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Prince William Sound Shrimp Pot Fisheries, 2010–2020

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Weights and measures (metric)		General		Mathematics, statistics	
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			base of natural logarithm	e
hectare	ha	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
kilogram	kg			coefficient of variation	CV
kilometer	km	at	@	common test statistics	(F, t, χ^2 , etc.)
liter	L	compass directions:		confidence interval	CI
meter	m	east	E	correlation coefficient (multiple)	R
milliliter	mL	north	N	correlation coefficient (simple)	r
millimeter	mm	south	S	covariance	cov
		west	W	degree (angular)	°
Weights and measures (English)		copyright	©	degrees of freedom	df
cubic feet per second	ft ³ /s	corporate suffixes:		expected value	E
foot	ft	Company	Co.	greater than	>
gallon	gal	Corporation	Corp.	greater than or equal to	≥
inch	in	Incorporated	Inc.	harvest per unit effort	HPUE
mile	mi	Limited	Ltd.	less than	<
nautical mile	nmi	District of Columbia	D.C.	less than or equal to	≤
ounce	oz	et alii (and others)	et al.	logarithm (natural)	ln
pound	lb	et cetera (and so forth)	etc.	logarithm (base 10)	log
quart	qt	exempli gratia		logarithm (specify base)	log ₂ , etc.
yard	yd	(for example)	e.g.	minute (angular)	'
		Federal Information Code	FIC	not significant	NS
Time and temperature		id est (that is)	i.e.	null hypothesis	H ₀
day	d	latitude or longitude	lat or long	percent	%
degrees Celsius	°C	monetary symbols		probability	P
degrees Fahrenheit	°F	(U.S.)	\$, ¢	probability of a type I error (rejection of the null hypothesis when true)	α
degrees kelvin	K	months (tables and figures): first three letters	Jan.,...,Dec	probability of a type II error (acceptance of the null hypothesis when false)	β
hour	h	registered trademark	®	second (angular)	"
minute	min	trademark	™	standard deviation	SD
second	s	United States (adjective)	U.S.	standard error	SE
		United States of America (noun)	USA	variance	
Physics and chemistry		U.S.C.	United States Code	population	Var
all atomic symbols		U.S. state	use two-letter abbreviations (e.g., AK, WA)	sample	var
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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PRINCE WILLIAM SOUND SHRIMP POT FISHERIES, 2010–2020

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ABSTRACT

This report summarizes the most recent fishing seasons and management actions for commercial and noncommercial (personal use, subsistence, and sport fish) shrimp pot fisheries managed by the Alaska Department of Fish and Game (department) in the Prince William Sound Management Area (Area E) through the 2020 season. Spot shrimp *Pandalus platyceros* is the targeted species in this fishery, although coonstripe shrimp *Pandalus hypsinotus* are harvested to a lesser extent. The shrimp pot fishery season runs from April 15 to September 15 for all commercial and noncommercial fisheries. The average harvest between 2018 and 2020 in the commercial and noncommercial fisheries was 68,740 lb and 124,089 lb, respectively. Catch per unit effort (CPUE) in the department index survey has increased to higher levels in the past 4 years, with an average of 3.75 lb per pot of all-sized shrimp and 1.88 lb per pot of large shrimp (≥ 32 mm carapace length). CPUE in the commercial fishery over the same period fluctuated because fishing areas were rotated; average CPUE was 1.96 lb per pot in Area 1, 1.73 lb per pot in Area 2, and 1.38 lb per pot in Area 3. Noncommercial fishery CPUE (where effort is measured in pot-days) averaged 1.7 lb per pot-day between 2010 and 2014 and increased to a 2.5 lb per pot-day average between 2015 and 2020. Commercial and noncommercial fisheries combined remained within the total allowable harvest (TAH) in 7 of the last 11 years between 2010 and 2020. Percentage of the TAH harvested has ranged from 60% to 128%. In most years, the TAH is set at the lower 90% confidence interval of maximum sustained yield (MSY); however, for the past 2 years, with increasing confidence in the survey and stable population levels, the point estimate has been used.

Keywords: Prince William Sound, Area E, spot shrimp, *Pandalus platyceros*, coonstripe shrimp, *Pandalus hypsinotus*, assessment, management, commercial, noncommercial, Alaska Board of Fisheries

INTRODUCTION

This report summarizes the most recent fishing seasons and management actions that occurred in the Prince William Sound (PWS) commercial, sport, personal use, and subsistence shrimp pot fisheries. The boundaries of the PWS Area (Registration Area E) historically included waters within PWS and territorial waters of Alaska outside of PWS between the longitudes of Cape Fairfield (long 148°50.25'W) and Cape Suckling (long 143°53'W). In 2001, the eastern boundary was moved to long 144°00'W (Figure 1), making the regulatory boundaries consistent among all state shellfish and groundfish fisheries.

The PWS Area for commercial fisheries is divided into the Inside and Outside Districts. The Inside District is defined as waters enclosed by lines from Point Whittshed to Point Bentinck, from Cape Hinchinbrook to Zaikof Point, and from Cape Cleare to Cape Puget (Figure 1). The Outside District, made up of Gulf of Alaska waters 0–3 miles from shore, is further divided into 2 sections: Western and Eastern. The Western Section includes waters between Cape Fairfield and long 147°00'W, and the Eastern Section includes waters between long 147°00'W and long 144°00'W.

The Alaska Department of Fish and Game (department) manages shrimp fisheries within the PWS Area: the Division of Commercial Fisheries manages the commercial shrimp fishery and the Division of Sport Fish manages noncommercial shrimp fisheries (sport, personal use, and subsistence). The Alaska Board of Fisheries (board) establishes management regulations; determines if customary and traditional use of a fishery exists and, if so, sets a range of harvest to ensure reasonable opportunity for subsistence (ANS); and the department uses its emergency order (EO) authority to make adjustments to fishing time and area. The board schedules regular meetings for shellfish on a triennial basis.

There are commercial and noncommercial shrimp pot fisheries that target spot shrimp *Pandalus platyceros* and, to a limited extent, coonstripe shrimp *Pandalus hypsinotus*. These pandalid shrimp are protandric hermaphrodites, first maturing as males and, as they get larger, later transitioning to females. Spot shrimp may reach sexual maturity by their third year, and eggs are typically found on females from October to March. A department tagging study in PWS between 1983 and 1986

indicated that spot shrimp lifespans may range from 7 to 10 years (Kimker et al. 1996). Although spot shrimp are typically caught in greatest concentrations around 60 fathoms, they occur at depths between 2 and 250 fathoms.

The commercial fishery is allocated 40% of the total allowable harvest (TAH) in years when the TAH exceeds 110,000 lb (Alaska Administrative Code 5 AAC 31.214; Table 1). Commercial shrimp harvests are monitored inseason through department fish tickets (5 AAC 39.130) with additional information from required inseason reporting on fishing location and effort (5 AAC 31.245). Logbooks are also required to be filled out and submitted to the department for this fishery. Reporting requirements specify that all shrimp retained, including harvest retained for personal use or used as bait, must be reported on department fish tickets. Also, regulations specify that only 50% of the harvest may come from a single statistical area (5 AAC 31.214).

The noncommercial fishery is allocated 60% of the TAH, and in years when the TAH exceeds 110,000 lb, a commercial fishery is opened. However, the noncommercial fishery will still open if the TAH falls below the commercial fishery threshold. Noncommercial harvest is currently monitored through a permit with a catch log, and data are analyzed postseason. Permits record location, effort, and harvest and are used to evaluate fishery dynamics.

Harvests from both commercial and noncommercial PWS shrimp pot fisheries are incorporated into a surplus production model to establish TAH and guideline harvest levels (GHLs) within the fisheries.

Data collected from the commercial and noncommercial PWS shrimp pot fisheries, as well as from department index surveys, provide the information necessary to manage PWS spot shrimp. This report gives background information on spot shrimp fisheries in PWS and summarizes available and relevant information for continued sustainable management of these fisheries.

RESEARCH

STOCK ASSESSMENT

The PWS shrimp pot survey has changed since its inception. The survey began in 1989 as part of the *Exxon Valdez* oil spill damage assessment process, and the department initiated an annual survey using pot gear to assess oiled spot shrimp in PWS (Trowbridge 1992, 1994). Variable numbers of pots were set at each survey site during these first 3 years of the survey. Between 1989 and 1991 there were 6 stations set on the survey (Unakwik, Golden, Culross, Herring Bay, Green Island, and north of Chenega [site later referred to as Junction Island]; Figure 1) using 2 depth strata: 20–70 fathoms and 70–120 fathoms. The survey transitioned into an abundance index assessment tool starting in 1992; south Chenega and Prince of Wales were added to the survey and fishing depths 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). The survey was also expanded to cover more area and now 10 areas are currently surveyed in PWS. The shrimp pots used in the survey are designed to catch all sizes of shrimp to evaluate small shrimp and potential recruitment, along with larger shrimp. These pots do not fit the regulatory guidelines of commercial pot gear and therefore survey catch per unit effort (CPUE) cannot be directly compared with that of the commercial fishery.

In 1992, the annual survey was standardized to a set of 4 strings at each survey site. Each string of standardized gear was made up of 11 pots spaced approximately 10 fathoms apart on a groundline

with buoys at each end. 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 nonsubsistence area to obtain fishery-independent data in this area of high noncommercial (sport and personal use) harvest.

In 2016 and 2017, the number of pots on each string was reduced from 11 to 5 pots. This allowed the number of strings to be increased to 8 at each survey site, which increased the coverage area. It is likely the reduction in number of pots per string did not affect CPUE results because a high correlation was found in CPUE across strings within each survey site. However, in 2018, the department returned to the previous 11-pot, 4-string method because of concerns over standardization, and this method has continued through the current 2020 survey.

Although a department damage assessment study following the *Exxon Valdez* oil spill concluded that PWS spot shrimp may have declined as a result of overfishing, environmental conditions may have also been instrumental in both the decline and slow recovery of spot shrimp in PWS and other shellfish populations throughout the Gulf of Alaska (Trowbridge 1992; Bechtol 1997). Spot shrimp are a sedentary species and there is no indication that they migrate out of an area after settling; this makes them particularly susceptible to localized and serial depletion.

The overall CPUE in the department's standardized index survey for spot shrimp declined from 0.71 lb/pot in 1992 to 0.29 lb/pot in 1998 (Figure 2, Table 2). After 1998, survey CPUE demonstrated a slow but steady increase in abundance and biomass. For the past 4 years, the average annual CPUE has been well above 3.0 lb/pot, ranging from 3.32 lb/pot in 2019 to a high of 3.94 lb/pot in 2020, the highest estimate in the history of the survey.

Similarly, index survey results for shrimp with a carapace length of 32 mm or greater (large shrimp) were at low levels between 1992 and 2006, less than 1.0 lb per pot (Figure 2, Table 2). From 2007 to 2020, large shrimp increased to a higher level, ranging from 1.01 lb/pot (2015) to 2.33 lb/pot (2020) (Table 2). During 1992 to 2009, the average CPUE for large shrimp was 0.6 lb per pot, and from 2010 to 2020, it increased to 1.6 lb per pot (Table 2).

