44	188	782	3,045,972	0	0	3,046,754	100%
2016	50	145	5,766	1,136,224	<sup>e</sup>	82,109	1,224,099	93%
2017	36	123	197	845,947	0	<sup>e</sup>	846,144	100%
2018	50	99	1,323	238,296	480	<sup>e</sup>	240,099	99%
2019	42	65	1,530	73,749	<sup>e</sup>	0	75,279	98%
2020			CLOSED <sup>f</sup>					
Average								
2010–2019	40	106	1,283	780,656			790,198	99%
2017–2019	43	96	1,017	385,997			387,174	99%

<sup>a</sup> Harvest is reported in round lb; includes bycatch to other groundfish fisheries.

<sup>b</sup> “Other” includes trawl and gillnet gear.

<sup>c</sup> Includes mechanical jig and hand troll.

<sup>d</sup> Total harvest does not include confidential data.

<sup>e</sup> Confidential data due to limited number of participants.

<sup>f</sup> Federal Gulf of Alaska Pacific cod fishery was closed, thereby closing the parallel fishery.

Table 12.—Average length, average weight, sex ratio (percent female), and number sampled (*n*) of Pacific cod from commercial fisheries in the Prince William Sound Area, 1994–2019.

Year	Average length (cm)	<i>n</i>	Average weight (kg)	<i>n</i>	Percent female	<i>n</i>
1994	71.3	102	4.1	102	56	102
1995	70.0	145	4.3	145	63	145
1996–1997 <sup>a</sup>						
1998	69.2	481	4.5	62	50	481
1999	66.1	640	3.6	72	59	639
2000	66.5	794	4.0	83	59	794
2001–2002 <sup>b</sup>						
2003	71.1	135	4.2	50	60	50
2004–2006 <sup>a</sup>						
2007	67.5	419	3.8	205	78	88
2008	70.3	79	4.4	79	65	79
2009	67.5	281	3.8	132	62	131
2010	65.8	750	3.9	374	62	375
2011	65.3	600	3.4	300	62	300
2012	63.5	500	3.3	250	65	250
2013	65.6	1,673	3.6	825	59	845
2014	65.4	1,799	3.8	860	57	899
2015	63.6	2,054	3.4	1,054	63	1,053
2016	60.5	2,000	2.7	998	56	964
2017	62.8	1,351	3.1	675	55	672
2018	66.0	1,349	3.8	700	61	673
2019	63.2	1,108	3.1	581	58	580
Average 2010–2019	64.2	1,318	3.4	662	60	661
Average 2017–2019	64.0	1,269	3.3	652	58	642

<sup>a</sup> No Pacific cod samples were collected 1996–1997 or 2004–2006.

<sup>b</sup> Sample sizes in 2001 and 2002 insufficient for biological data analyses.

Table 13.–Prince William Sound Area annual sablefish effort, guideline harvest level (GHL), and harvest, including test fish, from the Inside and Outside Districts, 1988–2019.

Year	Permits fished	Vessels	Landings	GHL	Harvest (lb)			Total <sup>b</sup>	% of GHL harvested
					Inside District	Outside District	Test fishery <sup>a</sup>		
1988		54	145	192,063	219,416	27,958		247,374	129%
1989		25	95	192,063	188,042	746		188,788	98%
1990		71	251	192,063	211,485	4,929		216,414	113%
1991		78	157	192,063	326,235	24,398		350,633	183%
1992		63	126	192,063	432,172	33,684		465,856	243%
1993		60	92	242,000	316,603	74,943		391,546	162%
1994		66	102	242,000	280,700	60,359		341,059	141%
1995		126	134	242,000	565,548	11,767		577,315	239%
Limited entry program implemented									
1996	67	69	77	242,000	247,545	33,475	10,376	291,396	120%
1997	51	51	81	242,000	196,370	2,689	9,311	208,370	86%
1998	59	59	60	242,000	233,005	14	11,676	244,695	101%
1999	39	42	45	242,000	206,142	0	7,765	213,907	88%
2000	31	32	32	242,000	342,854	77	13,582	356,513	147%
2001	46	47	49	242,000	310,216	0	13,692	323,908	134%
2002	48	49	51	242,000	320,694	0	7,924	328,618	136%
Shared quota fishery implemented									
2003	50	39	67	242,000	213,932	0	9,914	223,846	92%
2004	50	38	67	242,000	225,002	0	9,994	234,996	97%
2005	49	34	70	242,000	220,392	0	6,687	227,079	94%
2006	46	27	73	242,000	185,494	0	10,068	195,562	81%
2007	49	28	61	242,000	199,213	0		199,213	82%
2008	50	31	70	242,000	206,888	°		206,888	85%
2009	52	32	104	242,000	219,438	0		219,438	91%
2010	52	30	112	242,000	212,229	0		212,229	88%
2011	52	29	94	242,000	222,099	0		222,099	92%
2012	50	26	87	242,000	203,824	0		203,824	84%
2013	43	30	93	242,000	155,488	0		155,488	64%
2014	39	27	72	242,000	96,726	°		96,726	40%
2015	24	21	40	122,000	16,910	0		16,910	14%
2016	29	22	43	110,823	40,457	0		40,457	37%
2017	38	20	52	117,000	73,113	0		73,113	62%
2018	43	20	58	133,000	88,117	0		88,117	66%
2019	41	17	47	134,000	85,796	°		85,796	64%
Average									
2010–2019	41	24	70	182,682	119,476			119,476	61%
2017–2019	41	19	52	128,000	82,342			82,342	64%

<sup>a</sup> Fish harvested under ADF&G’s test fish program, which only existed from 1996-2006, are listed as “test fishery” and not included in vessels or landings.

<sup>b</sup> Confidential data excluded from total harvest.

<sup>c</sup> Confidential data due to fewer than three participants; Outside District was closed to sablefish harvest in 1997.

Table 14.—Average length, weight, and age; sex ratio (percent female); and number sampled (*n*) of commercially harvested sablefish sampled from the Prince William Sound Area, 1995–2019.

Year	Average length		Average weight		Average age		Percent female	
	cm	<i>n</i>	kg	<i>n</i>	Years	<i>n</i>	%	<i>n</i>
1995	62.6	220	2.4	220	6	35	64	220
1996	62.6	221	2.1	220	7	221	59	215
1997	65.8	327	2.7	316	7	325	67	325
1998	62.3	409	2.4	111	7	404	62	323
1999	59.9	470	2.1	464	7	163	<sup>a</sup>	
2000	59.3	471	2.3	471	5	442	<sup>a</sup>	
2001	61.7	464	2.2	464	7	461	<sup>a</sup>	
2002	61.4	759	2.7	349	8	755	63	677
2003	62.7	650	3.0	514	7	640	71	631
2004	62.0	993	2.9	962	6	958	70	947
2005	62.9	619	3.0	605	7	604	63	606
2006	59.3	589	2.4	590	5	585	62	587
2007	61.9	666	2.8	666	7	645	61	666
2008	64.1	619	3.0	619	7	591	61	618
2009	61.4	722	2.6	722	7	720	61	722
2010	60.1	777	2.4	777	7	777	56	777
2011	60.3	629	2.4	629	6	626	62	629
2012	60.7	688	2.5	688	7	686	59	688
2013	60.3	664	2.6	664	6	665	60	662
2014	65.5	758	3.5	758	7	758	59	758
2015	63.6	170	3.3	170	6	168	56	170
2016	56.8	686	2.2	686	5	684	57	675
2017	59.6	698	2.6	698	5	690	63	697
2018	61.0	839	2.5	839	6	834	71	839
2019	61.0	601	2.5	601	6	592	69	592
Average 2010–2019	60.9	651	2.7	651	6	648	61	649
Average 2017–2019	60.5	713	2.5	713	6	705	68	709

<sup>a</sup> Insufficient data to evaluate sex ratio for 1999–2001 samples; in 1999, 94%; in 2000, 57%; and in 2001, 100% were recorded as sex unknown.

