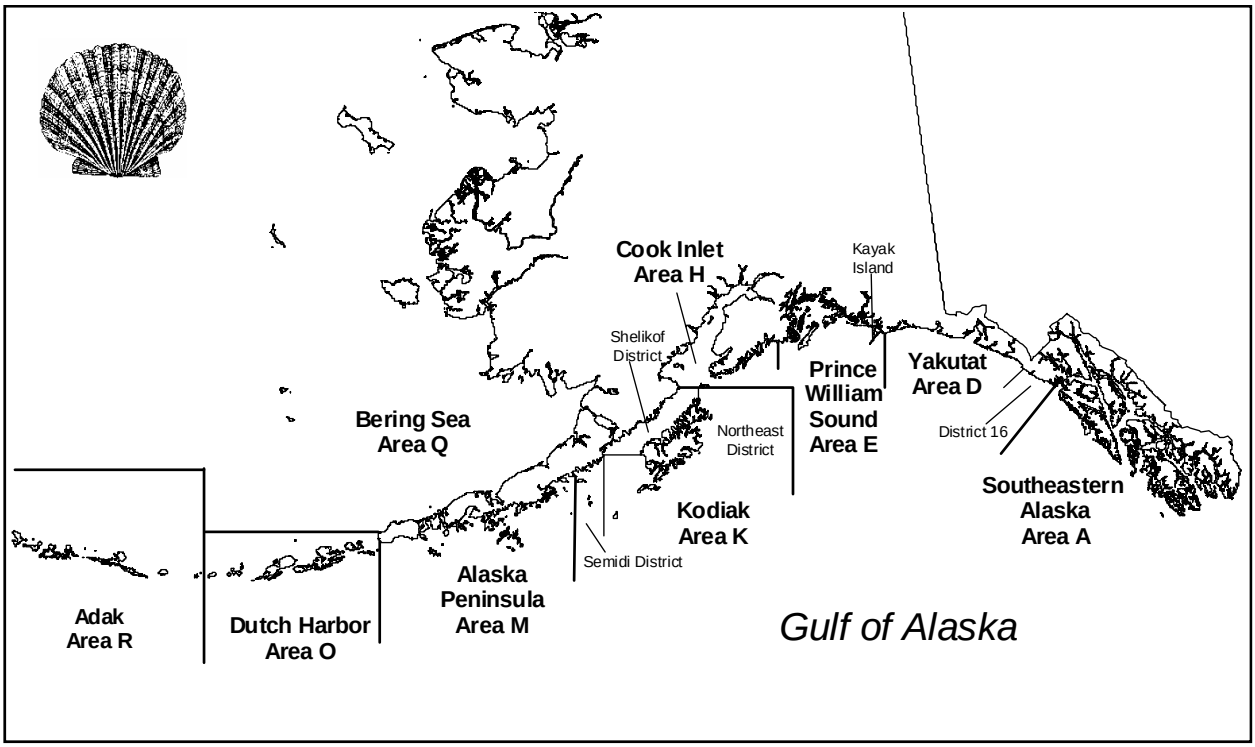
# STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

# FOR THE WEATHERVANE SCALLOP

# FISHERY OFF ALASKA




Compiled by

## The Scallop Plan Team

With contributions by:
R. Burt, K. J. Goldman, R. L. Gustafson,
J. Zheng, S. Miller, P. Murphy, G. Rosenkranz, E. Russ, Q. Smith,
M. Stichert, D. L. Stram, and C. E. Trowbridge.

**March 2013**

North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, Alaska 99501

## Table of Contents

## List of Tables

# List of Figures

# 1 Introduction

The National Standard Guidelines for Fishery Management Plans, published by the National Marine Fisheries Service, require that a stock assessment and fishery evaluation (SAFE) report is prepared and reviewed annually for each fishery management plan (FMP). The SAFE report summarizes the current biological and economic status of the fishery and analytical information used in fishery management such as guideline harvest levels (GHLs) and harvest strategies. The report is assembled by the Scallop Plan Team (SPT, Plan Team) with contributions from the State of Alaska Department of Fish and Game (ADF&G), the National Marine Fisheries Service (NMFS), and the North Pacific Fishery Management Council (NPFMC, Council). The SAFE report is presented to the Council on an annual basis and is also available to the public.

The Scallop Plan Team met in Kodiak on February 19th, and 20th 2013 to review the status of the weathervane scallop stocks, to discuss additional issues of importance in scallop management, and to compile the annual SAFE report. The Plan Team review was based on presentations by staff of the NPFMC, NMFS, and ADF&G with opportunity for public comment and input. Members of the Plan Team who compiled the report were Gregg Rosenkranz (co-chair), Diana Stram (co-chair), Scott Miller, Richard Gustafson, Ryan Burt, Quinn Smith, Jie Zheng, and Peggy Murphy.

The scallop fishery in Alaska's Exclusive Economic Zone (EEZ; from 3 to 200 miles offshore) is jointly managed by the state and federal government under the FMP. Most aspects of scallop fishery management are delegated to the State of Alaska (State), while limited access and other federal requirements are under jurisdiction of the federal government. The FMP was developed by the NPFMC under the Magnuson Stevens Act (MSA) and approved by NMFS on July 26, 1995. The NPFMC updated and adopted a revised FMP in 2005.

Although the FMP covers all scallop stocks off the coast of Alaska, including weathervane scallops (*Patinopecten caurinus*), pink or reddish scallops (*Chlamys rubida*), spiny scallops (*Chlamys hastata*), and rock scallops (*Crassadoma gigantea*), the weathervane scallop is the only commercially exploited stock at this time. Commercial fishing for weathervane scallops occurs in the Gulf of Alaska, Bering Sea, and Aleutian Islands. Scallop registration areas used by ADF&G in management of the fishery and general fishing locations are shown in Figure 2-1.

In 1996, optimum yield (OY) was established as 0 to 1.8 million pounds of shucked scallop meats. A more conservative approach was taken in 1998, when OY was defined as 0 to 1.24 million pounds of shucked scallop meats. OY was just recently redefined again in 2012 to 0 to 1.29 million pounds of shucked meats to include known discards over the time frame for which the upper end of the OY range was defined. Statewide scallop harvests have not exceeded OY, and scallop stocks are not overfished.

## 1.1 Responses to Comments from the SSC

**Comment 1.** In reviewing this year's SAFE report, the SSC notes some potential conservation concerns. **Two areas of some concern are the Kayak Island west bed and the Alaska Peninsula area.** However, as both areas have been closed to fishing in the last 2 and 3 years, respectively, no further conservation action is warranted at this time. **It would be useful if future SAFE documents could describe the criteria by which these areas would be reopened to fishing.** For the Kayak Island west bed, presumably a biomass-based threshold could be established using the biennial dredge survey. For the Alaska Peninsula, presumably a "test" fishery would be undertaken, barring implementation of a new survey in the area. However, given poor fishery performance in 2000/01 and extremely poor fishery

performance in 2006/07 and 2008/09, an extended fishery closure would seem to be warranted. Moreover, 18,302 Tanner crabs were taken as bycatch in the 2008/09 fishery that yielded a mere 2,460 pounds of shucked meats, indicating a potential bycatch issue for any future fisheries in this area.

**Response:** For Kayak Island, the ADF&G intends to try two approaches. First they will see what options the Age Structured Model will show for a threshold for sustainable production. Then they intend to compare it to an average harvest approach used for Tanner Crab in Cook Inlet. For the Alaska Peninsula, It is unknown at this time what would trigger the ADF&G re-opening this fishery. Consideration could be given should the fleet request this of the BOF

**Comment 2.** The SSC wishes to highlight two other fishing areas for additional consideration in next year's SAFE. Recent declines in fishery CPUE for District 16 and the Kayak Island east bed seem to parallel those for the Kayak Island west bed, which has been closed to fishing since 2010/11. The GHL for District 16 was increased from 21,000 to 25,000 lbs shucked meats in 2009/10. However, fishery CPUE for District 16 has generally declined since peaking at 65 lbs/hr in 2000/01 (see Figure 3-3) including the lowest CPUE on record of 27 lbs/hr in 2010/11. For comparison, CPUE at the west bed at Kayak Island (PWS area) declined from 120 lbs/hr in 2005/06 to 44 lbs/hr in 2009/2010 prior to fishery closures in the past two years (Table 3-6). Dredge surveys on the Kayak Island west bed indicated that low scallop densities (20 lbs/nm) are associated with the decline in CPUE. It is not clear whether fishery CPUE can be distinguished among the east and west beds of Kayak Island (see Tables 3-4, 3-5, and 3-6), however dredge surveys perhaps indicate more stable scallop densities on the east bed than on the west bed (Table 3-3). If CPUE can be estimated separately for the east and west Kayak Island beds, they should be reported separately in Tables 3-5 and 3-6.