Commercial Areas 1 and 2 have higher average survey CPUEs than Area 3 (Table 3, Figure 3). Since 2010, when the commercial fishery opened after a hiatus of 18 years, the average CPUE for Area 1 was 3.11 lb/pot, and for Area 2 the average CPUE was 3.28 lb/pot. Area 3 averaged less than half of that (1.48 lb/pot) during 2010–2020. However, like Areas 1 and 2, Area 3 had its highest recorded CPUEs between 2017 and 2020, ranging from 2.03 lb/pot to 3.20 lb/pot.

The department annual shrimp pot survey occurs in October. Sampling includes determining the sex of a subsample of the shrimp caught. The percentage of females caught in the survey has varied from 4.3 to 25.2 percent of the sample pool (Table 2). During surveys between 1992 and 2009, the average percentage of females was 7.8% and following that, the average percentage of females between 2010 and 2020 was 12.5%. Of the 26 years with survey information, 6 years occurred when 80–89% of the sampled females had eggs, but in the rest of the years, more than 90% of the sampled females had eggs.

Concerns about the commercial fishery overlapping with reproductive timing and potentially removing females with developing eggs from the population prompted department staff to conduct interviews with PWS commercial shrimp pot fishery participants after the first opening during the past 3 seasons. Interviewed participants reported observing less than 5% females with eggs.

Department shrimp 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 guideline harvest levels (GHLs) for both commercial and noncommercial spot shrimp fisheries. All of the biological metrics from this survey, which are used to examine the relative abundance and composition of spot shrimp in PWS, indicate that the abundance of spot shrimp has been stable or is increasing (depending on area) and that PWS spot shrimp fisheries are sustainable. Specifically, the survey and fishery results from the last 4 years show a healthy spot shrimp population in PWS.

POPULATION DYNAMICS MODEL

The population dynamics of spot shrimp in PWS is modeled using the Schaefer surplus production model (Haddon 2011). The equation is written as follows:

$$B_{t+1} = B_t + rB_t \left(1 - \frac{B_t}{K}\right) - C_t \quad (1)$$

where r is an intrinsic rate of population growth, K is a parameter that corresponds to the unfished equilibrium population size, B_{t+1} is the exploitable biomass at the end of year t or the beginning of year $t+1$, B_t is the exploitable biomass at the start of year t , and C_t is the biomass caught during year t .

Also, an index of relative abundance is generated from the equation

$$\hat{I}_t = q \frac{\hat{B}_{t+1} + \hat{B}_t}{2} \quad (2)$$

where \hat{I}_t is an estimated index of relative abundance for year t and q is the catchability coefficient. Taking the average of the biomass levels at the start and end of year t allows catches to be related to biomass more realistically.

The input data to the model are catches (C_t) and CPUE (observed I_t) from 1981 to present. The CPUE data are from 2 sources: the commercial fisheries (1981 to 1988) and the index survey (1989 to present). The CPUE from commercial fisheries is adjusted to the level of the survey CPUE using the ratio of the average of CPUE from 1989 and 1990 to the average of CPUE from 1987 and 1988. The catch data are the total catch weight, which is the summation of catches from the survey and from the commercial and noncommercial fisheries.

The parameters r , K , initial biomass B_0 , and q can then be estimated by minimizing the sum of squares error $\sum (I_t - \hat{I}_t)^2$. The maximum sustainable yield (MSY) is obtained from the equation

$$MSY = \frac{rK}{4} \quad (3)$$

To determine the uncertainty in the estimate of MSY , a bootstrap analysis is conducted by resampling the residuals between estimated CPUE (\hat{I}_t) and observed CPUE (I_t); 90% confidence intervals are constructed using at least 1,000 bootstrapping samples. The lower confidence interval

(CI) bound is used instead of MSY as the harvestable surplus biomass in order to deal with the uncertainty of MSY and set more conservative, sustainable harvest limits.

COMMERCIAL FISHERY

HISTORY

Commercial shrimp landings from pot gear were first documented in 1960 when approximately 5,000 lb were harvested (Table 4). The historical fishery occurred within the Inside District of PWS, primarily in the traditional harvest area that encompassed the northern and western shores of PWS from Port Valdez to Whittier and the entire southwest portion of PWS (Figure 1). From 1960 to 1977, harvest ranged from 0 in 1961 and 1966, to approximately 25,000 lb in 1974. The shrimp pot fishery expanded rapidly from 1978 to 1982 as local markets were established and major harvest areas were located. Commercial fishery seasons during 1960–1982 were open year-round with no harvest restrictions.

From 1982 to 1984, seasons were shortened to April 1 through November 30 and the first guideline harvest range (GHR) of 75,000–145,000 lb was adopted. Despite the shortened season, catch increased to approximately 214,000 lb in 1982, and effort increased to 79 vessels in 1984 (Table 4). Beginning in 1985, the board 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. An experimental harvest area in Montague Strait with no closed season was also established. The split season was intended to reduce harvests during the egg-bearing periods. 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. Harvest peaked at approximately 290,600 lb in 1986, and effort peaked at 86 vessels in 1987.

Harvest declines beginning in 1988 indicated potential stock conservation problems. The *Exxon Valdez* oil spill on March 24, 1989, complicated prosecution of the 1989 fishery in which 33 vessels harvested 29,315 lb (Table 4). In 1990, year-round harvest in the experimental area was discontinued and included with the traditional harvest area, and the spring season was shortened. Also in 1990, a gear limit of 150 pots and mesh size restrictions to allow the escape of undersized shrimp were adopted. In 1991, a limited commercial fishery with a conservative GHR of 10,000–40,000 lb was closed after 46 days of fishing. The fishery yielded only 17,580 lb taken by 15 vessels in 45 landings. Fishery performance information from the 1991 fishery indicated low shrimp abundance. In 1994, the board set the GHR for PWS pot shrimp to 0–100,000 lb. The commercial fishery was closed by department EO from 1992 to 1999, and in 2000, the board closed the fishery. The fishery remained closed for a total of 18 years (1992–2009). In 2009, the board adopted a new management plan and in 2010, the PWS commercial fishery opened.

CURRENT FISHERY REGULATIONS

Regulations to manage the PWS commercial shrimp pot fishery guideline harvest level (GHL) were adopted by the board in March of 2009 with additional regulation changes at the 2015 Statewide Dungeness and Miscellaneous Shellfish meeting:

- Shrimp may be taken April 15 through September 15.
- A person may only register 1 vessel to participate in the fishery during a registration year (5 AAC 31.206 [c]).

- No more than 50% of the GHL may be harvested from any one statistical area (5 AAC 31.214).
- Stringent reporting regulations require all shrimp fishers to contact the department within 24 hours of leaving to harvest shrimp, and additionally to contact the department before landing to provide all harvest information (5 AAC 31.245).
- Shrimp pots deployed on a longline consisting of more than 5 pots must have a buoy marking each end (5 AAC 31.226 [c]).

Other regulatory elements include the following:

- The estimated total allowable harvest (TAH) must be more than 110,000 lb before a commercial harvest may be opened (5 AAC 31.214).
- The commercial fishery is allocated 40% of the TAH for the GHL.
- The fishery occurs within the Inside District and is rotated on an annual basis between 3 different areas described in 5 AAC 31.210(a) (1), (2), and (3) (Figure 2).
- The department determines each season 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 guideline harvest level, with the maximum number of allowable pots set at 100 (5 AAC 31.223). This may change inseason by EO.
- Shrimp pot gear may only be deployed and retrieved between the hours of 8:00 AM and 4:00 PM, unless modified by EO.
- A vessel operator may not have more than the legal limit of pot gear on the vessel or in the water.

Statewide commercial shrimp regulations describe buoy marking, maximum tunnel size, and a biodegradable escape mechanism. Area shrimp pot regulations specify that a pot may not have more than 1 bottom, a vertical height of more than 24 in, more than 4 tunnel eye openings, or a bottom perimeter exceeding 124 in. 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 dowel. Although the PWS Area was originally designated a superexclusive registration area for vessels fishing for shrimp with pot gear, it was redesignated as an exclusive registration area at the 2012 board meeting when it was determined that superexclusive was not defined for shrimp fisheries and that exclusive met the same definition. A commissioner's permit is required to fish in the eastern area to allow monitoring of effort and catch with mandatory logbooks and department contact.

CURRENT FISHERY MANAGEMENT

The opening of the commercial fishery is dependent on the results of the surplus production model, described previously in the research section of this document, which sets the TAH. This model incorporates survey catch weight and CPUE and all commercial and noncommercial harvest, updated with the previous year's fishery. This information is available in early February when an announcement is made regarding whether or not the commercial fishery will occur. If a commercial fishery is to be prosecuted, registrations are then made available at area offices with a deadline of April 1. The registration deadline enables the department to estimate effort in the fishery. Following adoption of new regulations establishing the TAH threshold and GHL in 2009,

the commercial fishery has been open each year from 2010 to the present (Table 1). Immediately following the registration deadline, the department sets commercial gear limits and an initial fishing period based on the number of vessels registered relative to the GHL, expected CPUE, and likely participation. The registration deadline is critical in the management of this fishery. The number of vessels that register helps the department decide gear limits and the length of the initial period (Tables 5 and 6). After the initial fishing period, the department has information about participation and CPUE, which aid in determining the length of the next fishing period. Ultimately, the department is targeting the GHL and making sure that no more than 50% of the harvest comes from 1 statistical area.

Between 2015 and 2020, gear limits were set for the first fishing period and did not change throughout the season, although the department has the authority to adjust gear limits in season. In 2018, with 74 registered vessels, gear limits were set at a maximum of 50 pots per vessel (Table 7). The fishery was prosecuted in Area 3 where shrimp abundance is lower and the area is more remote, which are considerations for period and gear decisions (Table 6 and 7). In 2019 with 100 registered vessels, gear limits were set at 25 pots per vessel, and most recently in 2020 with 92 registered vessels, gear limits were set to 30 pots per vessel for the entire season.

Total fishing time and fishing period lengths vary each season depending on the number of vessels that registered and the area open to fishing (Tables 5 and 6). Between 2018 and 2020, total available fishing time ranged from 18 days in Area 2 in 2020 to 118 days of fishing time in 2018 in Area 3, the least productive area (Table 6).

Hours of gear operation (8:00 AM–4:00 PM by regulation) have been relaxed by EO in most seasons. For 2018 through 2020, these hours were relaxed; in 2018, they were expanded to 6:00 AM–10:00 PM, and in 2019 and 2020, they were 8:00 AM–8:00 PM (Table 5). These operating hours were relaxed to allow shrimp fishers to take advantage of the most favorable tide conditions for operating their gear and to allow more fishing time in Area 3, which is a longer distance to ports. Along with CPUE information, managers have effort information from the pre-trip call-in and data from landing reports, which allows the GHL to be targeted closely.

