

**Cook Inlet Area and Prince William Sound Area  
Commercial Fisheries for Shrimp and Miscellaneous  
Shellfish through 2021**

by

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February 2022

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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		less than	<
pound	lb	(for example)	e.g.	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	U.S.	probability of a type I error	
minute	min	(adjective)		(rejection of the null hypothesis when true)	$\alpha$
second	s	United States of America (noun)	USA	probability of a type II error	
		U.S.C.	United States Code	(acceptance of the null hypothesis when false)	$\beta$
<b>Physics and chemistry</b>		U.S. state	use two-letter abbreviations (e.g., AK, WA)	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. 22-03***

**COOK INLET AREA AND PRINCE WILLIAM SOUND AREA  
COMMERCIAL FISHERIES FOR SHRIMP AND MISCELLANEOUS  
SHELLFISH THROUGH 2021**

by

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## ABSTRACT

This report includes summaries of reported harvest and effort information and management actions for commercial shrimp and miscellaneous shellfish fisheries managed by the Alaska Department of Fish and Game (ADF&G) in the Central Region, which includes the Cook Inlet Area (Registration Areas H and G) and Prince William Sound Area (Registration Area E). The Cook Inlet Area is bounded on the east by the longitude of Cape Fairfield (148°50.25'W long) and on the south by the latitude of Cape Douglas (58°51.10'N lat). The Prince William Sound Area is bounded on the east at 144°00'W long, near Cape Suckling, to the longitude of Cape Fairfield at 148°50.25'W long. ADF&G is responsible for the management of commercial, subsistence, and personal use Dungeness crab *Cancer magister*, weathervane scallops *Patinopecten caurinus*, hardshell clams, blue mussels *Mytilus edulis*, razor clams *Siliqua patula*, all shrimp species, and miscellaneous shellfish, which includes squid *Berryteuthis magister*, North Pacific giant octopus *Enteroctopus dofleini*, green urchin *Strongylocentrotus droebachiensis*, and sea cucumber *Apostichopus californicus* fisheries. Information on Dungeness crab is provided in previous reports.

Keywords: assessment, management, commercial, Alaska Board of Fisheries, spot shrimp *Pandalus platyceros*, coonstriped shrimp *Pandalus hysinotus*, northern shrimp *Pandalus borealis*, weathervane scallops *Patinopecten caurinus*, hardshell clams, littleneck clams *Protothaca staminea*, butterclams *Saxidomus giganteus*, blue mussels *Mytilus edulis*, razor clam *Siliqua patula*, squid *Berryteuthis magister*, miscellaneous shellfish, North Pacific giant octopus *Enteroctopus dofleini*, green sea urchin *Strongylocentrotus droebachiensis*, sea cucumber *Apostichopus californicus*, Dungeness crab *Cancer magister*

## INTRODUCTION

This report provides information on shrimp and miscellaneous shellfish fisheries in the Cook Inlet Area (CI; Registration Areas H and G) and Prince William Sound Area (PWS; Registration Area E) within the Central Region managed by the Alaska Department of Fish and Game (ADF&G). ADF&G Division of Commercial Fisheries manages all commercial shellfish fisheries within state or territorial waters defined as those waters from the shoreline to 3 nautical miles (nmi) offshore and delegated fisheries within federal waters of the exclusive economic zone (EEZ) located 3–200 nmi offshore (Figure 1). In the EEZ, ADF&G manages fishing for all species not covered under a federal fishery management plan (FMP) developed by the North Pacific Fishery Management Council (NPFMC). Weathervane scallops *Patinopecten caurinus* are managed by ADF&G in EEZ waters under authority of a federal FMP. The Alaska Board of Fisheries (BOF) establishes management regulations and ADF&G uses its emergency order (EO) authority to adjust fishing time and area. The BOF schedules regular, triennial meetings to consider proposals to change shellfish regulations.

Historically, CI and PWS have had commercial and noncommercial (subsistence, sport, and personal use) fisheries for Dungeness crab *Cancer magister*, weathervane scallops, hardshell clams, razor clams *Siliqua patula*, blue mussels *Mytilus edulis*, numerous shrimp species, and miscellaneous shellfish. Hardshell clams refers to Pacific littleneck clams *Protothaca staminea* and butter clams *Saxidomus giganteus*. Miscellaneous shellfish includes North Pacific giant octopus *Enteroctopus dofleini*, magister armhook squid *Berryteuthis magister*, green sea urchin *Strongylocentrotus droebachiensis*, and giant red sea cucumber *Apostichopus californicus*. Many of these species are at the northern portion of their range.

Commercial, sport, and personal use fishing seasons for CI shrimp fisheries closed by regulation beginning in 1997 due to low abundance; the only exception was personal use shrimping in waters of the North Gulf Coast, which opened in 2008. Similar regulations closed commercial fisheries for green sea urchin, sea cucumber, Dungeness crab, and a directed fishery for octopuses.

In CI and PWS, there has been a shift in the dominant species since the late 1970s. Anderson and Piatt (1999) documented a regime shift in the Gulf of Alaska epibenthic community, which was once dominated by crustaceans and is now dominated by two species of gadid fishes: pollock *Gadus chalcogrammus* and Pacific cod *Gadus macrocephalus*. This shift has manifested itself as less shrimp and crabs and more pollock and Pacific cod. Shrimp and other small-mesh trawl surveys conducted since 1953 have documented this shift in species dominance. The information collected from these long-time data series provides evidence of a climate-driven regime shift in the Gulf of Alaska to a more groundfish-dominant community (Anderson and Piatt 1999). There was speculation that in 1999, with the Pacific Decadal Oscillation (PDO) switching back to a cold cycle combined with a couple of years of La Niña conditions, that there might be a shift back to pre-1977 relative species composition, but this has not occurred.

This report updates information on several commercially important shellfish species in CI and PWS through the 2021 calendar year (Trowbridge and Goldman 2006; Wessel et al. 2012; Rumble et al. 2016). Commercial fisheries include directed fisheries for spot shrimp *Pandalus platyceros*, sidestripe shrimp *Pandalopsis dispar*, razor clams, weathervane scallops; and a bycatch fishery for octopuses. Directed fishing for most other marine invertebrates, including squid, sea cucumbers, and sea urchins may occur only under the conditions of a commissioner's permit issued by ADF&G. Lacking abundance and status information, any permits ADF&G issues for these species will include an approach for determining a harvestable surplus and obtaining funding for determining abundance and responsible management. Harvest data for some species, within some years and areas, are confidential because there are less than 3 participants. Commercial fisheries for Dungeness crab are closed at this time due to low levels of abundance. No update on Dungeness crab is provided in this report; Rumble et al. (2016) describe historical data and management information on Dungeness crab.

## **CENTRAL REGION MANAGEMENT AREAS**

### **PRINCE WILLIAM SOUND AREA**

The boundaries of PWS (Registration Area E) historically included waters within Prince William Sound and territorial waters of Alaska outside of Prince William Sound between the longitudes of Cape Fairfield (148°50.25'W long) and Cape Suckling (143°53'W long). In 2001, the eastern boundary was moved to 144°00'W long, making the regulatory boundaries consistent among all state shellfish and groundfish fisheries (Figure 2).

PWS is divided into the Inside and Outside Districts. The Inside District is defined as waters enclosed by lines from Point Whitted to Point Bentinck, from Cape Hinchinbrook to Zaikof Point, and from Cape Cleare to Cape Puget. The Outside District, composed of Gulf of Alaska waters 0–3 miles from shore, is further divided into 2 sections, the Western and Eastern. 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 (Figure 2).

### **COOK INLET AREA**

CI consists of all waters west of the longitude of Cape Fairfield (148°50.25'W long) and north of the latitude of Cape Douglas (58°51.10'N lat). For all commercial shellfish fisheries, except shrimp, this area is defined as Registration Area H and is divided into 7 shellfish districts: Northern, Central, Southern, Kamishak Bay, Barren Islands, Outer, and Eastern Districts (Figure 3). For shrimp, CI is split into Registration Areas H and G, with H encompassing the area

that includes the Central Southern and Kamishak Bay shellfish districts, and G encompassing the area that includes the Barren Islands, Outer and Eastern shellfish districts.

The North Gulf Coast is defined for the personal use shrimp fishery in the Cook Inlet Area and includes waters extending from Gore Point (59°12.00'N lat, 150°57.85'W long) to the longitude of Cape Fairfield, including the waters of Resurrection Bay (Figure 4).

## **MANAGEMENT CONSIDERATIONS**

In the 1990s, there were concerns about the decreased abundance of many noncommercial and commercially harvested species of shellfish in CI and PWS. In 1997, the BOF adopted regulations that outlined 14 factors that ADF&G must consider prior to establishing management plans that allow for a commercial shellfish harvest. The factors included minimum acceptable biomass levels, maximum exploitation rates, stock assessment, operating and reporting requirements, avoiding biologically sensitive times of the year, and several other considerations. The regulation outlining the factors to be considered in a management plan was repealed in 2009 with the development of new management plans and regulatory fishery closures.

Miscellaneous shellfish and shrimp fisheries currently prosecuted in CI are the Kamishak Bay District commercial weathervane scallop fishery, Upper Cook Inlet commercial razor clam fishery, commercial harvest of octopuses as bycatch to other directed groundfish fisheries, and the North Gulf Coast personal use shrimp fishery. The commercial weathervane scallop fishery in Kamishak Bay has been declining in recent years with the south bed closed since 2009, and north bed closures in 2013 and 2014 and again for the last 4 seasons, 2018 through 2021. In CI, there has been no commercial harvest of hard shell clams since 2006 and no harvest of blue mussels since 1998.

Miscellaneous shellfish and shrimp fisheries currently prosecuted in PWS are the commercial and noncommercial shrimp pot fisheries, commercial shrimp trawl fishery, and commercial harvest of octopuses as bycatch to other directed groundfish fisheries. The commercial weathervane scallop fishery in PWS has been closed in the East Kayak Subsection since the 2012/2013 season and was open in the West Kayak Subsection for the 2021/22 season after being closed 8 of the previous 11 seasons. A management plan for octopuses in PWS was implemented in 2012 (5 AAC 38.217).

## **WEATHERVANE SCALLOPS**

The scallop fishery is managed jointly by the National Marine Fisheries Service (NMFS) and ADF&G under the federal FMP for the scallop fishery off Alaska. Most management measures under the FMP are delegated to the State of Alaska for management under federal oversight. ADF&G management of the weathervane scallop fishery covers both state and federal waters off Alaska.

The fishery typically remains open until the GHL is achieved. However, through its EO authority, ADF&G may close a season or area in response to declines in fishery CPUE or even apparent die-offs as occurred in Kamishak Bay in 2002. Additionally, in setting the GHL, ADF&G may consider other aspects of the survey results, such as a narrow size or age distribution or truncation of sizes observed within an area, to assist in the final management decision.

A comprehensive overview of the Alaska scallop fishery, including harvest, survey, and observer data can be found in the *Stock assessment and fishery evaluation (SAFE) report for the weathervane scallop fishery off Alaska* compiled by the Scallop Plan Team with contributions from Central Region ADF&G staff (NPFMC 2020).

## **PRINCE WILLIAM SOUND AREA**

### **Fishery Overview, 2010–2021**

PWS harvest occurs in a small portion of the registration area off Kayak Island, and typically more than 3 miles from shore, placing most fishing effort in federal waters. Waters open to scallop fishing are divided into 2 subsections: West Kayak Subsection (WKS) and East Kayak Subsection (EKS; Figure 5). The commercial weathervane scallop fishery was open in both of these areas for the 2009/2010 season; following that season, one or both of these subsections has been closed each year due to low estimated scallop abundance. The guideline harvest range (GHR) in regulation is between 0 and 50,000 lb.

Closures occurred in the WKS beginning in the 2010/2011 season through the 2015/2016 season, opened for 3 years from the 2016/2017 season through the 2018/2019 season, was closed for another 2 seasons, 2019/2020 and 2020/2021, and opened again for the 2021/2022 season. In the last 12 years, the GHLs for the 4 seasons that the fishery was open in the WKS have ranged between 6,300 lb during 3 consecutive open seasons and 8,000 lb in most recent season, much lower than pre-2007/2008 season levels, which were between 14,000 and 24,000 lb. The fishery is highly regulated with one vessel participating in recent years with the harvest very close to the GHL, ranging between 6,330 and 8,170 lb in these recent years. The CPUE has ranged between 48 lb/h to a high of 124 lb/h in the most recent 2021/2022 season, which was the highest since the 2004/05 season (Table 1).

For the recent 12 years, the EKS has only been open for the 2010/2011 and 2011/2012 seasons because of low estimated abundance from the survey. For both of these seasons, the GHL was 8,400 lb and the harvest was 8,445 lb in 2010/2011 and 8,460 lb, in 2011/2012, with relatively low CPUEs of 52 lb/h in 2010/2011 and 53 lb/h in 2011/2012 (Table 1).

With mandatory observer coverage and daily call-in reports, this fishery is closely monitored. In addition, logbooks are required, shell samples are taken, and skipper interviews are conducted.

### **Management and Regulations**

As discussed above, the Kayak Island scallop beds and open fishing area are primarily located in federal waters but do include some state waters (Figure 5). Although new open-access state waters fisheries regulations apply, no state waters-only registrations have been issued. Commercial weathervane scallop fishing in federal waters off Alaska is limited by a federal License Limitation Program (LLP), but participation in state waters (0–3 nautical miles) is open access. The LLP limits participation in the statewide scallop fishery conducted in federal waters to 9 vessels.

Although vessels were initially given substantial liberty to explore potential fishing areas, waters inside of Prince William Sound and adjacent waters of the Gulf of Alaska were closed in 1994 to scallop dredging due to concerns for the bycatch of depressed Tanner and Dungeness crabs (Figure 5). Additionally, in 2000, the BOF adopted a regulation restricting the scallop fishery to the Eastern Section of the Outside District. This measure provided the opportunity for some exploration and protected unassessed areas. Beginning in 2001, Tanner crab bycatch caps were set at 0.5% of the Tanner crab population estimate from the 2000 scallop assessment survey. This resulted in bycatch limits of 2,700 crabs in EKS and 8,700 crabs in WKS. The open season for weathervane scallops is July 1 through February 15 (adopted in 1997), unless closed earlier by EO. Current management measures include the following:

1. area registration requirement (a maximum of 2 valid area registrations at one time under certain conditions),
2. gear restrictions, including 4.0-inch ring size and a maximum of two 15-foot width dredges,
3. an industry-funded observer program, with mandatory observer coverage,
4. guideline harvest range of 0–50,000 lb of shucked meat,
5. crew size limit of 12,
6. crab bycatch limits set by ADF&G,
7. ADF&G specified catch reporting, and
8. required logbooks.

## **Research**

PWS fishery-independent assessment of the Kayak Island scallop beds was conducted by Central Region staff with a biennial dredge survey beginning in 1996 (Rumble et al. 2016), until 2016 when ADF&G initiated a statewide weathervane scallop survey. Recent ADF&G surveys were conducted in EKS in 2018 and WKS in 2019; scallop abundance in EKS was at its lowest level in the history of the survey and abundance in WKS declined significantly since the last survey in 2016 (NPFMC 2020); and therefore, EKS remained closed and WKS closed. In 2021, a survey was again conducted in both EKS and WKS; EKS scallop abundance remained low and the fishery remained closed; however, in WKS, scallop abundance and biomass had increased to levels high enough to allow for a commercial fishery to open for the 2021/22 season.

A comprehensive overview of the Alaska scallop survey program can be found in *Stock assessment and fishery evaluation (SAFE) report for the weathervane scallop fishery off Alaska* compiled by the Scallop Plan Team with contributions from Central Region ADF&G staff (NPFMC 2020).

## **COOK INLET AREA**

### **Fishery Overview, 2010–2021**

Data from Central Region’s fishery-independent scallop surveys are used to derive biomass estimates from which a GHL can be established, which are then in effect until another survey is conducted. The area is divided into the north bed and the south bed and survey estimates are provided for each bed (Figure 6).

The north bed of the Kamishak District scallop fishery has been opened 6 of the past 12 seasons. The season was open from 2010 through 2012, closed for 2 seasons, opened from 2015 to 2017, and then closed from 2018 through 2021. The GHL was 14,000 lb in 2010, decreased to 12,500 lb for 2011 and 2012, and then dropped to the minimum GHR level of 10,000 lb for 2015 through 2017 before the fishery closed from 2018 through 2021. The south bed has been closed for the past 12 years due to low estimated abundance (Table 2).

The north bed harvest has ranged from 0 lb in 2017 to 11,739 lb in 2012, and stayed within the GHL for all seasons that it has been open. When there was effort, the CPUE was at its lowest level for this time period in 2016 at 15 lb/h, highest in 2011 with 31 lb/h. The fishery was open in the north bed in 2017 although there was no effort and no harvest. Since 2018, the fishery has been closed in the north bed due to low estimated abundance (Table 2).

Until the closure in 2013, the fishery in the north bed was relatively stable for the prior 3 years. However, CPUE was still considerably lower (29 lb/h average) than during the peak years of the

fishery between 1993 and 2001 when CPUE averaged 54 lb/h, with a high of 75 lb/h in 2000 (Table 2). This fishery has been monitored closely with logbooks, shell samples, onboard observations, and skipper interviews.

### **Management and Regulations**

The Kamishak Bay scallop beds are located in federal waters and there has been no fishing activity in state waters; therefore, new open-access state waters fisheries regulations do not apply to the Cook Inlet Area (Figures 3 and 6). Commercial weathervane scallop fishing in federal waters off Alaska is limited by a federal LLP, but participation in state waters (0–3 nautical miles) is open access. The LLP limits participation in the statewide scallop fishery in federal waters to 9 vessels.

