Regional Operational Plan No. ROP.SF.2A.2022.24

Operational Plan: Assessment of Pacific Halibut and Groundfish Sport Harvest in Southcentral Alaska, 2022–2024

by

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and

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May 2022

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
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

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	′
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	″
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

REGIONAL OPERATIONAL PLAN NO. ROP.SF.2A.2022.24

OPERATIONAL PLAN: ASSESSMENT OF PACIFIC HALIBUT AND GROUNDFISH SPORT HARVEST IN SOUTHCENTRAL ALASKA, 2022–2024

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May 2022

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SIGNATURE PAGE

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Approval

Title	Name	Signature	Date
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ABSTRACT

The Gulf of Alaska bottomfish port sampling project monitors age, size, and sex characteristics of Pacific halibut, several rockfish species, lingcod, and a few other species landed by sport anglers at the major ports in Southcentral Alaska. Data will be combined with harvest and effort estimates from Alaska Department of Fish and Game's Statewide Sport Fish Harvest survey as well as Charter Logbook data to assess trends, evaluate changes in stock status, and design regulations that protect stocks and provide for long-term sustained yield. Data will be shared with the International Pacific Halibut Commission, the National Marine Fisheries Service, the North Pacific Fisheries Management Council, the Alaska Board of Fisheries, and the public. Survey areas will include Kodiak, Homer, Deep Creek, Seward, Whittier, and Valdez.

Keywords: Pacific halibut, rockfish, lingcod, sport fishery, marine fishery, Southcentral Alaska

INTRODUCTION

PURPOSE

The goal of the Gulf of Alaska bottomfish port sampling project (GOAB) is to provide information needed for management of Pacific halibut (*Hippoglossus stenolepis*) and groundfish sport fisheries in accordance with the principle of sustained yield. Annual estimates of Pacific halibut sport harvest (by weight) are needed by the International Pacific Halibut Commission (IPHC) and North Pacific Fishery Management Council (NPFMC) to set harvest quotas for the upcoming year and evaluate the position of the charter harvest relative to the guideline harvest level. The data are also used by the NPFMC for analysis to address Pacific halibut allocation issues. Estimates of rockfish (*Sebastes* spp.) species composition are needed by the Alaska Department of Fish and Game (ADF&G) to apportion annual harvests by species, and corresponding harvest composition data are used to assess relative stock status and formulate management alternatives for consideration by the Alaska Board of Fisheries. Rockfish data are also shared with the Statewide Rockfish Initiative working group for species-specific harvest estimates and stock assessments. Harvest composition data from lingcod (*Ophiodon elongatus*) fisheries are needed to evaluate the effects of regulatory proposals and monitor relative changes in abundance and recruitment.

BACKGROUND

The Southcentral Region (Region II) of the Alaska Department of Fish and Game (ADF&G) Division of Sport Fish stretches from Prince William Sound westward through the Alaska Peninsula and the Aleutians. From 1996 to 2020, estimated annual Southcentral saltwater sport fishing effort of all species (including shellfish) averaged 483,000 angler-days and ranged from about 366,000 to 616,000 angler-days[1]. During this period, Southcentral sport fishing effort made up 48–60% of the Statewide saltwater effort in each year. A major portion of the Southcentral saltwater fishing effort is directed at Pacific halibut and state-managed groundfish, including rockfishes, lingcod, and sharks.

The need for data from the Southcentral saltwater sport fishery is underscored by increasing harvests, measured or perceived declines in spawning biomass of harvested fish, and increased competition among user groups. Changes in management of commercial halibut fisheries in state and federal waters are also expected to affect state-managed groundfish species. For example, beginning in 1995, the federal halibut "IFQ program," based on individual fishing quotas, allowed shareholders to take their quotas at any time during the extended open season and in any area. This

[1] Alaska Sport Fishing Survey database [Intranet]. 1996–2020. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (Cited March 9, 2020). Available from: https://intra.sf.adfg.state.ak.us/EstimatesQueryApp/.

caused a redistribution of commercial fishing effort from traditional offshore grounds in the Gulf of Alaska to waters closer to port that were historically fished primarily by the sport fishing fleet. Potential challenges for management include increased commercial harvest of other groundfish, such as rockfish and lingcod, and localized depletion of stocks, at least on a seasonal basis. Furthermore, recent restrictions in the charter halibut fishery may also result in increased harvest of rockfish and lingcod. All agencies and user groups involved in allocation conflicts and development of local area management plans will benefit from accurate data on these groundfish fisheries.

Species, age, and length composition are among the primary tools used to monitor and manage marine fish stocks. Sampling the harvest is often more cost-effective than fishery-independent surveys or tagging studies and can provide basic information for broad geographic areas. Although not a substitute for fishery-independent surveys of stock size, relative changes in these data can indicate environmental or fishery-induced changes in the composition of fish stocks (e.g., Hand and Richards 1991; Stanley 1991).

Pacific Halibut

Pacific halibut make up the majority of the sport groundfish harvest in the Southcentral Region. Pacific halibut harvest in the region has grown dramatically, increasing to a peak of 400,000 fish in 2007 (Figure 1). The 2020 harvest made up nearly 70% (in number of fish) of the statewide sport halibut harvest. Cook Inlet halibut fisheries based primarily in Homer, Ninilchik, Seldovia, and Anchor Point have accounted for 59–66% of the annual Southcentral harvest in the last 10 years (Figure 1).

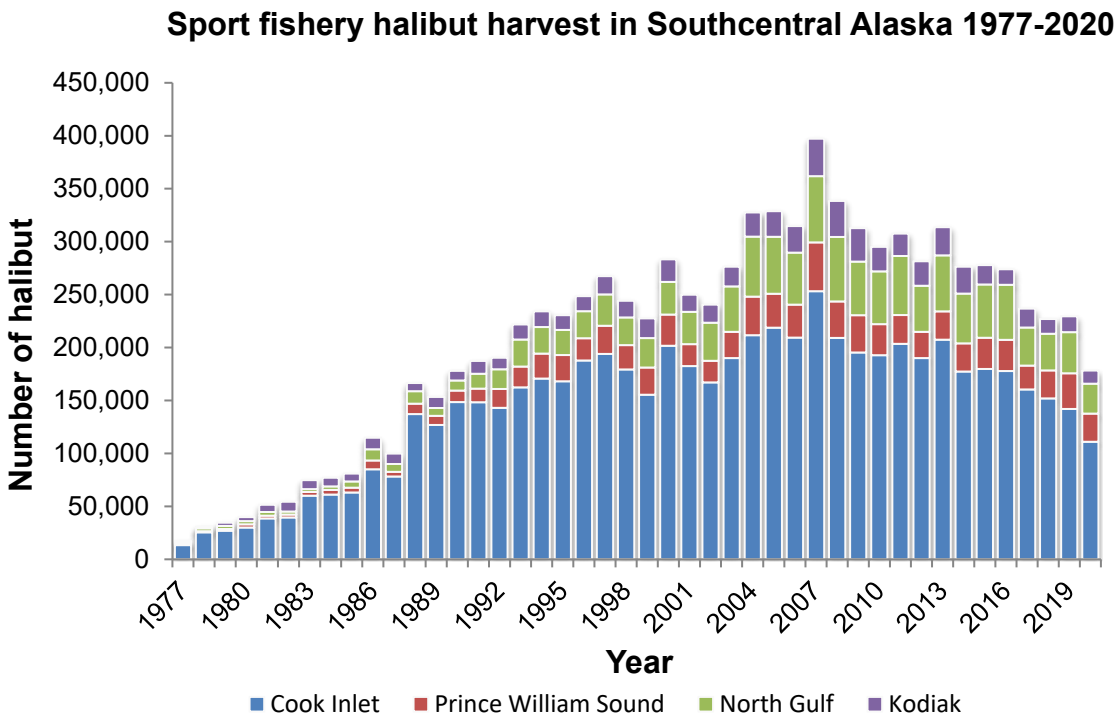

Figure 1.–Sport fishery Pacific halibut harvest in Southcentral Alaska by port of landing, 1977–2020.

Source: Alaska Sport Fishing Survey (SWHS) database [Intranet]. 1996–2020. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (Cited March 9, 20120. Available from: https://intra.sf.adfg.state.ak.us/EstimatesQueryApp/.

The 1953 Halibut Convention, as amended by the 1979 Protocol, mandates that the International Pacific Halibut Commission (IPHC) manage the stock based on optimum yield (McCaughran and Hoag 1992). The IPHC conducts research on Pacific halibut population dynamics throughout the range of the stock, establishes the harvest strategy, and sets allowable levels of harvest in each of the 10 regulatory areas. Regulatory Area 3A stretches from the west end of Kodiak Island to Cape Spencer and encompasses most of Southcentral and part of Southeast Alaska salt waters.

Over the years, sport harvest has grown unconstrained by catch quotas such as those placed on the commercial longline fishery. Individual fishing quotas (IFQs) were implemented for the commercial longline fishery in 1995, providing fishers a percentage share of the longline quota. Sport harvest was taken off the top of the total allowable harvest before the commercial quota was set. As a result, long-term increases in the sport harvest have caused allocation conflicts between commercial and sport user groups. Historically, the Area 3A sport charter fishery was managed under a guideline harvest level (GHL). If the GHL was exceeded, the North Pacific Fishery Management Council (NPFMC, or 'the council') could initiate a process to identify and implement control measures.

In April 2001, an attempt was made by the council to incorporate the Southcentral Alaska charter fleets into the existing IFQ program. The measure was intended to replace the GHL as a permanent solution to the allocation between the longline and charter halibut fleets. While the proposed IFQ incorporation was being considered, the GHL was exceeded from 2004 through 2007 with harvests equal to 100.5–109.6% of the GHL. In 2005, due to difficulties incorporating the charter fleet into the IFQ program, the council passed a motion containing a suite of alternatives for management of the charter fleet, including a moratorium, limited entry, direct allocation, and another IFQ program that incorporated recent fishery entrants. In March 2007, the council passed a motion to implement a moratorium (limited entry) on halibut charter boats. The moratorium was published in April 2009 and the final rule signed in January 2010. The moratorium permits, or Charter Halibut Permits (CHPs), were required as of 1 February 2011 for charter clients to catch and retain Pacific halibut.

In 2014, the council implemented a catch sharing plan (CSP) that would allocate Pacific halibut among the commercial and sport charter fleets and include annual management measures implemented preseason to keep the charter fishery within its allocation, thereby replacing the GHL program. The plan also allows charter operators to lease commercial IFQs within a season to provide additional fishing opportunity for clients, and these fish would count toward the commercial catch limit. The CSP allocates Pacific halibut between the commercial and sport charter sectors, establishes bag and size limits annually, and provides for additional harvest opportunity for the sport charter fleet through use of commercial IFQs.

Changes in Pacific halibut growth rates and exploitable biomass, changes in stock assessment procedures, and allocation conflicts all underscore the need for continuing halibut sport harvest monitoring by ADF&G.

Rockfishes

About a dozen species of rockfish are taken regularly in sport fisheries in Southcentral Alaska. Estimated harvest of all rockfish species combined has been increasing since the late 1990s, ranging from 22,000 fish in 1977 to a peak harvest of about 174,000 fish in 2019 (Figure 2). The North Gulf Coast fishery based in Seward has accounted for 32–46% of the Southcentral harvest

in the last 10 years. In recent years, rockfish harvest in Lower Cook Inlet, Prince William Sound, and Kodiak has also grown to represent a significant portion of Southcentral rockfish harvest.

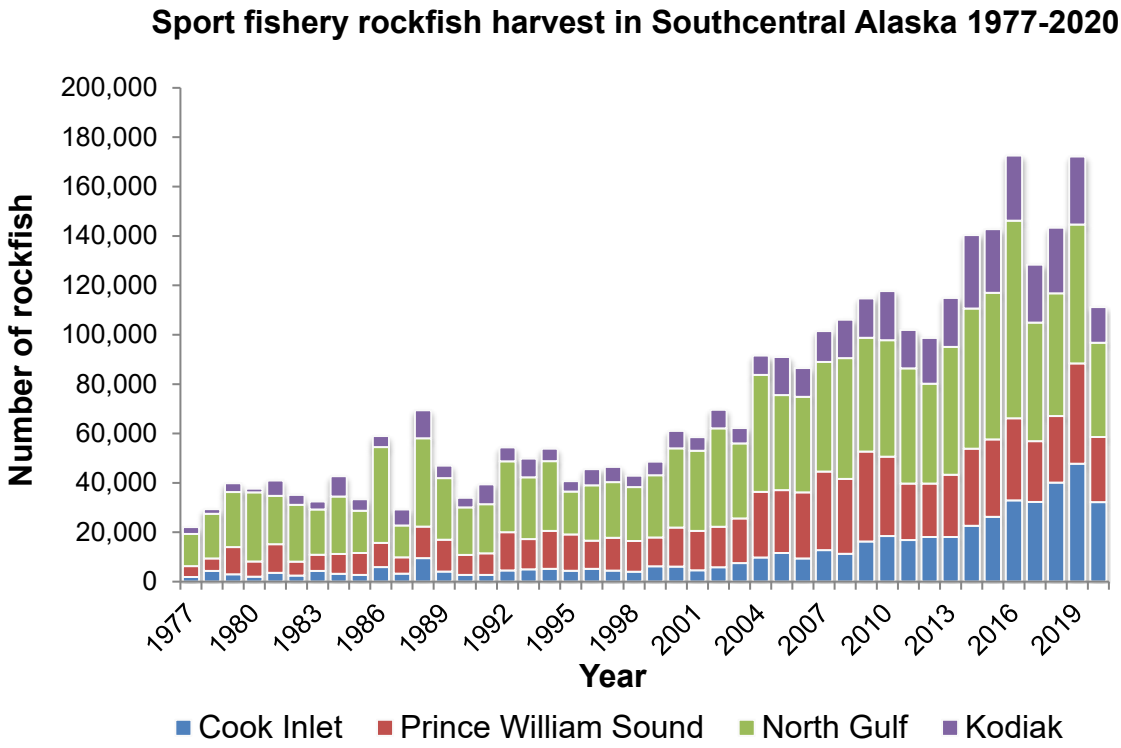

Figure 2.– Sport fishery rockfish harvest in Southcentral Alaska by port of landing, 1977–2020.

Source: Alaska Sport Fishing Survey (SWHS) database [Intranet]. 1996–2020. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (Cited March 9, 2020). Available from: https://intra.sf.adfg.state.ak.us/EstimatesQueryApp/.

Harvest estimates alone do not fully account for fishery removals. Rockfish swim bladders are physoclistous, or unvented. As a result, rockfish suffer decompression trauma when brought to the surface from depths in excess of 20 m (Parker et al. 2006; Hannah and Matteson 2007; Jarvis and Lowe 2008; Pribyl et al. 2009; Wilde 2009). However, recent research by Hochhalter and Reed (2011) suggests that release at depth of capture (recompression) can substantially improve survival rates of yelloweye rockfish. An estimated 57,000–93,000 rockfish have been caught and subsequently released annually in Southcentral Alaska in the last 10 years[2]. The GOAB program has collected information on the depth and distribution of rockfish caught and released since 2007 to estimate discard mortality. Even though the species composition and survival of released rockfish is currently unknown, total mortality is higher than just the harvest estimates.

In recent years, commercial rockfish removals have been less than the sport harvest in the Cook Inlet and Prince William Sound areas (state waters from Cape Douglas to Cape Suckling) and have ranged from about 116,000 to 305,000 lb for black and yelloweye during the recent 5-year period (2017–2021; E. Russ, Fishery Biologist, ADF&G, Division of Commercial Fisheries, Homer, personal communication, and unpublished ADF&G data). Estimates of the corresponding total sport removals for black and yelloweye rockfish, including estimates of released fish that have

[2] Alaska Sport Fishing Survey database [Intranet]. 1996–2020. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (Cited March 9, 2020). Available from: *https://intra.sf.adfg.state.ak.us/EstimatesQueryApp/*.

died, ranged from about 522,000 to 720,000 lb during 2017–2019 (M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, preliminary unpublished estimates).

Increasing harvest and the lack of stock assessment information have long caused concern for the long-term sustainability of rockfish stocks throughout the Gulf of Alaska (Howard et al. 2019a; Howard et al. 2019b). There is no available time series of fishery-independent indices of rockfish abundance for state-managed species. Available life history data (e.g., Francis 1985; Leaman 1991), as well as numerous case histories from Alaska, British Columbia, Washington, Oregon, and California point to the ease of overexploitation and the difficulty of managing for sustained yield (Bracken 1986, 1989; Parker et al. 2000; Yamanaka and Lacko 2001). Many rockfishes are long-lived, attain harvestable size before reaching sexual maturity, and show a high degree of fidelity to reefs and other rocky habitats. Commercial and sport fisheries typically develop rapidly, harvest more than the annual surplus production, and deplete the standing stock before it is evident in the available data. Current stock levels and virgin (unfished) biomass have not been estimated.

Because of the lack of information on rockfish stocks, the sport fishery has been managed using only bag limits. It is unknown whether the bag limits, combined with management measures for commercial and subsistence fisheries, are adequate to maintain these fisheries for the long term. Furthermore, the decline in Pacific halibut stocks, implementation of limited entry for charter halibut boats, and restrictions on charter halibut anglers appears to have resulted in increased targeting of rockfish by charter operators as a way to increase angling opportunity under variable harvest restrictions.

