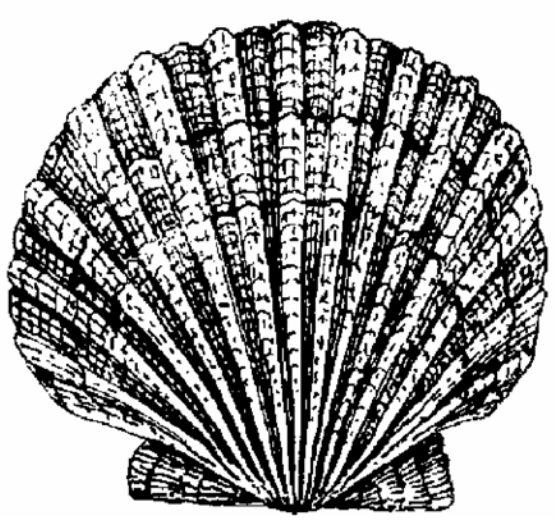
STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE SCALLOP FISHERY OFF ALASKA

April 2020

Prepared by:

The Scallop Plan Team



With contributions by:

Jim Armstrong (NPFMC), Asia Beder (ADF&G Dutch-Harbor), Ryan Burt (ADF&G-Kodiak), Mike Byerly (ADF&G Homer), Kendall Henry (ADF&G-Juneau), Tyler Jackson (ADF&G-Kodiak), Scott Miller (NMFS Juneau), Andrew Olson (ADF&G-Douglas), John Olson (NMFS Anchorage), Natura Richardson (ADF&G-Kodiak), Janet Rumble (ADF&G-Homer), Elisa Russ (ADF&G Homer), Ben Williams (ADF&G-Juneau), and Jie Zheng (ADF&G Juneau)

North Pacific Fishery Management Council
1007 W. 3rd Avenue, Suite 400
Anchorage, Alaska 99501

Table of Contents

List of Tables

List of Figures

Executive Summary

An annual Scallop Stock Assessment Fishery Evaluation (SAFE) report is required by the North Pacific Fisheries Management Council's *Fishery Management Plan for the Scallop Fishery off Alaska* (FMP). Under the FMP, the report is prepared by the Alaska Department of Fish and Game (ADF&G) with input from the National Marine Fisheries Service (NMFS) and the Council's scallop plan team (SPT). The SAFE summarizes current biological and economic status of the fisheries, guideline harvest levels, and support for different management decisions or changes in harvest strategies.

The Scallop Plan Team met on February 19th, 2020 in Kodiak to update the scallop SAFE report with recent abundance survey information and fishery performance data. Plan Team review was based on presentations by staff from the Council, NMFS, and ADF&G and included opportunities for public comment and input.

New Information in the 2020 SAFE:

- *2019 fishery-independent dredge survey results*
- *State management region – specific:*
  - *2018/19 discard estimates*
  - *2018/19 fishery CPUE*
  - *2019/20 landings*

Scallop Harvest:
Scallop abundance is estimated for portions of two of the nine registration areas only, therefore, in the absence of stock size and MSST estimates, **the status of the scallop stocks is "unknown"**.

The total catch estimate for the 2018/19 season is 238,973lb (108 t) of shucked meats. This is less than 20% of OFL, and, therefore, **overfishing did not occur in 2018/19**

Area-specific harvest limits were met in approximately two thirds of the fishing areas, specifically the Yakutat, Prince William Sound, Kodiak NE, Shelikof, Kodiak Southwest, and Bering Sea Districts.

Scallop *landings-only* in 2019/20 are estimated to be 224,765 lb (102 t) Fishery discard estimates are not yet available, and the Scallop Plan Team will evaluate total catch in the 2021 SAFE. However, the retained catch is well below OFL.

Scallop Plan Team Harvest Recommendations for 2020/21:
The Scallop Plan Team recommends that OFL in the 2020/21 season be set equal to maximum OY (1.284 million lb; 582 t) as defined in the Scallop FMP. The Team also recommends that ABC for scallops in 2020/21 be set consistent with the maximum ABC control rule (90% of OFL) as defined in the FMP, and which is equal to 1.156 million lb (524 t).

Definitions

The FMP contains the following stock status definitions:

Acceptable biological catch (ABC). The ABC is a level of annual catch of a stock that is set below the OFL and accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. The maximum ABC is calculated from the ABC control rule. Annually, the Council's Scientific and Statistical Committee will set a statewide ABC for the weathervane scallop fishery prior to the beginning of the fishing season. The Scientific and Statistical Committee may set an ABC lower than the maximum ABC, but it must provide an explanation for setting the ABC below the maximum ABC.

ABC Control Rule. The ABC control rule is the specified approach for setting the maximum ABC for weathervane scallops. The ABC control rule calculates a statewide maximum ABC at 90 percent of the OFL, which provides a 10 percent buffer to account for scientific uncertainty in the estimation of the OFL. Lacking a stock assessment model, the sources of scientific uncertainty in the weathervane scallop OFL estimate are not directly quantifiable at this time. The 10 percent buffer incorporates scientific uncertainty and limits the risk of overfishing occurring in the weathervane scallop fishery.

Annual catch limit (ACL). The ACL is the level of annual catch of a stock that serves as the basis for invoking accountability measures. For weathervane scallops, the ACL will be set equal to the ABC. Measures to ensure accountability with the ACL are described in section 3.2 of the FMP.

Guideline Harvest Levels (GHLs) are established by the State annually for each scallop management area at a level sufficiently below the ACL so that total catch (directed fishery removals plus all fishery discard mortality) does not exceed the ACL. As an accountability measure, if an ACL is exceeded, the overage will be accounted for through a downward adjustment to the GHL for the following fishing season by an amount sufficient to remedy the biological consequences of the overage.

Maximum Sustainable Yield (MSY). MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. The long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained is considered a reasonable proxy for MSY

MSY for weathervane scallops is 1.284 million lbs. (582 metric tons) of shucked meats. MSY is estimated based on the average retained catch from 1990-1997, (1995 data is not included as the fishery was closed most of the year), which is 1,240,000 lbs. (562.46 metric tons) of shucked meats, plus an amount equivalent to estimates of the additional fishing mortality during the 1990-1997 period (excluding 1995). Additional fishing mortality includes discard mortalities from the directed scallop fishery, the groundfish fisheries, and total mortality from agency surveys.

The time period from 1990 to 1997 reflects prevailing ecological conditions. The fishery was fully capitalized during this time period, and all areas of the state where scallops could be harvested were being exploited. Prior to that time period, vessels moved into and out of the scallop fishery, in part in response to economic opportunities available in other fisheries (Shirley and Kruse, 1995). However, since 1993, the fishery has been somewhat limited by crab bycatch limits, closure areas, and season length. As a consequence, a stable period during the history of this fishery does not exist. MSY estimation by averaging catches is problematic, however, a better solution does not exist at this point.

MSY Control Rule (F_{msy}). The MSY control rule is a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. In choosing an MSY control rule, the Council is guided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. In any MSY control rule, a given stock size is associated with a given level of

fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY. The MSY control rule is based on natural mortality, using the estimate of M = 0.13, the MSY control rule F_{msy} equals M, or F_{msy} = 0.13. *MSY Stock Size (B_{msy})*. The MSY stock size is the long term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, associated with the production of MSY. It is the stock size that would be achieved under an appropriate MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required.

As noted earlier, MSY for weathervane scallops is established at 1.284 million lbs. (582 mt) of shucked meats. Therefore, MSY stock size is estimated as MSY/M = 9.87 million lbs. (4,477 mt) of shucked meat biomass. In terms of whole animals (including shells and gurry) B_{msy} would be 98.7 million lbs. (44,760 mt), as expanded by a product recovery rate of 10%. This assumes that the stock was at B_{msy} and that catches were at MSY during 1990-1997 period, and that the logistic equation holds.

MSY stock size (B_{msy}). The long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at Fmsy.

Minimum Stock Size Threshold (MSST). The (MSST), to the extent possible, should equal whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. Should the actual size of the stock or stock complex in a given year fall below MSST, the stock or stock complex is considered overfished. The MSST should be expressed in terms of spawning biomass or other measure of reproductive capacity. Based on the national standard guidelines, a MSST for weathervane scallops is established based on ½ MSY stock size = ½ B_{msy} = 4.93 million lbs. (2,236 mt) of shucked meats.

Overfishing Control Rule ($F_{overfishing}$). The national standard guidelines define the terms Aoverfishing@ to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. The overfishing rate is established for weathervane scallop as a fishing rate in excess of the natural mortality rate. Hence, $F_{overfishing}$ = M = 0.13.

Overfishing Limit (OFL). The OFL will be used to determine if overfishing occurs in a given year. Overfishing occurs if the total catch exceeds the OFL. If an estimate of the statewide weathervane scallop spawning biomass is available, the overfishing control rule would be applied to that estimate of spawning biomass to determine the OFL. In the absence of an estimate of the statewide weathervane scallop spawning biomass, the default OFL is the MSY of 1.284 million lbs. (582 mt) of shucked meats.

Optimum Yield (OY). Optimum yield should be established on the basis of MSY. OY is upper bounded by MSY = F_{msy} B_{msy} = M B_{msy} (= 1.284 million lbs or 582 mt.). Hence, a numerical range for OY of 0-1.284 million lbs. (582 mt) can thus be established for Alaska weathervane scallops. Sufficient conservatism is built into establishing an annual OY cap of 1.284 million lbs. (582 mt) of shucked meats for the following reasons:

1. the years of averaging include years when no fishing occurred in the Bering Sea, but obviously some sustainable harvest was possible;
2. the period of averaging includes other areas and years when the harvest was constrained by fishery controls, such as recently by bycatch PSCs, and therefore the resulting catch underestimates the productivity of scallop stocks;
3. substantial areas are closed to scallop dredging due to concerns about bycatch, yet these areas have substantial productivity;

4. closed areas can almost be thought of as marine refuges and potential yields from these areas are not factored into MSY estimates;
5. there are years during the history of the fishery when effort was low due to market (not abundance) conditions;
6. $F_{30\%}$ is probably a better estimator of $F_{overfishing}$ than is F=M, yet $M<F_{30\%}$ so the overfishing rule is conservative; and
7. in years of good recruitment, the stocks are likely greater than B_{msy}, thus we will fish at $F<F_{overfishing}$ to achieve OY=MSY (recall MSY = F_{msy} B_{msy}, so if $B>B_{msy}$, then $F<F_{msy}$).

1 Introduction

National Standard 2 guidelines (50 CFR 600.315) require regular preparation and review of a Stock Assessment and Fishery Evaluation (SAFE) report, or similar document, for each federal fishery management plan (FMP). The SAFE report summarizes the current biological and economic status of the fishery as well as analytical information used in fishery management such as survey and fishery catches and OFL/ABC. This report was prepared by the Scallop Plan Team (SPT), members of which include biologists and researchers from the Alaska Department of Fish and Game (ADF&G), the National Marine Fisheries Service (NMFS), and the North Pacific Fishery Management Council (NPFMC). The annual SAFE reports are presented to the NPFMC and is also available to the public on the NPFMC web page at: https://www.npfmc.org/fishery-management-plan-team/scallop-plan-team/.

The scallop fishery in Alaska's Exclusive Economic Zone (EEZ; from 3 to 200 miles offshore) is jointly managed under Federal and State of Alaska authority under the FMP. Most aspects of scallop fishery management are delegated to the State, while Federal requirements are maintained within the FMP. The initial FMP was developed by the Council under the Magnuson Stevens Act (MSA) and approved by NMFS in 1995. The Council has adopted several amendments to the FMP with the latest (Amendment 15) being approved in 2012. Scallop fisheries inside 3 miles are managed by the State of Alaska.

Although the FMP covers all scallop stocks off the coast of Alaska, including weathervane scallop (*Patinopecten caurinus*), reddish scallop (*Chlamys rubida*), spiny scallop (*Chlamys hastata*), and rock scallop (*Crassadoma gigantea*), the weathervane scallop is the only commercially targeted stock at this time. Commercial fishing for weathervane scallops occurs in the Gulf of Alaska, Bering Sea, and waters off the Aleutian Islands. State scallop registration areas and general fishing locations are shown in Figure 1-1)

Note: The Alaska Department of Fish and Game has obtained release forms signed by vessel operators in order to display confidential catch information. Whenever possible, unless otherwise indicated as "confidential", catch records have been made available for publication by the State.

1.1 Basis for Optimum Yield

In the original FMP, optimum yield (OY) was established as a range from 0 to 1.1 million lb (~500 t) of shucked scallop adductor muscles (meats) with the upper end being based on the historic high in landings since 1993. Under Amendment 1, in 1996, the upper end for OY was increased to 1.8 million lb (816 t) to account for historic State water landings. A more conservative approach was taken in 1999, when OY was re-defined as 0 to 1.24 million lb (562 t) with the upper end reflecting *average* rather than *maximum* catch. The upper bound of OY is MSY, defined in the current FMP as the average catch from the reference period of 1990-1997 excluding 1995 (Table 1-1). Most recently, in 2012, under Amendment 13, OY was re-defined as 0 to 1.284 million lb (582 t) of shucked meats to include estimated discards over the reference time frame. Alaska scallop harvests have not exceeded OY in any year since it was first established.

In the absence of a stock assessment for scallops off Alaska, OFL and ABC have been set historically and recently based on the above definition of OY such that max OFL = OY. The maximum ABC control rule is defined as max ABC = 90% of OFL = 1.156 million lb.

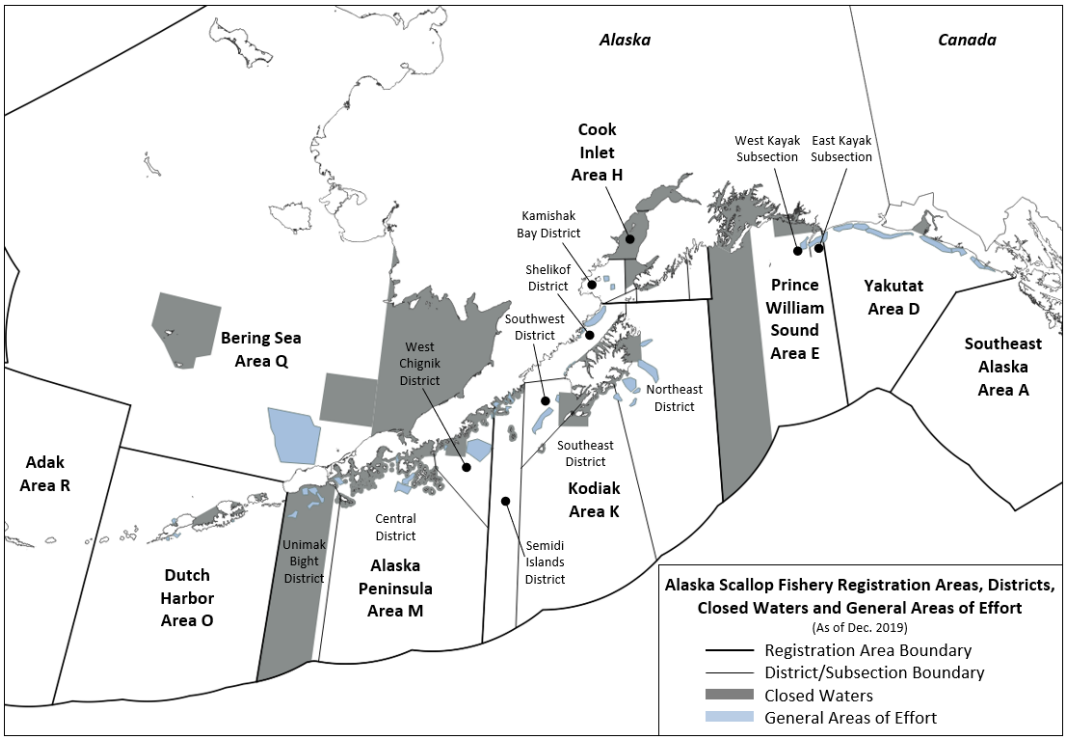


Figure 1-1 Alaska scallop fishery registration areas*.

**General areas of effort are overlaid by blue polygons. Exploratory fisheries in waters normally closed to scallop fishing (gray shading) have been opened by ADF&G Commissioner's Permit in the Alaska Peninsula Unimak Bight District during past seasons.*

Table 1-1 Weathervane scallop harvest 1990-1997 including state and federal waters.

Year	Unique Vessels	Total Pounds	Total Est. Earnings	Unique IUPs	Average Price / lb
1990	9	1,488,737	$5,073,572	15	$3.41
1991	6	1,136,649	$4,279,200	7	$3.76
1992	8	1,753,873	$6,796,699	12	$3.88
1993	15	1,511,539	$6,981,415	22	$4.62
1994	17	1,256,736	$7,039,262	22	$5.60
1995*	10	351,023	$1,847,666	10	$5.36
1996	9	728,424	$4,670,515	10	$6.41
1997	9	802,383	$4,329,752	11	$5.40
Mean all years	10.4	1,128,671	$5,127,260	13.6	$4.81
Mean excluding 1995	10.4	1,239,763	$5,595,774	14.1	$4.73

Adapted from Free-Sloan 2007. Catch differs from catch numbers in Table 2-1 due to the lack of discard mortality accounting.
* From February 23, 1995, until August, 1996, the EEZ was closed to fishing. 1995 federal waters harvest and earnings occurred in January and February prior to closure.

2 Weathervane Scallop Stock Assessment

A functional stock assessment model for weathervane scallops in Alaska does not exist, although efforts to develop an age-based assessment are ongoing. In the absence of a formal stock assessment, State harvest limits (i.e., GHLs) are established using data gathered through the scallop fishery observer program as well as fishery-independent scallop dredge surveys.

2.1 Stock Status Determination

Total Alaska scallop removals by fishing season are provided in Table 2-1, Figure 2-1 along with specified OFL. Since 1996, catches have averaged 37% of OFL. Catches by individual registration areas are provided in Table 4-1 and Table 4-2 in Section 4.

Scallop abundance is estimated for portions of two of the nine registration areas only, therefore, in the absence of a statewide stock size estimate relative to MSST, **the status of the scallop stocks is "unknown"**. This is not considered to be a conservation concern since scallops are distributed in many areas that have been closed to fishing to protect crab populations and in areas not defined as commercial beds (also, see the OY definition provided on page 8).

Without a reliable stock assessment model, MSY for weathervane scallops, as defined in the FMP, is 1.284 million lb (582 metric tons), the average catch (landed and estimated discard mortality) from 1990-1997 (excluding 1995). In the absence of an estimate of the statewide weathervane scallop spawning biomass, the default OFL is the MSY of 1.284 million lbs. (582 mt) of shucked meats. In 2018/19, total removals (landing + discards) were 238,973 lb (108 t) of shucked meats; therefore, **overfishing did not occur** .

Scallop *landings-only* in 2019/20 are estimated to be 224,765 lb (102 t) and discard estimates are not yet available.

Table 2-1 Alaska weathervane scallop removals (landings + discards) relative to specified OFL.

SEASON	TOTAL CATCH (LBS MEATS)	OFL (LBS MEATS)	% OY
1993/94	984,583	1,800,000	54.7
1994/95	1,240,775	1,800,000	68.9
1995/96	410,743	1,800,000	22.8
1996/97	732,424	1,800,000	40.7
1997/98	818,913	1,800,000	45.5
1998/99	822,096	1,240,000	66.3
1999/00	837,971	1,240,000	67.6
2000/01	750,617	1,240,000	60.5
2001/02	572,838	1,240,000	46.2
2002/03	509,455	1,240,000	41.1
2003/04	492,000	1,240,000	39.7
2004/05	425,477	1,240,000	34.3
2005/06	525,357	1,240,000	42.4
2006/07	487,473	1,240,000	39.3
2007/08	458,313	1,240,000	37.0
2008/09	342,434	1,240,000	27.6
2009/10	487,913	1,240,000	39.3
2010/11	468,466	1,240,000	37.8
2011/12	455,331	1,290,000	35.3
2012/13	418,880	1,290,000	32.5
2013/14	399,134	1,290,000	30.9
2014/15	308,868	1,290,000	23.9
2015/16	264,532	1,290,000	20.5
2016/17	232,991	1,290,000	18.1
2017/18	238,740	1,290,000	18.5
2018/19	238,973	1,290,000	18.5
2019/20[a]	224,765	1,290,000	17.4

[a] PRELIMINARY estimate, discards not included.

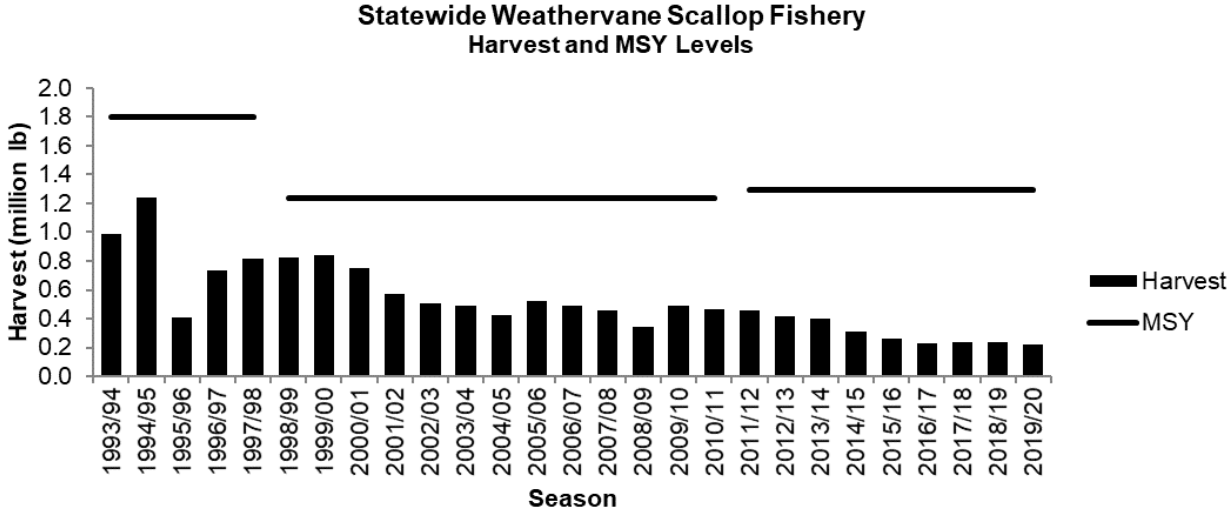


Figure 2-1 Statewide scallop harvest (lb shucked scallop meats) and MSY levels from FMP.

2.2 Fishery Observer Program

Data gathered through the observer program comprise the primary information source for the State in setting harvest limits. These data include time series of scallop harvest and fishery CPUE, fishing location, size and age composition of the catch, scallop discards, and crab bycatch. ADF&G and the SPT recognize inherent weaknesses in using fishery-dependent data for management purposes. Industry CPUE may be an unreliable index of scallop abundance due to factors such as the general incentive to seek out areas with the highest CPUE, but also market conditions, weather, tides, gear efficiency, bycatch avoidance, captain and crew performance, etc. Industry participants have noted that the time of year when fishing occurs can affect CPUE considerably due to summer and winter differences in weather and sea state. Additionally, fishery-dependent size composition data may not be representative of the true size composition of a given scallop bed, since fishing location within the bed is non-random and gear does not select all shell sizes.

2.3 Fishery Independent Survey

The Alaska Department of Fish and Game (ADF&G) initiated a statewide weathervane scallop (*Patinopecten caurinus*) dredge survey in 2016 to collect fishery-independent data for use in managing weathervane scallops in Alaska. Prior to 2016, fishery-independent weathervane scallop (hereafter scallop) dredge surveys had been restricted to the Cook Inlet and Prince William Sound registration areas (Figure 1-1). Initial surveys were conducted for Kamishak Bay and Kayak Island in 1984 and 1996, respectively (Hammarstrom and Merritt 1985, Bechtol et al. 2003), and were conducted biennially since 1996 (Gustafson and Goldman 2012). These surveys enabled ADF&G to (1) delineate the primary scallop beds; (2) estimate scallop abundance and biomass within these beds; (3) define bed composition through age and shell height data; and (4) estimate bycatch rates of non-target species, particularly Tanner crab (Chionoecetes bairdi). All other management areas in the state were reliant on fishery-dependent data gathered from the statewide scallop observer program to inform management decisions (NPFMC 2018). The statewide survey supersedes the previous survey, though follows a similar survey design (Gustafson and Goldman 2012, Smith et al. 2016) in order to provide fishery-independent information for the sustainable management of scallop stocks in Alaska waters.

The 2019 survey was scheduled to include Yakutat, Kamishak and Kayak Island Areas. There is limited fishery-independent data for a number of these areas to assist managers in their GHL determinations. In this report we examine the methods and results of the 2019 scallop dredge survey including (1) changes in methods from Smith et al. (2016), (2) catch rates and abundance estimates at the bed level and, (3) the survey abundance estimates from survey sites.

2.3.1 Study Areas

Under the current Operational Plan (Smith et al. 2016) the statewide scallop survey targets the main scallop beds from Cape Fairweather south of Yakutat to the Southwest District of the Kodiak Management Area. The areas surveyed in a given year is dependent on a combination of management, research and stock assessment considerations, as well as survey logistics and the availability of financial, personnel and material resources. The 2019 survey included a total of six scallop beds in the Cook Inlet, Prince William Sound, and Yakutat Districts (Figure 2-2).

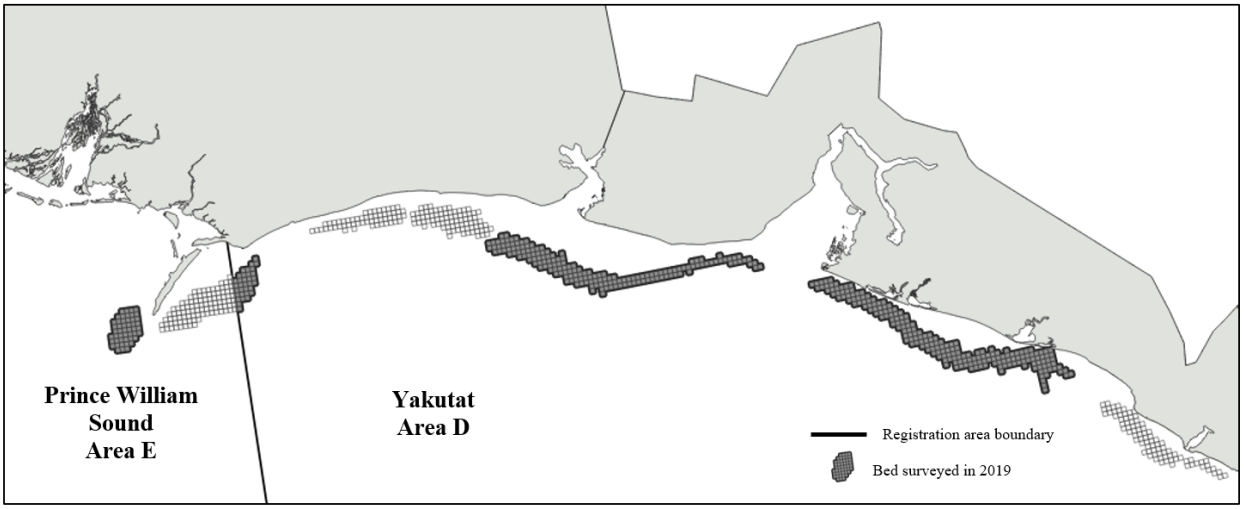


Figure 2-2 Location of scallop beds in ADF&G statewide scallop dredge survey areas. Dark outlines indicate beds surveyed in 2019.

Kamishak District

The Kamishak District (KAM) survey area is located in Cook Inlet near Augustine Island. Bottom depths in the scallop beds vary between 20–80 fathoms (36–146 m) throughout the area where commercial fishing occurs. The north bed (KAMN) was surveyed in fall 2019, but data was not yet available at the time of this summary.

Prince William Sound District

The western Kayak Island bed (WK1) bed was surveyed in 2019 (Figure 2-3). Bottom depths in this bed vary between 30–80 fathoms (55–146 m) throughout the area where commercial fishing occurs.

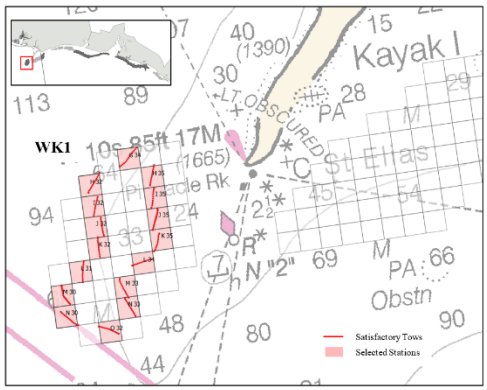


Figure 2-3 Sample locations in Prince William Sound district bed WK1 during the 2019 weathervane scallop survey. Red lines indicate successful dredge tow tracks in sampled stations. Pink cells were the randomly selected dredge location.

Yakutat District

The Yakutat District (YAK) survey area is a long narrow swath from the northwest to the southeast along the coast of Alaska on either side of Yakutat Bay (Figure 2-4). The scallop beds depths vary from 10–80 fathoms (55–146 m). Four beds were surveyed in 2018 (YAKB, YAK3, YAK4, YAK5).

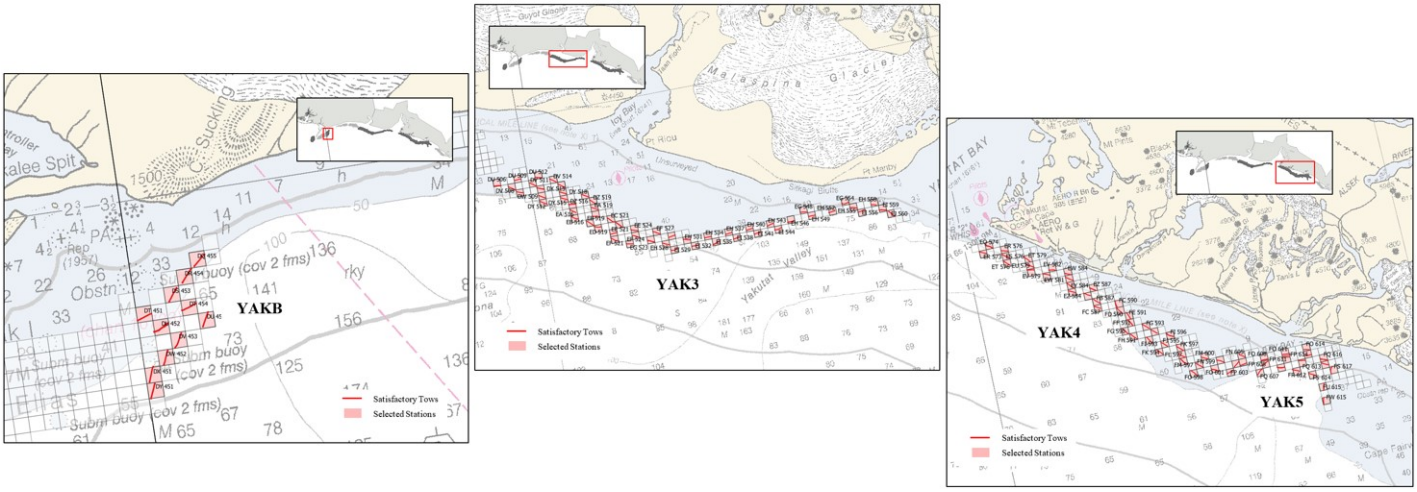


Figure 2-4 Sample locations in Yakutat district beds during the 2019 weathervane scallop survey. Red lines indicate successful dredge tow tracks in sampled stations. Pink cells were the randomly selected dredge location.

2.3.2 Methods

Survey stations within defined scallop beds (Smith et al. 2016) were fished using a New Bedford style scallop dredge. Scallop beds were delineated into a grid of 1 nmi x 1 nmi survey stations. Survey stations were selected for sampling using systematic random sampling independently for each bed. The target number of survey stations to be sampled in a given bed was chosen with the goal of keeping the coefficient of variation (CV) of catch rates and abundance estimates ≤20% for large-size scallops. The 2.43 m (8 ft) dredge was equipped with a ring bag composed of rings with an inside diameter of 101.6 mm (4.0 in) additionally a 38.1 mm (1.5 in) mesh liner was used to facilitate the retention of smaller scallops. A single 15–min tow approximately 1.0 nmi in length was made in each selected survey grid. Dredge performance was monitored, and stations were re-towed if performance was judged unsatisfactory. Actual tow lengths, needed for area-swept calculations, were determined by comparing the linear distance between tow start and end points with the distance recorded by the vessel's navigational system, the latter was used if the discrepancy between the two distances exceeded 10%.

Dredge haul contents were processed, and all data were recorded consistent with the protocols detailed in the statewide scallop survey Operational Plan (Smith et al. 2016). Scallops were sorted by size class (shell height < 100 mm; shell height ≥100 mm, small and large, respectively), counted and collectively weighed. The two size classes were subsampled for collection of individual biological information including shell height and for the larger size class: round weight, meat weight, i.e., weight of the shucked adductor muscle, meat condition, sex, gonad condition and various measures of shell condition. Shells from a secondary subsample of the large scallops were retained for aging (Siddon et al. 2017).

Abundance and Biomass

Area-swept estimates of abundance and round-weight biomass were estimated for both small and large scallops for each bed surveyed. Letting A denote total bed area in nmi² and *n* the number of survey stations with successful tows, the area-swept estimate of scallop abundance by bed is:

$$\hat{N} = A \cdot \frac{1}{n} \sum_{i=1}^{n} \frac{N_i}{Q \cdot a_i}, \qquad (1)$$

where N_i is the number of scallops caught during tow i, a_i is the corresponding area swept, and Q is the efficiency, or catchability, of the dredge. Dredge efficiency Q was assumed equal to 0.83 based on Gustafson and Goldman (2012). The area-swept estimate of scallop round weight biomass $\hat{B}_R$ was

estimated by substituting round weight W_i in place of N_i. Confidence intervals for these estimators were calculated using bootstrapping and the percentile method (Efron and Tibshirani 1993).

Scallop meat-weight biomass was estimated for each bed using the two-stage estimator. Survey protocols entail measuring individual scallop meat weight from a subsample of captured large scallops in each tow (Smith et al. 2016). Accordingly, bed meat weight biomass is estimated using the two-stage estimator

$$\hat{B}_M = A \cdot \frac{1}{n}\sum_{i=1}^{n} \frac{N_i}{n_i} \cdot \frac{\sum_{j=1}^{n_i} w_{i,j}}{Q a_i}, \qquad (2)$$

where n_i is the number of subsampled large scallops associated with tow i, $w_{i,j}$ the meat weight of subsampled scallop j from tow i.

Approximate confidence intervals were estimated through bootstrapping of the two-stage design. Note that this method of estimating meat weight biomass differs from that used in the reported results of the 2016 statewide scallop dredge survey (Williams et al. 2017).

Shell Height Distributions

Measurements of shell height were recorder for up to 30 scallops for both small and large scallops from each tow (Smith et al. 2016). Scallop shell height distributions were weighted by bed, to account for both subsampling of measured scallops within the two size classes and between-tow variation in the area swept by the dredge, measured scallop *j* captured in tow *i* was assigned weight

$$\lambda_{i,j} = \frac{\left(\frac{N_i}{n_i}\right)}{a_i}.$$

Here N_i denotes the number of large or small scallops captured in tow i, and n_i the number of those that were measured in subsampling. For display, histograms were constructed so that bar heights reflect the sum of the weights rather than the simple count of scallops within each bin.

Summaries of other biological data collected (e.g., presence of weak meats and clappers) during the survey were used as additional indicators of scallop stock status on surveyed beds.

2.3.3 Results

Survey Performance

A total of 140 successful ~1.0 nm survey tows were completed during the 2019 statewide scallop dredge survey between May 5 and May 16, 2019 (Table 2-1). The commercial vessel F/V Provider was the survey platform for all stations. A total of 16 successful tows were completed within the Western Kayak Island bed (Table 2-1).

Total catch was 2,085 scallops with a combined weight of 743 lb. Average density of small and large scallops were, 14,332 and 82,339 scallops nm^{-2}, respectively. Small scallop densities had a standard deviation of 5,446 scallops nm^{-2}, whereas large scallops had a standard deviation of 31,289 scallops nm^{-2} (Figure 2-5). Associated CVs were 38% for both large and small size classes (

Table 2-2).

The survey vessel made 124 successful tows in the Yakutat area during the 2019 statewide scallop dredge survey: 11 in YAK B, 54 in YAK 3, 40 in YAK 4, and 19 in YAK 5 (

Table 2-2). Total catch was 12,190 scallops with a combined weight of 3,290 lb. Small scallops had an average density of 23,801 scallops nm^{-2}, with a standard deviation of 48,361 scallops nm^{-2}. Large scallops had an average density of 48,563 scallops nm^{-2} with a standard deviation of 57,921 scallops nm^{-2}. Survey

efficiency, as measured by catch rate CVs, was somewhat better in this area than in the previous district. CV of larger scallop density within beds were within or near the desired 20% target, though smaller scallops had higher CVs than desired within all beds (Figure 2-5,

Table 2-2).

Table 2-2 Number of stations and tows for surveyed beds in the 2019 statewide scallop dredge survey with total scallop catches, average scallop densities and corresponding CVs by scallop size class.