In the Kamishak Bay District of the Cook Inlet Area, the season is August 15 through October 31. The Southern, Central, and Northern Districts are closed to scallop fishing, which was established to protect crab and crab habitat (Figure 3). In the remaining Cook Inlet Area districts, the season is from January 1 through December 31, and to participate, a commissioner's permit for exploratory fishing must be issued. Scallop fishing may be closed by EO prior to the end of the regulatory season. Scallop GHL and crab bycatch limits are announced before the season opens.

Regulatory GHRs for traditional scallop fishing areas were established in the *Alaska Scallop Fishery Management Plan* (5 AAC 38.076) and adopted by the BOF in 1993. The high end of the GHR was determined by averaging historical harvest from 1969 to 1992, excluding some years when there was no effort or if early catches inflated harvest (Barnhart 2003). GHRs are established for non-traditional registration areas, which are defined as the maximum sustainable yield (MSY) by the federal FMP. Other changes occurred after 1998, establishing a more conservative definition of MSY (and reduced optimum yield); GHR ceilings were reduced in many areas but not in the Kamishak District of Cook Inlet.

The BOF adopted regulations specific to Cook Inlet Area beginning in 1983 with a 6-foot width restriction for dredge gear; this was the only area to have this smaller gear size and a single-dredge limit. In 1985, the BOF adopted regulations for the Kamishak Bay District including the GHR of 10,000–20,000 lb and season dates. Other regulations for gear are the same as the statewide regulations: rings must be 4 inches or larger for inside diameter and include other chafing gear specifications.

In the Kamishak Bay District, the Tanner crab bycatch limit is set at 0.5% of the Tanner crab abundance from the most recent survey. The red king crab limit was fixed at 60 crab in earlier years but has since been reduced to 30 crab to be in line with the reduction in red king crab catch in trawl and dredge surveys in recent years. In the Kamishak Bay District fishery, vessels are required to collect a scallop shell sample of 100 top valves from each trip for age determination and to accommodate an ADF&G observer upon request. ADF&G staff are regularly deployed as onboard observers to collect scallop and crab biological data, catch composition information, and scallop catch data that is used to determine scallop deadloss. Onboard observers also verify fishery location, effort, and harvest data recorded in vessel logbooks and provide some inseason management capability.

### **Research**

CI fishery-independent assessment of the Kamishak District scallop beds was conducted by Central Region staff with a biennial dredge survey beginning in 1984 (Rumble et al. 2016), until 2016 when ADF&G initiated a statewide weathervane scallop survey. Recent ADF&G surveys

were conducted in the Kamishak District in 2018; survey results indicated that scallop abundance had declined sharply in both the north and south beds since the last surveys to the lowest levels in the history of the survey (NPFMC 2020). The 2018 survey biomass estimates were well below the level needed to open the fishery. The north bed was surveyed again in 2019 and results showed continued low abundance and the fishery remained closed.

A comprehensive overview of the Alaska scallop survey program can be found in *Stock assessment and fishery evaluation (SAFE) report for the weathervane scallop fishery off Alaska* compiled by the Scallop Plan Team with contributions from Central Region ADF&G staff (NPFMC 2020).

## **SHRIMP**

### **PRINCE WILLIAM SOUND SHRIMP POT FISHERY**

#### **Historical Fishery**

Commercial shrimp pot landings were first documented in 1960 when approximately 5,000 lb were harvested (Table 3). The historical pot fishery occurred within the current Inside District of PWS, primarily in the Traditional Harvest Area, which encompassed the northern and western shores, from Valdez to Whittier, and the entire southwest portion of Prince William Sound (Figure 7).

From 1960 to 1977, harvest ranged from 0 lb in 1961 and 1966 to approximately 25,000 lb in 1974 (Table 3). The shrimp pot fishery expanded rapidly between 1978 and 1982 as local markets were established and major harvest areas located. Early seasons were open year-round with no harvest restrictions. From 1982 to 1984, seasons were shortened to April 1 through November 30, and the first GHR of 75,000–145,000 lb was adopted by the BOF. Despite the shortened season, catch increased to approximately 214,000 lb in 1982 and effort increased to 79 vessels in 1984 (Table 3). Beginning in 1985, the BOF established a split season of March 15 through June 30 and August 15 through December 5, with a GHR of 75,000–100,000 lb each season. The split season was intended to reduce harvests during the egg bearing periods. An experimental harvest area in Montague Strait with no closed season was also established. Due to incomplete and late catch reporting, coupled with harvest from the experimental fishing area, harvests substantially exceeded the GHR over the next few years. Total shrimp harvest peaked at approximately 290,600 lb in 1986 and effort increased to 86 vessels in 1987 (Table 3).

Harvest declines beginning in 1988 indicated potential conservation issues. The *Exxon Valdez* oil spill on March 24, 1989, complicated prosecution of the 1989 fishery in which 33 vessels harvested 29,315 lb. In 1990, the year-round harvest in the experimental area was discontinued, this area was included with the traditional harvest area, and the spring season was shortened. Also in 1990, a gear limit of 150 pots was adopted along with mesh size restrictions to encourage the escape of undersized shrimp. In 1991, a limited commercial fishery was opened with a conservative GHR of 10,000–40,000 lb and then was closed after 46 days of fishing. The fishery yielded 17,580 lb of shrimp taken by 15 vessels in 45 landings (Table 3). Fishery performance in 1991 indicated low shrimp abundance. The commercial fishery was closed by EO between 1992 and 1999. In 1994, the BOF changed the PWS pot shrimp GHR to 0–100,000 lb. In 2000, the BOF closed the fishery until the shrimp population rebuilt and a new management plan was adopted. The fishery remained closed for 18 years (1992–2009). A new management plan for the PWS commercial shrimp pot fishery, with 3 fishery areas rotated on an annual basis, was adopted by the BOF in March of 2009 and is summarized later in this report.

## **Harvest and Effort**

The PWS commercial shrimp pot fishery reopened in 2010 for the “modern fishery” and has been prosecuted for 12 seasons. Each fishery area (Areas 1, 2, and 3) has been opened 4 seasons under the new management plan (Figure 8). Guideline harvest levels for the modern fishery ranged from a low of 47,061 lb in 2016 lb to a high of 70,000 lb in 2021. Since 2017, the GHL has remained relatively consistent, ranging from 67,000 to 70,000 lb. The fishery is highly regulated with participants required to call ADF&G and report harvest and effort information for each landing, in addition to calling when departing on a trip. These call-in reports and the cooperation of the fleet have allowed ADF&G to target the commercial GHL closely. Since the fishery reopened, harvest has ranged from 35% to 103% of the GHL; during the past 6 seasons (2016–2021), the GHL has been fully utilized with harvest ranging between 100% and 103% of the GHL (Table 4).

Examining harvest, effort, and resulting CPUE by fishery area, participants have had the most success in Areas 1 and 2 in the modern fishery. The average CPUE was highest in Area 1 at 1.96 lb per pot with an average harvest of 56,091 lb and 28,571 pot pulls. Area 2 had the highest average harvest but a lower CPUE than Area 1. The average harvest in Area 2 was 64,583 lb with 37,298 pot pulls resulting in a CPUE of 1.73 lb per pot. Area 3 is considered the least productive area, as demonstrated in the fishery and survey results; however, the GHL was achieved in Area 3 during the last 2 years the fishery occurred (2018 and 2021). The average harvest in Area 3 was 45,561 lb from 31,320 pot pulls for a CPUE of 1.45 lb per pot (Table 5).

Participation in the fishery has been variable and is not corroborated by the number of people purchasing Commercial Fisheries Entry Commission (CFEC) permits. The number of CFEC permits purchased in the modern fishery has ranged from 112 (2015 and 2018) to 195 (2010, the first year of the fishery) permits. From that, the actual number of participants in the fishery has ranged from 29 in 2015 to 82 participants in 2010 with participation percentage ranging between 25% in 2012 and 58% in 2020 (Table 6).

For this fishery, after purchasing a CFEC permit card, a person must register a vessel with ADF&G in order to participate. Vessel registration is the true indicator of effort because pot limits are per vessel, not permit. Even if 2 permit holders are fishing aboard 1 vessel, only 1 limit of gear is allowed to be fished per vessel. For the modern fishery, the number of vessels that registered was the highest in 2010, the first year the fishery was open, at 156 vessels, with the lowest number registered in 2014 at 65 vessels. Vessels may register but not actually participate in the fishery, which is common. The number of vessels that have participated in the modern fishery has ranged from a low of 30 vessels in 2015 to a high of 75 vessels in 2010. For the past 3 seasons (2019–2021), vessel participation has ranged between 71 and 73 vessels, with the highest participation percentage for the modern fishery ranging between 70% and 79%. Prior to 2019, the participation percentage for registered vessels ranged between 42% and 66% (Table 6).

## **Management and Regulations**

A new management plan for the PWS commercial shrimp pot fishery was adopted by BOF in March 2009, with minor revisions in subsequent BOF meetings. Specific regulations included the following:

- 1) A total allowable harvest (TAH) of more than 110,000 lb must exist in PWS before a commercial shrimp pot fishery may open (5 AAC 31.214).



- 2) The GHL for the commercial fishery is 40% of the TAH (60% is allocated to the noncommercial fishery; 5 AAC 31.214).
- 3) The fishery occurs within the Inside District and is rotated on a triennial basis between 3 different areas described in 5 AAC 31.210 (a)(1), (2), and (3).
- 4) Each season, ADF&G determines the number of shrimp pots that may be operated from a vessel based on total number of registered vessels, estimated catch per unit effort, and magnitude of the GHL, not to exceed 100 shrimp pots per vessel (5 AAC 31.223 (e)(1)).
- 5) Shrimp pot gear may only be deployed and retrieved between the hours of 8:00 AM and 4:00 PM, unless modified by EO (5 AAC 31.223 (e)(3)).
- 6) Stringent reporting regulations require all commercial shrimp harvesters to contact ADF&G prior to fishing for each trip, complete logbooks daily, and contact ADF&G before landing to provide harvest, effort, statistical area, and fish ticket information (5 AAC 31.245).
- 7) Shrimp pots deployed on a longline consisting of 5 or more pots must have a buoy marking each end (5 AAC 31.226 (c)).
- 8) No more than 50% of the GHL may be harvested from any single statistical area (25% restriction adopted in 2012 and increased to 50% in 2015; 5 AAC 31.214).

Statewide commercial shrimp gear regulations describe buoy marking, maximum tunnel size, and a biodegradable escape mechanism. PWS shrimp pot regulations specify that a pot may not have (1) more than 1 bottom; (2) a vertical height of more than 24 inches; (3) more than 4 tunnel eye openings, which individually do not exceed 15 inches in perimeter; or (4) a bottom perimeter exceeding 124 inches. Additionally, a shrimp pot must be entirely covered with net webbing or rigid mesh and at least 2 adjacent sides or 50% of the vertical or near vertical sides must be covered with net webbing or rigid mesh that allows the unaided passage of a 7/8-inch diameter by a 12-inch long wooden dowel (5 AAC 31.223). PWS was originally designated a superexclusive registration area for vessels fishing for shrimp with pot gear, and it was redesignated as an exclusive registration area at the 2012 BOF meeting when it was determined that superexclusive was not defined for shrimp. A vessel may only fish in 1 exclusive registration area during a registration year.

The opening of the commercial fishery is dependent on the results of a surplus production model, which determines the harvestable surplus (total allowable harvest; TAH) of spot shrimp in PWS (Rumble et al. 2018) Results of the model are available in early March when an announcement is made as to whether or not the commercial fishery will open. If a commercial fishery is allowed, participants must register at area offices by April 1. The registration deadline enables ADF&G to estimate effort in the fishery each season.

Immediately following the registration deadline, ADF&G sets gear limits and initial fishing periods based on the number of vessels registered relative to the GHL, expected CPUE, and likely participation. In 2010, gear limits were set at a maximum of 20 pots per vessel when 156 vessels registered for the fishery, although only 75 vessels participated. In subsequent years, vessel gear limits have initially been set between 25 and 60 pots based on vessel registration. In 2019, there were 100 vessels registered and the pot limit was set at 25 pots; in 2015, vessel registration was at the lowest level (56 vessels) and the pot limit was set at 60 pots (Tables 4 and 6). For 2 seasons, 2013 and 2021, ADF&G used inseason harvest and effort information to increase the pot limit inseason. Initial fishing periods are set to determine the true participation and pace of the fishery. Initial fishing periods varied between 4 and 15 days.

Available fishing days have varied during the modern fishery from 18 days in 2020, the quickest achievement of the GHL, to 146 days in 2015, when the fishery closed by regulation with 35% of the GHL harvested (Tables 4 and 6). For the 3 different areas, Area 3 has been open for the most fishing days, with an average of 121 days per season; Area 2 has been open for the least days, with an average of 67 days per season; and Area 1 averaged 81 days of fishing per season (Table 5).

For all seasons, except 2018, hours of gear operation have been consistently relaxed by EO to between 8:00 AM and 8:00 PM in order to allow fishermen to take advantage of the most favorable tide conditions to operate their gear. In 2018, hours of operation were relaxed to between 6:00 AM and 10:00 PM for the entire season. In 2011, 2013, and 2014, the gear deployment hours were extended to 6:00 AM to 10:00 PM daily late in the season to increase gear efficiency by increasing soak time and allowing fishery participants more time to relocate gear.

Stringent reporting requirements have allowed ADF&G to closely monitor harvest and effort. There was only one local area closure in season; Copper Bay closed to commercial harvest during the 2012 season when a decline in CPUE was detected.

## Research

In 1989, as part of the *Exxon Valdez* oil spill damage assessment process, ADF&G initiated an annual survey using pot gear to assess spot shrimp in PWS (Trowbridge 1992, 1994). During these first 3 years of the survey, the number of pots set at each survey site was variable. Between 1989 and 1991, 6 stations were set on the survey: Unakwik, Golden, Culross, Herring Bay, Junction Island, and Green Island (Figure 8). Two depth strata were fished during these 3 years: 20–70 fathoms and 70–120 fathoms. Starting in 1992, two more stations, south Chenega and Prince of Wales, were added to the survey and depths fished were standardized to range from 20 to 80 fathoms because survey catch rates dropped precipitously at depths below 80 fathoms in previous surveys (Trowbridge 1994). In 2009, the Green Island station was eliminated due to regular gear loss from heavy currents, and a new survey site was added at Long Bay. In 2012, another new survey site was added at Bald Head Chris to provide better area coverage, and in 2013, an additional survey site was added in the Valdez Arm area to obtain fishery-independent data in this area of high noncommercial effort and harvest. Beginning in 1992, for all but 2 years, the survey has set 4 strings of 11 pots each set at each survey site annually (Figure 8). Each string of standardized gear had pots spaced approximately 10 fathoms apart on a groundline with buoys at each end. Data from the shrimp pot survey, specifically CPUE and sex ratios, were used to make management decisions between 1991 and 1999, years when the fishery was closed by EO. The survey continued to monitor the population after BOF closed the fishery in 2000; observed population increases prompted ADF&G to submit proposals for a new management plan that was adopted by BOF in 2009. Since the current management plan has been in place, the survey data is used to determine if a commercial fishery will open and the resultant GHL for that season.

Sex ratios are important because spot shrimp are protandrous hermaphrodites, first recruiting to the fishery as males, and as they get larger, transitioning to females. From the annual survey for 1992 through 2009, the average percentage of the shrimp sampled that were male was 92% and ranged from 81% to 96% male shrimp. From 2010 through 2021, the sex ratio has been more variable ranging from 75% to 95% male shrimp with an average of 88% male. The percentage of female shrimp bearing eggs has been high, ranging between 81% to 99.6% of all females sampled and averaged 94% for all years (Table 7).

The CPUE for all sizes of spot shrimp in the PWS shrimp pot survey showed a decline from 0.71 lb/pot in 1992 to 0.29 lb/pot in 1998. After 1998, survey catches and CPUE demonstrated a slow but steady increase in abundance and biomass, from 0.29 lb/pot to 2.56 lb/pot for all shrimp in 2008. From 2008 to 2015, survey CPUE averaged approximately 2 lb/pot. Between 2016 and 2020, the CPUE for all shrimp were at the highest levels ranging from 2.75 lb/pot in 2016 to a high of 3.94 lb/pot in 2020. In 2021, the most recent year, the CPUE for all shrimp decreased to 2.43 lb/pot, slightly lower than the average of 2.59 lb/pot during 2010–2021 (Table 7, Figure 9).

Similarly, survey results for shrimp with a carapace length of 32 mm or greater, which are considered commercially marketable shrimp, remained less than 0.9 lb/pot from 1992 through 2006. Beginning in 2007, the CPUE for these larger shrimp, which are primarily females, has ranged between 1.01 lb/pot in 2015 to a high of 2.33 lb/pot in 2020; in 2021, the CPUE was 1.36 lb/pot, slightly lower than 1.58 lb/pot, the average from 2010 to 2021 for this size category (Table 7, Figure 9).

Beginning in 2004, survey CPUE in Area 1 for all sizes of shrimp has exceeded 1.7 lb/pot with a high of 5.2 lb/pot in 2020. Between 2016 and 2021, CPUE for all shrimp has been at high levels ranging from 3.1 lb/pot in 2021 to 5.2 lb/pot in 2020. The higher CPUE for all shrimp since 2016 indicated recruitment of smaller shrimp into the population. The CPUE in Area 1 for large shrimp (>32 mm) also decreased from 2020 to 2021, from approximately 3.7 lb/pot to 2.0 lb/pot, although the CPUE remains above the average for the time series (Figure 10).