**Response:** The CPUE from the east and west Kayak Island beds is now included in Tables 3-5 and 3-6, respectively.

**Comment 3.** Declines in scallop densities indicated by fishery CPUE (above) suggest that it may be prudent for the Scallop Plan Team to undertake a fresh review of weathervane scallop fishery management. Such a review could include a re-evaluation of the natural mortality rate used to prescribe OFL, target harvest rates, and the potential for some sort of rotational harvest scheme. A review of scallop fishery management, including spatial harvest strategies and/or exploitation rates, in other parts of the world may yield some fresh insights.

**Response:** The Scallop Plan Team held a discussion at their recent February 2013 meeting and recommends that a workshop on management of data-poor stocks be held to encourage evaluation and discussion of issues related to scallop assessment and management, as well as possible extension to other data-poor stocks in Alaska. See SPT report 2013 for additional details.

**Comment 4.** The SSC appreciates the presentation of estimated discard mortality (assuming 20% discard mortality rate) in Table 2-2 to allow easy evaluation of the total fishing mortality (catch plus discards) relative to the statewide ACL. Table 2-2 may be sufficient in this regard, but the Plan Team could consider taking a similar approach in Tables for individual fishing areas (e.g., Table 3-1 for Yakutat). At a minimum, footnotes for tables for individual fishing areas should indicate that a 20% discard mortality rate and meat recovery rates are applied to estimates of whole scallop discards for purposes of catch accounting.

**Response:** This has now been done.

**Comment 5.** The SSC looks forward to the Plan Team response to last year's SSC request that the team consider exploring other methods for estimating biological reference points, such as Productivity

Susceptibility Analysis or Depletion-Corrected Average Catch. Given the use of inseason fishery CPUE in fishery management decisions in several management areas, the SSC appreciates additional explanations of this process, such as the minimum performance standard reported in Appendix 1. **The team should consider formally describing the use of such inseason data in the management process in the body of the SAFE document.**

**Response:** Please see the workshop suggestion by the SPT with respect to analyses of Depletion-Corrected Average Catch and Productivity-Susceptibility Analyses. With respect to describing the use of in-season data in the management process in the main body of the SAFE report, this has now been included in this version.

**Comment 6.** The team is encouraged to consider whether the utility of fishery CPUE as an index of relative changes in scallop abundance can be evaluated in PWS and Cook Inlet, where dredge abundance surveys are conducted.

**Response**: The ADF&G area-management staff note that inseason monitoring of CPUE is a good management tool. The large decline in Kamishak's north bed was first observed fishery CPUE. The following year the survey showed the decline in abundance. It is important for managers to monitor CPUE.

**Comment** 7. Table 2-4 (p. 23) on crab bycatch limits is very useful. However, for areas in which the crab bycatch limit is 0.5% or 1.0% of estimated crab abundance, the actual number of crabs equating to these limits is not specified. The SSC recommends adding a column in Table 2-5 that provides area-specific crab bycatch limits (in numbers of crabs) to facilitate comparison to the estimated number of crabs taken as bycatch.

**Response:** A column of estimated number of crab has been added to Table 2-5.

**Comment** 8. Figure 3-4 indicates a shift to significantly higher discard rates for scallops >110 mm SH in District 16 in 2009/10 and 2010/11. **Please explain the cause of these high discard rates in District 16.**

**Response:** Discard rates were higher in that year due to small sized scallop meats compared to shell height. The scallop meats were in the 50-60 count size and could not be marketed, leading to higher discards in that year. This occurrence is not uncommon in District 16, although the magnitude of it in that year was somewhat extreme. This information has been added to that section.

**Comment 9.** Figure 3-5 does not have axis labels and CPUE is not correctly plotted.

**Response:** This has been corrected.

**Comment 10.** The sections on PWS and Cook Inlet could clarify whether the same catchability (q) and 5% harvest rate is used to estimate the annual GHL. For Cook Inlet, it is stated on p. 50 that ADF&G applies a 5% exploitation rate to the biomass data to set the GHL. However, p. 54 indicates that state regulations set a GHL range of 10,000-20,000 lbs. This seems inconsistent with information in Table 3-8, which indicates that the GHL calculation can result in GHLs less than 10,000 lb (2005 and 2006) and more than 20,000 lbs (1996). Please clarify the role, if any, of the 10,000- 20,000 lb GHL range. Is natural mortality from the time of the survey to the time of the fishery used to discount abundance estimates, as is done with BSAI crabs? If not, the actual harvest rate would be higher than 5% under the current procedure.

**Response:** The 10,000 to 20,000 lb meats was part of a ADF&G management plan adopted by Board of Fish in 1980's based on a survey (Hammarstrom & Merritt 1985). The 26,000 GHL was allowed because the fishery was closed in 1995 due to the "Mr Big" incident. This closure was due to regulatory issues not biological issues and would have been open had the regulatory issue had not closed the fishery state wide. Since the Kamishak fishery had appeared healthy the manager allowed that additional 8,000 lb meats. The 1996 indicated the harvest rate was well below the 5%. We should add the 20,000 GHL to 1993 & 1994. Managers have applied the 5% harvest rate when the 10,000 to 20,000 lb GHL cannot be met. This has been addressed in the SAFE under the "Seasons" heading.

**Comment 11.** On p. 49 it is stated that "Much of Cook Inlet is closed to scallop dredging" with a reference to Figure 2-1. However, Fig. 2-1 is a map of the scallop management areas and does not show closed areas in Cook Inlet. Figure 2-4 shows the two main scallop beds in Kamishak Bay. Are all other areas closed other than the two "main beds"?

**Response:** This has been addressed in the section on 'Seasons" Section 2.1.4.

**Comment 12.** The SSC appreciates new research with the sledge-dredge in the Central Region and looks forward to new estimates of survey catchability and improved estimates of stock biomass. Also, 9 now that aging issues seem to have been largely resolved and biometric support has been arranged, the SSC looks forward to the age-structured model for Central Region stocks.

**Response:** The age-structured model is in progress.

**Comment 13.** For the Kodiak Shelikof District, there is a comment (p. 61) that reduced CPUE of 58 lbs/hr in 2007/08 may be due to the participation of a small vessel with a single 10-ft dredge. However, CPUE continued to decline to 49-52 lbs/hr in subsequent years. Did this small vessel continue to participate or is this a real decline in CPUE? The Team should consider separately reporting CPUE data from vessels towing a single, small dredge to maintain some consistency in "core fleet" CPUE estimates for evaluation of fishery trends.

**Response:** Due to confidentiality CPUE cannot be reported for that vessel separately.

**Comment 14.** The SAFE indicates that the Kodiak SW District opened to fishing in 2009/10 after closure since 1969 due to crab bycatch concerns. Please report the CPUE for this new fishery. This could have been an excellent opportunity to examine scallop densities in an unfished (43 years) bed and its response to fishing. It would have been ideal if a CamSled survey was conducted in this area to obtain valuable baseline data. **The SSC recommends conducting CamSled surveys in previously unfished scallop beds, or in areas that have been closed for extended periods, prior to future new fishery openings, if and when possible.**

**Response:** Due to confidentiality CPUE cannot be reported. With respect to the CamSled recommendations, funding is limited and while some baseline images have been collected they have not yet been analyzed due to limited staff resources.

**Comment 15.** In the Dutch Harbor Area, scallop size distributions are shown in Fig. 3-22 for 2010/11. It would be useful to also report size distributions for prior years to evaluate whether changes in size composition support the current GHLs.

**Response:** Size distributions are reported where sample size is sufficient.

**Comment 16.** The SSC appreciates the improvements in the Ecosystem Considerations section, and the SSC appreciates the Team's intent to continue improving the section. In particular, the SSC looks forward to additional information on ocean acidification and dredging effects next year.

**Response:** The SPT received a report on potential impacts of ocean acidification as noted in the SPT report and research priorities. This information has not yet been included in the SAFE report.

**Comment 17.** Section 4.2 indicates that data before the current observer program (1993) are scarce. However, there are old observer data (late 1960s – early 1970s) available for Yakutat and Kodiak, as well as time series of CPUE for vessels with standard New Bedford dredges. Can any comparisons be made? Declines in CPUE and truncation of age structure in the early 1970s contributed to management restrictions at that time. For a review of those data from the 1960s and 1970s, see: Hennick, D.P. 1973. Sea scallop, *Patinopecten caurinus*, investigations in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Completion Report 5-23-R, Juneau.

**Response:** This work will be completed when staff timing and availability allow.

**Comment 18.** The section on the fishery effects on the ecosystem can be expanded. There have been many studies on the effects of scallop dredges (and other mobile bottom contact gear) on seafloor habitats by bottom habitat type and several reviews, including a somewhat dated section of the state FMP report (Kruse 1994) and a National Academy of Sciences report, among others.

**Response:** This work will be completed when staff timing and availability allow.

**Comment 19.** There is opportunity to expand the treatment of scallop predators. Consider exploring the groundfish stomach database for evidence of predation on scallops. Are skates predators of scallops? There are reports of crab predation on scallops, as well.

**Response:** This work will be completed when staff timing and availability allow. Please see SPT report regarding a suggestion to expand the membership of the SPT to include a member from AFSC whose position would be more aligned with evaluation of scallop resources.