Bed	Area	Sampled Stations	Size Class	Catch Number	Mean Density (nm^2)	CV %
WK1	48.66	16	large	1,178	82,339	38
			small	307	14,332	38
YAKB	33.36	11	large	233	15,814	20
			small	29	1,961	30
YAK3	167.46	54	large	3,722	52,015	19
			small	1,734	23,856	32
YAK4	127.51	40	large	3,355	59,482	13
			small	1,913	35,146	23
YAK5	54.86	19	large	318	12,407	23
			small	886	34,724	45

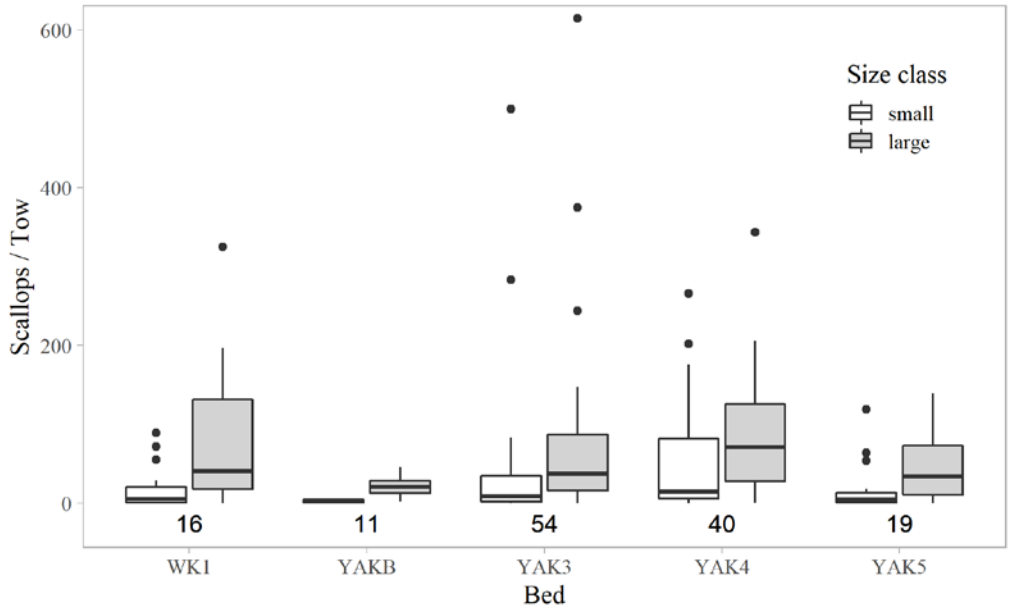


Figure 2-5 Catch distributions of small and large weathervane scallops by bed from successful tows completed during the 2019 statewide scallop dredge survey. Each bed is labeled with the number of tows.

Abundance and Biomass

Survey estimates of large scallop abundance were highest within YAK3 and YAK4 at ~ 10.5 million and ~9.1 million large scallops, respectfully (Table 2-3; Figure 2-6). Small scallop abundance estimates were also highest within YAK3 (~ 4.8 million) and YAK4 (~ 5.4 million), though contrary to large scallops, estimates within YAK4 were slightly higher. The remaining three beds (WK1, YAKB, and YAK5) all

had substantially lower abundance estimates in both size classes, with YAKB having the lowest estimates overall (~ 636 thousand large, ~ 79 thousand small scallops) (Table 2-3).

Table 2-3 Bed estimates of scallop abundance with 95 percent confidence intervals based on 2019 statewide scallop dredge survey. Large scallops are those with a shell height ≥100 mm.

Bed	Size-class	Abundance	Lower 95% CI	Upper 95% CI
WK1	large	4,827,241	1,865,560	8,873,433
WK1	small	840,254	338,356	1,479,146
YAKB	large	635,589	397,567	861,225
YAKB	small	78,809	40,665	121,764
YAK3	large	10,494,551	7,083,582	14,682,959
YAK3	small	4,813,146	2,383,390	8,096,588
YAK4	large	9,138,029	6,935,019	11,461,825
YAK4	small	5,399,349	3,127,339	7,830,434
YAK5	large	2,295,146	1,378,930	3,327,451
YAK5	small	820,044	253,978	1,589,497

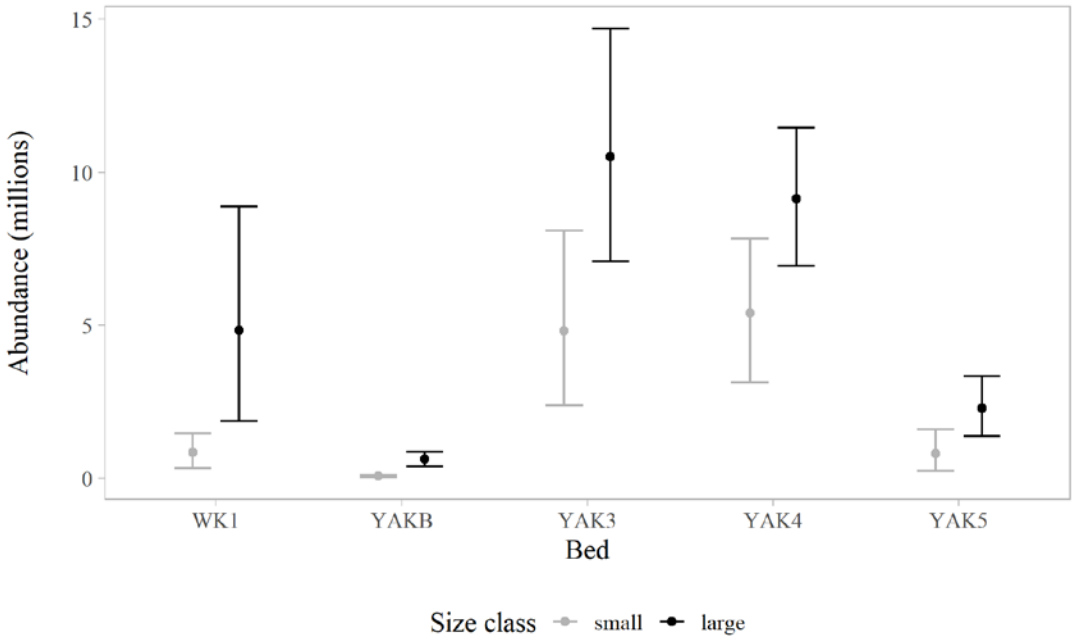


Figure 2-6 Estimates of scallop bed abundance based on 2019 statewide scallop dredge survey data. Error bars represent approximate 95% confidence intervals. Large scallops are those with shell height >= 100 mm.

Biomass estimates of both large and small scallops were highest within the YAK3 bed (~4.3 million lbs large scallops, ~359 thousand lbs small scallops) followed by YAK4 (~2.9 million lbs large scallops, ~350 thousand lbs small scallops) and WK1 (~1.9 million lbs large scallops, ~115 thousand lbs small scallops) (Table 2-4; Figure 2-7). Both YAK5 and YAKB were estimated to have under 1 million pounds of biomass for large and small scallops combined, with YAKB having less than 4 thousand pounds of small scallop biomass (Table 2-4; Figure 2-7)). Meat weights were proportional to round weight (Figure 2-8) and to shell height (Figure 2-9).

Table 2-4 Bed estimates of scallop round weight biomass (pounds) with 95 percent confidence intervals based on 2019 statewide scallop dredge survey. Large scallops are those with a shell height ≥100 mm.

Bed	Size-class	Biomass (lb)	Lower 95% CI	Upper 95% CI
WK1	large	1,905,931	874,346	3,400,765
WK1	small	115,079	33,455	218,930
YAKB	large	399,262	268,809	524,081
YAKB	small	3,932	1,816	6,238
YAK3	large	4,250,686	2,932,296	5,915,012
YAK3	small	358,876	184,638	624,309
YAK4	large	2,910,977	2,223,563	3,640,493
YAK4	small	349,564	215,104	503,487
YAK5	large	765,030	466,330	1,089,605
YAK5	small	61,588	24,757	120,507

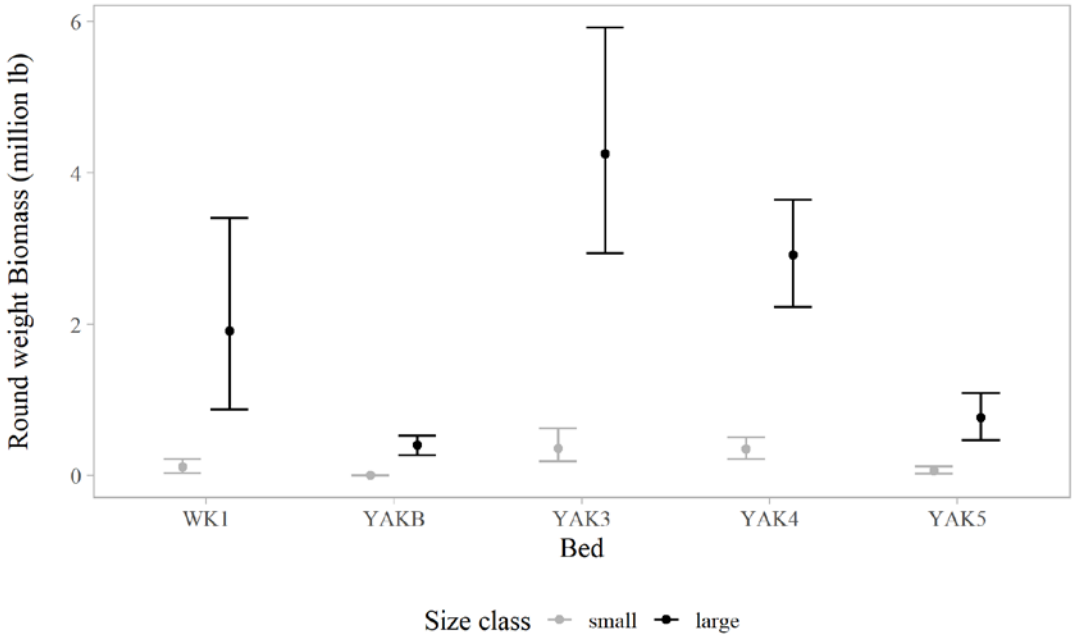


Figure 2-7 Estimates of scallop bed round weight biomass based on 2019statewide scallop dredge survey data. Error bars represent approximate bootstrap 95% confidence intervals. Large scallops are those with shell height ≥ 100 mm.

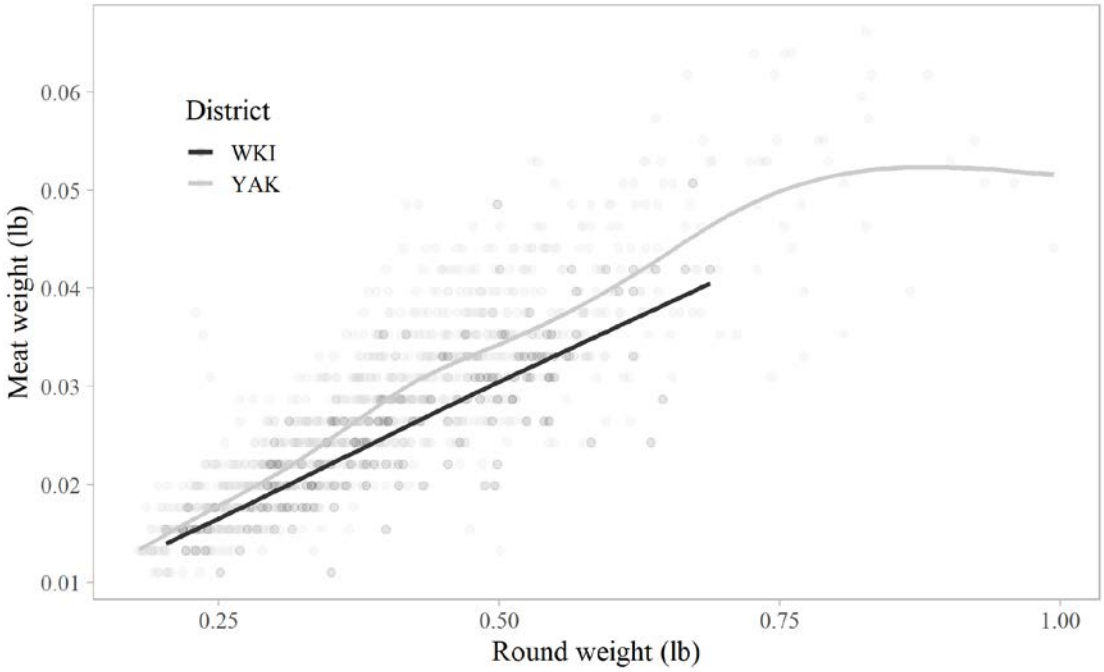


Figure 2-8 Comparisons of meat weight versus round weight by district for subsampled large scallops from the 2019 statewide scallop dredge survey.

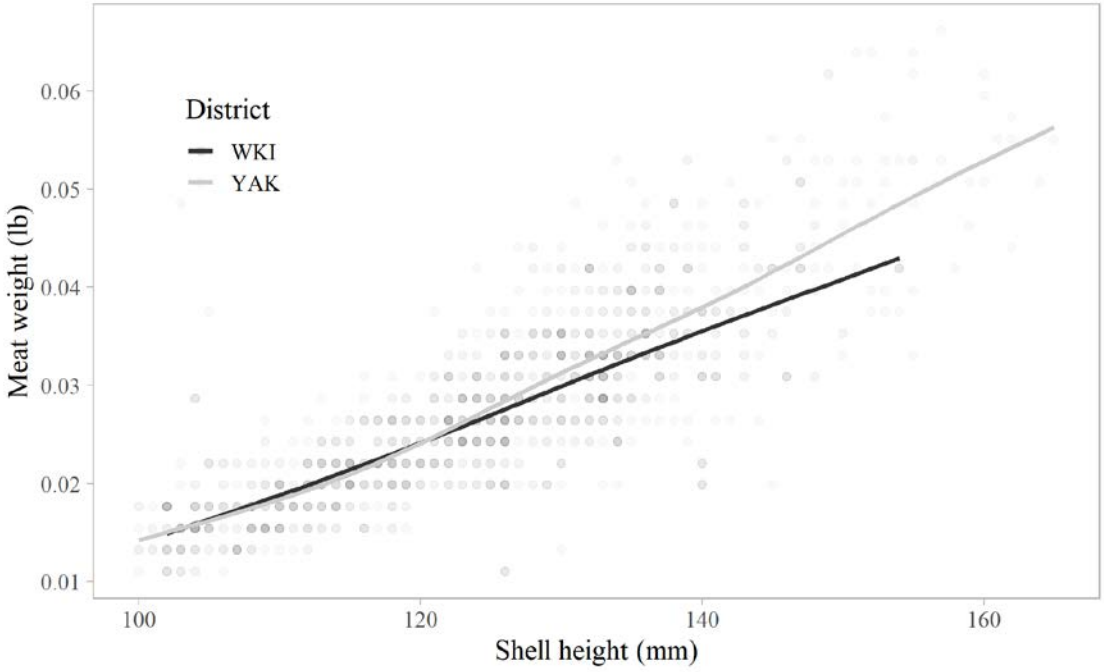


Figure 2-9 Comparisons of meat weight versus shell height by district for subsampled large scallops from the 2019 statewide scallop dredge survey data.

Shell Height Distributions

Survey biologists measured the shell height of 863 small and 1,249 large scallops, ranging from 12-165 mm. Estimated bed shell-height distributions are in line with estimates of small and large scallop abundance and biomass (Table 2-3, Table 2-4; Figure 2-10). Large scallops dominated the shell height

composition within each bed (Figure 2-10). Incoming pulses of smaller scallops < 40 mm and ~60 – 80 mm were observed in YAK3, YAK4, and YAK5, which all had similar size distributions. Both WK1 and YAKB size distributions were comprised of nearly all large scallops, with most shell heights being within the 90 – 130 mm size range in WK1 and within the 120 – 150 mm size range in YAKB (Figure 2-10).

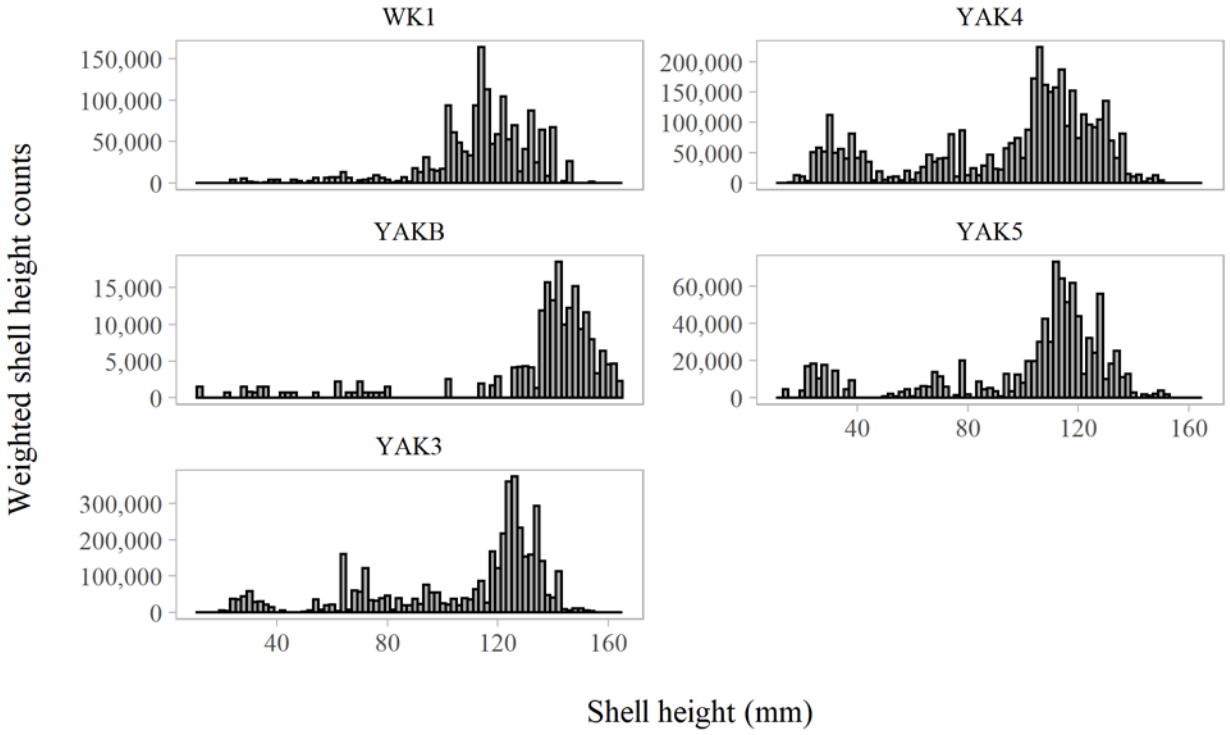


Figure 2-10 Scallop bed shell height distributions for the 2019 statewide scallop dredge survey. Distributions were weighted by sample sizes.

Additional Biological Data

An indicator of scallop stock status of importance with respect to the commercial scallop fishery is the prevalence of weak meats. "Weak meat" is a diseased condition of the adductor muscle characterized by tissue of stringy texture that tears easily during shucking (Brenner et al. 2012). The presence of this condition was recorded for subsampled large scallops in surveyed beds. The highest prevalence was 13.3% (N = 98) in bed YAKB and the lowest was 3.3% (N = 485) in bed YAK3 (Table 2-5).

Table 2-5 Bed percentages of clappers and weak meats from 2019 statewide scallop dredge survey data. Meat condition was assessed only for subsampled large scallops. N denotes the sample size.

Bed	N (large)	Weak meats (%)
WK1	145	4.1
YAKB	98	13.3
YAK3	485	3.3
YAK4	371	4.3
YAK5	152	7.2

As indicators of stock reproductive potential, the sex and gonad condition of subsampled large scallops were also recorded (Table 2-6 and Table 2-7). Sex was determined based on the color of the gonad after it fills with gametes. Among those scallops for which sex could be determined, males outnumbered females within all beds by ~10%, excepted within WK1 where males accounted for ~68% of sexed scallops. All beds had the majority of scallops recorded as having gonads that were filling (67% - 85%), followed by immature gonads, and those in initial recovery (i.e. having just spawned) (Table 2-7).

Table 2-6 Observed sex ratios (percent of scallops ≥100 mm). N denotes the sample size.

Bed	Unknown	Male	Female	Hermaphrodite	N
WK1	0	67.6	32.4	0	145
YAKB	0	58.2	41.8	0	98
YAK3	0.2	54.8	44.9	0	485
YAK4	0	55	45	0	371
YAK5	0.7	57.2	42.1	0	152

Table 2-7 Observed gonad status by bed. Values are percent of sampled scallops ≥100 mm. N denotes the sample size.

Bed	N	Immature	Empty	Initial Recovery	Filling	Full	Unknown
WK1	233	6.9	0	8.2	85	0	0
YAKB	127	14.2	0	0	85.8	0	0
YAK3	826	14.5	0.1	16.4	68.8	0	0.1
YAK4	684	23.2	0.3	9.4	67	0.1	0
YAK5	246	16.3	2.4	13.4	67.9	0	0

The survey team additionally recorded information describing the extent of shell-worm infestation and mud-blisters on the shells of subsampled large scallops using an ordinal scale based on percent of shell coverage (Table 2-8 and 2-9). Prevalence of both shell-worm intrusion and mud-blisters was greatest in YAKB, though individuals with the greatest coverage were found in YAK3 and YAK4.

Table 2-8 Area of scallop shells ≥100 mm with evidence of boring worms, by bed. N denotes the sample size.

Bed	N	0%	1-24%	25-49%	50-74%	75-100%
WK1	233	97.9	2.1	0	0	0
YAKB	127	64.6	35.4	0	0	0
YAK3	827	79.3	20.4	0.2	0	0
YAK4	682	89.6	9.8	0.3	0.3	0
YAK5	246	78.5	21.5	0	0	0

Table 2-9 Area of scallop shells ≥100 mm with evidence of mud blisters, by bed. N denotes the sample size.

Bed	N	0%	1-24%	25-49%	50-74%	75-100%
WK1	233	99.1	0.9	0	0	0
YAKB	127	71.7	28.3	0	0	0
YAK3	827	89.2	10.6	0.1	0	0
YAK4	683	93.3	6.4	0.1	0.1	0
YAK5	246	93.1	6.9	0	0	0

2.3.4 Discussion

The primary objective of this survey was to estimate scallop abundance by survey area with a CV < 20% for large-size scallops. From results reported in Table 2-3, only abundance estimates for bed for WK1 and YAK5 were above the target level. CVs higher than 20% are due to spatial patchiness in scallop distributions within these beds, and low abundance within YAK5. Additional sampling would be recommended to achieve a smaller CV in these survey areas for large scallops. The sample size for the other beds sampled during this survey produced acceptable results.

Comparisons of the current survey with 2016-2018 survey abundance estimates among beds show and increase in abundance of large and small scallops for YAKB, YAK3, and YAK4, and a decrease in abundance of both size classes for WK1 and YAK5 (Figure 2-11). In contrary, round weight biomass estimates increased for both size classes from prior survey estimates across all beds (Figure 2-12), highlighting the increase in scallop abundance for some beds, but also the increase in size as individuals within beds age.

The ratio of meat weight (lbs) per individual size in shell height (mm) and round weight (lbs) observed in 2019 was less than in previous years across all beds (Figure 2-13). This pattern in consistent with observations during the 2018/19 fishery across all districts, but particularly in the Yakutat district. At this time, it is unclear what might have contributed to a sudden decrease in meat weights per individual, though increased stress or energy reallocation in response to changing environmental conditions are likely (e.g. increase bottom temperature, decreased pH). Future surveys will seek to collect additional environmental data (i.e., temperature, pH) that may inform changes in biological condition.

Without a more substantial timeseries it remains difficult to ascertain how the survey relates to catch in the fishery. Future surveys will help address this question. Additionally, it is unknown whether the Q = 0.83 used in these abundance estimates is appropriate for the dredge used for this survey. Since this Q is uncertain, the abundance estimates, and associated meat weight estimates are indices rather than absolute population estimates.

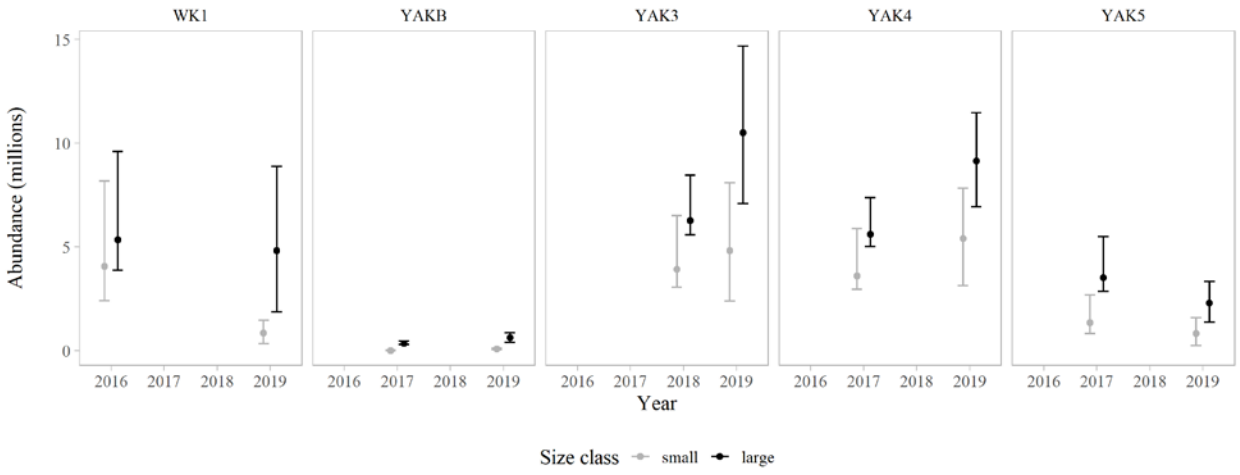


Figure 2-11 Comparisons of 2016 - 2019 survey abundance estimates for beds surveyed in 2019.

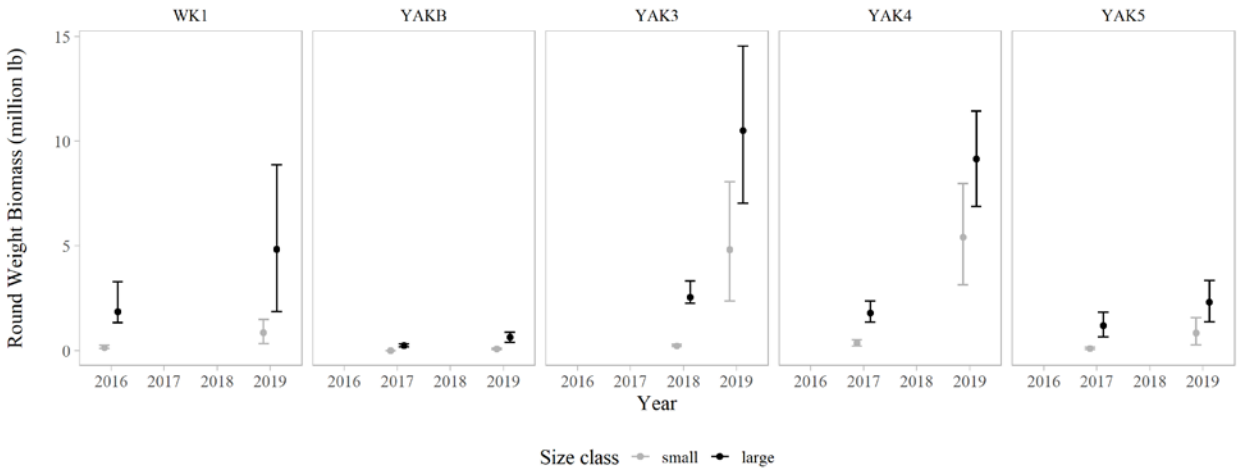


Figure 2-12 Comparisons of 2016 - 2019 survey biomass estimates for beds surveyed in 2019.

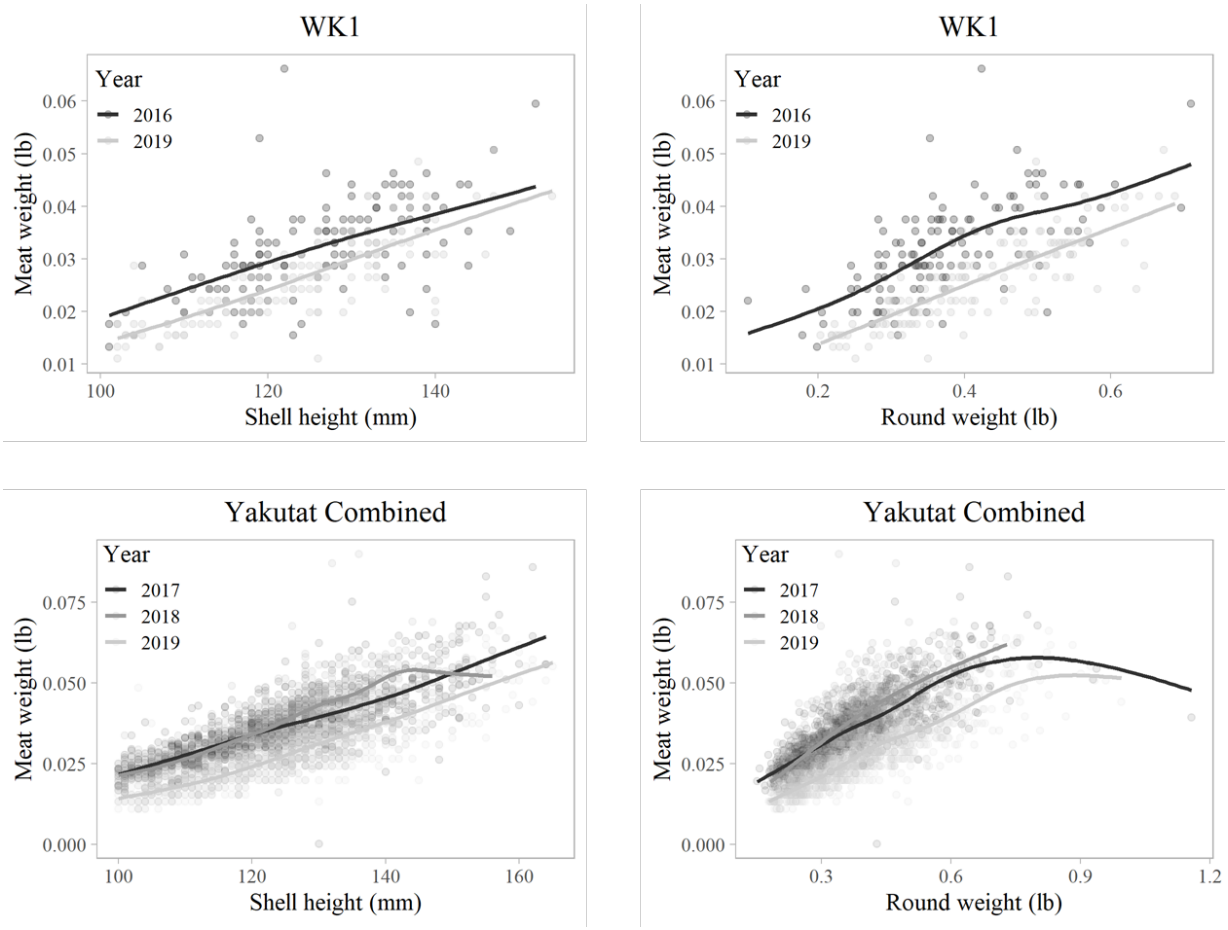


Figure 2-13 Meat weight in relation to shell height and round weight for WK1 and the Yakutat District observed during 2016-2019 surveys.

2.3.5 Acknowledgements

The authors would like to thank Capt. Thomas Minio and the crew of the F/V Provider. We would also like to thank Jim Stone and the Alaska Scallop Association for their logistical support.

3 Weathervane Scallop Fishery and Management

The Alaska weathervane scallop fishery is managed jointly by NPFMC and ADF&G under the Federal FMP for the Scallop Fishery off Alaska. Measures that are fixed in the FMP, implemented by Federal regulation and require an FMP amendment to change include: license limitation program, OY specification, overfishing specification, and EFH/HAPC designation. All other management measures under the FMP are delegated to the State for management under Federal oversight. ADF&G management of the weathervane scallop fishery covers both State and Federal waters off Alaska.

3.1 Alaska State Registration Areas

The State Scallop Fishery Management Plan established nine scallop registration areas in Alaska for vessels commercially fishing scallops (Figure 1-1). These include the Southeastern Alaska Registration Area (Area A); Yakutat Registration Area (Area D), which was historically subdivided into the Yakutat District and District 16; Prince William Sound Registration Area (Area E), which is subdivided into the East and West Kayak Island Subsections; Cook Inlet Registration Area (Area H), which is subdivided into the Northern, Central, Southern, Kamishak Bay, Barren Islands, Outer and Eastern Districts; Kodiak Registration Area (Area K), which is subdivided into the Northeast, Shelikof, Southeast, Southwest and Semidi Islands Districts; Alaska Peninsula Registration Area (Area M), which is subdivided into the West Chignik, Central and Unimak Bight Districts; Dutch Harbor Registration Area (Area O); Bering Sea Registration Area (Area Q); and Adak Registration Area (Area R). Scallop seasons have never been opened in Area A, and effort occurred in Area R during 1995 only.

3.2 Seasons

The regulatory fishing season for weathervane scallops in Alaska is **July 1 through February 15** except in the Cook Inlet Registration Area (5 AAC 38.167 & 5 AAC 38.420). In the Kamishak District of Cook Inlet, the season is **August 15 through October 31** (5 AAC 38.220 & 5 AAC 38.320). These seasons were developed to limit fishing during scallop spawning periods, to achieve the highest possible product quality, to limit gear conflicts with other fisheries, and to increase vessel safety. Scallop fishing in any registration area in the state may be closed by emergency order prior to the end of the regulatory season. Scallop GHLs are typically announced by ADF&G one month prior to the season opening date.

3.3 Annual Catch Limits

Annual catch limits (ACLs) and accountability measures (AMs) are requirements under the MSA for all fisheries managed by federal fishery management plans. The requirements include provisions intended to prevent overfishing by requiring that: FMPs establish a mechanism for specifying ACLs in the plan; implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery; and including measures to ensure accountability (AMs). The MSA includes a requirement for the SSC to recommend fishing levels to the Council and provides that ACLs may not exceed the fishing levels recommended by the SSC. NMFS's National Standard 1 Guidelines state that the ABC is the fishing level recommendation that is most relevant to ACLs. For scallops off Alaska, ACL=ABC.

Accountability measures were established in Amendment 13 such that the sum of the annual GHLs for each scallop management area be established by the State of Alaska at a level sufficiently below the ACL so that the sum of the estimated discard mortality in directed scallop and groundfish fisheries as well as

the directed scallop fishery removals does not exceed the ACL. Anytime an ACL is exceeded the overage will be accounted for through a downward adjustment to the GHL during the fishing season following the overage.

Directed fishing only occurs on weathervane scallops (*Patinopecten caurinus*) and the FMP only provides an estimate of MSY/OY for weathervane scallops thus it is defined as being 'in the fishery'. The remaining species of scallops under the Alaska Scallop FMP include reddish scallop (*Chlamys rubida*), spiny scallop (*Chlamys hastata*), and rock scallop (*Crassadoma gigantea*), which are contained in an 'Ecosystem component (EC)' of the FMP. ACLs are not required for EC species provided they are not being explicitly targeted. Ecosystem component species generally are not retained for any purpose, although *de minimis* amounts might occasionally be retained.

Catch in relation to ACLs

Total catch from 2018/19 is reported in Table 1-1, and preliminary retained catch from the 2019/20 fishery is provided in Table 1-1. Note that discard estimates are not yet available for 2019/20. Final catch in relation to the ACL for 2019/20 will be provided in the 2021 Scallop SAFE report.

3.4 Guideline Harvest Ranges

ADF&G manages the fishery by registration areas and districts. Guideline harvest ranges (GHRs) are hard caps established in State of Alaska regulations for each registration area and are not to be exceeded. GHLs are pre-season targets set for each fishing area (registration area, district, or statistical area) prior to the season by ADF&G regional managers. Total harvest for each fishing area in a given season is typically near or below the GHL, but may exceed it.

Regulatory GHRs for traditional scallop fishing areas were first established by the State of Alaska in 1993 under the Interim Management Plan for Commercial Scallop Fisheries in Alaska. Regulatory GHRs (pounds of shucked scallop meats) were set at 0–250,000 lb for Yakutat; 0–50,000 lb for Prince William Sound; 10,000–20,000 lb for the Kamishak District of Cook Inlet; 0–400,000 lb for Kodiak; and 0–170,000 lb for Dutch Harbor. These area GHR ceilings were determined by averaging historic catches from 1969 to 1992, excluding years when there was no fishing or a "fishing-up effect" occurred (Barnhart, 2003).

Prior to the August 1, 1996 re-opening of the weathervane scallop fishery, the State of Alaska established GHRs for non-traditional registration areas including: 0–200,000 lb for the Alaska Peninsula; 0–600,000 lb for the Bering Sea; 0–35,000 lb for District 16; and 0–75,000 lb for Adak. The combined total of the upper limits from traditional and non-traditional areas was 1.8 million lb, which was defined as MSY in Amendment 1 to the federal FMP.

In 1998, the scallop plan team recommended a more conservative definition of MSY. Based on average landings from 1990–1997 excluding 1995 when the fishery was closed for most of the year, MSY was subsequently established in Amendment 6 of the FMP at 1.24 million lb, with optimum yield defined as the range 0–1.24 million lb. To accommodate the new definition, regulatory GHR ceilings were reduced by the State of Alaska from 400,000 to 300,000 lb in Kodiak; from 170,000 to 110,000 in Dutch Harbor; and from 600,000 to 400,000 lb in the Bering Sea. Hence, the regulatory GHR ceiling written into Alaska regulatory code is also 1.24 million lb.

3.5 In Season Data Use

Observers, which are required on all vessels fishing for scallops in Alaska outside Cook Inlet, monitor the fishery during the season and transmit data to ADF&G at least three times per week. Fishing may be closed in any area before the GHL is reached if collected data raise concerns about localized depletion,

trends in CPUE, or bycatch rates. In-season data are also used by the scallop industry to avoid areas of high crab bycatch.

Following concern over declining harvest within the Kodiak Area during the 2002/03 season, an in-season minimum performance standard (MPS; formerly 'benchmark') was established prior to the 2003/04 season to gauge fishery performance and support in-season fishery closures, if warranted. CPUE of shucked meats is tracked throughout the season by management area and compared to the MPS standard. If the in season cumulative CPUE is less than or equal to the MPS, when approximately half of the GHL is taken, the fishery may close prior to achieving the upper end of the GHL. If CPUE is higher than the MPS, the fishery may continue toward the upper end of the GHL with continued monitoring. This approach has been applied to management areas, major beds within management areas and statistical reporting areas, depending upon the level of concern. It is important to clarify that the MPS is not viewed as a management goal, but rather a low mark around which to base conversation on in-season management actions.

Westward Region adopted the use of an MPS within subunits (e.g., bed, statistical area) of all major harvest areas prior to the 2010/11 season based on the lowest observed meat weight during a historic timeseries including only vessels larger than 80 ft that deploy two 15 ft dredges (Table 3-1). An MPS was also implemented in the Yakutat area prior to the 2013/14 season. MPS have been utilized at the district level in the Kodiak Area since the 2017/18 season and have not been used in the Bristol Bay – Bering Sea Area since the 2014/15 season.

Table 3-1 CPUE minimum performance standards and basis years for major harvest areas.