There are several requirements to participate in the commercial shrimp pot fishery in PWS, including purchasing a permit from the Commercial Fishery Entry Commission (CFEC; \$75) and registering for the fishery with the department, which is free but has a deadline of April 1. In this fishery, many vessels are registered that do not participate. Between 2010 and 2020, an average of 58% of registered vessels participated in the fishery (Table 7). From 2010 to 2020, an average of 142 CFEC permits were issued annually, with an average of 38% of these permits being fished, ranging from 43% (2018) to 58% (2020) in the last 3 seasons. Between 2018 and 2020, an average of 89 vessels registered, with an average of 63 participating and landing shrimp. Multiple permits can fish on 1 registered vessel, but the vessel is still limited to the maximum gear allowance.

For the past 3 years, the Division of Commercial Fisheries has organized preseason meetings with participants to review previous seasons' harvests and effort, survey results, registration requirements, inseason management, and season planning. These meetings have been a great tool for establishing a relationship with the fleet and have allowed the department to closely target the GHL because participants have been very compliant with inseason communication requirements. It has also allowed the fleet to provide managers with feedback regarding the pot limit, fishing period lengths, and other adjustments that the department makes before and within the season. The division will continue to hold these annual meetings, either in person or virtually.

CURRENT FISHERY HARVEST AND EFFORT

Fishing areas are defined in regulation and have rotated through all three areas (per regulation) the past 3 seasons (2018–2020). The 2020 PWS commercial shrimp pot fishery was prosecuted in Area 2 and the GHL was set at 68,100 lb (Table 1). A total 69,898 lb of shrimp was harvested by 74 permit holders on 73 vessels from 226 landings and 32,679 pot pulls (Tables 6, 7, and 8). The fishery closed by EO on May 9 (Table 5). Harvest composition was 69,777 lb spot shrimp (99%), 120 lb coonstripe shrimp (0.2%), and 1 lb other shrimp (0.001%; Table 6).

Since the commercial fishery reopened in 2010, the commercial GHL has been achieved (between 100% and 103% of the GHL) in 7 out of the 11 years (Table 1). The commercial GHL has been similar for the past 4 years, ranging from 67,000 to 68,100 lb. Commercial harvest has been highest in Area 2, with an average of 64,702 lb for the 4 seasons it has been open in that area (Table 8). Area 1 had an average harvest of 56,072 lb for its 4 open seasons, whereas Area 3 has only been open 3 seasons between 2010 and 2020, with the lowest average harvest of 37,358 lb; the Area 3 GHL was achieved for the first time in 2018.

The first year the commercial fishery reopened (2010), the CPUE was the highest with 2.52 lb/pot. The lowest CPUE (1.10 lb/pot) occurred the first year that Area 3 was opened (2012). Discounting 2010, Area 1 has still had the highest average CPUE, with values ranging from 1.77 to 2.02 lb/pot and averaging of 1.85 lb/pot since 2013 (Tables 6 and 8). The fisheries prosecuted in Area 2 ranged from 1.49 to 2.14 lb/pot, averaging 1.73 lb/pot. The least productive Area 3 had a CPUE range of 1.10 to 1.63 lb/pot, with an average of 1.38 lb/pot (Table 8).

NONCOMMERCIAL FISHERY

HISTORY

Shellfish have played an important role in the diets of the indigenous Chugach and Eyak peoples of Prince William Sound and the Copper River Delta (ADF&G 2008). In 1999, as PWS shrimp stocks began to recover, the board determined there was not enough surplus to prosecute a commercial fishery but established pot limits for the noncommercial fisheries to allow for historical levels of harvest. The board also made a positive customary and traditional use finding for shrimp (various species), Dungeness crab, and miscellaneous shellfish in the Prince William Sound Management Area (5 AAC 02.208). The noncommercial shrimp pot fishery in PWS was historically composed of sport, personal use, and subsistence fisheries.

The sport fishery harvest of shrimp has been documented since 1994 by statewide harvest surveys (SWHS¹) and intermittently by harvest permits since 2002 (no permits were required from 2006 to 2008; Marston and Brazil 2008). Data from the SWHS and subsistence household surveys were used from 2006 to 2008 to estimate noncommercial harvests, but estimates from the SWHS are not comparable to current harvest estimates and are not included in this report.

In 1999, the board established a pot limit of 5 pots per vessel to maintain a modest noncommercial shrimp fishery in PWS. In 2000, the Anton Anderson Memorial Tunnel opened to vehicle traffic, providing increased access to the PWS port of Whittier. In March 2009, the board adopted the *PWS Noncommercial Shrimp Fishery Management Plan* (5 AAC 55.055) that included an

¹ Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish. Available from: <http://www.adfg.alaska.gov/sf/sportfishingsurvey/>.

allocation of 60% of the total allowable harvest (TAH) to noncommercial users. TAH is estimated annually prior to the start of the fishing season (April 15) with a surplus production model that requires more timely and precise estimates of noncommercial harvest than are provided by the SWHS. As such, it became necessary to reinstate the noncommercial shrimp permit prior to the start of the 2009 shrimp pot fishery season. In 2012, the board revisited the shrimp pot fishery management plan and repealed the department's emergency order authority under 5 AAC 75.003 to increase the pot limit. However, this did not limit the department's emergency order authority under AS 16.05.060 to restrict the fishery prior to the season and inseason as needed for conservation purposes.

Between 2009 and 2015, there were no preseason or inseason restrictive actions taken. The GHL ranged from 57,900 to 100,000 lb, harvest averaged 75,140 lb (range: 55,765–92,072 lb), and effort average 54,378 pot-days (range: 47,631–78,083 pot-days; Table 9). The only year shrimp pot limits were ever liberalized was in 2010, and prior to 2016, there were never any pot restrictions.

In 2016, the noncommercial GHL level, which is derived from the TAH, was at its lowest level since 2009 (70,500 lb), and based on historical effort and harvest, it was necessary for the department to reduce the number of pots allowed per permit (and vessel) from 5 to 4 pots to keep harvest within the GHL. Two emergency orders (EO 2-SHR-6-13-16 and EO 2-SHR-6-14-16) were issued in 2016 for the sport and personal use shrimp fisheries that reduced the number of pots allowed. Even with a 20% reduction in pots, which led to the lowest number of pot-days of effort recorded since 2005, the harvest of 102,785 lb exceeded the previous 7-year average (2009–2015) of 75,140 lb and exceeded the GHL by 32,285 lb. This was the second time since the adoption of the management plan in 2009 that the GHL was exceeded; however, prior to 2016, the GHL had not been fully utilized in most years. In 2016, personal use fishing regulations were repealed by the board to simplify regulations because they were redundant with sport fishing regulations. Starting in 2017, the noncommercial shrimp season only consisted of sport and subsistence shrimp pot fisheries in PWS. In 2017, the GHL increased to 100,000 lb, nearer to the GHLs between 2013 and 2015 (Table 9). However, concern that harvest and effort would be similar to 2016 and cause the GHL to be exceeded again, an emergency order (EO 2-SHR-6-11-17) was issued for the 2017 noncommercial shrimp season reducing the pot limit to 4 pots per permit and vessel. In 2017, the noncommercial shrimp harvest was 8,173 lb below the GHL.

CURRENT FISHERY REGULATIONS

A management plan for the PWS noncommercial shrimp pot fishery (5 AAC 55.055) was adopted by the board in March of 2009. Specific regulations include the following:

1. The guideline harvest level for shrimp taken by pot gear in noncommercial fisheries is calculated as 60% of the TAH for PWS.
2. Shrimp may be taken from April 15 to September 15.
3. A harvest recording form (permit) is required to participate in the fishery.
 1. Shrimp fishers must be in possession of a permit at the time of harvest and must record harvest before leaving the fishing area or concealing shrimp.
 2. The permit can be issued to a household where all household members listed on the permit can fish the permit, or it can be issued to individuals.
 3. Permits must be returned to the department by October 15.
4. There is no bag, possession, or size limit on shrimp.

5. No more than 5 pots per person and 5 pots per vessel may be used.
6. The amount reasonably necessary for all subsistence uses (ANS) of shrimp in the Prince William Sound Area is 9,000–15,000 pounds of usable weight of shrimp.

Statewide noncommercial shrimp regulations describe buoy marking, maximum tunnel size, and a biodegradable escape mechanism (5 AAC 02.010; 5 AAC 39.145; 5 AAC 75.035; 5 AAC 77.010). In addition, a shrimp pot must be entirely covered with net webbing or rigid mesh and at least 2 vertical 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 round wooden peg 12 inches long and $\frac{7}{8}$ inches in diameter (5 AAC 55.022).

CURRENT FISHERY MANAGEMENT

The noncommercial shrimp fishery occurs annually as described in the *PWS Noncommercial Shrimp Fishery Management Plan* (5 AAC 55.055). PWS noncommercial shrimp permits are required to participate in the fishery and are available online beginning in mid-March to early April. Management actions to reduce the pot limit are taken preseason as needed to maintain harvest below the noncommercial GHL. The department uses the permits to produce estimates of harvest and effort that are used to guide management actions for the following season.

The department has issued preseason emergency orders reducing the number of pots per vessel every year since 2016. In 2016, 2017, and 2018 the pot limit allowed per person per vessel was reduced to 4 pots, and in 2019 and 2020, the pot limit was further reduced to 3 pots (Table 10).

NONCOMMERCIAL SHRIMP PERMIT

Before 2001, there were no regulatory restrictions on the noncommercial shrimp fishery in PWS. In March 2000, the board adopted regulations to restrict the noncommercial fishery (effective January 2001). The regulations required a shrimp permit for all noncommercial users (sport, personal use, and subsistence, effective during the 2002–2005 seasons), established pot limits of no more than 5 pots per person with a limit of 5 pots per vessel that may be used to take shrimp, and established a fishing season from April 15 through September 15. Data from the SWHS and occasional household surveys were used from 2006 to 2008 to estimate noncommercial harvests during a time when no PWS commercial fisheries targeting shrimp were prosecuted. With the adoption of the *PWS Noncommercial Shrimp Fishery Management Plan* by the board in March 2009, a noncommercial shrimp fishery permit was reinstated for the 2009 season and has since been required annually. Prior to 2016, permits were only available in person at locations where sport fishing licenses were sold, and harvest reporting forms needed to be delivered in person or mailed to the department. In 2016, permits became available online and online harvest reporting has been available since 2018.

The number of PWS shrimp permits reporting harvest from 2018 to 2020 increased by 338 permits. Since 2009, the percentage of individuals that turned in harvest reports (86.0–92.0%), and the percent that reported harvesting shrimp (55.1–63.1%) has remained relatively constant (Table 9).