Table 15.–Prince William Sound Area walleye pollock average length, weight, and age, sex ratio (percent female), and number sampled (*n*), harvested from the commercial directed pelagic trawl fishery, 1995–2020.

Year	Average length		Average weight		Average age		Percent female	
	cm	<i>n</i>	kg	<i>n</i>	years	<i>n</i>	%	<i>n</i>
1995	53.4	500	1.3	500	NA	NA	54	500
1996	54.3	498	1.4	498	8	440	44	498
1997	55.1	1,153	1.5	887	7	703	49	1,153
1998	54.2	1,096	1.6	995	8	858	40	1,094
1999	50.4	1,534	1.0	1,534	7	629	43	1,534
2000	48.6	1,005	1.0	1,005	<sup>a</sup>	280	42	1,005
2001	50.9	1,492	1.1	1,492	<sup>a</sup>	994	42	1,487
2002	51.9	628	1.3	623	<sup>a</sup>	552	39	626
2003	43.1	697	0.8	557	<sup>a</sup>	697	25	697
2004	45.0	1,604	0.9	639	4	639	41	639
2005	47.4	930	1.0	480	4	743	43	744
2006	50.2	650	1.1	624	6	624	26	625
2007	52.7	1,956	1.2	730	7	730	49	730
2008	50.8	1,074	1.3	350	6	349	12	349
2009	45.1	1,024	0.9	677	5	692	25	681
2010	48.3	2,383	1.0	1,064	5	1,199	39	1,267
2011	49.0	1,900	1.1	950	5	949	33	950
2012	50.0	1,600	1.1	800	5	798	36	800
2013	50.0	2,184	1.3	1,100	5	1,096	34	1,099
2014	52.4	1,400	1.3	700	6	695	36	697
2015	51.8	1,800	1.2	900	6	894	37	900
2016	45.4	1,854	0.7	908	<sup>b</sup>		29	906
2017	42.4	1,400	0.6	699	<sup>b</sup>		22	699
2018	45.1	1,600	0.8	798	<sup>b</sup>		43	798
2019	47.0	2,270	0.9	1,150	<sup>b</sup>		37	1,150
2020	48.0	1,600	0.8	800	<sup>b</sup>		37	800
Average 2010–2019	48.1	1,839	1.0	907	5	939	35	927
Average 2017–2019	44.8	1,757	0.8	882	<sup>b</sup>		34	882

Note: “NA” indicates the data were unavailable.

<sup>a</sup> Age data produced 2000–2003 using criteria inconsistent with remaining years; age data scheduled to be reproduced.

<sup>b</sup> Analysis of age data at the ADF&G lab in Homer is not yet complete.

Table 16.—Prince William Sound Area commercial lingcod effort and harvest, directed and bycatch fisheries combined, from Inside District, Outside District, and adjacent federal waters, 1988–2019.

Year	Vessels	Landings	Harvest (lb)				% of Harvest in federal waters
			Inside District	Outside District	Federal	Total	
1988	20	27	1,338	7,106	18,508	26,952	69%
1989	20	24	1,279	5,335	15,096	21,710	70%
1990	25	31	8,117	3,155	31,628	42,899	74%
1991	30	51	20,244	4,928	7,679	32,851	23%
1992	45	57	2,349	3,981	19,611	25,941	76%
1993	29	49	246	7,462	59,073	66,781	88%
1994	29	56	9,542	851	33,615	44,007	76%
1995	36	49	138	2,751	107,319	110,208	97%
1996	27	46	5,799	790	22,164	28,753	77%
1997	42	73	22,890	2,933	12,375	38,198	32%
1998	18	27	3,399	1,468	6,229	11,096	56%
1999	16	18	1,483	5,352	2,509	9,344	27%
2000	18	41	5,113	12,174	6,568	23,855	28%
2001	32	49	4,359	18,796	3,657	26,812	14%
2002	20	27	1,007	777	18,386	20,170	91%
2003	32	51	5,593	7,023	11,619	24,235	48%
2004	30	47	6,024	6,791	17,477	30,292	58%
2005	30	46	6,193	8,986	9,065	24,244	37%
2006	22	46	5,911	6,303	15,869	28,084	57%
2007	34	41	6,866	2,615	21,215	30,695	69%
2008	30	49	8,051	1,822	30,728	40,601	76%
2009	42	89	8,492	8,782	55,198	72,472	76%
2010	21	39	6,670	4,115	44,141	54,925	80%
2011	29	49	7,952	5,648	32,210	45,810	70%
2012	45	69	4,114	5,665	30,706	40,485	76%
2013	26	35	1,527	4,986	23,818	30,331	79%
2014	20	25	4,199	1,000	10,671	15,871	67%
2015	18	35	2,968	1,778	15,618	20,364	77%
2016	27	40	404	2,563	11,127	14,093	79%
2017	22	28	460	4,043	8,119	12,622	64%
2018	36	60	6,688	4,316	18,551	29,554	63%
2019	38	64	7,388	8,231	10,789	26,408	41%
Average 2010–2019	28	44	4,237	4,234	20,575	29,046	70%
2017–2019	32	51	4,845	5,530	12,486	22,861	56%

Table 17.—Prince William Sound Area commercial lingcod harvest from directed and bycatch fisheries, and GHLS by district, 2006–2019.