Area	Minimum Performance Standard (CPUE)	Basis Year	Reference Time Series
Yakutat Area			
Yakutat District	34	2011/12	1998/99 – 2013/14
Kodiak Area			
Northeast District	46	2005/06	2000/01 – 2009/10
Shelikof District	47	2002/03	2000/01 – 2009/10

3.6 Crab Bycatch Limits

Bycatch of crabs in the scallop fishery is controlled through the use of Crab Bycatch Limits (CBLs) that are based on condition of individual crab stocks. CBLs were first instituted by the state in July 1993. Methods used to determine CBLs in 1993 and 1994 were approved by the BOF and the Council and, with few exceptions, remain unchanged. Annual CBLs are established preseason by ADF&G for areas with current crab resource abundance information (surveys). For areas without crab abundance estimates, CBLs may be set as a fixed number of crabs that may be adjusted seasonally.

Statewide CBLs by region are shown in Table 3-2. In the Kodiak Area, the Tanner crab CBLs are set at 0.5% or 1.0% of the total crab stock abundance estimate based on the most recent survey data. In districts where Tanner crab abundance is sufficient to support a commercial crab fishery, the cap is set at 1.0% of the most recent Tanner crab abundance estimate. In registration areas or districts where the Tanner crab abundance is insufficient to support a commercial fishery, the CBL is set at 0.5% of the most recent Tanner crab abundance estimate. Red king crab CBLs in the Kodiak Area are fixed at 25 crab per district. In the Alaska Peninsula Area CBLs are fixed at 25 red king crab and 3,750 Tanner crab. Bycatch limits are expressed in numbers of crabs and include all sizes of crabs caught in the scallop fishery.

Table 3-2 Statewide crab bycatch limits in percentage of crab abundance estimates (where available) or number of crabs.

Area/District	Red King Crab	*C. bairdi*	*C. opilio*
Yakutat District	NE[a]	NE	NA[b]
Prince William Sound	NE	0.5%	NA
Cook Inlet Kamishak District	30 crab	0.5%	NA
Kodiak Northeast District	25 [c]	0.5% or 1.0%	NA
Kodiak Shelikof District	25 [c]	0.5% or 1.0%	NA
Kodiak Southwest District	25 [c]	0.5% or 1.0%	NA
Alaska Peninsula	25 [c]	3,750[c]	NA
Alaska Peninsula Unimak Bight District	25 [c]	3,750[c]	NA
Bering Sea	500 crab[c]	3 tier approach	3 tier approach
Dutch Harbor	0.5% or 1.0%	0.5% or 1.0%	NA
Adak[d]	50	10,000 crab	NA

[a] *Not established.*
[b] *Not applicable.*
[c] *Fixed CBL.*
[d] *Bycatch limit established to provide scallop fleet opportunity for exploratory fishing while protecting crab resources.*

In the Kamishak District of the Cook Inlet Registration Area, the Tanner crab bycatch limit is set at 0.5% of the total crab stock abundance from the most recent dredge survey and the red king crab limit was fixed at 60 crabs in earlier years and has since been reduced to 30 crabs commensurate with the reduction in red king crab catch in trawl and dredge surveys in recent years. In 2001, ADF&G set Tanner crab bycatch limits in the Prince William Sound Registration Area at 0.5% of the Tanner crab population estimate from the 2000 scallop survey. This resulted in bycatch limits of 2,700 and 8,700 for the east and west harvest areas. Starting in 2010, the department set crab bycatch limits at 0.5% of the Tanner crab abundance estimated from the scallop survey.

CBLs in the Bering Sea (registration Area Q) have evolved from fixed numbers in 1993 to a three tier approach used in the current fishery. In 1993, Bering Sea CBLs were set by ADF&G to allow the fleet adequate opportunity to explore and harvest scallop stocks while protecting the crab resource. CBLs were established at 260,000 *Chionoecetes spp*. and 17,000 red king crabs. In Amendment 1 of the federal scallop FMP, the Council approved the CBLs established by ADF&G. The Council also recommended that king crab bycatch limits be set within a range of 500 to 3,000 annually. From the 1996/97 through 1998/99 fishing seasons the CBL for *Chionoecetes spp*. in the Bering Sea was established annually by applying the percentages established for snow and Tanner crab limits in Amendment 1 of the FMP.

Beginning with the 1996/97 fishing season ADF&G took a conservative approach and set the red king crab limit in Registration Area Q at 500 red king crabs annually. In 1998, consistent with the Tanner crab rebuilding plan in the Bering Sea, crab bycatch limits were modified.

The current three tier approach was established utilizing the bycatch limits established in Amendment 1 of the FMP, 300,000 snow crabs and 260,000 Tanner crabs. The three tiers include (1) Tanner crab

spawning biomass above minimum stock size threshold (MSST); bycatch limit is set at 260,000 crabs, (2) Tanner crab spawning biomass below MSST; bycatch limit is set at 130,000 crabs, and (3) Tanner crab spawning biomass is below MSST and the commercial fishing season is closed; Tanner crab limit is set at 65,000 crabs. A similar three tier approach was taken with the snow crab bycatch limits. The three tiers include (1) snow crab spawning biomass above the MSST; bycatch limit is set at 300,000 crabs, (2) snow crab spawning biomass below MSST; bycatch limit is set at 150,000 crabs, and (3) snow crab spawning biomass below MSST and the commercial fishing season is closed; the snow crab limit is set at 75,000 crabs.

Bycatch limits and the estimated number of crabs caught during 2018/19 scallop fisheries of king crab are shown in Table 3-3 and Tanner, Dungeness and snow crabs are shown Table 3-4. Bycatch of snow, king, and Tanner crabs during the Bering Sea scallop fishery tends to be much lower than for other Bering Sea fisheries. Observer data on carapace width for sampled crabs are shown in Figure 3-1.

Table 3-3 Bycatch of King crabs in the 2018/19 Alaska weathervane scallop fishery.

Registration Area	District/Subsection	King crab bycatch cap	Est number crab
Yakutat		NE	0
Prince William Sound	West Kayak Island Subsection	NE	0
Kodiak	Northeast District	25	0
	Shelikof District	25	0
	Southwest District	25	1
	Southeast District	25	0
Alaska Peninsula	Central District	25	0
	Unimak Bight District	25	0
Dutch Harbor		10	0
Bering Sea		500	0
	Statewide total	690	1

NE: not established

Table 3-4 Bycatch of *Chionoecetes* and Dungeness crabs in the 2018/19 Alaska weathervane scallop fishery.

Registration Area	District/Subsection	Tanner crab			Dungeness[b]
		Bycatch cap	Est number crab	Est weight (lb)[a]	Est number crab
Yakutat		NE	719	20	293
Prince William Sound	West Kayak Island Subsection	1,600	9	0	0
Kodiak	Northeast District	9,000	7,242	1,167	0
	Shelikof District	12,500	3,115	476	1,522
	Southwest District	18,000	1,501	311	1,035
	Southeast District	7,500	2,163	1,008	0
Alaska Peninsula	Central District	3,750	305	156	0
	Unimak Bight District	7,500	3,323	603	0
Dutch Harbor		5,000	611	135	0
Bering Sea		65,000	15,007	8,955	0
		Snow and *C.* hybrid crab			
Bering Sea		300,000	2,097	2,494	0
	Statewide Total	429,850	36,092	15,325	2,850

NE: not established
[a] Weight estimation for areas outside Cook Inlet uses estimated number crab, carapace width distributions from observer sampling and CW-weight relationship parameters from NMFS Bering Sea crab research. Cook Inlet estimate is based on sampling weight of crab by ADF&G.
[b] Bycatch cap not established.

Scallop fishery closures due to attainment of CBLs have decreased over the years, in part due to decreased crab abundance (Barnhart and Rosenkranz, 2003) as well as a voluntary industry cooperative, which provides the fleet additional flexibility to move from high crab bycatch areas. ADF&G closely monitors crab bycatch rates during scallop fisheries and crab bycatch may affect scallop harvest and CPUE as vessel operators move or cease scallop fishing when crab bycatch rates rise.

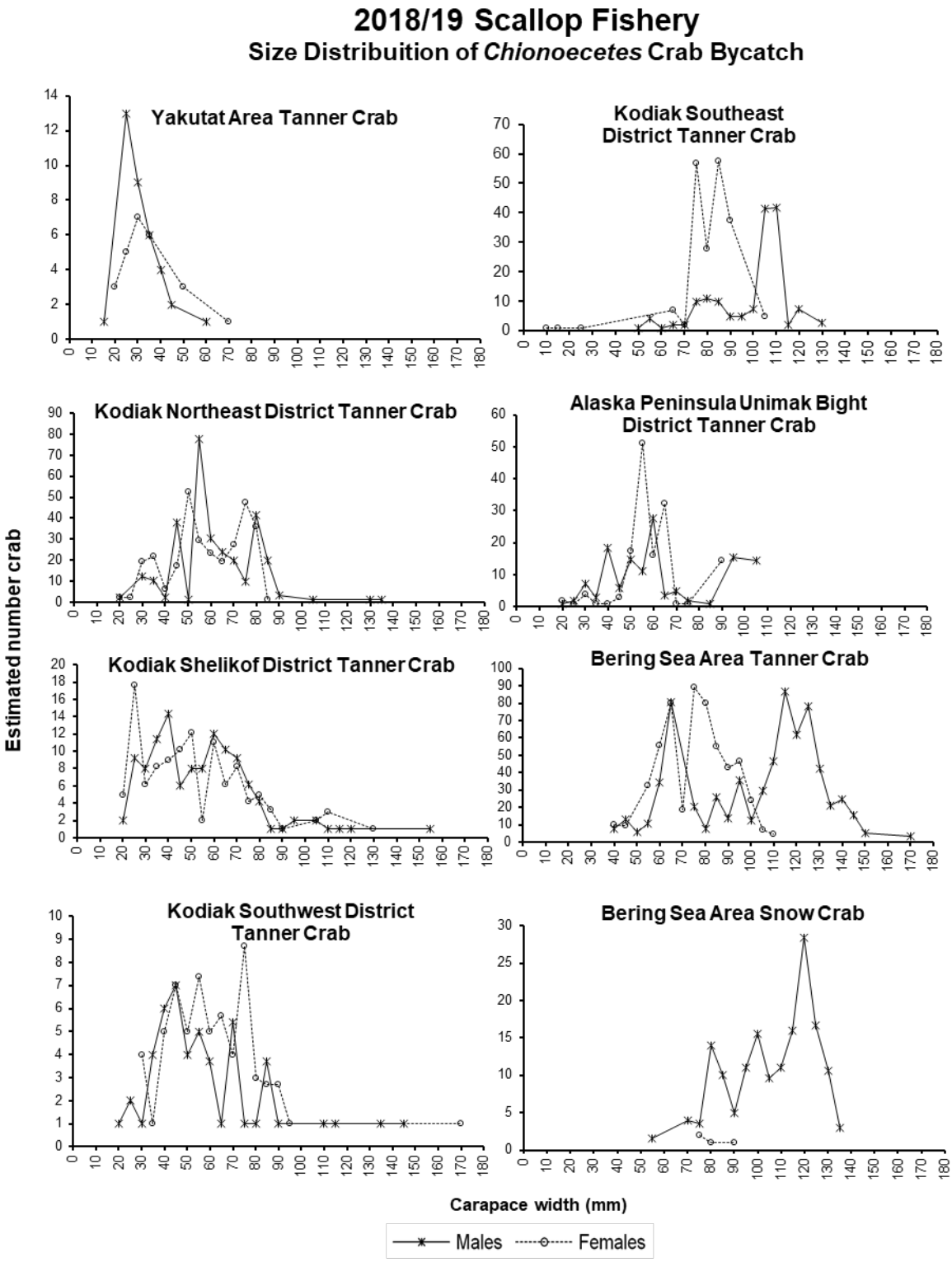


Figure 3-1 Tanner and snow crab carapace width distributions by management unit from catch sampling during the 2018/19 scallop fishery. West Kayak Island Subsection, Alaska Peninsula Central District and the Dutch Harbor Area are not shown due to very low sample sizes.

3.7 Vessel Participation in the Scallop Fishery

Commercial weathervane scallop fishing in Federal waters off Alaska is limited by a Federal license limitation program (LLP), while scallop fishing in State waters is open access. The Federal LLP, effective 2001 under Amendment 4, limits participation in the scallop fishery in Federal waters to nine vessels. Seven LLP vessels were permitted to fish statewide outside of Cook Inlet using up to two 10-foot dredges statewide, and two LLP vessels were permitted to fish statewide utilizing single 6-foot dredges. In August, 2005, NMFS implemented Amendment 10 to the FMP, which modified the gear restriction to allow the single 6-foot dredge LLPs to be used with up to two 10-foot dredges outside of Cook Inlet. All 9 licenses allow vessel owners to fish inside Cook Inlet with a single 6-foot dredge. Vessel length for a given LLP is restricted to vessel length during the qualifying period. Unless otherwise restricted by the LLP, vessels fishing in the remainder of the state may simultaneously operate a maximum of 2 dredges that are 15 feet or less in width.

Participating in the Scallop fishery in Alaska state waters (0-3 nautical miles) had been limited by a vessel-based limited entry program until State limited entry expired in 2013 and was not renewed by the Alaska State Legislature. To date, no additional state-only vessels have participated in the open access state water fishery.

Four vessels with Federal LLP permits as well as state vessel-based limited entry permits (when required) have harvested most of the scallop catch outside Cook Inlet over the past several seasons. Only one of these vessels typically participates in the Cook Inlet Registration Area fishery.

Establishment of a Voluntary Scallop Cooperative

In 2000, six of the nine LLP owners formed the North Pacific Scallop Cooperative under authority of the Fishermen's Cooperative Marketing Act, 48 Stat. 1213 (1934), 15 U.S.C. Sec. 521. The cooperative is self-regulated and is neither endorsed nor managed by ADF&G or NMFS. The cooperative regulates individual vessel allocations within the GHL and crab bycatch caps under the terms of their cooperative contract. Non-coop vessels are not bound by any contract provisions. The cooperative does not receive an exclusive allocation of the scallop harvest. Some owners opted to remove their boats from the fishery and arranged for their shares to be caught by other members of the cooperative. Since formation of the cooperative, harvest rates have slowed and fishing effort occurs over a longer time period each season.

Vessel owners within the cooperative have taken an active role in reducing crab bycatch. Vessel operators provide confidential in-season fishing information to an independent consulting company contracted by the cooperative. This firm reviews crab bycatch data, fishing locations, and scallop harvest, which allows for real time identification of high crab bycatch areas. When these areas are identified, the fleet is provided with the information and directed to avoid the area.

4 Regional Fishery Performance

The **2018/19** season statewide Guideline Harvest Level (GHL) for weathervane scallops was 271,300 lb of shucked meats. Of this GHL 238,973 lb were retained with an additional 11,166 lb of estimated discard mortality for a total take of 250,139 lb of shucked meats (Table 4-1).

The **2019/20** season statewide Guideline Harvest Level (GHL) for weathervane scallops was 267,500 lb of shucked meats. Of this GHL 224,765 lb were retained (Table 4-2). Discard estimates have not yet been completed for the 2019/20 fishing year.

Table 4-1 GHLs and summary statistics from 2018/19 Alaska weathervane scallop fishery.

Registration Area	District/Subsection	GHR (lb meat)	GHL (lb meat)	Retained catch (lb meat)	CPUE (lb meat per dredge hr)	Est scallop discard mortality (lb meat)[a]
Yakutat		0-285,000	145,000	145,083	64	3,478
Prince William Sound	West Kayak Island Subsection	0-50,000	6,300	6,420	48	424
Kodiak	Northeast District	0-300,000 for whole Kodiak Area	15,000	15,210	58	1,111
	Shelikof District		25,000	25,020	53	3,310
	Southwest District		30,000	30,000	66	2
	Southeast District		15,000	470	8	2,077
Alaska Peninsula	Central District	0-100,000 for whole Alaska Peninsula Area	7,500	0		4
	Unimak Bight District[b]		15,000	8,905	34	690
Dutch Harbor		0-110,000	5,000	325	14	2
Bering Sea		0-300,000	7,500	7,540	21	68
	Statewide Totals		**271,300**	**238,973**	**56**	**11,166**

[a] Calculated from round weight discard estimates assuming 20% mortality (as previously used in scallop ACL analysis) for discarded scallops and meat recovery percentages from observer experiments.

[b] Exploratory fishery prosecuted under ADF&G Commissioner's Permit.

Table 4-2 GHLs and preliminary catch from the 2019/20Alaska weathervane scallop fishery.

Registration Area	District/Subsection	GHL (lb scallop meats)	Retained catch (lb scallop meat)
Yakutat		155,000	144,245
Kodiak	Northeast District	15,000	9,880
	Shelikof District	20,000	20,125
	Southwest District	35,000	35,010
	Southeast District	15,000	0
Alaska Peninsula	Central District	7,500	0
	Unimak Bight District[a]	7,500	5,750
Dutch Harbor		5,000	2,625
Bering Sea		7,500	7,130
	Statewide Totals	**267,500**	**224,765**

[a] Exploratory fishery prosecuted under ADF&G Commissioner's Permit.

4.1.1 Southeast Region

Yakutat

District 16 and Yakutat District GHRs were combined in 2018 as a result of having a low District 16 GHL (5,000 lb) and to simplify management of the fishery in Yakutat.

The 2019/20 season GHL was increased due to continued increases in fishery CPUE for the 3rd consecutive year in meat weight and an increase in round weight CPUE observed during the 2018/2019 season (Table 4-3). Based on preliminary harvest and effort from the 2019/20 season, mean weight CPUE decreased 31% from the previous season.

Table 4-3 Yakutat Area D scallop fishery summary statistics, 2000/01 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours[a]	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01	3	250,000	195,699	2,734,559	4,241	46	645	10,401
2001/02	2	200,000	103,800	1,521,537	2,406	43	632	4,809
2002/03	2	200,000	122,718	1,541,867	2,439	50	632	6,326
2003/04	2	200,000	160,918	1,939,004	3,360	48	577	6,940
2004/05	2	200,000	86,950	1,262,499	2,132	41	592	3,869
2005/06	2	200,000	199,351	2,662,031	5,089	39	523	6,988
2006/07	2	150,000	150,041	1,771,229	2,817	53	629	6,715
2007/08	2	150,000	125,960	1,593,223	2,601	48	613	9,184
2008/09	3	150,000	150,289	2,053,912	3,286	46	625	7,361
2009/10	2	160,000	158,225	2,317,273	3,946	40	589	10,985
2010/11	3	160,000	156,575	2,087,228	3,495	45	610	10,216
2011/12	3	160,000	156,463	2,386,748	4,598	34	513	10,303
2012/13	3	120,000	118,140	1,708,044	3,354	35	501	8,706
2013/14	3	120,000	122,290	1,540,114	2,391	51	644	3,770
2014/15	3	120,000	120,353	1,446,693	2,736	44	529	2,861
2015/16	2	120,000	119,820	1,684,050	2,530	47	666	3,169
2016/17	2	120,000	120,140	1,633,663	2,083	57	784	4,424
2017/18	2	140,000	140,075	1,782,558	2,728	51	650	6,964
2018/19	2	145,000	145,083	1,777,744	2,267	64	784	3,478
2019/20[d]	2	155,000	144,245	NA	3,288	44	NA	NA

[a] *lb scallop meat / dredge hour*
[b] *lb scallop round / dredge hour*
[c] *Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 8.3% from observer experiments.*
[d] *PRELIMINARY data subject to change.*

In the 2018/19 Yakutat fishery, 145,083 lb of scallop meats were retained and an estimated 34,820 lb, or approximately 24.8%, were discarded. Discards have been increasing for three years increased and are now approximately equal to the 10-year mean level of 24.5%. Using a 20% discard mortality, an estimated 3,478 lb of scallop meat weight was lost to discard mortality in the 2018/19 season (Table 4-3).

Estimated shell height distributions in Area D show a slight decrease in the range of scallop sizes in the 2018/19 season, with continued narrowing of size distributions. The bulk of the retained scallops remain in the 115–140 mm shell height (SH) range (Figure 4-6).

Since 2013 a minimum performance standard has been used for Yakutat as part of an in-season management assessment. The minimum performance standard is based on the lowest fishery CPUE within the observer time series. In the case of Yakutat this is 34 lb shucked meats / dredge hour based on the 2011/12 season (Table 3-1).

Crab bycatch estimates calculated from 2018/19 Yakutat observer samples were 719 Tanner crabs (Table 3-4), and 293 Dungeness crabs. Tanner crabs sampled by observers ranged from about 10mm to 70mm carapace width (CW), with the vast majority in the 20-30mm range (Figure 3-1).

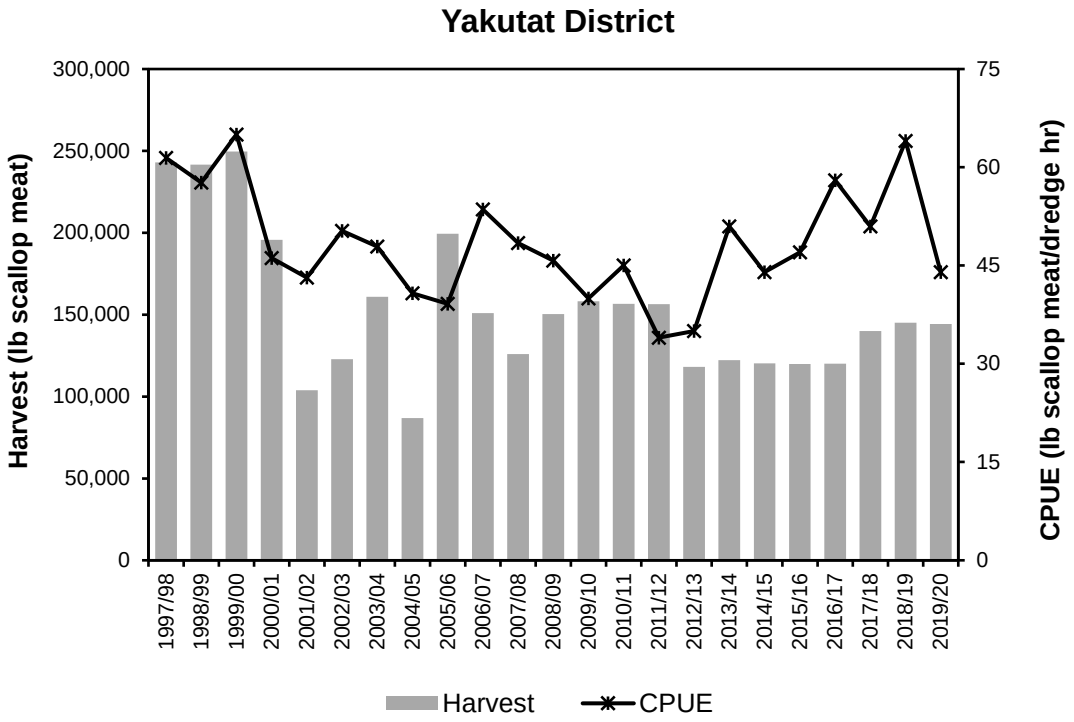


Figure 4-1 Yakutat Area D seasonal scallop harvest and CPUE.

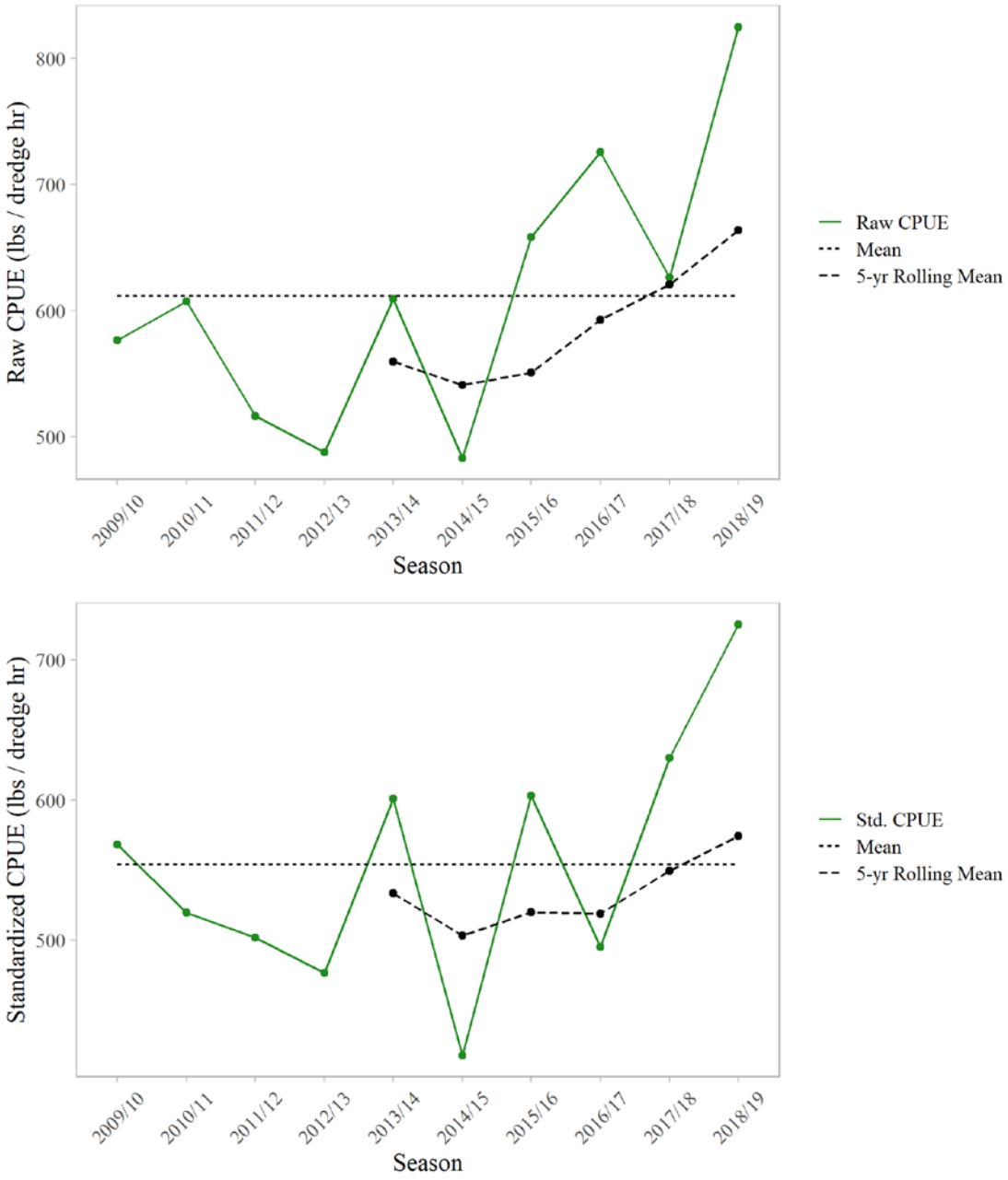


Figure 4-2 Prince William Sound scallop raw and standardized (when available) meat CPUE.

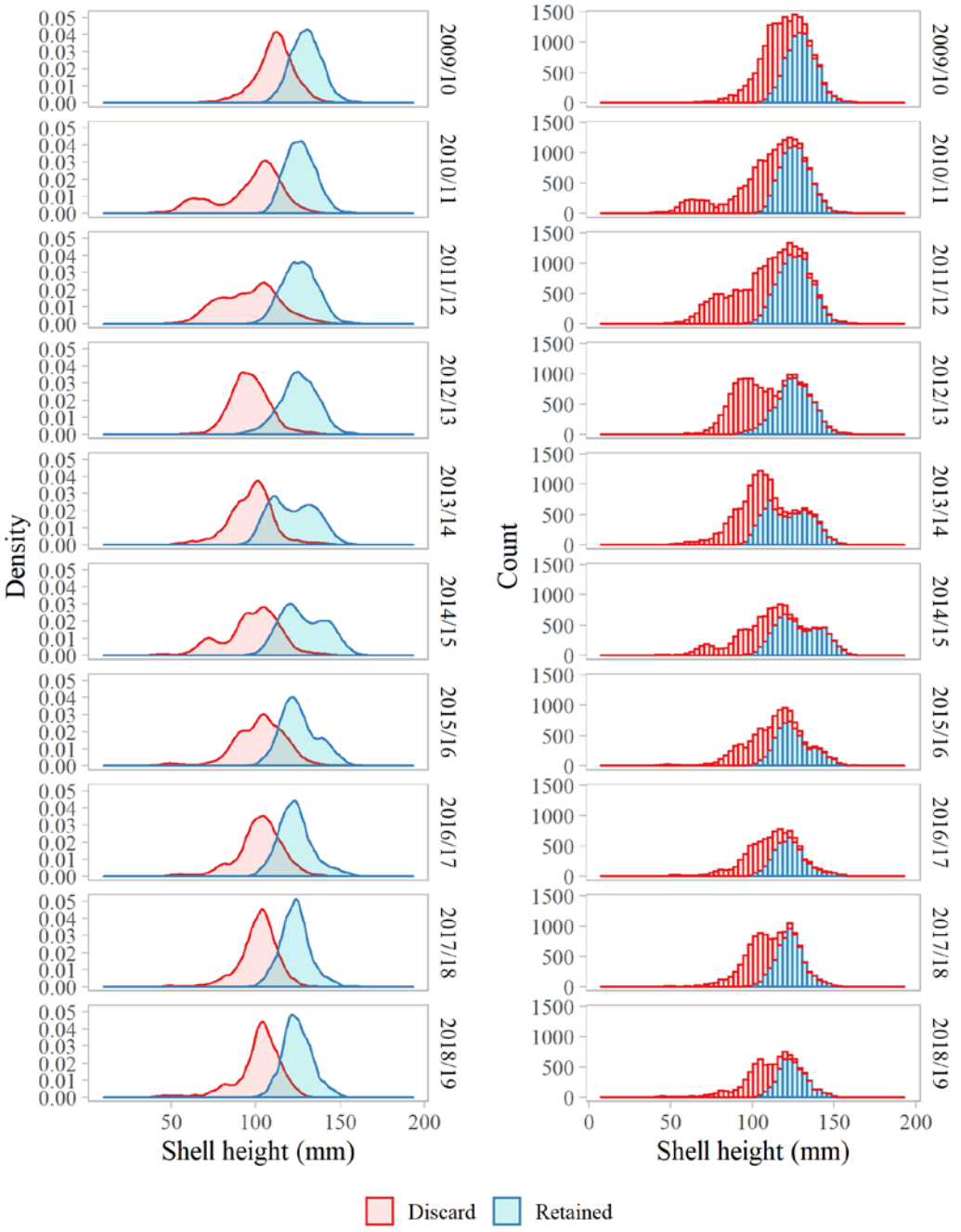


Figure 4-3 Yakutat District retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

4.1.2 Central Region

Kayak Island

The Kayak Island weathervane scallop commercial fishery in the Prince William Sound Area (PWS, Area E) was closed for the 2019/20 season. The East Kayak Subsection (EKS) has been closed since 2012. West Kayak Subsection (WKS) was open for the 2018/19 season; however, fishery performance was poor with a significant decline in CPUE. ADF&G surveys were conducted in EKS in 2018 and WKS in 2019. Abundance in EKS was at its lowest level in the history of the survey and abundance in WKS declined significantly since the last survey in 2016.

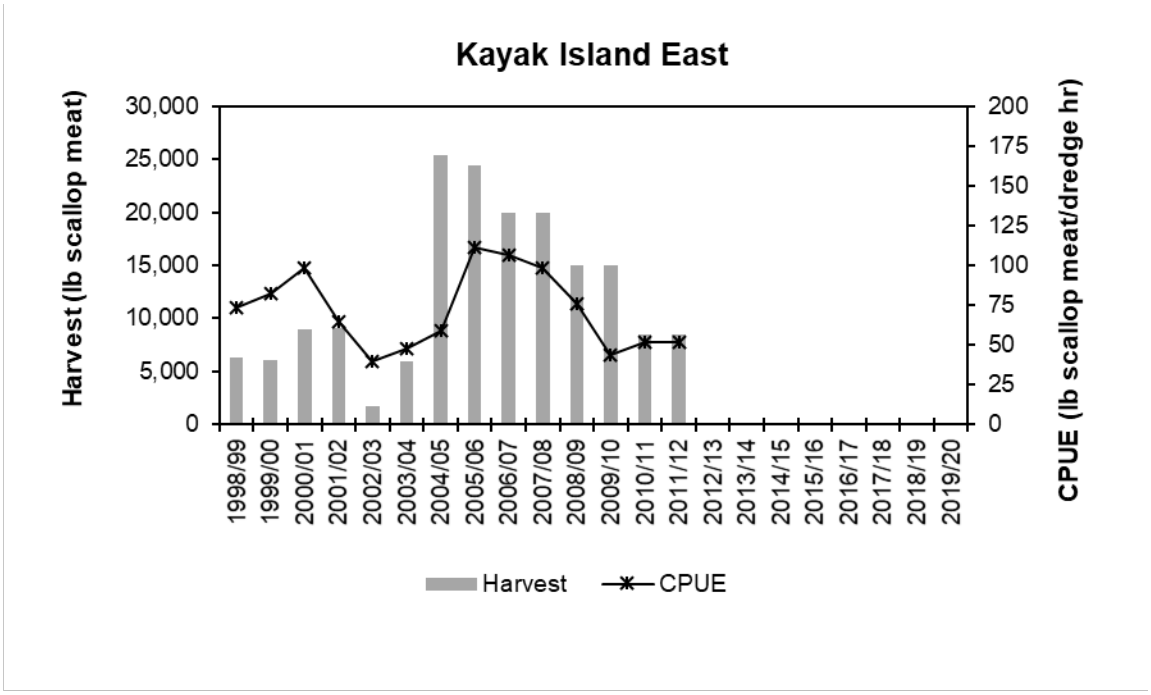
The Kayak Island scallop fishery has a guideline harvest range (GHR) of zero to 50,000 lb of shucked scallop meats, with a regulatory season of July 1 through February 15 in the Eastern Section of the Outside District of PWS. The GHL is set based on the Kayak Island ADF&G dredge survey estimates of abundance and biomass. For the PWS scallop fishery, the Eastern Section is divided into the WKS (West bed) and EKS (East bed) marked by Cape St. Elias.

The 2018/19 season opened in WKS on July 1 with a 6,300 lb guideline harvest level (GHL), EKS remained closed. One vessel participated and harvested 6,420 lb; the season closed at 12:00 noon August 21 when the GHL was projected to be achieved, which represented 5 days of fishing time. The season's CPUE was 48 lb/hr, a decrease of 23% from the 2017/18 season CPUE of 62 lb/hr (Figure 4-4).

Using observer information for the 2018/19 season in the WKS, scallop catch estimates were 85,467 lb round weight retained and 26,502 lb round weight discarded, a discard rate of 31.0%, double the 2017/18 discard rate of 14.6%.

Shell height distributions provided by the statewide observer program indicate that scallops retained during the 2018/19 season in the WKS ranged from 94 to 140 mm with an average shell height of 123 mm, n=220 sampled (Figure 4-3). Although the range of scallops from the 2018/19 season indicated smaller sized scallops than in some previous season, the average shell height was larger than the 2017/18 season in the WKS.

During the 2018/19 season in the WKS, 19 Tanner crab were caught as bycatch, less than a quarter of the 2017/18 season when 180 Tanner crab were caught; however, catches for both seasons are considered low and Tanner crab size was very small with total crab weight estimated at 1 lb for both years. No King or Dungeness crab have been encountered in sampled dredges during the last three open seasons. Two hundred halibut were caught during the 2018/19 season.