Beginning in 2002, the survey CPUE in Area 2 for all sizes of shrimp has exceeded 1.6 lb/pot. The survey CPUE for all shrimp in Area 2 reached its highest levels between 2017 and 2020, peaking at 5.6 lb/pot in 2017, then remaining between 4.0 to 4.5 lb/pot for the next 3 years, until declining to 2.9 lb/pot in 2021, which is still above the long-term average. The catch of large shrimp (>32 mm) in Area 2 was less variable, with a CPUE above approximately 1.3 lb/pot from 2009 through 2021, with a peak of 2.3 lb/pot in 2016. Following 2015, the CPUE for all shrimp was much higher than the CPUE for large shrimp, showing high levels of recruitment in Area 2 (Figure 10).

Area 3 is the least productive area for spot shrimp in PWS, with the lowest CPUE for all sizes and large (>32 mm) shrimp. Pulses of recruitment can be seen in the CPUE of all shrimp, from 2005 to 2009 and from 2016 to 2021. CPUE for all shrimp has been at its highest levels between 2017 and 2020, exceeding 2.0 lb/pot and reaching 3.2 lb/pot in 2018, with a decrease to 1.3 lb/pot in 2021, which is still above the long-term average. Similarly, large shrimp in Area 3 were at relatively high levels between 2017 to 2020, ranging between 0.86 lb/pot in 2019 to 1.46 lb/pot in 2018. Large shrimp also decreased in 2021, down to 0.44 lb/pot, which is slightly below the long-term average, although the survey did occur after the fishery concluded in Area 3 in 2021 and will not be commercially fished again until 2024 (Figure 10).

Survey results are currently used to assess the relative abundance of spot shrimp in PWS and these data, along with survey CPUE and total catch weight, are used in combination with harvests from the commercial and noncommercial fisheries each year to model the harvestable surplus of spot shrimp in PWS. Model results provide the following year's TAH and GHF for both commercial and noncommercial spot shrimp fisheries (Rumble et al. 2018).

## **PRINCE WILLIAM SOUND SHRIMP TRAWL FISHERY**

### **Harvest and Effort**

Since 2007, all harvest data for the PWS shrimp trawl fishery is confidential due to less than 3 participating vessels, except for 2019. Since 2014, GHGs have been set at 60,300 lb in the Wells Section, 14,000 lb in the Northwest Section, and 33,000 lb in the Central and Southwest Sections combined. In 2019, 3 vessels harvested 63,917 lb of shrimp which was composed of 35,631 lb of sidestripe shrimp sold, 28,277 lb of deadloss (approximately 50/50 northern/sidestripe juvenile shrimp), and a minimal amount of spot, coonstripe, and northern (pink) shrimp sold (9 lb; Table 8, Figure 11). The majority of 2019 harvest (89%) was taken in the Wells Section with 10% taken in the Northwest Section, and the remainder from the Central Section. No GHGs were achieved, although 86% of the Wells Section GHG was harvested.

Refer to Rumble et al. (2016) for historical fishery information and GHG development.

### **Management and Regulations**

Regulations for shrimp trawling in northwestern PWS were adopted in 1986 and included seasons, a commissioner's permit requirement, cod end specifications including 1 $\frac{1}{8}$ -inch mesh hung square to the mouth of the net, and a 10% limit on retention of northern shrimp. In 1990, the cod end mesh size restriction was increased to 1 $\frac{7}{8}$ -inch to facilitate release of small sidestripe and pink shrimp. Shrimp trawling regulations were restructured in 1994 when the BOF adopted open season dates of April 15 through August 15 and October 1 through December 31, amended the cod end requirement, and created the Northwest Shrimp Trawl Fishing District (NSTFD). The NSTFD was defined as waters north of 60°27.00'N lat and west of 147°20.00'W long and integrated important harvest areas as Port Wells, Wells Passage, and Perry Passage. The new season dates were based on biological data that indicated egg release was not complete until April 15 and industry reports that soft-shell shrimp were present until October 1.

In 2000, the BOF adopted a regulation that required shrimp trawls be equipped with a finfish excluder device. In 2003, the BOF adopted regulations that restructured shrimp trawl management areas. The NSTFD was repealed and the new sections created by this action were the Northwest, Wells, Southwest, and Central Sections (Figure 11).

PWS is a nonexclusive registration area for shrimp fishing with trawl gear, and current regulations restrict the retention of northern shrimp or other pandalid species to no more than 20% by weight of the shrimp in possession. They also require catch reporting within 24 hours of landing and completed logbook sheets to be returned with fish tickets within 7 days of landing.

Other regulatory measures for the PWS shrimp trawl fishery include the following:

1. Season dates of April 15 through August 15 and October 1 through December 31 (5 AAC 31.211).
2. Cod end mesh composed entirely of 1 $\frac{7}{8}$ -inch stretched mesh hung horizontal and perpendicular to the mouth of the trawl (5 AAC 31.225 (a)(1)).
3. A year-round closure in eastern Prince William Sound to minimize indirect fishing mortality on current low levels of abundance of king and Tanner crabs in key production areas (5 AAC 31.211 (a)) (Figure 10).

4. A shrimp trawl must be equipped with a finfish excluder device consisting of a rigid grate with parallel bars spaced not more than 2.5 inches apart, except they may be spaced 4.0 inches apart if the operator of the shrimp trawl also holds a PWS limited entry sablefish permit and is registered for the current year's fishery. Regulations specify how the excluder must be secured within the trawl and define an escapement outlet (5 AAC 31.225 (a)(2)).

The regulatory spacing of 2.5 inches for excluder bars was adopted as a compromise between ADF&G and the industry in an effort to reduce discard mortalities of finfish and shrimp. With the exception of the PWS sablefish fishery, nonpelagic or "bottom" trawls are not legal gear for targeting groundfish in PWS.

## **Research**

Currently, there is no stock assessment program for sidestripe shrimp in PWS. Previously, there was harvest sampling conducted by ADF&G (Rumble et al. 2016).

## **COOK INLET AREA NORTH GULF COAST PERSONAL USE FISHERY**

### **Harvest and Effort**

The North Gulf Coast personal use (NGC PU) shrimp fishery is the only shrimp fishery that is currently open annually in the Cook Inlet Area (Figure 4). The fishery is regulated by annual permits. Harvest information was reported in gallons or numbers of shrimp and then converted to pounds. The conversion used is 1 gallon of whole shrimp equals 3.89 lb equals 73 shrimp, developed from a conversion method developed by ADF&G PWS staff in 2012.

Since the permit's inception in 2008, the number of permits issued annually has remained steady until 2020, the first year of the COVID-19 pandemic, which seemed to have increased outdoor activities among Alaskan residents. Between 2008 and 2019, the average annual number of permits issued was 141. During the last 2 years, the number of permits more than doubled to 422 issued in 2020 and 342 issued in 2021. The permit return percentage was very high between 2008 and 2016, between 91 and 100%, because of staff following up with emails, letters, and phone calls to get fishing information from unreturned permits. From 2017 to 2020, compliance decreased, with a low of 47% in 2020, likely due to less follow-up because of staff priorities with other fisheries. ADF&G's online permitting program has been in place since 2020, and 2021 was the first year that the failure to report (FTR) policy was put into place. This policy made permits unavailable to applicants who did not return their permits the previous year and increased the permit returned percentage to 89% in 2021 (Table 9).

Between 2008 and 2017, the percentage of permits that were fished ranged between 50% and 72%, then dropped to the lowest level of 24% in 2018, with the last 2 years, 2020 and 2021, having participation levels of 16% and 27%, respectively. The number of permits fished has been variable with a low of 29 permits in 2018 and a high of 121 permits in 2012. In 2020, 69 permits were fished, and 93 permits were fished in 2021 (Table 9).

The recorded harvest has varied greatly with the lowest harvest of 56 lb in 2017 from 54 permits and the highest harvest of 621 lb in 2019 with low participation of 40 permits (Tables 9 and 10). In 2020 and 2021, harvest continued to be high for this fishery at 465 lb and 589 lb, respectively.

Examining the effort more closely, the total pot soak time for the past 3 years has been at a high, from ~27,000 hours in 2019 and peaking at ~82,000 hours in 2021. As expected, the pot count was also the highest ranging from 802 pots in 2019 to 1,441 pots in 2021. Although the effort was

highest in the past 2 years, 2020 and 2021, the harvest was the highest in 2019 with 621 lb of shrimp harvested. The CPUE show somewhat similar success, although the highest CPUE occurred in 2015 at 1.05 lb per pot and the second highest in 2019 with 0.77 lb per pot. The CPUE in 2020 and 2021 was 0.41 lb per pot for both years (Table 10, Figure 12).

Two areas dominated the effort and harvest since the inception of the permit in 2008: Aialik Bay and Resurrection Bay. In Aialik Bay, between 2008 and 2016, total pot soak time reported was between 3,327 (2008) and 14,844 hours (2010; Table 11). The harvest for the same period peaked in 2010 with 419 lb taken from this area. The highest CPUE for this period was 1.40 lb per pot in 2015; the lowest CPUE occurred in 2017 at 0.12 lb per pot (Table 11). Resurrection Bay became a popular area to set pots for shrimp beginning in 2012 when the eastern boundary of the NGC was extended east of Aialik Cape to include that area (Figure 4). Between 2012 and 2018, the annual soak time ranged from ~2,500 to ~12,000 hours. Although there was effort before 2018, the harvest never surpassed 84 lb per year. Things changed in 2019 with an increase in effort to 21,542 pot soak hours and resulting harvest of 434 lb. This trend continued in the following 2 years with 45,385 pot soak hours and 404 lb harvest in 2020 and again in 2021 to 77,150 pot soak hours and 524 lb of shrimp harvested. The highest annual CPUE was recorded at 0.80 lb per pot in 2019 (Table 12).

## **Management and Regulations**

Recreational shrimp fisheries in the Cook Inlet Area were closed since 1997 until the NGC PU shrimp fishery was established by the BOF in 2006. The NGC PU fishery is administered through a fishery-specific permit required to participate. Only Alaska residents possessing a valid Alaska resident sport fishing license or Alaska residents exempt from licensing under AS 16.05.400 may participate in the fishery. No permits were issued in 2006 and 2007.

The original fishery area included waters from Aialik Cape west to Gore Point. However, in 2012, the BOF expanded the NGC area to include additional waters between Aialik Cape and Cape Fairfield, including Resurrection Bay (Figure 4) to align with the Cook Inlet Area eastern boundary.

The personal use season for shrimping with pot gear in NGC waters is from April 15 through September 15. Legal gear for the fishery is 5 pots per person and a maximum of 5 pots per vessel. Each shrimp pot must meet the tunnel eye, mesh, and biodegradable escape mechanism requirements as described in 5 AAC 77.509, 5 AAC 77.511, and 5 AAC 39.145.

The permit has been online since 2020. State of Alaska residents can obtain the permit online through the ADF&G store and reporting has been a blend of online and/or paper permit information being entered by staff. Failure to Report (FTR) was implemented in 2021 and if residents obtained a permit and did not report harvest or that they did not fish, they are no longer allowed to get a permit the following season.

The permit has undergone changes through the years to better define fishing locations and allow flexibility when recording shrimp amounts. The 2021 online permit allowed participants to report either gallons of whole shrimp or number of whole shrimp by statistical area (Figure 4) or the nearest bay or headland. Daily reporting is required on the permit with number of pots being pulled and the soak time in hours. Reporting shrimp by species is not required, and the harvested species could be a mix of spot shrimp, coonstripe shrimp *P. hypsinotis*, and Northern (pink) shrimp *P. borealis*, although the targeted and primary species is spot shrimp.

## Research

There is no current directed research on North Gulf Coast shrimp. Post-fishery monitoring occurs with permit information. Previous research is described in Rumble et al. (2016).

# OCTOPUS AND SQUID

## PRINCE WILLIAM SOUND AREA

### Harvest and Effort

There is no directed fishery for octopuses in PWS. However, octopuses have been harvested incidentally to the Pacific cod pot fishery, to a lesser degree in the shrimp trawl fishery, and more recently in the shrimp and Tanner crab pot fisheries. Octopus harvests first exceeded 1,000 lb in 1992 and attained the highest harvest of 5,798 lb by 7 vessels in 34 landings in 1994. Octopus harvests from 1992 to 1998 averaged approximately 3,400 lb, with no reported harvests during 1999–2001, 2006–2009, and 2011; harvest from 2003 to 2005 was confidential with less than 3 vessels retaining octopuses. From 2010 through 2021, except for 2011, octopus harvest has ranged between 105 to 1,468 lb annually, from between 3 (2012) and 55 (2019) landings (Table 13).

There is no directed fishery for squid in PWS. However, squid are harvested incidentally to the commercial pollock trawl fishery and to a lesser degree in the shrimp trawl fishery. Since 1989, the harvest of squid has ranged from 0 lb in 1991 and 1994 to 240,125 lb from 17 landings in 2015 (Table 13). In the PWS pollock trawl fishery, the squid bycatch allowance is 3% of the directed pollock catch onboard.

### Management and Regulations

The PWS *Registration Area E Octopus Management Plan* (5 AAC 38.217), which permits the retention of octopuses commercially caught as bycatch to other directed fisheries, was adopted by the BOF in March 2012.

The plan sets an annual GHL of 35,000 lb. In directed fisheries for groundfish and shellfish, except shrimp, octopuses may be retained as bycatch up to 20% by weight of the directed species onboard a vessel. In directed fisheries for shrimp, octopuses may be retained in an amount not to exceed 35%, by weight, of the shrimp onboard the vessel.

Following the 2002 harvest of 180,250 lb of squid, squid bycatch in the pollock trawl fishery was managed to no more than 3% of the round weight of pollock onboard, with no more than 5% bycatch overall, adopted by the BOF into regulation to encourage more efficient fishing practices. ADF&G monitors squid bycatch in the pollock fishery so that the harvest cap is not exceeded. In 2014 and 2015, squid harvest in the pollock fishery was close to and above the 2002 level, at approximately 172,000 and 240,000 lb, respectively; however, due to large pollock GHLs, squid bycatch levels remained below 3% of the pollock harvest. In 2020, squid harvest was 156,912 lb, which was 101% of the 3% bycatch cap at the time of the pollock fishery closure. In 2021, squid harvest decreased to a lower level at 39,848 lb and 26% of the 3% bycatch cap.

## **COOK INLET AREA**

### **Harvest and Effort**

Since 2011, the octopus GHL in the Cook Inlet Area has been achieved annually in all years except 2020 and 2021. Most of those years, retention of octopuses has been closed in March because of the achievement of the GHL during the Pacific cod pot fishery, when the vast majority of octopuses are harvested as bycatch (Table 14). The last 2 years, 2020 and 2021, octopus harvest has been 11,145 lb and 9,315 lb, respectively. This is related to the downturn in the Pacific cod fishery in CI, and there has been decreasing vessel participation from 17 vessels landing octopuses in 2017 to 3 vessels in 2021.

There has been some interest in a directed fishery, but because there is already a management plan for the bycatch-only fishery and no fishery-independent abundance information is available for CI, directed harvest has not been permitted.

There has been no squid commercially harvested in the Cook Inlet Area.

### **Management and Regulations**

Octopus is considered a shellfish under state regulation; however, octopus is designated as “other groundfish” under federal regulations. In 1997, regulation 5 AAC 38.390 was adopted, which closed all state waters to commercial fishing for octopus until a management plan was adopted. Commercial octopus fishing remained open in adjacent federal waters. Therefore, ADF&G set a 20% bycatch allowance for octopuses during groundfish fisheries in state waters.

In 1999, the BOF adopted 5 AAC 38.360, *Cook Inlet Area Octopus Management Plan*, which established octopus retention as bycatch only, set an annual GHL of 35,000 lb, and kept the bycatch allowance at 20% of the targeted harvest, by whole weight. Once the annual GHL is achieved, retention of octopuses is not allowed, and octopuses must be released. Octopus retention has closed 8 times in the past 10 years.

### **RESEARCH**

The giant Pacific octopus is found in the waters of CI and PWS. Most octopus species spawn only once because both sexes stop feeding and die within several weeks after spawning; the female protects and maintains water flow over the eggs until her death, which may occur before the eggs hatch. Sexual maturity occurs between 1.5 and 2 years.

In 2006, University of Alaska scientists working in CI attempted to develop an abundance estimate of giant Pacific octopus. The viability of using a mark–recapture study was examined by tagging octopuses caught in Pacific cod pots. There were 97 octopuses tagged with Peterson discs and visible implant elastomer tags. The data collected from this study suggested that the visible implant elastomer tags were more effective at marking octopuses, but no abundance estimate was developed (Barry et al. 2011).

Beginning in 2011, an assessment of the “octopus complex” was conducted by NOAA fisheries because it had previously been included in the “other species” complex. In compliance with the reauthorized Magnuson-Stevens Act, there was a need to establish an annual catch limit specifically for octopuses. Knowledge about octopuses in the Gulf of Alaska (GOA) was poor, but some research was initiated in recent years.



NOAA has been conducting research on capture/tagging methods and determining life history information on the giant Pacific octopus in the GOA. They found that these octopuses have a protracted reproductive cycle with peak spawning occurring in the winter to early spring months. Mating occurs several months before spawning and females have the ability to store sperm. Giant Pacific octopuses in the GOA mature between 10 kg and 20 kg and have a fecundity of approximately 100,000 eggs per female. Life expectancy for the giant Pacific octopus is 4.5–5 years based on aquarium studies (Conrath and Conners 2014).