**Comment 20.** The SSC appreciates the economic overview of the fishery. Potential additional information to include is port of landings, updated price of scallop per lb with size, crew size, and crew wages. Some of these are described in historical reports, such as: a. Kruse, G.H., and S.M. Shirley. 1994a. The Alaskan scallop fishery and its management. In: N.F. Bourne, B.L. Bunting, and L.D. Townsend (eds.), Proceedings of the 9th International Pectinid Workshop, vol. 2. Can. Tech. Rep. Fish. Aquat. Sci. 1994:170-177. b. Shirley, S.M., and G.H. Kruse. 1995. Development of the fishery for weathervane scallops, *Patinopecten caurinus* (Gould, 1850), in Alaska. J. Shell. Res. 14:71-78. 10 c. Miller, S.A. 2006. Economic factors in the scallop fishery off Alaska. 21. The SSC noted a number of typos and other errors; a list will be provided to the Plan Team separately.

**Response:** To the extent possible these have been included in the economics section as confidentiality allows.

Previous comments from 2011:

**Comment 21.** Review of stock boundaries using the format contained in the stock structure report.

**Response:** See SPT report for draft stock structure application and discussion

**Comment 22.** Development of standardized surveys for other areas.

**Response:** Development of standardized surveys for other areas remains a research priority but is limited by funding and staff availability.

**Comment** 23 Presentation of camera sled biomass estimates for seven regions where this technology has been deployed.

**Response:** Presentation of camera sled results remains a research priority but is limited by funding and staff availability.

**Comment 24.** Given the reliance on CPUE as an index of abundance, the SSC requested an evaluation of the difference in dredge selectivity between fishing regions including an analysis of the influence of bottom type on catch efficiency.

**Response:** Further evaluation of CPUE by area is included in the SPT research priorities.

**Comment 24.** Regarding the structure of the SAFE, the SSC has the following comments. Section 1.4 should include a general discussion of the issue of weak meats as it affects the stock and economics of the fishery. The Economic section should be moved to the end of the document. The ACL Section 2.10 should be moved to the section on Management (2.1) and focus on the recommendation for the upcoming 2011/12 fishing season. Annual total catch and ACL should be added to Table 2-4. A summary catch table based on appropriate management sub-units should be assembled to evaluate management by sub-area.

**Response:** The incidence of weak meats in scallop harvests is presently being assessed in the Kamishak and Kayak Island surveys; however, there is no data available presently that would allow estimation of the proportion of commercial scallop discards that are due to weak meats. Similarly, there is no data available to estimate changes in fishing behavior, and potentially operating costs, from relocation of effort to avoid weak meats. Thus, it is not presently possible to estimate economic impacts of weak meats. However, team members will attempt to address this in future iterations of the report. Other changes as requested have been addressed.

**Comment 25.** In addition to these structural changes, the SSC identified the following general issues: Discards for the 2008/09 and 2009/10 seasons are shown in tables; however the tables should clarify whether the 20% discard mortality has been applied to the estimates. In addition, showing the discard weight and catch in the same weight type (round or shucked weight) or providing an additional column with the converted weights for the discards would be useful for comparison.

**Response:** These comments have been addressed.

**Comment 26.** The SSC notes that local and traditional knowledge may be a useful source of information to assess the historical incidence of weak meats.

**Response:** Team members will attempt to address this in future iterations of the report.

**Comment 27.** Catch recorded in round weights should include the conversion information used to estimate weight.

**Response:** This has been addressed.

**Comment 28.** The SSC was informed that only preliminary catch estimates will be available to assess management performance relative to the ACL. This issue should be discussed with the ADF&G to identify whether catch estimates can be finalized on a shorter time frame. While the definitions of OFL and ACL have been established by the NPFMC, the SSC encourages the SPT to continue to explore other methods for estimating biological reference points including Productivity Susceptibility Analysis (PSA), or Depletion-Corrected Average Catch (DCAC), as an example.

**Response:** Please see response to Comment 3.

**Comment 29.** The economic assessment contained within the draft was succinct. The inclusion of the inflation adjusted real price series makes a very nice and informative contribution to the analysis. It would be advisable and appropriate to explicitly note that references to revenues are gross estimates and that all initial sales of scallops, whether fresh or frozen are post-primary processing transactions. That is, the landed product is (presumably) only shucked meats. To the extent practical, the SSC recommends that additional economic data be provided, possibly in an appendix. Examples of potentially useful data include port landings, crew size and wages.

**Response:** To the extent possible these have been included in the economics section as confidentiality allows.

## 1.2 Summary of New Information Included in the SAFE Report

This SAFE Report includes updated information through the 2011/2012 fishing season. New information included in this report since the previous report (NPFMC, 2012) includes the following:

1) Updated observer program summary data through 2011/2012 fishing season; including shell height distributions, retained catch, discarded catch, preliminary 2011/12 catch data where available, bycatch information from the directed fishery including Tanner, snow and red king crab bycatch by region;
2) Updated information on economic wholesale value of the fishery;
3) Annual catch limits (ACL) recommendation for 2013/14 fishing year and preliminary catch through 2012/13;
4) Updated survey information in Prince William Sound and Cook Inlet;
5) Updated haul composition data indicating bycatch in the directed fishery:
6) Revised maps of trawl locations and known scallop locations; and
7) Shell height histograms in addition to the updated age data for the Central district

## 1.3 Historical Overview of the 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. While this

management strategy may have been acceptable for a sporadic and low intensity fishery, 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 in-season 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.

## 1.4 Weathervane Scallop Biology

There are eight known species of scallops in Alaskan waters (Hennick, 1973), but only the Pacific Weathervane scallop is commercially fished. Exploratory fishing for the pink scallop *Chlamys rubida* has not found commercial concentrations and the species is not targeted commercially off Alaska. Weathervane scallops are distributed from Point Reyes, California, to the Pribilof Islands, Alaska. The highest known densities in Alaska have been found to occur along the eastern Gulf of Alaska coast from Cape Spencer to Cape St. Elias, off Kodiak Island and in the Bering Sea. Weathervane scallops are found from intertidal waters to depths of 300 m, but abundance tends to be greatest between depths of 40-130 m on beds of mud, clay, sand, and gravel. Beds tend to be elongated along the direction of current flow. A combination of large-scale (overall spawning population size and oceanographic conditions) and small-scale (site suitability for settlement) processes influence recruitment of scallops to these beds.

***External Anatomy.*** Scallops are bivalves, referring to the right and left valves of a scallop's shell. The weathervane scallop is a large scallop with prominent, heavy, widely spaced, smooth ribs. The valves are wider than long and slightly convex. Weathervane scallops naturally lie on their right valve (bottom valve) which is white in color when scallops are small and light brown to golden yellow in mature scallops. The right valve is typically larger than the left valve (top valve), has less discrete color patterns, and flattened ridges.

The left valve is typically brown in color and may have barnacles and other marine flora and fauna attached to it. The left valve is normally always brown in color but, on occasion, an all white scallop may be found in the catch. A ligament along the dorsal margin at the hinge holds the two valves together. This ligament is a dark, elastic pad called the resilium and is located in a pit in the center of the hinge, at a point referred to as the umbo. The resilium will spring the valves open when the adductor muscle relaxes. Two protrusions at the hinge called auricles (sometimes called ears or wings) lengthen the hinge line. The auricles on individual weathervane scallops are nearly the same size. In a scallop, the hinge area of the shell is dorsal and the edge of the shell opposite the hinge is the ventral margin.

***Internal Anatomy.*** A scallop's soft inner parts can be viewed if the left (top) valve is carefully removed by cutting the adductor muscle away from the valve. The mantle is a thin, almost transparent sheet of tissue that envelops the body. It is normally attached to the valves except near the edges. The functions of the mantle are to secrete the shell, assist in respiration, control the inflow and outflow of water, and control movement when the animal swims. A row of tentacles emerge from the mantle and act primarily as feeding organs. A second row of shorter, more proximal tentacles are chemoreceptors. Numerous eyes occur along the margin of the mantle, capable of sensing shadows or movement.

The large, white, circular adductor muscle is centrally located on the valves. The adductor is composed of a large anterior smooth muscle (known as the "quick muscle") which contracts to snap the valves closed when the scallop is disturbed or swimming, and a smaller posterior striated muscle (known as the "catch muscle") which holds the valves in position after they have been closed by the smooth muscle. The adductor is known as the meat of the scallop and is normally the only part retained. Crescent-shaped gills encircle the adductor muscle and are composed of four demibranchs, two on either side of the body. Along with the mantle, they are used for respiration. The gills are also important in feeding.

The urogenital system is conspicuous upon dissection of a scallop, with the gonad lying in a semicircle around the anterior and ventral portions of the adductor. Sex is easily distinguished by the appearance of the gonad, unless it is completely empty of reproductive cells. The female gonad is orange-red to red in color and the male gonad is creamy white. Two kidneys, seen as small, thin, brown sac-like bodies lie flattened against the anterior part of the adductor muscle. The kidneys empty through large slits into the

mantle chamber. Eggs or sperm are likewise extruded through ducts into the lumen of the kidney and then flow into the mantle chamber and expelled.