Lingcod

Division of Sport Fish Statewide Harvest Survey (SWHS) estimates of lingcod sport harvest have only been available for the entire Southcentral Region since 1991. Annual harvest gradually climbed throughout the 1990s and then increased abruptly to about 25,000 fish in 2007 (Figure 3), which coincides with an increase in angler effort during that year. Lingcod harvest in most areas was high through 2010, after which fewer lingcod were harvested in each of the following years, except for 2018–2020, when harvest increased slightly.

The sport fishery is the primary source of removals in nearshore waters. Preliminary estimates of lingcod sport harvests of the Cook Inlet and Prince William Sound areas (Cape Douglas to Cape Suckling) ranged from about 154,000 to 657,000 lb during the period 1992–2014 (Scott Meyer, Fishery Biologist Retired, Division of Sport Fish, Homer, preliminary unpublished estimates; no estimates are available after 2014). Commercial harvest in the same area and period ranged from 26,000 to 154,000 lb (Berceli et al. 2002; Trowbridge et al. 2008; C. Trowbridge, Fishery Biologist, ADF&G, Division of Commercial Fisheries, retired, and E. Russ, Fishery Biologist, ADF&G, Division of Commercial Fisheries, Homer, personal communications). Thus, the sport fishery in state and federal waters of the Cook Inlet and Prince William Sound areas accounted for 83–93% of the combined sport and commercial harvests from 2005 to 2014. A similar situation exists in Kodiak. Sport harvest in Kodiak has ranged from 13,000 to 92,000 lb per year since 1992. Commercial harvest since 1992 has ranged from 3,900 to 67,000 lb (Ruccio et al. 2003; Sagalkin et al. 2009; Stichert et al. 2011).

The North Gulf Coast lingcod fishery based in Seward was historically the most important lingcod sport fishery in the region. During the early period of the GOAB program, ADF&G noted a lack of recruitment in the sport harvest (based on length distribution). In addition, anecdotal reports of declining abundance in Resurrection Bay were substantiated with an ADF&G survey in 1992. In

response, the Alaska Board of Fisheries enacted reduced bag limits, a minimum size limit, closed seasons, and closed waters in 1993 for the Cook Inlet–Resurrection Bay area. Some of these regulations were extended to the Prince William Sound, Kodiak, and Aleutian Islands areas in subsequent years as a precautionary approach to provide long-term sustainability to these fisheries. Despite these regulations, lingcod harvest almost doubled from 2003 to 2010 and has steadily decreased through the present day. The reason for these fluctuations in harvest are unknown and warrant a precautionary approach to lingcod management in the future.

The status of lingcod stocks throughout the region is unclear. There is no long-term survey to provide a fishery-independent index of abundance; there are only relative measures based on port sampling or charter logbook data. Current assessment efforts are focused on using historical age, size, and sex composition, along with catch rates from the fishery or catch rates from other agency surveys to assess stock status. The current management approach is to structure the regulations to maximize reproductive effort and protect males during the nest-guarding season. Regulations include a minimum size limit and seasonal closure during the nest-guarding season. As with rockfish, lingcod harvest could increase with evolving restrictions on the halibut charter industry.

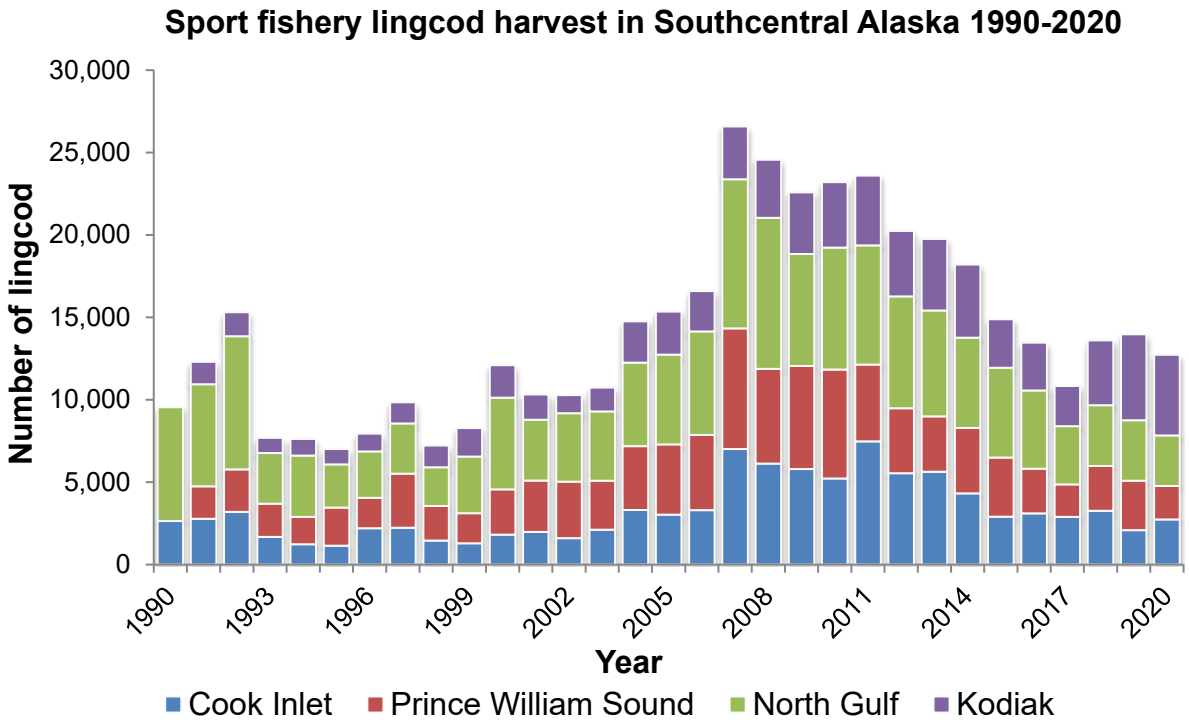

Figure 3.–Sport fishery lingcod harvest by area in Southcentral Alaska by port of landing, 1991–2020.

Source: Alaska Sport Fishing Survey (SWHS) database [Intranet]. 1996–2020. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (Cited March 9, 2020). Available from: https://intra.sf.adfg.state.ak.us/EstimatesQueryApp/.

OBJECTIVES

PRIMARY OBJECTIVES

1) Estimate the mean weight of Pacific halibut taken by each user in each area of Southcentral Alaska (Kodiak, Lower Cook Inlet, Central Cook Inlet, North Gulf Coast, Eastern Prince William Sound, and Western Prince William Sound), such that the mean weight estimates for each user group in each area are within 0.20 of the true mean weight at least 90% of the time.
2) Estimate the length composition of the Pacific halibut harvest by area such that the estimated proportions are within 0.20 of the true proportions at least 95% of the time.
3) Estimate the species composition by port of the rockfish harvest landed at Kodiak, Homer, Seward, Whittier, and Valdez during May through September such that the estimated proportions of each species are within 0.20 of the true proportions at least 95% of the time.
4) Estimate the age, length, and sex composition by port of the principal rockfishes landed at Kodiak, Homer, Seward, Whittier, and Valdez during May through September such that the estimated proportions are within 0.20 of the true proportions at least 95% of the time.
5) Estimate the age, length, and sex composition by port of the lingcod harvest landed at Kodiak, Homer, Seward, Whittier, and Valdez during July through September such that the estimated proportions are within 0.20 of the true proportions at least 90% of the time.

SECONDARY OBJECTIVES

1) Identify differences in the geographic distribution of groundfish effort and harvest between user groups and across years for each port during May through September.
2) Estimate the proportion of the Pacific halibut harvest that was cleaned (and carcasses discarded) at sea at each port. These estimates will be used to stratify length and weight estimates at ports where cleaning at sea is prevalent.
3) Estimate the proportions of released Pacific halibut that were caught on circle hooks versus other types of hooks at each port. This information is needed to refine estimates of halibut release mortality in the sport fishery.
4) To refine discard mortality estimates, gather data on the depths of capture for pelagic and nonpelagic rockfish that were released.
5) Estimate the proportions of released lingcod that were of sublegal (under 35 inches total length) and legal size (35 inches and greater) for ports with a minimum size limit regulation. These data will provide information on future recruitment and abundance indices used for future stock assessments.
6) Biological data will be collected from salmon sharks (*Lamna ditropis*), Pacific sleeper sharks (*Somniosus pacificus*), and spiny dogfish (*Squalus acanthias*) harvested in the sport fishery in order to estimate the age, length, sex composition, and spatial distribution of the harvest. No sampling objectives are established for sharks because harvests are too small to generate reliable estimates for any given year. It is expected that age, length, and sex data will be compiled across a number of years and combined with commercial harvest sampling and other research programs to estimate life history parameters.

7) In addition to recording the primary statistical area fished, interviews conducted at Seward will include recording whether the anglers fished inside or outside Resurrection Bay (north or south of a line from Cape Aialik to Cape Resurrection). This information will only be collected from anglers that report fishing a statistical area that overlaps the bay boundary. This information is needed for evaluation of lingcod catch rates to address potential regulatory proposals dealing with opening of Resurrection Bay to lingcod fishing.

METHODS

STUDY DESIGN

Six port or beach launch areas are sampled to represent the 6 major SWHS areas within the central Gulf of Alaska (Table 1). These ports generally account for over 90% of halibut, rockfish, and lingcod landings in Southcentral Alaska[3]. A single technician will be assigned to each port. Sampling at each port will be conducted at harbors, boat ramps, beach launching sites, and military recreation facilities. Data collection will begin between early May and early June and end between mid-August and early September.

Table 1.–Ports or beach areas that will be sampled within the Southcentral Region in 2022–2024.

Port or beach area	SWHS estimate area
Kodiak (city)	Kodiak
Homer	Lower Cook Inlet
Deep Creek	Central Cook Inlet
Seward	North Gulf Coast
Whittier	Western Prince William Sound
Valdez	Eastern Prince William Sound

Sampling will consist of 2 primary components:

1) biological sampling for species, size, age, etc. (Primary Objectives 1–5)
2) angler interviews to estimate the geographic distribution of effort and harvest at all ports (Secondary Objective 1), the proportion of the charter-caught halibut harvest that was cleaned and discarded at sea at each port (Secondary Objective 2 and needed for Primary Objectives 1–2), and other fishery information (Secondary Objectives 3–7)

At all ports but Kodiak, biological and interview sampling will be conducted on separate days. This separation of data collection is more efficient for gathering each type of information. Biological sampling and interviews will be conducted simultaneously at Kodiak because effort and harvest are low compared to other ports so both tasks can be handled simultaneously. Whittier was sampled under this methodology through the 2008 season; however, fishing effort has increased to the point that biological and interview days need to be separated for sampling efficiency.

A randomized work schedule will be used to avoid bias of any parameters related to user group and to avoid bias in estimation of the spatial distribution of effort and harvest. Five workdays per week will be selected at random subject to the constraint that 2 days off must be consecutive. At all ports but Kodiak, 3 biological sampling days and 2 interview days per week will be selected at

[3] (Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited May 2020]. Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/).

random such that each type is distributed proportionally between weekends and weekdays. Holidays will be given no special treatment in terms of sampling effort.

During 2003–2005, estimated mean weight of harvested halibut was often highly variable from month to month for each user group, and there was no consistent pattern from year to year (S. C. Meyer, Assessment of recreational halibut and groundfish harvest in Southcentral Alaska, unpublished ADF&G operational plan FY2007). Possible explanations for the variability in mean weight by month include the following: 1) small sample sizes, particularly in May and September, 2) sampling the harvest from too few boats, 3) variation in the availability or catchability of certain size groups, or 4) temporal changes in the spatial distribution of the harvest. The variability is likely due to a combination of these factors.

Variability in mean weight does not result in biased estimates if the sample size over time is proportional to the magnitude of harvest. However, if a temporal component of the harvest is disproportionately sampled, and the mean weight during that period is especially high or low, estimates of mean weight for the season could be biased. Neither the SWHS nor onsite interviews from this project provide the information needed to estimate temporal patterns of harvest by charter or private anglers, but the ADF&G charter logbook program does provide information on effort. The 2006 and 2007 port sampling operational plans (S. C. Meyer, Assessment of recreational halibut and groundfish harvest in Southcentral Alaska, unpublished ADF&G operational plans FY2007, FY2008) compared unstratified and stratified estimates (stratified by month with logbook data for stratum weights) and found no differences for 2002–2006.

The practice of cleaning fish at sea also poses a risk of bias in the estimation of halibut statistics. This issue is more crucial when obtaining fish from the charter fleet because charters tend to clean and dispose of a higher percentage of carcasses from their catch at sea than unguided anglers (Table 2). In the past, some charter operators have cleaned smaller halibut at sea and returned to the dock with only the larger fish for photos or derby weigh-in. At most ports, when charter operators do clean at sea, they tend to clean all the fish as a matter of convenience (Table 3). Private anglers in Whittier also clean most of their fish at sea because they are on small boats and often make overnight or multi-day trips. When only smaller fish are cleaned at sea, sampling only the fish brought to shore can bias length and weight estimates toward larger fish and could bias sex ratio estimates in favor of females. When all or nearly all fish are cleaned at sea, there is little bias as long as anglers that clean their halibut in the harbor are no more likely to catch smaller or larger fish than anglers that clean at sea. Technicians at all ports will attempt to convince charter operators and other anglers that clean all their fish at sea to return the carcasses to port for sampling.

Table 2.–Estimated percentages of the Pacific halibut harvest cleaned at sea, by port, during the period 2019–2021.

Port	User group	Percentage of halibut harvest cleaned at sea 2019	2020	2021
Kodiak	Charter	0%	2%	0%
	Private	6%	6%	1%
Homer	Charter	62%	65%	68%
	Private	29%	41%	4%
Seward	Charter	28%	58%	54%
	Private	15%	17%	26%
Whittier	Charter	54%	79%	68%
	Private	72%	63%	71%
Valdez	Charter	0%	0%	0%
	Private	0%	0%	2%

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

Table 3.–Estimated percentage of Pacific halibut cleaned at sea by charter users on trips where cleaning at sea occurred, presented by port for 2019–2021.

Port	Percentage of charter halibut harvest cleaned at sea for boats where cleaning at sea occurred 2019	2020	2021
Kodiak	–	–	–
CCI	99%	94%	100%
Homer	98%	100%	98%
Seward	98%	98%	99%
Whittier	100%	100%	98%
Valdez	–	–	–

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

Note: An endash indicates no boats cleaned at sea.

Design by Port

Kodiak

The city of Kodiak is the only population center with an appreciable level of halibut or groundfish sport harvest in the Kodiak area. The port of Kodiak accounted for about 50% of the Pacific halibut harvest, 68% of the rockfish harvest, and 60% of the lingcod harvest by sport anglers in the Kodiak area in 2014[4]. The remainder came from outlying areas such as Larson Bay, Old Harbor, and Port Lions, which are places where it is impractical to implement a sampling program. Harvest landed at Kodiak is therefore assumed to represent the entire area.

Biological sampling and angler interviews will be conducted between 1430 hours and 2130 hours at St. Paul's Harbor, St. Herman's Harbor (Dog Bay), and the U. S. Coast Guard Base. These hours have captured the majority of returning anglers in past years. The distance between the 3 harbors is too great to intercept all returning anglers. Starting at approximately 1430 hours, the technician

[4] Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited May 2020]. Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

will begin sampling at the initially assigned area then rotate systematically through the 3 sites in a predetermined order. The technician will stay at each site long enough to interview returning anglers and sample available fish. Each site is visited 2–3 times per day on average using this scheme.

In recent years, many of the Kodiak charter skippers have delivered their clients' sport-caught fish directly to 2 processing facilities, making it difficult to obtain samples. Sampling was conducted at both processors from 2005 through 2007 and again from 2009 through 2011. In 2008 and from 2012 to present, only 1 processing facility has processed sport-caught fish. The technician will interview these charter skippers in the harbor and may follow up with sampling later, at the convenience of the processor. Scheduling may have to be adjusted to accommodate this. This type of sampling is neither systematic nor random. Therefore, the technician will attempt to make the sample representative by allocating sampling effort among charters that do and do not use this processor in proportion to their share of the charter harvest. No portion of the daily harvest of a species category (halibut, lingcod, rockfish, sharks) from any one boat will be sampled unless all fish or cleaned carcasses of that species are returned to port.

Homer

There are numerous exit points in the Lower Cook Inlet fishery, including the communities of Homer, Seldovia, Nanwalek, and Port Graham, as well as several hundred private docks along the south side of Kachemak Bay from Bear Cove to Kasitsna Bay (ADF&G 1993: page A-37). Because it would be cost-prohibitive to sample all exit points, the fishery will be sampled only at the major access point—the city harbor on the Homer Spit (Figure 4).

Biological sampling will generally start at 1400 hours, but the technician will be free to begin sampling earlier on weekends or on bad weather days to intercept the majority of landings. The harbor and associated facilities cover a large area, making it difficult to distribute sampling effort in a representative manner across both user groups (charter and private). When sampling fish that are cleaned in port, the technician will spread sampling effort between the public fish cleaning stations at Ramps 4 and 6 (Figure 4), boats cleaning fish on deck, the boat ramp, the fish-cleaning table near the salmon enhancement lagoon, and numerous charter cleaning facilities in an effort to allocate the samples throughout the day's landings. Emphasis will be placed on obtaining data from private-caught fish because of their lower availability. Ideally, due to the high volume of charter-caught fish, approximately 4 to 5 charter boats would be randomly selected from a list of all known charter boats for biological sampling each day. However, the reality of sampling in the dynamic atmosphere of a harbor makes this problematic because upon arriving at the dock, the sampler may find any of the following scenarios: 1) none of those boats have gone out that day, 2) some have already returned and cleaned all or a portion of their harvest, or 3) all returned at once, forcing a sampler to choose a single boat from amongst that list. Instead, the sampler will systematically move through the cleaning locations (cleaning tables, charter offices, and the boats that clean fish on their decks) to obtain samples. Sampling will also be distributed between private and charter-caught fish throughout the shift to spread samples over time and avoid selecting for early or late-returning boats.