Methods

All participants in the Prince William Sound noncommercial shrimp fisheries are required to get a permit for the year of the fishery or to be named on the permit of another household member. Permits are issued online at the ADF&G online store and printed by the applicant. A copy of the

relevant advisory announcement is included along with each permit (Appendices A1 and A2). This permit is required to be in the possession of the person working shrimp gear. Permit holders are required to record their effort (number of pots and soak time) and harvest on the permit prior to leaving the fishing site or concealing the shrimp from view and must return the permit to the department by October 15 of that year or submit the information online. Permit holders are mailed up to 2 reminder letters via the U.S. Postal Service if harvest data are not received (Appendix B1). Details about data management and handling of the permit data can be found in the Prince William Sound Shrimp Harvest Monitoring Operational Plan (Baumer and Blain 2018).

Shrimp harvest is converted from gallons of whole shrimp to pounds of shrimp with the conversion factor of 3.89 lb/gal of whole shrimp (Maria Wessel, Division of Commercial Fisheries Biologist, Alaska Department of Fish and Game, Cordova; unpublished data). This conversion factor was determined in 2012 and is higher than the previous conversion factor of 2.4 lb/gal used prior to 2013 for estimating pound-per-gallon of shrimp.

In addition to the estimates of total harvest and effort, the catch per unit effort (CPUE) is estimated for selected statistical areas with catch equal to pounds of whole spot shrimp and effort equal to 1 pot soaked for 24 hours. The proportional distribution of effort and harvest by nonrespondents was assumed to be like that of respondents. Therefore, to calculate effort and harvest by statistical area, the percentage of the total reported effort and harvest for each statistical area is multiplied by the expanded estimate of total effort and harvest. Temporal trends in effort, harvest, and CPUE were investigated for those statistical areas that support most of the noncommercial effort and harvest.

CURRENT FISHERY HARVEST AND EFFORT

Since 2002, effort in the noncommercial fishery has ranged from 19,387 pot-days in 2002 to 78,083 pot-days in 2010 (Table 9). From 2012 to 2020, effort remained relatively consistent, averaging 46,801 pot-days and ranging from 39,816 (2019) to 52,620 (2012) pot-days. Harvest in this fishery has ranged from 9,288 lb in 2002 to 140,488 lb in 2020. From 2018 to 2020, the average harvest was 124,089 lb, an increase from the prior 5-year average of 92,336 lb (2013–2017), during which harvests ranged from 85,988 (2013) to 102,785 (2016). The average effort during 2018–2020 was 44,068 pot-days, a decrease from the prior 5-year average of 47,278 pot-days (2013–2017; Table 9).

In 2018, the GHL increased to 100,700 lb, a slight increase from the 100,000 lb GHL in 2014, 2015, and 2017 (Table 9). However, there was concern prior to the 2018 season that if harvest and effort trends in 2018 were like those observed in 2016 and 2017, the established GHL would again be exceeded. To reduce harvest and effort during the 2018 noncommercial shrimp season, EO 2-SHR-6-05-18 was issued reducing the pot limit to 4 pots per person and a maximum of 4 pots per vessel (Table 10). In 2018, even with the issued EO, effort was higher than anticipated, and the noncommercial shrimp GHL was exceeded by 28,160 lb.

In 2019, the GHL increased slightly from the 2018 level to 102,100 lb (Table 9). However, the same concern over harvest and effort trends led to the issuing of EO 2-SHR-6-15-19 reducing the allowable pot limit from 5 pots to 3 pots per person with a maximum of 3 pots per vessel (Table 10). In 2019, the harvest was close to the GHL, only exceeding the GHL by 819 lb, and overall effort was the lowest since 2005.

In 2020, the GHL increased slightly from the 2019 level to the 102,109 lb (Table 9). Trends in prior years indicated that pot limit reductions needed to be enacted to keep harvest within the GHL.

Therefore, to reduce harvest and effort during the 2020 noncommercial shrimp season, and to keep harvest near the GHL, EO 2-SHR-6-13-20 was issued reducing the pot limit to 3 pots per person with a maximum of 3 pots per vessel. Although effort was still below the historical average, effort increased slightly from 2019 during the 2020 season, which could be attributed to shrimp fishers spending more time on the water during the COVID-19 pandemic. In 2020, the highest CPUE ever recorded in the noncommercial fishery at 3.45 lb of shrimp per pot was the primary contributing factor to exceeding the GHL by 38,379 lb in 2020. The reason for the high CPUE is unknown; however, it could be due to a combination of factors, including high shrimp abundance and participant efficiency.

The spatial distribution of effort (Table 11) and harvest (Table 12) in the noncommercial fishery has remained relatively constant except for Valdez Arm, which has had a decrease in effort. The PWS statistical areas that support most of the noncommercial effort and harvest are the waters close to ports, including Whittier vicinity (486033), Valdez Arm (466100), and Port Wells (486034), and also the known productive shrimp areas of Unakwik Inlet (476036 and 476101) and Port Nellie Juan (486031 and 486003). During 2010–2020, the Whittier and Valdez statistical areas have supported on average a combined sum of 66% (range: 55–74%; Table 11) of the total annual reported effort and 51% (range: 44–56%) of the total annual reported harvest. These two areas are not open to the commercial fishery.

The CPUE in the noncommercial shrimp fishery has been steadily increasing since 2017 and reached its highest level in 2020 (3.45 lb/pot; Table 9; Figure 4). CPUEs have been over 2 lb/pot since 2016. This increase in CPUE in recent years reflects greater success in catching shrimp even with less effort (pot-days). Although the noncommercial fishery has a high CPUE, the surplus production model results have not varied widely between 2017 and 2020, ranging from a TAH of 167,000 to 170,209 lb (Table 1).

CPUEs in the statistical areas with the most harvest and effort (Whittier and Valdez) have increased since 2017 (Figure 5). In Port Wells and Port Nellie Juan, the CPUE has been more variable. Since permits were reinstated in 2009, Unakwik has continued to have the highest CPUE with the exception of 2017. Variation in the CPUE from one area to another is probably impacted by variability in shrimp fisher efficiency and fishing effort near major ports.

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TABLES

Table 1.—Prince William Sound total allowable harvests (TAH), guideline harvest levels (GHL), harvests in commercial and noncommercial shrimp pot fisheries, and percentage of total allowable harvest (TAH), 2010–2020.

Year	TAH (lb)	GHL (lb)		Shrimp harvest (lb)			% of TAH	Non-commercial % of GHL	Commercial % of GHL
		Non-commercial	Commercial	Non-commercial	Commercial	Total			
2010	137,500	82,200	55,000	87,699 ^a	45,349	133,048	97%	107%	82%
2011	131,900	79,200	52,760	59,182 ^a	52,694	111,876	85%	75%	100%
2012	128,100	76,860	51,240	55,765 ^a	21,561	77,326	60%	73%	42%
2013	165,750	99,450	66,300	85,988 ^b	61,644	147,632	89%	86%	93%
2014	166,500	99,900	66,600	89,155 ^b	68,464	157,619	95%	89%	103%
2015	167,000	100,000	67,000	92,072 ^b	23,138	115,209	69%	92%	35%
2016	117,653	70,500	47,061	102,785 ^b	48,346	151,131	128%	146%	103%
2017	167,000	100,000	67,000	91,827 ^b	67,421	159,248	95%	92%	101%
2018	168,000	100,700	67,200	128,860 ^b	67,375	196,235	117%	128%	100%
2019	170,200	102,100	68,100	102,919 ^b	68,947	171,866	101%	101%	101%
2020	170,209	102,109	68,100	140,488 ^b	69,898	210,386	124%	138%	103%

^a Calculated with 2.4 lb spot shrimp/gallon conversion.

^b Calculated with 3.89 lb spot shrimp/gallon conversion.

Table 2.—Prince William Sound spot shrimp survey results, 1992–2020.

Year	Number of pots	Catch weight (lb)	CPUE	CPUE	Number of shrimp	Percent		Females with eggs
			lb/pot all shrimp	lb/pot >32 mm		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	4,128	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	94.9	5.1	NA
1997	345	142	0.41	0.20	3,835	94.1	5.9	NA
1998	264	76	0.29	0.14	2,252	94.6	5.4	99.2
1999 ^a	346	165	0.47	0.21	4,392	94.3	5.7	97.8
2000	349	245	0.70	0.38	6,545	95.1	4.9	97.2
2001	351	331	0.94	0.63	7,034	92.7	7.3	99.6
2002 ^b	304	377	1.24	0.81	8,797	91.0	9.0	98.5
2003	352	398	1.13	0.78	9,333	92.0	8.0	99.7
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	553	1.59	0.81	14,203	91.6	8.4	91.7
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	81.4
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	687	1.95	1.67	11,627	74.8	25.2	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	93.1
2015	395	629	1.59	1.01	14,118	91.7	8.3	98.3
2016	359	986	2.75	1.97	19,821	86.8	13.2	99.6
2017	359	1,413	3.92	1.91	37,722	92.8	7.2	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
Average								
2010–2020	378	986	2.60	1.60	23,229	87.5	12.5	95.0
1992–2009	341	374	1.08	0.61	9,414	92.2	7.8	94.6

Note: NA means data are not available and some reported information has changed with updated analysis.

^a Sex data interpolated for 452 lost data points.

^b Sex data interpolated for 192 lost data points.

Table 3.—Catch per unit effort (CPUE) of spot shrimp in the shrimp pot survey of 3 Prince William Sound management areas, 1992–2020.

Year	Survey CPUE (lb/pot) ^a		
	Area 1	Area 2	Area 3
1992	0.86	0.62	0.75
1993	0.69	0.48	0.19
1994	0.40	0.41	0.41
1995	0.67	0.61	0.55
1996	0.58	0.53	0.49
1997	0.50	0.40	0.39
1998	0.22	0.38	0.19
1999	0.23	0.73	0.34
2000	0.40	0.77	0.73
2001	1.14	1.19	0.71
2002	0.77	1.99	0.65
2003	0.61	1.75	0.80
2004	3.12	1.82	0.71
2005	1.66	1.92	0.89
2006	2.85	1.84	1.08
2007	3.58	3.23	1.49
2008	3.46	3.17	1.87
2009	2.79	2.67	1.75
2010	1.87	1.63	0.77
2011	3.64	2.19	0.61
2012	2.94	2.32	1.12
2013	1.79	2.55	1.35
2014	1.98	2.73	1.03
2015	1.84	2.48	0.46
2016	3.38	3.61	1.26
2017	3.87	5.59	2.33
2018	3.72	4.50	3.20
2019	3.92	4.00	2.03
2020	5.21	4.53	2.13
Average 2010–2020	3.11	3.28	1.48

^a All sizes of shrimp are included.

Table 4.—Prince William Sound Area commercial shrimp pot fishery harvest and effort, 1960–2009.

Year	Vessels	Landings	Harvest (lb)			Total
			Spot	Coonstripe	Other	
1960						4,988
1961						0
1962						3,576
1963						1,101
1964						4,248
1965						4,356
1966						0
1967						749
1968						6,866
1969						5,146
1970						19,776
1971						13,073
1972						6,949
1973						6,370
1974						24,978
1975						4,150
1976						2,410
1977						7,516
1978	9	17				15,466
1979	17	98				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: blank cells indicate data not available.