The small, white-colored foot is located anterior and ventral to the gonad. In the larval and juvenile stages, the foot is used for locomotion but in the adult, the foot is rudimentary and has little function. The opening of the byssal gland is halfway along the foot. Weathervane scallops often attach themselves to surfaces with an abyssal thread until they are about one year old.

The digestive system consists of a mouth (located anteriorly near the hinge), a short esophagus, a stomach, an intestine that loops through the gonad and around the adductor muscle and an anus. Lying partly in the stomach and partly in the section of the intestine that enters the gonad is a structure called the crystalline style. This organ is amber colored, translucent, and rod-shaped. The crystalline style churns food in the stomach and releases an enzyme that assists in digestion. A simple circulatory system carries blood throughout the soft tissues. The heart lies in a transparent sac (the pericardium) dorsal to the adductor muscle. Blood flows through the anterior and posterior aorta to all parts of the body, and returns via a series of thin walled sinuses which form the venous system.

***Growth.*** Embryonic and larval scallop development is highly affected by temperature. The embryo normally develops into a larva within 72 hours. In the early stage, the larva has two valves, a complete digestive system and a velum. The velum is an organ peculiar to molluscan larvae, and is ciliated along its outer margin enabling the larva to swim well enough to maintain itself in the water column though it drifts with tides and currents. The velum also collects unicellular phytoplankton on which the larva feeds.

Adult scallops are filter feeders, feeding on plankton and other organic materials. Growth is very rapid in the first few years and is minimal after age 10. In general, weathervane scallops are long lived and individuals with shell height of 250 mm and 28 years have been reported.

Most scallops have concentric rings (circuli) on the shell and by studying these it is possible to tell their approximate age. Annuli are compressions of circuli that form during periods of very little growth; an annulus begins to develop on the margin of the scallop shell around October or November. These slow growth periods may correspond to gonad development and spawning activity (November to June) and changes in water temperatures in winter. Growth in young scallops, as indicated by the distances between the first three annuli is rapid, but slows down progressively afterward.

Prior to sexual maturity, annuli are not distinct because growth is relatively rapid for immature scallops. However, an annulus can often be found during the first three years by examining a scallop shell under a microscope and looking for a slowdown in growth. By the ten-ring stage and beyond, the gaps between succeeding annuli are often less than one millimeter. Very little growth takes place after the seventeenth annulus. In the Bering Sea, shells with up to twenty-nine annuli have been noted. Accurate shell aging of scallops is most easily accomplished after a biologist has a wide range of experience with scallop shells. Average shell heights of weathervane scallops vary from population to population (Figure 1-1).

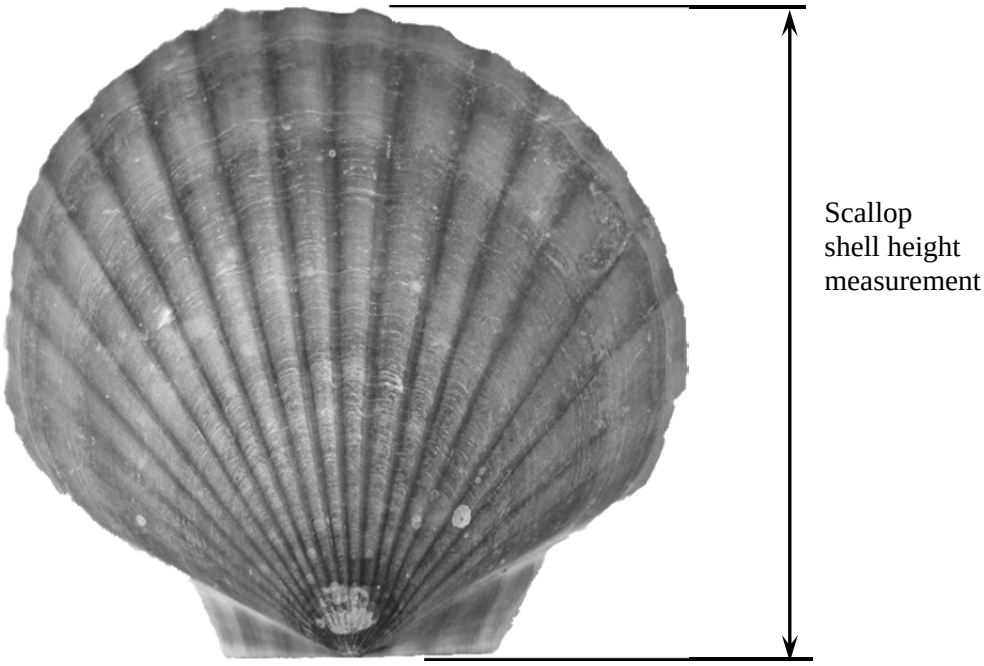



Figure 1-1 Left (upper) valve of weathervane scallop shell showing orientation of shell height measurement.

***Reproduction.*** Weathervane scallops sexually mature around age 3 or 4. They spawn annually, usually in early summer between May and early June and are generally about 100mm in shell height when they are sexually mature. Scallops are dioecious (the sexes are separate) although one hermaphroditic specimen has been reported (Kaiser, 1986). The sexes can be distinguished by the color of the gonads; female gonads are orange-red to red in color, and male gonads are creamy white. Otherwise, male and female gonads are similar in size and shape.

The mechanisms that initiate production and release of eggs and sperm are poorly understood, but water temperature is likely important. Spawning occurs over a protracted period of time and timing of spawning varies based on geographical location. Scallops discharge millions of eggs and sperm, which leave the gonads, pass through the lumen of the kidney, and are expelled from the mantle cavity. Fertilization occurs at random in the water; eggs that are fertilized drift with the tides and currents for several weeks.

Within two to three weeks, metamorphosis takes place and the larva settles to the bottom. Metamorphosis is a time of high mortality, because the animal must rely on food reserves accumulated during the larval period. Over a two-week period, the gills develop into feeding organs. At this stage the larva is mature, with a well-developed foot, a pair of eyespots, rudimentary gills and a transparent shell. The juvenile scallop, or spat, may attach itself to the substrate, use its foot to move around, or swim. Within a few months, the shell becomes pigmented as they become adults.

***Behavior.*** Scallops generally lie on the bottom on their right valve with the valves open about 10-15 mm at the ventral margins. The tentacles are extended and the eyes can be seen. If the scallop is disturbed, the valves are quickly snapped shut. Often, a disturbed scallop will spin in place and end up faced in a different direction. Scallops are the only bivalve mollusks capable of swimming. The scallop uses a water jet action by opening its valves and taking in water, then closing its valves and forcing the water out - propelling the animal forward, ventral margin first. Repetition of this action lifts the scallop off the

bottom, allowing it to swim forward. Swimming is most likely used to avoid predators and distances covered are short, no more than about 10 meters.

# 2 Overview of Scallop Fishery and Management

The scallop fishery is managed jointly by NMFS and ADF&G under the federal FMP for the Scallop Fishery off Alaska. Most management measures under the FMP are delegated to the State for management under Federal oversight. ADF&G management of the weathervane scallop fishery covers both state and federal waters off Alaska. The following sections provide background on the fishery and its management, including registration areas, season, guideline harvest ranges and levels, the onboard observer program, crab bycatch limits, and the Federal License limitation program.