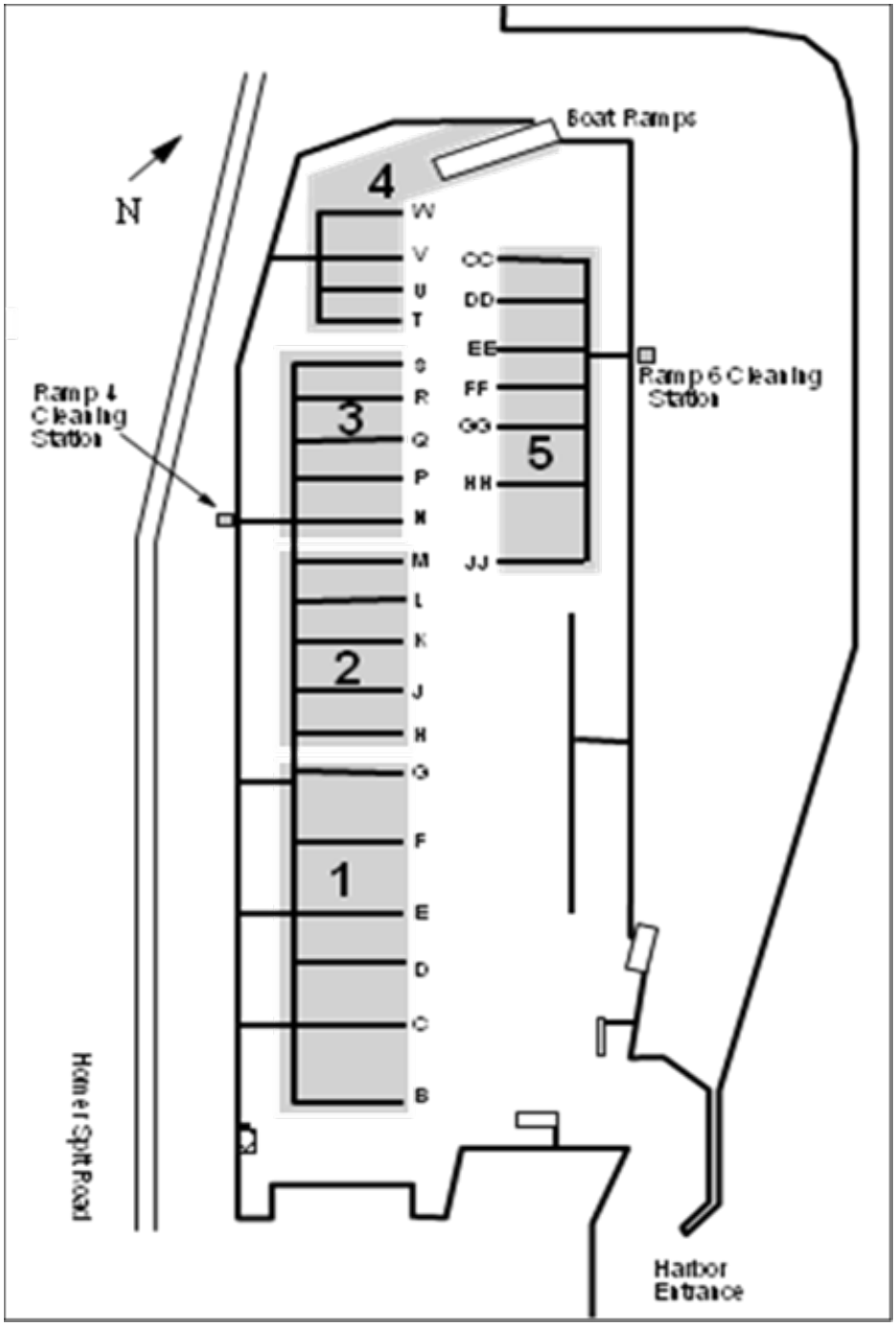

Figure 4.–Homer harbor interview areas.

About 65% of the halibut caught by charter anglers in Homer during the last 3 years were cleaned at sea (Table 2). The estimated mean weights (from a weight–length relationship) of halibut cleaned at sea versus halibut cleaned in port were significantly different in all years after 2003 (Table 4). Because there are potential differences in mean weight, halibut cleaned at sea will be sampled from Homer charter boats that have indicated in past interviews that they clean fish at sea. On the day before each biological sampling day, the technician will select up to 3 charter boats from a randomized list of charter boats that clean halibut at sea and request the skipper to retain

all carcasses of fish cleaned at sea the following day. This arrangement should minimize inconveniences to the charter operations and provide adequate data to detect and correct for this potential bias. These fish will only be sampled if all harvested fish from a boat are available to be sampled.

Interviews will be conducted during 1200–1900 hours. The Homer harbor is too large and effort is too great to obtain interviews from all returning boats. The harbor is therefore divided into 5 areas, and interviews will be conducted for 1 hour in each area (Figure 4). The initial order of areas is assigned randomly then "rotated" systematically, repeating areas sampled each day in order to fill out a 7-hour shift. Under this design, all areas and hours will receive equal sampling effort during the season. Because boats may offload in one area and tie up in another, the technician will contact and obtain interviews from boats tying up or offloading in the assigned area, unless previously interviewed.

Table 4.–Estimated mean weights and results of *t*-tests comparing Pacific halibut cleaned at sea versus those cleaned in port at Homer, 2001–2021.

	Cleaned in port		Cleaned at sea				
Year	Mean weight (lb)	*n*	Mean weight (lb)	*n*	*t* value [a]	*P* value	df
2001	21.2	511	19.3	161	1.74	0.084	418
2002	20.3	547	17.7	120	1.90	0.059	240
2003	21.7	643	21.8	147	–0.11	0.915	268
2004	21	1,224	16.7	169	5.54	<0.001	427
2005	18.8	1,078	14.1	158	5.36	<0.001	485
2006	18.3	906	16.3	165	2.60	0.010	404
2007	19	707	12.5	254	8.31	<0.001	939
2008 [b]	17.6	430	13.6	–	–	–	–
2009	18.6	236	11.1	95	6.19	<0.001	329
2010	17.9	345	12.5	108	4.21	<0.001	238
2011	17.1	940	13.8	193	4.16	<0.001	457
2012	14.7	869	10.0	271	6.63	<0.001	1,036
2013	14.5	786	8.4	206	8.67	<0.001	958
2014	10.9	1,171	8.5	319	3.95	<0.001	1,488
2015	12.6	872	7.7	350	9.80	<0.001	1,218
2016	12.3	913	8.9	487	5.54	<0.001	1,383
2017	11.6	474	7.9	378	5.47	<0.001	812
2018	10.8	494	7.7	538	4.77	<0.001	741
2019	11.1	522	8.9	717	4.30	<0.001	1237
2020	14.6	697	11.2	680	5.33	<0.001	1375
2021	12.9	386	10.0	408	4.02	<0.001	792

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

[a] Satterhwaite approximate *t* used when variances were unequal.

[b] Cleaned at sea (CAS) mean weight based on double exponential projection of 1994–2007 data due to no CAS samples obtained after June in 2008.

Deep Creek and Anchor Point

The Central Cook Inlet fishery is primarily a halibut and salmon fishery, with any additional groundfish harvest consisting mostly of Pacific cod. The beaches near the mouths of Deep Creek and the Anchor River are the primary access areas and account for most of the halibut landings from the Central Cook Inlet fishery. Currently, we do not have funding to employ a full-time

sampler for Deep Creek and Anchor Point. Instead, the Homer sampler will cover Deep Creek twice per week on an opportunistic basis, collecting charter halibut biological data to fulfill Primary Objectives 1 and 2. The harvest for Anchor Point is low relative to Deep Creek so Anchor Point will not be sampled until additional funding is available. On days when the Homer sampler is in Deep Creek, project leaders will sample in Homer. Neither interviews nor rockfish, lingcod, or other groundfish sampling will be carried out in Deep Creek.

Biological sampling will primarily be conducted at charter offices and private cleaning tables. The first portion of each shift will be spent on the beach sampling fish or finding out where private anglers or charter boats will be transporting their fish for cleaning. Anglers usually leave the beach immediately to clean fish at charter facilities or other sites located away from the beach. Sampling harvest at the tractor-launch facilities is impractical because it detains boats and disrupts the flow of traffic. Sampling at the boat ramps also requires climbing aboard large boats on trailers, and fish are often in totes or holds and cannot be laid out for sampling. Most of the sampling, therefore, will be at charter cleaning facilities, RV parks, and campgrounds where fish are cleaned. Prior to sampling, the technician will determine whether all fish from the trip are available for sampling. If some of the harvest was cleaned at sea and those carcasses discarded, those fish will not be sampled.

If funding becomes available to employ a Central Cook Inlet sampler during this project's operational period, the methods outlined in the rest of this section will be used. A single dedicated technician will cover both the Deep Creek and Anchor Point access points such that sampling effort will be allocated in a way that is representative of the size and spatial distributions of the harvest in the Central Cook Inlet fishery.

Analyses of recent data (2010–2019) show that for charter anglers, there are differences in mean weight of harvested halibut between the Deep Creek and Anchor Point sites in most years and a significant difference every year in the spatial distribution of halibut harvest for both charter and private anglers (Table 5).

The possibility of differences in either the mean weight or spatial distribution of the harvest makes it prudent to distribute interview effort and biological sampling between the two sites such that the resulting harvest reported in interviews and biological samples are proportional to harvest at the two sites. Determining the appropriate allocation of sampling effort is problematic for the following reasons: 1) estimates of the overall sport harvest are not available for Deep Creek and Anchor Point separately, 2) sampling efficiency differs by site, 3) sampling efficiency differs by technician, and 4) the distribution of harvest between sites is dynamic. In 2002 and 2003, staff observed that more of the Ninilchik-based charter operators that normally launch at Deep Creek were launching at Anchor Point to reduce running time on the water and to save fuel. In addition, the Deep Creek boat launch was washed out by floods in 2002, which reduced access particularly for unguided boats. The loss of the Deep Creek boat ramp and a decrease in the number of private boats launching off the beach south of the tractor launch allowed increased sampling on the tractor launch, increasing interview sampling efficiency at Deep Creek.

Because charter harvest data are available from guide logbooks for the 2 sites separately (1998–2001 and 2006–2018), allocation of sampling effort has been based on relative levels of reported charter harvest. It is assumed that sampling efficiency for the charter and private fisheries is similar and that a sample that is representative of the charter harvest will represent the private harvest adequately. Logbook data for 2014 indicated 74% of the charter harvest (number of fish) was

attributed to Deep Creek versus Anchor Point. Similarly, 78% of the halibut harvest reported in interviews and 77% of the biological samples were from Deep Creek rather than Anchor Point in 2014. Since 2006, the proportion of the logbook charter harvest reported for Deep Creek has averaged 72%. Based on this information, 70% of interview effort will be allocated to Deep Creek.

Table 5.–Tests for differences in mean weight and spatial distribution of Pacific halibut harvest by charter and private anglers between the Deep Creek and Anchor Point sampling sites, 2010–2019.

		Charter			Private		
Test	Year	Test statistic	df	*P* value	Test statistic	df	*P* value
t test for differences in mean weight between Deep Cr. and Anchor Pt.	2010	−5.84	302	<0.01	1.50	105	0.14
	2011	−4.17	348	<0.01	−0.43	227	0.67
	2012	−4.27	164	<0.01	1.27	221	0.21
	2013	−3.26	74	<0.01	−0.12	203	0.91
	2014	0.95	175	0.34	1.47	184	0.14
	2015	−4.82	108	<0.01	0.12	164	0.91
	2016	–2.11	32	0.04	2.59	267	0.01
	2017	–2.64	136	<0.01	3.23	247	<0.01
	2018	–1.28	168	0.20	–1.28	252	0.2
	2019	1.59	588	0.11	2.99	364	<0.01
Chi-square contingency test for differences in spatial distribution (proportion by statistical area) between Deep Cr. and Anchor Pt.	2010	103	5	<0.01	201	6	<0.01
	2011	360	10	<0.01	600	8	<0.01
	2012	450	7	<0.01	170	7	<0.01
	2013	94	8	<0.01	212	6	<0.01
	2014	496	9	<0.01	230	8	<0.01
	2015	29	5	<0.01	275	6	<0.01
	2016	515	5	<0.01	127	5	<0.01
	2017	240	7	<0.01	84	6	<0.01
	2018	149	6	<0.01	174	6	<0.01
	2019	177	8	<0.01	113	6	<0.01

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

Between 1994 and 2004, the sampling design for this fishery was based on data from 1993 that showed that the majority of boats exited the fishery during the 6-hour period following high tide (S. C. Meyer, Assessment of recreational halibut and groundfish harvest in Southcentral Alaska, unpublished ADF&G operational plan FY1995). In the mid-1990s, many of the boats were launched off the beach or the boat ramps at high tide using personal vehicles. Since then, the boat ramp at Deep Creek has washed out and commercial tractor launching facilities have become well developed. Most charter and private boats now use the commercial tractor facilities and can launch on any tide stage. In 2005, the sampling schedule was changed based on information from charter operators and the tractor launch operator. The changes were made to intercept a greater proportion of returning boats. The schedule now accounts for seasonal changes in the hours of operation of the tractor launches, the approximate 1.5-hour delay between the published tide times and actual slack tide in the center of Cook Inlet, and the changed pattern of use at Anchor Point.

The work shift at Anchor Point will be 1200–1800 hours, regardless of tide. Biological sampling and interviews at Deep Creek will still be structured around tides, but based on the following rules that correspond with hours of operation of the tractor launch; sampling will target high slack tide if it falls within 0330–1630 hours before 24 July, or within 0430–1630 hours from 24 July to 6

August, or within 0530–1630 hours after 6 August. If high slack tide does not meet these criteria, sampling will target low slack tide. If the tide is before 0630 hours, the shift will start at 1000 hours. If the tide is after 1430 hours, the shift starts at 1500 hours. For all other tides, if the tide is in the first half of the hour, the shift starts 2 hours after the hour of the tide. If the tide is in the last half of the hour, the shift starts 3 hours after the hour of the tide.

Biological sampling will be carried out as stated previously under the current funding.

Seward

Biological sampling will be conducted at the Seward harbor and at the Army recreation camp. Biological sampling shifts will start at 1500 hours but may be adjusted in season to maximize sampling efficiency. The proportion of halibut cleaned at sea increased in 2020 and 2021 compared to 2019 (Table 2), and when halibut are cleaned at sea, nearly all harvested halibut are processed at sea (Tables 3). Mean weights for halibut harvested in Seward are significantly different for fish cleaned at sea vs. fish cleaned in port (Table 6) so charter operators that regularly clean halibut at sea will be asked to retain carcasses for sampling. A species, or species group, will only be sampled if all fish or cleaned carcasses of that species are returned to port.

Table 6.–Estimated mean weights and results of *t*-tests comparing Pacific halibut cleaned at sea versus those cleaned in port at Seward, 2020–2021.

	Cleaned in port		Cleaned at sea				
Year	Mean weight (lb)	*n*	Mean weight (lb)	*n*	*t* value [a]	*P* value	df
2020	17.90	1,237	12.83	316	4.81	<0.001	1,551
2021	15.84	1,166	10.92	417	5.64	<0.001	1,581

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

[a] Satterhwaite approximate *t* used when variances were unequal.

Technicians will disperse sampling effort between the public fish cleaning stations, boat ramps, and Army camp cleaning facilities such that data are drawn from throughout the day's landings. Emphasis will be placed on contacting and obtaining data from private boats because of their lower success rates and generally smaller catches per vessel-trip. Sampling will be alternated between cleaning sites throughout the shift to spread samples over time and to avoid selecting for early or late returning boats.

Angler interviews will utilize a design and schedule like that used in Homer. Interviews will be conducted in the Seward harbor from 1400–2100 hours. The harbor will be divided into 4 areas (Figure 5) and interviews will be conducted for approximately 1 hour (minus travel time) in each area. The order in which areas are sampled is assigned randomly and shifted systematically to apportion sampling effort equally among areas. Military vessels will be interviewed in Zone 3 (Figure 5) where they offload their fish before transport to the Army recreation camp.

Figure 5.–Seward harbor interview areas.

Whittier

All interview and biological sampling for Western Prince William Sound will take place in the Whittier harbor. Prior to 2009, biological sampling and interviews were conducted concurrently. Beginning in 2009, interviews and biological sampling were conducted on separate days. Interviews and biological sampling will be conducted during the period 1500–2200 hours. Interviews will be conducted throughout the Whittier harbor on scheduled interview days. The technician will attempt to interview all returning boats during this period. During lingcod season, lingcod samples will be collected on both biological sampling and interview days. To optimize the amount of data collected, the technician may have to focus on gathering interview data and storing fish carcasses during this period. For example, carcass buckets may be assigned to specific boats, or fish will be labeled with stat area and user group information for biological sampling later in the shift.