Year	GHL	District	Harvest (lb)			% of Total as bycatch
			Directed	Bycatch	Total	
2006	5,500	Inside District	5,041	870	5,911	47%
	19,000	Outside District	9,795	12,377	22,173	
2007	5,500	Inside District	6,480	386	6,866	60%
	19,000	Outside District	5,798	18,031	23,829	
2008	7,300	Inside District	7,500	551	8,051	28%
	25,300	Outside District	21,929	10,620	32,550	
2009	7,300	Inside District	2,147	6,345	8,492	72%
	25,300	Outside District	18,238	45,742	63,980	
2010	7,300	Inside District	4,643	2,027	6,670	68%
	25,300	Outside District	13,031	35,225	48,256	
2011	7,300	Inside District	5,956	1,997	7,952	43%
	25,300	Outside District	19,998	17,860	37,858	
2012	7,300	Inside District	4,056	58	4,114	36%
	25,300	Outside District	22,025	14,346	36,371	
2013	7,300	Inside District	0	1,527	1,527	43%
	25,300	Outside District	17,405	11,399	28,804	
2014	7,300	Inside District	4,008	192	4,199	31%
	25,300	Outside District	6,945	4,727	11,672	
2015	7,300	Inside District	1,568	1,400	2,968	54%
	25,300	Outside District	7,740	9,656	17,396	
2016	7,300	Inside District	0	404	404	64%
	25,300	Outside District	5,132	8,558	13,690	
2017	7,300	Inside District	0	460	460	52%
	25,300	Outside District	6,021	6,140	12,162	
2018	7,300	Inside District	3,114	3,574	6,688	36%
	25,300	Outside District	15,686	7,181	22,867	
2019	7,300	Inside District	5,596	1,792	7,388	69%
	25,300	Outside District	2,583	16,437	19,020	
Average 2010–2019	7,300	Inside District	2,894	1,343	4,237	50%
	25,300	Outside District	11,657	13,153	24,810	
Average 2017–2019	7,300	Inside District	2,903	1,942	4,845	52%
	25,300	Outside District	8,097	9,919	18,016	

Table 18.—Average length, weight, and age; sex ratio (percent female); and number sampled (*n*) of commercially harvested lingcod sampled from the Prince William Sound Area, 2003–2019.

Year	Average length		Average weight		Average age		Percent female	
	cm	<i>n</i>	kg	<i>n</i>	years	<i>n</i>	%	<i>n</i>
2003	105.9	243	13.1	191	17	124	79	236
2004	107.4	453	13.1	403	15	450	92	453
2005	108.0	257	14.2	177	16	254	83	254
2006	106.1	372	13.3	164	15	367	85	317
2007	105.5	368	11.0	108	15	241	80	254
2008	103.1	392	11.1	377	14	383	87	392
2009	105.1	530	12.1	511	14	524	90	530
2010	105.1	133	12.3	133	15	133	80	133
2011	108.6	484	13.4	420	16	482	89	480
2012	108.9	314	12.9	314	17	314	95	314
2013	110.1	281	13.9	281	16	281	98	280
2014	110.9	96	14.1	96	15	96	95	96
2015	110.7	277	13.7	277	17	271	89	276
2016	109.2	186	13.4	186	17	182	93	182
2017	109.2	133	13.5	133	<sup>a</sup>		98	133
2018	109.4	324	13.6	278	<sup>a</sup>		84	314
2019	107.0	257	12.8	257	<sup>a</sup>		66	240
Average 2010–2019	108.9	249	13.4	238	16	251	89	245
Average 2017–2019	108.5	238	13.3	223			83	229

<sup>a</sup> Age structures submitted to Age Determination Unit for 2017–2019 have not yet been analyzed.

Table 19.—Prince William Sound Area annual reported catch (lb) of miscellaneous groundfish species, including discards at sea, 1988–2019.

Year	Vessels	Landings	Flatfish <sup>a</sup>	Salmon	Sharks <sup>b</sup>	Skates	Other <sup>c</sup>	Octopus	Squid	Total
1988	12	20	15,457	0	<sup>d</sup>	11,770	<sup>d</sup>	0	0	27,227
1989	4	10	<sup>d</sup>	0	0	<sup>d</sup>	0	0	<sup>d</sup>	<sup>d</sup>
1990	20	85	72,973	0	0	0	<sup>d</sup>	0	<sup>d</sup>	72,973
1991	28	58	5,742	0	0	11,022	2,124	<sup>d</sup>	510	19,398
1992	34	79	8,942	0	1,338	19,192	17,035	1,230	<sup>d</sup>	47,737
1993	18	72	664	0	<sup>d</sup>	1,565	2,781	5,625	917	11,552
1994	21	74	1,216	0	2,465	4,435	19,203	5,798	2523	35,640
1995	34	110	10,421	79	1,368	9,668	5,534	3,814	3,134	34,018
1996	33	87	76,346	0	32,052	26,700	3,636	<sup>d</sup>	1873	140,607
1997	27	84	320	72	4,840	37,256	1,326	3,547	19,191	66,552
1998	24	70	4,182	371	8,692	44,790	6	2,928	23,782	84,751
1999	10	72	462	2,148	14,233	868	1,240	0	6,897	25,848
2000	13	55	7,637	545	2,044	999	129	0	6,227	17,581
2001	10	50	1,235	<sup>d</sup>	7,149	4,158	457	0	31,388	44,387
2002	11	66	4,214	1,274	188,256	6,783	776	<sup>d</sup>	180,250	381,553
2003	11	60	3,893	189	47,939	8,938	5,718	<sup>d</sup>	21,612	88,289
2004	12	43	4,527	156	42,869	7,748	1,850	<sup>d</sup>	11,947	69,097
2005	21	56	5,624	775	76,558	87,044	5,456	<sup>d</sup>	7,117	182,574
2006	16	48	6,826	635	159,462	10,845	11,254	<sup>d</sup>	32,770	221,792
2007	10	27	2,449	872	11,169	2,587	535	0	11,805	29,417
2008	17	44	515	<sup>d</sup>	19,613	13,741	911	0	31,559	66,339
2009 <sup>e</sup>	38	81	10,551	142	31,572	333,777	4,989	0	16,022	397,053
2010 <sup>f</sup>	46	109	12,360	229	47,464	228,837	11,511	939	17,210	318,550
2011	39	105	1,723	73	25,659	216,426	1,347	0	16,841	262,069
2012	59	129	6,739	1,431	28,291	154,781	6,328	104.84	8,123	205,798
2013	57	205	1,292	61	76,231	245,215	2,163	1,160	88,210	414,332
2014	66	160	13,605	260	15,322	124,576	11,303	482	171,949	337,496
2015	46	208	3,799	442	17,255	284,026	5,484	1,278	240,125	552,409
2016	51	186	9,620	1,271	10,469	103,886	1,515	596	57,906	185,262
2017	33	130	893	177	833	41,987	1,616	721.12	275	46,502
2018	36	86	7,177	1,171	4,724	36,163	11,593	1608	1,731	64,167
2019	39	72	4,118	305	66,262	35,493	12,902	1,245	35,006	155,332
Average										
2010–2019	47	139	6,132	542	29,251	147,139	6,576	813	63,738	254,192
2017–2019	36	96	4,062	551	23,940	37,881	8,704	1,191	12,337	88,667

<sup>a</sup> Flatfish includes general flatfish, flounders, sole and turbot.

<sup>b</sup> Sharks include spiny dogfish, salmon, Pacific sleeper, and unspecified sharks.

<sup>c</sup> Other includes general groundfish, miscellaneous unidentified fish, eel, greenling, and sculpin.

<sup>d</sup> Confidential data.

<sup>e</sup> 2009 Skate harvest includes 258,389 lb harvested by 9 vessels in 17 landings in the directed fishery.

<sup>f</sup> 2010 Skate harvest includes 104,509 lb harvested by 6 vessels in 16 landings in the directed fishery.