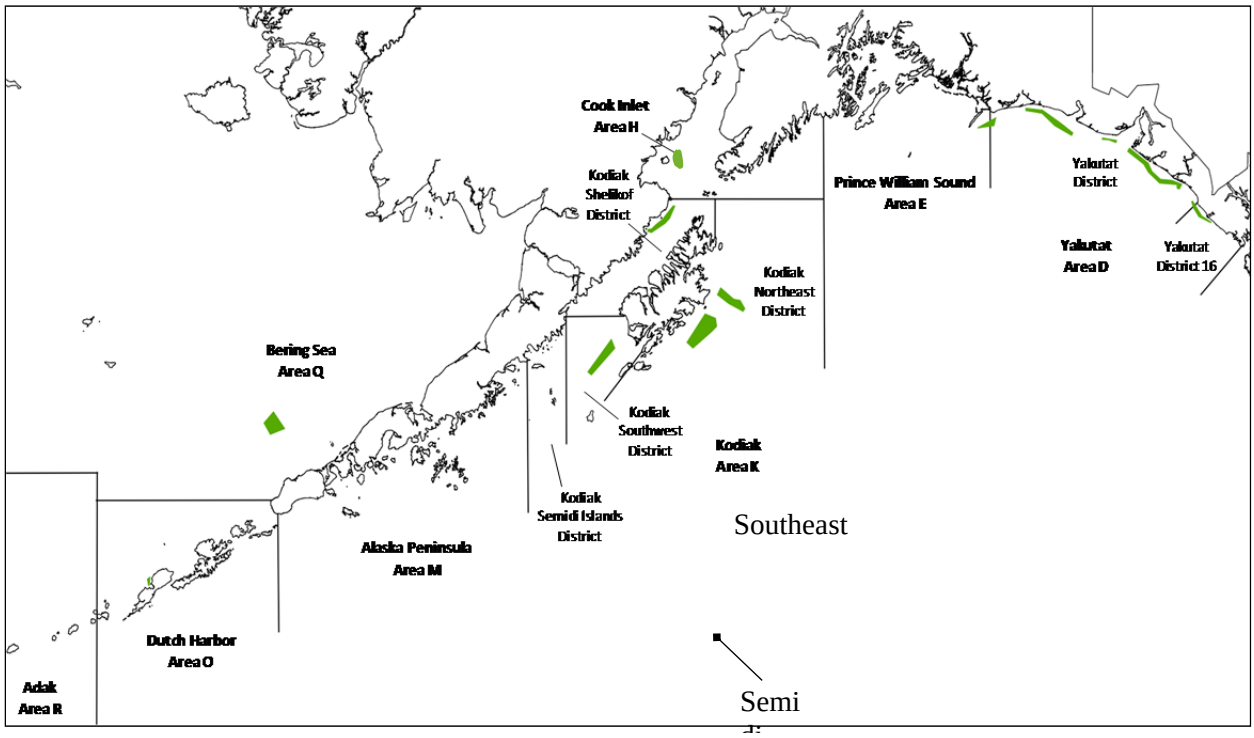



Figure 2-1 Map showing Alaska scallop fishery registration areas. General areas of effort during the 2011/12 season are overlaid by green polygons.

## 2.1 Management

### 2.1.1 Overfishing Definition

Overfishing is a level of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis. MSY is defined as the largest long-term average catch that can be taken from a stock under prevailing ecological and environmental conditions. Amendment 6 to the scallop FMP established MSY for weathervane scallops at 1.24 million lbs of shucked meats based on the average catch from 1990-1997 excluding 1995. Optimum Yield (OY) was defined as 0–1.24 million lbs, and the overfishing control rule was defined as a fishing rate in excess of the natural mortality rate, which has been estimated as $F_{overfishing}$ = M = 0.13 (12% per year) statewide. OY was just recently redefined again in 2012 to 0 to 1.29 million pounds of shucked meats to include known discards over the time frame for which the upper end of the OY range was defined. Catch towards the OFL (and ACL, see

Section 2.1.2 below) is a total catch and thus includes discards. Statewide scallop harvests have not exceeded OY, and scallops are not overfished.

At this time, abundance is estimated for only two of the nine registration areas and a determination of MSST cannot be made. The fishery is managed conservatively with harvest levels well below MSY. Figure 2-2 shows statewide scallop catch and MSY levels both prior to amendment 6 and following inception of the new MSY level in 1996. Since 1996, catches have averaged from 39% to 66% of MSY ( Table 2-1). Control rules for other Alaskan scallop species have not been developed as no commercial harvests occur. Catch by individual registration area is shown in Table 2-2and Table 2-3.

Table 2-1 Alaska weathervane scallop harvest and Maximum Sustainable Yield from FMP, 1993/94—2012/13 seasons.

| Season | Harvest (lbs meat) | MSY | % MSY |
|---|---|---|---|
| 1993/94 | 984,583 | 1,800,000 | 55 |
| 1994/95 | 1,240,775 | 1,800,000 | 69 |
| 1995/96 | 410,743 | 1,800,000 | 23 |
| 1996/97 | 732,424 | 1,800,000 | 41 |
| 1997/98 | 818,913 | 1,800,000 | 45 |
| 1998/99 | 822,096 | 1,240,000 | 66 |
| 1999/00 | 837,971 | 1,240,000 | 68 |
| 2000/01 | 750,617 | 1,240,000 | 61 |
| 2001/02 | 572,838 | 1,240,000 | 46 |
| 2002/03 | 509,455 | 1,240,000 | 41 |
| 2003/04 | 492,000 | 1,240,000 | 40 |
| 2004/05 | 425,477 | 1,240,000 | 34 |
| 2005/06 | 525,357 | 1,240,000 | 42 |
| 2006/07 | 487,473 | 1,240,000 | 39 |
| 2007/08 | 458,313 | 1,240,000 | 37 |
| 2008/09 | 342,434 | 1,240,000 | 28 |
| 2009/10 | 488,059 | 1,240,000 | 39 |
| 2010/11 | 459,759 | 1,240,000 | 37 |
| 2011/12 | 456,058 | 1,290,000 | 36 |
| 2012/13 | 417,551 | 1,290,000 | 34 |

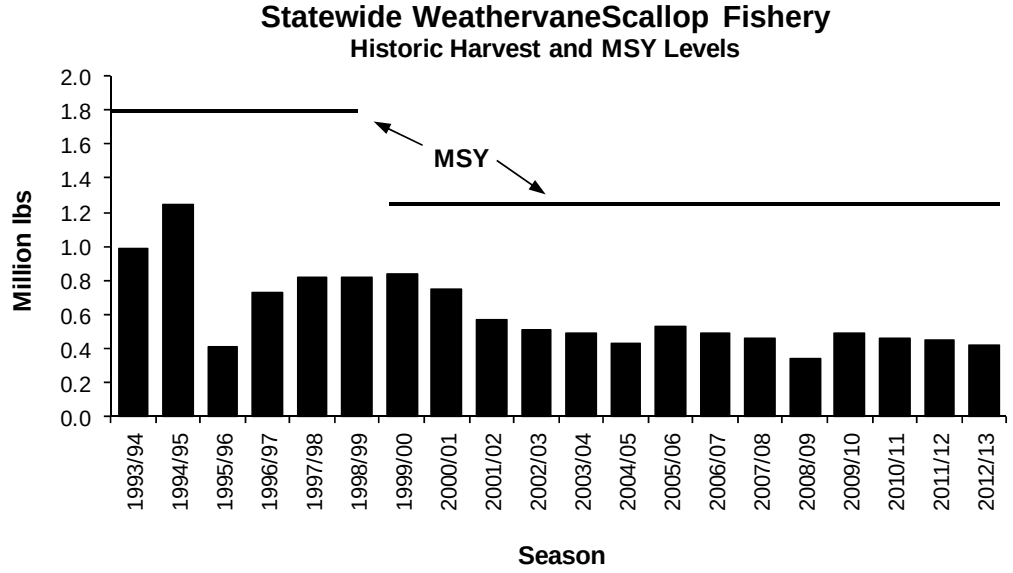



Figure 2-2 Statewide scallop harvest (pounds shucked scallop meats) and MSY levels from FMP.

### 2.1.2 Annual Catch Limits and Accountability Measures

On January 16, 2009, NMFS issued final guidelines for National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). These guidelines provide guidance on how to comply with new annual catch limit (ACL) and accountability measure (AM) requirements for ending overfishing of fisheries managed by federal fishery management plans. Annual catch limits are amounts of fish allowed to be caught in a year. A legal review of the Alaskan Scallop FMP found there were inadequacies in the FMP that needed to be addressed to facilitate compliance with requirements of the MSA to end and prevent overfishing, rebuild overfished stocks and achieve optimum yield.

The new requirements include provisions intended to prevent overfishing by requiring that: FMPs establish a mechanism for specifying ACLs in the plan (including a multiyear 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). Scallop fisheries must have ACL and AM mechanisms by the 2011/2012 scallop fishing year. The MSRA 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.

Procedurally, the SSC must recommend amounts of acceptable biological catch for the stocks in the fishery on an annual basis, and the annual catch limits may not exceed the SSC's fishing level recommendations. The Scallop FMP must also designate which stocks are "in the fishery", as all target stocks in the fishery must have established MSY and OY, as well as ACLs, AMs and ABC control rules. Alaska weathervane scallops are treated as one scallop stock.

In October 2010, the Council took final action on an amendment analysis to meet these requirements. The Council recommended establishing a maximum ABC control rule equal to 90% of the OFL. The Council also recommended that in conjunction with this the OFL will be redefined to account for all estimated sources of fishing mortality. The OFL is re-estimated to include known discards at the time of the average catch calculation employed in establishing this level. The current OFL was estimated based

upon retained catch only, thus the re-estimation is necessary to account for discards occurring over that time period and for consistency with current regulation to account for all sources of mortality. The OFL is considered to be a conservative estimate due to the fact that there are areas of known scallop beds that are not included in the catch calculation as they are currently closed to fishing although they have supported historic harvests in the past. This would result in an OFL = 1.29 million pounds.

Management of an ACL at a statewide level rather than a regional level is a fundamental aspect to this recommendation. The statewide management approach was recommended by both the SPT and the SSC given that the registration areas and their regional groupings themselves are not biologically-based and thus a statewide ACL is more biologically meaningful and consistent with current understanding of stock structure then a regional ACL.