The proportion of halibut harvest that is cleaned (and carcasses disposed of) at sea by both charter and private boats out of Whittier is relatively high (Table 2), and when halibut are cleaned at sea, nearly all of the harvested halibut are processed at sea (Table 3). Mean weights for harvested halibut in Whittier are significantly different for fish cleaned at sea vs. fish cleaned in port so

charter operators that regularly clean halibut at sea will be asked to retain carcasses for sampling (Table 7). Data collected since 2011 indicate that rockfish and lingcod are also cleaned at sea in relatively high proportions (M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data). Many private boats go out on overnight or multiple-day trips and clean or eat their catch before returning to the harbor. Fish cleaning tables were installed in the harbor in 2002, but they are inadequate to handle the demand and there are sometimes long waits for tables. Beginning in 2006, seasonal technicians repeatedly noted that charter halibut sampling goals were easily obtained, but that it was more difficult to attain the desired sample size for the private fleet and for species other than halibut. Various technicians also noted success in getting charter operators to retain rockfish and lingcod carcasses for sampling, but this is rarely possible with private anglers. To address the potential bias associated with a lack of cleaned at sea samples, ADF&G will be issuing a News Release (NR) at the beginning of each season directed toward all Whittier anglers.

Table 7.–Estimated mean weights and results of *t*-tests comparing Pacific halibut cleaned at sea versus those cleaned in port at Whittier, 2020–2021.

	Cleaned in port		Cleaned at sea				
Year	Mean weight (lb)	*n*	Mean weight (lb)	*n*	*t* value [a]	*P* value	df
2020	21.34	550	14.37	271	6.31	<0.001	819
2021	18.57	388	12.67	168	4.00	<0.001	554

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

[a] Satterhwaite approximate *t* used when variances were unequal.

Valdez

All interview and biological sampling for Eastern Prince William Sound will take place in the Valdez harbor because this is virtually the only access point. Biological sampling at Valdez will be conducted primarily during the period 1500–2200 hours. Fish will be sampled by moving among the fish cleaning stations to spread samples over time and to avoid selecting for early- or late-returning boats.

Only about 2% of private-caught halibut and 0% of charter-caught halibut were cleaned at sea in 2021 (Table 2). Therefore, no specific program will be implemented to collect data from halibut cleaned at sea. The technician, however, will solicit cooperation with charter operators and private anglers to return fish carcasses.

Interviews will be conducted throughout the Valdez harbor during the period 1500–2200 hours on scheduled interview days. The technician will attempt to interview all returning boats during this period.

Sample Sizes

Bootstrap variance estimators are used by this project to estimate variances around the means for many objectives (see *Data Analysis* section) because multinomial sampling assumptions are often violated. The resulting standard errors can be 2 or more times greater than standard errors estimated under multinomial sampling assumptions. Despite this, we continue to achieve precision objectives for halibut, rockfish species composition, and black and yelloweye rockfish sex and age composition. For lingcod and most other rockfish species, harvest is low and sample sizes cannot realistically be increased. Because staffing levels are constant and samplers are completely

occupied during most of the season, sample sizes are likely to be similar to past years (Table 8) and we expect that the precision objectives will continue to be met.

Table 8.–Average sample sizes by port for biological sampling, 2019–2021.

Port	User group	Average sample size		
		Halibut	Rockfish	Lingcod
Kodiak				
	Charter	128	262	52
	Private	140	193	49
	Total	268	455	101
Deep Cr.–Anchor Pt.				
	Charter	626	8	–
	Private	168	–	–
	Total	794	8	–
Homer				
	Charter	–	514	90
	(Cleaned at sea)	433	–	–
	(Cleaned in port)	602	–	–
	Private	693	147	8
	Total	1,728	661	98
Seward				
	Charter	1,163	937	117
	Private	386	329	27
	Total	1,549	1,266	144
Whittier				
	Charter	429	480	37
	Private	188	144	10
	Total	617	624	47
Valdez				
	Charter	421	418	105
	Private	204	134	57
	Total	625	552	162

Source: M. Schuster, Fishery Biologist, ADF&G, Division of Sport Fish, Homer, unpublished data.

Some of the data collected during this project may contain substantial variation among boats sampled on the same day. Thus, there is potential for bias if boats are selected for sampling in a nonrepresentative manner. Because one potential source of bias is associated with sampling boats with higher catches, sampling goals are not emphasized to field staff. Instead, the primary consideration with respect to sample selection should be to obtain a representative sample, rather than to achieve a sample size target.

DATA COLLECTION

All methods presented below are subject to change if necessary due to COVID-19 or other pandemic concerns. See Appendix A1 for the COVID action plan used in 2020.

Biological Sampling

Fish landed by sport fishing anglers are usually filleted with viscera and skin intact but may also be whole or gutted and bled. Rockfish will be identified to species in the field using Kramer and O'Connell (1995) or Orr et al. (1998). Difficult fish may be keyed out using Mecklenburg et al.

(2002). The user group and unique identifier for each boat (boat name for charters, unique alpha-numeric code p1, p2, etc. by boat for private boats) and ADF&G groundfish statistical area of capture will be recorded for all fish.

Biological data will be recorded in the field either on an electronic tablet with an "HTML-based" XLS Form or on pre-stamped coin envelopes (for corresponding tissue sample). Tablet data will be downloaded after each shift and entered into an Excel database and coin envelope data will be hand entered after each shift into the same Excel database. Sex of all fish except sharks will be determined by examination of gonads. Sex of sharks will be determined by external appearance of the urogenital area (Castro 1983; Appendix B1). Lengths will be measured in slightly different ways depending on species (Table 9). Cleaned-at-sea carcasses will be measured in the same way as whole fish. If the head or tail is missing, carcasses will not be measured.

Table 9.–Type and precision of length measurements by species.

Species	Measurement(s)	Precision
Halibut	Tip of the snout to the central lobe of the caudal fin	Nearest cm
Lingcod	Fork length, tip of snout to central fork of the caudal fin	Nearest cm
All rockfishes	Fork length, tip of snout to central fork of the caudal fin	Nearest cm
Salmon shark	(1) Total length, (2) fork length, and (3) pre-caudal length	Nearest cm
Pacific sleeper shark	Total length	Nearest cm
Spiny dogfish	Total length	Nearest cm

Only whole rockfish and lingcod that are not filleted will be weighed. Rockfish will be weighed using brass spring scales (12.5 × 0.1 kg) and weights will be recorded to the nearest 0.1 kg. Lingcod will be weighed using aluminum spring scales (35 × 0.5 kg) with weights recorded to the nearest 0.5 kg. All scales will be calibrated prior to each field season.

A variety of structures, depending on the species, will be collected and used to determine age. The left (ventral) otolith (saggitus) will be removed from halibut. Both otoliths will be removed from all rockfish and lingcod. Otoliths will be hand-cleaned in water and stored in the labeled coin envelopes recorded with associated biological data. For lingcod, the 4th–8th rays of the posterior lobe of the dorsal fin will also be removed and stored flat in labeled, weatherproof paper envelopes. Lingcod otoliths will be stored in a small plastic bag in the same envelopes. Each day's collection of lingcod fins and otoliths will then be frozen in individual sealable plastic bags to minimize dehydration. A 15–20 cm section of the vertebrae will be removed from the gill area of salmon sharks and placed into a locking plastic bag with its associated data sheet. At the end of the day, it will be frozen for later age estimation (Appendix B1). The posterior dorsal fin spine will be removed from spiny dogfish and stored in a labeled coin envelope.

The subsistence fishery for halibut began in May 2003. Subsistence fishing for halibut is allowed in all federal waters and all state waters that are outside of nonsubsistence areas. Technicians may encounter subsistence-caught halibut and other bottomfish taken as bycatch in the subsistence fishery. Technicians will determine whether the halibut or other species were harvested by subsistence or sport fishing. No halibut, rockfish, lingcod, or sharks caught by subsistence users will be sampled or recorded in this project.

Because this project covers a wide area, project personnel are in a unique position to assist other agencies and ADF&G research projects. In addition to data required for this project, staff may also

collect tissue samples for other ADF&G projects, collect samples for other agencies and institutions, and distribute deep water release devices to anglers.

XLS Form

Electronic data collection via HTML XLS forms is faster, less error-prone, and easier to use than paper forms. For this project we will use KoBoToolbox, a data hosting platform that offers HTML data form design at no cost to government organizations. Forms are created by building questions in a Microsoft Excel spreadsheet, which is uploaded to the KoBoToolbox website[5]. The Excel sheet (Appendix C1) is then converted into a simple data entry form linked to a URL[6], which can be accessed by the technician on their tablet either using a SIM card in the field or on a network connection. Data are collected on the tablet using a web browser, which does not require internet connectivity to enter data but only to submit and to load the initial form. The data can then be downloaded to a computer and loaded into the conventional Excel spreadsheet used by port samplers. More information on the XLS Forms design system, including design help, can be found at https://docs.getodk.org/xlsform/. There is also an active open data kit forum that can be used to search for help and to ask form design or connectivity questions.

During the 2021 field season, electronic biological data collection was piloted in Homer. During the 2022 and 2023 field seasons, we plan to collect biological data using electronic tablets at all ports. Technicians will be provided with and trained on paper data collection and data entry procedures in case of technical issues.

Angler Interviews

In 2021, project leaders decided that increased resolution for effort data is necessary. For example, with just 1 statistical area and 1 time per trip, it is impossible to calculate species-specific catch per unit effort (CPUE). Under the new interview procedure, anglers will be asked for a location (statistical area) and effort (time spent fishing) associated with what the angler is targeting (Appendix D1). When halibut, rockfish, or lingcod are specifically targeted, location and effort will be recorded under the field for that species regardless of angler success. If the angler targets anything that bites (bottomfish) and does not harvest or release any halibut, rockfish, or lingcod, the location and effort will be recorded under the "statistical area combined" and "hours fished combined" fields. If the angler targets anything that bites and *does* harvest or release halibut, rockfish, or lingcod, the location will be recorded under the field for the fish they harvested but effort will still be recorded under "hours fished combined" because they were not specifically targeting the fish that they harvested or released.

Technicians will attempt to contact all boats returning to the harbor or assigned area. Because of the seasonal preponderance of salmon sport fishing and subsistence fishing, the initial step in each contact will be to determine whether the boat was sport fishing and whether anglers targeted or caught any halibut, rockfish, lingcod, or sharks (Appendix D1). Boat parties that were sport fishing and targeted these species or caught them while targeting other species will be interviewed, regardless of fishing success.

Once it is established that a boat is eligible for and consents to an interview, the following information will be recorded for each vessel-trip (Appendix D1)**:**

[5] https://kobotoolbox.org

[6] Testdummy KoBoToolbox form available for viewing at https://ee.kobotoolbox.org/x/Pw3Dzynb

1) date and time
2) boat name (if charter trip)
3) logbook number (if charter trip, dummy logbook number if private trip)
4) whether trip is first or second trip of the day
5) duration of trip in days
6) user group (e.g., charter, private)
7) target species category
8) primary ADF&G groundfish statistical area where halibut, rockfish, or lingcod were targeted, harvested, or released—each assemblage or species gets a statistical area when possible[7]
9) specific location of the interview (harbor or harbor area)
10) whether anglers fished inside Resurrection Bay, outside the bay, or both (Seward only)
11) number of angler-days of effort for entire trip (recorded separately as client and crew days)
12) number of hours spent targeting halibut, rockfish, lingcod, or "anything that bites"—each assemblage or species gets a time[7]
13) number of halibut kept, and the number of those that were cleaned at sea
14) whether halibut harvest was counted (verified) or not
15) numbers of halibut released that were caught on circle hooks and on all other hook types
16) numbers of pelagic, yelloweye, and other nonpelagic rockfish kept, released, and cleaned at sea
17) whether pelagic, yelloweye, and other nonpelagic rockfish harvest was counted (verified) or not
18) the most common depth of capture (in feet) for pelagic, nonpelagic and yelloweye rockfish that were released
19) numbers of pelagic, yelloweye, and other nonpelagic rockfish released, by release method (whether at the surface or with a deep-water release mechanism)
20) numbers of lingcod kept and cleaned at sea
21) number of lingcod released that were under 35 inches in length and number released 35 inches or greater in length
22) whether lingcod harvest was counted (verified) or not
23) numbers of Pacific cod (*Gadus macrocephalus*) kept and released, cleaned at sea, and whether harvest was counted (verified) or not
24) numbers of sablefish (*Anoplopoma fimbria*) kept and released, cleaned at sea, and whether harvest was counted (verified) or not
25) numbers of pollock kept and released, cleaned at sea, and whether harvest was counted (verified) or not
26) numbers of sharks kept and released (by species), cleaned at sea, and whether harvest was counted (verified) or not

Charter skippers, rather than crew or clients, will be interviewed to obtain accurate reporting of statistical areas and species. Interview data will be recorded on Allegro CX or Allegro 2 field computers using DataPlus Professional data capture software, as outlined in Appendix D2. The DataPlus software contains numerous data validation routines that should catch most errors at the point of data entry. Port samplers will create a new data file each interview day and back it up to

[7] Questions used for the first time in 2021.

a desktop computer at the end of each shift. Beginning in 2022, an interview HTML form will be tested in Homer, collecting the same data presented above. If the form is deployed successfully in Homer, it will be implemented regionwide in 2023.

AGE DETERMINATION

Halibut otoliths will be sent to the IPHC for age analysis. Ages of rockfish will be determined from otoliths following procedures outlined in Chilton and Beamish (1982), MacLellan (1997), and CARE (2006) using the cut-and-bake method under a dissecting microscope. The ages of harvested lingcod will be determined from fin-rays by thin section using a compound microscope (Beamish and Chilton 1977).

Otolith Preparation

All otoliths will be cleaned in the field before any preparation or age determination. Rockfish otoliths will be cut on an Isomet low speed saw at a speed setting of approximately 6.5. The cut must be directly through the center (nucleus) of the otolith to ensure consistency and accuracy. To cut the otolith, the otolith is placed into a block of clay attached to the cutting arm of the saw. The clay holds the otolith while the blade is cutting and prevents the two halves from falling into the water tray. Otoliths will then be baked in a toaster oven at about 500°F for 13 minutes. This ensures dark enough annuli for age determination without burning the otolith. When re-baking specimens with determined ages for precision tests or training, a bake time of 4–6 minutes is adequate. Otoliths are baked in batches of 18–24 on aluminum trays.

Fin-ray Preparation

Field Preparation

Port samplers will remove the 4th–8th rays of the posterior lobe of the lingcod dorsal fin. The tips of the fin rays will be trimmed, as necessary, leaving at least 2.5 in (63.5 mm) to the bottom of the base (Appendix E1). After recording all pertinent information on the sample envelope, the sample will be placed inside the envelope with the ventral side oriented toward the opening. To prevent desiccation and spoilage, all sample envelopes for each sampling date will be stored together in a Ziploc bag and placed in the freezer.

Thawing, Prepping, and Drying

Processing in the lab will begin by removing the samples from the freezer. After the samples are sufficiently thawed, the sample will be removed from the envelope and the outer fin rays will be removed (4th and 8th), leaving fin rays 5–7. If some fin rays are damaged, priority is placed on obtaining the 3 best adjacent fin rays from the sample. The fin rays will be washed to remove slime and trimmed with scissors to remove excess tissue at the base. The skin will be trimmed back about an inch from the base, taking care not to cut holes into the tissue. Using binder clips, the sample will then be sandwiched between 2 pieces of wire mesh hardware cloth, orienting the fin rays so they are parallel to each other and so that the ventral side is perpendicular to the short edge of the hardware cloth (Appendix E2). The envelope will then be attached to the wire frame and the sample will be placed in a slotted wooden drying rack (Appendix E3). Samples will be processed sequentially in the order they were collected. The wooden drying rack can accommodate about 50 samples and has sufficient space to allow adequate air flow. The rack is positioned in front of an air circulating fan to facilitate drying overnight. Once dry, the samples will be returned to their

respective envelopes and ordered sequentially in holding boxes just wide enough to accommodate their width and keep them in sequential order (Appendix E4).

Trimming and Gluing

Samples will be removed from their respective envelopes and trimmed of any excess tissue to 1 in distal from the ventral end, using a knife to scrape waste into a trash receptacle. Underneath a fume hood, a thin coat of cyanoacrylate glue (INSTA-CURE+) will be applied to the area to be sectioned. An accelerator (INSTA-SET) will be sprayed on top of the glue to expedite curing (Appendix E5). After 10 seconds, the sample will be placed underneath the fume hood to continue fully drying while proceeding to the next sample. The samples will then be returned to their respective envelopes and holding boxes.

Sectioning and Cutting

A diamond wafering blade in a low-speed precision sectioning saw (Buehler ISOMET) will be used to section each sample. A mineral oil bath lubricates and cleans the blade during cutting. Cutting will be performed at its highest speed (300 revolutions per minute) with an attached arm weight (160 gm). The sample will be placed perpendicular to the blade in the chuck, and the first cut will be made within 0.1 in (2.54 mm) of the base of the fin ray (Appendix E6). After discarding the ventral side of the cut, 4 subsequent sections will be made at 0.075 in (1.905mm) thickness. While controlling the chuck arm with the left hand, the fin section is held with forceps during the cutting process. After completion of the cut, the section will be cleaned of mineral oil in a hot soapy water bath (about 160°F, 71°C) and placed on a paper towel to dry (Appendix E6). The four clean sections will be arranged on the paper towel adjacent to the glass slide they will be mounted on (Appendix E7). The slide will have all pertinent information transcribed from the sample envelope.