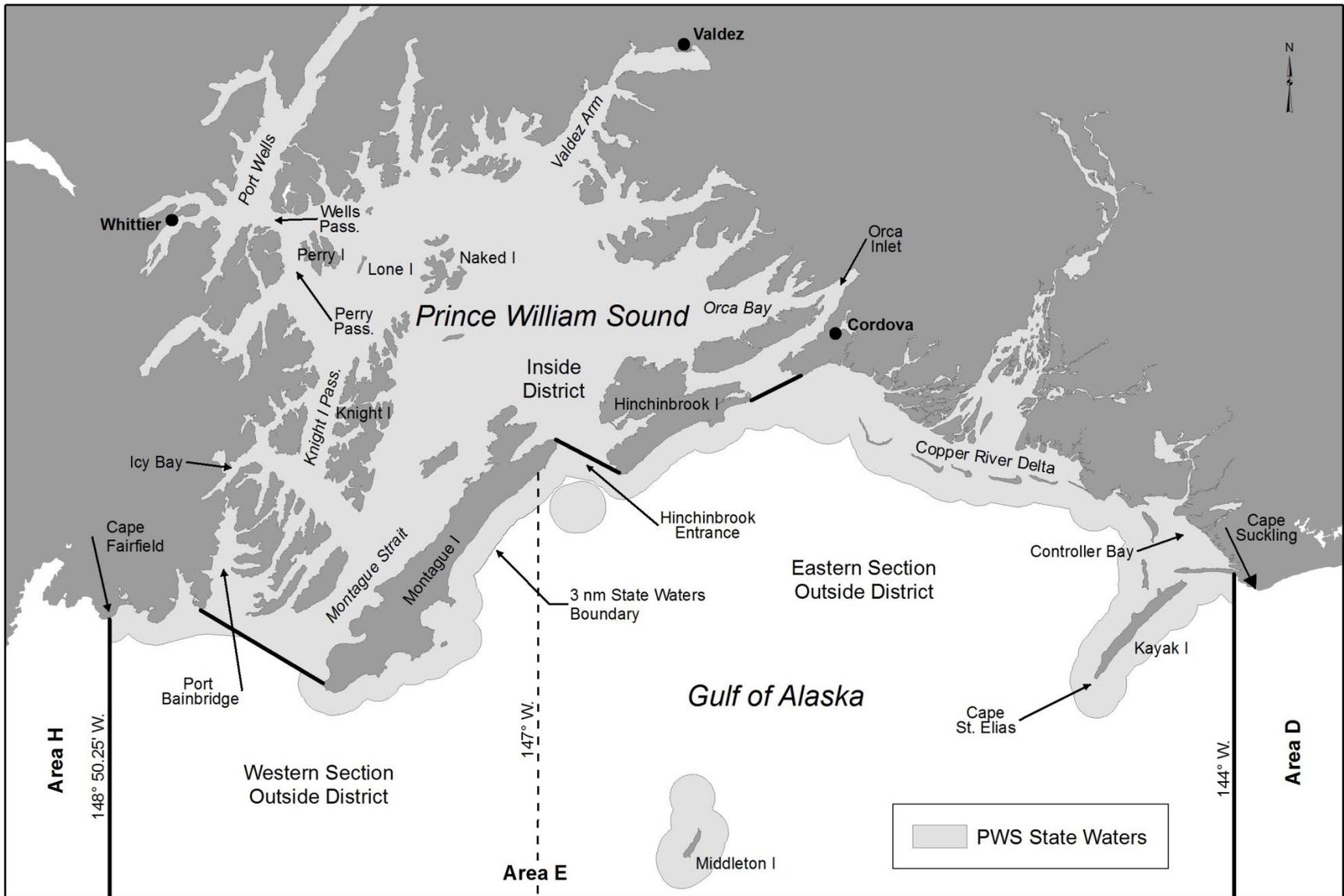


Figure 1.—Prince William Sound Area groundfish fishing districts and other landmarks.

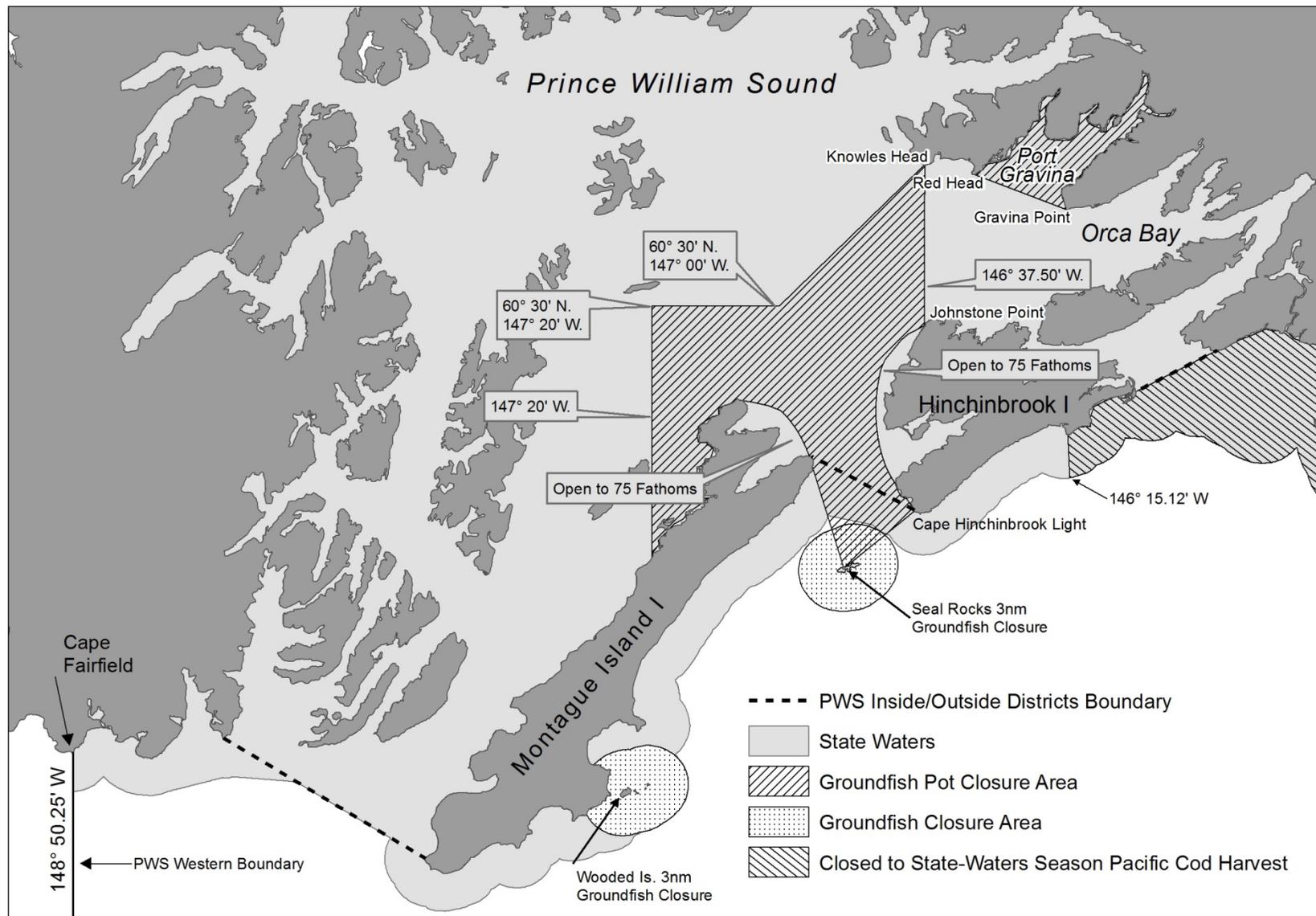


Figure 2.—Prince William Sound Area groundfish fishing closures implemented for Stellar sea lion and Tanner crab protection.