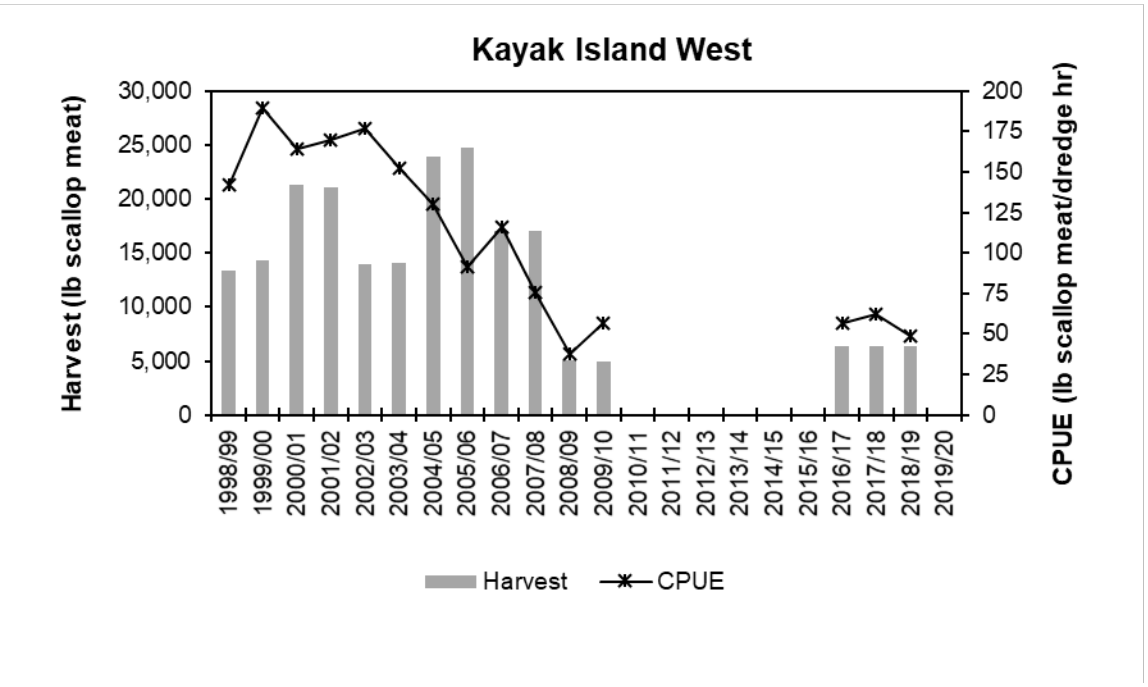


Figure 4-4 Prince William Sound scallop harvest and CPUE, 1996/97 - 2019/20 seasons

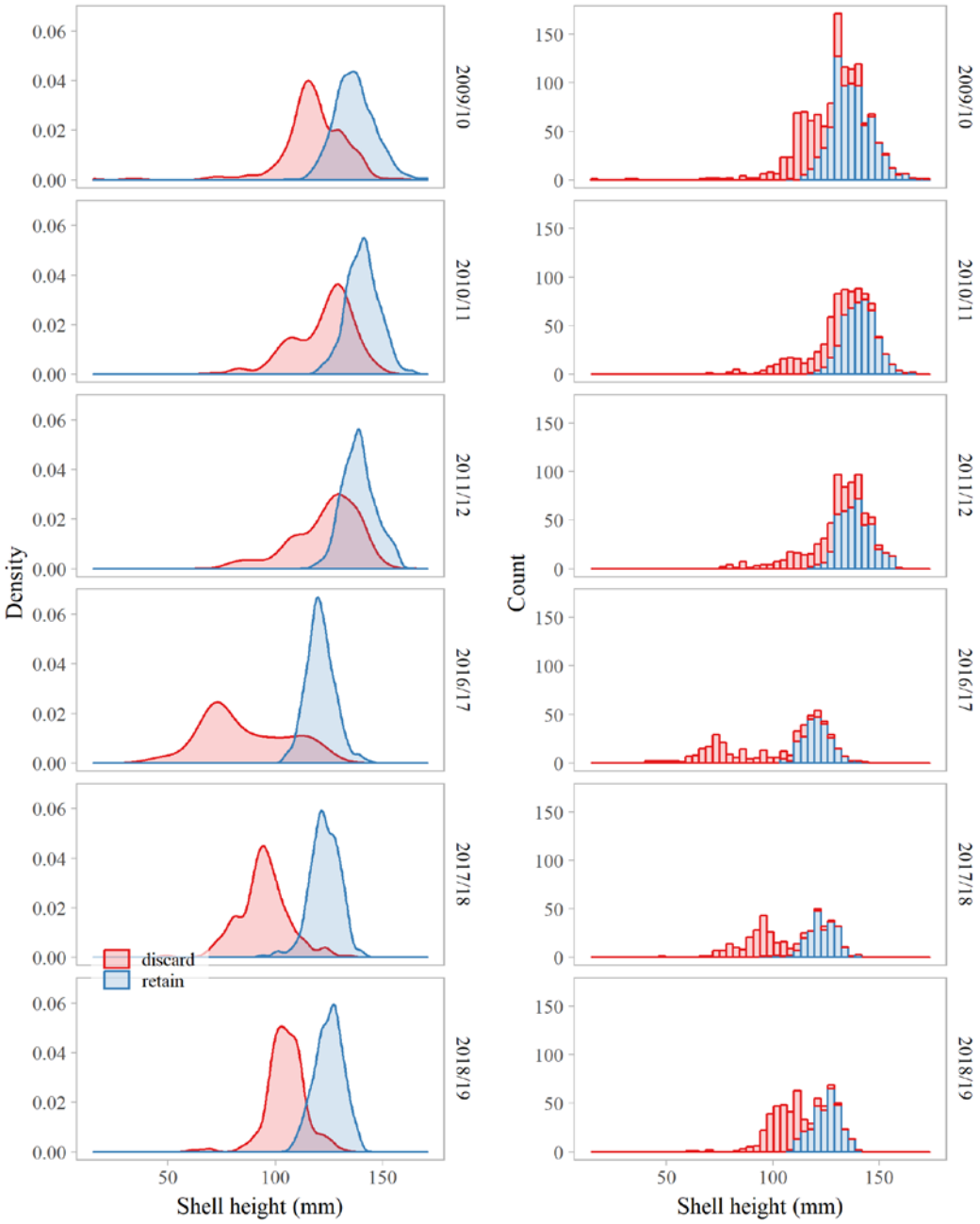


Figure 4-5 Prince William Sound retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Table 4-4 Commercial harvest of weathervane scallops from Kayak Island beds, 1995/96 - 2019/20.

		East Bed				West Bed				Total Both Beds			
Season	Number Vessels	GHL[a] (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb per dredge hr)	GHL[a] (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb meat per dredge hr)	GHL[a] (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb meat per dredge hr)
1995/96	3									50,000	108,000	NA	NA
1996/97		Closed				Closed				Closed			
1997/98	1									17,200	18,000	171	105
1998/99	2	6,000	6,300	85	74	14,000	13,350	94	142	20,000	19,650	179	110
1999/00	2	6,000	6,065	74	82	14,000	13,345	76	190	20,000	20,410	149	137
2000/01	3	9,000	8,998	92	98	21,000	21,268	129	164	30,000	30.266	221	137
2001/02	1	9,000	9,060	140	65	21,000	21,030	124	170	30,000	30,090	263	114
2002/03	2	6,000	1,680	43	39	14,000	13,961	79	177	20,000	15,641	122	128
2003/04	1	6,000	5,910	123	48	14,000	14,070	93	152	20,000	19,980	216	93
2004/05	2	26,000	25,350	430	59	24,000	23,970	185	130	50,000	49,320	615	80
2005/06	3	26,000	24,435	219	112	24,000	24,781	272	91	50,000	49,216	491	100
2006/07	2	20,000	20,010	188	106	17,000	17,005	147	116	37,000	37,015	335	110
2007/08	2	20,000	20,015	203	99	17,000	17,090	225	76	37,000	37,105	428	87
2008/09	1	15,000	15,030	197	76	5,000	5,010	134	37	20,000	20,040	331	61
2009/10	2	15,000	15,035	335	45	5,000	4,980	84	59	20,000	20,015	419	48
2010/11	1	8,400	8,445	161	52	Closed				8,400	8,445	161	52
2011/12	1	8,400	8,460	160	53	Closed				8,400	8,460	160	53
2012/13		Closed				Closed				Closed			
2013/14		Closed				Closed				Closed			
2014/15		Closed				Closed				Closed			
2015/16		Closed				Closed				Closed			
2016/17	1	Closed				6,300	6,360	112	57	6,300	6,360	112	57
2017/18	1	Closed				6,300	6,330	102	62	6,300	6,330	102	62
2018/19	1	Closed				6,300	6,420	133	48	6,300	6,420	133	48
2019/20		Closed				Closed							

[a] *Separate GHLs were established for the east and west beds beginning in 1998.*

Kamishak Bay

The Kamishak District weathervane scallop commercial fishery in the Cook Inlet Area (CI; Area H) was closed for the 2018 and 2019 seasons. ADF&G survey results from 2018 indicated that scallop abundance in the Kamishak District had declined sharply in both the north and south beds since the last surveys; the lowest levels in the history of the survey. In the North Bed, the scallop biomass estimate was less than half of the 2015 estimate, and in the South Bed, the biomass estimate had decreased 91% from 2013. The GHR set in regulation is 10,000 to 20,000 lb of shucked scallop meats for the Kamishak District and 2018 survey biomass estimates were well below the level needed to open the fishery.

The two most recent open seasons, 2016 and 2017, have been characterized by low effort or no effort. In 2016, one vessel participated and harvested 3,982 lb of scallops (Table 4-5), less than half of the 10,000 lb GHL. Effort was 271 dredge hours for a CPUE of 15 lb/hr, the second lowest CPUE in the history of the fishery (Table 4-5, Figure 4-6). The CPUE decreased as the 2016 fishery progressed from 17 lb/hr on the first trip to 13 lb/hr on the third and final trip. In 2017, the Kamishak District was open with a GHL of 10,000 lb. No vessels registered or fished in the 2017 season.

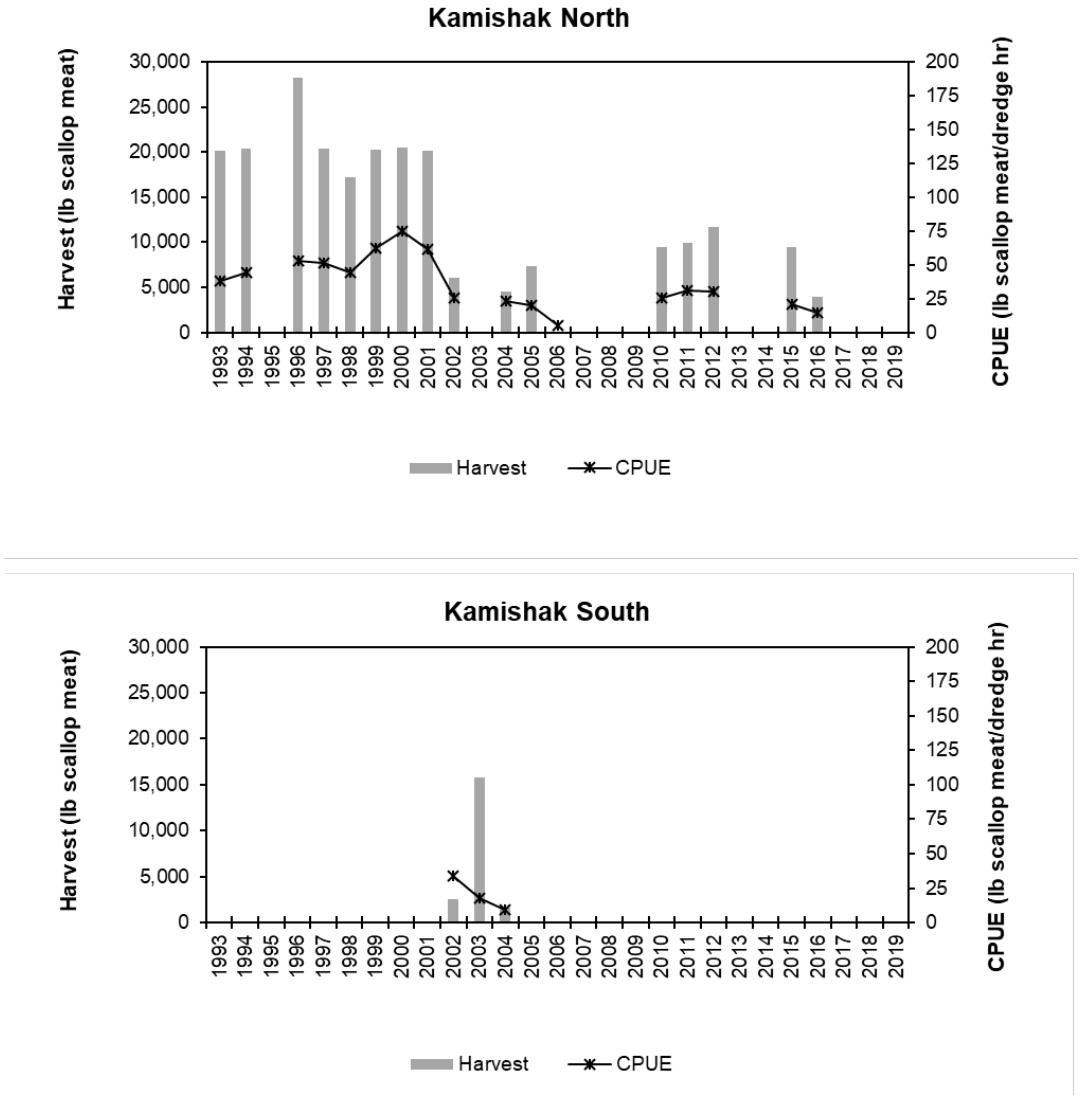


Figure 4-6 Cook Inlet Area scallop harvest and CPUE, 1993 - 2019 seasons for north and south beds in the Kamishak District.

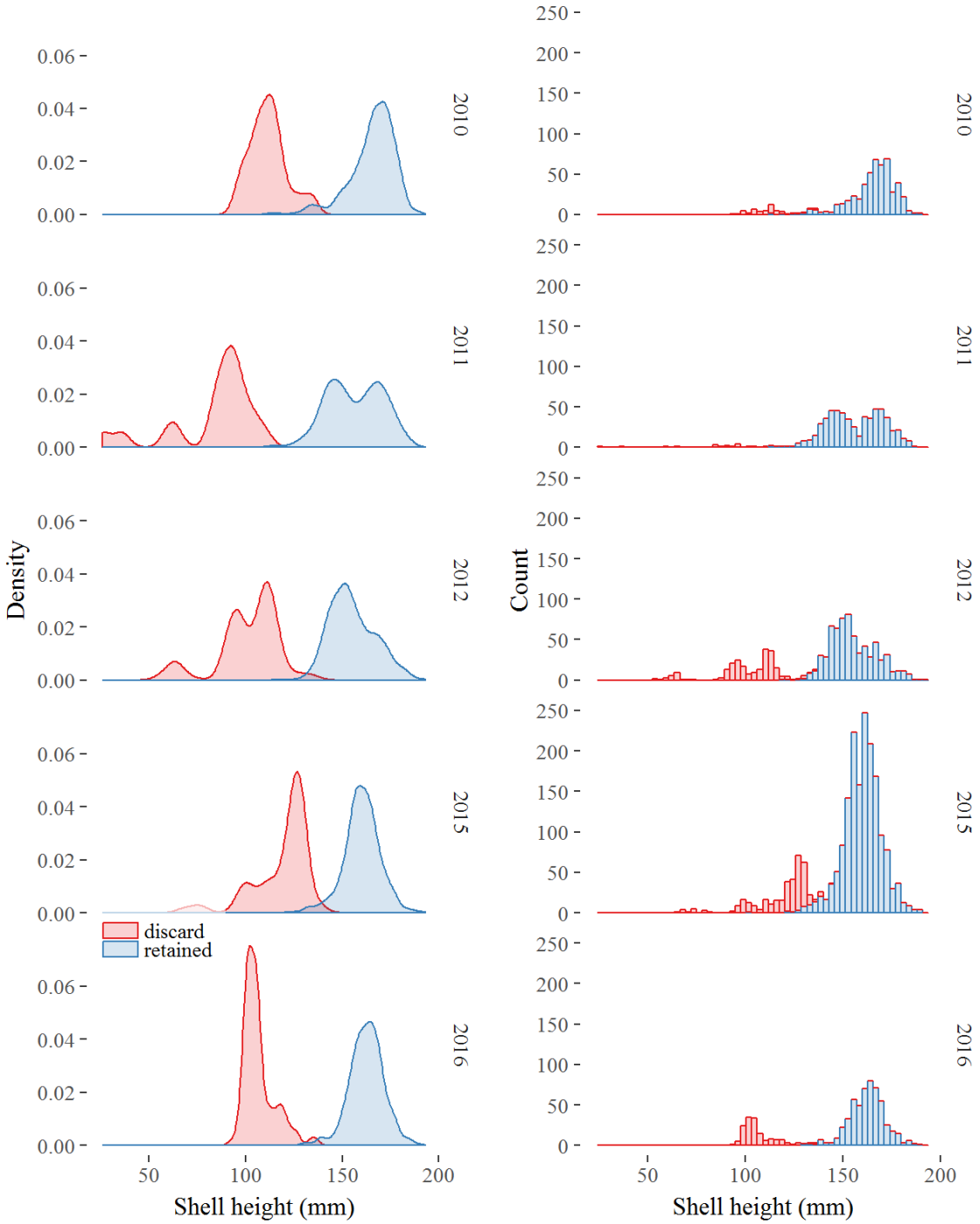


Figure 4-7 Kamishak District, Cook Inlet Area, retained and discarded scallop shell heights by density and count for the 2010 through 2016 seasons. Values are not adjusted to size of catch.

Table 4-5 Cook Inlet, Kamishak District scallop fishery summary statistics, 1994 - 2019.

		North Bed				South Bed				Total Both Beds			
Season	Number Vessels[a]	GHL (lb	Catch (lb meat)	Dredge hours	CPUE (lb per dredge	GHL (lb	Catch (lb meat)	Dredge hours	CPUE (lb per dredge hr)	GHL (lb meat)	Catch (lb meat)	Dredge hours	CPUE (lb per dredge hr)
1994	4	20,000	20,431	458	45					20,000	20,431	458	45
1995		Closed											
1996	5	28,000	28,228	534	53					28,000	28,228	534	53
1997	3	20,000	20,336	395	52					20,000	20,336	395	52
1998	1	20,000	17,246	390	44					20,000	17,246	390	44
1999	3	20,000	20,315	325	63					20,000	20,315	325	63
2000	3	20,000	20,516	275	75					20,000	20,516	275	75
2001	2	20,000	20,097	325	62					20,000	20,097	325	62
2002	3	20,000	6,045	235	26		2,546	76	34	20,000	8,591	311	28
2003	2	Closed				20,000	15,843	896	18	20,000	15,843	896	18
2004	3	6,500	4,519	198	23	13,500	1,598	166	10	20,000	6,117	364	17
2005	2	7,000	7,378	372	20	Closed				7,000	7,378	372	20
2006	1	7,000	50	10	5	Closed				7,000	50	10	5
2007	0	7,000	0			5,000	0			12,000	0		
2008	0	7,000	0			5,000	0			12,000	0		
2009	0	14,000	0			Closed				14,000	0		
2010	1	14,000	9,460	365	26	Closed				14,000	9,460	365	26
2011	1	12,500	9,975	324	31	Closed				12,500	9,975	324	31
2012	1	12,500	11,739	392	30	Closed				12,500	11,739	392	30
2013		Closed				Closed				Closed			
2014		Closed				Closed				Closed			
2015	1	10,000	9,485	459	21	Closed				10,000	9,485	459	21
2016	1	10,000	3,982	271	15	Closed				10,000	3,982	271	15
2017	0	10,000	0			Closed				10,000	0		
2018		Closed				Closed				Closed			
2019		Closed				Closed				Closed			

Confidential data voluntarily released by vessel operators

4.1.3 Westward Region

Kodiak Registration Area

Kodiak Northeast

The 2019/20 season was the second season with a 15,000 lb GHL. The Northeast District GHL was reduced from 55,000 to 15,000 lb for the 2018/19 season due to the CPUE remaining below the minimum performance standard (MPS) for three consecutive seasons (2015/16–2017/18) and the GHL not being fully harvested during the 2016/17 and 2017/18 seasons. The preliminary 2019/20 CPUE was 73 pounds of shucked meats per dredge hour, which is the highest CPUE since 2014/15, and second highest since 2000/01. Preliminary retained catch was 15,070 lb of meats and effort was 205 dredge hours (Table 4-6; Figure 4-8).

Table 4-6 Kodiak Northeast District scallop fishery summary statistics, 1993/94 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained (lb meat)	Retained (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01	4	80,000	79,965	681,198	1,101	73	619	2,382
2001/02	3	80,000	80,470	822,110	1,142	70	720	2,286
2002/03	2	80,000	80,000	871,918	1,350	59	646	3,497
2003/04	2	80,000	79,965	747,517	1,248	64	599	2,384
2004/05	2	80,000	80,105	848,527	1,227	65	692	5,522
2005/06	3	80,000	79,990	831,378	1,759	46	473	4,408
2006/07	2	90,000	75,150	703,388	1,168	64	602	2,842
2007/08	2	90,000	75,105	822,697	1,170	63	703	4,264
2008/09	3	90,000	74,863	808,277	1,363	55	596	2,328
2009/10	1	75,000	69,360	831,709	1,222	57	681	2,541
2010/11	3	65,000	64,475	671,928	1,015	64	663	1,804
2011/12	4	70,000	61,209	663,927	986	62	678	2,014
2012/13	4	60,000	62,496	748,055	1,322	47	568	2,086
2013/14	4	55,000	54,926	524,124	935	59	563	1,457
2014/15	3	55,000	55,659	667,123	752	74	888	1,327
2015/16	3	55,000	55,577	568,543	1,228	45	463	1,981
2016/17	2	55,000	24,410	196,939	1,095	22	180	574
2017/18	1	55,000	14,190	136,295	349	41	391	432
2018/19	1	15,000	15,210	155,334	262	58	593	1,111
2019/20[d]	2	15,000	15,070	NA	205	73	NA	NA

[a] lb scallop meat / dredge hour
[b] lb scallop round / dredge hour
[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 10.5% from observer experiments.
[d] PRELIMINARY data subject to change.

In the 2018/19 Northeast District fishery, 15,210 lb of scallop meats were retained with a CPUE of 58 pounds of shucked meats per dredge hour. This is an increase from the previous three years and above the MPS of 46. In addition to the retained catch, an estimated live scallop equivalent of and 5,555 lb of meat were discarded, or approximately 34.0%, were discarded. This is the highest discard rate since 2000/01 and

above the 10-year mean of 13.3%. Using a 20% discard mortality estimate, 1,111 lb of scallop meat weights was lost to discard mortality in the 2018/19/18 season (Table 4-6).

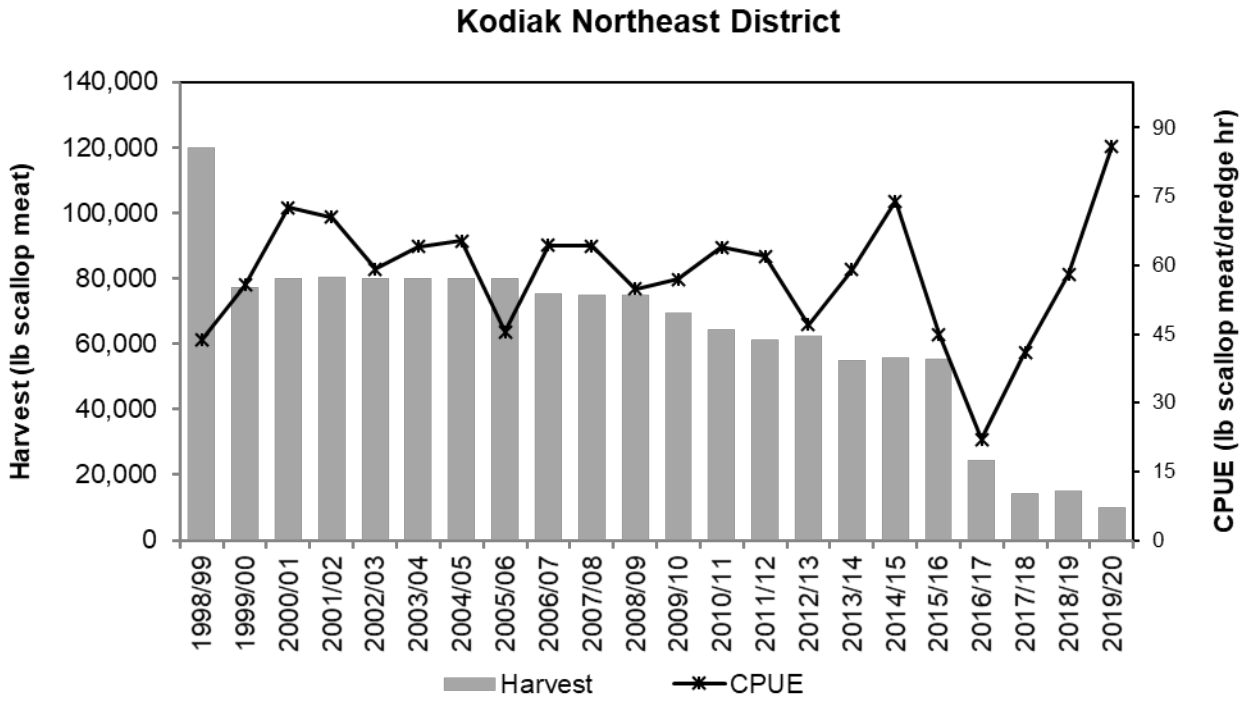


Figure 4-8 Kodiak Northeast District harvest and CPUE, 1998/99 - 2019/20 seasons.

Estimated shell height distributions in Northeast District for 2018/19 were more narrow and slightly smaller relative to the previous seasons.. The bulk of the retained scallops were in the 100–150 mm shell height (SH) range and most discarded scallops were around 100 mm SH (Figure 4-10).

In response to steep declines in CPUE in 2015/16 and 2016/17, a districtwide MPS of 46 was established for the Northeast District for the 2017/18 season which was based upon the lowest CPUE observed for the district prior to the 2015/16 season. In 2017/18, districtwide CPUE was below the MPS and the participating vessel voluntarily stopped fishing due to low fishery performance (Table 4-6). In 2018/19, a reduced GHL of 15,000 pounds was established and the districtwide CPUE was 58, which is above the MPS and 43% higher than the 2017/18 CPUE (Table 4-6; Figure 4-9).

Crab bycatch estimates calculated from 2018/19 Northeast District fishery observer samples were 7,242 Tanner crab (Table 3-4). This is an increase of 30% relative to the 2017/18 season. Carapace width of Tanner crabs sampled by observers ranged from approximately 15mm to 145mm, with the majority in the 40–90mm range (Figure 3-1).

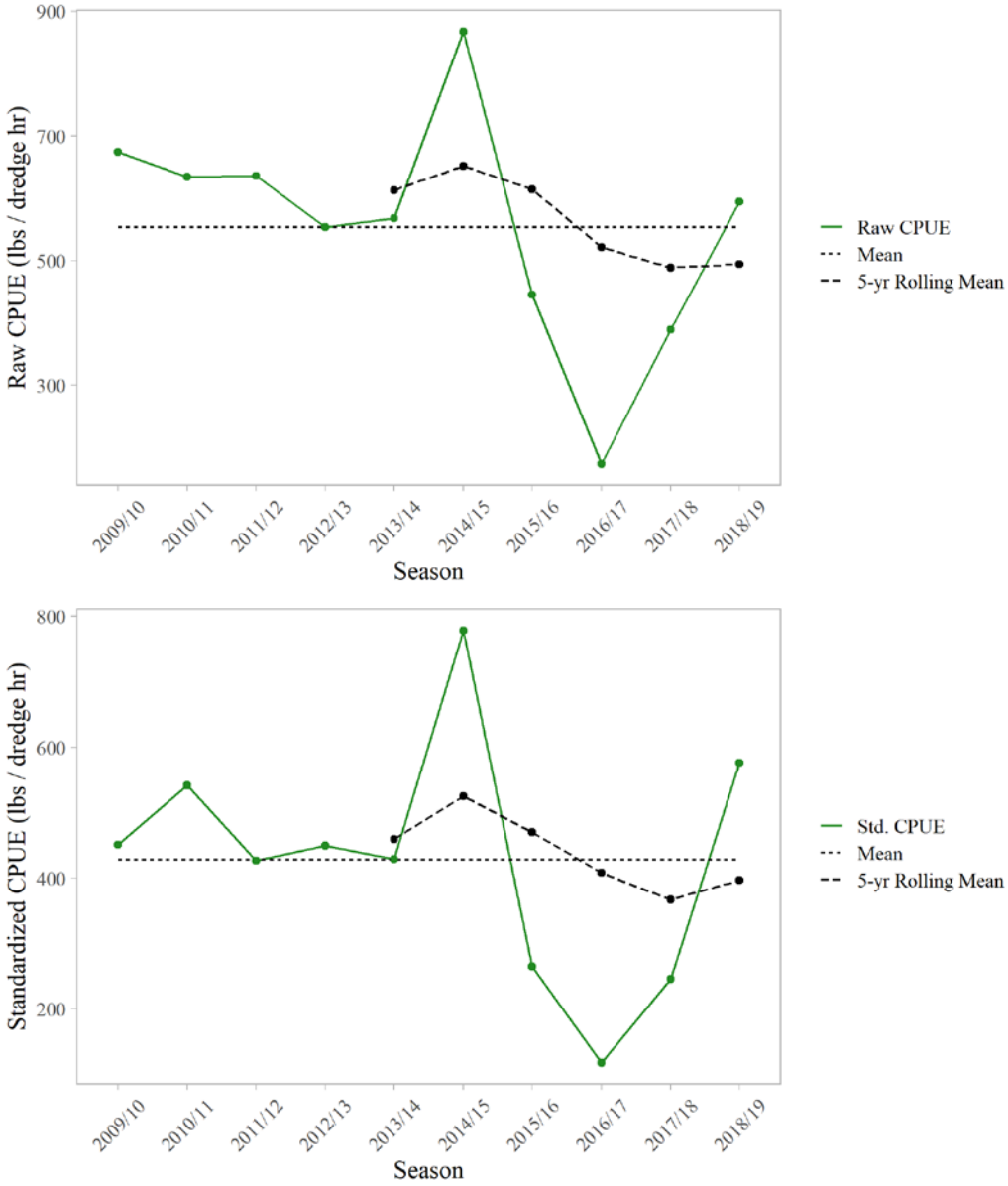


Figure 4-9 Kodiak Northeast District scallop raw and standardized (when available) meat CPUE.

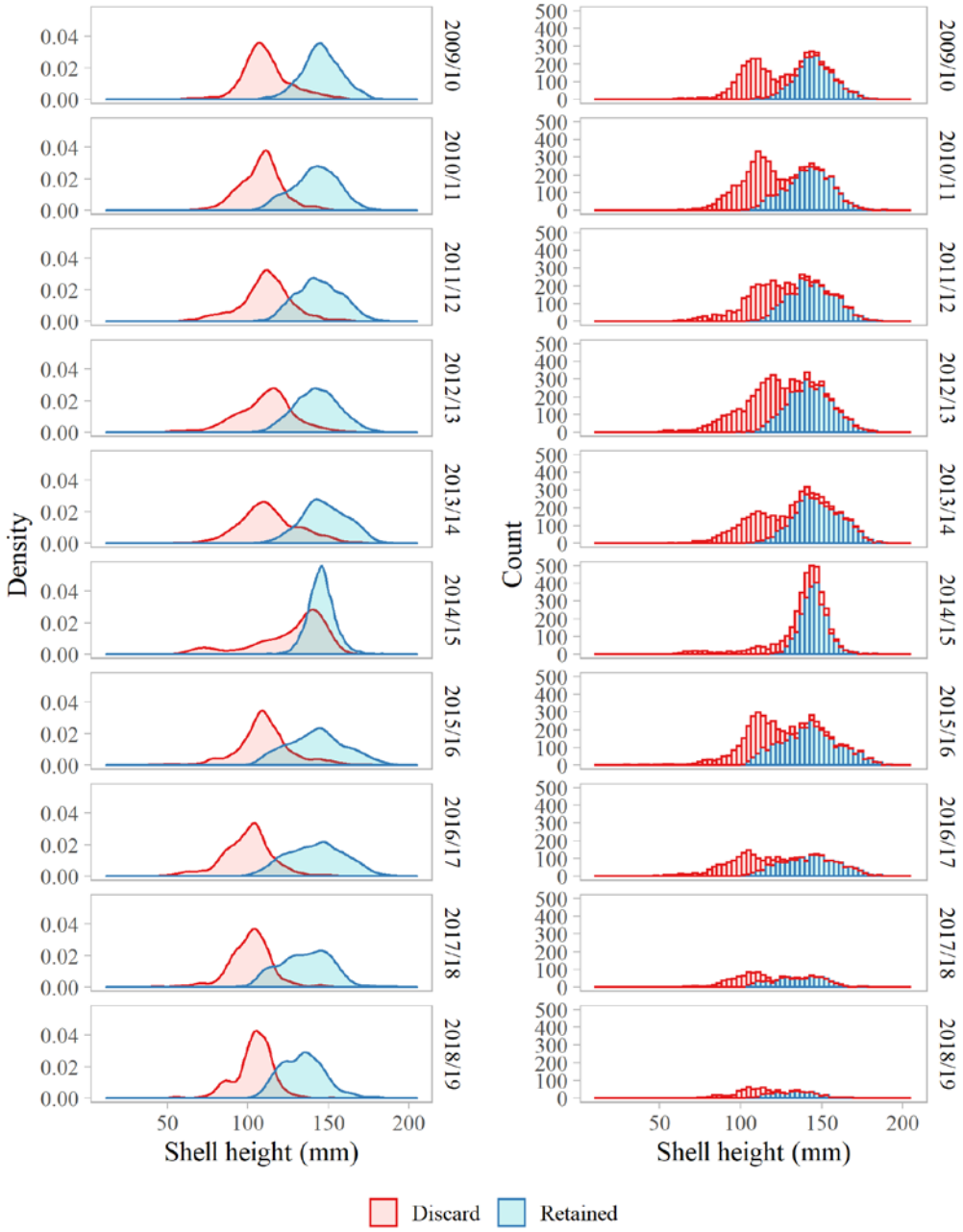


Figure 4-10 Kodiak Northeast District retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Shelikof

The Shelikof District has been managed as two distinct eastern and western sections with 20,000 and 5,000-pound GHLs respectively. For the 2019/20 season, the western section was combined with the Southwest District, leaving the Shelikof District with a 20,000-pound GHL. . Based on preliminary harvest and effort from the 2019/20 season, 20,125lb of meats were retained with a CPUE of 53 pounds of meats/dredge hour (Table 4-7 Figure 4-11). After severe reductions in GHL since 2014/15, the Shelikof District CPUE appears to be stabilizing.

Table 4-7 Kodiak Shelikof District scallop fishery summary statistics, 1993/94 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01	5	180,000	180,087	1,768,376	2,907	62	609	2,621
2001/02	4	180,000	177,112	1,830,265	3,398	52	539	4,880
2002/03	3	180,000	180,580	1,857,466	3,799	48	489	10,120
2003/04	2	180,000	180,011	1,724,498	3,258	55	529	8,209
2004/05	2	180,000	174,622	1,641,608	3,467	50	474	8,883
2005/06	2	160,000	159,941	1,453,656	2,280	70	638	4,767
2006/07	3	160,000	162,537	1,404,134	2,183	74	644	4,789
2007/08	3	170,000	169,968	1,695,563	2,937	58	577	7,685
2008/09	2	170,000	13,761	161,065	263	52	615	658
2009/10	3	170,000	170,021	1,667,958	3,496	49	477	7,132
2010/11	4	170,000	171,076	1,888,965	3,507	49	539	8,623
2011/12	4	135,000	136,491	1,437,781	2,437	56	590	2,618
2012/13	4	105,000	106,051	992,769	2,002	53	496	2,575
2013/14	4	105,000	106,099	910,919	2,472	43	369	1,162
2014/15	3	105,000[1]	66,138	650,367	1,629	41	399	962
2015/16	3	75,000[2]	40,290	482,896	1,323	30	365	1,100
2016/17	2	25,000	25,120	326,111	830	30	393	971
2017/18	1	25,000	25,050	261,384	545	46	480	932
2018/19	1	25,000	25,020	281,890	473	53	596	3,310
2019/20[d]	2	20,000	20,125	NA	379	53	NA	NA

[a] lb scallop meat / dredge hour
[b] lb scallop round / dredge hour
[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 10.2% from observer experiments.
[d] PRELIMINARY data subject to change.
[1] Inseason Closure at 65,000 lb
[2] Inseason Closure July 30, 2015

In the 2018/19 Shelikof District fishery, 20,020 lb of scallop meats were retained and 16,550 lb, or approximately 39.8%, were discarded. This discard rate is the highest since 2000/01 and above the 10-year mean of 13.5%. Using a 20% discard mortality estimate, 3,310 lb of scallop meat weights was lost to discard mortality in the 2018/19 season (

Table 4-7).

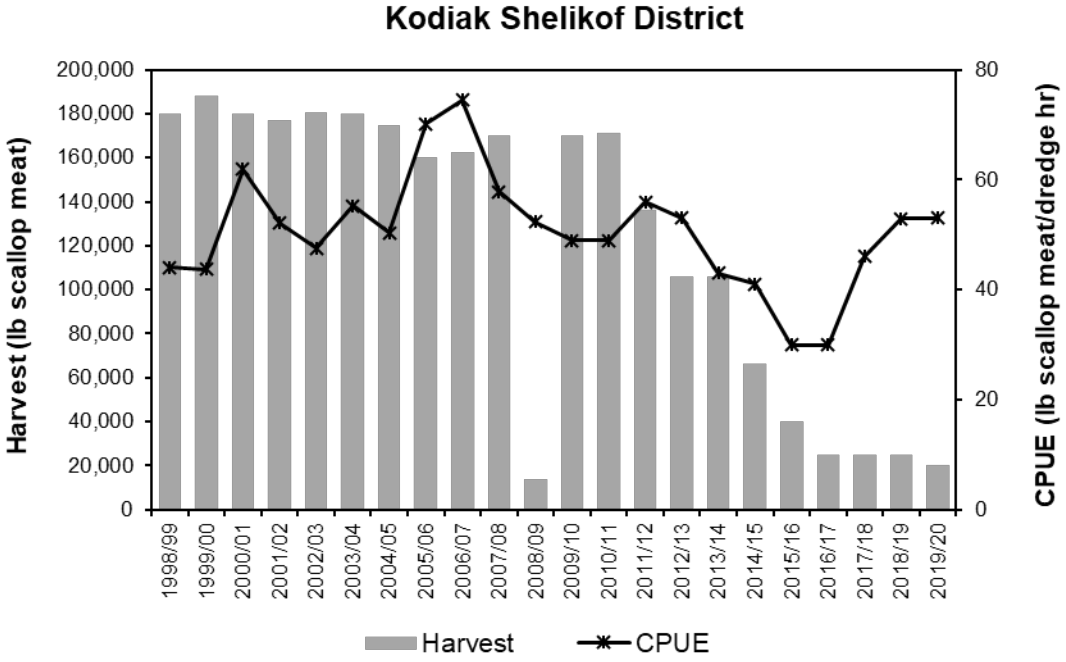


Figure 4-11 Kodiak Shelikof District harvest and CPUE, 1998/99 - 2019/20 seasons.

Estimated shell height distributions for the 2018/19 season in Shelikof District show a similar range of scallop sizes relative to prior seasons. Smaller scallops (50–75 mm) observed in 2017/18, were still present but at a much lower frequency. The size range of discarded scallops decreased, and most discarded scallops were 100 mm. The bulk of the retained scallops remain in the 100–175 mm shell height (SH) range (Figure 4-13).

The Shelikof District CPUE had been in a declining trend since 2007/08 and in response, beginning in 2012/13, managers started a series of GHL reductions and began making inseason closures prior to achieving the GHL when fishery performance failed to maintain CPUEs above the established MPS of 47 (Table 3-1). After the most recent and most aggressive GHL reduction in 2016/17, the CPUE has improved from the low of 30 and has remained stable at 53 for the past two seasons (Figure 4-12).

Crab bycatch estimates calculated from 2018/19 Shelikof District fishery observer samples were Tanner crab (Table 3-4). Estimated Shelikof District Tanner crab bycatch decreased 9.5% from the 2017/18season. The majority of Tanner crabs sampled by observers were approximately 20mm to 80 mm in carapace width (Figure 3-1).