Mounting sections on slides

Sections will be mounted on slides underneath the fume hood using a liquid cover slip mounting medium (Flo-Texx). A thin layer of mounting medium will be spread on the slide, large enough to accommodate all four sections (Appendix E8), then the sections are oriented in a manner so that corresponding fin rays and section cuts are adjacent to one another. The sections may need to be oriented diagonally if the width of the fin rays exceeds the height of the slide (Appendix E9). A thin layer of mounting medium will be applied on top of the sections twice: once after mounting and once at the conclusion of the day. The slides will be allowed to dry overnight and placed in 100 count slide boxes in the morning (Appendix E10).

Age Determination Training

Initially, technicians will learn to determine otolith ages (what we call “aging”) from black rockfish, then move on to yelloweye rockfish, and finally to lingcod if they show aptitude in accurately aging yelloweye rockfish. Age determination training begins with a set of photographs or otoliths of known age. The novice “ager” will receive instruction from someone more experienced for about half a day at the dissecting microscope for rockfish and at the compound microscope for fin rays. After aging a few dozen specimens, the novice ager will move on to “free aging,” where they will examine otoliths or slides with known ages from previous years and compare their ages to the known ages. After a few days of free aging, the novice ager will move on to their first calibration test. Without knowing the ages, the novice ager will determine the ages for sets of 18–36 samples and then check them against their known ages. Calibration tests will

begin with samples of younger age. Once the novice ager can meet calibration criteria for younger otoliths or fin rays, they will move on to older samples. Care must be taken to age samples from all ports to account for differences in growth. Once the novice ager meets calibration criteria for otoliths or fin rays of all ages, they will perform a full 20% precision test on otoliths or fin-rays that they have aged themselves. If the criterion for that precision test is met, they are ready to move on to production aging. Standards for calibration and precision tests are presented below. Generally novice age readers should be able to meet precision standards for black rockfish within 10 working days and for yelloweye rockfish withing 15 working days. Lingcod may take longer.

Calibration and Precision Testing

Precision thresholds for repeatability in age determination will be analyzed both between readers and within a reader's own assigned ages. We will take into consideration not only percent agreement but also the distribution of errors. Preferred percent agreement for many species can be found in Table 10. In summarizing the distribution of errors, it is desirable these differences are roughly symmetrical around zero. Error distribution plots, age bias plots, average percent error, and coefficient of variation are all used to assess precision.

Table 10.–Calibration and precision testing criteria for rockfish and lingcod.

Species	Percent agreement	90% within	Average percent error
Black rockfish	70%	±1 year	< ± 1.5%
Yelloweye rockfish	50%	±2 years	< ± 2.0%
Other rockfish species	50%	±2 years	< ± 2.0%
Lingcod	50%	±2 years	< ± 4.0%

DATA REDUCTION

Halibut otoliths will be stored dry in individually labeled coin envelopes and sent to the IPHC for age analysis annually. Rockfish otoliths and lingcod fin rays will be prepared and read as described above. Salmon shark vertebrae will be frozen upon collection and preserved for future aging if requested. A subsample (random 20%) of rockfish and lingcod age structures will be read twice to assess within-reader error over time. Otoliths, fin rays, and shark vertebrae will be archived at ADF&G in Homer.

Interview data files and Excel workbooks containing biological data will be emailed to the field supervisor and crew leader weekly for error checking and compilation of sampling summaries. At the end of the season, all files will be converted to SAS datasets for analysis and ASCII files for archiving. The file structure of the ASCII files will be documented. All files will be named using conventions established by ADF&G Division of Sport Fish Research and Technical Services (RTS).

All sample envelopes will be hand checked against Excel datasheets for errors. Initial editing of biological data files will include checks of frequency listings for impossible or unlikely data and will ensure correspondence with collected age structures (e.g., there should be a coin envelope containing data and an age structure for each record). After aging is complete and age data are entered, data files will be checked using a program developed to spot data entry errors and outliers not detectable with frequency listings. The program includes checks of data against length-weight and length-age relationships and outputs a list of suspect records that will then be compared to the original data (coin envelopes). Troubleshooting of errors will also involve established relationships between fish length and otolith length or weight for selected species.

Interview files will also be checked with a program that finds data entry errors and outliers not detectable with simple range checks or frequency listings. Hopefully, most of these errors will be identified and corrected at the time of data entry.

Copies of edited biological and interview files will be stored on the ADF&G Homer server and the project leader's computer. Historical archived files and original files can be found in the same locations.

Database Project

A request has been submitted to the State of Alaska Office of Information Technology to receive assistance in creating an online query database for this project. Currently, our data are stored in a series of SAS files which require SAS experience to query. See request below:

> "The Gulf of Alaska Bottomfish (GOAB) port sampling program has a comprehensive AWL and interview dataset reaching back to 1992. Currently these data are housed in many dozens of SAS files which can be concatenated and queried only with SAS. This requires each incoming port sampling supervisor to become proficient in SAS to maintain the 'database'. I spend time at the Kodiak ADFG office as we have a sampler there. The Westward database, which houses both CF and SF data, is accessible via their WIKI internet portal by any person on the SOA network authorized to access the database. Queries can be populated into the WIKI by the database manager and then run by ADFG staff. Data are entered into the database at varying timeframes, usually once per year. I've explored various options to create a more permanent database for our program, but short of trying to create one in Access I do not have the knowledge or time to pursue this project to its conclusion.
>
> I request IT assistance in creating a permanent database for our AWL and interview data which can be accessed by all ADFG personnel to perform pre-loaded queries via an internet portal. Limited staff with permission should be able to upload data to the database on an annual basis and most staff should be able to perform queries or select fields and years to download as a CSV file. If this is a feasible project it would be beneficial to communicate with Westward programming staff as their system is ideal and has been in use for over a decade.
>
> If successful, this database could be further expanded to house other groundfish data in Region II or Statewide."

DATA ANALYSIS

Halibut Mean Weight (Primary Objective 1)

Most sampled halibut are filleted or gutted and because of this, most fish cannot be weighed; however, with the head still retained, it is possible to measure the length of the carcass and then use the IPHC length-weight relationship to estimate the mean weight of all measured halibut. Mean net weight will be estimated separately for each combination of interest (usually user group, area, and processing method) g as the mean of the predicted weights over all n_g sampled fish (Nielsen and Schoch 1980):

$$\overline{w}_g = \frac{\sum_{k=1}^{n_{ua}} 1.063 \times 10^{-5} L_{gk}^{3.13}}{n_g} \quad (1)$$

where L_{gk} is the observed length of fish k to the nearest centimeter. Parameters in Equation 1 were estimated from a log-log regression of length and weight data from a sample size of 5,184 halibut taken between British Columbia and the eastern Aleutians (Webster and Stewart 2022) and give a net weight in pounds. No correction will be made for log transformation bias because the length-

weight relationship was based on a large sample and the residual variance is extremely small. Mean weight estimates are presented in pounds rather than kilograms because that is the standard unit used by halibut management agencies.

Variances of the mean predicted weights will be estimated through a bootstrap procedure[8]. A 2-stage bootstrap will be conducted for each port, where the first stage is the sampling date, and the second stage is the boat. The bootstrap routine resamples days within a year and vessel trips within a day. All sampling is conducted with replacement, and the number of resampled data points is equal to the original sample size. Mean weight is calculated across all resampled fish, and the process is repeated 1,000 times. The standard deviation of the 1,000 bootstrap values of mean weight is the standard error[9] for the mean weight estimate in Equation 1.

Charter halibut data from Homer, Seward, and Whittier will be designated "cleaned in port" or "cleaned at sea." There were significant differences in the mean net weight of charter-harvested halibut cleaned at sea versus cleaned in port for the past several years (Tables 4, 6 and 7). Therefore, we will continue to separate these groups during data collection. The mean weight and variance of the mean weight for the charter sector ($\overline{w}$) will be estimated as follows:

$$\overline{w} = \overline{w}_{sea}\hat{p}_{sea} + \overline{w}_{port}\left(1 - \hat{p}_{sea}\right) \tag{2a}$$

$$= \overline{w}_{sea}\hat{p}_{sea} + \overline{w}_{port} - \overline{w}_{port}\hat{p}_{sea} \tag{2b}$$

where

$\overline{w}_{sea}$ = the sample mean weight of charter-caught halibut cleaned at sea,

$\overline{w}_{port}$ = the sample mean weight of charter-caught halibut cleaned in port, and

$\hat{p}_{sea}$ = the estimated proportion of charter-caught halibut cleaned at sea.

The proportion $\hat{p}_{sea}$ (Secondary Objective 2) and its variance is estimated using completed-trip interview data:

$$\hat{p}_{sea} = \frac{n_{sea}}{N} \tag{3}$$

and

$$\mathrm{var}\left(\hat{p}_{sea}\right) = \frac{\hat{p}_{sea}\left(1 - \hat{p}_{sea}\right)}{n - 1} \tag{4}$$

where n_{sea} is the number of halibut cleaned at sea on interviewed charter boats, and N is the number of halibut kept by interviewed charter boats. The variance of the mean weight for charter-caught halibut will be estimated as follows (Goodman 1960):

$$\begin{aligned}\mathrm{var}(\overline{w}) = \mathrm{var}(\overline{w}_{sea}\hat{p}_{sea}) + \mathrm{var}\left(\overline{w}_{port}\right) + \mathrm{var}\left(\overline{w}_{port}\hat{p}_{sea}\right) - 2\mathrm{cov}\left(\overline{w}_{sea}\hat{p}_{CS}, \overline{w}_{port}\hat{p}_{sea}\right) \\ - 2\mathrm{cov}\left(\overline{w}_{port}, \overline{w}_{port}\hat{p}_{sea}\right)\end{aligned} \tag{5}$$

[8] Methodology used to estimate variances of the mean predicted weights may continue to evolve. Closed-form variance estimates for multistage designs are currently being developed for similar programs in southeast Alaska.

[9] Standard errors produced from this method are approximate and could have a high or low bias. For instance, the sampling schedule has a systematic (weekly) periodicity, yet the resampling algorithm assumes independent selection of dates within a year, which would tend to overestimate the standard error. On the other hand, on some occasions only a single boat is sampled per day, leading the 2-stage resampling procedure to miss the second-stage component of variance entirely and underestimate the standard error.

where

$$\mathrm{var}\left(\overline{w}_{sea}\hat{p}_{sea}\right) = \overline{w}_{sea}^2\mathrm{var}\left(\hat{p}_{CS}\right) + \mathrm{var}(\overline{w}_{sea})\hat{p}_{sea}^2 - \mathrm{var}(\overline{w}_{sea})\mathrm{var}\left(\hat{p}_{sea}\right) \quad (6)$$

$$\mathrm{var}\left(\overline{w}_{port}\hat{p}_{sea}\right) = \overline{w}_{port}^2\mathrm{var}\left(\hat{p}_{sea}\right) + \mathrm{var}\left(\overline{w}_{port}\right)\hat{p}_{sea}^2 - \mathrm{var}\left(\overline{w}_{port}\right)\mathrm{var}\left(\hat{p}_{sea}\right) \quad (7)$$

$$\mathrm{cov}\left(\overline{w}_{sea}\hat{p}_{sea},\overline{w}_{port}\hat{p}_{sea}\right) = \overline{w}_{sea}\overline{w}_{port}\mathrm{var}\left(\hat{p}_{sea}\right) \quad (8)$$

$$\mathrm{cov}\left(\overline{w}_{port},\overline{w}_{port}\hat{p}_{sea}\right) = \hat{p}_{sea}\mathrm{var}\left(\bar{\mathrm{w}}_{\mathrm{port}}\right) \quad (9)$$

and where $\mathrm{var}(\overline{w}_{sea})$ and $\mathrm{var}\left(\overline{w}_{port}\right)$ are obtained through the 2-stage bootstrap described above.

Waters fished by the Whittier and Valdez halibut fleets overlap spatially, especially in the charter fishery. However, there are substantial differences in the harvest characteristics between these ports. The Statewide Harvest Survey (SWHS) now provides harvest estimates for trips ending in Whittier or western Prince William Sound (PWS) and Valdez or eastern PWS. The SWHS estimates for Whittier and western PWS will be applied to the mean weight estimates from Whittier to estimate harvest biomass. SWHS harvest estimates for eastern PWS will be applied to the mean weight estimated from Valdez data to estimate harvest biomass for eastern PWS.

Halibut Length Composition (Primary Objective 2)

Halibut length composition estimates for Homer, Seward, and Whittier will be stratified by 3 user groups: 1) private harvest, 2) charter harvest cleaned in port, and 3) charter harvest cleaned at sea. The stratified estimator for the proportion of halibut in length group i, $\hat{\delta}_i$ is as follows:

$$\hat{\delta}_i = \frac{H_P}{H}\hat{\delta}_{iP} + \frac{H_C}{H}\left[\left(1 - \hat{p}_{sea}\right)\hat{\delta}_{iCport} + \hat{p}_{sea}\hat{\delta}_{iCsea}\right] \quad (10)$$

where

$\frac{H_P}{H}$ = a stratum weight representing the proportion of the total halibut harvest taken by private anglers (H_P is SWHS estimate of private halibut harvest and H is the SWHS estimate of total halibut harvest),

$\hat{\delta}_{Pi}$ = the estimated proportion of private-caught halibut in length group i,

$\frac{H_C}{H}$ = a stratum weight representing the proportion of the total halibut harvest taken by charter anglers (H_C is SWHS estimate of charter halibut harvest),

$\hat{p}_{sea}$ = the estimated proportion of charter-caught halibut that were cleaned in sea,

$\hat{\delta}_{iCport}$ = the estimated proportion of charter-caught halibut cleaned in port in length group i, and

$\hat{\delta}_{iCsea}$ = the estimated proportion of charter-caught halibut cleaned at sea in length group i.

The stratum weights are based on large sample sizes and are therefore considered constants. Variances of the proportions will be estimated by

$$\begin{aligned}\text{var}[\hat{\delta}_i] &= \left(\frac{H_P}{H}\right)^2 \text{var}[\hat{\delta}_{Pi}] + \left(\frac{H_C}{H}\right)^2 \{\text{var}[(1-\hat{p}_{sea})\hat{\delta}_{iCport} + \hat{p}_{sea}\hat{\delta}_{iCsea}]\} \\ &= \left(\frac{H_P}{H}\right)^2 \text{var}[\hat{\delta}_{Pi}] + \left(\frac{H_C}{H}\right)^2 \{\text{var}[(1-\hat{p}_{sea})\hat{\delta}_{iCport}] + \text{var}[\hat{p}_{sea}\hat{\delta}_{iCsea}]\}\end{aligned} \tag{11}$$

where

$$\text{var}[(1-\hat{p}_{sea})\hat{\delta}_{iCport}] = \text{var}[\hat{p}_{sea}]\hat{\delta}^2_{iCport} + \hat{h}^2_{port}\text{var}[\hat{\delta}_{iCport}] - \text{var}[\hat{p}_{sea}]\text{var}[\hat{\delta}_{iCport}] \text{ and} \tag{12}$$

and

$$\text{var}[\hat{p}_{sea}\hat{\delta}_{iCsea}] = \text{var}[\hat{p}_{sea}]\hat{\delta}^2_{iCsea} + \hat{h}^2_{sea}\text{var}[\hat{\delta}_{iCsea}] - \text{var}[\hat{p}_{sea}]\text{var}[\hat{\delta}_{iCsea}] \tag{13}$$

The variances of $\hat{p}_{sea}$ will be obtained through the 2-stage bootstrap described above.

Rockfish Species Composition (Primary Objective 3)

There is potential for bias in our estimate of rockfish species composition if composition varies by user group and sample size is not proportional to harvest by each user group. Because rockfish species composition frequently differs between user groups and our project does not attempt to sample charter and private anglers in proportion to their harvest, estimates of rockfish species composition will be stratified by harvest using SWHS[10] rockfish harvest estimates by port of landing. The proportion of harvest consisting of species *i* will be estimated for each port and year as follows:

$$\hat{p}_i = \frac{\hat{p}_{iG}\widehat{R}_C + \hat{p}_{iU}\widehat{R}_P}{\widehat{R}} = \frac{\widehat{R}_{iC} + \widehat{R}_{iP}}{\widehat{R}} = \frac{\widehat{R}_i}{\widehat{R}} \tag{14}$$

where

$\hat{p}_{iC}$ and $\hat{p}_{iP}$ = the observed proportion of species *i* in the charter (C) or private (P) harvest at each port,

$\widehat{R}_C$ and $\widehat{R}_P$ = the estimated rockfish harvest by charter (C) and private (P) anglers landed at each port (from SWHS),

$\widehat{R}_{iC}$ and $\widehat{R}_{iP}$ = the estimated harvest of species *i* by charter (C) and private (P) anglers landed at each port,

$\widehat{R}_i$ = the estimated harvest of species *i* landed at each port,

$\widehat{R}$ = the estimated number of rockfish (all species) harvested and landed at each port (from SWHS).