Table 5.—Prince William Sound commercial shrimp pot fishery emergency orders (EOs) 2018–2020.

Calendar year	EO	Effective date (month/day/year)	EO description
2018	2-SF-E-01-18	04/15/18	Decreased number of shrimp pots allowed to harvest shrimp in the in the subsistence fishery from 5 to 4 per person and vessel.
	2-SF-E-03-18	04/15/18	Established first commercial fishing period 6:00 AM April 15–10:00 PM April 30, set maximum gear limit at 50 pots per vessel, and set hours of gear operation 6:00 AM to 10:00 PM.
	2-SF-E-04-18	05/07/18	Set second commercial fishing period 6:00 AM May 7–10:00 PM September 15.
	2-SF-E-08-18	08/16/18	Close the commercial shrimp pot season 10:00 PM August 16.
2019	2-SF-E-03-19	04/15/19	Decreased number of shrimp pots allowed to harvest shrimp in the in the subsistence fishery from 5 to 3 per person and vessel.
	2-SF-E-05-19	04/15/19	Established first commercial fishing period 8:00 AM April 15–8:00 PM April 23, set maximum gear limit at 25 pots per vessel, and set hours of gear operation 8:00 AM to 8:00 PM.
	2-SF-E-06-19	04/29/19	Set second commercial fishing period 8:00 AM April 29–8:00 PM May 7.
	2-SF-E-07-19	05/14/19	Set third commercial fishing period 8:00 AM May 14–8:00 PM September 15.
	2-SF-E-08-19	05/29/19	Closes commercial shrimp pot fishing in statistical area 476036 at 10:00 AM May 29 and in remaining open statistical areas at 8:00 PM May 29.
2020	2-SF-E-02-20	04/15/20	Decreased number of shrimp pots allowed to harvest shrimp in the in the subsistence fishery from 5 to 3 per person and vessel.
	2-SF-E-05-20	04/15/20	Established first commercial fishing period 8:00 AM April 15–8:00 PM April 26, set maximum gear limit at 30 pots per vessel, and set hours of gear operation 8:00 AM to 8:00 PM.
	2-SF-E-06-20	05/04/20	Opened the second fishing period 8:00 AM May 4 and closed fishing in statistical area 486034 at 8:00 PM May 7 and in remaining open statistical areas at 8:00 PM May 9.

Table 6.—Prince William Sound commercial shrimp pot fishery guideline harvest levels (GHL), effort, gear limits, harvest, catch per unit effort (CPUE), and available fishing days, 2010–2020.

Year	Area	GHL (lb)	Effort		Gear limits		Shrimp harvest (lb)				CPUE (lb/pot)	Available fishing days
			Vessel fished	Pot lifts	Open	Close	Spot	Coonstripe	Other	Total		
2010	1	55,000	75	18,025	20	20	45,076	263	10	45,349	2.52	118
2011	2	52,760	45	29,580	40	40	51,302	1,204	44	52,550	1.78	96
2012	3	51,240	35	19,644	50	50	18,097	3,428	36	21,561	1.10	93
2013	1	66,300	43	34,804	30	50	59,376	2,266	2	61,644	1.77	145
2014	2	66,600	32	41,027	40	50	64,220	4,085	158	68,464	1.67	111
2015	3	67,000	30	20,004	60	60	21,193	1,934	11	23,138	1.16	146
2016	1	47,061	57	27,360	30	30	47,822	580	21	48,423	1.77	28
2017	2	67,000	54	45,261	40	40	66,555	783	83	67,421	1.67	41
2018	3	168,000	44	41,351	50	50	65,101	2,268	5	67,374	1.63	118
2019	1	68,100	72	34,094	25	25	68,700	245	2	68,947	2.02	34
2020	2	68,100	73	32,679	30	30	69,777	120	1	69,898	2.14	18

Table 7.—Number of CFEC permits issued and fished, number of registered vessels, vessels fished, and number of landings in the Prince William Sound commercial shrimp pot fishery by year, 2010–2020.

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

Table 8.—Prince William Sound commercial shrimp pot fishery harvest, pots pulled, and CPUE by area and year from 2010–2020.

Area	Year	Harvest (lb)	Pot pulls	CPUE (lb/pot)
Area 1	2010	45,349	18,025	2.52
	2013	61,644	34,804	1.77
	2016	48,329	27,360	1.77
	2019	68,947	34,094	2.02
	Average	56,072	28,571	1.96
Area 2	2011	52,550	29,580	1.78
	2014	68,938	41,670	1.65
	2017	67,421	45,261	1.49
	2020	69,898	32,679	2.14
	Average	64,702	37,298	1.73
Area 3	2012	21,561	19,644	1.1
	2015	23,138	20,004	1.16
	2018	67,375	41,351	1.63
	Average	37,358	27,000	1.38

Table 9.—Number of permits issued, number of permits reporting harvest, percent of issued permits reporting harvest, guideline harvest level (GHL), pounds (lb) of whole shrimp, pot-days of effort, and catch per unit effort (CPUE) in the noncommercial Prince William Sound pot shrimp fishery, 2002–2020.

Year	Noncommercial PWS shrimp permit data							
	Permits issued	Response rate	Permits reported harvest	% Permits reported harvest	Effort (pot-days)	Catch per unit effort	Harvest (lb)	GHL ^a
2002	717	84.0%	385	53.7%	19,387	0.78	9,288	—
2003	1,061	91.0%	614	57.9%	24,094	0.94	13,965	—
2004	1,649	90.0%	902	54.7%	30,694	1.36	25,694	—
2005	2,112	90.0%	1,202	56.9%	37,271	1.39	31,950	—
2006 ^b	—	—	—	—	—	—	—	—
2007 ^b	—	—	—	—	—	—	—	—
2008 ^b	—	—	—	—	—	—	—	—
2009	2,733	89.0%	1,719	62.9%	47,631	1.91	56,120	57,900
2010	3,181	90.0%	2,007	63.1%	78,083	1.82	87,699	82,200
2011	3,309	88.0%	1,972	59.6%	56,543	1.70	59,182	79,200
2012	3,098	87.0%	1,829	59.0%	52,620	1.72	55,765	76,860
2013	3,101	89.0%	1,895	61.1%	48,967	1.76	85,988	99,500
2014	3,134	86.0%	1,903	60.7%	48,283	1.85	89,155	100,000
2015	3,033	86.7%	1,847	60.9%	48,521	1.90	92,072	100,000
2016	3,592	90.7%	2,107	58.7%	45,012	2.28	102,785	70,500
2017	3,441	92.0%	2,149	62.5%	45,606	2.01	91,827	100,000
2018	3,810	89.9%	2,259	59.3%	51,704	2.49	128,860	100,700
2019	4,211	88.0%	2,321	55.1%	39,816	2.58	102,919	102,100
2020	4,501	88.7%	2,597	57.1%	40,685	3.45	140,488	102,109
Average								
2013–2017	3,260	88.9%	1,980	60.8%	47,278	1.96	92,365	93,970
2018–2020	4,174	88.9%	2,392	57.2%	44,068	2.84	124,089	101,636

Note: Permits were first offered online in 2016. Between 2002 and 2012, the conversion factor for a gallon of shrimp was 2.4 lb. In 2013, this was reevaluated and updated to a conversion factor of 3.89 lb per gallon of shrimp.

^a Guideline harvest levels (GHL) were not set until 2009.

^b Permits were not required during these years, so no information is available.

Table 10.—Prince William Sound noncommercial shrimp pot fishery emergency orders (EOs), 2018–2020.

Calendar year	EO	Effective date (month/day/year)	EO description
2018	2-SHR-6-05-18	04/15/18	Restricts the number of shrimp pots allowed to harvest shrimp in the Prince William Sound sport fishery from 5 pots per person with a maximum of 5 pots per vessel, to 4 pots per person with a maximum of 4 pots per vessel.
2019	2-SHR-6-15-19	04/15/19	Restricts the number of shrimp pots allowed to harvest shrimp in the Prince William Sound sport and subsistence fisheries from 5 pots per person with a maximum of 5 pots per vessel, to 3 pots per person with a maximum of 3 pots per vessel.
2020	2-SHR-6-13-20	04/15/20	Restricts the number of shrimp pots allowed to harvest shrimp in the Prince William Sound sport and subsistence fisheries from 5 pots per person with a maximum of 5 pots per vessel, to 3 pots per person with a maximum of 3 pots per vessel.

Table 11.—Contribution of major statistical areas to estimated total effort in the noncommercial shrimp fishery in Prince William Sound by year, 2010–2020.

Year	Whittier vicinity (486033)		Valdez Arm (466100)		Unakwik Inlet (476036, 476101)		S. Port Wells (486034)		Port Nellie Juan (486031, 486003)		All other areas ^a	
	Pot-days	%	Pot-days	%	Pot-days	%	Pot-days	%	Pot-days	%	Pot-days	%
2010	24,987	32%	32,795	42%	5,466	7%	3,123	4%	3,123	4%	8,589	11%
2011	17,528	31%	22,617	40%	3,393	6%	3,393	6%	3,393	6%	6,220	11%
2012	21,048	40%	17,891	34%	3,683	7%	3,683	7%	2,631	5%	4,210	8%
2013	15,669	32%	11,262	23%	3,428	7%	2,448	5%	3,428	7%	12,731	26%
2014	18,348	38%	14,002	29%	3,863	8%	3,380	7%	2,414	5%	6,277	13%
2015	17,953	37%	15,042	31%	4,367	9%	4,367	9%	2,911	6%	4,367	9%
2016	16,204	36%	11,703	26%	2,701	6%	3,601	8%	3,151	7%	7,652	17%
2017	16,874	37%	12,314	27%	3,648	8%	3,192	7%	912	2%	8,665	19%
2018	15,596	32%	14,234	29%	4,331	9%	3,499	7%	728	2%	10,659	22%
2019	12,417	33%	9,921	27%	3,775	10%	1,567	4%	2,967	8%	6,546	18%
2020	14,546	38%	8,535	22%	3,650	10%	2,562	7%	2,387	6%	6,308	17%
Average	17,379	35%	15,483	31%	3,846	6%	3,165	8%	2,550	5%	7,475	15%

Note: The number of each statistical area follows its name in parentheses.

^a Each of the remaining 24 statistical areas where noncommercial shrimp harvest was reported contributed on average less than 5% to the total reported shrimp harvest in any given year.

Table 12.—Contribution of major statistical areas to total harvest of whole shrimp in the noncommercial shrimp pot fishery in Prince William Sound, 2010–2020.