In order to establish adequate accountability measures, the Council recommended that the annual GHL 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 and the FMP only provides an estimate of MSY and OY for weathervane scallops. Under the new reorganization of the FMP, the weathervane scallop stock is by default defined as being 'in the fishery'. The remaining species of scallops under the Alaska Scallop FMP include pink scallops, spiny scallops and rock scallops. The Council recommended moving these non-target scallops (pink, spiny and rock scallops) into Component of the FMP as their preferred management approach "Ecosystem component (EC) species" generally are not retained for any purpose, although *de minimis* amounts might occasionally be retained. This approach is preferred as it eliminated the risk of over-harvesting these species should they be removed from the FMP, while acknowledging that information is not sufficient to establish ACLs for these species at this time, nor is harvest of these species currently occurring.

To be considered for possible EC classification, species should, among other considerations, conform to the following criteria; conversely, failure to satisfy these criteria could eliminate some groups from further consideration as EC species.

- Be a non-target species or non-target stock;
- Not be determined to be subject to overfishing, approaching overfished, or overfished;
- Not be likely to become subject to overfishing or overfished in the absence of conservation and management measures; and
- Not generally be retained for sale or personal use.

Additional information on the noon-target scallop stocks is contained in Section 4.1.

#### 2.1.2.1 ACL recommendation for the 2012/13 Scallop fishing season

The SPT recommends that the ACL for the weathervane scallop stock in the 2012/13 fishing year be established as the maximum ABC equal to 90% of the statewide OFL. The SPT will evaluate total catch (including discards) against this statewide ACL level in the 2013 SAFE report for the 2011/12 fishing year to determine if this ACL has been exceeded. The Scallop SAFE and data therein is lagged one year (although preliminary data from the current year is presented to the extent available but final catch numbers are not available until the subsequent year).

#### 2.1.2.2 Catch in relation to ACLs

The following tables summarize the total catch in relation to the area-specific GHLs (retained catch), discards by area and the total statewide retained catch, discards and total catch. The total catch is then compared against the ACL which is applied statewide. Final catch in relation to the ACL for 2012/13 will be provided in the 2014 Scallop SAFE report. Preliminary retained catch from the 2012/13 fishery is also provided in Table 2-3 but discard estimates are not yet available for comparison. This information will be provided in the 2014 SAFE report.

Table 2-2 GHLs and summary statistics from 2011/12 Alaska weathervane scallop fishery.

| Area/District | GHL (lbs meat) | Retained catch (lbs meat) | CPUE (lbs meat per dredge hr) | Est scallop discard mortality (lbs meat)[a] |
|---|---|---|---|---|
| Yakutat Area D | 160,000 | 157,560 | 34 | 10,019 |
| Yakutat District 16 | 25,000 | 1,825 | 32 | 53 |
| Prince William Sound | 8,400 | 8,460 | 52 | 197 |
| Cook Inlet | 12,500 | 9,558 | 31 | 418 |
| Kodiak Northeast District | 70,000 | 61,209 | 62 | 1,647 |
| Kodiak Shelikof District | 135,000 | 136,491 | 56 | 2,206 |
| Kodiak Southwest District | 25,000 | 25,110 | 55 | 306 |
| Dutch Harbor | 10,000 | 5,570 | 73 | 44 |
| Bering Sea | 50,000 | 50,275 | 51 | 530 |
| Statewide total | 495,900 | 456,058 | 50 | 15,420 |

[a]Conversion of scallop discard estimates to discard mortality in lbs meat uses 8.6% meat recovery estimate based on statewide retained catch (lbs meat) and estimated retained round catch from 2011/12 season and assumption of 20% mortality of discarded scallops as previously used in scallop ACL analysis.

Table 2-3 GHLs and preliminary catch from the 2012/13 Alaska weathervane scallop fishery.

| Area/District | GHL (lbs scallop meats) | Retained catch (lbs scallop meats) |
|---|---|---|
| Yakutat Area D | 120,000 | 117,725 |
| Yakutat District 16 | 25,000 | 24,985 |
| Prince William Sound | Closed | 0 |
| Cook Inlet | 12,500 | 11,407 |
| Kodiak Northeast District | 60,000 | 62,391 |
| Kodiak Shelikof District | 105,000 | 105,902 |
| Kodiak Southwest District[a] | 25,000 | 24,976 |
| Alaska Peninsula – Unimak Bight[a] | 15,000 | 15,040 |
| Dutch Harbor | 5,000 | 5,100 |
| Bering Sea | 50,000 | 50,025 |
| Statewide total | 417,500 | 417,551 |

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

### 2.1.3 Registration Areas

The State of Alaska Scallop Fishery Management Plan established 9 scallop registration areas in Alaska for vessels commercially fishing scallops (Figure 2-1). These include the Southeastern Alaska Registration Area (Area A); Yakutat Registration Area (Area D and District 16); Prince William Sound Registration Area (Area E); Cook Inlet Registration Area (Area H); Kodiak Registration Area (Area K), which is subdivided into the Northeast, Shelikof and Semidi Districts; Alaska Peninsula Registration Area (Area M); 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.

### 2.1.4 Seasons

The regulatory fishing season for weathervane scallops in Alaska is July 1 through February 15 except in the Cook Inlet Registration Area. In the Kamishak District of Cook Inlet, the season is August 15 through October 31, and in all other districts of Cook Inlet, the season is from January 1 through December 31 only under terms of a commissioner's permit (Figure 2-3). 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 and CBLs are typically announced by ADF&G approximately one month prior to the season opening date.

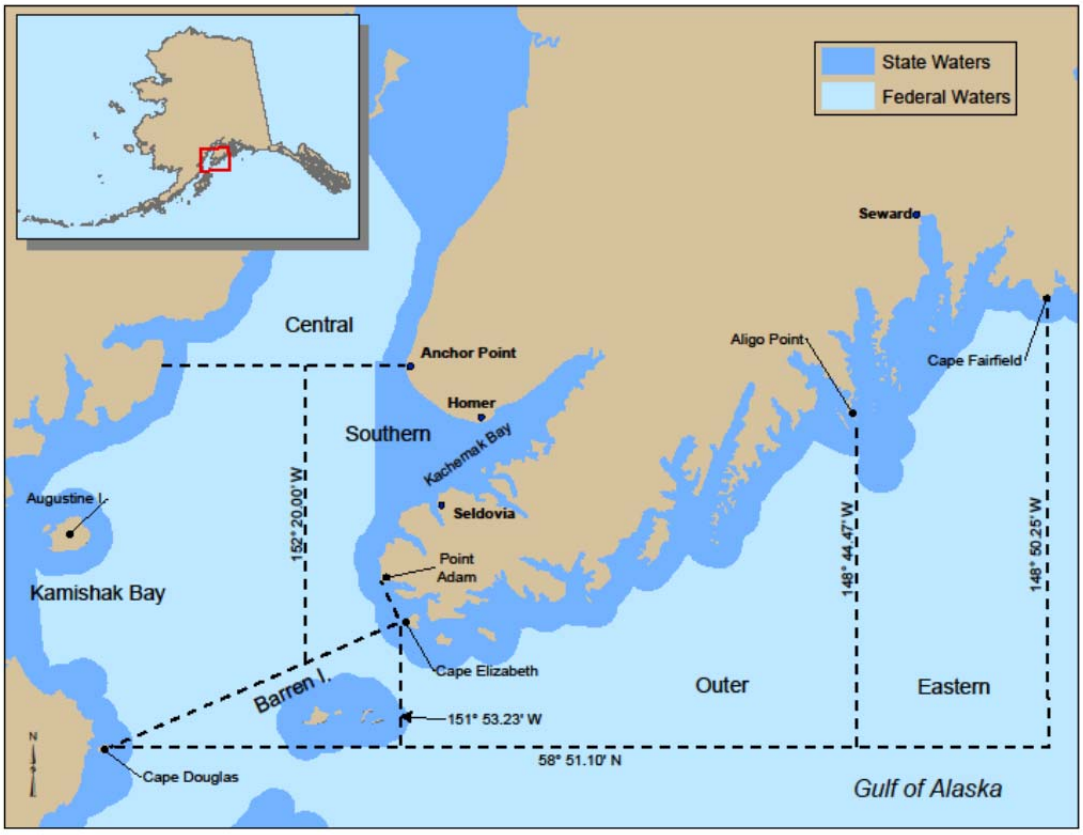



Figure 2-3 Cook Inlet Management Districts.

### 2.1.5 Guideline Harvest Ranges (GHR)

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.

Guideline harvest limits (GHLs) are pre-season targets set for each fishing area (registration area, district, or statistical area) prior to each season. Total harvest for each fishing area during a given season will typically be 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 (lbs of shucked scallop meats) were set at 0–250,000 lbs. for Yakutat, 0–50,000 lbs. for Prince William Sound, 0–20,000 lbs for the Kamishak District of Cook Inlet, 0–400,000 lbs for Kodiak, and 0–170,000 lbs 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 lbs for the Alaska Peninsula, 0–600,000 lbs for the Bering Sea, 0–35,000 lbs for District 16, and 0–75,000 lbs for Adak. The combined total of the upper limits from traditional and non-traditional areas was 1.8 million lbs, which was defined as maximum sustainable yield (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 lbs, with optimum yield defined as the range 0–1.24 million pounds. To accommodate the new definition, regulatory GHR ceilings were reduced by the State of Alaska from 400,000 to 300,000 lbs for Kodiak, from 170,000 to 110,000 for Dutch Harbor, and from 600,000 to 400,000 lbs for the Bering Sea. Hence, MSY and the regulatory GHR ceiling written into Alaska law are both 1.24 million lbs.