One of the goals of Conrath and Conners (2014) study was to find the best method for capturing octopuses. Different materials were used for the traps, and plywood box pots caught the most octopuses and were the easiest to handle. They caught octopuses over a wide range of sizes, which included the size range caught during commercial fishing. Tagging with visible implant elastomers was used and found to be effective to mark octopuses; there was no evidence of mortality caused by the handling and tagging.

ADF&G has sampled commercial landings of giant Pacific octopuses harvested as bycatch to CI Pacific cod pot fisheries since 2000. Octopuses are generally landed in gutted condition and the landed weight is converted to whole weight. The average weight has ranged from 10.1 kg (22.2 lb) in 2000 to 15.5 kg (34.1 lb) in 2002 (Table 15). The percent of female octopuses sampled annually has ranged from a low of 33% in 2018 up to 62% in 2000; the proportion of females has been increasing since 2018 and was 54% in 2021. Octopus sampling occurs opportunistically, and the highest number of samples ( $n = 452$ ) was collected in 2019 (Table 15).

## **RAZOR CLAMS**

### **PRINCE WILLIAM SOUND AREA**

There is no commercial razor clam fishery or research currently being conducted in PWS.

### **COOK INLET AREA**

#### **Harvest and Effort**

The commercial harvest of razor clams from Upper Cook Inlet (UCI) beaches dates back to 1919 (Table 16). Harvest levels have fluctuated from no fishery to production in excess of 500,000 lb. The sporadic nature of the fishery was more a function of limited market opportunities than limited availability of the resource. Razor clams are present in many areas of Cook Inlet, with particularly dense concentrations occurring near Polly Creek on the western shore and from Clam Gulch to Ninilchik on the eastern shore (Nickerson 1975).

The last year of harvest occurred in 2019, taken primarily from the Polly Creek/Crescent River area, with no effort or harvest in 2020 and 2021. The harvest in 2019 was approximately 137,530 lb in the shell from 16 diggers that participated (Table 17). Harvest was reported from 68 different days between May 2 and August 6. Diggers were paid an average of \$0.66/lb for their harvest, resulting in an exvessel value of approximately \$90,770.

#### **Management and Regulations**

The eastern shoreline of Cook Inlet between the Kenai River and the end of the Homer Spit has been set aside exclusively for sport harvest since 1959, and all commercial harvests since that time have come from the west shore, principally from the Polly Creek and Crescent River sandbar areas. A large portion of the Polly Creek beach is approved by the Alaska Department of Environmental

Conservation for the harvest of clams for the human food market. Within this approved area, a limit of 10% shell breakage is allowed and broken-shelled clams are required to be dyed prior to being sold as bait clams. No overall commercial harvest levels are in place for any area in regulation. However, ADF&G manages the commercial razor clam fishery to achieve a harvest of no more than 350,000 to 400,000 lb (in the shell) annually. Virtually all of the commercial harvest is by hand-digging, although regulations prior to 1990 allowed the use of mechanical harvesters (dredges) south of Spring Point or within a 1-mile section of the Polly Creek beach. Numerous attempts to develop feasible dredging operations were unsuccessful because of excessive shell breakage or the limited availability of clams in the area open to this gear. Mechanical means of harvesting is no longer permitted in any area of Cook Inlet.

Historically, the commercial razor clam fishery on the west side of Cook Inlet has been confined to the area between Crescent River and Redoubt Creek (Figure 13). All clams harvested in this area are directed, by regulation, to be sold for human consumption, except for the small percentage (less than 10% of the total harvest) of broken clams, which may be sold for bait. Razor clams are present throughout this area, with dense concentrations in the Polly Creek and Crescent River areas. In the remainder of the UCI Management Area, there are no restrictions on the amount of clams that can be sold for bait. Currently, there is no directed effort to harvest razor clams for the bait market. The minimum legal size for razor clams is 4.5 inches (114 mm) in shell length (5 AAC 38.075).

## **RED SEA CUCUMBERS AND GREEN SEA URCHINS**

### **PRINCE WILLIAM SOUND AREA**

There has never been a commercial fishery for giant red sea cucumbers in PWS; the prevalence of sea otters has led ADF&G managers to believe that these populations have been kept at low levels. For the past 5 years, anecdotal information has been brought to ADF&G managers from SCUBA divers indicating that giant red sea cucumber populations may support an economically viable and sustainable fishery in PWS. A handful of PWS salmon fishery participants, who also have participated in the Southeast (SE) Alaska commercial giant red sea cucumber fishery, have been SCUBA diving in between salmon openings during the summer. These fishers have observed what they consider high abundances of giant red sea cucumbers in distinct areas of PWS.

In the summer of 2021, to corroborate anecdotal information, the ADF&G PWS Area Management Biologist partnered with a graduate student at Alaska Pacific University to examine some of the locations where sea cucumbers had been seen by commercial divers. These commercial divers provided the latitudes and longitudes where they had seen considerable giant red sea cucumber quantities. Underwater transects were conducted with the same methods that are currently being used in Southeast Alaska with encouraging results. This project will be continued in the summer of 2022 for ADF&G to determine if there is a harvestable surplus of sea cucumbers. ADF&G intends to work collaboratively with interested stakeholders to identify areas with high sea cucumber abundance to assist in ADF&G's stock assessment efforts.

### **COOK INLET AREA**

No current research is being conducted on green sea urchins in CI. Refer to Rumble et al. (2016) for additional information.

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## **TABLES AND FIGURES**

Table 1.—Kayak Island commercial harvest of weathervane scallops in the Prince William Sound Area, 1992–2021.

Season	Number vessels	East Bed				West Bed				Total (both beds)			
		GHL (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb meat per dredge hr)	GHL <sup>a</sup> (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb meat per dredge hr)	GHL <sup>a</sup> (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb meat per dredge hr)
1992	4	a				a				64,000	208,836	NA	NA
1993	7	a				a				50,000	63,068	638	99
1994/95		Closed				Closed				Closed			
1995/96	3	a				a				50,000	108,000	NA	NA
1996/97		Closed				Closed				Closed			
1997/98 <sup>b</sup>	1	a				a				17,200	18,000	171	105
1998/99 <sup>b</sup>	2	6,000	6,300	85	74	14,000	13,350	94	142	20,000	19,650	179	110
1999/00 <sup>b</sup>	2	6,000	6,065	74	82	14,000	13,345	76	190	20,000	20,410	149	137
2000/01	3	9,000	8,998	92	98	21,000	21,268	129	164	30,000	30,266	221	137
2001/02 <sup>b</sup>	1	9,000	9,060	140	65	21,000	21,030	124	170	30,000	30,090	263	114
2002/03 <sup>b</sup>	2	6,000	1,680	43	39	14,000	13,961	79	177	20,000	15,641	122	128
2003/04 <sup>b</sup>	1	6,000	5,910	123	48	14,000	14,070	93	152	20,000	19,980	216	93
2004/05 <sup>b</sup>	2	26,000	25,350	430	59	24,000	23,970	185	130	50,000	49,320	615	80
2005/06	3	26,000	24,435	219	112	24,000	24,781	272	91	50,000	49,216	491	100
2006/07 <sup>b</sup>	2	20,000	20,010	188	106	17,000	17,005	147	116	37,000	37,015	335	110
2007/08 <sup>b</sup>	2	20,000	20,015	203	99	17,000	17,090	225	76	37,000	37,105	428	87
2008/09 <sup>b</sup>	1	15,000	15,030	197	76	5,000	5,010	134	37	20,000	20,040	331	61
2009/10 <sup>b</sup>	2	15,000	15,035	335	45	5,000	4,980	84	59	20,000	20,015	419	48
2010/11 <sup>b</sup>	1	8,400	8,445	161	52	Closed				8,400	8,445	161	52
2011/12 <sup>b</sup>	1	8,400	8,460	160	53	Closed				8,400	8,460	160	53
2012/13		Closed				Closed				Closed			
2013/14		Closed				Closed				Closed			
2014/15		Closed				Closed				Closed			
2015/16		Closed				Closed				Closed			
2016/17 <sup>b</sup>	1	Closed				6,300	6,360	112	57	6,300	6,360	112	57
2017/18 <sup>b</sup>	1	Closed				6,300	6,330	102	62	6,300	6,330	102	62
2018/19 <sup>b</sup>	1	Closed				6,300	6,420	133	48	6,300	6,420	133	48
2019/20		Closed				Closed				Closed			
2020/21		Closed				Closed				Closed			
2021/22 <sup>b</sup>	1	Closed				8,000	8,170	66	124	8,000	8,170	66	124

Note: NA means not available

<sup>a</sup> Separate GHLs were not established for the East and West Beds until 1998.

<sup>b</sup> Confidential data released by vessel operators.

Table 2.—Cook Inlet Area Kamishak District commercial scallop fishery summary statistics, 1983–2021.

Year	Number of vessels	North Bed				South Bed				Total (both beds)			
		GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>	GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>	GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>
1983 <sup>de</sup>	1	NA	2,346	109	22	NA	0			NA	2,346	22	109
1984	3	NA	6,305	248	25	NA	0			NA	6,305	25	248
1985 <sup>e</sup>	1	20,000	11,810	299	40	NA	0			20,000	11,810	40	299
1986	3	20,000	15,364	424	36	NA	0			20,000	15,364	36	424
1987 <sup>e</sup>	2	20,000	1,488	24	15	NA	0			20,000	1,488	15	99
1988–92							No effort						
1993	3	20,000	20,115	528	38	NA	0			20,000	20,115	528	38
1994	4	20,000	20,431	458	45	NA	0			20,000	20,431	458	45
1995		Closed				Closed				Closed			
1996	5	28,000	28,228	534	53	NA	0			28,000	28,228	534	53
1997	3	20,000	20,336	394	52	NA	0			20,000	20,336	394	52
1998 <sup>e</sup>	1	20,000	17,246	390	44	NA	0			20,000	17,246	390	44
1999	3	20,000	20,315	325	63	NA	0			20,000	20,315	325	63
2000	3	20,000	20,516	275	75	NA	0			20,000	20,516	275	75
2001 <sup>e</sup>	2	20,000 <sup>e</sup>	20,097	325	62	NA	0			20,000	20,097	325	62
2002	3	20,000	6,045	235	26	NA	2,546	76.1	33.5	20,000	8,591	311	28
2003	2	Closed				20,000	15,843	896.0	17.7	20,000	15,843	896	18
2004	3	6,500	4,519	198	23	13,500	1,598	165.9	9.6	20,000	6,117	364	17
2005 <sup>e</sup>	2	7,000	7,378	372	20	Closed					7,378	372	20
2006 <sup>e</sup>	1	7,000	50	10	5	Closed					50	10	5
2007	0	7,000				5,000				12,000			
2008	0	7,000				5,000				12,000			
2009	0	14,000				Closed				14,000			

-continued-

Table 2.–Page 2 of 2.

Year	Number of vessels	North Bed				South Bed				Total (both beds)			
		GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>	GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>	GHL (lb) meat	Harvest (lb) <sup>a</sup>	Hours <sup>b</sup>	CPUE <sup>c</sup>
2010 <sup>e</sup>	1	14,000	9,460	365	26	Closed				14,000	9,460	365	26
2011 <sup>e</sup>	1	12,500	9,975	324	31	Closed				12,500	9,975	324	31
2012 <sup>e</sup>	1	12,500	11,739	392	30	Closed				12,500	11,739	392	30
2013		Closed				Closed				Closed			
2014		Closed				Closed				Closed			
2015 <sup>e</sup>	1	10,000	9,485	459	21	Closed				10,000	9,485	459	21
2016 <sup>e</sup>	1	10,000	3,982	271	15	Closed				10,000	3,982	271	15
2017	0	10,000	0			Closed				10,000			
2018		Closed				Closed				Closed			
2019		Closed				Closed				Closed			
2020		Closed				Closed				Closed			
2021		Closed				Closed				Closed			

Note: NA means not applicable

<sup>a</sup> Harvest includes retained scallops and estimated deadloss.

<sup>b</sup> Dredge hours equals 1 dredge fished for 60 minutes.

<sup>c</sup> CPUE (catch per unit effort) is pound of scallops per dredge hour.

<sup>d</sup> GHL was amended during the season to 9,000 lb.

<sup>e</sup> Confidential data released by vessel operators.



Table 3.—Effort and harvest in the commercial shrimp pot fishery of Prince William Sound, 1960–2009.

Year	Vessels	Landings	Spot harvest (lb)	Coonstripe harvest (lb)	Other	Total
1960	NA	NA	NA	NA	NA	4,988
1961	NA	NA	NA	NA	NA	0
1962	NA	NA	NA	NA	NA	3,576
1963	NA	NA	NA	NA	NA	1,101
1964	NA	NA	NA	NA	NA	4,248
1965	NA	NA	NA	NA	NA	4,356
1966	NA	NA	NA	NA	NA	0
1967	NA	NA	NA	NA	NA	749
1968	NA	NA	NA	NA	NA	6,866
1969	NA	NA	NA	NA	NA	5,146
1970	NA	NA	NA	NA	NA	19,776
1971	NA	NA	NA	NA	NA	13,073
1972	NA	NA	NA	NA	NA	6,949
1973	NA	NA	NA	NA	NA	6,370
1974	NA	NA	NA	NA	NA	24,978
1975	NA	NA	NA	NA	NA	4,150
1976	NA	NA	NA	NA	NA	2,410
1977	NA	NA	NA	NA	NA	7,516
1978	9	17	NA	NA	NA	15,466
1979	17	98	NA	NA	NA	52,208
1980	23	155	84,787	5,174	67	90,028
1981	51	509	153,017	20,055	465	173,537
1982	57	397	205,746	7,250	784	213,781
1983	71	646	198,719	14,119	583	213,420
1984	79	513	198,729	7,911	640	207,280
1985	78	528	271,928	3,919	860	276,707
1986	80	540	286,105	3,715	812	290,632
1987	86	498	265,707	3,795	151	269,653
1988	76	433	191,630	764	48	192,442
1989	33	69	28,884	431	0	29,315
1990	23	59	36,378	358	0	36,737
1991	15	45	17,302	278	0	17,580
1992–2009			Fishery closed			

Note: NA means not available.

Table 4.–Prince William Sound Area commercial shrimp pot fishery guideline harvest levels (GHL), effort, gear limits, harvest, and catch per unit effort (CPUE), 2010–2021.

Year	Area	GHL (lb)	Vessels	Landings	Pot lifts	Gear limits begin	Gear limits close	Spot harvest (lb)	Coonstripe harvest (lb)	Other harvest (lb)	Total harvest (lb)	% of GHL caught	CPUE (lb/pot)
2010	1	55,000	75	232	18,025	20	20	45,076	263	10	45,349	82%	2.52
2011	2	52,760	45	183	29,580	40	40	51,302	1,204	44	52,550	100%	1.78
2012	3	51,240	35	106	19,644	50	50	18,097	3,428	36	21,561	42%	1.10
2013	1	66,300	43	214	34,804	30	50	59,376	2,266	2	61,644	93%	1.77
2014	2	66,600	32	214	41,670	40	50	64,220	4,085	158	68,464	103%	1.64
2015	3	67,000	30	110	20,004	60	60	21,193	1,934	11	23,138	35%	1.16
2016	1	47,061	57	219	27,360	30	30	47,822	580	21	48,423	103%	1.77
2017	2	67,000	54	356	45,261	40	40	66,555	783	83	67,421	101%	1.49
2018	3	67,200	44	249	41,351	50	50	65,101	2,268	5	67,375	100%	1.63
2019	1	68,100	72	284	34,094	25	25	68,700	245	2	68,947	101%	2.02
2020	2	68,100	73	226	32,679	30	30	69,777	120	1	69,898	103%	2.14
2021	3	70,000	71	291	44,281	30	40	69,488	677	4	70,168	100%	1.58

Table 5.—Prince William Sound Area commercial shrimp pot fishery harvest, pot lifts, catch per unit effort (CPUE), and number of fishing days, by area and year, 2010–2021.

Area 1					
	2010	2013	2016	2019	Average
Harvest (lb)	45,349	61,644	48,423	68,947	56,091
Pot lifts	18,025	34,804	27,360	34,094	28,571
CPUE (lb/pot)	2.52	1.77	1.77	2.02	1.96
Fishing days	118	145	28	34	81

Area 2					
	2011	2014	2017	2020	Average
Harvest	52,550	68,464	67,421	69,898	64,583
Pot lifts	29,580	41,670	45,261	32,679	37,298
CPUE (lb/pot)	1.78	1.64	1.49	2.14	1.73
Fishing days	96	111	41	18	67

Area 3					
	2012	2015	2018	2021	Average
Harvest	21,561	23,138	67,375	70,168	45,561
Pot lifts	19,644	20,004	41,351	44,281	31,320
CPUE (lb/pot)	1.10	1.16	1.63	1.58	1.45
Fishing days	93	146	118	126	121

Table 6.—Prince William Sound Area commercial shrimp pot fishery permits, purchased and participated; and vessels, registered and participated, 2010–2021.