Year	Whittier vicinity (486033)		Valdez Arm (466100)		Unakwik Inlet (476036, 476101)		S. Port Wells (486034)		Port Nellie Juan (486031, 486003)		All other areas ^a	
	Pounds	%	Pounds	%	Pounds	%	Pounds	%	Pounds	%	Pounds	%
2010 ^b	29,818	34%	19,294	22%	7,893	9%	13,155	15%	7,893	9%	9,647	11%
2011 ^b	20,122	34%	12,428	21%	8,877	15%	5,918	10%	5,918	10%	5,918	10%
2012 ^b	21,748	39%	9,480	17%	8,922	16%	6,134	11%	4,461	8%	4,461	8%
2013	29,236	34%	12,898	15%	7,739	9%	8,599	10%	7,739	9%	20,637	24%
2014	33,879	38%	14,265	16%	15,156	17%	9,807	11%	5,349	6%	10,699	12%
2015	31,304	34%	14,732	16%	21,177	23%	9,207	10%	7,366	8%	9,207	10%
2016	34,358	35%	12,762	13%	12,762	13%	10,798	11%	11,780	12%	16,688	17%
2017	32,178	37%	9,566	11%	8,697	10%	18,263	21%	2,609	3%	16,524	19%
2018	37,251	31%	16,136	13%	15,529	13%	23,616	19%	2,847	2%	26,312	22%
2019	37,601	37%	12,263	12%	16,398	7%	7,269	7%	10,398	10%	17,444	17%
2020	56,915	43%	13,333	10%	14,199	11%	15,881	12%	10,331	8%	20,403	16%
Average	33,128	36%	13,378	15%	12,486	13%	11,695	12%	6,972	8%	14,358	15%

Note: The number of each statistical area follows its name in parentheses. Permits were first offered online in 2016.

^a Each of the remaining 24 statistical areas where noncommercial shrimp harvest was reported contributed on average less than 5% to the total reported shrimp harvest in any given year.

^b The conversion factor for a gallon of shrimp was 2.4 lb. In 2013, this was reevaluated and updated to a conversion factor of 3.89 lb per gallon of shrimp for 2013 and following years.

FIGURES

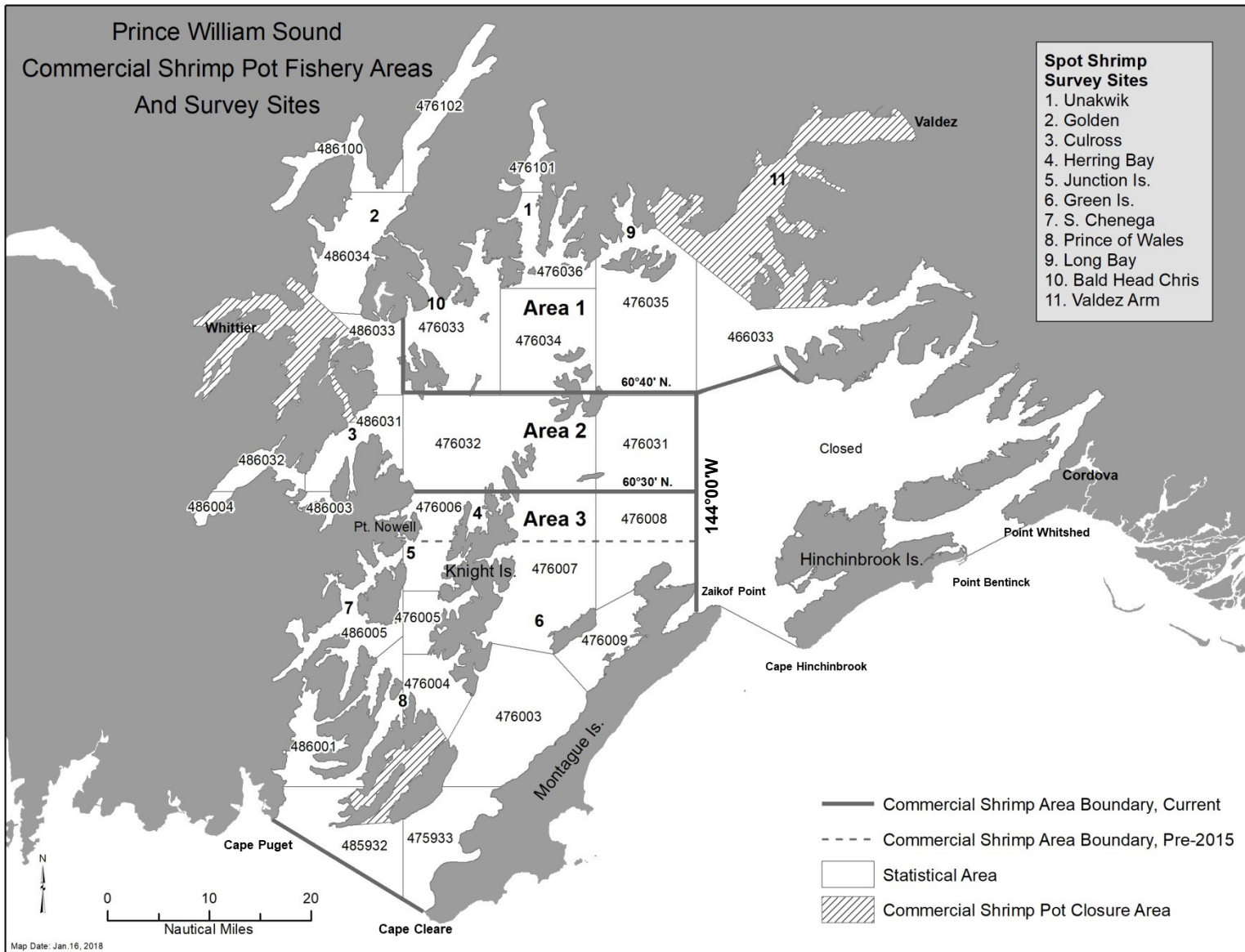


Figure 1.—Prince William Sound commercial management areas for the Inside District and index survey sites for spot shrimp.

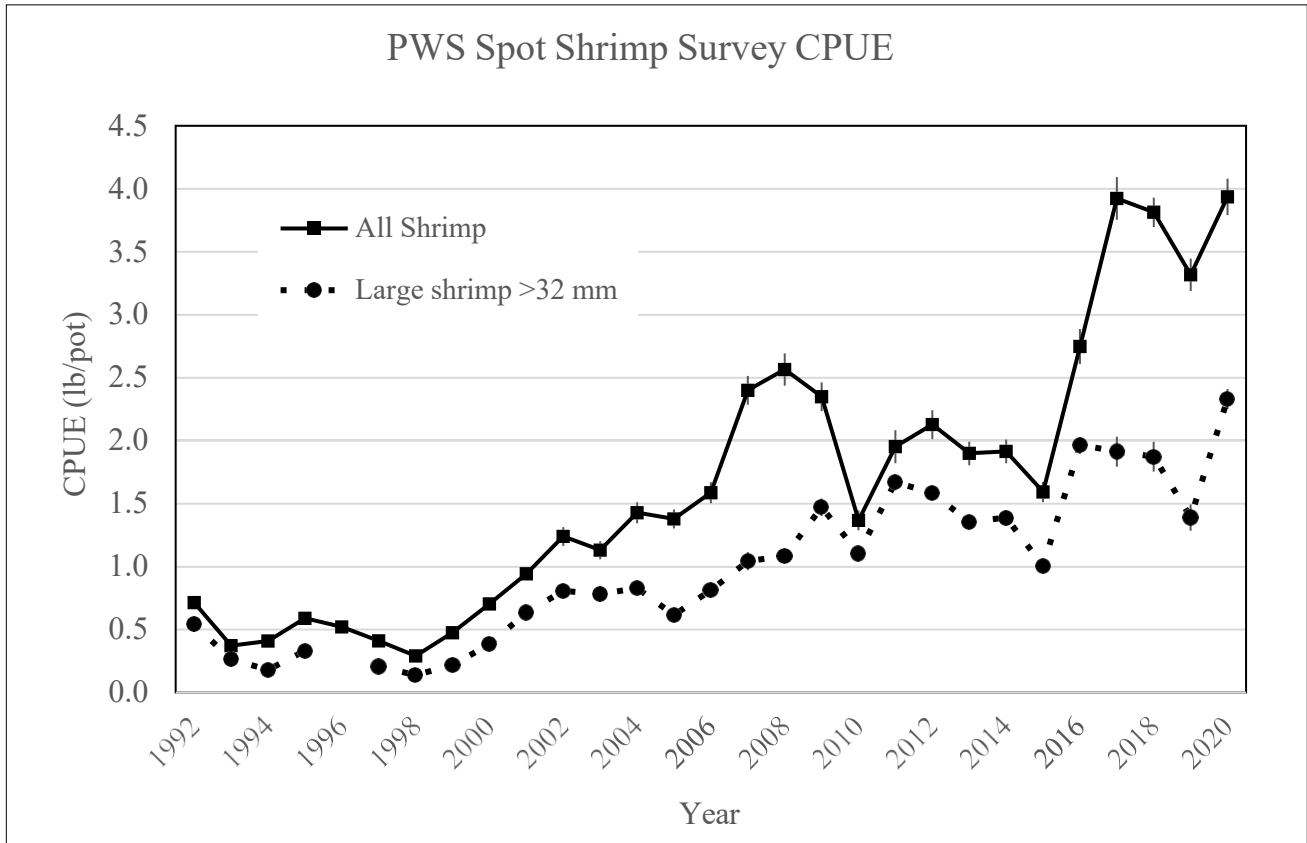


Figure 2.—Prince William Sound spot shrimp survey average catch per unit effort (CPUE) for all spot shrimp and large spot shrimp (those equal to or greater than 32 mm in carapace length) with standard errors, 1992–2020.