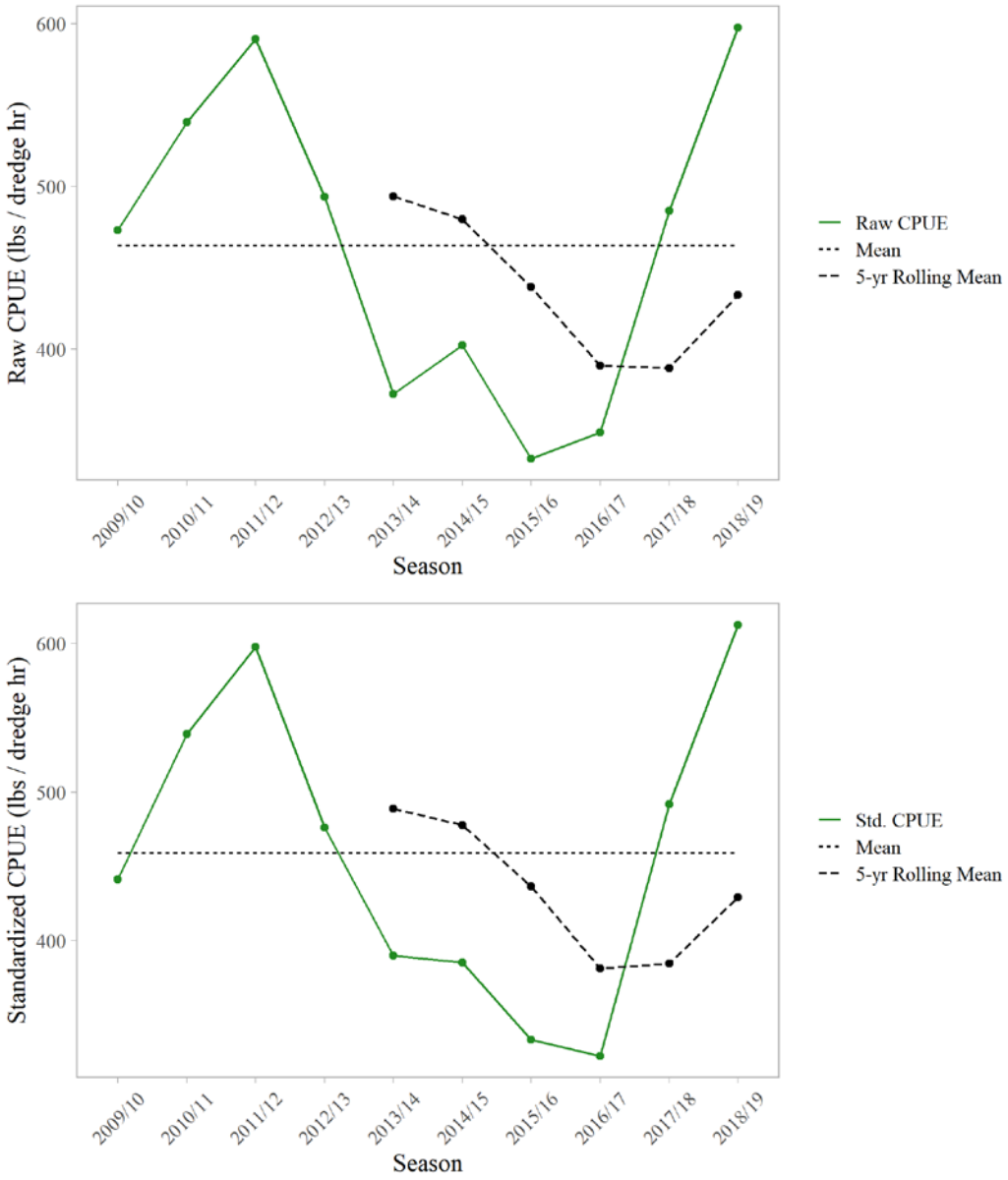


Figure 4-12 Kodiak Shelikof District scallop raw and standardized (when available) meat CPUE, 1995/96 - 2017/18 seasons.

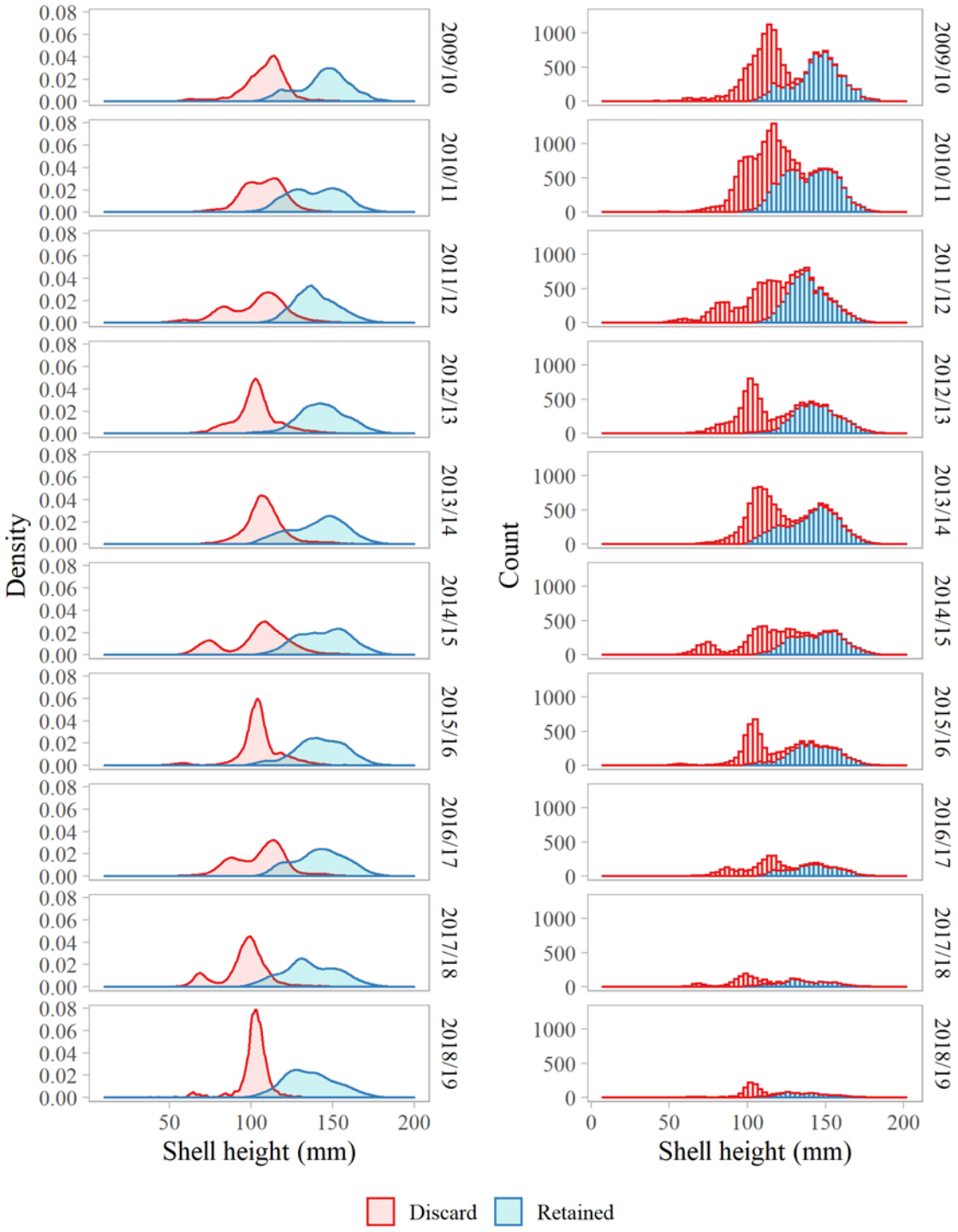


Figure 4-13 Kodiak Shelikof District retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Kodiak Southwest

The 2019/20 Southwest District GHL was 35,000 pounds. In March of 2018, the Alaska Board of Fisheries expanded the area open to scallop fishing in the Southwest District. The newly opened area is likely an extension of the same scallop bed in the western portion of the Shelikof District. Therefore, management staff shifted 5,000 pounds from the Shelikof District to the Southwest District. Based on preliminary harvest and effort data from the 2019/20 season, 35,010 lb of meats were retained with a CPUE of 55 pounds of meats/dredge hour (Table 4-8; Figure 4-14).

Table 4-8 Kodiak Southwest District scallop fishery summary statistics, 2009/10 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2009/10	1	25,000	3,480	62,241	159	22	392	76
2010/11	0	25,000	0					
2011/12	1	25,000	25,110	348,142	455	55	766	364
2012/13	2	25,000	25,014	261,318	671	37	389	312
2013/14	2	25,000	20,340	230,034	526	39	437	301
2014/15	2	25,000	24,973	310,921	555	45	561	193
2015/16	1	25,000[1]	10,950	157,087	281	39	558	143
2016/17	1	25,000	25,110	441,088	448	56	984	455
2017/18	1	25,000	25,020	334,784	377	66	887	1,699
2018/19	1	30,000	30,000	356,737	453	66	787	2,077
2019/20[d]	2	35,000	35,010	NA	634	55	NA	NA

[a] lb scallop meat / dredge hour
[b] lb scallop round / dredge hour
[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 10.2% from observer experiments.
[d] PRELIMINARY data subject to change.
[1] Inseason closure due to Tanner crab bycatch

The 2019/20 Southwest District CPUE was lower than the previous two seasons, but still on the upper end the range of CPUEs since 2011/12. The Southwest District CPUE has been steadily increasing since the 2012/13 season, with exception to the 2015/16 season when the district closed prior to harvesting the full GHL because the Tanner crab bycatch cap of 12,000 crab was exceeded.

In the 2018/19 Southwest District fishery, 30,000 lb of scallop meats were retained and 10,385 lb, or approximately 25.7%, were discarded. This is the second year that discards were higher than average; the average discard rate for the 2011/12 through 2017/18 seasons is 10.1%. Using a 20% discard mortality estimate, 2,077 lb of scallop meat weight was lost to discard mortality in the 2018/19 season (Table 4-13).

Estimated shell height distributions in the Southwest District from the 2018/19 season were similar to previous two seasons. The recruitment pulse first detected in 2015/16 has likely recruited into the fishery and is contributing to the smaller retained scallops. The bulk of the retained scallops remain in the 125–175 mm SH size range (Figure 4-16).

Crab bycatch estimates calculated from 2018/19 Southwest District fishery observer samples were 1,501 Tanner crab (Table 3-4). Estimated Southwest District Tanner crab bycatch is much lower than recent

years and decreased 78% from the 2017/18 season. Carapace width of Tanner crabs sampled by observers ranged from approximately20 mm to 160 mm, with the majority in the 35-90 mm range (Figure 3-1).

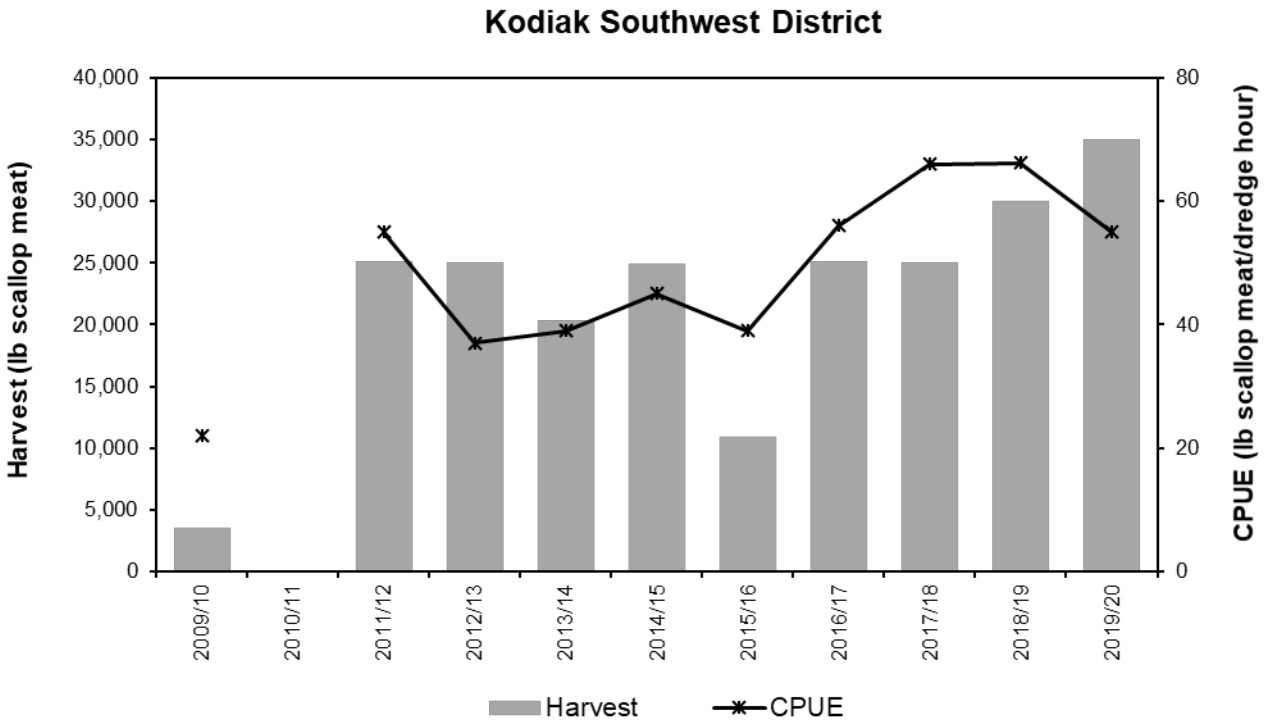


Figure 4-14 Kodiak Southwest District harvest and CPUE, 2009/10 and 2011/12 - 2019/20 seasons.

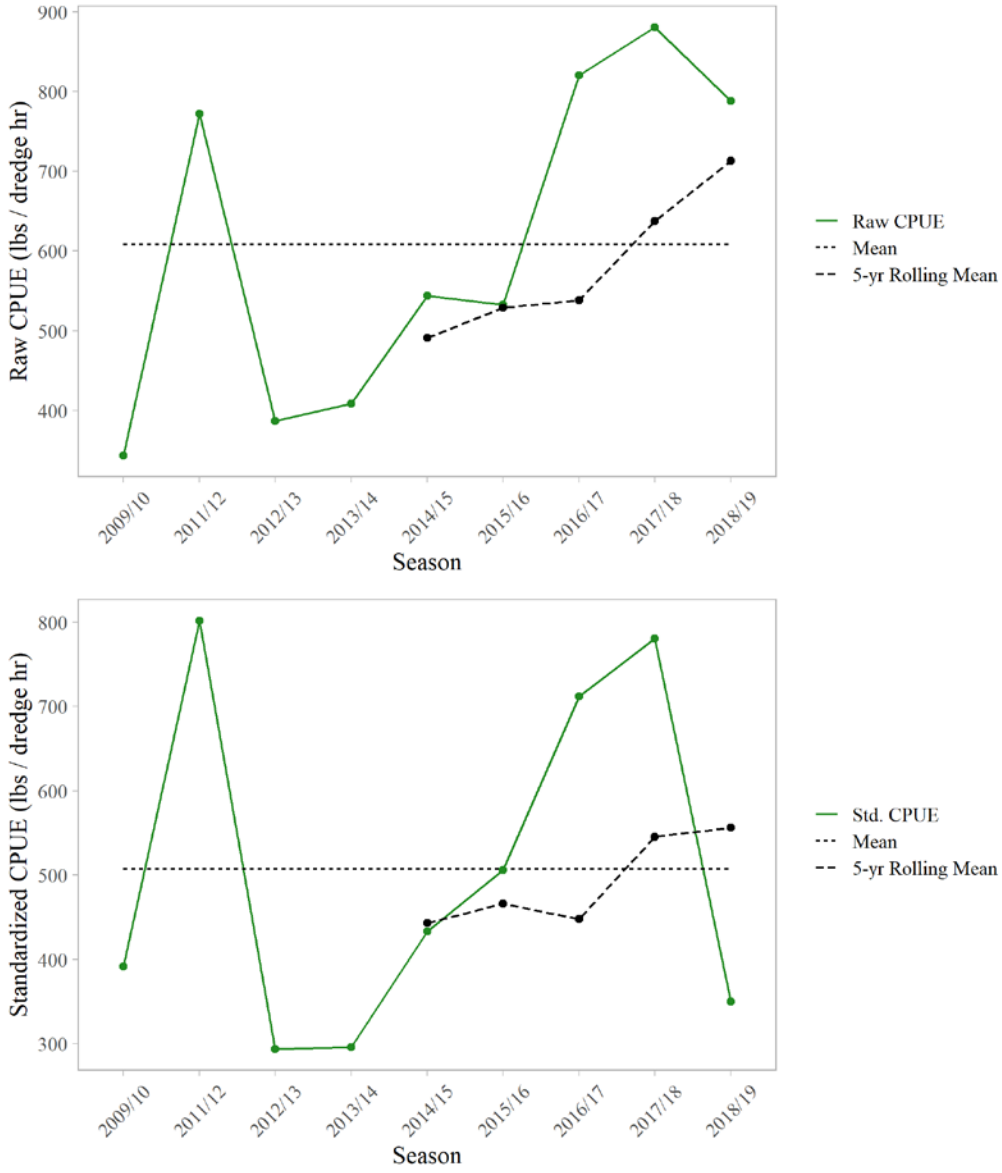


Figure 4-15 Kodiak Southwest District scallop raw and standardized (when available) meat CPUE, 2009/10 - 2017/18 seasons.

Intentionally Left Blank

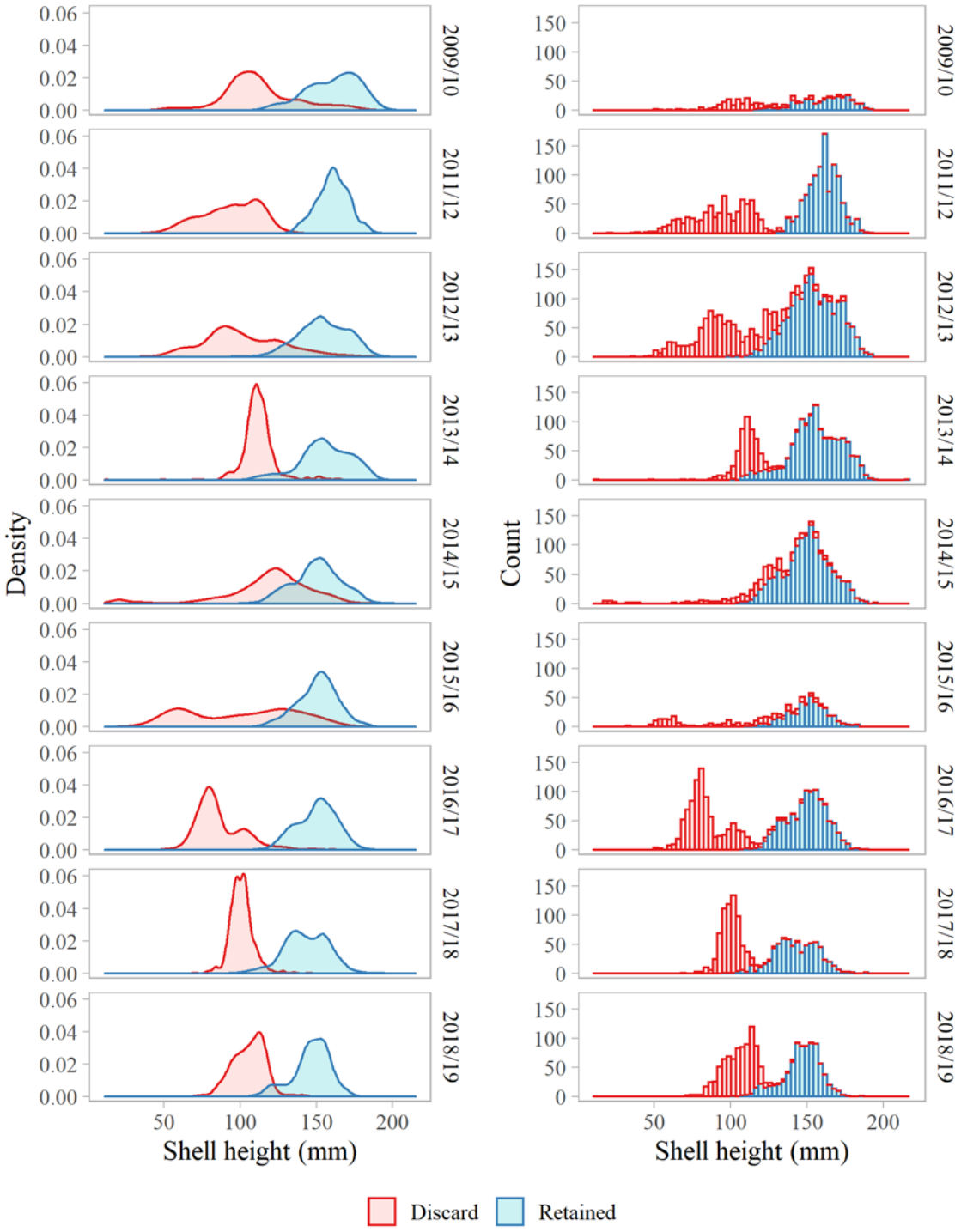


Figure 4-16 Kodiak Southwest District retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Kodiak Southeast

The Southeast District opened to fishing in 2018/19 with a GHL of 15,000 pounds. The 2019/20 season was the 2nd season the Southeast District was open with a 15,000 pound GHL, however no effort occurred (Table 4-9).

Table 4-9 Kodiak Southeast District scallop fishery summary statistics, 2018/19 – 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2018/19	1	15,000	470	3,348	60	8	56	2
2019/20[d]	0	15,000	0	NA	0		NA	NA

[a] *lb scallop meat / dredge hour*
[b] *lb scallop round / dredge hour*
[c] *Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 10.2% from observer experiments.*
[d] *PRELIMINARY data subject to change.*

There was minimal harvest in 2018/19 therefore, information on discards and shell high distributions are limited to one year with small sample sizes. Shell heights ranged from 75 to 175 mm SH and the bulk of retained scallops were 100–150 mm SH.

In the 2018/19 Southeast District fishery, 470 lb of scallop meats were retained and 10 lb, or approximately 2%, were discarded. Using a 20% discard mortality estimate, 2 lb of scallop meat weight was lost to discard mortality (Table 4-9).

Crab bycatch estimates calculated from 2018/19 Southeast District fishery observer samples were 2,163 Tanner crab (Table 3-4). Given the small harvest, this bycatch rate is high relative to other Kodiak districts.

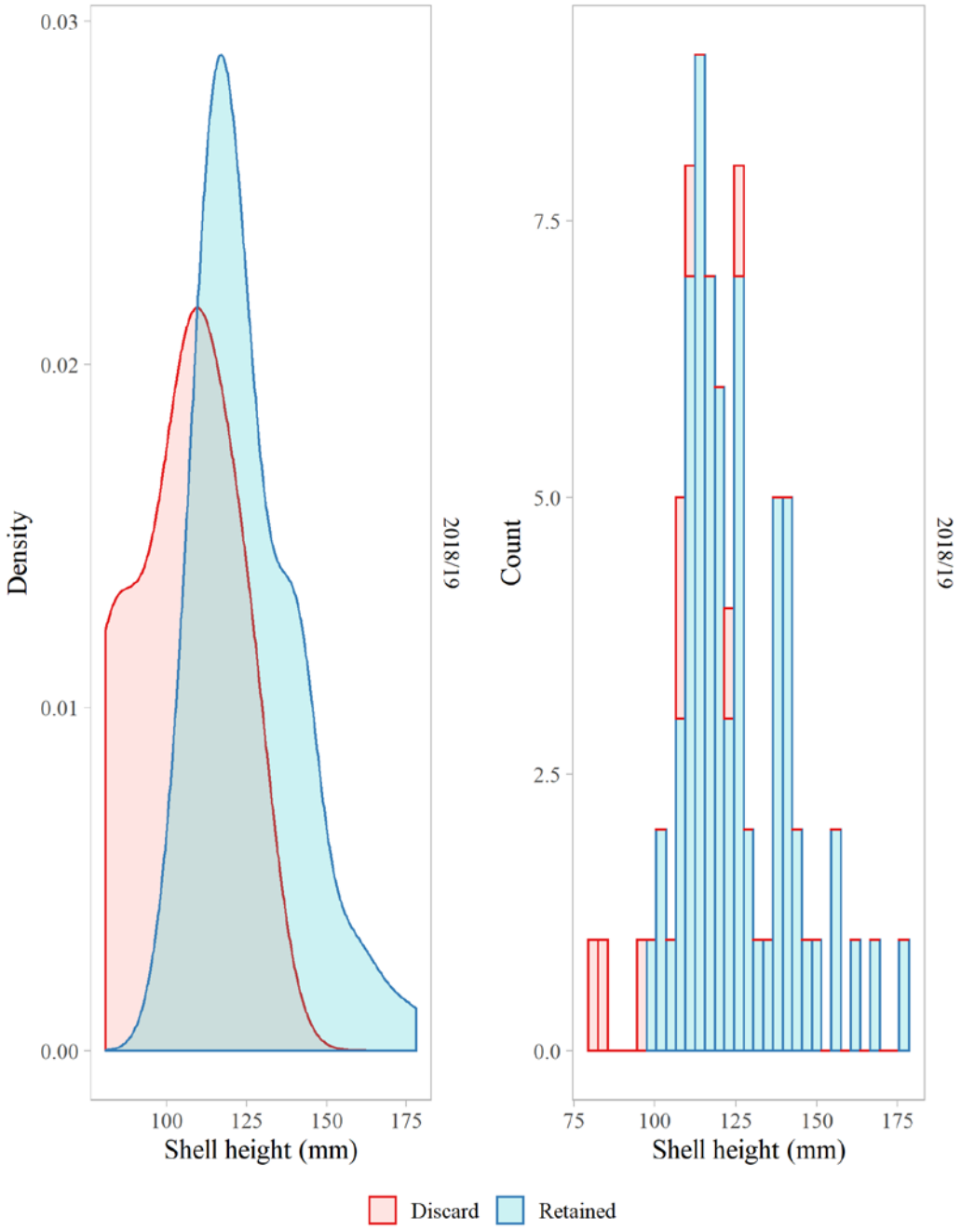


Figure 4-17 Kodiak Southeast District retained and discarded shell heights by density and count for the 2018/19 season.

Alaska Peninsula Registration Area

Waters between Longitude 160°W and 161°W

After a prolonged closure, waters between longitude 160°W and longitude 161°W were reopened in 2014/15 and have had a 7,500-pound GHL since. In 2018/19, one vessel fished for 4 hours while transiting the area; no scallops were harvest and estimated Tanner crab bycatch was 140 crab.

Unimak Bight

For the 2018/19 season, the Unimak Bight District GHL was reduced to 7,500 pounds from the prior 15,000-pound GHL. Rational for the reduction includes a declining CPUE and effort becoming increasingly concentrated. Preliminary harvest for the 2019/20 season is 5,750 lb of meat with a CPUE of 49 pounds of meats/dredge hour. This is the second year the GHL has now been fully harvested, even with a reduced GHL (Table 4-10; Figure 4-18).

Table 4-10 Alaska Peninsula Area scallop fishery summary statistics, 1993/94 – 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	(lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01	3	33,000	7,660		320	24		83
2001/02		closed						
2002/03		closed						
2003/04		closed						
2004/05		closed						
2005/06	0	20,000	0		0			
2006/07	2	25,000	155		64	2		15
2007/08	0	10,000	0		0			
2008/09		10,000	2,460		151	16		75
2009/10		closed						
2010/11		closed						
2011/12		closed						
2012/13	1	15,000[1]	15,040	217,607	255	59	853	541
2013/14	1	15,000[1]	15,155	193,106	247	61	781	325
2014/15	2	15,000[1]	15,000	227,369	288	52	789	325
2015/16	1	15,000[1]	15,000	207,991	302	50	689	172
2016/17	1	15,000[1]	15,013	202,806	340	44	597	200
2017/18	1	15,000[1]	15,250	181,646	328	47	555	448
2018/19	1	15,000[1]	8,905	119,458	260	34	459	690
2019/20[d]	1	7,500[1]	5,750	NA	118	49	NA	NA

[a] lb scallop meat / dredge hour

[b] lb scallop round / dredge hour

[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 9.2% from observer experiments.

[d] PRELIMINARY data subject to change.

[1] Exploratory Unimak Bight District fishery opened by Commissioner's Permit

In the 2018/19 Unimak Bight District fishery, 8,905 lb of scallop meats were harvested and 3,450 lb, or 27.9%, were discarded. This discard rate is the highest since 2012/13 much higher than the 10-year mean

of 10.0%. Using a 20% discard mortality estimate, 690 lb of scallop meat weight was lost to discard mortality in the 2018/19 season (Table 4-10).

Estimated shell height distributions in Unimak Bight District show a decrease in the range of scallop sizes from 2016/17–2018/19 when compared to the 2012/13–2015/16. The bulk of the retained scallops remain in the 125–175 mm shell height range (Figure 4-20).

There is no MPS established for Unimak Bight District but there is a bycatch crab cap of 12,000.

Crab bycatch estimates calculated from 2018/19 Unimak Bight District fishery observer samples were 3,323 Tanner crab (Table 3-4). Estimated Unimak Bight District Tanner crab bycatch decreased 35% from the 2017/18 season. Carapace width of Tanner crabs sampled by observers ranged from approximately 20 mm to 110 mm but the majority of sampled crab were between 40 mm to 70 mm (Figure 3-1).

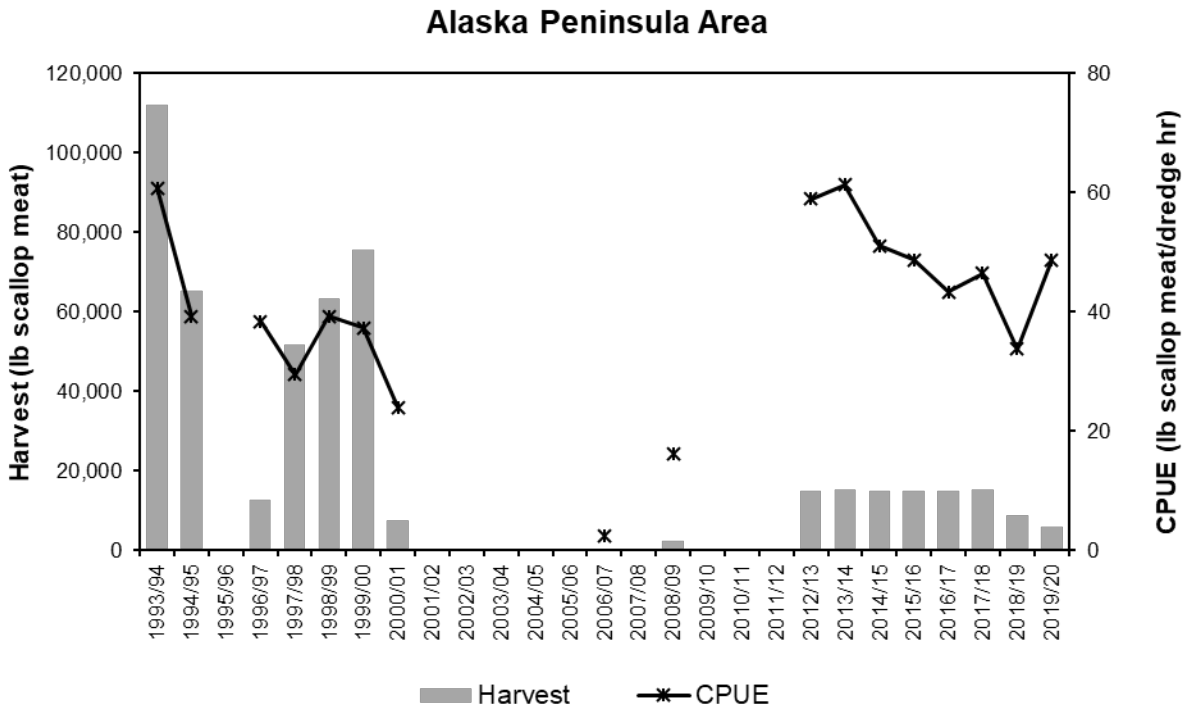


Figure 4-18 Alaska Peninsula Area harvest and CPUE, 1993/94 - 2019/20 seasons.

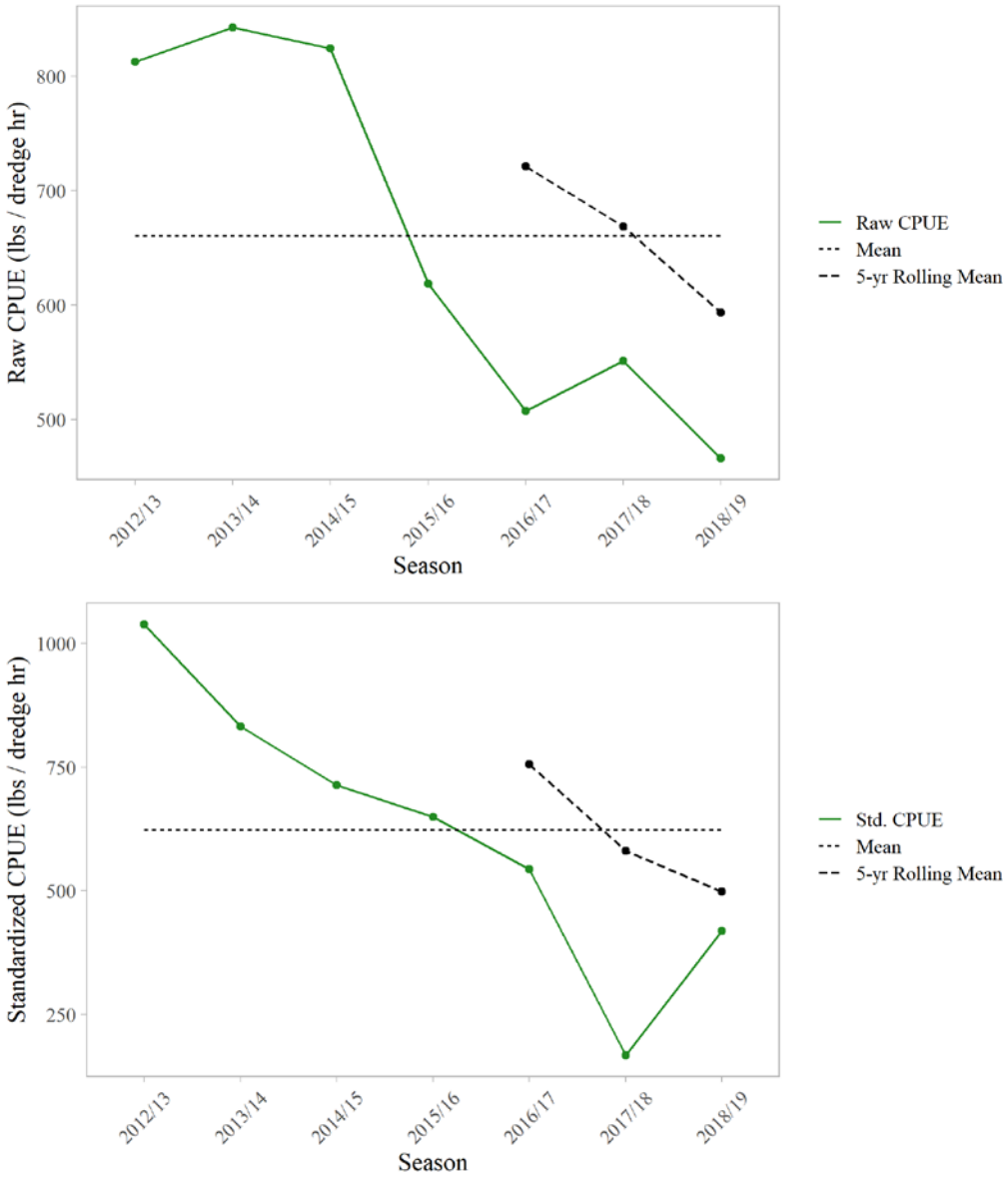


Figure 4-19 Alaska Peninsula Area scallop raw and standardized (when available) meat CPUE, 1995/96 - 2017/18 seasons.

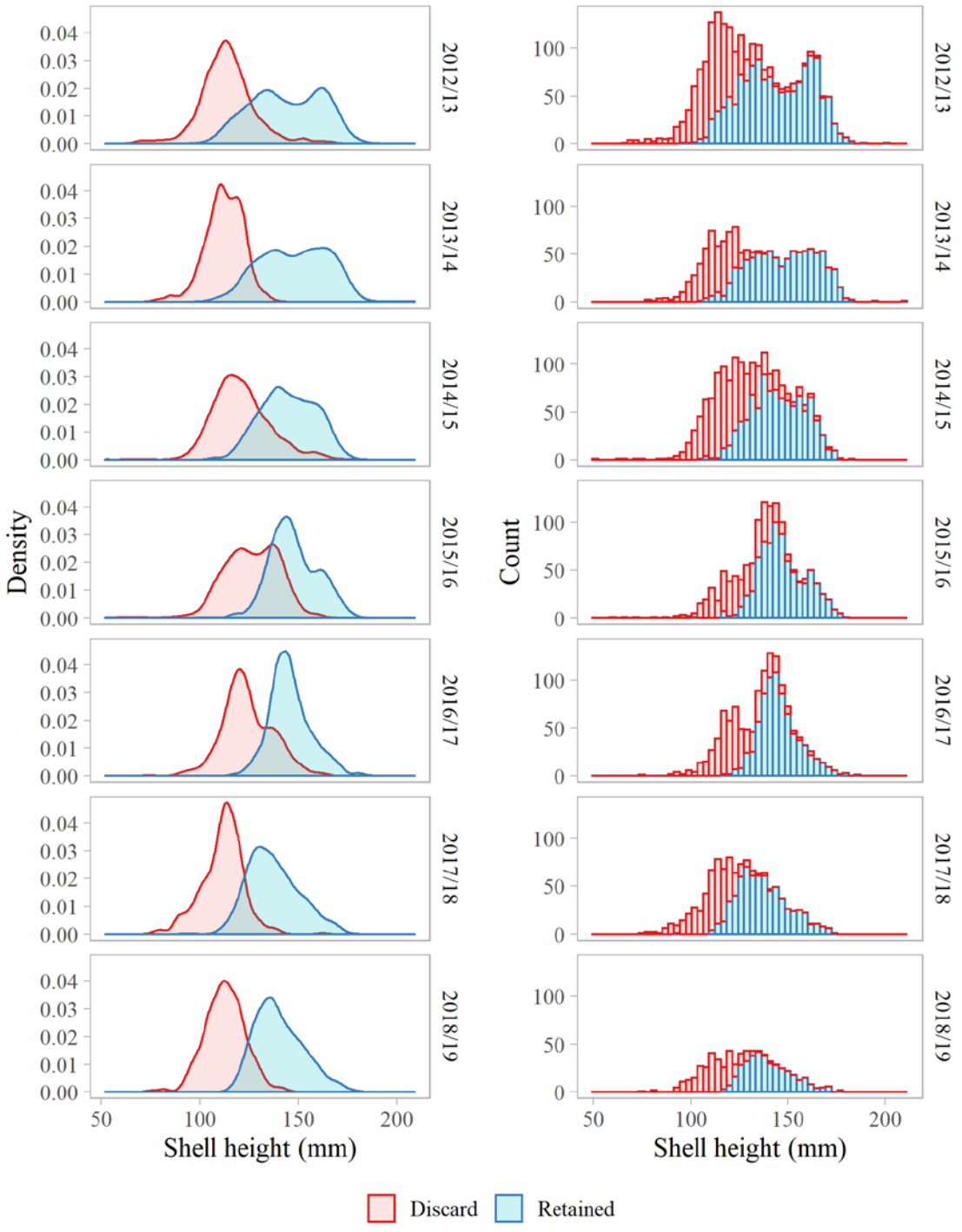


Figure 4-20 Alaska Peninsula Area Unimak Bight District retained and discarded shell heights by density and count for the 2012/13-2018/19 seasons.