The variance of $\hat{p}_i$ will then be estimated using the multivariate delta method and assuming $[\text{cov}(R_C, \widehat{R}_P) = 0]$ as follows:

[10] Estimated charter and private rockfish harvest and standard errors for each SWHS subarea were provided by Division of Sport Fish, Research and Technical Services.

$$\widehat{\text{var}}(\hat{p}_i) = \frac{1}{\hat{R}^2}\left[\frac{\widehat{\text{var}}(\hat{R}_C)\left(\hat{p}_{iC}\hat{R}_P - \hat{R}_{iP}\right)^2}{\hat{R}^2} + \frac{\widehat{\text{var}}(\hat{R}_P)\left(\hat{p}_{iP}\hat{R}_C - \hat{R}_{iC}\right)^2}{\hat{R}^2} + \widehat{\text{var}}(\hat{p}_{iC})\hat{R}_C^2 + \widehat{\text{var}}(\hat{p}_{iP})\hat{R}_P^2\right] \quad (15)$$

Variance of the species composition estimates for the charter, $\widehat{\text{var}}(\hat{p}_{iC})$, and private, $\widehat{\text{var}}(\hat{p}_{iP})$, user groups will be estimated using a single stage nonparametric bootstrap to account for our cluster sampling of anglers (by vessel) in the fishery. To conduct the bootstrap, vessels will be resampled for each combination of port and year allowing $\hat{p}_{iC}$ and $\hat{p}_{iP}$ to be estimated for each bootstrap sample and $\widehat{\text{var}}(C)$ and $\widehat{\text{var}}(\hat{p}_{iP})$ to be calculated as the variance of $\hat{p}_{iC}$ and $\hat{p}_{iP}$ across bootstrap samples.

Age, Length, and Sex Composition (Primary Objectives 4 and 5)

Age, length, and sex composition will be estimated for black rockfish, yelloweye rockfish, and lingcod at each port. Pooled age composition estimates for rockfish species will be calculated as follows:

$$\hat{p}_{ij} = \frac{a_{ij}}{A_i} \quad (16)$$

where

a_{ij} = the number of samples collected from age j fish of species i, and

A_i = the total number of age samples collected from species i in the sample.

The variance of $\hat{p}_{ij}$was estimated as follows:

$$\widehat{\text{var}}\left(\hat{p}_{ij}\right) = \frac{\hat{p}_{ij}\left(1-\hat{p}_{ij}\right)}{A_i - 1} \quad (17)$$

Stratified estimates age, sex and length composition estimates will be calculated as follows:

$$\hat{p}_{ij} = \frac{\hat{p}_{ijG}\hat{R}_{iC} + \hat{p}_{ijP}\hat{R}_{iP}}{\hat{R}_i} = \frac{\hat{p}_{ijC}\hat{R}_{iC} + \hat{p}_{ijP}\hat{R}_{iP}}{\hat{R}_{iC} + \hat{R}_{iP}} \quad (18)$$

where

$\hat{p}_{ijC}$and $\hat{p}_{ijP}$ = the observed proportion of age j in the charter (C) and private (P) harvest of species i (using equation 16 separately for each user group),

$\hat{R}_{iC}$ and $\hat{R}_{iP}$ = the estimated harvest of species i by charter (C) and private (P) anglers landed at each port port (from the SWHS),

$\hat{R}_i$ = the estimated harvest of species i landed at each port.

The variance of $\hat{p}_{ij}$ will then be estimated using the multivariate delta method and assuming $[\text{cov}(\widehat{R}_{iC},\widehat{R}_{iP}) = 0]$ as

$$\widehat{\text{var}}(\hat{p}_{ij}) = \frac{1}{\widehat{R}_i^2}\left[\frac{\widehat{\text{var}}(\widehat{R}_{iC})\left(\hat{p}_{ijC}\widehat{R}_{iP} - \hat{p}_{ijP}\widehat{R}_{iP}\right)^2}{\widehat{R}_i^2} + \frac{\widehat{\text{var}}(\widehat{R}_{iP})\left(\hat{p}_{ijP}\widehat{R}_{iC} - \hat{p}_{ijC}\widehat{R}_{iC}\right)^2}{\widehat{R}_i^2} + \widehat{\text{var}}(\hat{p}_{ijC})\widehat{R}_{iC}^2 + \widehat{\text{var}}(\hat{p}_{ijP})\widehat{H}_{iP}^2\right] \tag{19}$$

When composition estimates ($\hat{p}_{ijC}$ and $\hat{p}_{ijP}$) differ between user groups, stratified estimates are appropriate to prevent bias in the overall composition estimate ($\hat{p}_{ij}$), which was introduced because our project may not collect samples in proportion to the harvest by each user group. Conversely, stratified estimates can introduce bias when small samples are obtained for 1 or both user groups. This situation has occurred with some regularity when estimating age, length, and sex compositions of rockfish and lingcod in previous seasons. We will use contingency table tests to identify significant differences in age, sex, or length composition (with a false discovery rate of 0.05 using the Benjamini and Hochberg correction) between user groups. When the contingency table for a certain port, year, and species are significant and sufficient samples (about 20) were obtained from both user groups, then stratified estimates will be produced, otherwise unstratified estimates will be produced after pooling data across user groups.

Length and sex composition will be estimated using Equations 16–19, substituting length or sex for age. Composition estimates for lingcod will be estimated using Equations 16–19 while substituting lingcod harvest estimates from the SWHS for the species-specific rockfish harvest estimates used above.

Spatial Distribution of Effort and Harvest

We will use multinomial logistic regression to identify patterns in the spatial distribution of reported harvest and effort. Management areas were divided into smaller subareas to represent geographic zones of management significance representing several groundfish statistical areas. Spatial distribution will be modeled as a proportion that varies by subarea, user group, and year. The scale of inference for spatial and temporal patterns in harvest and effort is port of landing, so interview data is pooled within each port annually, and a separate analysis is conducted for each port.

Reported harvest data H_{yua} for year y and user group u in subarea a is modeled

$$H_{yua} \sim \text{Multinomial}\left(\hat{\pi}_{yua}, M_{yu}\right) \tag{20}$$

where

$$M_{yu} = \sum_a H_{yua} \tag{21}$$

is the total number of fish harvested by interviewed anglers and

$$\hat{\pi}_{yua} = \frac{\widehat{\emptyset}_{yua}}{\sum_a \widehat{\emptyset}_{yua}} \tag{22}$$

where

$$\log \widehat{\emptyset}_{yua} = \alpha_a + \beta_{ua} + \varepsilon_a y + \gamma_{ua} y + re_{yua} \tag{23}$$

subject to the constraint that $\alpha_1 = \beta_{u1} = \varepsilon_1 = \gamma_{u1} = \beta_{1a} = \gamma_{1a} = 0$ (variables defined below). We expect considerable overdispersion and the term $re_{uya} \sim \text{Normal}(0, \sigma)$ is an observation level random effect allowing us to model variability that occurs outside of the categorical sampling process. This model will be fit using JAGS (through the rjags package) to run 3 chains for 10 thousand iterations each using a 3 thousand iteration burn-in while retaining every 20th iteration. Convergence is assessed using convergence plots, Gelman's R^2 and effective sample sizes.

To detect differences in spatial distribution by fleet and through time, we will use cross validation to identify the best performing model from among 4 candidate models, sequentially adding the first 4 terms on the right hand side of Equation 23:

α	where distribution differs by area,
α and β	where distribution differs by area and user group,
α, β and ε	where distribution differs by area and user group with a shared temporal trend,
α, β, ε and γ	where distribution differs by area and user group with different temporal trends for each user group.

During cross validation, data (H_{uia}) from year i will be withheld while each model is fit to data from all other years. The posterior predicted probability ($\hat{\pi}^{-(i)s}_{muia}$) from model m will provide an estimate of the out-of-sample predictive density for user group u and year i summarized by s posterior simulations:

$$pd_{mui} = \log\left(\text{median}\left(\frac{M_{ui}!}{\prod_a H_{uia}!}\prod_a \hat{\pi}^{-(i)s}_{muia}\right)\right) \tag{24}$$

Model performance is evaluated by calculating the log pointwise predictive density for all 2×Y (2 user groups for each year) withheld data:

$$lppd_m = -\sum_y^Y \sum_u^U pd_{muy} \tag{25}$$

The model with the smallest $lppd_m$ will indicate the best fit although some differences in model fit ($\Delta lppd_m = lppd_m - lppd_{min}$) are small. Assuming independence between data points, pointwise differences ($\Delta pd_{muy} = pd_{muy} - pd_{(min)uy}$) will be used to estimate variability in $\Delta lppd_m$. Two methods will be considered. First, the standard deviation of pointwise differences provides a rough approximation of significance assuming the differences are normally distributed. A second method is to bootstrap the pointwise differences, sum the result for each bootstrap replicate, and consider comparisons where over 95% the summed bootstrap replicates are greater than zero as indicative

of a significantly worse model fit. In situations where several models are thought to have similar fit, we will choose the most parsimonious model.

When summarizing the spatial distribution of halibut, rockfish, or lingcod harvest, the proportions of harvest by subarea will be calculated regardless of the target species indicated. Because of this difference, there may be subareas with substantial harvest but minimal effort.

SCHEDULE AND DELIVERABLES

Dates	Activity
10 May–early June	Begin data collection at ports.
14 September	Data collection completed at all ports. Begin data reduction, data validation, and age determination.
October	Analysis and preliminary estimates of halibut mean weight and harvest biomass. Memo to the International Pacific Halibut Commission.
As needed	Preliminary data summaries to the North Pacific Fishery Management Council, Alaska Board of Fisheries, other agencies, and public.
Fall–winter	Analysis and report preparation for previous years' data.

Preliminary estimates of halibut harvest will be reported to the IPHC in October annually, and final estimates will be reported in an ADF&G, Division of Sport Fish Special Publication following publication of the statewide harvest survey estimates. Halibut data summaries will be provided to the NPFMC as needed for analyses of management alternatives, and to National Marine Fisheries Service (NMFS) regulators, the Alaska Board of Fisheries, Fish and Game Advisory Committees, or individuals as requested.

RESPONSIBILITIES

Martin Schuster, Fisheries Biologist II, Project Supervisor
Duties: Oversees all aspects of the project. Formulates research objectives to meet regional management goals, writes operational plan, oversees budgets, supervises all staff, analyzes results, and writes research reports and Federal Aid Progress Reports, summarizes research for other agencies, attends Alaska Board of Fisheries meetings, NPFMC meetings, and IPHC annual meetings as needed and budgets allow, formulates and comments on regulatory proposals, and provides information to the public. Submits invoices and manages budget, prepares budget requests, analyzes data, and writes research reports.

Marian Ford, Fisheries Biologist I, Project Leader
Duties: Supervises day-to-day aspects of project, including hiring, training, and monitoring technicians. Supervises age readers and designs and analyzes tests of age reader precision. Ensures quality of field data, purchases and distributes sampling equipment, collects weekly sampling reports, and writes weekly fishing updates. Provides information to the public. Assists with formulating research objectives, writing operational plans, summarizing research for other agencies, and formulating comments on regulatory proposals.

Fish and Wildlife Technicians (5) Beginning in 2020, the Central Cook Inlet technician was not hired due to budget cuts.

Duties: Collect biological and fishery data following procedures outlined in the operational plan and other instructions, complete data forms in an accurate and timely manner, identify sampling needs and problems, provide fishery information to the regional office for weekly fishing reports, explain the sampling program to the general public, maintain state vehicles and other equipment in good working order, and submit all necessary paperwork in a neat and timely manner. Some technicians will be responsible for enforcing sport fishing regulations, computer data entry, simple statistical analyses, or preparation and reading of age structures.

Brianna King, Fishery Biologist IV
Duties: Assists project supervisor with sample design, formulation of operational plan, data analysis, and editing of annual data reports. Compiles statewide halibut harvest estimates and projections. Presents ADF&G research at IPHC annual meeting and NPFMC meetings dealing with halibut and groundfish issues, and coordinates data collection and sharing with other federal and state agencies.

Adam Reimer, Biometrician III
Duties: Technically reviews study design, sampling methods, and data analysis of operational plan, and reviews report. Provides assistance in drafting operational plan and technical assistance inseason should changes in the design be necessary.

BUDGET SUMMARY

Line item budget for final FY 23 request for 2011220029.

Line item	Category	Budget ($K)
100	Personal Services	124.9
200	Travel	2.0
300	Contractual	8.6
400	Commodities	2.1
500	Equipment	0.0
Total		139.6

Detailed Line 100: Personnel for final FY 23 request for 2011220029.

Name (Location)	PCN	Title	Months	OT hours	Swing hours	Total ($K) (incl. benefits)
Ford (Homer)	4089	FB I	2.0	30	75	18.8
Litwiniak (Seward)	4157	FWT III	3.5	15	575	26.7
Unknown (Homer)	4124	FWT III	3.25	15	575	22.1
Not budgeted (CCI)	4154	FWT III	-	-	-	-
Unknown (Kodiak)	4142	FWT II	3.0	15	575	19.4
Unknown (Valdez)	4122	FWT II	3.0	15	575	19.6
Unknown (Whittier)	5328	FWT II	2.75	15	575	17.1
Total			17.5			124.9

Detailed Line 200: Travel for final FY 23 request for 2011220029.

Item	Cost
Field Travel	2.9

Detailed Line 300: Contractual for final FY 23 request for 2011220029.

Item	Cost ($K)
Print / Copy	0.2
Parking Permits	0.6
Transportation	0.03
Rents and leases	7.8
Total	8.6

Detailed Line 400: Commodities for final FY 23 request for 2011220029.

Item	Cost ($K)
Operating supplies	2.1

Line item budget for final FY 23 request for 2011222821.

Line item	Category	Budget ($K)
100	Personal Services	181.4
200	Travel	3.4
300	Contractual	1.1
400	Commodities	1.6
500	Equipment	0.0
Total		187.4

Detailed Line 100: Personnel for final FY 23 request for 2011222821.

Name (Location)	PCN	Title	Months	OT hours	Swing hours	Total ($K) (incl. benefits)
Schuster (Homer)	4289	FB II	12			112.7
Ford (Homer)	4089	FB I	6.5	15	125	57.1
Blackmon (Homer)	4171	FWT III	1.5	0	0	11.6
Total			20			181.4

Detailed Line 200: Travel for final FY 20 request for 11220000–11222821.

Item	Cost ($K)
Travel	3.4

Detailed Line 300: Contractual for final FY 23 request for 11220000–11222821.

Item	Cost ($K)
Software licensing	0.8
Internet	0.3
Total	1.1

Detailed Line 400: Commodities for final FY 20 request for 11220000–11222821.

Item	Cost ($K)
Operating supplies	1.6

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APPENDIX A: COVID ACTION PLAN

Appendix A1.–ADF&G COVID-19 Response Action Plan (2020).

General Introduction

Port sampling can be carried out safely with 6 ft personal distance mandates in place. Our highest priority for this season will be to prevent transmission of the virus and to maintain public confidence that we are following health mandates. Sampling will be slower, but after discussions with managers and RTS we are confident that port sampling needs can be met. Each port will have specific guidelines, and these will change as the health mandates develop over the season. We will be staying in close contact with port samplers to ensure safe practices.

Administration

- All paperwork will be provided to port samplers returning from SLWOP ahead of time to be filled out before biologists arrive at each port for training.
- 3 of 6 port samplers work out of area offices (Homer, Central Cook Inlet, and Kodiak). Training in the offices will be limited to 1 biologist and 1 technician at a time, in an area that is conducive to maintaining 6 ft distance from each other and other office personnel. Training in remote ports (Seward, Whittier, Valdez) is always limited to 1 biologist and 1 technician. 6 ft distance will be maintained.

Travel to Ports

- Port samplers will be mailed a digital thermometer 1 week prior to departure for their duty station. If a port sampler or biologist becomes symptomatic (fever over 100.3, dry cough, headache) they must maintain a 2-week quarantine and be symptom free before departing for work. Project has 2 biologists so training, midseason checks, and end of season port closures could be accomplished with one biologist if the other is in quarantine.

Training

- Standard group trainings such as Firearms, Wildlife Safety, and First Aid/CPR will be postponed for this field season, unless individualized online versions are available. Technicians for this project are not asked to carry firearms in the field.
- For new and returning samplers training generally takes pace over 2-4 weekend days at the port where the technician will be working. For the 2020 season training we will focus on port specific strategies to prevent 1) becoming infected by the public and 2) infecting the public if COVID 19 is contracted and the technician is not showing symptoms. Trainer and trainee will maintain a 6 ft personal distance if personal distance mandates are still in effect during training.

Personal Protective Equipment

- Technicians will always be required to wear a face shield and either latex disposable or rubber Atlas brand gloves. Face shield and rubber Atlas brand gloves will be sterilized daily using a 10% dilute bleach solution.
- Technicians will always be required to wear either cloth or N95 face masks. We request 5 cloth masks (30 total) and 2 N95 masks (12 total) per sampler for the 2020 season.
- Masks will be worn for 1 day before sanitizing.

Transmission mitigation procedures (all ports)

- The following contingency procedures will be used if a 6 ft personal distance mandate is in effect.
    - AWL for charter halibut and rockfish, and interviews at Homer for cleaned-at-sea halibut ratio are used by ADFG and NPFMC staff and will be prioritized. Private AWL samples and interviews will be collected whenever time permits.

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- Port samplers will always maintain a 6 ft personal distance from anglers and the public. This will require slowing down and moving with intention at ports that generally have a lot of tourism such as Seward, Homer, and Valdez and will not be as difficult at other ports. See port specific guidelines for more details.
- Port samplers will not touch the public. This includes logbooks, which charter skippers often give to port samplers to expedite interviews.
- Samples will be worked up either at a public cleaning station when 6 ft distance can be maintained or using a folding table and traffic cones to mark a 6 ft boundary. Water jugs will be made available to port samplers to keep gear clean when away from cleaning stations.
- Launch ramps are common areas to collect interview data. Normally port samplers walk up and down launch ramps to interview anglers. Port samplers will wait at the top of launch ramps to collect interviews.
- No sampling will occur on the 4th of July if personal distance mandate in effect. This holiday is extremely busy for tourism but often less busy in terms of fishing effort.
- Port samplers will park away from other vehicles when possible.