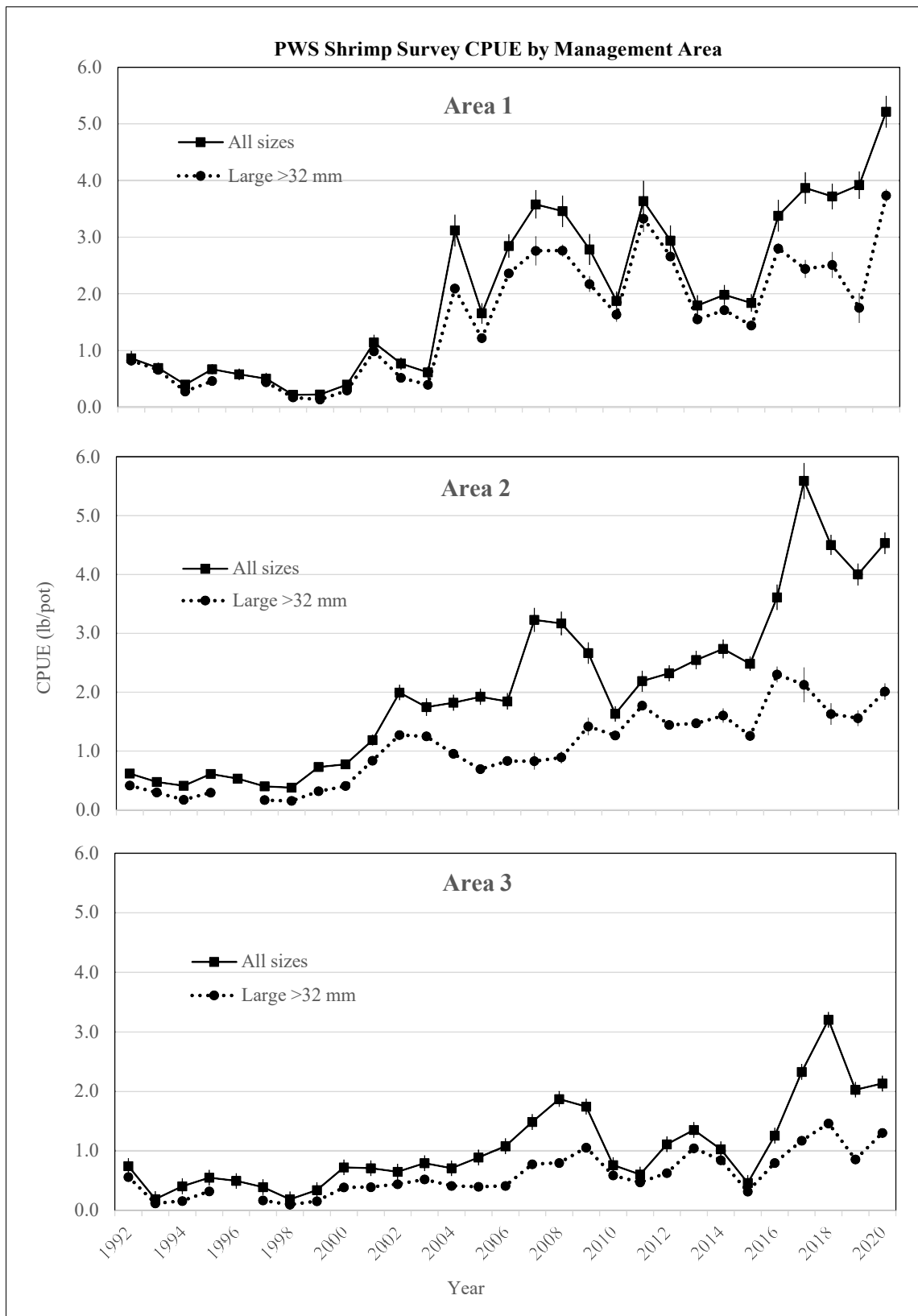


Figure 3.—Prince William Sound spot shrimp survey average catch per unit effort (CPUE) and standard errors for all, and large spot shrimp in the three management areas 1, 2, and 3.

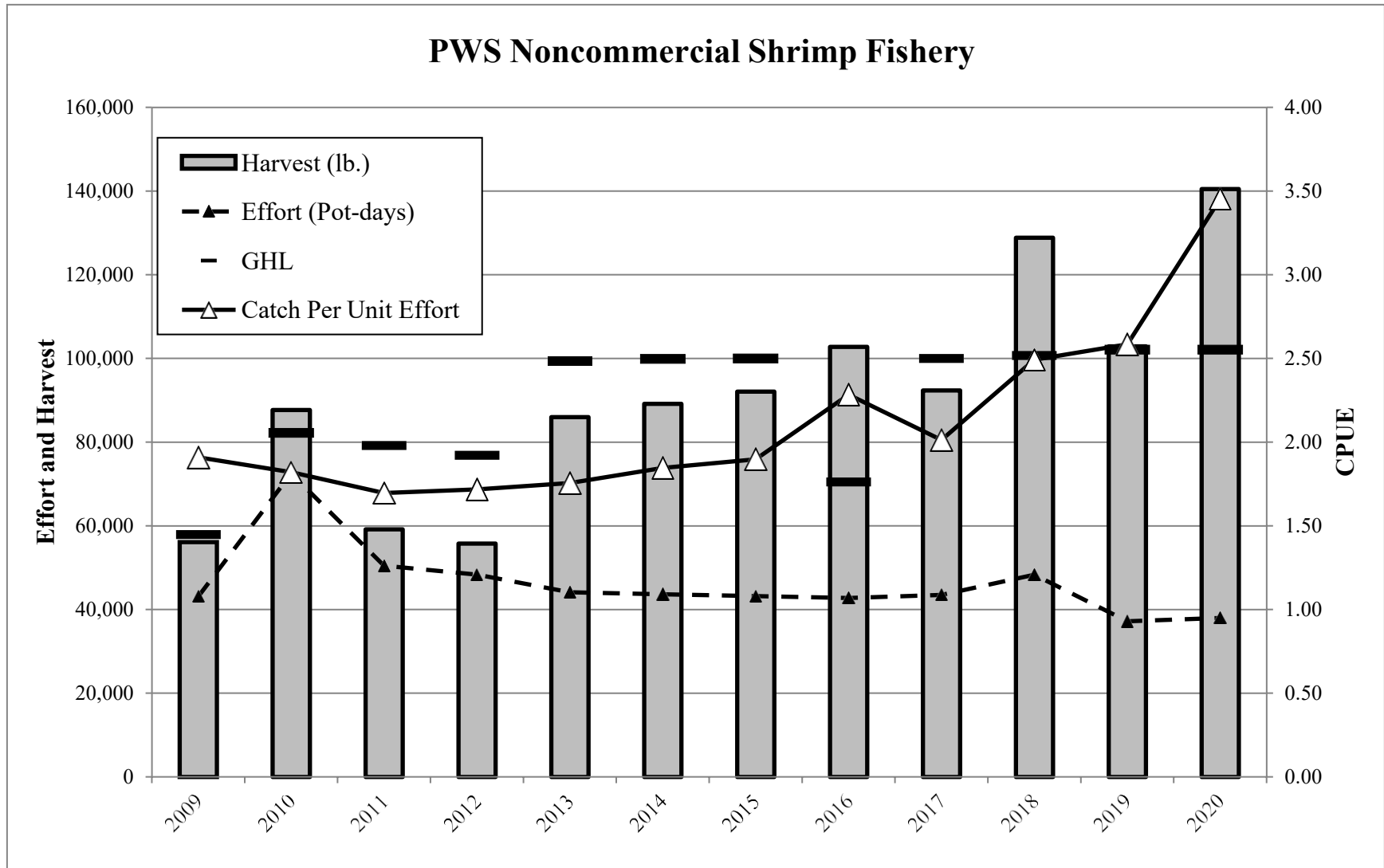


Figure 4.—Guideline harvest level (GHL), effort (pot-days), harvest (lb), and catch per unit effort (pounds of whole shrimp caught in 1 pot soaked for 24 hours; CPUE) in the noncommercial shrimp fishery in the Prince William Sound Management Area (PWSMA), 2009–2020.

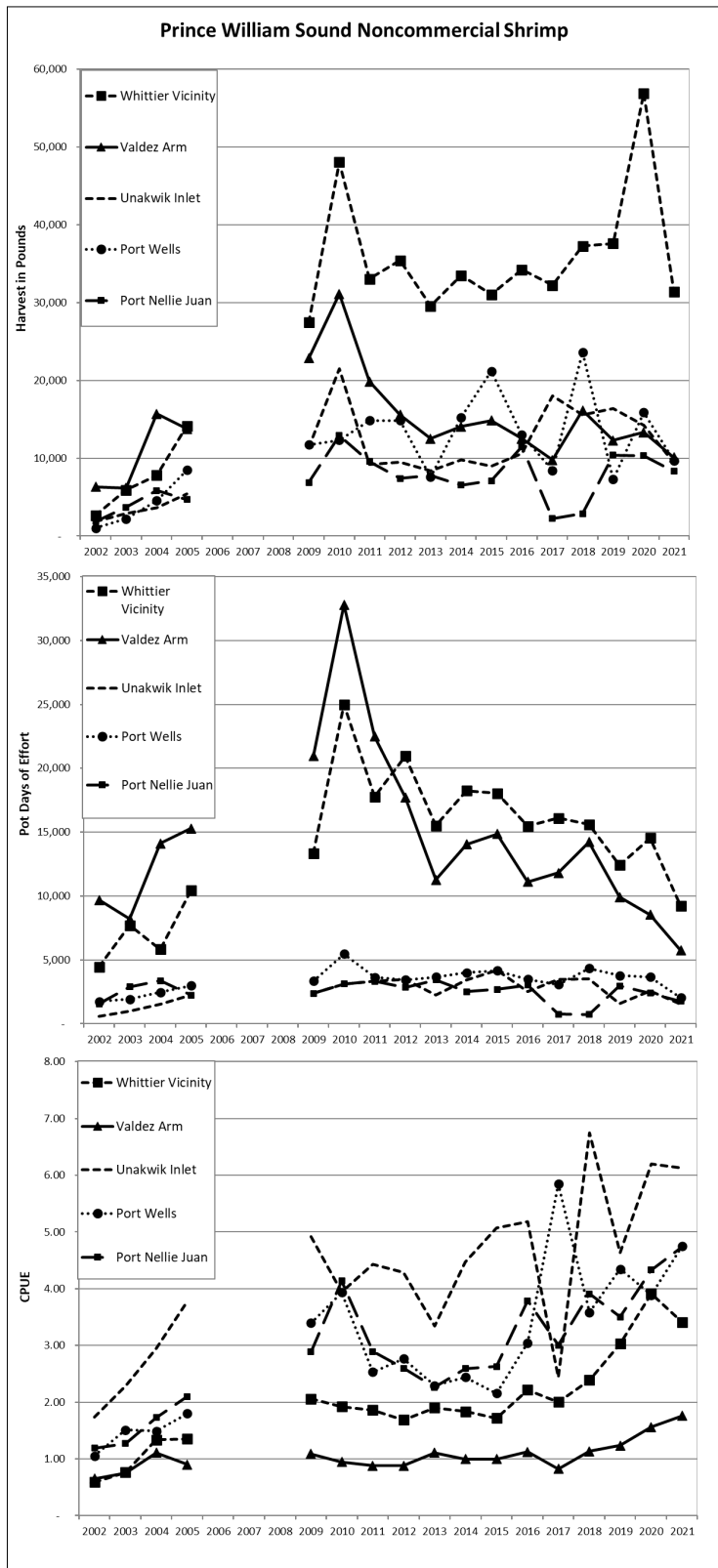


Figure 5.—Harvest, effort, and catch per unit effort (pounds of whole shrimp caught in 1 pot soaked for 24 hours; CPUE) at the 5 major statistical areas in the noncommercial pot shrimp fishery of Prince William Sound, 2002–2005, 2009–2020.

**APPENDIX A: NONCOMMERCIAL SHRIMP PERMIT AND
ATTACHED ANNOUNCEMENT**

Appendix A1.-Copy of noncommercial shrimp permit.