Bering Sea Registration Area

The 2019/20 season was the fifth season with reduced GHL in the Bering Sea Registration Area (BSRA). Based on preliminary harvest and effort from the 2019/20 season the CPUE of 20 lb of shucked meats per dredge hour is down slightly with respect to 2018/19 and is the lowest seen in the timeseries (Table 4-11).

Table 4-11 Bering Sea Area scallop fishery summary statistics, 2000/01 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01	3	200,000	205,520	2,376,601	3,355	61	710	1,789
2001/02	3	200,000	140,871	1,700,500	3,072	46	559	1,393
2002/03	2	105,000	92,240	951,938	2,038	45	468	1,008
2003/04	2	105,000	42,590	537,552	1,020	42	527	627
2004/05	1	105,000	10,050	128,128	275	37	475	103
2005/06	1	50,000	23,220	231,700	602	39	386	318
2006/07	1	50,000	48,246	529,590	1,138	42	466	995
2007/08	2	50,000	49,995	697,288	1,084	46	647	901
2008/09	1	50,000	49,995	502,450	962	52	525	1,067
2009/10	1	50,000	48,921	595,602	1,275	38	467	1,059
2010/11	2	50,000	50,100	547,302	972	52	563	1,336
2011/12	2	50,000	50,275	529,235	984	51	538	563
2012/13	1	50,000	50,045	564,787	943	53	599	716
2013/14	2	50,000	49,989	561,033	1,086	46	517	400
2014/15	2	50,000	12,445	227,196	525	24	432	144
2015/16	1	7,500	7,500	107,337	307	24	350	85
2016/17	1	7,500	7,575	108,191	275	28	393	123
2017/18	1	7,500	7,535	105,668	316	24	334	72
2018/19	1	7,500	7,540	105,668	357	21	296	68
2019/20[d]	1	7,500	7,130	NA	365	20	NA	NA

[a] lb scallop meat / dredge hour
[b] lb scallop round / dredge hour
[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 9.1% from observer experiments.
[d] PRELIMINARY data subject to change.

In the 2018/119 BSRA fishery, 7,540 lb of scallop meats were retained with a CPUE of 21 lb of shucked meats per dredge hour. Meat weight CPUE decreased 5% from the 2017/18 season (Figure 4-21) and is 50% of the long-term fishery average (2000/01-2017/18) of 42 lb of shucked meats per dredge hour. In addition to the retained catch an estimated live scallop equivalent of 296 lb of meats were discarded, for an estimated discard rate of 0.8% of the total meat weight caught, consistent with the 2017/18 season. Using a 20% discard mortality estimate, 68 lb of scallop meat weight was lost to discard mortality in the 2018/19 season. Average estimated BSRA scallop meats discarded for the last 10 seasons was 2,283 lb.

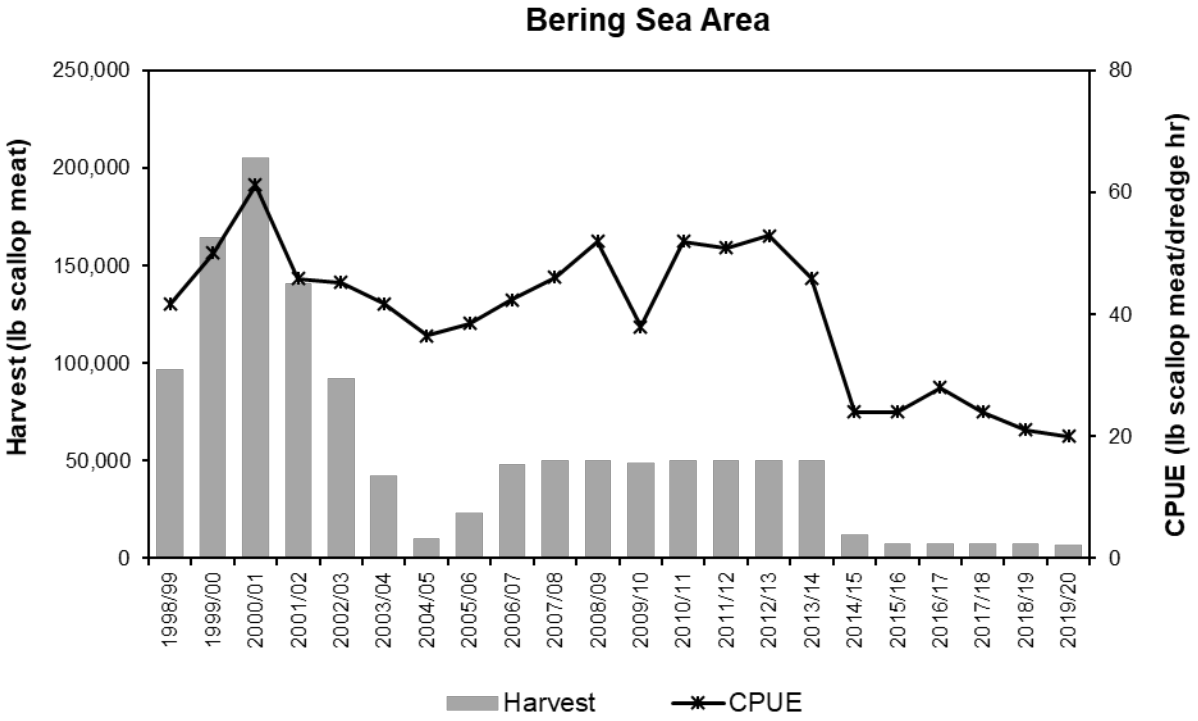


Figure 4-21 Bering Sea Area scallop harvest and CPUE, 1998/99 - 2019/20 seasons.

Estimated shell height distributions in BSRA show a decreased range of scallop sizes from the 2014/15 through 2018/19 seasons. Whether these changes are due to growth rates, disease, fleet behavior, or a decrease in pre-recruit scallops is not known. The bulk of the retained scallops are currently in the 150–180 mm shell height range and seems to be trending toward smaller sized scallops (Figure 4-23).

Since the 2010/11 season the BSRA fishery has been managed using an inseason minimum performance standard of 43 lb of shucked scallop meats per dredge hour. This MPS is based on the average CPUE during the 2004/05 to 2009/10 seasons, a period chosen because the GHL was static at 50,000 pounds and it encapsulated a broad range of fishery CPUE values (37 to 52 lb of shucked scallop meats per dredge hour). The 2019/20 season CPUE was 20 lb of shucked scallop meats per dredge hour, was well below the MPS (Table 3-1). During the 2015/16, 2016/17, 2017/18, 2018/19, and 2019/20 seasons the fishery was allowed to continue despite low CPUEs to gather data following a disease event first observed in 2014/15.

Bycatch cap for Tanner crab was 65,000 crab for the 2019/20 scallop season due to closure of the eastern Bering Sea Tanner crab fishery. Expanded crab bycatch rates are unavailable at this time. Preliminary raw counts form observer sample data indicate that crab bycatch rates have increased compared to the 2018/19 season.

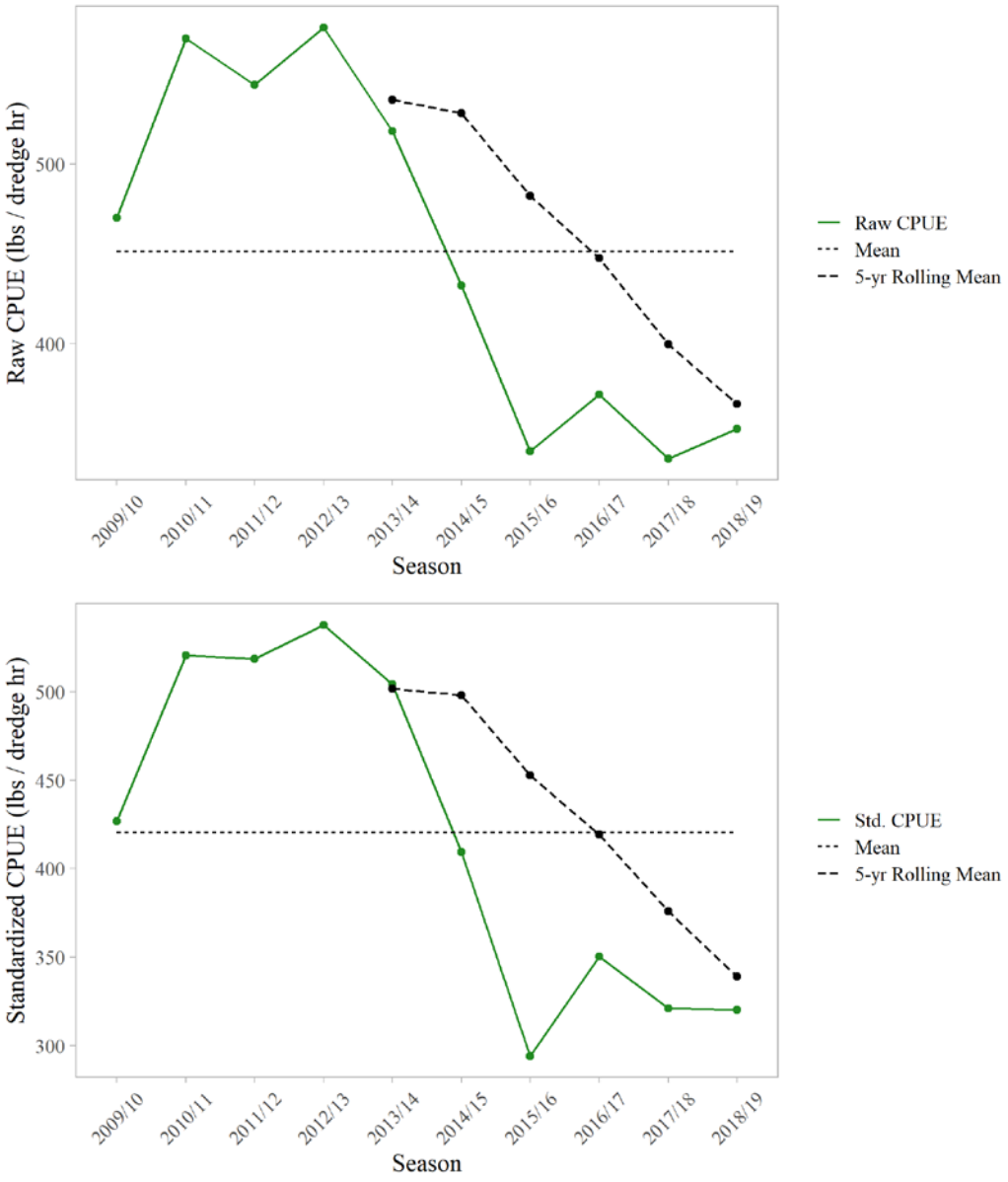


Figure 4-22 Bering Sea Area scallop raw and standardized (when available) meat CPUE.

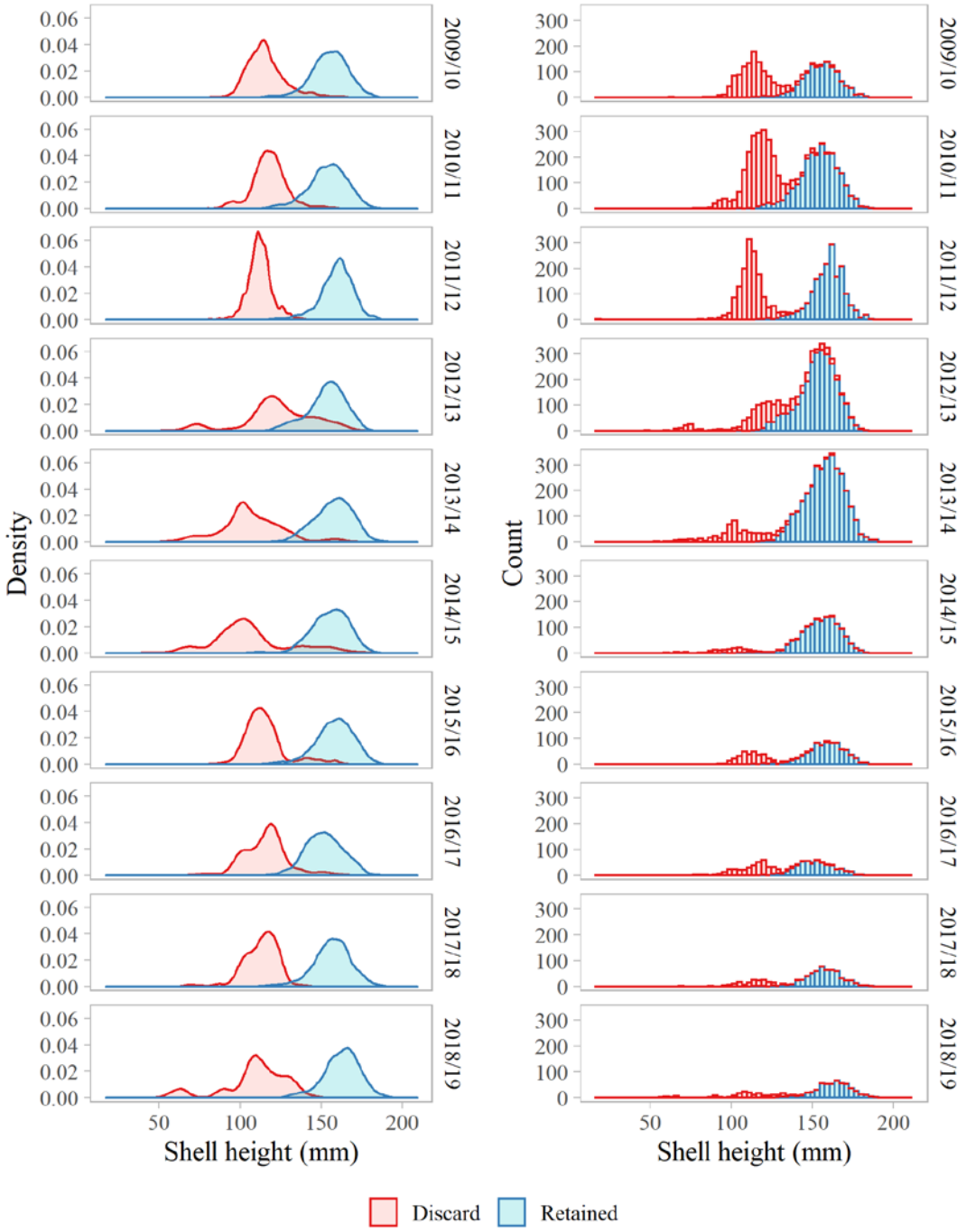


Figure 4-23 Bering Sea Area retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Dutch Harbor Registration Area

The 2019/20 season was the second season with a reduced GHL in the Dutch Harbor Registration Area (DHRA). This decrease reflects the closure of the Pacific Ocean side of the DHRA. Based on harvest and effort from the 2019/20 season CPUE was up from the 2017/18 low (Figure 4-24) and fishing was better compared to the last two seasons. All harvest occurred in the Bering Sea subarea of the DHRA.

Table 4-12 Dutch Harbor Area scallop fishery summary statistics, 1993/94 - 2019/20.

Season	Number vessels	GHL (lb meat)	Retained catch (lb meat)	Retained catch (lb round)	Dredge hours	Meat weight CPUE[a]	Round weight CPUE[b]	Discard mortality (lb meat)[c]
2000/01		closed						
2001/02		closed						
2002/03	1	10,000	6,000	59,066	184	33	333	94
2003/04		closed						
2004/05		closed						
2005/06		closed						
2006/07		closed						
2007/08		closed						
2008/09	1	10,000	10,040	93,077	225	45	488	706
2009/10	1	10,000	6,080	54,882	104	59	528	45
2010/11	1	10,000	5,640	42,177	83	68	506	70
2011/12	1	10,000	5,570	45,513	77	73	593	56
2012/13	1	5,000	5,100	37,730	64	79	588	59
2013/14	1	5,000	5,225	44,572	56	94	798	96
2014/15	1	5,000	5,160	41,323	73	70	563	85
2015/16	1	10,000	5,040	45,215	157	32	288	74
2016/17	1	10,000	5,050	39,181	104	48	376	35
2017/18	1	10,000	285	2,250	24	12	93	1
2018/19	1	5,000	325	3,300	24	14	138	2
2019/20[d]	1	5,000	2,625	NA	130	20	NA	NA

[a] lb scallop meat / dredge hour
[b] lb scallop round / dredge hour
[c] Calculated from round weight discard estimates assuming 20% mortality for discarded scallops and meat recovery of 10.8% from observer experiments.
[d] PRELIMINARY data subject to change.

In the 2018/19 DHRA fishery, 325 lb of scallop meats were retained with a CPUE of 14 lb of shucked meat per dredge hour. Catch per unit effort increased 14% from the 2017/18 season but is 76% lower than the long-term (2008/09-2017/18) fishery average CPUE of 58 (Figure 4-25). In addition to the retained catch an estimated whole weight of 10 lb were discarded, for an estimated discard rate of 3.1% of the total meat weight caught, a 1.3% increase from the 2017/18 season. Using a 20% discard mortality estimate 2 lb of scallop meat weight was lost to discard mortality in the 2018/19 season. Average estimated DHRA scallop meats discard for the last 8 seasons was 255 lb.

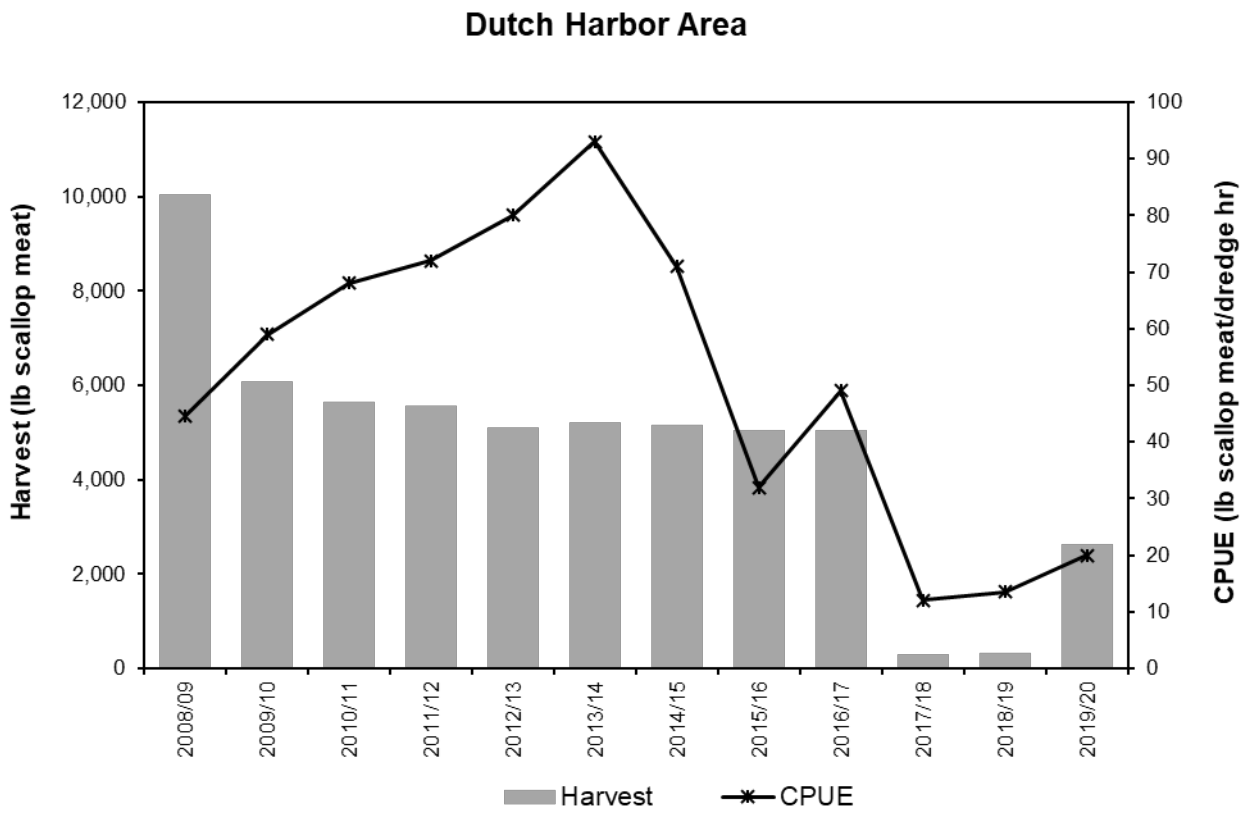


Figure 4-24 Dutch Harbor Area scallop harvest and CPUE, 2008/09 - 2019/20 seasons.

Shell height distributions in the DHRA show a decreased range of scallop sizes with respect to all other seasons. It is not known why these drastic changes have occurred in this population, but minimal recruitment was seen in the little fishing effort that occurred. The few retained scallops that were sampled were primarily in the 150–180 mm shell height range (Figure 4-26).

Tanner crab bycatch estimate calculated from 2018/19 DHRA fishery observer sample was 26 crabs. With such minimal fishing, it is estimated that there was no impact on crab bycatch from scallop efforts this season.

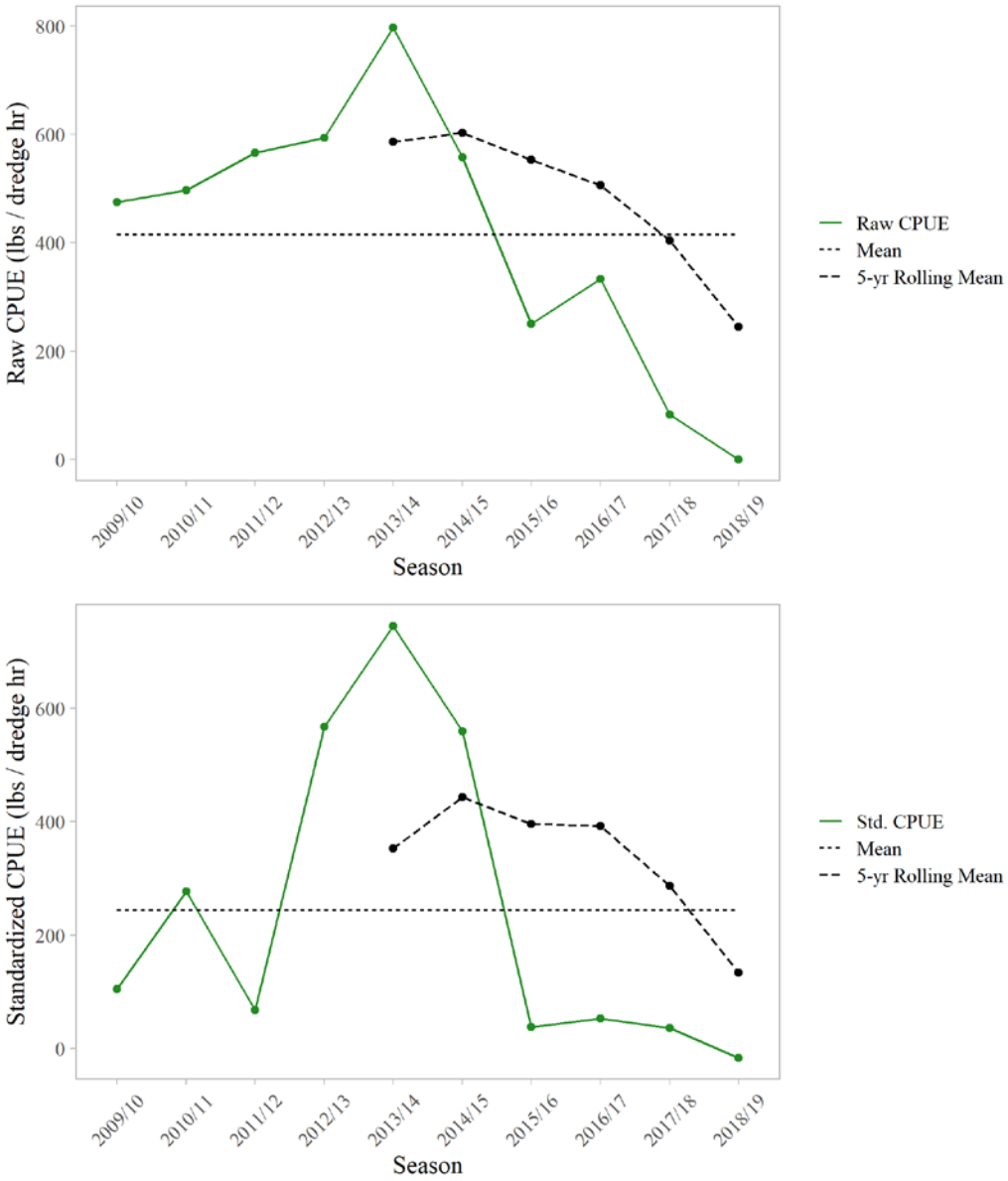


Figure 4-25 Dutch Harbor Area scallop raw and standardized (when available) meat CPUE, 1995/96 - 2017/18 seasons.

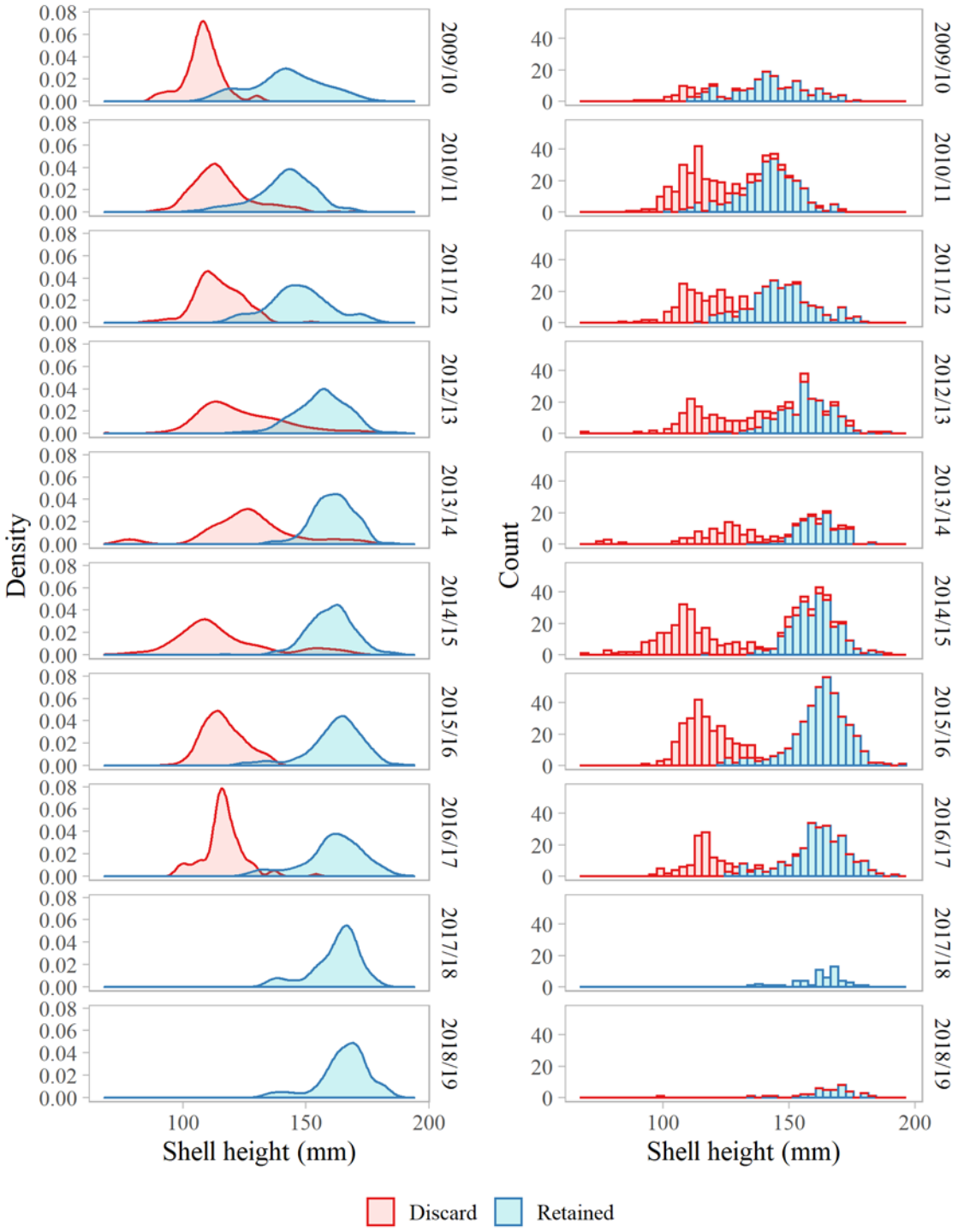


Figure 4-26 Dutch Harbor Area retained and discarded shell heights by density and count for the 2009/10-2018/19 seasons.

Adak Registration Area

Scallops were first harvested from the Adak Registration Area in 1979 with subsequent fishing periods in 1992 and 1995. Bathymetry of the Aleutian Islands, along with a narrow continental shelf edge, provides limited scallop habitat; however, a scallop bed was known to occur on Petrel Bank, an area of important

red king crab habitat. To protect red king crab habitat on Petrel Bank, and reduce red king crab bycatch mortality, the waters were closed to commercial scallop fishing in 1991.

5 Ecosystem Considerations

The Ecosystem Considerations section was added to the SAFE in 2006, and the SPT hopes to continue improving the section. A wealth of information on climate effects on ecosystems and ecosystem trends contained in the GOA Groundfish Plan Team Ecosystems Considerations document is equally relevant to the scallop fishery and may be accessed at: https://www.afsc.noaa.gov/REFM/Docs/2017/ecosysGOA.pdf.

Commercial concentrations of weathervane scallops occur along the Alaska coast in elongated beds oriented in the same direction as prevailing currents. Image data from ADF&G CamSled tows show that benthic habitats where scallop fishing occurs in the Bering Sea, eastern GOA, and Shelikof Strait, consist predominately of fine sediments (silt, mud, and sand), with heavy sediment clouds regularly suspended by tidal currents. Areas of harder bottom and larger sediments are found inshore where scallop fishing occurs.

5.1 Ecosystem Components

In Amendment 13 to the Scallop FMP, a new category was created within the FMP for the 'Ecosystem Component" (EC). The non-target scallop stocks (pink, rock and spiny scallops) were moved into this EC under the FMP. Stocks contained under this category of the FMP are stocks which are not the subject of a directed fishery. For these stocks ACLs are not required to be annually specified.

While these stocks are currently not targeted commercially, moving them to the ecosystem component discourages uncontrolled fishing on these species without applicable management measures in place should they become economically viable in the future. There are currently low-level personal use/subsistence fisheries for some of these species.

The following factors were considered, per the National Standard 1 Guidelines, in classifying these non-target species as an EC species:

- These scallop species are not the target of commercial exploitation or retention by commercial fisheries.
- None of the non-target scallop species are generally retained for sale or personal use.
- The best available scientific information indicates that none of the non-target scallop species are overfished or subject to overfishing.
- The best available scientific information indicates that none of the non-target stocks are likely to become subject to overfishing or overfished in the absence of conservation and management measures.

Limited data exists currently to assess the spatial extent or biomass of these non-weathervane scallop stocks. No commercial harvests have been documented for scallop species other than weathervane scallops in waters off Alaska since at least 1992 (C. Russ, ADF&G, Homer, pers. Comm.). Major fishery development is not anticipated for non-weathervane scallops, but market potential does exist for both "pink and rock" scallops. The spatial distribution of non-weathervane scallop species is not well defined, although these species currently compose a relatively minor component of catches in both NMFS and ADF&G surveys. In conjunction with the EA for amendment 12, data on capture of non-target scallop species was derived from ADF&G and NMFS trawl surveys for the years 1998–2008 (M. Stichert, ADF&G, Kodiak; M. Spahn, ADF&G, Homer; and R. Foy, NMFS, Kodiak, all pers. comm.). Trawl

surveys are conducted in Region 1 only by NMFS and in Regions 2 and 4 by both ADF&G and NMFS. Among all ADF&G surveys, all non-target scallops were recorded as Chlamys sp. Although data extrapolated to area-swept estimates were not available for the ADF&G surveys, and these trawl surveys are not designed to assess non-target scallop species, surveys catches of non-target scallops were relatively small (Table 5-1). Data on non-target species was summarized according to whole weight (lb). In Region 1, catches of non-target scallops by the NMFS survey in odd-numbered years from 1999 to 2007 averaged 1 lb annually. For Region 2, ADF&G catches among either annual trawl surveys averaged 22 lb (whole weight; CV = 84%) annually, ranging from <1 to 53 lb, whereas NMFS surveys caught an average of 4 lb annually. For Region 4, annual catch of Chlamys among ADF&G trawl surveys ranged from 3 to 109 lb, averaging 35 lb (CV = 97%), whereas NMFS survey catches averaged 70 lb (CV = 50%) annually.

Table 5-1 Annual biomass (whole pounds) of non-target scallops captured in ADF&G and NMFS surveys within ADF&G management region during 1998-2008.

	Region 1		Region 2				Region 4		
Year	NMFS Trawl	Region Total	ADF&G Dredge	ADF&G Trawl	NMFS Trawl	Region Total	ADF&G Trawl	NMFS Trawl	Region Total
1998			NA	46		46	75		75
1999	1	1		6	10	15	68	36	105
2000				33		33	109		109
2001	0	0		53	2	55	23	32	55
2002				15		15	19		19
2003	2	2		12	2	13	33	96	129
2004				38		38	11		11
2005	3	3		10	3	14	3	111	114
2006				18		18	20		20
2007	0	0		7	2	9	15	77	92
2008				<1		<1	8		8
Total	5	5		238	18	257	384	352	736
Mean	1.0	1.0		21.7	3.7	23.3	34.9	70.3	66.9
CV (%)	55.1	55.1		24.9	43.0	22.2	29.3	22.4	20.8

Additional information will be included in the SAFE report on these non-target stocks as it becomes available. Any recorded catch of these species will be recorded in order to best evaluate retention of these species in conjunction with their vulnerability and potential for directed targeting. Should a target fishery become desirable for any of these species, either as a whole complex or by individual stock grouping, an FMP amendment would need to be initiated by the Council to move the stock 'into the fishery' under the FMP and ACLs annually specified.

5.2 Ecosystem Effects on the Stock

Weathervane scallops are distributed in dynamic relationship to other benthic marine organisms as well as the non-living components of the marine ecosystem off Alaska. Spatiotemporal ecosystem dynamics, therefore, influence the abundance and distribution of scallops and other benthic community organisms. A recent study by Glass and Kruse (2017) provides analyses of continental shelf benthic communities off Alaska in areas historically and currently targeted by the commercial Weathervane scallop fishery. Based on observer records of bycatch from 1996–2012 the researchers found significant changes in community composition associated with a temperature regime shift in 1998. Differences in community structure in

the Kodiak Northeast and Yakutat management districts were correlated with abiotic ecosystem features such as depth and sediment size.

Species distribution models (SDM) were developed for most managed groundfish and crab species in Alaska as part of the Essential Fish Habitat (EFH) 5-year review (Simpson et al 2017). Scallops, however, were not included in this modeling effort due to a lack of data for SDMs. Glass and Kruse (2017) advance potentially useful information to defining EFH for scallops by characterizing the composition of biotic habitat in weathervane scallop EFH areas. According to the authors, further improvements in understanding scallop EFH could be achieved through bed-specific sampling of environmental variables.

5.3 Fishery Effects on Ecosystem

The Alaska weathervane scallop fishery occurs in continental shelf waters at depths 40–150 m in three main areas: the eastern Gulf of Alaska between Prince William Sound and Cape Spencer; around Kodiak Island; and in the eastern Bering Sea (Figure 1-1). There is strong evidence that scallop dredging reduces diversity, at least in the near term, however, the level of impact and the recovery rate tend to vary among habitat types (Collie et al. 2000; Kaiser et al. 2006). Past studies on the effects of scallop dredging in the Gulf of Alaska have found differences in community abundance and diversity for areas either open or closed to dredging (Stone et al. 2005). More recently, Glass and Kruse (2017) found evidence of recovery from disturbance by fishing gear in the Bering Sea scallop bed through increases in sessile benthic organisms during a period of decreased fishing activity. Although Glass and Kruse (2017) also found contrasting impacts in the Kodiak Shelikof district, the authors suggest that reductions in bycatch through self-regulatory fishing practices, extensive closure areas, and the small size of the fishery combine to constrain impacts, overall. It is proposed, however, that controlled fishing experiments that apply a before–after, control–impact (BACI) approach could be used to better characterize the effects of scallop dredging on benthic communities off Alaska.

A Fishing Effects (FE) model was developed to assess the effects of fishing on managed species as part of the 2017 EFH 5-year review (Simpson et al 2017). However, catch data for scallops was not available. For the 2022 EFH 5-year review, model authors will seek to include scallop fishery data into the FE model to estimate habitat reduction across modeled scallop habitat.

Effects on Predators: Little is known about scallop predators. Plankton feeders probably eat a large amount of floating larvae. Small weathervane scallops have been found in the stomachs of flounders, crabs, and sea stars. Twenty-arm sea stars and giant pacific octopus are known predators of weathervane scallops.

Bycatch: Scallop fishery bycatch is closely monitored by the onboard observer program. Bycatch in the scallop fishery includes prohibited species such as red king crab, Tanner crab, snow crab, and Pacific halibut, other commercially important species of fish and invertebrates, miscellaneous non-commercial species, and natural and man-made debris. Crab bycatch in the scallop fishery is highest in the Bering Sea, although this accounts for a small proportion of total Bering Sea crab bycatch.