### 2.1.6 In-season data

Observers that 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 thrice weekly. Fishing may be closed in any area before the GHL is reached due to 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 bycatch.

## 2.2 Stock Assessments and GHLs

Management of the Alaska scallop fishery is handled by ADF&G biologists from the three regions where scallop fishing occurs. In general, the state's approach to management is conservative, with large areas known to contain scallops closed to fishing (see Section 4.4) and onboard observers required on all vessels operating outside Cook Inlet.

Dredge surveys are conducted only in Central Region and data are used to set GHLs for Kayak Island (Area E) and Cook Inlet (Area H). Scallop observer program data are the primary information source for setting GHLs in all other areas. These data consist of time series of scallop harvest and fishing effort, including catch per unit effort (CPUE), fishing locations, size structure of the catch, discard of scallops, and crab bycatch. Spatially explicit catch and effort data that cannot be displayed in the SAFE report due to State of Alaska confidentiality requirements are examined by ADF&G staff each year when GHLs are set.

ADF&G and the SPT recognize inherent weaknesses in using fishery data for management purposes. CPUE may be an unreliable index of scallop abundance due to factors such as market conditions, weather on the grounds, tides, gear efficiency, bycatch avoidance, captain and crew performance, etc. Industry participants have noted that the time of year when fishing occurs can drastically affect CPUE due to

differences in weather and sea state between summer and winter. Size composition data from the commercial catch are affected by choice of fishing locations and gear selectivity and hence may not be representative of the true size composition of any scallop population.

ADF&G is developing methodology to survey scallop beds with a towed imaging system, ADF&G CamSled (Rosenkranz et al. 2008). Currently, efforts are focused on collection of baseline data from primary fishing areas in the Gulf of Alaska (GOA), training personnel to operate the equipment, manual review of images, and statistical techniques for abundance estimation. Fieldwork planned for 2010 includes an NPRB-funded project examining Tanner crab habitat in the Kodiak vicinity and a survey of Kodiak scallop beds on a chartered industry vessel. Due to the large volumes of data collected, another priority is a workshop on computer processing of benthic image data tentatively planned for Kodiak in 2013.

### 2.2.1 Southeast Alaska Region

No regular assessment surveys are conducted in the Southeast Alaska Region. Management of the fishery relies solely on fishery dependent data. Separate GHLs are assigned for Area D and District 16, both of which fall into Scallop Registration Area D (Yakutat). Southeast shellfish management staff meets annually with the scallop biometrician to go over his analysis of the most recent scallop observer data. Data considered when adjusting GHLs include: total harvest and CPUE for the entire registration area; total harvest and CPUE by scallop bed; daily CPUE versus cumulative catch in each bed where effort occurred; shell height histograms for Area D and District 16; and Tanner crab bycatch for the entire registration area. The GHLs are set prior to each fishing season based on these data. There are no crab bycatch limits in Scallop Registration Area D. The fishery is managed by Quinn Smith (Douglas office).

### 2.2.2 Central Region

ADF&G conducts biennial dredge surveys for weathervane scallops in the Kamishak District of the Cook Inlet Management Area and near Kayak Island in the Prince William Sound Management Area (Figure 2-4 and Figure 2-5). Data from these surveys are used to set guideline harvest limits (GHLs) for two scallop beds at each location. In the Kamishak District fishery, observers are not required, but vessels are limited to a single 6 ft dredge, and ADF&G staff is regularly deployed as observers when fishing occurs. The Cook Inlet fishery is managed by Jan Rumble and Elisa Russ from the Homer office and the Kayak Island fishery is managed by Maria Wessel from the Cordova office and Jan Rumble.

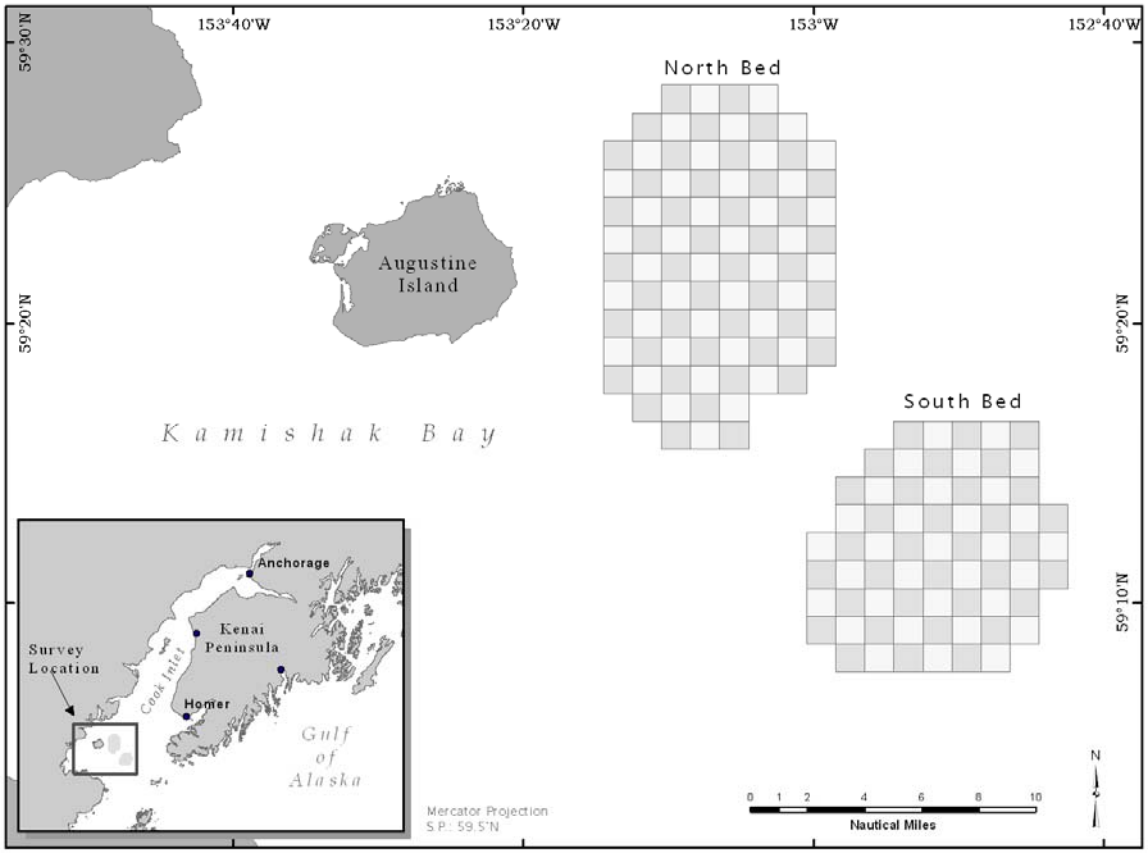



Figure 2-4 Location of main scallop beds in Kamishak Bay with the delineated edge of each scallop bed and black and white checkerboard sampling grid shown.