**Alaska Department of Fish and Game
2020 Prince William Sound Shrimp Permit**

**This permit is valid through
September 15th, 2020**

Permit Number


Alaska Resident

Last Name First Name M.I. Sport Fishing License #

Mailing Address

City State Zip Code Phone Number Driver's License # State

E-Mail Address



Names of other household members authorized to fish this permit:

This permit is valid for the period April 15th – September 15th, 2020

- ▶ **You must have this permit with you while taking shrimp** in the waters of Prince William Sound (from Cape Fairfield to Cape Suckling).
- ▶ See the Southcentral Sport Fishing Regulations for complete descriptions of shrimp pot regulations (including marking requirements).
- ▶ If you share pots with a friend or relative, be careful to report each harvest on only ONE permit.
- ▶ By signing this permit you agree to all conditions and terms of this fishery. See back side of permit for additional information.
- ▶ Harvest information must be recorded in ink below prior to leaving the fishing site or concealing the shrimp from view. Please continue on another piece of paper if you need more lines to report your harvest. ▶ **You must submit a report even if you did not fish.**
- ▶ **You must report online by October 15th, 2020.**

You Can Now Report Online
Scan the QR code or visit us at
www.adfg.alaska.gov/harvest

Permit Holder Signature Date

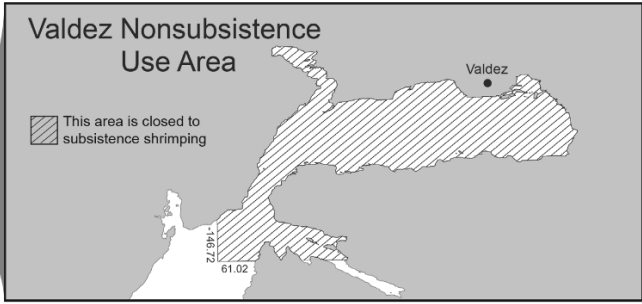
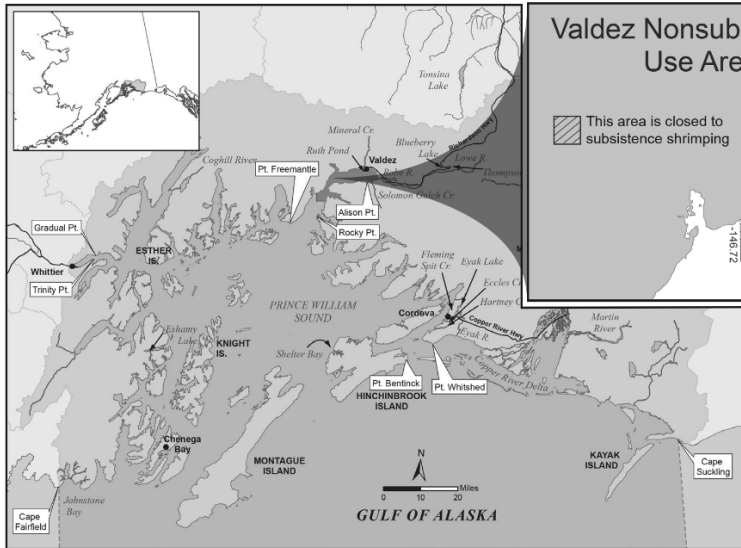
▶ Was this permit used to set shrimp pots in 2020? YES NO Number of lost shrimp pots:

How to enter for gallons of harvested shrimp:
Example: 0.5 = harvest ½ gallon whole shrimp (shrimp heads on)

DATE (Pots Set)		LOCATION shrimp was harvested from in Prince William Sound	NUMBER OF POTS FISHED	TIME SOAKED	WHOLE SHRIMP HARVESTED
MM	DD	Examples include: specific bay, fjord, canal, arm, etc.	Pots	Hours	Gallons
1.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
7.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
9.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
10.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Report each day you shrimped and record your harvest, even if you did not catch anything.

-continued-



The Alaska Joint Board of Fisheries and Game has defined an area of Prince William Sound that is within the Valdez city limits as "non-subsistence" (described in 5 AAC 99.015(a)(5) as of March 1993).

Summary Of Shrimp Pot Regulations

1. Each keg or buoy must have the name of the fisher (first initial, last name) the address, and the name or AK number of the boat used to fish the pots. Phone numbers are also recommended.
2. Two vertical sides of all shrimp pots must be entirely made of webbing big enough to allow a 7/8-inch round wooden dowel to go through without stretching or otherwise deforming the opening. The two vertical sides must touch each other. The webbing on these two sides cannot be covered by anything. The other two sides, as well as the top and bottom, can be composed of any material. The 7/8-inch size allows undersized and juvenile shrimp to escape.
3. A pot with no definable sides, such as a round pot, must have 50% of its vertical surface area covered with the 7/8-inch webbing. The other 50% of the vertical sides, as well as the top and bottom, may be composed of any material.
4. The 7/8-inch requirement does not apply to the tunnels.

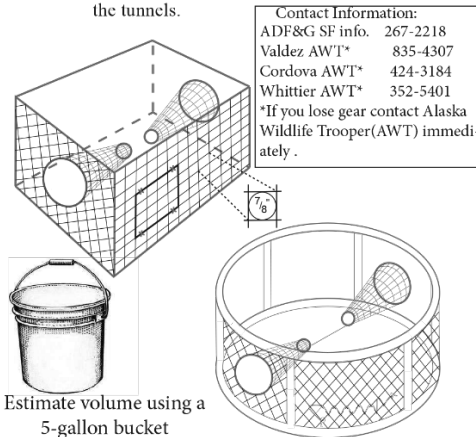
Summary of regulations	Sport	Subsistence
Alaska residency required?	No	Yes
Fishing license required?	Yes	No
Open season?	April 15 - September 15	
Bag limit?	none	
Number of pots allowed?	Per Emergency Order: Only 3 pots per vessel may be used to take shrimp in 2020	
Open areas?	All salt waters of PWS	All salt waters of PWS (except "Valdez non-subsistence area", see map above)
Can keep crab caught?	No	
Can keep finfish?	No	
Can keep octopus?	Yes	

Escape Mechanisms

Rigid mesh pots: Each pot must have an opening at least four (4) inches square with its lower edge within six (6) inches of and parallel to the bottom of the pot. This opening may be covered with a single panel secured with no more than four (4) single loops of 100% untreated cotton twine no larger than 30-thread. Each single loop of cotton twine may contain only one knot. Cotton twine fastenings may not be looped or laced along the edges of the opening. The panel must be attached in such a manner that when the cotton twine degrades the panel will drop away leaving the opening fully exposed.

Net mesh pots and pots with no definable sides: Each pot must have an opening at least six (6) inches long on one sidewall. The opening must be within six (6) inches from the bottom of the pot. The opening must be parallel to the bottom of the pot. To lace the opening together, you must use 100% untreated cotton twine no larger than 30-thread. Knots may be used only at each end of the opening, not in the middle. The twine cannot be tied to or looped around the web bars.

If a pot is lost, the 100% cotton twine will degrade and allow shrimp to escape.



Report harvest online at www.adfg.alaska.gov/harvest
 Final report must be received by October 15, 2020 - even if you did not fish.

Guide to reporting accurately:
 MM/DD = Month and Day shrimp gear deployed. Location= specific name of bay, canal, arm or fjord in P.W.S.
 Time soaked = The hours between when you dropped your gear to the time you check your gear.

Harvest must be recorded as you are actively shrimping on paper permit. Final reports can be submitted to ADF&G after each trip (online) or at the conclusion of the season (September 15).

Division of Sport Fish

David Rutz, Director

Region II Area Office
333 Raspberry Road
Anchorage, AK 99518



Alaska Department of Fish and Game

Doug Vincent-Lang, Commissioner

P.O. Box 115526
Juneau, AK 99811-5526
www.adfg.alaska.gov

Division of Sport Fish
Advisory Announcement

For Immediate Release

Issued: March 10, 2020

Contact: Jay Baumer, Area Management Biologist
(907) 267-2265; jay.baumer@alaska.gov

**Pots Reduced in the Prince William Sound
Sport and Subsistence Shrimp Fishery**

(Anchorage) - The Alaska Department of Fish and Game (ADF&G) is reducing the number of pots allowed per person and per vessel in the 2020 Prince William Sound (PWS) sport and subsistence shrimp pot fishery from five pots to three pots. The season is open from 12:01 a.m. Wednesday, April 15 through 11:59 p.m. Tuesday, September 15, 2020, with no bag limit. This seasons guideline harvest level (GHL) for the noncommercial (sport and subsistence) shrimp fishery is 102,100 pounds of shrimp.

“The noncommercial shrimp fishery is allocated 60% of the total allowable harvest limit, while the commercial shrimp fishery receives 40%,” stated Area Management Biologist Jay Baumer. “Even with only three pots, the noncommercial shrimp fishery still exceeded its guideline harvest level by approximately 800 pounds of shrimp last season. Therefore, in order to stay within this seasons GHL, the 2020 sport and subsistence shrimp fishery pot limits will remain the same as the 2019 season.”

The commercial shrimp fishery rotates every year between three separate areas in the PWS area. This season commercial shrimpers will be harvesting in Area 2 which is generally in the middle section of PWS. For additional information about the PWS commercial shrimp fishery areas, please review advisory announcement dated [March 5, 2020](#).

PWS sport and subsistence shrimp permits will be [available online](#) the last week of March. All participants are required to have a permit with them while shrimping. In addition, all permit harvest reports are due by October 15, 2020, regardless of whether you went shrimping or not. Participants may [report their harvest online](#) at any time, whether you have completed shrimping for the season or not. The total season’s harvest must be reported by the due date. Participants who report online with a valid email address will receive an emailed confirmation their harvest has been reported.

For additional information about the PWS sport shrimp pot fishery, please contact Area Management Biologist Jay Baumer in Anchorage at (907) 267-2265. For additional information about the PWS subsistence and commercial shrimp pot fisheries, please contact Area Management Biologist Jan Rumble in Homer at (907) 235-8191.

**APPENDIX B: REMINDER LETTER TO
NONRESPONDENTS**

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
Division of Sport Fish

Doug Vincent-Lang,
COMMISSIONER

333 Raspberry Road
Anchorage, AK 99518
907-267-2218

October 6, 2020

To: Recipient Mailing Address

From: Jay Baumer (Area Management Biologist) jay.baumer@alaska.gov

Brittany Blain (Assistant Area Biologist) brittany.blain@alaska.gov

Subject: 2020 Prince William Sound Area Non-Commercial Shrimp Permits

Our records show that you have not returned your 2020 Prince William Sound Shrimp permit. Even if you think you have returned your permit, it has not reached us. Please go to <https://www.adfg.alaska.gov/Harvest/> and enter your harvest data. Your permit number is: XXXXXX Please do not mail or drop off your paper permit to Alaska Department of Fish and Game offices.

Note that you must report on your permit even if you did not shrimp – be sure to check the “Did Not Fish” box on the harvest reporting webpage if this is the case. Failure to report may result in denial of your shellfish harvest privileges in the future. Please enter your harvest data online immediately.

If you have any questions, please email Area Management Biologist Jay Baumer or Assistant Area Management Biologist Brittany Blain for further assistance.

Sincerely,

Jay Baumer

Jay Baumer, Area Management Biologist
Anchorage/Prince William Sound/ North Gulf Coast
Division of Sport Fish