Although a variety of marine vertebrates, invertebrates, and debris are caught incidentally in scallop dredges, weathervane scallops predominate catches. For example, during the 2000/01–2007/08 seasons, the most frequently caught species or items in the statewide scallop fishery by weight were weathervane scallops and scallop shells (84%), twenty arm sea stars *Pycnopidia helianthoides* (4%), natural debris (kelp, wood, etc., 3%), and several species of skates (2%). A summary of results of select species encountered during scallop observer haul composition sampling (% by weight) during the 2016/17 season is shown in Table 5-2. Gorgonian (hard) corals are infrequently encountered by scallop observers. Since 1996, corals have been observed in only 11 of the 15,836 tows sampled for catch composition and

bycatch. Summaries of haul composition sampling by area are presented in observer reports prepared by ADF&G (e.g., Rosenkranz and Burt, 2009)

Table 5-2 Summary of results from scallop observer haul composition sampling (% by weight) during the 2018/19 season.

Registration Area	District/Subsection	Weath. scallops	shells/ debris	basket/ brittle stars	*Pycno.* seastar	All other seastars	Skates [b]	Flatfish	*Chionoecetes* crabs [c]
Yakutat		87.5	3.1	5.9	0.4	0.3	1.1	0.6	0
Prince William Sound	W Kayak Island Subsection	94.1	1.3	0.2	0.5	0.2	0.8	1.7	0
Kodiak	NE District	88.9	2	0.2	5.5	0.1	0.5	0.3	0.4
	Shel District	87.3	3.8	0	0.6	0	3.1	2.3	0.1
	SW District	88.7	3.8	1.5	0	0	1.2	2.1	0.1
	SE District	16.8	21.8	0.6	18.4	4.1	12.9	8.5	11.7
Alaska Peninsula	Unimak Bight District[a]	92	2.9	1.2	0.1	0.3	0.1	2	0.5
Dutch Harbor		0	76.3	1.4	5.8	0	0.9	11	1.7
Bering Sea		78.1	4.2	0.4	0	0.1	7.5	2.1	5.9

[a] Exploratory fishery prosecuted under ADF&G Commissioner's Permit.
[b] Includes all species skates plus all skate egg cases.
[c] Includes snow crab, Tanner crab, and snow crab × Tanner crab hybrids.

6 Literature Cited

Abramoff, M.D., P.J. Magalhaes, and S. J. Ram. 2004. Image Processing with ImageJ. Biophotonics International, volume 11, issue 7, pp. 36-42.

Alaska Department of Fish and Game and University of Alaska Fairbanks. 2000. A workshop examining potential fishing effects on population dynamics and benthic community structure of scallops with emphasis on the weathervane scallop *Patinopecten caurinus* in Alaskan waters. Alaska Department of Fish and Game, Division of Commercial Fisheries. Spec. Pub., 14 (2000) Juneau.

Barnhart, J.P. 2003. Weathervane scallop fishery in Alaska with a focus on the Westward Region, 1967-2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-5, Kodiak.

Barnhart, J. P., and G. E. Rosenkranz. 2003. Summary and Analysis of Onboard Observer-Collected Data from the 1999/2000 through 2001/2002 Statewide Commercial Weathervane Scallop Fishery. Alaska Department of Fish and Game, Regional Information Report #4K03-9, 115 pp.

Bechtol, W. R., R. L. Gustafson and T. R. Kerns. 2009. A survey of weathervane scallops in Kamishak Bay, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 09-24, Anchorage.

Bechtol, W.R., Gustafson, R.L., and Cope, J.L. 2003. A survey of weathervane scallops in Kamishak Bay, Alaska, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-31, Anchorage.

Brenner, K., Oliveira, A.C.M., Rozenkranz, G., Burt, R., Spaford, M., Bechtel, P., Crapo, C.A., and Ralonde, R. 2012. Quality of Weathervane scallops (*Patinopecten caurinus*) in Eastern and Western Gulf of Alaska. Journal of Shellfish Research. 31: 1123-1132.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behaviour and drag efficiency. J. Fish. Res. Bd. Can., 25 (1968), pp. 2123–2141.

Caddy, J.F. 1989. A perspective on the population dynamics and assessment of scallop fisheries, with special reference to the sea scallop, *Placopecten magellanicus* Gmelin. J.F. Caddy (Ed.), Marine
Invertebrate Fisheries: Their Assessment and Management, John Wiley and Sons, New York (1989), pp. 559–589.

Collie, J. S., S. J.Hall,M. J. Kaiser, and I. R. Poiner. 2000.Aquantitative analysis of fishing impacts on shelf-sea benthos. Journal of Animal Ecology 69:785–798.

Efron, B., and Tibshirani, R.J. 1993. An introduction to the bootstrap. Chapman and Hall, New York.

Free-Sloan, N. 2007. A brief overview of the Alaska weathervane scallop fishery and the vessel permit limited entry program. Alaska Commercial Fisheries Entry Commission, Report 07-2N.

Glass and Kruse (2017; Spatiotemporal variability of benthic communities on weathervane scallop beds off Alaska. Marine and Coastal Fisheries, 9:1, 521-534, DOI: 10.1080/19425120.2017.1370041).

Gustafson, R. J., and K. J. Goldman. 2012. Assessment of weathervane scallops in Kamishak Bay and at Kayak Island, 2004 through 2010. Alaska Department of Fish and Game, Fishery Data Series No.12-62, Anchorage .

Hammarstrom, L., and Merritt, M. 1985. A survey of Pacific weathervane scallops (*Pecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Informational Leaflet No. 252, Juneau.

Howland, J., S. Gallager, H. Singh, A. Girard, L. Abrams, and C. Griner. 2006. Development of a towed survey system for deployment by the fishing industry. IEEE Oceans (2006), p. 06.

Kaiser, M. J., K. R. Clarke, H. Hinz, M. Austen, P. J. Somerfield, and I. Karakassis. 2006. Global analysis of response and recovery of benthic biota to fishing. Marine Ecology Progress Series 311:1–14.

Kruse, G.H. 1994. Draft fishery management plan for commercial scallop fisheries in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Draft Special Publication 5, Juneau. 56 pp.

Kruse, G. H., Barnhart, J.P., and G.E. Rosenkranz. 2005. Management of the data-limited weathervane scallop fishery in Alaska. Pages 51-68 In G.H. Kruse, V.F. Galucci, D.E. Hay, R.I. Perry, R.M. Peterman, T.C. Shirley, P.D. Spencer, B. Wilson, and D. Woodby (eds.). Fisheries Assessment and Management in Data-limited Situations. Alaska Sea Grant College Program, University of Alaska Fairbanks. 958 pp.

MacDonald, B. A., and N. F. Bourne. 1987. Growth, reproductive output, and energy partitioning in weathervane scallops, *Patinoyecten caurinus*, from British Columbia. Canadian Journal of Fisheries and Aquatic Sciences. 44: 152- 160.

North Pacific Fishery Management Council (NPFMC). 2014. Fishery Management Plan for the Scallop Fishery off Alaska.

Northeast Fisheries Science Center (NEFSC). 2007. 45th Northeast Regional Stock Assessment Workshop (45th SAW): 45th SAW assessment report. NEFSC Ref Doc. 07-16.

Quinn, T.J., and R.B. Deriso. 1999. Quantitative Fish Dynamics. Oxford University Press, New York (1999).

Restrepo, V. R, G. G. Thompson, P. M. Mace, W. L. Gabriel, L. L. Low, A. D. MacCall, R. D. Methot, J. E. Powers, B. L. Taylor, P. R. Wade, and J. F. Witzig. 1998. Technical Guidance on the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31. 54 p.

Rosenkranz, G.E., S.M. Gallager, R.W Shepard, and M. Blakeslee 2008. Development of a high-speed, megapixel benthic imaging system for coastal fisheries research in Alaska. Fisheries Research 92:340–344.

Rosenkranz, G., and R. Burt. 2009. Summary of observer data collected during the 2006/07 Alaska weathervane scallop fishery. Alaska Department of Fish and Game, Fishery Data Series No. 09-49, Anchorage.

Siddon, C., Smith, Q., McNeel, K., Oxman, D., and Goldman, K. 2017. Protocol for estimating age of weathervane scallops *Patinopecten caurinus* in Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 17-07, Anchorage.

Simpson, S. C., Eagleton, M. P., Olson, J. V., Harrington, G. A., and Kelly, S.R. 2017. Final Essential Fish Habitat (EFH) 5-year Review, Summary Report: 2010 through 2015. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/AKR-15, 115p.

Smith, Q., B. Williams, and R. Burt. 2016. Statewide weathervane scallop survey operational plan, 2016 through 2018. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.1J.2016.07, Juneau.

Spencer, P., M. Canino, J. DiCosimo, M. Dorn, A.J. Gharrett, D. Hanselman, K. Palof, and M. Sigler. 2010. Guidelines for determination of spatial management units for exploited populations in Alaskan fishery groundfish management plans. Paper prepared for the September 2010 NPFMC Plan Team meeting.

Stone, R. P., M. M. Masuda, and P. W. Malecha. 2005. Effects of bottom trawling on soft-sediment epibenthic communities in the Gulf of Alaska. Pages 439–453 in P. W. Barnes and J. P. Thomas,

editors. Benthic habitats and the effects of fishing. American Fisheries Society, Symposium 41, Bethesda, Maryland.

Williams, B., Q. Smith, K. Palof, and J. Mumm. 2017. 2016 Statewide Weathervane Scallop Dredge Survey Report. Alaska Department of Fish and Game, Fishery Data Series No. 17-09 Anchorage

7 Appendix 1: Response to Comments from SSC

The SSC provided comments to the Scallop Plan Team in their April 2019 report to the Council. The following reflects SPT discussion and response for each SSC recommendation indicated in bold font in their report.

The SSC recommends that the authors consider presenting an "Executive Summary" format every other year.

Response: There was discussion about less frequent updating of the SAFE, and the Team is supportive of more efficient use of staff time. Prior to the next meeting, Plan Team leadership will discuss whether progress in organizing data inputs and other considerations for developing an age-structured model is sufficient to justify a full SAFE. If not an Executive Summary may be deemed to be sufficient.

The SSC recommends that the analysts consider what the goal of the survey is when considering their future survey designs and the desired level of precision (current target is a CV of 20%).

Response: Initially the survey was designed to provide supplemental, fishery-independent information for management decisions. The strategy going forward is to focus on the two districts that provide the greatest amount of scallop catch (Yakutat and Kodiak). The survey will now focus on bouncing between these districts from year to year. The survey precision will be reduced in the Yakutat District to facilitate surveying more of the district in a given year. Due to lack of resources it is not feasible to survey the entire GOA in a single year.

The SSC also recommends that the analysts explore the NMFS bottom trawl survey catches of scallops to see if they could be used to inform the sampling frame. Additionally, it would be useful to see fishery catches in the same table as survey results (and in the same units; e.g., round weight) to easily assess the potential range of exploitation rates by area.

Response: The analysts reviewed the NMFS bottom trawl survey data and found that there is limited data to inform an assessment. From 1984-2019 the total number of scallops caught in the survey GOA-wide ranges between 0 and 361 with an average of 45.6 (sd = 75.9). However, the State of Alaska large-mesh bottom trawl survey has a time series of scallop catches and some associated biological data (shell heights). This survey is being reviewed and considered as a possible index for an age or length-integrated model in the Kodiak district.

The SSC recommends that the authors elucidate a framework for the data and steps needed to improve the assessment and potentially move to an age- or length-based assessment model in the future, even if staffing to implement the model remain pending.

Response: Jie Zheng developed an age-structured model in Stock Synthesis on the Kamishak Beds using a mix of fishery and survey data. The model provides a reasonable fit and is stable when running the model with and without survey data.

Availability of data for other management areas

- Survey
- Fishery independent data is currently sparse
    - Survey runs from 2016 – 2019
    - No district has been surveyed in every year:

        - YAK, KSH = 3 yrs
        - WKI, EKI = 2 yr
        - KNE = 1 yr
        - KAM = 2 yr

- Fishery independent data includes
    - Scallop catch including smaller size classes than caught in the fishery
    - Shell heights and ages
    - Individual meat weight vs round weight
    - Maturity status
- Fishery (logbook)
    - Meat weight per haul 1996 – present as total meat per day divided by the number of baskets in that haul
    - Round weight per haul 2009 – present as average basket weight multiplied by the number of baskets
- Fishery Observers
    - Observer data 1996 – present includes:
    - Shell heights (20 discard, 20 retained)
    - Ages paired with shell heights (1 for each discard and retained, unless told otherwise, then more)
    - Data only currently exists up until 2015
- Data Limitations
    - Only data 2009 – present can be considered high quality, data pre-2009 must undergo additional vetting, data entry, and/or entry into the database (depending on data type)
    - Small areas like M, Q, and O have sparse fishery data and no survey data
- *Next Steps*
    - Evaluate Stock Synthesis approach used by Zheng with other major harvest areas (i.e., Kodiak, Prince William Sound, Yakutat)?
        - Relies on availability of pre-2009 fishery data
        - Survey data is sparse, and not available until 2016 – though survey data is not strictly necessary
        - Relies on obtaining age data from 2016 – present
    - Evaluate other approaches for improving assessment as survey timeseries builds?
        - Try a size-structured model using GMACS?
            - Disregards available age-data
            - *Unsure at this time if model framework is too crab specific to be used for scallops*
    - Data limited modelling
        - Surplus production model for scallops? (does not require survey timeseries)
        - Virtual population analysis for scallops?
    - Continue to build survey data timeseries for major harvest areas

---

The SSC requests further documentation of the methods used to standardize the time series that are used to inform Minimum Performance Standards and to infer relative stock trends.

Response: The SPT has revised the SAFE report to include more detail on the determination of current minimum performance standards (MPS). In summary, MPS are based on the lowest observed meat weight during a historic timeseries including only vessels larger than 80 ft that deploy two 15 ft dredges (Table 3-1, 2020 SAFE). It is possible to re-evaluate historical timeseries with the addition of observer data to standardize CPUE estimates, although the current daily (or tri-weekly) observer reports do not

include data that would be necessary for in-season CPUE standardization (catch per haul, depths, lat/lon). It should be noted that managers implement MPS are regarded as a "blunt tool" not a harvest control rule. These standards are in place to provide a flag for managers should harvest levels be on a poor trajectory. That said, managers are open to evaluating the use of MPS based on abundance or round weight CPUE in future fisheries.

The SSC stated that it would be useful to see fishery catches in the same table as survey results (and in the same units; e.g., round weight) to easily assess the potential range of exploitation rates by area and that bycatch rates as crabs/ton of scallops or crabs per hours of dredge so that bycatch relative to target catch can be examined

Response: Both of these measures will be implemented and presented in the forthcoming SAFE.

With respect to documenting communities substantially engaged in, or dependent on, the scallop fishery, the SSC acknowledges the data confidentiality constraints inherent in a fishery with few participants. The SSC recommends that the analysts explore ways to use qualitative information, potentially in combination with indices of relative change, to illustrate the changes that have resulted in this fishery that involved 13 communities (according to the FMP) from the 1990s through the early 2000s, but is now apparently concentrated in a single community. This represents an important case study of the sustained participation (or lack thereof) of fishing communities in a federally managed fishery, per National Standard 8. The analysts intended to include social and economic data in the main SAFE, but because of the furlough, were unable to complete that task this year. **The SSC recommends these data be integrated in the next full SAFE report.**

Response: The Scallop Plan Team discussed the SSC comments regarding economic considerations in the scallop SAFE report and appreciates that that SSC has acknowledged the data confidentiality constraints in the scallop fishery. In response to the SSCs comments over the past several years, the scallop plan team chose to reorganize the economic considerations information into an appendix to the scallop safe that will be annually updated and can be enhanced with specific analytical content that the SSC may suggest considering in the future. This appendix will include discussion of the scallop fishery history, ownership of scallop LLPs and participation in the fishery, economic performance of the fishery, and scallop market conditions.

8 Appendix 2: Socioeconomic Considerations

Scott A. Miller Industry Economist
National Marine Fisheries Service
Sustainable Fisheries Division
Juneau, Alaska
March 2020

8.1 Introduction

This chapter provides an update of available economic information in an attempt to identify factors that have contributed to major changes in the Alaska scallop fishery over time. Thus, the analyst is limited to landings, price, value, ownership, and basic marketing data and does not have access to current vessel operational costs, crew shares, or other economic information. Nonetheless, every effort has been made to utilize data submissions from industry for past analyses to highlight likely current conditions in the fishery.

The following overview of the history of the fishery is largely excerpted from information presented in Appendix A of the current Scallop Fishery Management Plan (NPFMC, 2009) and incorporates that discussion and information sources identified in that discussion here by reference.

8.2 History of the Alaska Weathervane Scallop Fishery: The Early Years

The Atlantic sea scallop fishery is the predominant source of U.S. domestic sea scallop supply. A cyclical decrease in stocks, possibly due to overfishing, began to occur on the Atlantic's Georges Bank in the late 1960's. In response to these stock conditions, management measures, focused on protecting stocks, were adopted. The result was a steady decline in sea scallop landings from the Georges Bank area. As a direct result of these changes, interest in developing a weathervane scallop fishery off Alaska materialized in the late 1960's. Weathervane scallop stocks off Alaska had been evaluated for commercial potential in the 1950's but the first effort recorded in the fishery occurred in 1967. In that year, two vessels made six landings of scallops totaling less than 1,000 pounds of shucked meats.

As shown in Table 8-1, an additional 17 vessels entered the fishery in 1968 and the 19 vessels that participated made 125 landings totaling 1,677,268 pounds of shucked meats. In 1969, 19 vessels continued harvesting scallops and made 157 landings totaling 1,849,947 pounds of shucked meats. The 1969 fishery had the largest number of landings and the largest pound total in the history of the fishery. The inflation adjusted first wholesale value of the 1969 catch was just over $1.5 million (inflation adjusted value would exceed $6.6 million[1]). However, this level of harvest and effort was not to be sustained.

[1] Note that previous versions of this document provided inflation adjusted number; however, since that time at the urging of the SSC the inflation adjustment that has been provided in the economic section of the Scallop SAFE utilizes the Frozen and Processed Seafood Producer Price Index and that index is presently re-based to the year 1996, and not available for the historic time series of harvests shown here. The intent here is to show the changing scale of harvest and participation in this fishery and inflation adjusted wholesale value from 1993/94 to present is available in *Table 0-1* below.

Table 8-1 Historic Statewide Commercial Weathervane Scallop Statistics, 1967-2019/20.

Year	Vessels	Landings[a]	Catch (lb meats)[b]	Average Price/lb	Wholesale Value	Real Wholesale Value
1967	2	6	778[c]	$0.70	$545	
1968	19	125	1,677,268	$0.85	$1,425,678	
1969	19	157	1,849,947	$0.85	$1,572,455	
1970	7	137	1,440,338	$1.00	$1,440,338	
1971	5	60	931,151	$1.05	$977,709	
1972	5	65	1,167,034	$1.15	$1,342,089	
1973	5	45	1,109,405	$1.20	$1,331,286	
1974	3	29	504,438	$1.30	$655,769	
1975	4	56	435,672	$1.40	$609,941	
1976	7	21	264,788	$1.59	$421,013	
1977-79	No Fishery					
1980	8	56	616,717[c]	$3.60	$2,220,181	
1981	18	101	924,441	$4.00	$3,697,764	
1982	13	120	913,996	$3.25	$2,970,487	
1983	5	30	192,310	$5.00	$961,550	
1984	6	52	383,512	$4.00	$1,534,048	
1985	7	47	615,564	$4.00	$2,462,256	
1986	8	74	667,258	$4.25	$2,835,847	
1987	4	54	599,947[d]	$3.45	$2,069,817	
1988	4	47	341,070	$3.68	$1,255,138	
1989	7	55	534,763	$3.87	$2,069,533	
1990	9	144	1,481,136	$3.43	$5,080,296	
1991	6	136	1,136,649	$3.82	$4,341,999	
1992	8	136	1,785,673	$3.96	$7,071,265	
1993[e]	7	51	568,077	$5.15	$2,925,597	
1993/94	15	111	984,583	$5.15	$5,070,602	$7,491,342
1994/95	15	104	1,240,775	$5.79	$7,184,087	$10,520,805
1995/96	10	29	410,743d	$6.05	$2,484,995	$3,737,433
1996/97	9	30	732,424	$6.30	$4,614,271	$6,419,856
1997/98	9	31	818,913	$6.50	$5,322,935	$7,028,704
1998/99	8	35	822,096	$6.40	$5,261,414	$5,945,280
1999/00	10	22	837,971	$6.25	$5,237,319	$5,297,194
2000/01	8	20	750,617	$5.50	$4,128,394	$4,779,911
2001/02	6	26	572,838	$5.25	$3,007,400	$3,495,463
2002/03	6	28	509,455	$5.25	$2,674,639	$3,059,055
2003/04	4	32	500,379	$5.25	$2,626,990	$2,707,200
2004/05	5	22	431,594	$5.50	$2,373,767	$2,674,427
2005/06	3	35	532,741	$8.02 [g]	$4,272,583	$5,525,127

Year	Vessels	Landings[a]	Catch (lb meats)[b]	Average Price/lb	Wholesale Value	Real Wholesale Value
2006/07	3	21	486,564	$7.78 [g]	$3,785,468	$4,916,922
2007/08	4	21	458,313	$5.94	$2,722,379	$3,499,537
2008/09	4	20	342,434	$6.34	$2,171,032	$3,009,430
2009/10	3	31	488,059	$6.48	$3,162,622	$3,807,175
2010/11	3	37	459,759	$8.35	$3,838,988	$4,269,364
2011/12	4	26	456,058	$10.39	$4,738,443	$5,678,577
2012/13	4	24	417,551	$10.63	$4,438,567	$4,488,507
2013/14	4	20	399,134	$12.25	$4,889,392	$4,988,904
2014/15	4	24	308,888	$12.39	$3,827,122	$4,050,401
2015/16	3	20	264,316	$12.22	$3,229,942	$3,152,920
2016/17	2	17	233,003	$12.53	$2,919,528	$3,017,693
2017/18	2	8	238,710	$11.54	$2,754,713	$2,782,610
2018/19	2	13	238,973	$11.26	$2,690,836	$2,690,836
2019/20[f]	2	17	229,955	$11.26	$2,589,293	$2,589,293
10 year average	3	21	325,587	$11.28	$3,591,682	$3,770,910

Sources: ADF&G fish ticket data, and Alaska Department of Revenue annual fish prices.

[a] Prior to and including 1995, number of landings equals number of fish tickets. After 1995, the number of landings equals number of deliveries (off-loads). A delivery typically includes multiple tickets, normally one per week.
[b] Pounds of shucked scallop meats.
[c] Unshucked scallop deliveries were converted to shucked meats using a 10 percent conversion factor.
[d] Includes illegal harvest.
[e] January 1 through June 30
[f] preliminary
[g] estimated by fresh product ex-vessel price and limited first wholesale product value data.

Data from 1970 suggest that there may have been relatively few vessels landing most of the scallops during 1968 and 1969. This appears so because only 7 vessels remained in the fishery in 1970 despite an 18 percent increase in the average nominal price per pound. These 7 vessels made 137 landings totaling 1,440,338 pounds of shucked meats, which was 78 percent of the harvest taken by 19 vessels the previous year. The first wholesale value of the 1970 catch was about $1.4 million, or an average of more than $205,000 per vessel. While this revenue picture appears rosy, there is no data available on operating costs or effort levels in the early days of this fishery, and the trend during the rest of the 1970's suggests that the fishery was not as lucrative as the 1970 revenue numbers suggest.

In 1971, effort fell to 5 vessels and remained at 5 vessels for several years before falling to 3 vessels in 1974. During those years, landings fell from 137 in 1970 to 29 in 1974. However, shucked meat totals stayed near or above 1 million pounds through 1973 before falling by more than 50 percent to approximately a half million pounds in 1974. Prices continued to rise over this time frame, however, the declining catch forced revenue to decline to just over $421,000 in 1976 when 264,788 pounds, just 14 percent of the 1969 peak harvest, of shucked meats were caught. In 1977 and 1978, no effort was expended in the weathervane scallop fishery off Alaska.

The period of 1967 to 1976 demonstrates what can happen in an emerging fishery with passive management. There were no effort controls, limits, or guideline harvest levels in place. The fishery

expanded rapidly as scallop beds were located and exploited, experienced substantial effort consolidation as marginal vessels departed, and eventually overexploited the known beds to the point that the fishery was not economically viable by 1977 and 1978. This could have been the end of the weathervane scallop fishery off Alaska, except for the fact that scallops are somewhat resilient and discoveries of new beds had yet to be made.

In 1979, following two years with no harvest, a single vessel made 4 landings totaling less than 25,000 pounds. of shucked meats. Three years of zero or minimal effort had likely allowed the scallop resource to regenerate somewhat. That likelihood, combined with a price increase to $3.80 per pound contributed to 8 vessels making 56 landings totaling about 617,000 pounds in 1980.

Given fishing success in 1980 and significant price increases to $3.60 per pound, it is not surprising to see that 1981 participation increased to 18 vessels that made 101 landings totaling 924,441 pounds of shucked meats. The 1980 first wholesale value was approximately $2.2 million and rose to nearly $3.7 million in 1981. However, data for the next several years show a similar cycle as occurred between 1969 and 1974. By 1983, five vessels made 30 landings totaling less than 200,000 pounds of shucked meats. However, 1983 was the year of record high nominal prices of $5 per pound so first wholesale value was nearly $1 million.

Over the next several years, participation increased slightly as did landings and catch but repeated the cyclical pattern by trending back downwards before another cyclic increase in landings and catch began in 1989. Beginning in 1990, an influx of East Coast scallop vessels began to occur; once again this was because of unfavorable economic conditions in East Coast scallop fisheries. The upward trend continued into 1992, when the second highest historic catch of 1,785,673 pounds was taken by 8 vessels making 136 landings. The first wholesale value of over $7 million recorded in 1992 is the second highest nominal first wholesale value ever recorded in the fishery and if inflation adjusted is the historic high value in the history of this fishery.

This period of this fishery has been characterized as a “gold rush atmosphere” (Barnhart, 2006). It is also important to note that by this time, scallop beds had been located in several areas around Kodiak Island, in Shelikof Strait, near Yakutat, in the Northern Gulf of Alaska near Kayak Island, in Cook Inlet, as well as in the Aleutians and Bering Sea.

In the early 1990’s, the State of Alaska determined that the fishery was expanding rapidly without active management. Thus the State moved to declare this fishery a high impact emerging fishery in May of 1993. This action required fishery closure and implementation of an interim management plan. Table 1 shows that, prior to closure in May of 1993, the fishery had participation by 7 vessels with 51 landings totaling 568,077 pounds. Following implementation of the interim management plan, the fishery reopened on June 17, 1993. The interim management plan required 100 percent observer coverage and set crab bycatch limits. From this point on, data is presented by season years. Thus, the remained of 1993 catch is listed for the 1993-94 season. The seasons established in the management plan extend into the first three months of the following year.

Catch statistics shown in table 1 for the 1993-94 season indicate participation by 15 vessels making 111 landings of a total of 984,583 pounds of shucked meats. Total first wholesale value was just over $5 million in 1993-94. The 1994-95 season also had participation by 15 vessels making 104 landings totaling 1,240,775 pounds. Total first wholesale value in 1994-95 was nearly $7.2 million, the highest nominal value in history.

In the 1995/96 season the captain of a single vessel turned in his State scallop registration card but proceeded to fish scallops in the Federal waters of the Exclusive Economic Zone (EEZ)

without State observer coverage and with total disregard for harvest limits. In response, Federal regulators closed the EEZ to scallop harvest by emergency rule on February 23rd of 1995 and then enacted a Fisheries Management Plan for the scallop fisheries off Alaska (FMP) and an amendment to that plan that closed the fishery in the EEZ until August of 1996, nearly 18 months later. (NPFMC, 2005) The actions of this one individual, and the resulting closures likely had a devastating economic impact on remaining participants. Nonetheless, the period from 1994/95 to 2000, with the exception of the 1995/96 season, had fairly constant participation and landed pounds trended upwards.

In 1997, the North Pacific Fisheries Management Council (Council) sought to restrict effort in the scallop fishery off Alaska by adopting a vessel moratorium, under which 18 vessels qualified to fish in Federal waters. Following that action, the Council undertook analysis of further capacity reductions and adopted a License Limitation Program, including 9 vessels, which took effect in 2000.(NPFMC, 2005) These changes ushered in a new era in the scallop fishery off Alaska. The successes of the early exploratory years had now necessitated stock and effort management measures and capacity reduction.

8.3 Economic Performance in the Fishery

An overview of Alaska weathervane scallop harvest and wholesale revenue and real wholesale value is presented in Table 8-1. Vessel participation in this fishery has declined since the late 1990s due to the Federal LLP and formation of a voluntary marketing association which will both be discussed in detail below. The Federal LLP limits the participation to 9 permit holders. In the early 2000s as many as 8 vessels have participated; however, since 2014 no more than 4 vessels have participated. In each of the past four years two vessels have participated, as the harvest levels have fallen to historically low levels.

Table 8-1 provides estimated statewide commercial Weathervane scallop landings and value from 1993/94 to present. Total real gross first wholesale revenue is calculated by multiplying landed pounds of meats by the adjusted price. Adjusted price converts the landed prices by year to year 2019 values to allow for comparisons in current dollar values, after accounting for inflation. The statewide scallop price used here is calculated by the Alaska Department of Revenue (ADOR), Division of Taxation, and is an average of all the reported annual State fish tax revenue collected from all participants in the scallop fishery as reported on Commercial Operators Annual Report submissions.

The majority of the scallop meats that are landed have been processed (shucked) and frozen at sea and their value represents gross revenue at the first wholesale level. However, in some past years some shucked meats were delivered fresh to dockside processors (pers. comm, Bill Harrington, February 2013). There have also been some anecdotal reports of scallop meats landed and sold in a roadside stand outside of Homer in the distant past. In 2018, the Alaska Board of Fisheries approved a proposal to allow delivery of live scallops; however, none of the current Scallop LLP holders have delivered live scallops to port to date. Thus, although landed price is often referred to as an ex-vessel price, it is actually primarily a first wholesale price in that the landed product is a primary processed product. As a result, gross revenue is identified as first wholesale gross revenue here.

Nominal Alaska scallop prices have shown considerable variability over time and have increased dramatically since the mid-2000s. After trending downward to $5.25 per pound in the early to mid-2000s, nominal scallop prices increased to $7.86 by the 2006/07 season. However, in the 2007/08 season the nominal scallop price declined significantly to $5.94 per pound of shucked meats. Since the 2007/08 season, nominal Alaska Weathervane scallop price has trended upward and reached $12.53 per pound of shucked meats in 2016/17 but fell to $11.54 in 2017/18 and $11.26 in 2018/19.

The historical variability in Alaska scallop prices are likely due to market factors that are driven by the much larger U.S. east coast sea scallop fishery, as well as by import markets. However, in recent years, the Alaska Scallop Association has made considerable progress in its marketing efforts and has been able to maintain relatively high prices it receives for the scallops landed by the three vessels that are associated with the cooperative. However, the present strength in Alaska scallop prices may face some market pressure in the coming years as indicated by declines in U.S. commercial sea scallop average price per pound from $12.52 per pound in 2014 to $12.00 per pound in 2016 and below $10 per pound as supply expanded in 2017 but has risen to $12.18 in 2018. The average price per pound of imported scallop products declined from $7.11 to $6.40 between 2015 and 2017 and continued declines to $5.24 and 5.93 in 2018 and 2019 respectively. Please see section 8.4 for further discussion of competing scallop markets.

First wholesale revenue in this fishery has varied considerably over the period as both price and landings have varied. The peak value in the fishery, occurred in 1994/95 season when inflation adjusted $10.5 million was earned. Since that time, real total first wholesale revenue in the fishery has fluctuated with prices, and the reduction in landed pounds. Overall, the total value has trended downward as landings have fallen from more than 1.2 million pounds down to a preliminary low in 2019/20 of 229,955 pounds. The total real first wholesale revenue of less than $2.6 million in the most recent season is lowest revenue total historically. If market forces continue to exert downward pressure on prices with harvest held relatively constant, as has occurred since 2017 the total value of the fishery will continue to decline in the near future.

8.4 License Limitation Program Permit Ownership, Consolidation, and Current Participation

A review of fish ticket data suggest that, in the early days of this fishery, much of the harvest was made by catcher vessels (CVs) making single day trips and delivering to shoreside processors. The shoreside processors then processed the meats (e.g. trim, freezing, and packaging) and moved the product to market, whether in fresh or frozen form. That method appears to have continued into the mid 1990's. At that time, single day trips had begun to be replaced by multiday trips and freezing at sea by catcher processors (CPs). This change was likely the result of some vessels earning marginal returns due to the cost of daily transit to and from port as well as the 10 day maximum that shucked meats can be held on ice by a CV (Kandianis 2006) The further vessels operated from port the more severe this inefficiency became. As new beds were found in distant areas some vessels likely found their participation was not economically sustainable. This fact was likely exacerbated by the fact that harvesters had little or no market power.

Under these conditions, vessel operators are constrained by the inefficiency of the day trip and external market forces dictating the value of their catch. Thus, operators would look to reduce inefficiencies, reduce operating costs, and attempt to capture processing value added that was being captured by the shoreside processing sector. Operators might even attempt to improve value by increasing quality. It can be argued that fresh frozen (at sea) product may be superior to product that is iced for a period of time before being consumed and/or frozen. The result of these forces appears to be the entrance of catcher processors (CPs) into the scallop fishery. That this began to happen should be no surprise. It was around this time that the CP fleet began to expand in several of the Bering Sea fisheries for many of the same reasons. This practice expanded over the next several seasons. By the time the vessel moratorium was imposed in 1997 there were 18 vessels included under the moratorium.

Further consolidation of the fleet was deemed necessary by the North Pacific Fisheries Management Council. In 1999 the Council adopted Amendment 4 to the Scallop FMP, which established the Federal License Limitation Program (LLP). The LLP recognized 9 participants and granted them statewide access with maximum vessel length overall (MLOA) limits (equal to the length of the vessel they were using during the qualifying period) and with gear restrictions for two vessels that primarily fished inside the

Cook Inlet registration area. All of the remaining 7 participants in the statewide fishery outside the Cook Inlet registration area were using vessels categorized as CPs. Thus, at the time of the LLP, virtually all effort in the statewide fishery outside the Cook Inlet registration area was from CPs. Thus, the transition away from the inefficiency of day trips, the capture of shoreside processing value added by offshore processing, and any potential improvement in quality brought about by at-sea freezing appeared to be complete by the time of LLP implementation in 2000. However, further fleet consolidation was predictable, and had already begun.

The Regulatory Impact Review (RIR) analysis supporting the action to create the LLP (NPFMC 1999) develops a breakeven analysis for the scallop fishery in the statewide fishery outside the Cook Inlet registration area. This analysis estimates the number of vessels that could breakeven in the fishery under a series of price and landings scenarios. The analysis is based on operating cost and revenue data provided voluntarily by fishery participants. Table 8-2 presents the analysis.

Table 8-2: Number of Vessels that Could Breakeven Under Various Price and Landings Scenarios (recreated from Regulatory Impact Review for Amendment 4 to the North Pacific Scallop FMP)

Price	Landing (pounds)			
	600,000	800,000	1,000,000	1,200,000
$5.00	3.6	4.9	6.1	7.3
$5.50	4.0	5.3	6.7	8.0
$6.00	4.4	5.8	7.3	8.7
$6.50	4.7	6.3	7.9	9.5
$7.00	5.1	6.8	8.5	10.2
$7.50	5.5	7.3	9.1	10.9
$8.00	5.8	7.8	9.7	11.6

In the 1999/00 season 10 vessels, including two inside the Cook Inlet registration area, landed 837,971 pounds of scallops with an average price of $6.25. The analysis recreated in Table 2 indicates that approximately 6 vessels could breakeven fishing in the statewide fishery outside the Cook Inlet registration area under this price and landings scenario. Thus, participation in the statewide fishery outside the Cook Inlet registration area exceeded the breakeven number of vessel by two.

In 2000/01 8 vessels, including two operating inside the Cook Inlet registration area, landed 750,617 pounds of scallops with an average price of $5.50 per pound. The breakeven analysis suggests that this price and landings combination could probably support 5 vessels in the statewide fishery outside the Cook Inlet registration area; however, 6 were fishing in that season.

In 2001/02 6 vessels, likely four in the statewide fishery outside the Cook Inlet registration area, landed 572,838 pounds of scallops with an average price of $5.25 per pound. The breakeven analysis suggests that this landings and price scenario could support fewer than four vessels at breakeven levels and this appears to be the case in 2002/03 as well.

In 2000 a group of six of the LLP holders, who traditionally have fished in the statewide fishery outside the Cook Inlet registration area, formed a voluntary marketing cooperative (NPFMC 2005). The cooperative members agreed to reduce harvesting capacity and entered into revenue sharing agreements with members who agreed to not use their vessel(s). That the cooperative chose to do this is not surprising given the effect of declining landings and price on breakeven numbers in this fishery between 2000/01 and 2002/03.

In 2001, the cooperative reduced vessel participation by 50 percent, however, one vessel continued to operate independently in the statewide fishery outside the Cook Inlet registration area. Two vessels continued to fish independent of the cooperative inside the Cook Inlet registration area. Thus, capacity reduction efforts made by the cooperative had reduced overall capacity but not to the level suggested by the breakeven analysis presented above.

A point worth considering is that several of the LLP holders who had joined the cooperative had, at one time, been involved in the East Coast Atlantic sea scallop fishery. This was true of the LLP associated with the vessels Carolina Girl and Carolina Boy and the vessel Pursuit. The Pursuit was operating out of Kodiak when the LLP was implemented and the Carolina Boy and Carolina Girl were operating out of Seward (Barnhart, 2006). Each of these operations, however, was East Coast based and likely had to bear costs of travel to and from the east coast, or vessel caretaking costs during the off-season, and idle vessel time. These factors likely contributed to these three vessels not fishing under the cooperative.

Instead of fishing, the owners of the LLP that originally used these vessels received some form of revenue and/or ownership sharing while the other cooperative members continued to fish. Evidence of this was presented in Appendix A to the Environmental Assessment conducted for Amendment 10 to the FMP (NPFMC 2005). Provider Inc. and Ocean Fisheries LLC provided operating cost data for their scallop fishing enterprise in 2003. This data shows that these two operators paid $244,516 in “scallop leases” in 2003.