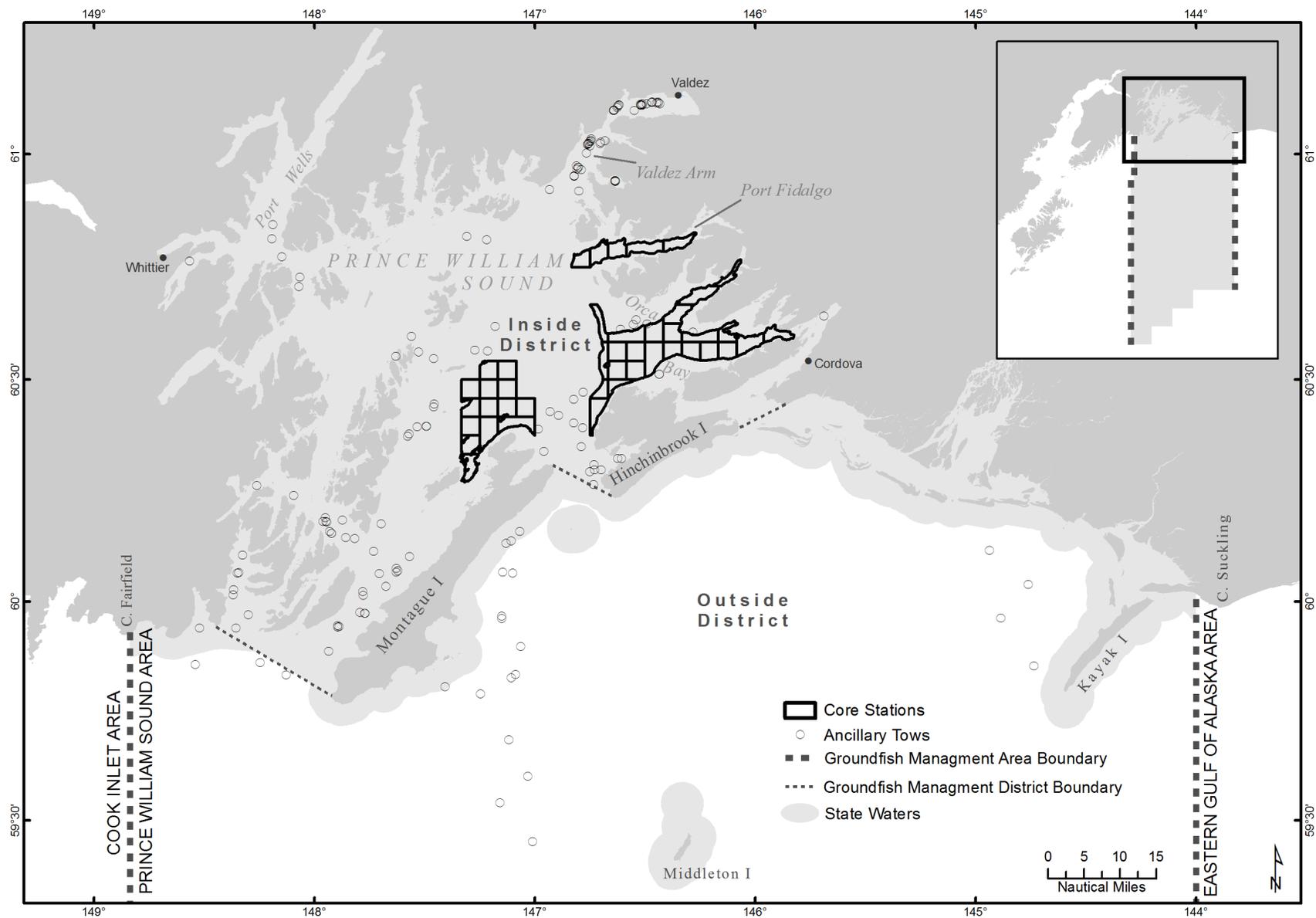


Figure 4.—Prince William Sound large mesh trawl survey core stations.