Year	Permits			Vessels			Landings	Fishing days
	Purchased	Participated	% Participation	Registered	Participated	% Participation		
2010	195	82	42	156	75	48	233	118
2011	182	48	26	91	45	49	183	96
2012	158	40	25	83	35	42	105	93
2013	148	46	31	89	45	51	214	145
2014	129	33	26	65	32	49	214	111
2015	112	29	26	56	30	54	107	146
2016	131	52	40	86	57	66	219	28
2017	122	61	50	85	54	64	349	41
2018	112	48	43	74	44	59	249	118
2019	143	74	52	100	72	72	284	34
2020	128	74	58	92	73	79	226	18
2021	155	75	48	102	71	70	291	126
Average 2010–2021	142	53	38	89	51	59	217	90

Table 7.—Prince William Sound spot shrimp survey results, 1992–2021.

Year	Number of pots	Catch weight (lb)	CPUE shrimp (lb/pot)		Number of shrimp	Percent		Egg bearing females
			All	>32mm		Male	Female	
1992	349	249	0.71	0.54	5,009	88.2	11.8	96.8
1993	325	121	0.37	0.26	2,434	80.6	19.4	97.7
1994	355	145	0.41	0.18	4,119	95.1	4.9	95.5
1995	350	206	0.59	0.33	5,053	95.7	4.3	NA
1996	350	182	0.52	NA	4,618	NA	NA	NA
1997	345	141	0.41	0.20	3,816	94.1	5.9	NA
1998	264	76	0.29	0.14	2,252	94.6	5.4	99.2
1999 <sup>a</sup>	346	164	0.47	0.21	4,385	94.3	5.7	97.8
2000	349	245	0.70	0.38	6,545	95.1	4.9	96.9
2001	351	331	0.94	0.63	7,034	92.7	7.3	99.6
2002 <sup>b</sup>	304	377	1.24	0.81	8,794	91.0	9.0	98.2
2003	352	398	1.13	0.78	9,333	92.0	8.0	99.6
2004	352	502	1.43	0.83	12,593	91.5	8.5	97.3
2005	349	481	1.38	0.61	14,453	95.0	5.0	95.0
2006	346	549	1.59	0.81	14,133	91.6	8.4	89.9
2007	349	838	2.40	1.04	24,152	94.2	5.8	83.7
2008	348	893	2.56	1.08	23,004	93.4	6.6	80.9
2009	351	825	2.35	1.47	17,622	86.2	13.8	88.0
2010	350	478	1.37	1.10	8,585	81.8	18.2	93.5
2011	350	683	1.95	1.67	11,580	75.1	24.9	99.1
2012	392	834	2.13	1.58	15,928	84.7	15.3	90.8
2013	392	744	1.90	1.36	14,453	85.7	14.3	87.1
2014	393	752	1.91	1.39	16,051	89.2	10.8	85.4
2015	395	629	1.59	1.01	14,118	91.7	8.3	98.3
2016	359	986	2.75	1.97	19,821	87.0	13.0	98.8
2017	359	1,409	3.92	1.91	37,674	92.9	7.1	98.6
2018	392	1,495	3.81	1.87	40,894	94.8	5.2	94.3
2019	393	1,304	3.32	1.39	38,965	93.6	6.4	96.8
2020	387	1,523	3.94	2.33	37,356	86.6	13.4	94.1
2021	385	936	2.43	1.36	24,486	89.1	10.9	94.5
Average 2010–2021	379	981	2.59	1.58	23,326	88.0	12	94.0
Average 1992–2009	341	373	1.08	0.61	9,408	92.1	7.9	94.4

Note: NA means not available.

<sup>a</sup> Sex interpolated for 452 lost data points.

<sup>b</sup> Sex interpolated for 192 lost data points.

Table 8.—Prince William Sound shrimp trawl harvest and effort, 1972–2020.

Year	GHL (lb)				Landings	Harvest (lb) <sup>a</sup>				Total
	Vessels	Wells	NW	Central/SW		Northern	Sidestripe	Other	Deadloss	
1972	NA	NA	NA	NA	NA	NA	NA	NA	NA	5,153
1973	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,243
1974	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,345
1975	NA	NA	NA	NA	NA	NA	NA	NA	NA	26,961
1976	NA	NA	NA	NA	NA	NA	NA	NA	NA	134,115
1977	NA	NA	NA	NA	NA	NA	NA	NA	NA	170,757
1978	8	NA	NA	NA	NA	NA	NA	NA	NA	440,684
1979	4	NA	NA	NA	NA	NA	NA	NA	NA	634,518
1980	6	NA	NA	NA	NA	NA	NA	NA	NA	557,328
1981	4	NA	NA	NA	NA	NA	NA	NA	NA	70,560
1982	9	NA	NA	NA	NA	NA	NA	NA	NA	346,517
1983	13	NA	NA	NA	46	420,275	1,058	2,345	NA	423,678
1984	14	NA	NA	NA	55	1,292,643	8,842	1,155	NA	1,302,640
1985	6	NA	NA	NA	44	432,514	15,696	440	NA	448,650
1986	3	NA	NA	NA	44	218,156	27,701	13	NA	245,870
1987	2	NA	NA	NA	109	b	b	b	NA	b
1988	4	NA	NA	NA	99	497	111,898	52	NA	112,447
1989	1	NA	NA	NA	b	b	b	b	b	b
1990	4	60,500	NA	NA	89	3,348	105,795	15	18,303	127,461
1991	5	80,000	NA	NA	67	3,453	84,483	193	51,429	139,558
1992	5	65,000	NA	NA	70	651	196,467	28	49,097	246,243
1993	7	46,000	NA	NA	72	23	190,976	51	55,140	246,190
1994	6	33,500	NA	NA	47	749	85,980	0	24,134	110,863
1995	4	35,000	16,000	NA	39	0	73,706	0	24,189	97,895
1996	3	49,000	18,500	33,000	42	0	89,551	0	21,704	111,255
1997	3	48,700	18,500	33,000	63	0	70,026	0	22,060	92,086
1998	2	25,000	18,500	33,000	39	b	b	b	b	b
1999	3	19,000	14,000	33,000	47	0	56,386	0	7,754	64,140

-continued-

Table 8.–Page 2 of 2.

Year	GHL (lb)				Landings	Harvest (lb) <sup>a</sup>				Total
	Vessels	Wells	Northwest	Central/SW		Northern	Sidestripe	Other	Deadloss	
2000	3	25,000	14,000	33,000	46	0	61,566	0	12,377	73,943
2001	3	34,388	14,000	33,000	45	0	59,736	0	21,765	81,501
2002	3	23,565	14,000	33,000	43	0	54,736	0	14,532	69,268
2003	3	31,954	14,000	33,000	46	612	61,269	106	18,236	80,223
2004	3	36,700	14,000	33,000	44	1,371	54,437	423	29,002	85,238
2005	3	32,000	14,000	33,000	41	0	61,130	413	23,028	84,571
2006	3	47,000	18,500	33,000	40	0	66,552	0	32,485	99,037
2007	2	59,500	14,000	33,000	24	b	b	b	b	b
2008	2	92,300	14,000	33,000	29	b	b	b	b	b
2009	2	71,423	14,000	33,000	32	b	b	b	b	b
2010	1	104,700	14,000	33,000	32	b	b	b	b	b
2011	1	67,649	14,000	33,000	24	b	b	b	b	b
2012	1	65,957	14,000	33,000	19	b	b	b	b	b
2013	2	61,928	14,000	33,000	28	b	b	b	b	b
2014	2	60,300	14,000	33,000	22	b	b	b	b	b
2015	1	60,300	14,000	33,000	13	b	b	b	b	b
2016	1	60,300	14,000	33,000	13	b	b	b	b	b
2017	2	60,300	14,000	33,000	37	b	b	b	b	b
2018	2	60,300	14,000	33,000	31	b	b	b	b	b
2019	3	60,300	14,000	33,000	25	4	35,631	5	28,227	63,917
2020	2	60,300	14,000	33,000	20	b	b	b	b	b

Note: NA means data not available.

<sup>a</sup> Catches converted from tail weight to whole weight using a conversion factor of 1.67.

<sup>b</sup> Confidential data.

Table 9.—North Gulf Coast personal use shrimp fishery number of permits issued, returned, and fished, 2008–2021.

Year	Permits issued	Permits returned	% Returned	Permits fished	% Permits fished
2008	123	123	100%	79	64%
2009	163	158	97%	115	71%
2010	162	151	93%	116	72%
2011	121	110	91%	78	64%
2012	195	181	93%	121	62%
2013	138	125	91%	79	57%
2014	150	139	93%	102	68%
2015	150	139	93%	91	61%
2016	112	107	96%	66	59%
2017	109	77	71%	54	50%
2018	119	104	87%	29	24%
2019	144	75	52%	40	28%
2020	422	198	47%	69	16%
2021	342	303	89%	93	27%

Table 10.—North Gulf Coast personal use shrimp fishery statistics including soak time (hours), pot lifts, harvest, and catch per unit effort (CPUE), 2008–2021.

Year	Soak time (h)	Pot lifts	Harvest (lb)	CPUE (lb/pot)
2008	4,585	212	103	0.49
2009	4,175	283	130	0.46
2010	16,922	556	483	0.87
2011	13,871	516	366	0.71
2012	11,118	566	143	0.25
2013	14,539	602	417	0.69
2014	9,169	453	210	0.46
2015	11,443	506	530	1.05
2016	18,132	513	193	0.38
2017	4,245	190	56	0.29
2018	5,584	278	120	0.43
2019	27,224	802	621	0.77
2020	49,601	1,141	465	0.41
2021	82,059	1,441	589	0.41



Table 11.—North Gulf Coast personal use shrimp fishery statistics including soak time (hours), pot lifts, harvest, and catch per unit effort (CPUE) in Aialik Bay, 2008–2021.

Year	Soak time (h)	Pot lifts	Harvest (lb)	CPUE (lb/pot)
2008	3,327	153	86	0.56
2009	3,609	238	122	0.51
2010	14,844	441	419	0.95
2011	12,459	451	341	0.76
2012	6,027	280	89	0.32
2013	9,025	337	344	1.02
2014	4,562	229	141	0.62
2015	3,885	191	267	1.4
2016	3,851	163	45	0.28
2017	1,026	58	7	0.12
2018	734	31	8	0.26
2019	2,541	79	50	0.63
2020	2,608	106	33	0.31
2021	2,067	83	29	0.35

Table 12.—North Gulf Coast personal use shrimp fishery statistics including soak time (hours), pot count, harvest, and catch per unit effort (CPUE) in Resurrection Bay, 2012–2021.

Year	Soak time (h)	Pot lifts	Harvest (lb)	CPUE (lb/pot)
2012	3,955	201	24	0.12
2013	3,443	141	29	0.21
2014	2,808	143	18	0.13
2015	48	2	0	0
2016	12,263	173	83	0.48
2017	2,488	86	26	0.3
2018	3,448	156	84	0.54
2019	21,542	545	434	0.8
2020	45,385	934	404	0.43
2021	77,150	1,170	524	0.45

Table 13.—Landings and harvest of octopuses and squid from Prince William Sound Area, 1989–2021.

Year	Octopus		Squid	
	Landings	Harvest (lb)	Landings	Harvest (lb)
1989	0	0	3	1,467
1990	0	0	9	2,166
1991	0	0	0	0
1992	10	1,230	7	399
1993	45	5,625	3	317
1994	34	5,798	0	0
1995	22	3,779	4	289
1996	4	994	10	168
1997	11	3,547	32	18,316
1998	5	2,928	27	21,461
1999	0	0	35	6,104
2000	0	0	17	5,951
2001	0	0	17	31,101
2002	a	a	22	180,250
2003	a	a	16	20,547
2004	a	a	9	11,175
2005	a	a	4	6,155
2006	0	0	31	32,758
2007	0	0	17	11,437
2008	0	0	20	31,359
2009	0	0	13	15,622
2010	24	939	11	17,210
2011	0	0	13	16,841
2012	3	105	7	8,123
2013	9	1,095	13	88,155
2014	12	427	19	171,946
2015	18	1,278	17	240,125
2016	19	286	9	57,906
2017	22	721	9	275
2018	41	1,468	13	2,394
2019	55	1,245	26	34,506
2020	41	712	27	156,912
2021	41	1,170	19	39,848

<sup>a</sup> Confidential data.

Table 14.—Commercial octopus harvest in the Cook Inlet Area in various fisheries, 1983–2021.

Year	Vessels	Landings	Harvest (whole lb)	Date of commercial closure	Gear group
1983	41	101	32,841	NA	NA
1984	36	77	46,698	NA	NA
1985	37	70	48,067	NA	D, M, P, T, Z
1986	8	16	435	NA	D, M, P
1987	21	56	4,512	NA	B, D, M, P, Z
1988	17	43	5,569	NA	B, C, D, M, T
1989	0	0	0	NA	
1990	3	6	1,343	NA	O, M
1991	7	16	2,134	NA	M, P, O
1992	18	45	5,581	NA	B, M
1993	11	42	8,660	NA	B, M, O
1994	15	82	14,614	NA	M, O
1995	8	38	8,879	NA	M, O
1996	10	35	7,435	NA	P, M, O
1997	13	144	28,117	NA	B, M, O, P
1998	9	76	12,914	NA	B, M
1999	9	103	22,052	NA	M
2000	11	127	25,104	NA	M
2001	8	103	24,406	NA	M
2002	9	164	38,518	NA	M
2003	8	132	28,922	NA	B, M
2004	11	127	35,981	NA	B, M
2005	9	104	34,977	NA	M
2006	7	107	30,556	NA	M
2007	13	83	36,003	3/22/2007	B, M
2008	12	135	35,318	12/10/2008	B, M
2009	13	106	37,110	11/21/2009	B, M
2010	12	106	33,548	<sup>a</sup>	B, M
2011	13	101	37,564	3/04/2011	B, M
2012	12	150	34,860	12/20/2012	B, M
2013	14	134	35,599	3/21/2013	B, M
2014	10	136	35,213	4/21/2014	M
2015	12	106	35,552	3/21/2015	B, M
2016	15	151	36,079	3/21/2016	B, M
2017	17	117	36,568	3/12/2017	M
2018	9	82	35,377	3/26/2018	B, M
2019	8	53	38,203	2/24/2019	M
2020	4	19	11,145	<sup>a</sup>	M
2021	3	41	9,315	<sup>a</sup>	M

Note: Commercial Fisheries Entry Commission (CFEC) gear card types: B-Halibut (longline); C-Sablefish (longline); D-Dinglebar; M-Misc Finfish, e.g., Pacific cod, pollock (pot, jig, trawl); P-Shrimp (pot or trawl); T-Tanner crab (pot); Z-Marine invertebrate (experimental fishery). Discards at sea not included (e.g., delivery code 98 or disposition code 98). NA means not applicable.

<sup>a</sup> Octopus harvested as bycatch was open all year.

Table 15.–Octopuses sampled from Cook Inlet Area commercial fisheries, 2000–2021.

Year	Number sampled	Average weight (kg)	Average weight (lb)	Sex ratio (% female)
2000	78	10.1	22.2	62
2002	129	15.5	34.1	57
2005	66	15.3	33.8	47
2006	143	13.0	28.7	41
2007	119	12.9	28.5	50
2008	238	12.9	28.4	57
2009	75	13.3	29.2	48
2010	119	13.8	30.5	50
2011	88	13.0	28.6	38
2012	154	12.6	27.7	45
2013	239	12.8	28.1	35
2014	265	12.7	27.9	39
2015	310	14.3	31.5	42
2016	138	13.1	28.9	48
2017	108	13.1	28.9	46
2018	292	11.6	25.6	33
2019	452	13.7	30.2	36
2020	189	12.6	27.8	47
2021	171	13.0	28.7	54

*Note:* Weights are converted from delivery condition (usually gutted) into whole weight.

Table 16.—Commercial harvest of razor clams in Upper Cook Inlet, 1919–2021.

Year	Harvest (lb)	Year	Harvest (lb)
1919	76,963	1971	14,755
1920	11,952	1972	31,360
1921	72,000	1973	34,415
1922	510,432	1974	0
1923	470,280	1975	10,020
1924	156,768	1976	0
1925	0	1977	1,762
1926	0	1978	45,931
1927	25,248	1979	144,358
1928	0	1980	140,420
1929	0	1981	441,949
1930	0	1982	460,639
1931	ND	1983	269,618
1932	93,840	1984	261,742
1933	ND	1985	319,034
1934	ND	1986	258,632
1935	ND	1987	312,349
1936	ND	1988	399,376
1937	8,328	1989	222,747
1938	ND	1990	323,602
1939	ND	1991	201,320
1940	ND	1992	296,727
1941	0	1993	310,481
1942	0	1994	355,165
1943	0	1995	248,358
1944	0	1996	355,448
1945	15,000	1997	366,532
1946	11,424	1998	371,877
1947	11,976	1999	352,910
1948	2,160	2000	369,397
1949	9,672	2001	348,917
1950	304,073	2002	338,938
1951	112,320	2003	411,403
1952	0	2004	419,697
1953	0	2005	371,395
1954	0	2006	368,953
1955	0	2007	283,085
1956	0	2008	390,999
1957	0	2009	361,388
1958	0	2010	379,547
1959	0	2011	189,172
1960	372,872	2012	307,409
1961	277,830	2013	380,912
1962	195,650	2014	348,294
1963	0	2015	318,538
1964	0	2016	284,800
1965	0	2017	177,147
1966	0	2018	199,162
1967	0	2019	137,530
1968	0	2020	0
1969	0	2021	0
1970	0		

Table 17.—Daily commercial harvest of razor clams, Upper Cook Inlet, 2019.