Transmission mitigation procedures (port specific)

- **Homer** – Homer is a large harbor and requires lots of movement to sample representatively.
  - Charter AWL samples are collected at a few locations
    - Charter offices
      - Distance is easy to maintain, unless tourists are watching filleting, in which case sampler will return later. Arrival times can be discussed in advance with charter office and carcass totes can be dropped in advance and picked up after filleting is finished.
    - Buttwackers
      - Buttwackers cleans fish for many charter operators. It is a small confined area in between the Salty Dog and another gift shop which is often surrounded by spectators. We have a good relationship with the operator and will be able to arrange carcass tote drops and retrievals over the phone. This may decrease sampling efficiency but will ensure that we still sample this operation.
    - Cleaned-at-sea (CAS)
      - Charter CAS is common in Homer (~60% for halibut). The Department uses CAS halibut lengths in charter management measures analyses. CAS samples can be arranged in person or on the phone using the carcass tote drop method. This is an established and safe practice.
  - Private sample collection
    - Private samples are collected at 1 of 2 cleaning stations in the harbor. Carcass bins are dropped with private anglers and retrieved later. This can be accomplished using 6 ft distance protocols.
  - Interviews
    - Homer harbor is divided into 5 interview areas, each sampled for 1 hour. Most areas can be observed from either inside the truck or away from the public. The sampler can then intercept anglers as they come up the ramps or go down onto the docks if not too crowded.

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- **Central Cook Inlet**- Central Cook Inlet is a beach launch only fishery – no harbors.
    - Contacting charter and private anglers
        - Both user groups are initially contacted at the launch site. It is busy and care must be taken to avoid pickup trucks and large CAT machines. Introducing 6 ft distancing to this operation may slow down sampling, but it can be accomplished by speaking loudly and clearly.
    - Charter AWL samples are collected at Charter office/campgrounds
        - Distance is easy to maintain unless especially crowded, in which case the sampler will wait or ask people to disperse. Carcass totes can be given to operators at their cleaning station and retrieved for sampling at a cleaning station or on the folding table with traffic cones to keep public distanced.
        - A common practice in the past has been to sample fish on the vessel at the tractor launch. This will not be permitted in 2020.
    - Private sample collection
        - Private samples are collected either at a campground (see above) or at a private residence. 6 ft distance will be easy to maintain in each situation.
    - Interviews
        - Interviews are taken at the tractor launch. See 'Contacting charter and private anglers' above.

- **Seward**- Seward is a large harbor and requires lots of movement to sample representatively.
    - Charter AWL samples are collected at a few locations
        - Harbor cleaning tables
            - Most charter guides clean their fish at 1 of 2 extremely crowded fish cleaning stations. Under ideal circumstances, with 1 or 2 guides cleaning fish, the sampler will be able to sample at the table as well. When tourists, private anglers, and more guides utilize the stations the sampler will need to provide carcass totes to guides and then go seek fish elsewhere or stand aside while guides process fish. Then bins can be retrieved, and carcasses sampled in a less crowded location.
        - Military facility
            - Once a week samples are collected at the Seward military camp away from the harbor. This area can become busy while fish are being cleaned and carcass bins will need to be provided in advance and collected once processing is complete. It may not be feasible to sample the military facility, this decision will be made during training.
    - Private sample collection
        - Same procedures as Homer.
    - Interviews
        - Same procedures as Homer except fuel dock.
        - The fuel dock is a location where we collect most of our charter interviews. It is a small dock and will only be utilized when not very busy. If the fuel dock becomes busy, then sampler will go to the far end of dock and wait until free movement is possible or skip the fuel dock rotation and move onto the next interview area.

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- **Kodiak-** 2 harbors, USCG small boat facility (not likely to be allowed here)
    - Charter AWL samples are collected exclusively at Island Seafoods (processing facility)
        - Will need to arrange protocols with site supervisor, he has caused problems in the past but has been more cooperative since changes in project management in 2017
        - In some ways it is ideal, since we can set aside a location at the facility where we will not be approached by the public. Will need to make clear to processing personnel that they are to maintain 6 ft of personal space.
        - Charter sampling may be extremely slow at Kodiak, 92% of guided effort is non-residents.
    - Private sample collection
        - Takes place at 2 locations. St. Herman's harbor cleaning table and USCG base.
        - At St. Herman's there are rarely many people at once. We can drop carcass bins and retrieve once cleaning is complete.
        - As of now no ADFG personnel will be allowed on USCG base, but this may change.
    - Kodiak interviews
        - Interviews take place during biological sampling. Will always need to maintain distance.
- **Whittier-** Small harbor, not very busy except at launch ramp
    - Charter AWL samples
        - Charter samples are collected from 1 or 2 CAS vessels, which is very good for maintaining distance.
        - Charter samples are also collected at 1 harbor cleaning station, where carcass totes can be dropped.
    - Private samples
        - Private samples are collected at harbor cleaning stations, where carcass totes can be dropped and retrieved later.
    - Sampling location
        - Samples will be processed at empty cleaning tables, or using folding table and traffic cones.
    - Interviews
        - Interviews will be conducted concurrently with biological sampling this season at Whittier because effort is expected to be lower than usual.
- **Valdez-** Small harbor, not very busy except at main cleaning stations when charters return
    - Charter AWL samples
        - A group of private fish cleaners clean 80% of charter samples at the public cleaning stations. It will be integral to communicate with these cleaners to arrange carcass bin drops and prevent mixing of vessels.
        - If public cleaning stations are too busy, sampler will set up folding table and cones and sample away from the main cleaning stations as they can get very busy.
    - Private samples
        - Private samples are collected at cleaning stations throughout the harbor, as well as from fish cleaners at main stations (see above).
    - Interviews
        - Interviews will be conducted concurrently with biological sampling this season at Valdez because effort is expected to be lower than usual.

-continued-

Work and Living Protocols

- No guests outside of family units will be allowed at Seward and Whittier housing until personal distance mandates are no longer in effect.
- Port samplers will practice Covid-19 protocol, frequent hand washing, sanitize common areas and equipment, wear gloves when practical.
- Port samplers will take their temperatures each morning and evening.

Communication

- Port samplers will check in weekly with project supervisors with the usual reporting procedures as well as general summary of their health and a record of daily body temperatures.

Quarantine Contingency

- If a sampler contracts COVID-19 or shows symptoms they must quarantine for 14 days and seek testing. This will need to be arranged through project funds in ports with no housing, if the sampler has no quarantine possibilities. In ports with housing quarantine can be maintained at those locations.
- Project biologists will fill in to maintain data flow when possible.

APPENDIX B: SHARK DATA COLLECTION PROCEDURES

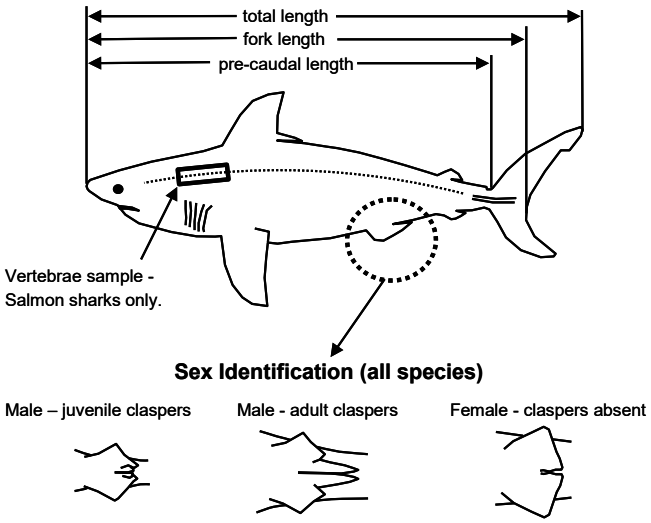
Appendix B1.–Shark data collection procedures.

Alaska Department of Fish and Game
Division of Sport Fish

Shark Data Collection

Salmon shark:

1. Record the following data on data form:
   - Port, Date, User Group (private/charter).
   - Total, fork, and pre-caudal lengths (cm)
   - Sex (see below) and male clasper lengths of salmon sharks
   - Lat / long (preferred) or stat area of capture
2. Remove a 6-inch long piece of vertebrae and freeze in ziplock with data form.



Spiny dogfish:

1. Record the following data on small coin envelope:
   - Port, Date, User Group (private/charter).
   - Total length (cm) and Round Wt (kg)
   - Sex (see above)
   - Lat / long (preferred) or stat area of capture
2. Remove the posterior dorsal fin spine and place in coin envelope.

Sleeper and other sharks:

Record the following data on small coin envelope:
- Species
- Port, Date, User Group (private/charter).
- Total length (cm)
- Sex (see above)
- Lat / long (preferred) or stat area of capture

APPENDIX C: XLS FORMS

Appendix C1.–XLS Form building structure example for the port of Homer, designed in Microsoft Excel, columns A–F.

type	name	label	appearance	hint	default
begin repeat	portdata	Port Data			
select_one metadata_port	Port	Port			2
date	Date	Date			
begin repeat	vesseldata	Vessel Data			
text	Vessel_Name	Vessel Name			
integer	user_input	User		1=Guided 2=Unguided	
calculate	User	User			
select_one ADFG_Stat	ADFG_Statarea	ADFG Statarea	autocomplete		
integer	CAS	Cleaned-At-Sea?		1=yes 0=no	0
begin repeat	sampledata	Sample data			
calculate	vessel_samplenum	Vessel and Sample Num			
calculate	sample_id	Sample ID			
calculate	concat_sample_id	Concatenated Sample ID			
note	note_id	Sample ID: **${concat_sample_id}**			
text	url_widget	Additional Species Codes	url		https://elandings.alaska.gov/elandings/SpeciesLookup
integer	Species	Species		ADFG species code 200=halibut 130=lingcod 142=black 172=dusky 173= dark 145=yelloweye 138=copper 147=quillback	
integer	Length	Length			
integer	sex_input	Sex		1 = Male 2 = Female 3 = Unknown	
calculate	Sex	Sex			
decimal	Weight	Weight			
text	Comments	Comments			
note	note_id	**Data Check** **Sp:** ${Species} **Ln:** ${Length}cm **Sex:** ${Sex} **Wt:** ${Weight}kg			
end repeat					
end repeat					
end repeat					

Appendix C2.–XLS Form building structure example for the port of Homer, designed in Microsoft Excel, columns G–M.

required	parameters	constraint	constraint_message	relevant	calculation	choice_filter
true						
true					today()	
false						
true		. > 0 and . < 3				
					if(${user_input}=1, 'C', if(${user_input}=2, 'P', ' '))	
false		. > 9999 and . < 555555	Statistical Area Invalid!			
true						
false					concat(position(../..)," ",position(..))	
					concat(substr(today(),7,5),substr(today(),10,8),substr(today(),2,4),' ',${vessel_samplenum})	
					once(concat(2,' ',${sample_id}))	
true		. > 100 and . < 999	Species Code Invalid!			
false		. < 200 and . >20	Check length!			
true		. > 0 and . < 4	Invalid sex code!			
					if(${sex_input}=1, 'M', if (${sex_input}=2, 'F', 'U'))	
false						
false						

APPENDIX D: ANGLER INTERVIEWS

Appendix D1.–Standardized procedures and questions for angler interviews, 2021.

1) Introduction and background:

Example Question	Background Info
"Hi, I'm XXX with the Alaska Department of Fish and Game. Would you be willing to provide some information about your fishing trip today to assist the department with fishery monitoring?	Introduce yourself as a department employee gathering information for fishery monitoring. If they refuse to participate, thank them and move on to the next interview. You can skip the intro once you have established a rapport with a charter operator.

2) Establish whether you should complete the interview: you will interview anyone who fishes for halibut, other bottomfish, or sharks, or catches one of these species while targeting salmon.

Example Question	Background Info
"What species were you fishing for today?"	1. If they targeted halibut, rockfish, lingcod or other bottomfish (including sharks), record the appropriate target species category and continue with the interview. Ask follow up questions to correctly classify the target. For example, if their initial response is "halibut," ask if they targeted any other species for a portion of the trip. 2. If they were NOT targeting one of the species listed, proceed with the next question.
"Did you catch any halibut, rockfish, lingcod, or sharks while targeting salmon?"	1. If "yes," record the target and complete the interview. 2. If "no," abort the interview and thank them for cooperating.

3) Collect user, effort, and area information:

Example Question	Background Info
"Was this a charter (guided) or private fishing trip?"	Remember that when guides take friends or other people fishing for free, it's a private trip. If any of the anglers are paying clients, consider it a charter trip and validate the halibut harvest if you can.
"What is your boat name?"	Charter boats only – no need to record boat names of private boats.
"What is your logbook number?	Charter boats only - Record the 6-digit number stamped in the upper right corner of the logbook (valid numbers are 190000-193000)
"Is this your first trip of the day?"	Record whether this was the boat's first or second trip of the day (some charter boats make 2 trips per day, though only one halibut trip is allowed per day).
"Were you out for more than one day?"	If they were out for portions of more than one calendar day, record the number of days where fishing occurred. For example, if the boat was out for a week but people only fished 3 days, enter three days.

-continued-

Example Question	Background Info
"In which stat area were most of your halibut caught?" *"In which stat area were most of your rockfish caught?"* *"In which stat area were most of your lingcod caught?"*	Show them the stat area map and help identify landmarks, particularly the 3-nautical-mile line. If necessary follow up with more specific questions regarding location and depth to get the correct stat area. Reassure reluctant people that the information is confidential, and that we're not looking for specific spots, but rather only stat areas. If they did not fish for rockfish or lingcod, leave these fields blank.
"Were you fishing north or south of a line connecting Cape Resurrection and Cape Aialik?"	Seward only – This question needs to be asked if the anglers report fishing in stat areas 495932 or 495938. Record the response as either (1) Inside Res. Bay, (2) Outside Res. Bay, or (3) Both. All other interviews should be coded as Outside.
"How many clients or comps were fishing?" ("Comps" are people that fished for free) *OR # PRIVATE ANGLER DAYS IF A PRIVATE TRIP*	Record the number of **angler-days, not anglers.** An angler-day is defined as an angler fishing any portion of a day. If the boat was only out for one day, the number of anglers is the number of angler-days. If the boat was out for more than one day, sum the number of people that fished each day to get the total angler-days. Count anyone on board the boat, including people that fished for free, if they fished for at least 30 minutes or caught any fish.
"Did the skipper or deckhands fish also?"	Record the number of angler-days for captain and crew as above. Captain and crew are allowed to fish in 2021, but may not retain halibut. Other species may be retained by crew.
"How many hours did you spend fishing for halibut?" *"How many hours did you spend fishing for rockfish?"* *"How many hours did you spend fishing for lingcod?"*	Use the answers to determine the time spent fishing and moving between fishing spots. If a multi-day trip, record the total for all days. Do not include large chunks of time spent in other activities when no gear was in the water. Record fishing time to the nearest 15 minutes (0.25 hours). If they did not fish for rockfish or lingcod, leave these fields blank.

4) Collect catch and harvest information: Start by asking whether they caught anything at all. Once you start into these questions, periodically ask if they caught any other fish in order to expedite the interview. Probe for additional information until you are sure they accurately identified the fish they caught. For multi-day trips record the totals for the entire trip.

Example Question	Background Info
"How many halibut did you keep (harvest)?"	Record ***total*** harvest for the boat-party, including fish cleaned or eaten at sea. Enter the sum for the entire trip, even if it lasted more than 1 day. If all of the halibut that were harvested are available and in sight, count them and enter a "Y" in the HA_KPT_VER field to indicate that the halibut harvest was verified, otherwise enter "N." - The harvest should not exceed 2 times the number of client or comp angler-days. Proxy fishing is not allowed for halibut.

-continued-

Example Question	Background Info
"How many GAF halibut did you harvest?"	**Charter trips only –** this is a subset of the total halibut harvest. Record the number of "guided angler fish – or GAF" that were harvested. Remember, GAF only allows Ch. anglers to keep up to the same bag and size limit as the unguided fleet (2 fish of any size) but not to exceed it.
"Of the halibut you kept, how many did you clean at sea?"	This question is asked to assess the accuracy of our sampling program by knowing what fraction of harvest is available for sampling. This number cannot exceed the number of halibut kept.
"How many halibut did you release that were caught on circle hooks?" *"How many halibut did you release that were caught on all other hook types?"*	These questions may be difficult for private anglers and charter skippers to recall. Ask them to estimate as close as possible. The questions about hook use will be used in the estimation of release mortality.
"How many pelagic rockfish did you keep?"	Pelagic assemblage includes primarily black, dusky, and yellowtail rockfish ("black bass"). -If all of the pelagic rockfish that were harvested are available and in sight, count them and enter "Y" in the validation field.
"Of the pelagic rockfish you kept, how many did you clean at sea?"	This question is asked to assess the accuracy of our sampling program by knowing what fraction of harvest is available for sampling. This number cannot exceed the number of pelagic rockfish kept.
"How many pelagic rockfish were released at the surface?"	Include all pelagic rockfish released at the surface (even dead fish), except those that were vented or fizzed.
"How many pelagic rockfish did you release at depth?"	Include all pelagic rockfish released at depth with a deepwater release mechanism, even dead fish.
"How many pelagic rockfish were vented or fizzed?"	Include all pelagic rockfish that were vented or fizzed then released, even dead fish. Venting or fizzing refers to the practice of puncturing the swim bladder to allow the fish to submerge.
"What was the average depth of capture for the pelagic rockfish you released?"	Reiterate that this is the depth of capture for pelagic rockfish released, not kept. This may be difficult for anglers and charter operators to estimate, but ask them to take their best guess. This information will be used for estimation of rockfish mortality.
"How many yelloweye rockfish did you keep?"	If all the yelloweye rockfish that were harvested are available and in sight, count them and enter a "Y" in the validation field.
"Of the yelloweye rockfish you kept, how many did you clean at sea?"	This question is asked to assess the accuracy of our sampling program by knowing what fraction of harvest is available for sampling. This number cannot exceed the number of yelloweye rockfish kept.
"How many yelloweye rockfish were released at the surface?"	Include all yelloweye rockfish released at the surface (even dead fish), except those that were vented or fizzed.
"How many yelloweye rockfish did you release at depth?"	Include all yelloweye rockfish released at depth with a deepwater release mechanism, even dead fish.