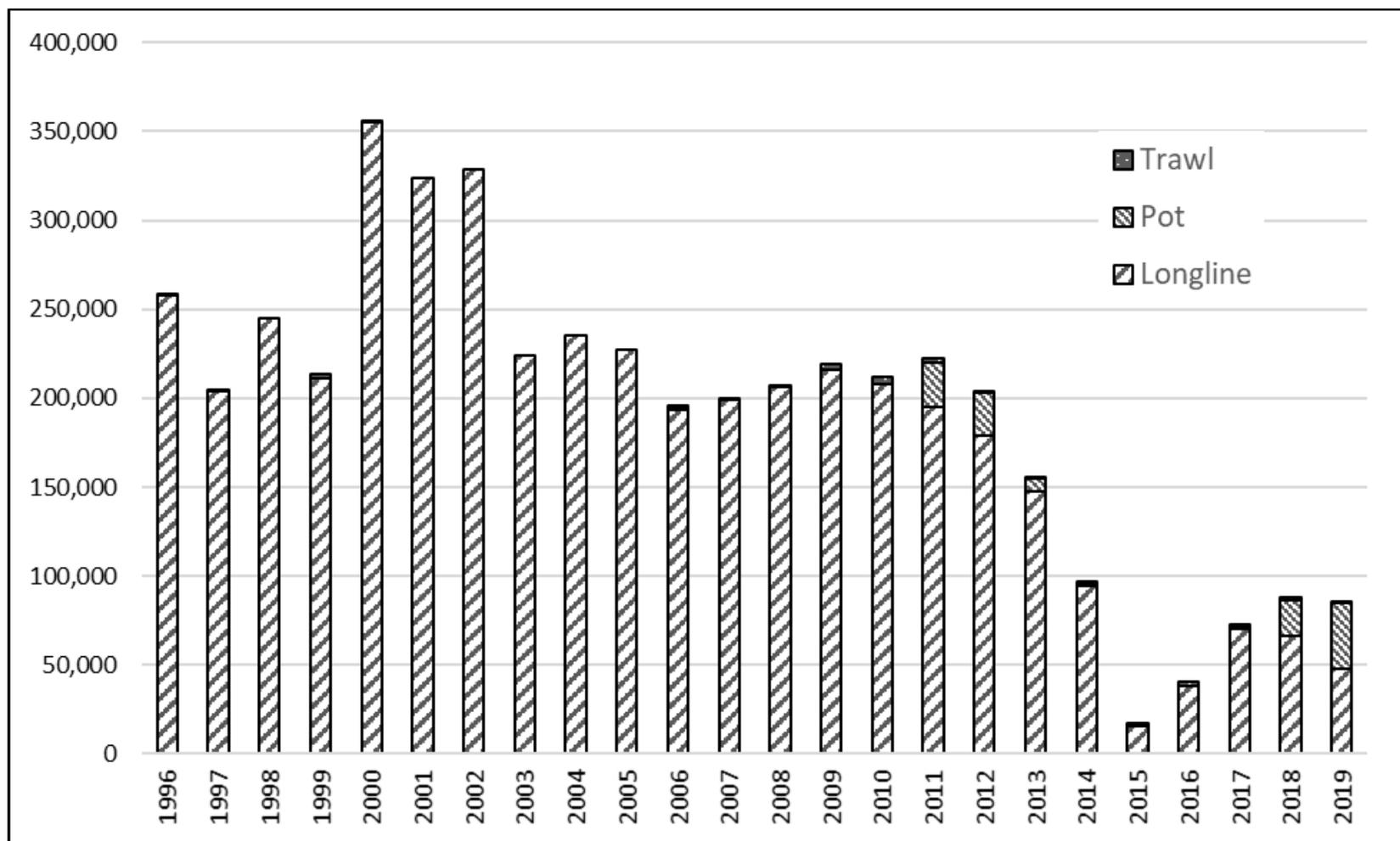


Figure 5.—Prince William Sound Area sablefish harvest by gear type, 1996–2019.

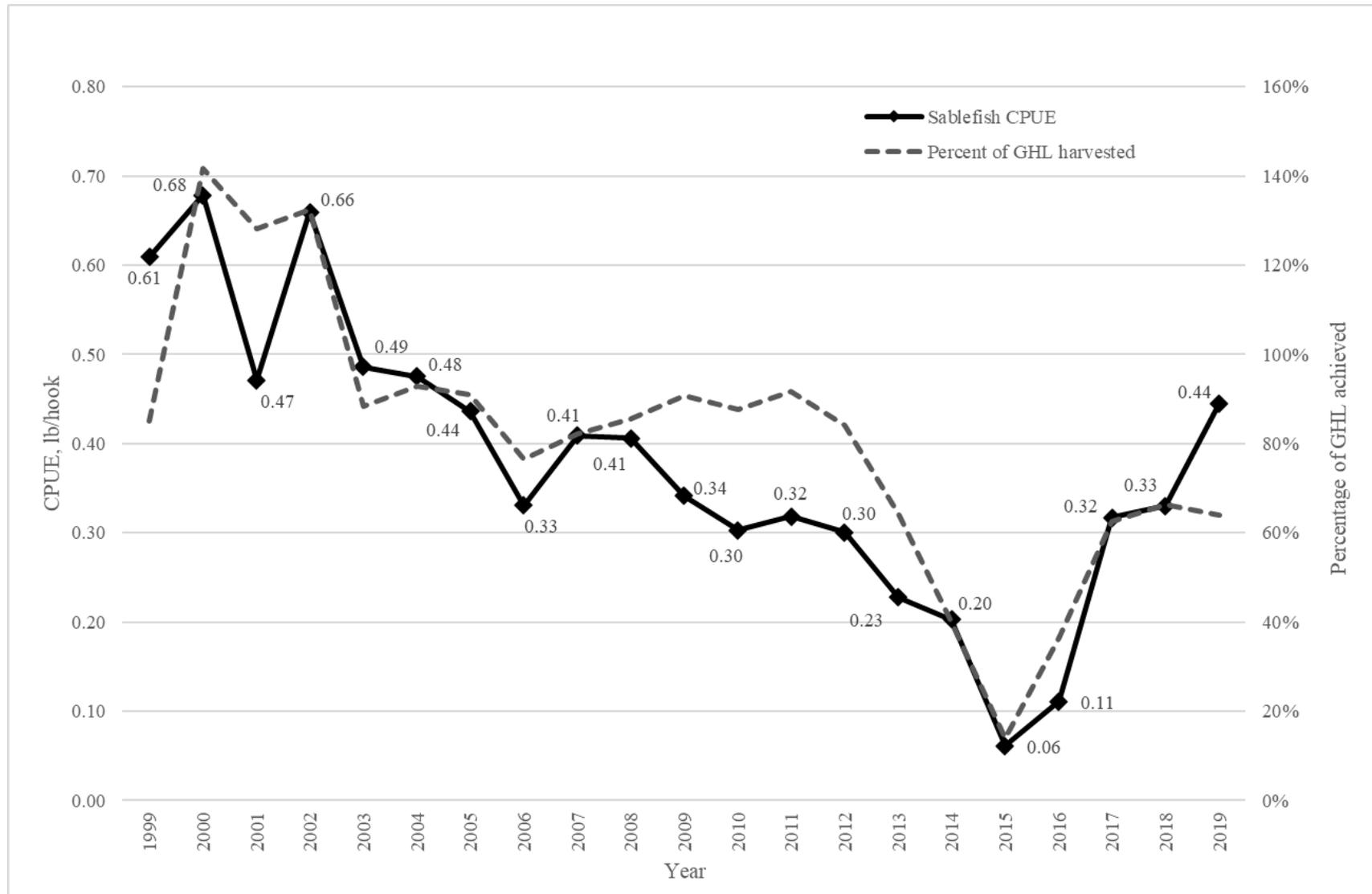


Figure 6.—Prince William Sound Area catch per unit effort (CPUE) of sablefish in lb per hook from logbook data on primary vertical axis with data labels, and percentage of GHL harvested on secondary axis, 1999–2019.