The lease fees paid by Ocean Hunter and Provider Inc. could only be afforded if the operations gained considerably more revenue and/or if they are able to decrease operating costs under the cooperative. The revenue earned by these two vessels is confidential.

However, the breakeven analysis presented in the RIR for Amendment 4 (LLP) to the FMP determined that the average fixed and variable non-labor costs of the fleet at the time (pre LLP, pre coop) was approximately 59 percent (NPFMC 2005, Appendix B).

The data provided by Provider Inc. and Ocean Hunter/ Ocean Fisheries LLC in 2003 indicate a non-labor cost ratios of 59 percent and 57 percent for Provider and Ocean Hunter respectively. However, these non-labor cost ratios include lease fees of $157,493 paid by Provider Inc. and $87,097 in lease fees paid by Ocean Hunter. Thus, these two cooperative vessels were able to maintain the same, or slightly lower, cost ratio inclusive of leases paid to other cooperative members totaling $244,516. While revenue cannot be discussed directly, it is likely that overall revenue for these vessels increased with fewer vessels fishing. It is likely that payments to labor, including owner shares, increased with greater overall revenue and similar non-labor cost ratios.

While the cooperative initially limited effort by using revenue sharing to compensate owners of unused vessels, a more permanent effort reduction began to take place in 2002. It is important to understand that Federal Alaska Scallop LLP permits are not directly associated with a specific vessel. The only vessel requirement on the LLP permit is that it cannot be used on any vessel larger than the MLOA assigned to the LLP. Further restrictions are that no more than two LLPs may be held by one “individual” and that LLPs may not be leased.

In contrast, the Alaska Commercial Fisheries Entry Commission (CFEC) Limited Entry Scallop permit, which was allowed to sunset in 2014 and no longer exists, was specifically attached to a vessel. Thus, through 2013, to fish in both Federal and State waters, one had to have a Federal LLP and would need to use the actual vessel assigned the CFEC Limited Entry permit if also fishing in State waters. However, if one wanted to fish only in Federal waters, without harvest restriction, they could use any vessel so long as it was under the MLOA of that LLP and was not an American Fisheries Act (AFA) vessel (sideboarded by State statue). Alternatively, if an individual or entity were to purchase a Federal LLP, they would not

be required to actually fish the LLP, nor would they then have need of a CFEC Limited Entry licensed vessel.

Starting in 2002, the members of the cooperative wishing to remain in the fishery formed several Alaska corporations with shared ownership and purchased the interest of those who no longer wished to remain in the fishery and consolidated operations on three vessels. There was one additional original cooperative member; Forum Star Inc. The vessel Forum Star is an AFA eligible vessel and has been permitted as such since 2000. Under Amendment 8 to the FMP authority was delegated to the State of Alaska to set an AFA sideboard in the scallop fishery. The State set a limit of approximately 35,000 pounds (Barnhart, 2006) at present stock levels, on that vessel.

In 2005, Forum Star Inc. and its Scallop LLP were purchased by American Seafoods LLC, also an AFA entity. If the LLP held by American Seafoods LLC remains in the control of an AFA entity, it will continue to be restricted by the AFA sideboard. It is, however, important to note that the LLP itself is not AFA endorsed. This means that it could presumably be sold to a non-AFA entity. As long as a vessel no longer than 97' (the MLOA allowed under Federal Scallop LLP #002) with no AFA endorsement is used with LLP #002, the AFA sideboard restriction would not apply. Thus, an existing scallop operation could buy this LLP and use it on a 97 foot non-AFA vessel under current federal regulations (50 CFR 679.4, 50 CFR 679.7). Alternatively, an existing entity would not have to use it at all as just holding the second permit means more scallop harvest for the remaining vessels.

Table 8-3 provides a summary of LLP holdings and changes in those holdings over time separately for independent operators and for cooperative members. The three LLPs not associated with cooperative members have also gone through several permit transfers and organizational changes. LLP #003, and the vessel Kilkenny that has most recently been used to fish that LLP, were until very recently owned by Atlantic Cape Fisheries Inc. of New Jersey. During the 2020 Scallop Fishery Management Plan Team meeting in Kodiak it was unofficially learned that the Kilkenny may have been sold by Atlantic Capes Fisheries Inc. However, the Alaska Commercial Fisheries Entry Commission Vessel Database (as of 03-09-2020) continues to list Atlantic Capes Fisheries Inc. as the owner of the Kilkenny. Atlantic Capes has not fished that LLP since it was purchased. LLP #004 is originally registererd to Max G. Hulse was transferred to Scott Hulse in 2018. The vessels historically utilized by the Hulse family have been lengthened and re-purposed and would no longer be eligible to fish the LLP; however, Scott Hulse has indicated to NMFS Alaska Region Restricted Access Management staff that he is interested in fishing the LLP in the future. Finally, LLP #006 was most recently transferred to EWT LLC, which is an Alaska LLC with ownership by U.S. East coast scallop interests. However, EWT LLC was involuntarily dissolved by the State of Alaska either due to non-filing of renewal and/or nonpayment of fees. The vessel historically used to fish this LLP has been sold by the original LLP holder and is not owned by EWT LLC interests. Thus none of these three original LLPs are currently directly associated with vessel ownership but could be used on any vessel that meets the MLOA restrictions and gear restrictions for the LLPs.

Also shown in Table 8-3 are the present owners of LLPs associated with the Alaska Scallop Cooperative. The information provided includes corporate and individual ownership percentages which will be discussed further below. At present, there are effectively two cooperative associated vessels fishing in the statewide fishery outside the Cook Inlet registration area: Ocean Hunter, and Provider. However, Arctic Hunter LLC recently replaced the Arctic Hunter with the Polar Sea, thus, the cooperative has three vessels, all homeported in Kodiak, that are prepared to fish scallops and these are the only vessels owned by entities that also own LLPs.

Table 8-3 provides the ownership percentages of Alaska Weathervane Scallop LLPs, by Alaska Corporation. Alaska corporate records available online include the ownership percentages of each identified owner and they are presented in Table 8-4 as well. Several of the identified owners of LLPs

that are associated with the Alaska Scallop Cooperative are Washington based corporate entities. Table 8-5provides available information from Washington corporate records online regarding the individuals who own these Washington corporations. Unfortunately, Washington State does not publicly identify ownership percentages. For this analysis, it is assumed that a single identified governor of a Washington corporation holds 100 percent ownership, and when two governors are identified it is assumed they each hold equal 50% shares. Table 8-4identifies these individuals and the assumptions regarding their ownership shares.

Utilizing the Alaska corporate LLP ownership percentages and the ownership percentages of individual owners of the Washington corporations identified in Alaska corporate records it is possible to assign ownership shares of each LLP to the individual owners and to tabulate cumulative ownership shares of Alaska Weathervane scallop LLPs attributable to Alaska Scallop Cooperative members. This ownership attribution is provided in Table 8-5for each cooperative member, individually, and shows that the highest level of cumulative ownership shares is 110%, or the equivalent of 1.1 LLP. LLP ownership limitations enacted when the LLP was established allow up to two LLP to be owned by one person.

Table 8-3 Federal Scallop LLP Holder History and Current Activity.

LLP	Original Holder	MLOA	Current Holder	Restrictions	Alaska Corporate Ownership	Vessel Historically Used	Fished in 2015-2018
Independent Operators							
003	Hogan, Thomas C.	75	Atlantic Capes Fisheries LLC	2 dredges with 20' max. combined width	Atlantic Capes Fisheries Inc: Daniel Cohen (100%) in good standing	**Kilkenny**: Owned by Atlantic Cape Fisheries Inc, New Jersey	no
004	Hulse, Max G. et al.	79	Hulse, Scott D.	2 dredges with 20' max. combined width	Transferred to Scott D. Hulse in 2018	**La Brisa / Wayward Wind**: Vessels rebuilt (lengthened) and re-purposed	no
006	Oceanic Research Services	70	EWT LLC	none	EWT LLC: Eric Orman (66.67%) Warren Alexander (33.33%) Involuntarily Dissolved	**Artic Storm**: sold	no
Alaska Scallop Association Members							
002	Forum Star Inc.	97	American Seafoods Co., LLC	State Imposed AFA Sideboard	American Seafoods Group, LLC (100%), in turn owned by ASG Parent LLC (100%) home state Delaware	Forum Star (owned by Forum Star LLC, which is 100% owned by American Seafoods Company LLC)	no

LLP	Original Holder	MLOA	Current Holder	Restrictions	Alaska Corporate Ownership	Vessel Historically Used	Fished in 2015-2018
005	Ocean Fisheries LLC	102	Arctic Hunter LLC	none	Egil Mikkelsen, Glenn Mikkelsen, James Stone, John Lemar, Stein Nyhammer (20% each)	Artic Hunter, Replaced by Polar Sea (owned by Arctic Hunter LLC)	yes
007	Pursuit, Inc.	101	Ocean Fisheries LLC	none	Festus Fisheries Inc (WA). (20%) Mikkelsen Fisheries Inc (WA). (40%) Stein Enterprises Inc. (WA) (20%), Stone Maritime Inc (WA). (20%)	Pursuit (no longer documented)	no
008	Provider, Inc.	124	Provider Fisheries LLC	none	Egil Mikkelsen (20%), Glenn Mikkelsen (20%), James Stone (25%), John Lemar (25%), Tom Minio (10%)	Provider (owned by Provider Fisheries LLC)	yes
009	Carolina Boy, Inc.	95	Ocean Fisheries, LLC	none	Festus Fisheries Inc(WA). (20%) Mikkelsen Fisheries Inc(WA). (40%) Stein Enterprises inc. (WA) (20%), Stone Maritime Inc(WA) (20%)	Ocean Hunter (owned by Ocean Fisheries LLC)	yes
010	Carolina Girl, Inc.	96	Alaska Scallop Fisheries , LLC	none	Egil Mikkelsen (20%), Glenn Mikkelsen (20%), James Stone (25%), John Lemar (25%), Tom Minio (10% each)	Carolina Girl (no longer documented)	no

Source: https://alaskafisheries.noaa.gov /and https://myalaska.state.ak.us/business/sosb

Table 8-4 Ownership Interest of Washington Corporations

Washington Corporation	Governors	Ownership
Festus Fisheries, Inc.	John Lemar, Curtis Lemar	Assumed equal 50% shares
Mikkelsen Fisheries Inc.	Egil Mikkelsen, Glenn Mikkelsen	Assumed equal 50% shares
Stein Enterprises	Stein Nyhammer	100%
Stone Maritime	James Stone	100%

Source: Washington Corporate Records Search: https://www.sos.wa.gov/corps/

Table 8-5 Cooperative Member LLP Ownership Attribution

Owner	LLP Number						Cumulative Ownership
	002	005	007	008	009	010	
American Seafoods	100%						100%
John Lemar		20%	10%	25%	10%	25%	90%
Curtis Lemar			10%		10%		20%
Egil Mikkelsen		20%	20%	20%	20%	20%	100%
Glenn Mikkelsen		20%	20%	20%	20%	20%	100%
Tom Minio				10%		10%	20%
Stein Nyhammer		20%	20%		20%		60%
James Stone		20%	20%	25%	20%	25%	110%

8.5 Effects of Fleet Consolidation

The story of fleet consolidation in the Alaska Weathervane scallop fishery is not unlike that of any other fishery that has had overexploitation under open access, inefficiency caused by the race for fish, and marginally profitable operations due to overcapacity. Fleet consolidation likely results in access to a greater proportion of available harvest for each remaining participant, and reductions in cost are likely due to reduced crowding on available grounds and elimination of the inefficiencies of the race for fish that occurs in an overcapitalized fishery. However, consolidation has also likely occurred as the harvest levels have trended downwards to historically low levels in the most recent years.

Fleet consolidation undoubtedly has a direct effect on the number of crew and operator positions in the fishery. At the time of the vessel moratorium, 18 vessels qualified and likely employed at least 216 crew members (12, including operator, cooks, mechanics, etc. per vessel). However, crew earnings and data linking crew members to vessels do not exist. It is impossible to say, using presently available data, exactly how many crew were employed or the amount of their crew shares. Similarly, it is impossible to determine how many crew were locally (Alaska Residents) acquired or available. In any event, the Federal LLP effectively reduced the number of crew positions, including operators etc., to 108. The fleet consolidation that has occurred under the cooperative, and due to declining guideline harvest levels, has further reduced crew positions to no more than 24. It is possible; however, that the crew shares earned by these crew members are higher than what was earned in the past.

The formation of the scallop cooperative, and its further development into what is now the Alaska Scallop Association, along with declining CPUE in several areas, reduced harvest levels, and high participation costs have had some impacts on crew positions. Some participants have reported that they will vary the number of crew they carry depending on their expectations of fishing conditions. Essentially, if they feel that the pace of fishing will slow, on any given trip, they may carry anywhere between 8 and 12 crew. The one non-cooperative vessel in the fleet, the Kilkenny, most recently fished the Kamishak Bay beds, when open, and areas near Kodiak Island. They delivered fresh-shucked meats to buyers in Homer and Kodiak and indicate that, since they are not freezing their product at sea, they can fish with as few as 3 crew but usually take 4 or more (pers. comm, Bill Harrington, February 2013).

Crew wages in the present fishery are undoubtedly less, in the aggregate, than they would have been as a share of total revenue in the past. What is not clear; however, is whether individual crew shares have increased for those who continue to work in the scallop fishery. Improved efficiency and reduced numbers of crew on a vessel create the opportunity to have increased crew shares; however, there is no economic data collection program in the scallop fishery that could be used to confirm this possibility.

As has been discussed above, the Alaska Scallop Association has entered into a revenue sharing system that resulted in payments to members who agreed to not use their vessels so that the vessels that do fish can remain economically viable. At present, all three active vessels associated with the Alaska Scallop Association members are homeported in Kodiak (personal communication, Jim Stone, February 2018) as is the one identified non-cooperative vessel that has recently fished.

Fleet consolidation has also affected deliveries to several Alaska ports. Information on scallop deliveries to ports from 1990-2017 (ADF&G 2018) show that, since formation of the cooperative and associated fleet consolidation, scallop landing have occurred in several ports and the location of landings has varied over the years. Cordova, Dutch Harbor, Homer, Kodiak, Sitka and Yakutat have all had landings in between 2012 and 2017; however occasional past landings in Alaska ports of Juneau, Ketchikan, Pelican, Petersburg, Sand Point, Seldovia, Seward and Whittier are not presently occurring. Also of note is that past landings made outside of Alaska to ports in Bellingham, and Seattle have not occurred since 2008 and not by any of the present members of the Alaska Scallop Association.

All of the vessels that participate in this fishery, at present, are homeported in Alaska ports and pay both Alaska Business taxes and Resource Landings taxes and any applicable local taxes in landing ports and their home port (e.g. sales tax). From 2017-2019 the two vessels fishing made between 8 and 17 landings per year in ports of Yakutat, Homer, Kodiak and Dutch Harbor. While all of the effects of consolidation mentioned above have negative consequences for some fishery participants and fishing communities, it is likely that the overall effect of fleet reduction is improved profitability for the remaining participants given that the harvest level is at historic lows.

A fundamental question is whether another vessel could fish in the Alaska Scallop Fishery profitably. Table 8-6 decomposes the breakeven analysis from the Amendment 4 Regulatory Impact Review and re-specifies those breakeven levels using present harvest and price ranges. Doing so imposes the same fixed cost ratios as were used in the Amendment 4 and data from vessels that, with the exception of the Provider, do not currently participate in the fishery. With that limitation duly noted, application of present price of $11.00 to $11.50 and just over 200,000 pounds of harvest roughly 1.2 vessels would breakeven under present fishery and market conditions assuming cost ratios are similar to the past. It is likely that the members of the Alaska Scallop Cooperative have achieved some cost efficiencies since this breakeven analysis was conducted as evidenced by their two vessels currently operating.

In addition, Appendix B to the analysis of Amendment 10 to the Scallop FMP (NPFMC 2005) contains cost and breakeven data from 2003 for the Provider and Ocean Hunter, both of which are presently active in the fishery. That data, though limited to an average of two vessels shows that breakeven levels of income from 2003, inflation adjusted to 2019 values using the U.S. Gross Domestic Product Implicit Price Deflator, also suggests that fewer than two vessels would breakeven under current price and landings values.

Table 8-6 Number of Vessels that Could Breakeven Under Current Price and Landings Scenarios (recreated from Regulatory Impact Review for Amendment 4-10 to the North Pacific Scallop FMP)

Price	Landing (pounds)			
	200,000	400,000	600,000	800,000
$10.00	1.1	2.1	3.2	4.3
$10.50	1.1	2.2	3.4	4.5
$11.00	1.2	2.3	3.5	4.7
$11.50	1.2	2.4	3.7	4.9
$12.00	1.3	2.6	3.8	5.1
$12.50	1.3	2.7	4.0	5.3
$13.00	1.4	2.8	4.2	5.5

Purchase of LLPs from other cooperative members has likely reduced revenue sharing obligations for active participants, albeit with the potential cost of debt finance for these transactions. Overall, it is likely that fleet consolidation has resulted in a more efficient fleet with lower operating costs, potentially greater average crew wages, and improved returns to owned capital. However, the historically low harvest levels in the Alaska Weathervane scallop fishery, even with historically high prices are limiting the economic performance of the fishery and likely also preventing new entrants to the State waters fishery.

8.6 Scallop Market Conditions

In the domestic U.S. market, Alaska weathervane scallops are similar to Atlantic sea scallops; however they tend to be smaller and sweeter to the palate. Table 8-7 compares total landings and value of Alaska weathervane scallops with Atlantic sea scallops from 1990 through 2018/19 and with imports of all scallop products from 1990 through December of 2019. These data show that Atlantic sea scallop harvest is consistently orders of magnitude larger than weathervane scallop harvests off Alaska.

There are some intuitive conclusions that can be made from the data presented in Table 8-7 and from the price trends displayed in Figure 8-1. First, domestic markets are dominated by Atlantic sea scallop production and scallop imports. For example, in 2018, 60.1 million pounds of Atlantic Sea Scallops were landed in the United States, and 46.5 million pounds of scallop products were imported into the United States. This compares to just over 200,000 pounds of Alaska Weathervane scallop landings in 2018. Even in the highest production year of 1994, the 1.2 million pounds of Alaska Weathervane scallop landings made in that year compare to 16.8 million pounds of Atlantic Sea scallop landings and 56.8 million pounds of imported scallop products.

Second, prices of weathervane scallops track closely to those of Atlantic sea scallops. Thus, it is highly likely that domestic market price is dominated by the relationship between quantity supplied in the Atlantic sea scallop fishery and domestic market demand as well as by substitution of imported scallop product. Figure 8-1 provides a very clear picture of the relationship between Sea scallop prices and Alaska Weathervane scallop prices. These data appear to show that Alaska Weathervane scallop price

declines tend to lag U.S. Sea scallop price declines and, at least since formation of the Alaska Scallop Association, have tended to slightly lead market price increase

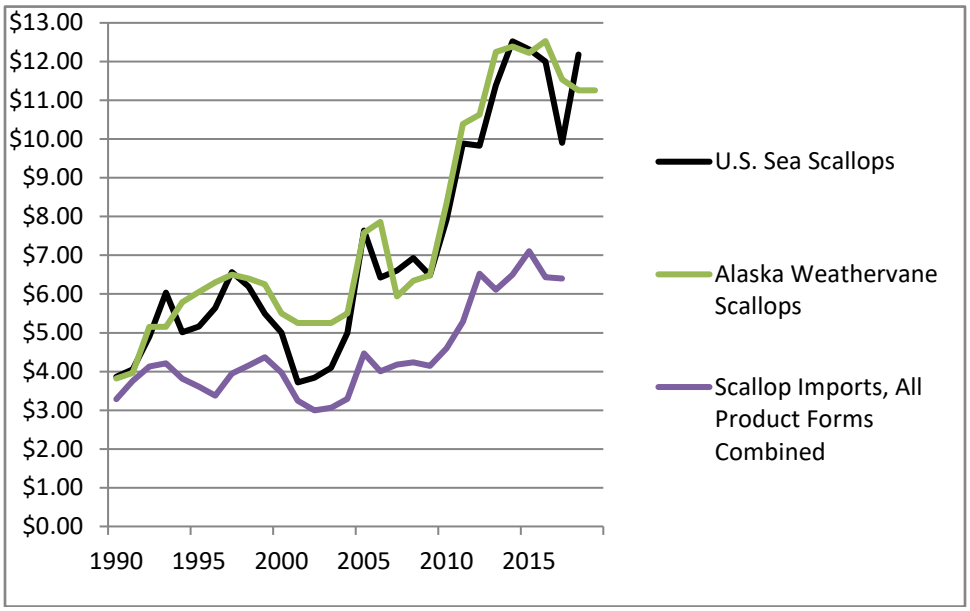


Figure 8-1 Scallop Price Comparisons, 1990-2019.

One might argue that the appearance may be driven by data collection differences. Sea Scallop prices are tabulated somewhat continuously through the season and landings and value are available on a monthly basis. In contrast, Alaska Weathervane scallops are primarily processed at sea and a value is not established at the time of landing but rather via the annual tax filings of harvesting entities with the Alaska Department of Revenue. The Alaska Weathervane scallop price determination for the previous year is usually published in May or June of the following year. However, for this analysis, average prices are tabulated for each year and, thus, are from a comparable time frame leading one to wonder as to the price dynamics at work behind the apparent time lag in declines and slight lead in increases that Alaska Weathervane scallops seem to exhibit.

Unfortunately, while Sea Scallop landings and value data are incredibly rich, Alaska Weathervane scallop pricing data is represented by a single data point per year with occasional fish ticket values when fresh product has been landed. These imbalanced data sets largely prevent meaningful econometric analysis of the demand for each product, including the extent to which Alaska Weathervane scallop prices may be driven by the Sea Scallop market.

Another important factor in scallop market is imports of scallop products. Unfortunately, available import data commingles imports of several small scallop species (e.g. pink, calico, bay etc.) with larger scallop varieties such as sea scallops and weathervane scallops. However, as these products are substitutes for one another, although not perfectly, the imports of these other species may have an effect on domestic market prices.

Table 8-7 : US Scallop Landings and Value versus Scallop Imports and Value, 1990-2017

Year	U.S. Sea Scallops			Alaska Weathervane Scallops*			Scallop Imports, All Product Forms Combined		
	Millions of Pounds	Value ($ millions)	Av. $/lb	Millions of Pounds	Value ($ millions)	Av. $/lb	Millions of Pounds	Value ($ millions)	Av. $/lb
1990	38.6	$149.1	$3.87	1.1	$4.3	$3.82	40.0	$131.6	$3.29
1991	37.9	$153.7	$4.05	1.8	$7.1	$3.96	29.7	$111.4	$3.76
1992	31.3	$153.4	$4.90	0.6	$2.9	$5.15	38.8	$160.2	$4.13
1993	16.1	$97.1	$6.04	1.0	$5.1	$5.15	52.1	$219.2	$4.21
1994	16.8	$84.1	$5.01	1.2	$7.2	$5.79	56.8	$216.9	$3.82
1995	17.4	$89.8	$5.16	0.4	$2.5	$6.05	48.4	$174.8	$3.61
1996	17.5	$98.8	$5.64	0.7	$4.6	$6.30	58.8	$198.8	$3.38
1997	13.6	$89.5	$6.56	0.8	$5.3	$6.50	60.3	$238.1	$3.95
1998	12.1	$75.1	$6.19	0.8	$5.3	$6.40	53.2	$221.1	$4.16
1999	22.0	$121.0	$5.49	0.8	$5.2	$6.25	44.6	$194.7	$4.37
2000	32.2	$160.9	$5.00	0.8	$4.1	$5.50	54.1	$214.8	$3.97
2001	46.4	$172.6	$3.72	0.6	$3.0	$5.25	40.0	$130.0	$3.25
2002	52.7	$202.1	$3.84	0.5	$2.7	$5.25	49.0	$146.7	$3.00
2003	56.0	$229.1	$4.09	0.5	$2.6	$5.25	52.9	$161.9	$3.06
2004	64.1	$320.0	$4.99	0.4	$2.3	$5.50	45.3	$149.4	$3.29
2005	56.6	$432.5	$7.64	0.5	$4.0	$7.58	51.4	$229.8	$4.47
2006	60.1	$386.3	$6.43	0.5	$3.8	$7.86	60.8	$243.3	$4.00
2007	58.5	$386.0	$6.60	0.5	$2.7	$5.94	56.6	$236.8	$4.18
2008	53.4	$370.1	$6.93	0.3	$2.2	$6.34	57.8	$244.8	$4.24
2009	57.9	$375.6	$6.48	0.5	$3.2	$6.48	56.3	$233.0	$4.14
2010	57.5	$455.7	$7.92	0.5	$3.8	$8.35	51.9	$238.5	$4.60
2011	59.2	$585.1	$9.89	0.5	$4.7	$10.39	56.8	$300.4	$5.29
2012	56.9	$559.0	$9.82	0.4	$4.4	$10.63	34.5	$224.7	$6.52
2013	41.0	$466.8	$11.39	0.4	$4.9	$12.25	60.9	$371.9	$6.11
2014	33.8	$423.7	$12.52	0.3	$3.8	$12.39	60.7	$394.4	$6.50
2015	35.7	$439.7	$12.32	0.3	$3.2	$12.22	49.3	$350.2	$7.11
2016	40.5	$486.0	$12.00	0.2	$2.9	$12.53	51.0	$328.5	$6.43
2017	53.8	$532.9	$9.90	0.2	$2.8	$11.54	41.3	$264.5	$6.40
2018	60.1	$732.0	$12.18	0.2	$2.8	$11.26	46.5	$243.6	$5.24
2019	n/a	n/a	n/a	0.2	$2.7	$11.26	35.3	$209.2	$5.93

Sources: NMFS Data at https://www.fisheries.noaa.gov and ADF&G Fish Ticket data.
* Seasonal data is displayed as annual data for comparison with annual sea scallop landings
n/a= data for 2019/20 Atlantic US Sea scallop fishery is not yet available.

The conclusion that can be drawn from the data presented in Table 8-7 is that the wholesale price of weathervane scallops is likely heavily influenced by domestic supply and import supply. This suggests that North Pacific harvesters have little market power to negotiate prices, except based on quality and taste preferences, and are likely price takers in the wholesale market.

8.7 References

ADF&G (Alaska Department of Fish and Game). 2019. Annual Alaska Scallop Port Landings. Alaska Department of Fish and Game. Kodiak, Alaska.

ADOC (Alaska Department of Commerce). 2019. Alaska Corporations Business and Professional Licensing Database, available at https://myalaska.state.ak.us/business/soskb/

ADOR (Alaska Department of Revenue). 2019. Annual statewide fish price data published at http://tax.alaska.gov/programs/

Anchorage Daily News, 2016. Obituary of Max G. Hulse. Published February 16, 2016, Anchorage Alaska.

Barnhart, Jeffrey, 2006. Personal Communication with Jeffrey Barnhart , Alaska Department of Fish and Game, Division of Commercial Fisheries., Kodiak Alaska., January 2006.

Harrington, Bill, 2013. Public testimony at the 2013 Scallop Plan Team meeting, February 24, 2013., Kodiak, Alaska.

Kandianis, Mark, 2006. Public testimony at the 2006 Scallop Plan Team meeting, February 24, 2006., Anchorage Alaska.

NMFS., 2019. National Marine Fisheries Service National Fishery Statistics and Import data available at https://www.fisheries.noaa.gov.

NPFMC (North Pacific Fishery Management Council). 1999. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Amendment 4 to the Fishery Management Plan for the Scallop Fishery off Alaska. North Pacific Fishery Management Council, 605 West 4th Avenue, Suite 306, Anchorage, Alaska.

NPFMC (North Pacific Fishery Management Council). 2009. Fishery Management Plan for the Scallop Fishery off Alaska. North Pacific Fishery Management Council, 605 West 4th Avenue, Suite 306, Anchorage, Alaska.

NPFMC (North Pacific Fishery Management Council). 2005. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Amendment 10 to the Fishery Management Plan for the Scallop Fishery off Alaska. North Pacific Fishery Management Council, 605 West 4th Avenue, Suite 306, Anchorage, Alaska.

State of Washington., 2019 Corporate Records Search available at https://www.sos.wa.gov/corps/

Stone, Jim., 2018 Public testimony at the 2018 Scallop Plan Team meeting, February 21, 2018., Kodiak, Alaska.

9 Appendix 3: Weathervane Scallop Stock Structure

A summary of the available data (Spencer et al, 2010) on the stock identification for weathervane scallops is shown below. This information is necessary to determine stock structure, stock boundaries, as well as to identify data gaps and research needs for scallops. The Scallop Plan Team intends to update these data as additional information becomes available in the annual SAFE report.

Harvest and trends	
Factor and criterion	**Available information**
Fishing mortality (5-year average percent of F_{max})	Cook Inlet and Kayak bed-specific information available where surveyed, unknown for other areas.
Spatial concentration of fishery relative to abundance (Fishing is focused in areas << management areas)	Fishery concentrated in areas smaller then broad distribution of scallop stocks by management region. See figures in SAFE for overall distribution. Scallops known to occur in closed waters, sometimes in dense aggregations.
Population trends (Different areas show different trend directions)	Survey biomass trends in some regions, CPUE trend data available for other regions, trends differ by area, no clear overall trend statewide, age distributions differ by region and beds, recruitment difficult to detect due to fishery-dependent data (commercial fishery catch does not necessarily indicate recruitment or biomass trends)
Barriers and phenotypic characters	
Generation time (e.g., >10 years)	No, areas tend to be similar, some differences in growth rates by area and maturity
Physical limitations (Clear physical inhibitors to movement)	Consideration of GOA oceanography and the ~30 day larval phase (Bourne, 1991) suggest linkages between different subpopulations of this spatially structured metapopulations but advection and settlement information unknown
Growth differences (Significantly different LAA, WAA, or LW parameters)	Yes, Kodiak scallops grow faster and are larger at given shell height than scallops from the eastern GOA; unknown if genetic or environmental but literature suggests environmental factors such as depth, water temperature, and primary production strongly affect growth. (Ignell and Haynes, 2000; Kruse et al. 2005).
Age/size-structure (Significantly different size/age compositions)	Complicated by comparison of survey data with fishery data; age structure varies regionally and may be affected by fishery removals in local subpopulations.
Spawning time differences (Significantly different mean time of spawning)	Scallop spawning occurs in early summer and appears to be temperature dependent. Spawning of southern populations (Washington, BC) starts earlier (MacDonald and Bourne 1987)
Maturity-at-age/length differences (Significantly different mean maturity-at-age/ length)	Unknown, histological analyses not completed but visual inspection indicates age 3 in both Kamishak and Kayak but no data available for other regions
Morphometrics (Field identifiable characters)	Yes shell shape, weight, height differences by region
Meristics (Minimally overlapping differences in counts)	Unknown

Behavior & movement	
Spawning site fidelity (Spawning individuals occur in same location consistently)	Weathervane scallops are capable of swimming but it is thought they have spawning site fidelity.
Mark-recapture data (Tagging data may show limited movement)	N/A
Natural tags (Acquired tags may show movement smaller than management areas)	Unknown
Genetics	
Isolation by distance (Significant regression)	Unknown
Dispersal distance (<<Management areas)	Unknown
Pairwise genetic differences (Significant differences between geographically distinct collections)	Weak evidence for difference between Bering Sea and GOA, no evidence for differences within GOA (Gaffney et al, 2010). Gaffney et al. (2010) note that "lack of genetic differentiation measured by neutral markers does not preclude the existence of locally adapted, self-sustaining populations". Limited genetic data available may not be relevant to time scales for management.

10 Appendix 4: Historical Overview of Scallop Fishery

Alaska weathervane scallop *Patinopecten caurinus* populations were first evaluated for commercial potential in the early 1950s by government and private sector investigators. Interest in the Alaska fishery increased in the late 1960s as catches from U.S. and Canadian sea scallop *Placopecten magellanicus* fisheries on Georges Bank declined. Commercial fishing effort first took place in Alaska during 1967 when two vessels harvested weathervane scallops from fishing grounds east of Kodiak Island. By the following year, 19 vessels including New England scallopers, converted Alaskan crab boats, salmon seiners, halibut longliners, and shrimp trawlers, entered the fishery.

From the inception of the fishery in 1967 through mid-May 1993, the scallop fishery was passively managed with minimal management measures. Closed waters and seasons were established to protect crabs and crab habitat. When catches declined in one bed, vessels moved to new areas. This management strategy may have been acceptable for a sporadic and low intensity fishery but increased participation inevitably led to boom and bust cycles (Barnhart, 2003).

In the early 1990s, the Alaska weathervane scallop fishery expanded rapidly with an influx of boats from the East Coast of the United States. Concerns about overharvest of scallops and bycatch of other commercially important species such as crabs prompted the ADF&G Commissioner to designate the weathervane scallop fishery a high-impact emerging fishery on May 21, 1993. This action required ADF&G to close the fishery and implement an interim management plan prior to reopening. The interim management plan contained provisions for king and Tanner crab bycatch limits (CBLs) for most areas within the Westward Region. Since then, crab bycatch limits have been established for the Kamishak District of the Cook Inlet Registration Area and for the Prince William Sound Registration Area. The commissioner adopted the regulations and opened the fishery on June 17, 1993, consistent with the measures identified in the interim management plan. The interim management plan included a provision for 100% onboard observer coverage to monitor crab bycatch and to collect biological and fishery data. In March 1994, the Alaska Board of Fisheries (BOF) adopted the interim regulations identified as the Alaska Scallop Fishery Management Plan, 5 AAC 38.076.

From 1967 until early 1995, all vessels participating in the Alaska scallop fishery were registered under the laws of the State of Alaska. Scallop fishing in both state and federal waters was managed under state jurisdiction. In January 1995, the captain of a scallop fishing vessel returned his 1995 scallop interim use permit card to the State of Alaska Commercial Fisheries Entry Commission in Juneau and proceeded to fish scallops in the EEZ with total disregard to harvest limits, observer coverage, and other management measures and regulations. In response to this unanticipated event, federal waters in the EEZ were closed to scallop fishing by emergency rule on February 23, 1995.

The initial emergency rule was in effect through May 30, 1995, and was extended for an additional 90 days through August 28, 1995. The intent of the emergency rule was to control the unregulated scallop fishery in federal waters until an FMP could be implemented to close the fishery. Prior to August 28, NPFMC submitted a proposed FMP which closed scallop fishing in the EEZ for a maximum of one year with an expiration date of August 28, 1996. The final rule implementing Amendment 1 to the FMP was filed July 18, 1996 and published in the Federal Register on July 23, 1996. It became effective August 1, 1996, allowing the weathervane scallop fishery to reopen in the EEZ. Scallop fishing in state waters of the Westward Region was delayed until August 1, 1996 to coincide with the opening of the EEZ. The state continued as the active manager of the fishery with inseason actions duplicated by the federal system (Barnhart, 2003).

In March 1997, NPFMC approved Amendment 2, a vessel moratorium under which 18 vessels qualified for federal moratorium permits to fish weathervane scallops in federal waters off Alaska. By February 1999, the Council recommended replacing the federal moratorium program with a Federal License

Limitation Program (LLP), which became Amendment 4 to the FMP. The Council's goal was to reduce capacity to approach a sustainable fishery with maximum net benefits to the Nation, as required by the Magnuson-Stevens Act. NPFMC's preferred alternative created a total of nine licenses with no area endorsements; each vessel is permitted to fish statewide. However, vessels that fished exclusively in the Cook Inlet Registration Area where a single 6-foot dredge was the legal gear type during the qualifying period were also limited to fishing a single 6-foot dredge in federal waters outside Cook Inlet. The NPFMC later modified the gear restriction in Amendment 10 to allow these vessels to fish 2 dredges with a combined maximum width of 20 feet. Amendment 10 was approved on June 22, 2005. NMFS published final regulations on July 11, 2005, which were effective August 10, 2005. NMFS implemented Amendment 10 by reissuing the two LLP licenses with the larger gear restriction.

Amendment 6 which established overfishing levels for weathervane scallops was approved by the NPFMC in March 1999. This amendment established an overfishing level as a fishing rate (F_{OFL}) in excess of the natural mortality rate M=0.13. It also established an Optimum Yield of 0-1.24 million pounds of shucked meats. The upper bound of which became was designated MSY, and was based on average catch from 1990-1997 (excluding 1995) (Table 1-1).

In 1997, the Alaska legislature approved legislation (AS 16.43.906) establishing a scallop vessel moratorium in state waters. In 2001, the legislature authorized a 3-year extension of the moratorium set to expire July 1, 2004. During the 2002 legislative session, passage of CSHB206 resulted in significant changes to the state's limited entry statutes. The changes authorized use of a vessel-based limited entry program in the weathervane scallop and hair crab fisheries. However, the program has a sunset provision. Under AS 16.43.450-520, the vessel permit system was set to expire on December 30, 2008 unless statutory authority was extended. Introduced in the 25th Alaska Legislature in January 2007, House Bill 16 would have extended the existing vessel permit system until December 30, 2013. House Bill 16 became locked in committee. It was offered up under Senate Bill 254, where it passed through the legislative process and was signed into law on June 5, 2008. The State's vessel-based limited entry program for weathervane scallops did expire on December 30, 2013.

In January 2014, the Board of Fisheries implemented a new State-Waters Weathervane Scallop Management Plan (5 AAC 38.078) that delineates additional tools needed to manage open-access weathervane scallop fisheries in waters of Alaska. The management plan applies to the Yakutat, Prince William Sound, Kodiak, and Dutch Harbor scallop registration areas which all have scallop beds that span both state and federal waters. The new management plan is in addition to the existing Alaska Scallop Fishery Management Plan (5 AAC 38.076) that establishes registration, reporting, gear, and observer coverage requirements.

The state-waters management plan allows the department to manage scallop beds in waters of Alaska separately from beds in adjacent federal waters if effort increases in the open-access state-waters fishery. The plan defines the scallop vessel registration year (April 1 – March 31) and establishes an annual preseason registration deadline of April 1. It also requires a registered scallop vessel to have onboard an activated vessel monitoring system, permits the department to establish trip limits, and allows for separate registrations for state and federal-waters fishing. The additional management measures are necessary to prevent overharvest of the weathervane scallop resource during an open-access fishery.

In 2014, eight vessels acquired state open-access permits. None of these vessels fished for scallops, however. Information provided at the 2015 Scallop Plan Team meeting indicated that these vessels may not have fished due to the cost of carrying observers and/or a lack of needed scallop harvesting gear.