-continued-

Example Question	Background Info
"How many yelloweye rockfish were vented or fizzed?"	Include all yelloweye rockfish that were vented or fizzed then released, even dead fish. Venting or fizzing refers to the practice of puncturing the swim bladder to allow the fish to submerge.
"What was the average depth of capture for the yelloweye rockfish you released?"	Reiterate that this is the depth of capture for yelloweye rockfish released, not kept. This may be difficult for anglers and charter operators to estimate, but ask them to take their best guess. This information will be used for estimation of rockfish mortality.
"How many other (non-pelagic) rockfish did you keep?"	If all of the non-pelagic rockfish (not including yelloweye) that were harvested are available and in sight, count them and enter "Y" in the validation field.
"Of the other non-pelagic rockfish you kept, how many did you clean at sea?"	This question is asked to assess the accuracy of our sampling program by knowing what fraction of harvest is available for sampling. This number cannot exceed the number of non-pelagic rockfish kept.
"How many other (non-pelagic) rockfish were released at the surface?"	Include all other (non-pelagic) rockfish released at the surface (even dead fish), except those that were vented or fizzed.
"How many other (non-pelagic) rockfish did you release at depth?"	Include all other (non-pelagic) rockfish released at depth with a deepwater release mechanism, even dead fish.
"How many other (non-pelagic) rockfish were vented or fizzed?"	Include all other (non-pelagic) rockfish that were vented or fizzed then released, even dead fish. Venting or fizzing refers to the practice of puncturing the swim bladder to allow the fish to submerge.
"What was the average depth of capture for the non-pelagic rockfish you released?"	Reiterate that this is the depth of capture for non-pelagic rockfish released, not kept. This may be difficult for anglers and charter operators to estimate, but ask them to take their best guess. This information will be used for estimation of rockfish mortality.
"How many lingcod did you keep?"	If all of the lingcod that were harvested are available and in sight, count them and enter "Y" in the validation field.
"Of the lingcod you kept, how many did you clean at sea?"	Again, the question is asked to assess the accuracy of our sampling program by knowing what fraction of harvest is available for sampling. This number cannot exceed the number of lingcod kept.
"How many lingcod 35 inches and larger did you release?" *"How many lingcod less than 35 inches did you release?"*	Include all lingcod released, regardless of release condition. The questions are broken down by size category for stock assessment purposes.
"How many Pacific cod (or gray cod) did you keep?"	Include all cod killed and cut up for bait. Validate numbers if fish are available. Do not include Walleye Pollock or sablefish (black cod), you will ask the same questions for both species as you are asking for Pacific cod.
"Of the Pacific cod you kept, how many did you clean at sea?"	This number cannot exceed the number of Pacific cod kept, but should include all Pacific cod killed and cut up for bait.
"How many Pacific cod (gray cod) did you release?"	Include all cod released, regardless of release condition.

-continued-

Example Question	Background Info
"How many sablefish (or black cod) did you keep?"	Validate numbers if fish are available. Do not include Walleye Pollock or Pacific (grey) cod.
"Of the sablefish you kept, how many did you clean at sea?"	This number cannot exceed the number of sablefish kept.
"How many sablefish did you release?"	Include all sablefish released, regardless of release condition.
"How many walleye Pollock did you keep?"	Validate numbers if fish are available. Do not include sablefish (black cod) or Pacific (grey) cod.
"Of the Pollock you kept, how many did you clean at sea?"	This number cannot exceed the number of walleye Pollock kept.
"How many pollock did you release?"	Include all Pollock released, regardless of release condition.

At this point you can simply ask if any sharks were caught. If any were, repeat the last three questions for all applicable shark species.

Appendix D2.–Data fields for Data Plus Professional interview data application program (DataPlus CE Professional Version 3.05.0) deployed on an Allegro CX field PC (Juniper Systems).

Field	Description	Format	Valid entries
PORT	Port of landing (except is sublocation in CCI application)	Text	Kodiak, Homer, DC (Deep Creek), AP (Anchor Point), Seward, Whittier, Valdez
DATE	Date	MM/DD/YEAR	Autoentry
NAME	Name of port sampler	Text	
SURVEYAREA	Standard SF Division site codes	Text	Autoentry
BOATNAME	Name of boat	Text	
LOGBOOK	ADF&G logbook number	Integer	180000–183600
INT_TIME	Time of interview	HHMMSS	Autoentry
TRIP	First or second trip of the day	Integer	1 or 2
TOT_DAYS	Duration of trip in days (number of days fishing)	Integer	1-9
USER_GRP	User group (charter/private)	Text	C or P
TARGET	Target species category	Text	B (bottomfish), B+S (bottomfish & salmon), H (halibut), L (lingcod), R (rockfish), S (salmon), SSK (salmon shark), O (other)
STATAREA_H	ADF&G groundfish statistical area where halibut was harvested, released, or targeted	Integer 6	Port-specific values in drop down list
STATAREA_R	ADF&G groundfish statistical area where rockfish were harvested, released, or targeted	Integer 6	Port-specific values in drop down list
STATAREA_R	ADF&G groundfish statistical area where lingcod were harvested, released, or targeted	Integer 6	Port-specific values in drop down list
STAT_ALLSPECIES	ADF&G groundfish statistical area for trips where 'anything that bites' were targeted, and no fish were harvested or released	Integer 6	Port-specific values in drop down list
INT_AREA	Interview area; varies by harbor	Integer	1-5
IN_OUT_BAY	Use to indicate whether the boat was fishing inside or outside Resurrection Bay (or both)	Text	I (inside), O (outside), B (both)
CLIENTDAYS	Number of angler-days of effort by clients and comps (anglers that fish for free)	Integer	0-99

-continued-

Field	Description	Format	Valid entries
CREW_DAYS	Number of angler-days of effort by skipper and crew	Integer	0-9
HOURS_H	Number of hours of time spent targeting halibut	HH:MM (nearest 15 min)	0.25-100
HOURS_R	Number of hours of time spent targeting rockfish	HH:MM (nearest 15 min)	0.25-100
HOURS_L	Number of hours of time spent targeting lingcod	HH:MM (nearest 15 min)	0.25-100
HOURS_ALLSPECIES	Number of hours of time spent targeting 'anything that bites'	HH:MM (nearest 15 min)	0.25-100
HA_KPT	Number of halibut kept	Integer	0-60 with bag limit check
HA_KPT_VER	Verified the number of halibut kept	Text	Y (yes) or N (no)
HA_CAS	Number of halibut cleaned at sea	Integer	0-60
HA_REL_CIR	Number of halibut released that were caught on circle hooks	Integer	0-99
HA_REL_OTH	Number of halibut released that were caught on all other hook types	Integer	0-99
P_KPT	Number of pelagic rockfish kept	Integer	0-150 with bag limit check
P_KPT_VER	Verified the number of pelagic rockfish kept	Text	Y (yes) or N (no)
P_CAS	Number of pelagic rockfish cleaned at sea	Integer	0-150
P_R_SURF	Number of pelagic rockfish released at the surface except those fish that were vented or fizzed.	Integer	0-99
P_R_DRM	Number of pelagic rockfish released at the depth of capture with deepwater release mechanism	Integer	0-99

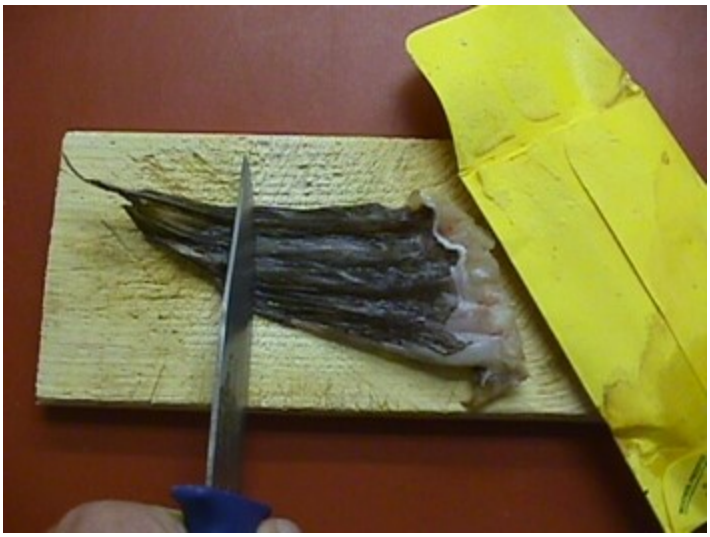
-continued-

P_R_DEPTH	Average depth of capture (in feet) for pelagic rockfish that were released	Integer	0-999
YE_KPT	Number of yelloweye rockfish kept	Integer	0-150 with bag limit check
YE_KPT_VER	Verified the number of pelagic rockfish kept	Text	Y (yes) or N (no)
YE_CAS	Number of yelloweye rockfish cleaned at sea	Integer	0-150
YE_R_SURF	Number of yelloweye rockfish released at the surface except those fish that were vented or fizzed	Integer	0-99
YE_R_DRM	Number of yelloweye rockfish released at the depth of capture with a deepwater release mechanism.	Integer	0-99
YE_R_DEPTH	Average depth of capture (in feet) for yelloweye rockfish that were released	Integer	0-999
NP_KPT	Number of other non-pelagic rockfish kept	Integer	0-60 with bag limit check
NP_KPT_VER	Verified the number of other non-pelagic rockfish kept	Text	Y (yes) or N (no)
NP_CAS	Number of other non-pelagic rockfish cleaned at sea	Integer	0-30
NP_R_SURF	Number of other non-pelagic rockfish released at the surface except those that were vented or fizzed.	Integer	0-99
NP_R_DRM	Number of other non-pelagic rockfish that were released at the depth of capture with a deepwater release mechanism.	Integer	0-99
NP_R_DEPTH	Average depth of capture (in feet) for other non-pelagic rockfish that were released	Integer	0-999
LC_KPT	Number of lingcod kept	Integer	0-60 with bag limit check
LC_KPT_VER	Verified the number of lingcod kept	Text	Y (yes) or N (no)

-continued-

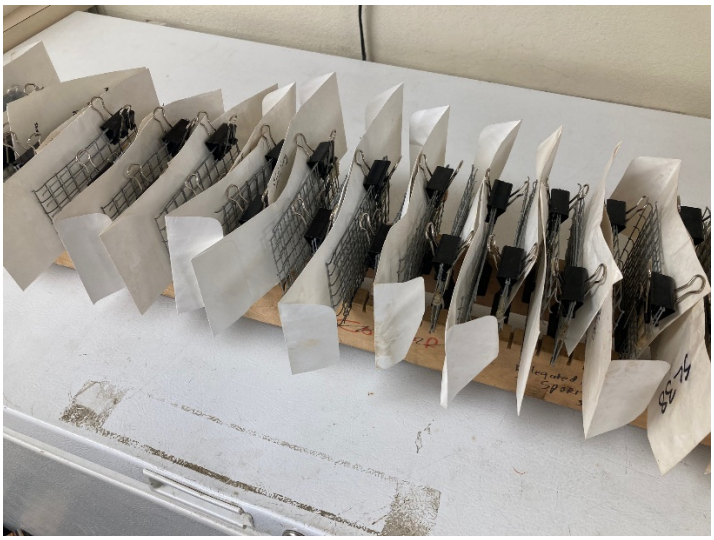
LC_CAS	Number of lingcod cleaned at sea	Integer	0-60
LC_REL_OVR	Number of lingcod released that were 35 inches or greater in total length	Integer	0-99
LC_REL_UND	Number of lingcod released that were under 35 inches total length	Integer	0-99
PCOD_KPT	Number of Pacific cod kept, includes those used for bait.	Integer	0-99
PCOD_KPT_VER	Verified the number of Pacific cod kept	Text	Y (yes) or N (no)
PCOD_CAS	Number of Pacific cod cleaned at sea (include those caught and used for bait)	Integer	0-99
PCOD_REL	Number of Pacific cod released	Integer	0-99
SAB_KPT	Number of sablefish (black cod) kept	Integer	0-99
SAB_KPT_VER	Verified the number of sablefish kept	Text	Y (yes) or N (no)
SAB_CAS	Number of sablefish cleaned at sea	Integer	0-99
SAB_REL	Number of sablefish released	Integer	0-99
POL_KPT	Number of Pollock kept	Integer	0-99
POL_KPT_VER	Verified the number of Pollock kept	Text	Y (yes) or N (no)
POL_CAS	Number of Pollock cleaned at sea	Integer	0-99
POL_REL	Number of Pollock released	Integer	0-99
SS_KPT	Number of salmon sharks kept	Integer	0-99
SS_KPT_VER	Verified the number of salmon sharks kept	Text	Y (yes) or N (no)
SS_CAS	Number of salmon sharks cleaned at sea	Integer	0-99
SS_REL	Number of salmon sharks released	Integer	0-99
SD_KPT	Number of spiny dogfish kept	Integer	0-99
SD_KPT_VER	Verified the number of spiny dogfish kept	Text	Y (yes) or N (no)
SD_CAS	Number of spiny dogfish cleaned at sea	Integer	0-99
SD_REL	Number of spiny dogfish released	Integer	0-999
SLP_KPT	Number of sleeper sharks kept	Integer	0-99
SLP_KPT_VER	Verified the number of sleeper sharks kept	Text	Y (yes) or N (no)
SLP_CAS	Number of sleeper sharks cleaned at sea	Integer	0-99
SLP_REL	Number of sleeper sharks released	Integer	0-99
COMMENTS	Unrestricted comments.	Text	

APPENDIX E: LINGCOD FIN RAY PREPARATION



Appendix E1.–Trimming the tip of the fin ray.

Appendix E2.–Fully trimmed fin ray clipped for drying.

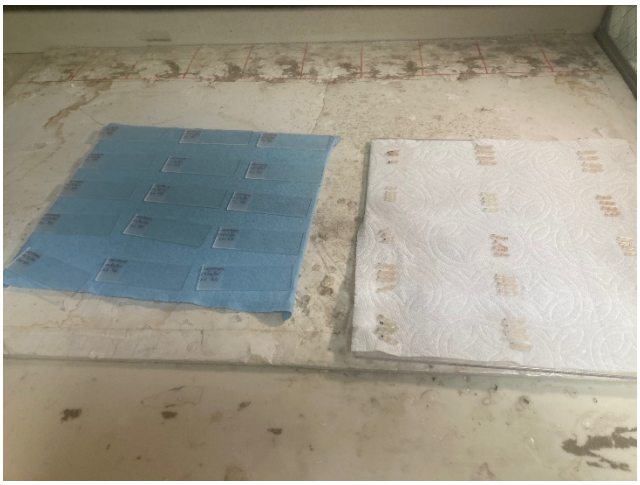


Appendix E3.–Fin rays drying overnight.

Appendix E4.–Dried fin rays stored and ready for sectioning.

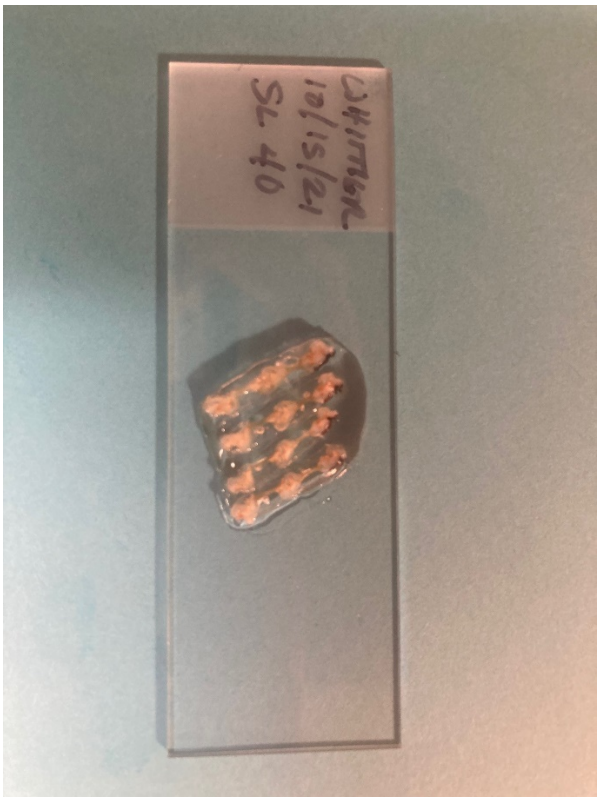
Appendix E5.–Insta-set and Insta-cure system for gluing fin rays.

Appendix E6.–Sectioned fin ray pieces drying on paper towel.



Appendix E7.–Labeled slides and associated fin ray sections ready for mounting.

Appendix E8.–Thin layer of Flo-Texx liquid cover slip ready for fin ray sections.



Appendix E9.–Mounted fin rays.

Appendix E10.–Mounted fin rays drying overnight.