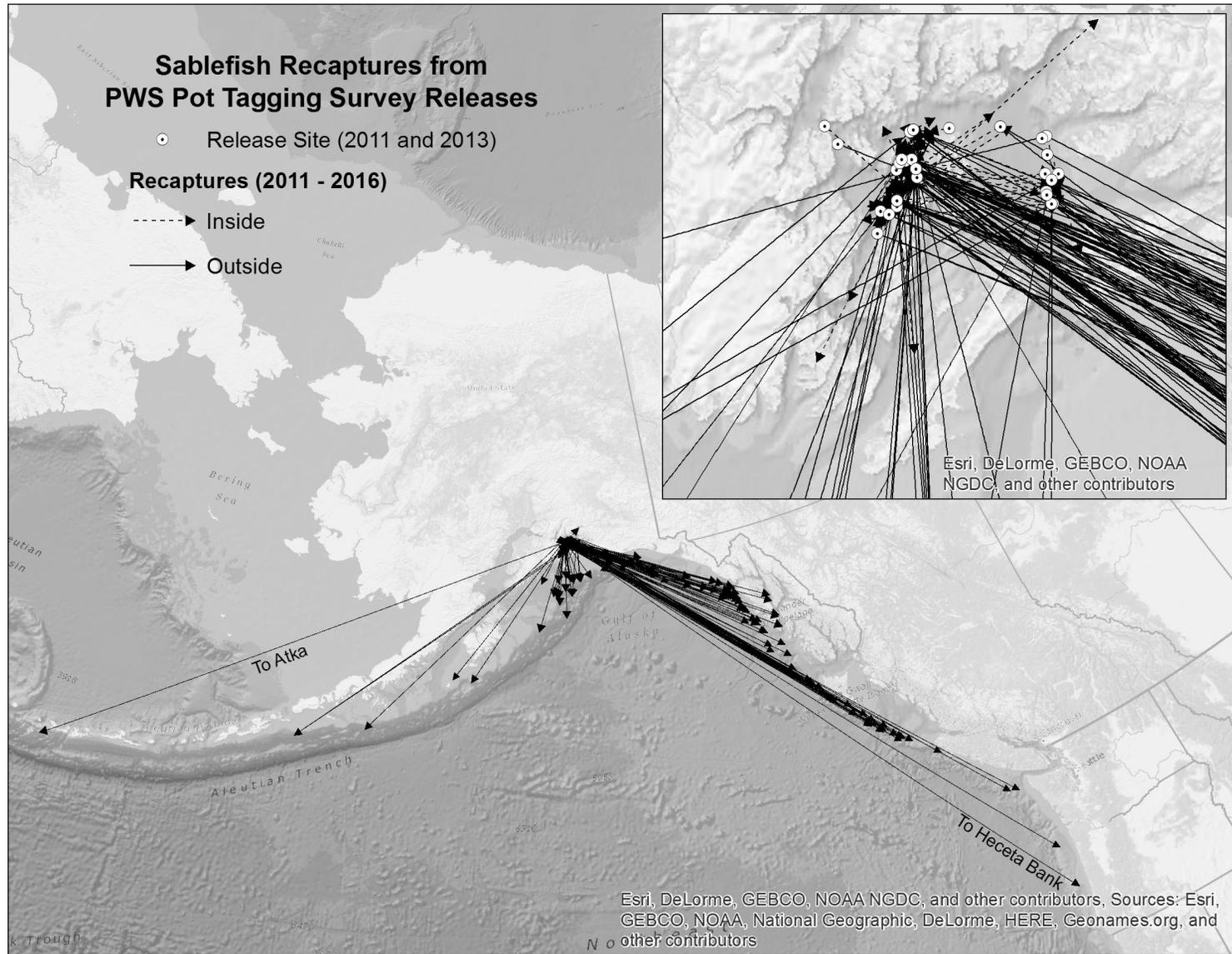


Figure 7.—Prince William Sound Area sablefish tagging project recapture sites, 2011–2016.

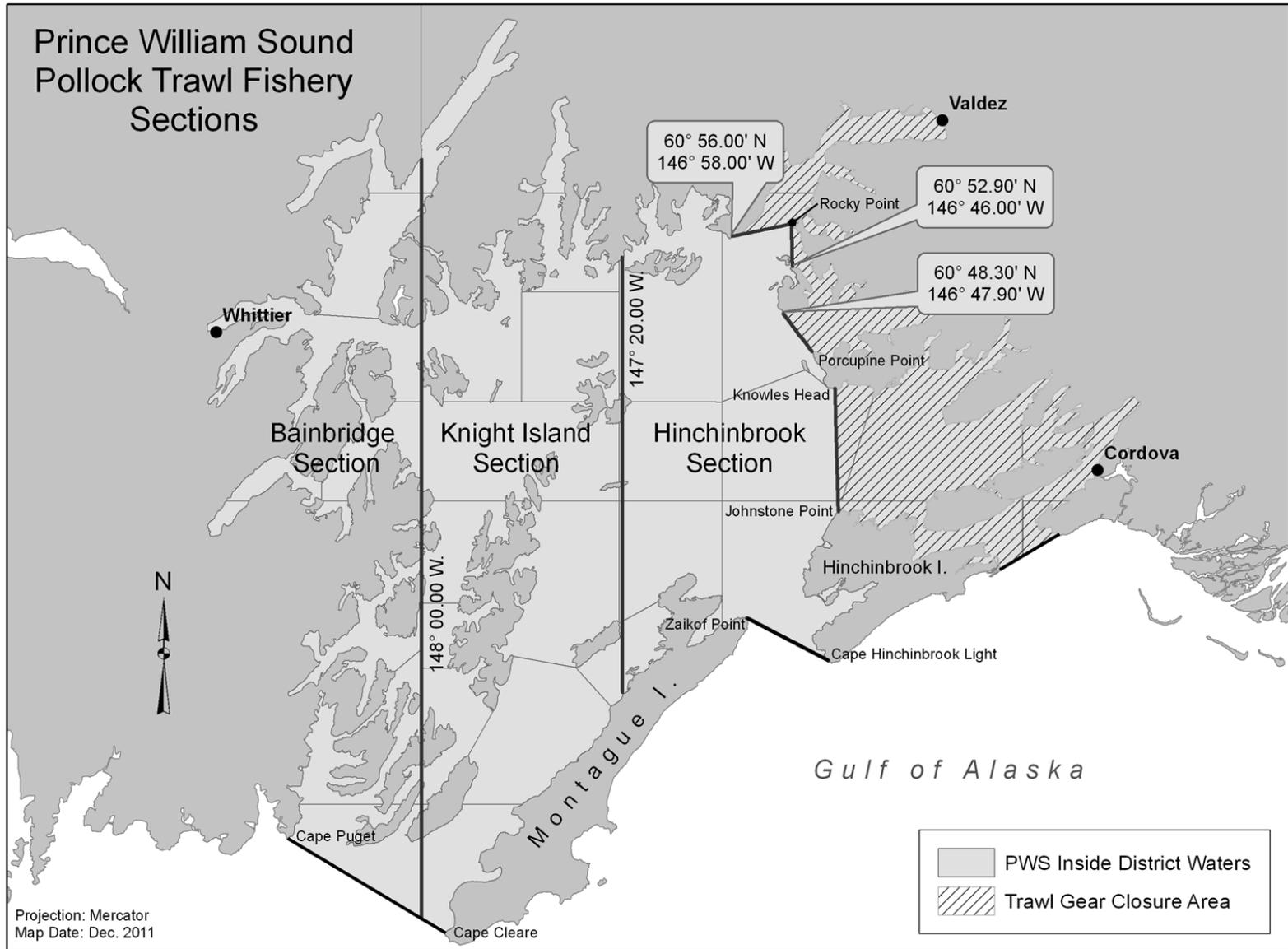


Figure 8.—Prince William Sound Area Inside District pollock management sections for the directed commercial trawl fishery.