Date	Harvest (lb)	No. diggers	Date	Harvest (lb)	No. diggers
5/2	704	11	6/20	1,963	12
5/3	881	12	6/21	2,002	13
5/4	1,571	15	6/22	2,489	14
5/5	885	11	6/29	2,916	14
5/8	1,982	14	6/30	1,983	12
5/9	1,833	15	7/1	1,895	10
5/11	1,087	12	7/2	2,858	11
5/16	1,809	14	7/3	2,581	12
5/17	1,882	16	7/4	1,442	9
5/18	1,989	11	7/5	2,582	12
5/19	836	9	7/6	2,634	12
5/20	2,610	15	7/7	2,504	12
5/21	1,931	14	7/8	1,831	12
5/22	2,980	16	7/12	830	7
5/23	970	10	7/13	1,760	12
5/24	2,809	15	7/14	1,003	8
5/31	1,098	14	7/15	967	9
6/1	2,142	13	7/16	1,608	11
6/2	2,959	12	7/17	1,617	12
6/3	3,948	14	7/18	1,747	12
6/4	3,701	13	7/19	1,404	12
6/5	2,979	14	7/20	1,484	12
6/6	3,687	14	7/21	1,658	12
6/7	3,570	14	7/22	1,583	11
6/8	2,883	14	7/28	1,012	10
6/9	2,630	13	7/29	1,543	11
6/10	2,133	13	7/30	1,753	11
6/13	1,751	12	7/31	1,817	12
6/14	2,006	9	8/1	1,004	6
6/15	3,097	14	8/2	1,955	12
6/16	3,009	13	8/3	1,948	11
6/17	3,052	14	8/4	1,694	12
6/18	2,851	13	8/5	1,655	12
6/19	2,724	14	8/6	829	11
Total for year = 137,530 lb					

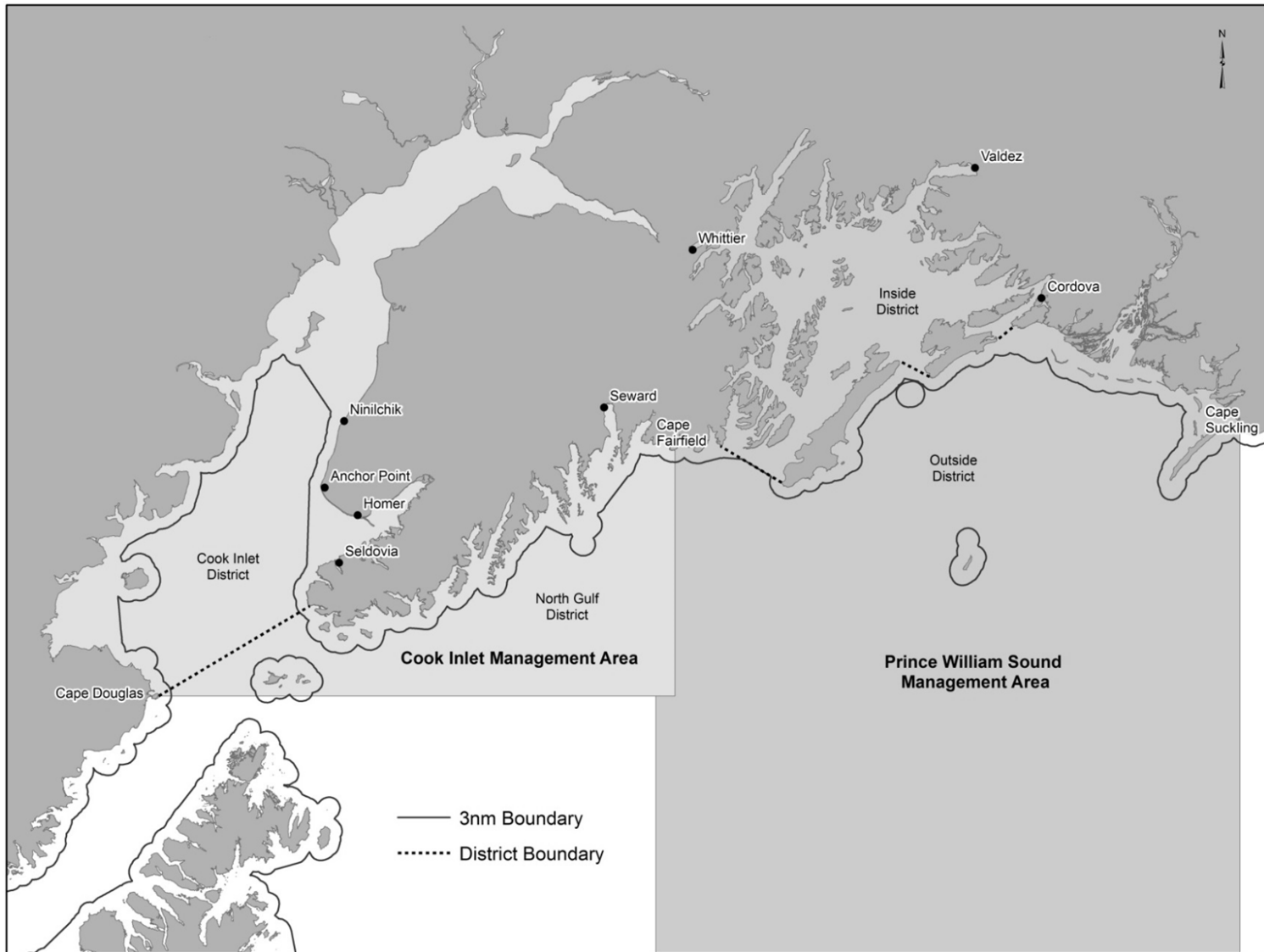


Figure 1.—ADF&G shellfish management areas in Central Region: Cook Inlet and Prince William Sound.

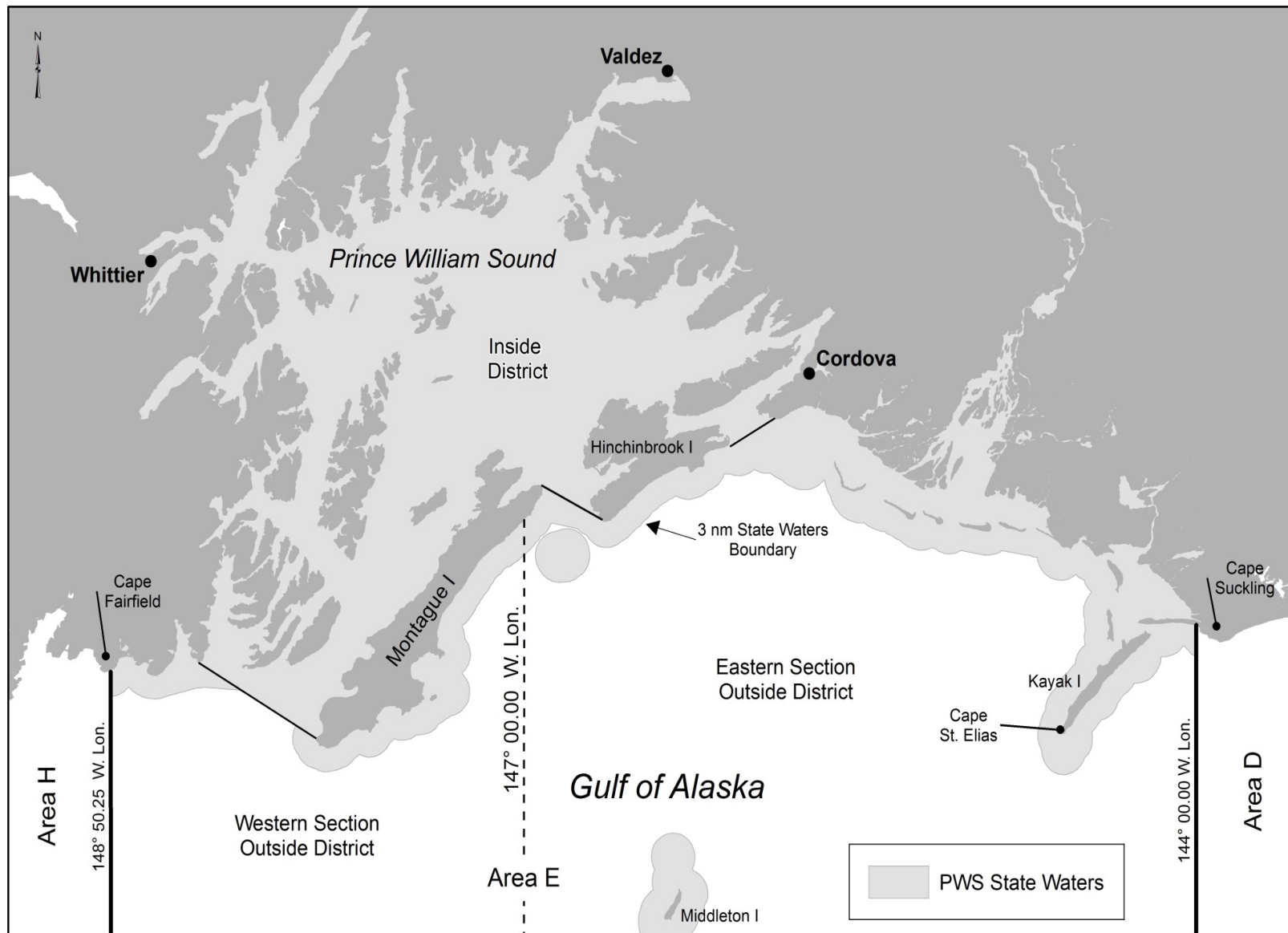


Figure 2.—Prince William Sound Area (Registration Area E) shellfish management districts and sections.



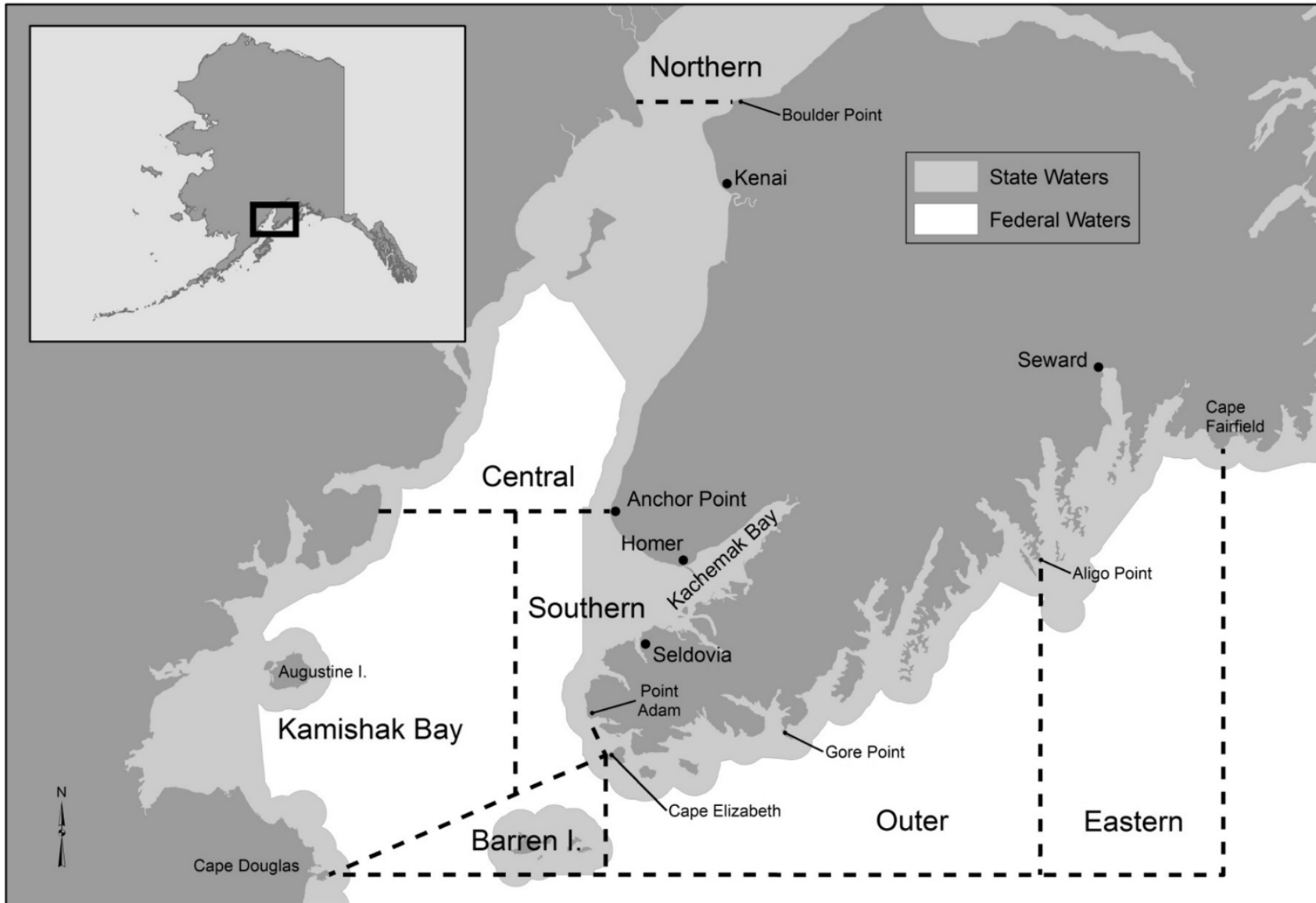


Figure 3.—Cook Inlet Area shellfish districts: Northern, Central, Southern, Kamishak Bay, Barren Islands, Outer, and Eastern.

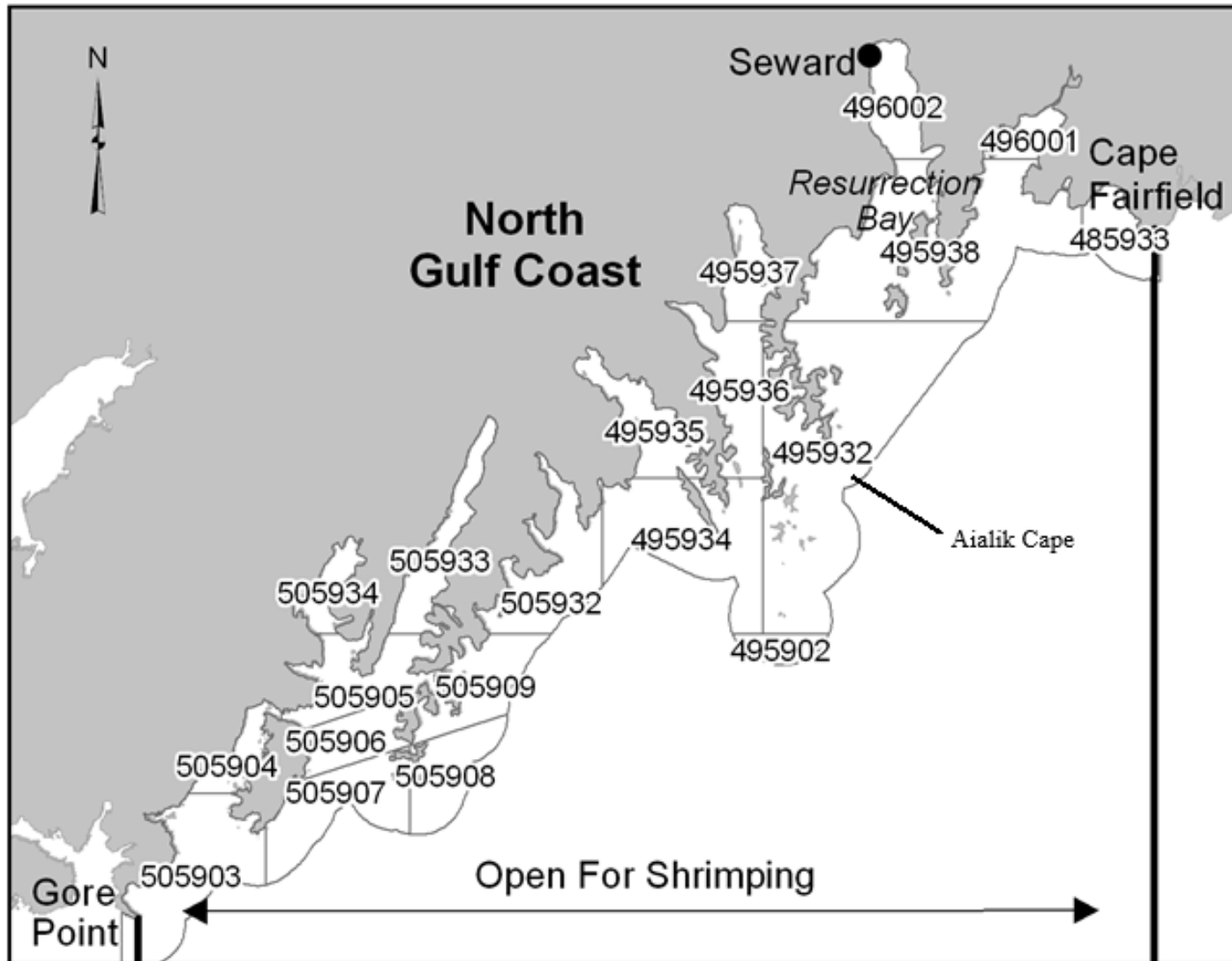


Figure 4.—North Gulf Coast waters defined for the personal use shrimp fishery in the Cook Inlet Area with statistical areas used for permit reporting.

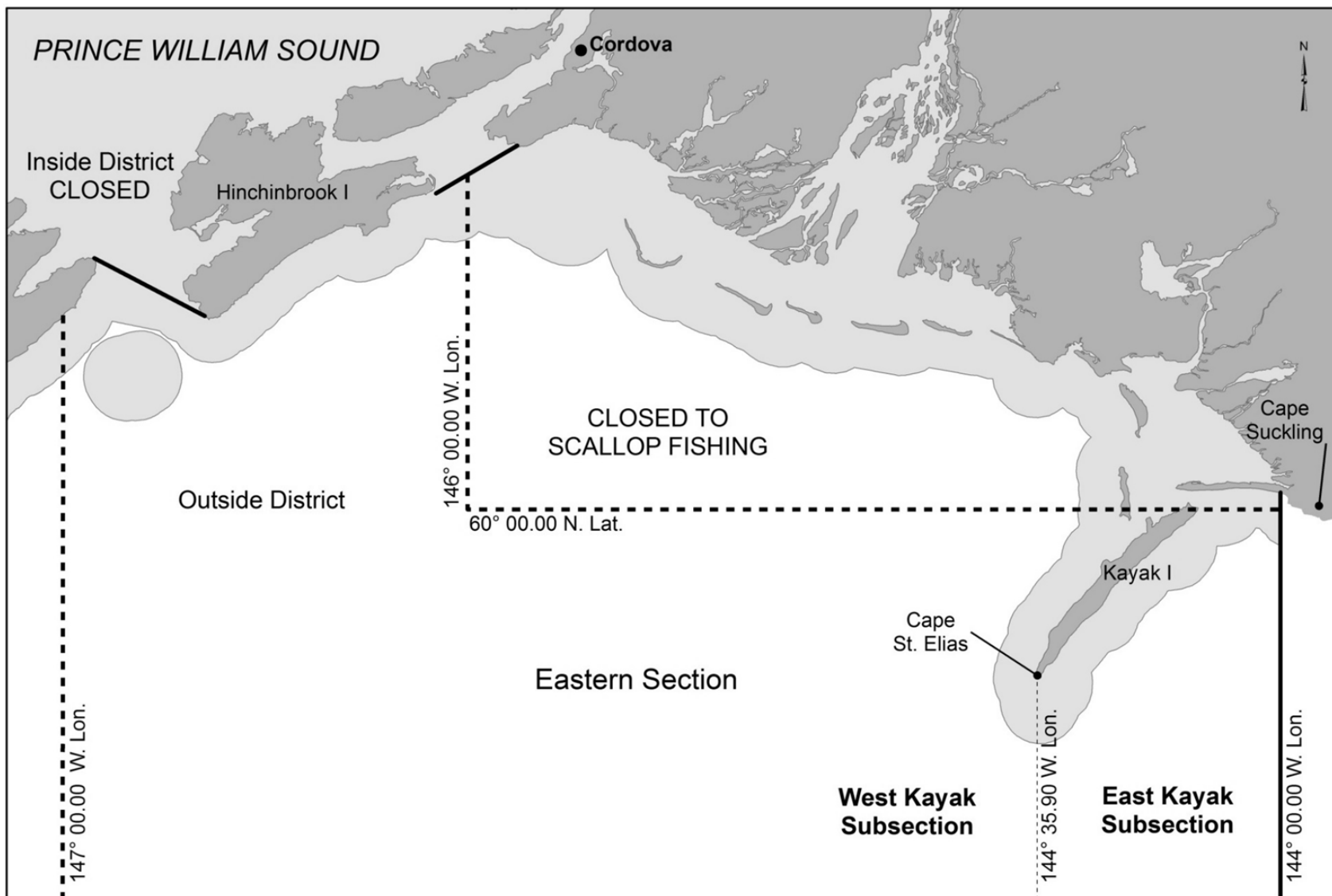


Figure 5.—Prince William Sound weathervane scallop fishing subsections and closed waters.

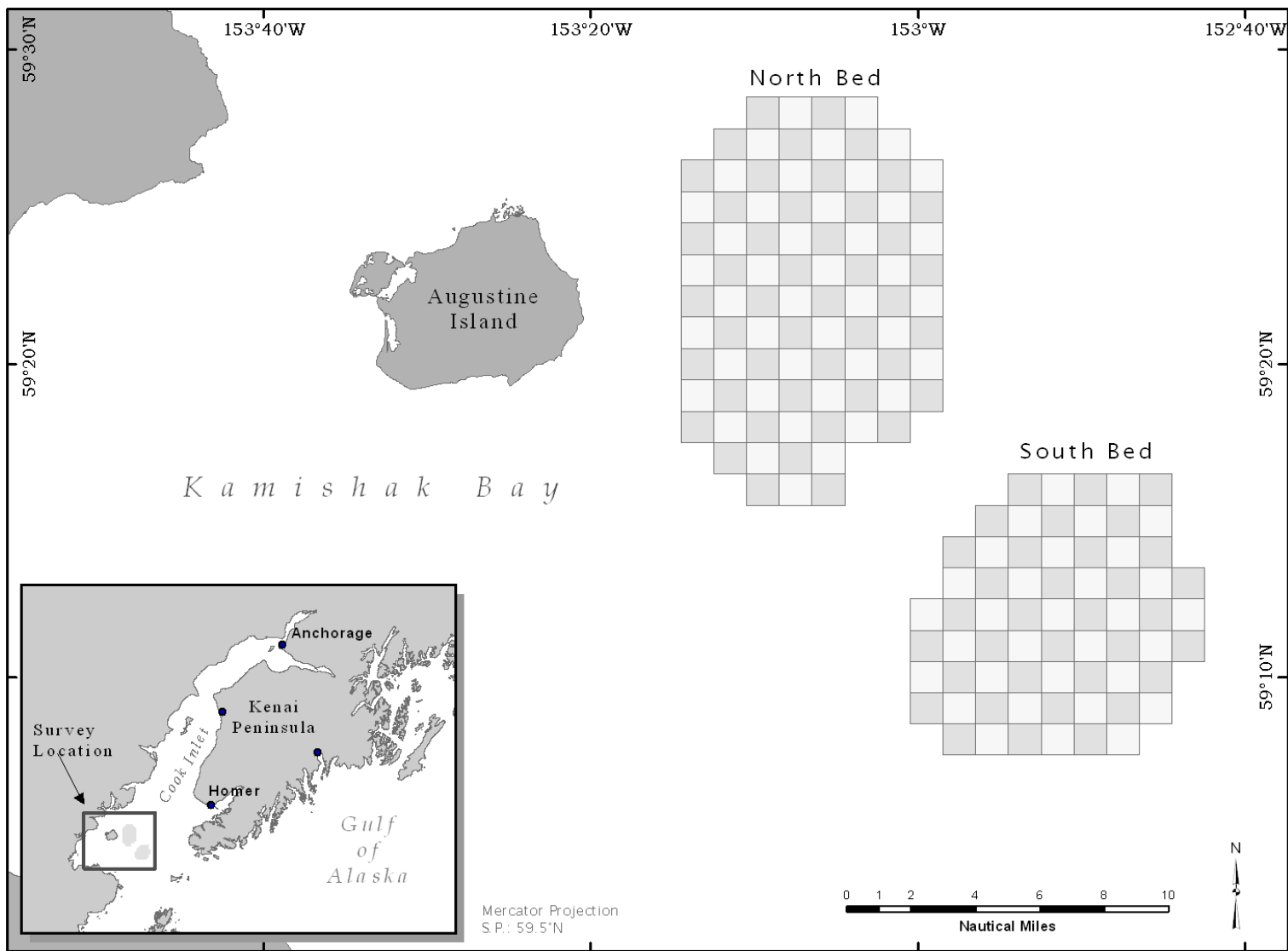


Figure 6.—Kamishak Bay weathervane scallop survey station locations in Cook Inlet Area.

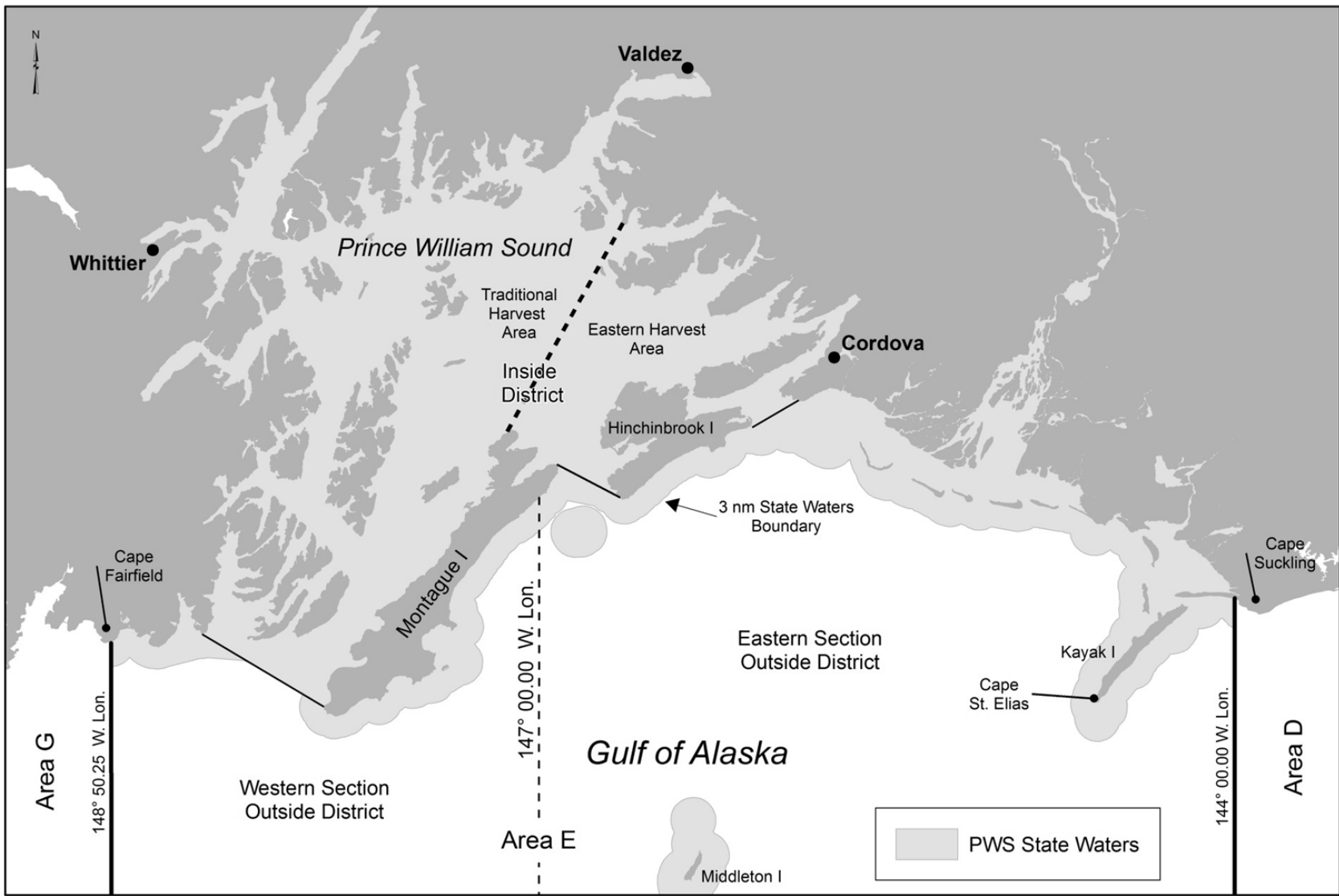


Figure 7.—Prince William Sound Area historical shrimp pot fishery areas.

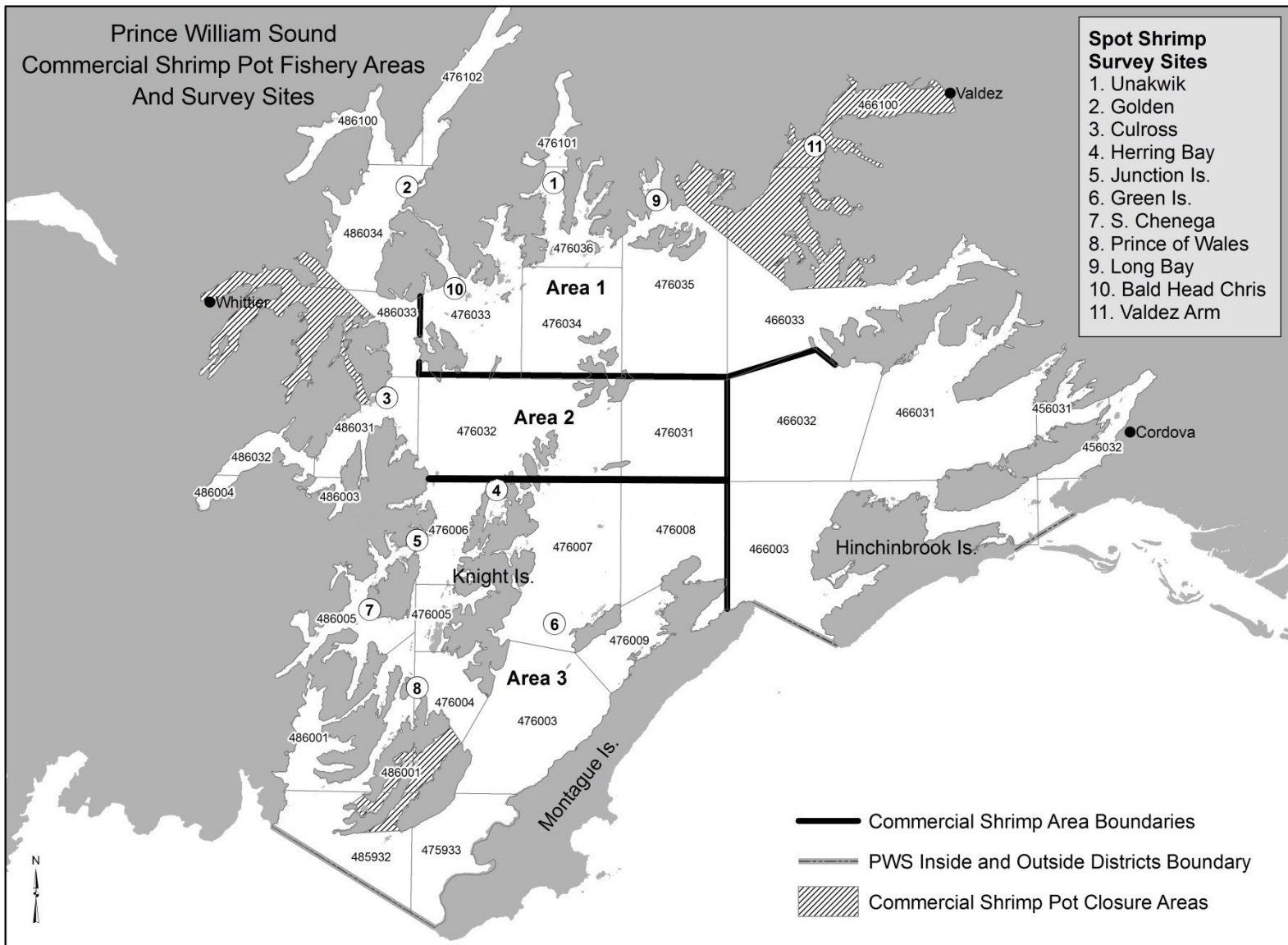


Figure 8.—Prince William Sound Area with 3 shrimp pot fishery areas (Areas 1, 2, and 3) and fishery-independent spot shrimp survey sites.

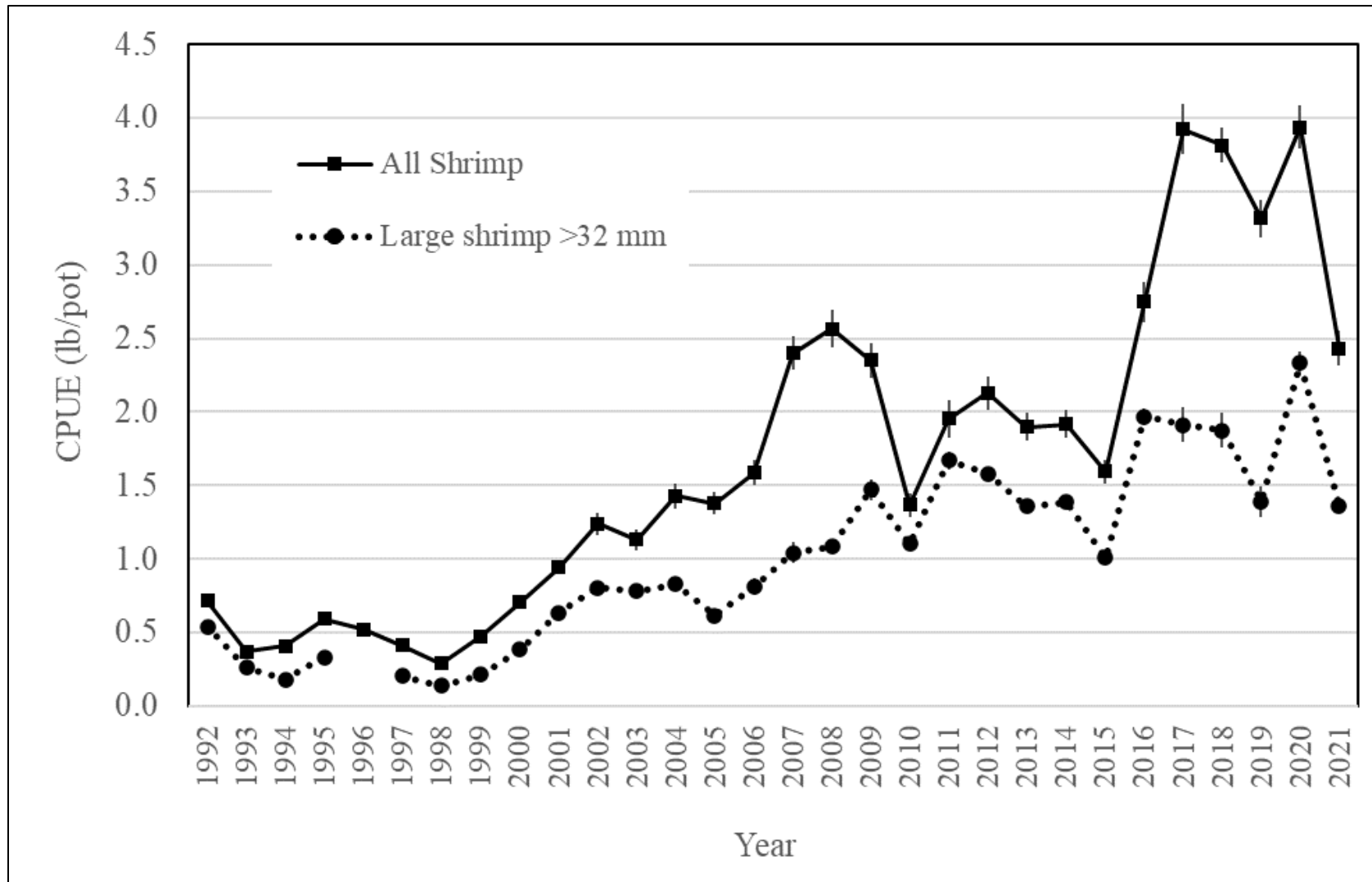


Figure 9.—Prince William Sound Area spot shrimp survey average catch per unit effort (CPUE) for all spot shrimp and large spot shrimp (>32 mm in carapace length), 1992–2021.