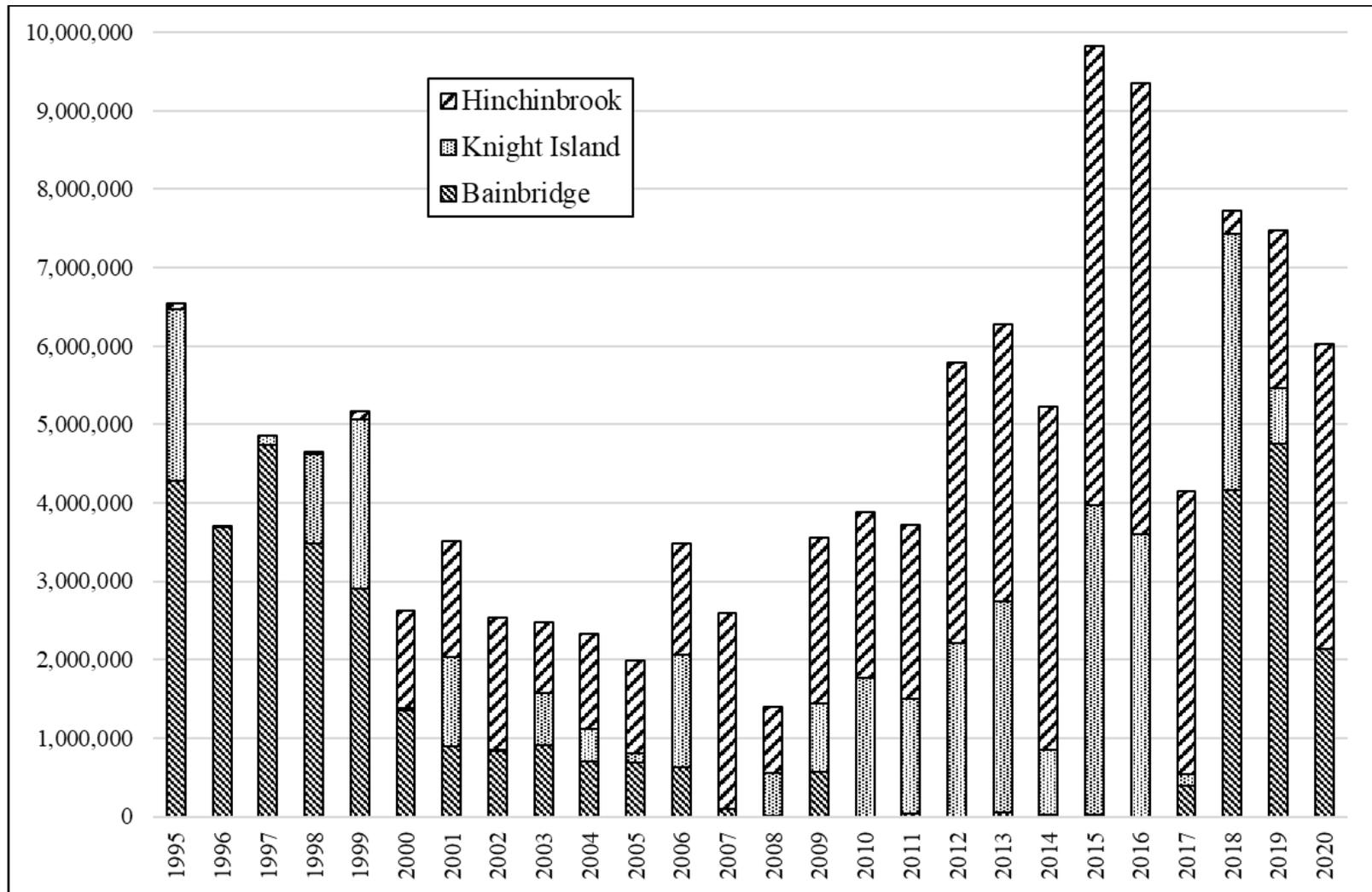


Figure 9.—Prince William Sound Area pollock harvest by section, 1995–2020.

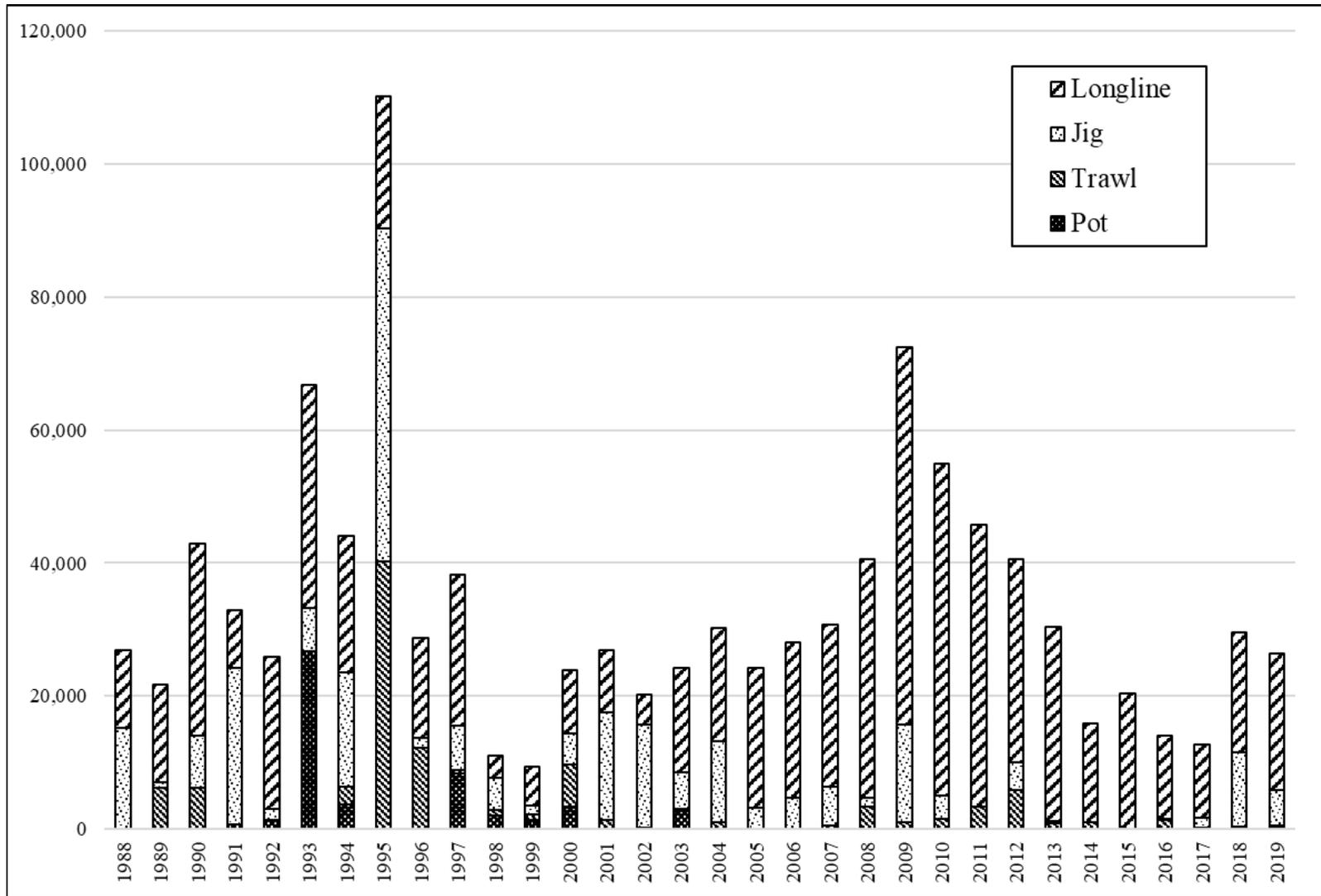


Figure 10.—Prince William Sound Area lingcod harvest by gear type, 1988–2019.



**APPENDIX A: PRINCE WILLIAM SOUND STATE  
MANAGED GROUND FISH HARVEST VALUES**

Appendix A1.–Prince William Sound Area state managed groundfish, percent of fishery contribution to total exvessel value, 2014–2019.