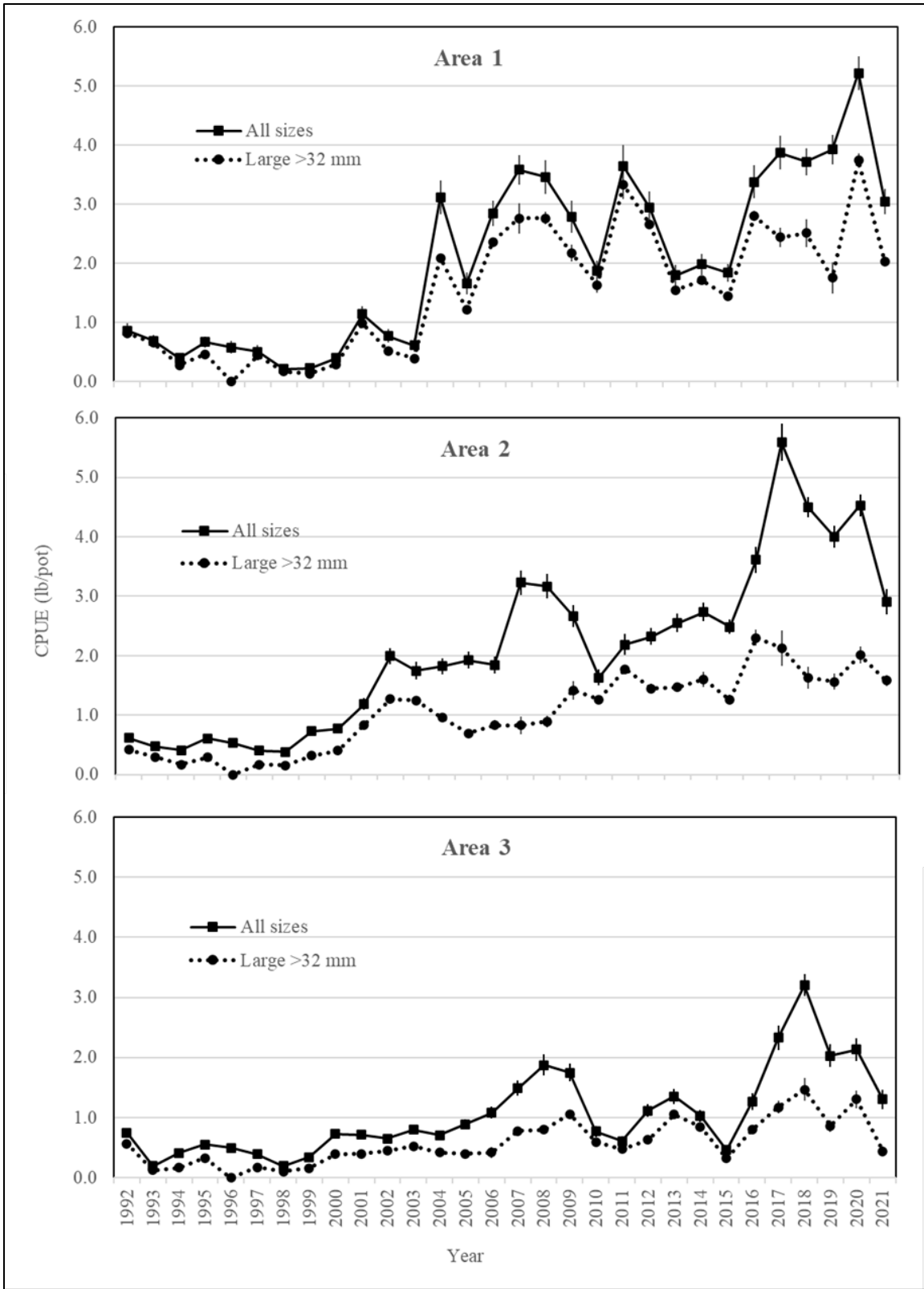


Figure 10.—Prince William Sound Area spot shrimp survey average catch per unit effort (CPUE) for all spot shrimp and large shrimp (>32 mm carapace length) in shrimp fishery Areas 1, 2, and 3, 1992–2021.



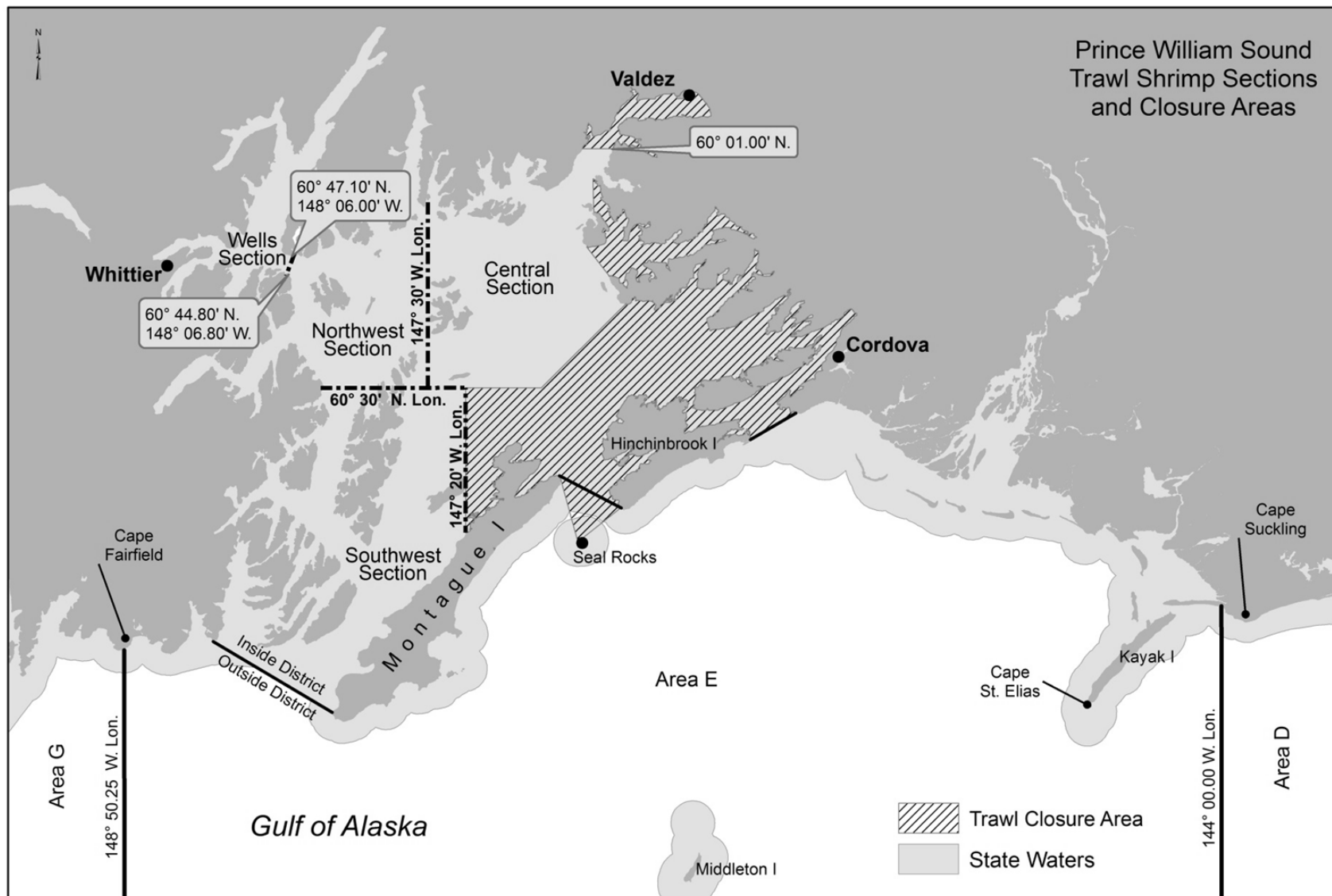


Figure 11.—Prince William Sound Area shrimp trawl fishing sections and closure areas.

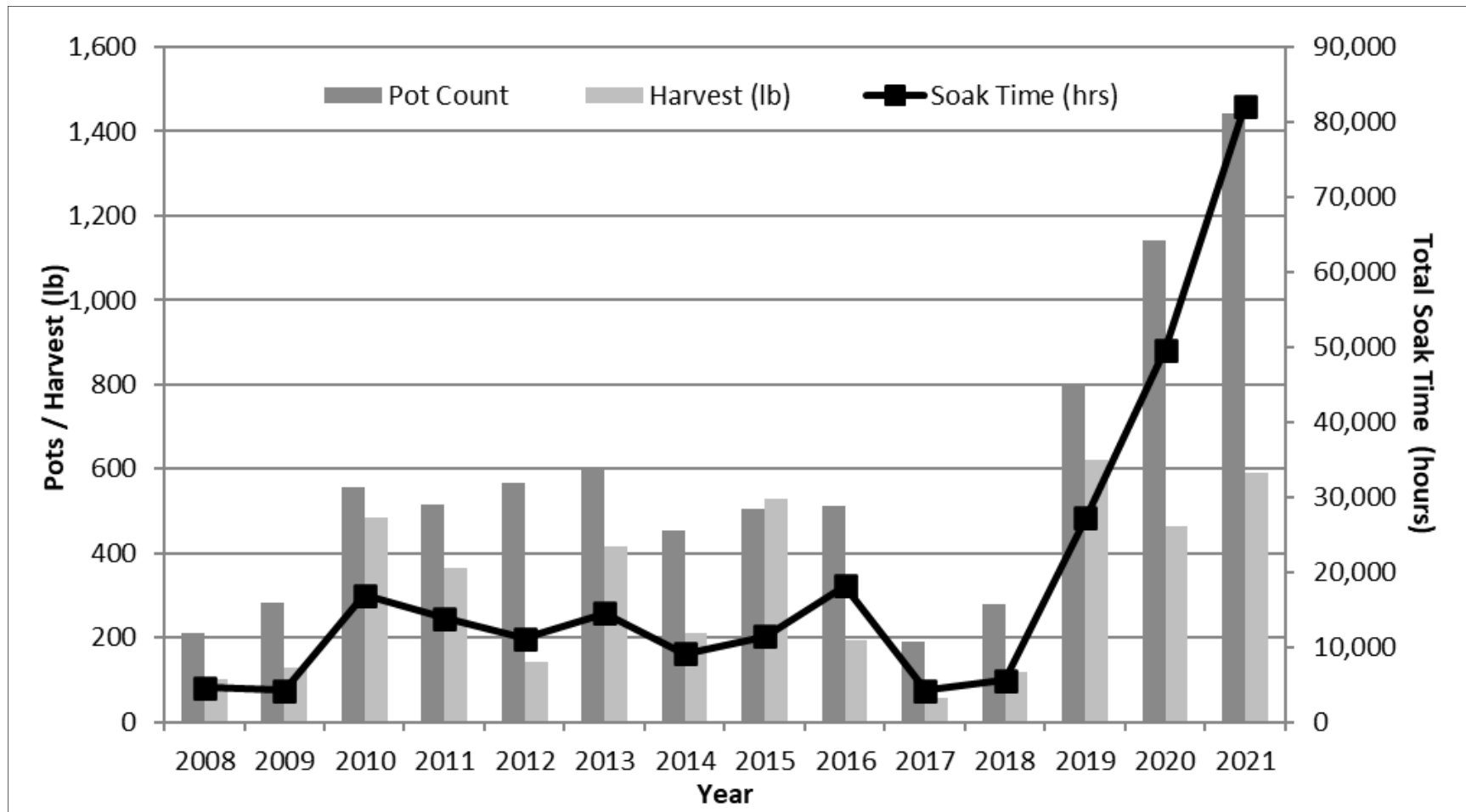


Figure 12.—North Gulf Coast personal use shrimp fishery annual pot count, soak time (hours), and harvest in lb of whole shrimp, and catch per unit effort (lb/pot) for 2008–2021.

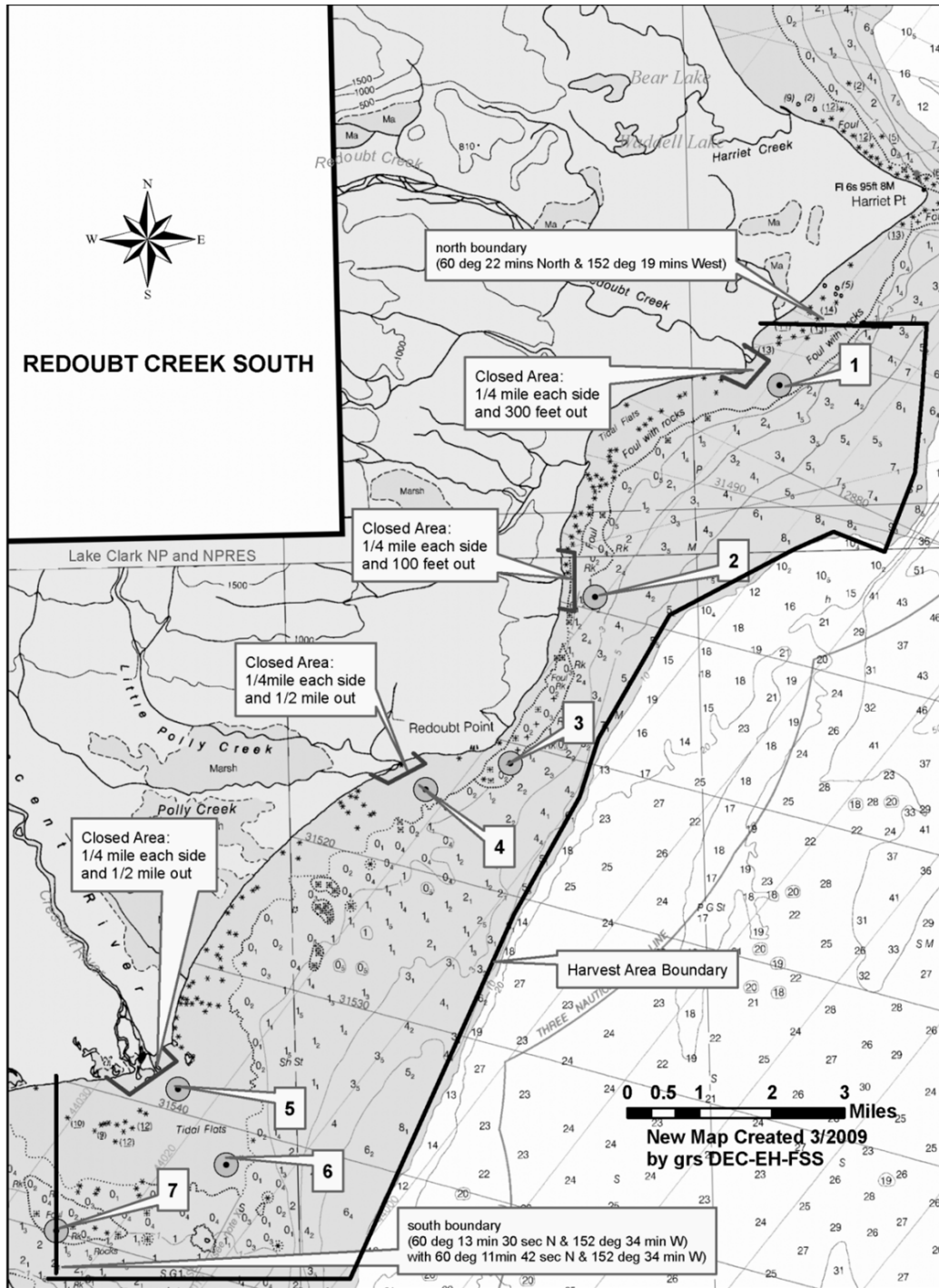


Figure 13.—Area open to the commercial razor clam fishery on the west side of Cook Inlet.