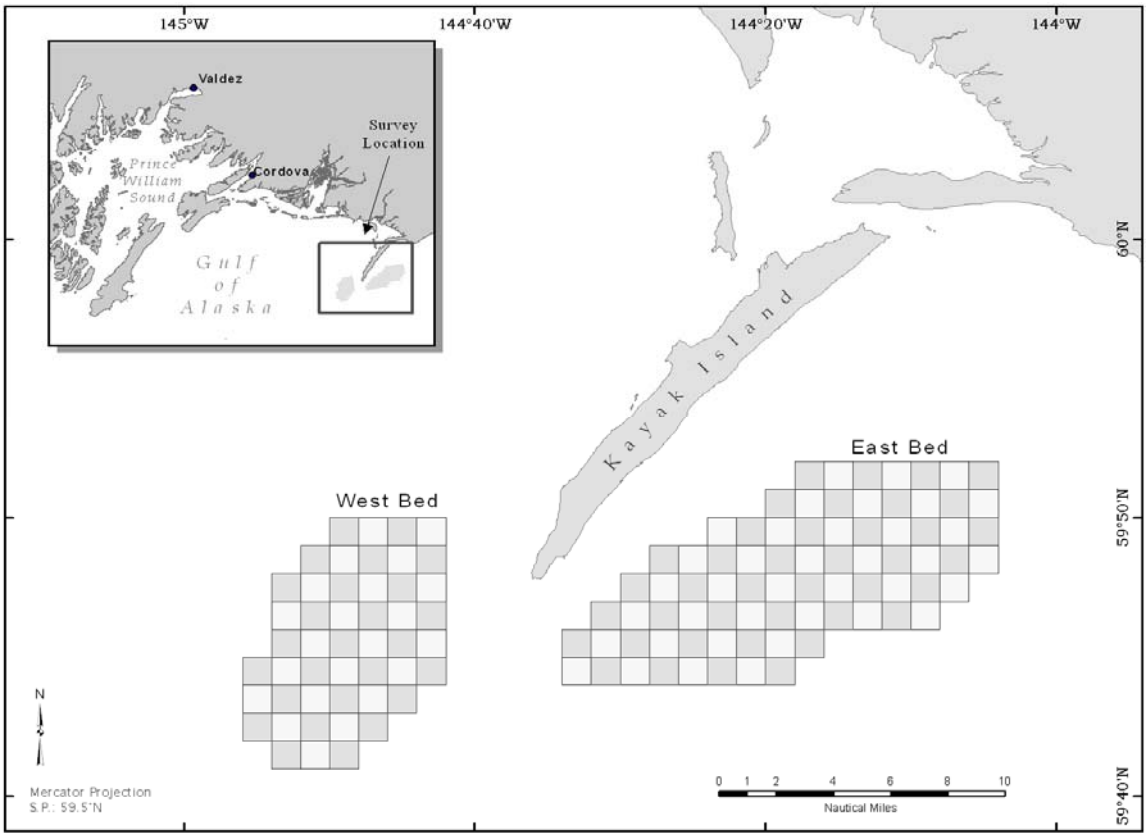



Figure 2-5 Location of main scallop beds at Kayak Island with the delineated edge of each scallop bed and black and white checkerboard sampling grid shown.

#### 2.2.2.1 Surveys through 2006

Central Region conducts fishery independent, area-swept, dredge surveys with a systematic sampling design. From 1996 through 2006, this systematic survey design was accompanied by an adaptation for delineating the edge of the scallop beds. Sampling stations were defined by overlaying a checker-board grid of 1,855 $m^2$ (1.0 $nmi^2$) squares over a chart of the study area (Figure 2-4 and Figure 2-5). A systematic design was used in which every other station was designated for sampling after the primary sampling unit (light or dark squares) was randomly selected to give an equal probability of selecting either set of grid cells. The vessel skipper, in cooperation with the project leader, determined the specific tow location within each sample station. The dredge was towed for a distance of approximately 1,855 m (1.0 nmi) within the sample station. To delineate the scallop bed margin, stations (light or dark) were added diagonally when catches along the edge of the initial sampled stations exceeded a threshold level of 9.1kb (20 lb). The edge of a scallop bed was considered delineated when catch in a given station was below the threshold amount.

#### 2.2.2.2 Surveys since 2007

The 2007 Kamishak Bay and 2008 Kayak Island surveys were set to standardized areas, which continue to be used (Gustafson and Goldman 2012). The survey designs were done in a manner that enables all previous years of survey data to be standardized and comparable; all historical survey catch data was entered into ARC GIS and, for each year, a polygon was drawn around all stations where the catch exceeded the threshold of 9.1 kg/nm (20 lbs). Ancillary stations will be conducted outside these standardized areas to look for changes in bed size or shape. Central Region staff has also developed a sled-dredge, which is analogous to the video sled used by the statewide scallop program in Kodiak;

however, instead of only allowing for video and counts to be made, this sled has a pinning system on the back to allow for an ~6' wide dredge setup to be attached. The sled-dredge setup allows for video cameras to look forward and aft to obtain counts of scallops before the sled reaches them and looking aft at the foot of the dredge bag to examine the efficiency of the gear (i.e. how many scallops go in vs. under the dredge) and collects scallops for obtaining data on shell height, age and meat weight, which are critical to pursuing an age-structured model and for setting the GHL's at Kayak Island and in Kamishak Bay. The sled-dredge continues to undergo field tests with the goal of comparing catches to the 8' dredge and eventually replacing the 8' dredge with the sled dredge for all scallop surveys in Central Region (Gustafson and Goldman 2012).

#### 2.2.2.3 Guideline Harvest Levels (GHLs) in Central Region

Regular assessments have been conducted biennially on Central Region scallop beds at Kamishak Bay and at Kayak Island since 1996. Data from the assessments are used to set GHLs which are then in effect for the subsequent two seasons. Following several surveys designed to establish the extent of the beds, the department standardized the survey area for each bed beginning in 2007 for Kamishak and in 2008 for Kayak. The Kayak Island estimate was adjusted using a dredge efficiency of 0.83, which is based upon the relative efficiency from a small amount of dredge/video comparison work conducted in 2004. Comparison between the video sled and the dredge was conducted at Kamishak in 2007 but has not been incorporated into management decisions. The department has applied a 5% harvest rate to the final survey estimates of abundance and used whole weight to meat weight conversions to assign the GHL for each area. Typically, the fishery remains open until the GHL is achieved. However, through its emergency order authority the department may close a season or area in response to declines in CPUE or even apparent die-offs as occurred at Kamishak in 2002. Additionally, in setting GHLs the department may consider such factors as a narrow size or age distribution or truncation of sizes observed within an area.

### 2.2.3 Westward Region

Regular scallop stock assessment surveys are not conducted in Westward Region. GHLs are set after review of observer data collected during recent seasons. For some areas, GHLs are set by statistical area to spread effort and reduce the likelihood of localized depletion. Management staff also set CPUE benchmarks for some areas prior to the season, and if CPUE falls below the benchmark level during fishing, management staff meets to review inseason observer data and the fishery may be closed or allowed to continue. In all areas, crab bycatch and CPUE are closely monitored during the season, and scallop harvest may be stopped due to high crab bycatch or poor fishery performance. State regulation 5 AAC 39.975(27) defines guideline harvest level (GHL) as the preseason estimated level of allowable fish harvest which will not jeopardize the sustained yield of the fish stocks. In general, ADF&G manages scallops without biomass estimates. Therefore, inseason management should be precautionary given the lack of biomass information. An area, district, section or portion thereof may close to fishing before or after the GHL has been reached if principles of management and conservation dictate such action.

In the Westward Region, stock information consists of previous seasons' fishery data (catch per unit effort or CPUE, retained shell height, discard quantity and discard shell height) and inseason information on CPUE and crab bycatch. CPUE is assumed to decline as the stock declines.

Concern over declining harvest prompted a review of fishery performance. Westward Region implemented a minimum performance standard as part of inseason management assessment. Beginning with the 2003/2004 season ADF&G began establishing minimum performance standards. All major harvest areas now have standards developed.

CPUE is tracked throughout the season by management area and compared to the minimum performance standard. If the inseason cumulative CPUE is less than or equal to the minimum performance standard, at approximately half the upper end of GHL, the fishery may close prior to achieving the upper end of the

GHL. If CPUE is higher than the minimum performance standard, the fishery may continue toward the upper end of the GHL with continued monitoring. This approach is applied to management areas, major beds within management areas and statistical reporting areas, depending upon the level of concern. This approach is used to help guard against localized depletion.

## 2.3 Fishery

Scallop vessels in the Alaska fishery are 58–124 feet length overall, with maximum 1,200 horsepower. Standard New Bedford style scallop dredges are used in the fishery. On average, a 15-foot dredge weighs a minimum of 2,600 pounds and a 6-foot dredge weighs at least 1,000 pounds. The frame design provides a rigid, fixed dredge opening. Attached to and directly behind the frame is a steel ring bag consisting of 4-inch (inside diameter) rings connected with steel links; 4 inch or larger rings are required by state law. A sweep chain footrope is attached to the bottom of the mesh bag. The top of the bag consists of 6-inch stretched mesh polypropylene netting which helps hold the bag open while the dredge is towed along the ocean floor. A club stick attached to the end of the bag helps maintain the shape of the bag and provides for an attachment point to dump the dredge contents on deck. Steel dredge shoes that are welded onto the lower corners of the frame bear most of the dredge's weight and act as runners, permitting the dredge to move easily along the substrate. Each dredge is attached to the boat by a single steel wire cable operated from a deck winch.

Scallop fishing operations involve the following steps: (a) dredge deployment; (b) dredge towed for 50 to 60 minutes on the bottom at an average speed of 4.7 knots; (c) dredge retrieved; (d) dredge contents emptied on deck; (e) retained scallops sorted from the catch and bycatch discarded overboard; (f) baskets of retained scallops moved from the deck to the shucking area; (g) gear prepared for the next set; (h) gear deployed; and (i) shuck, wash, grade, package and freeze scallop meats. The scallop meat is the single adductor muscle that is removed from the scallop by crew members using specialized hand-held scallop knives. Scallop meats represent approximately 8-12% of the round weight depending on area and season (Barnhart and Rosenkranz, 2003). Scallop meats are graded by size and sold primarily to domestic seafood markets, with a smaller amount going to foreign markets (Kruse et al, 2005).

## 2.4 Observer Program

The primary purposes of the onboard scallop observer program are to collect biological and fishery data and to monitor bycatch. ADF&G requires observers on all trips of all vessels fishing scallops outside Cook Inlet in both state and federal waters. Observers are briefed and debriefed by ADF&G staff from the Kodiak office prior to and after deployment.

Dredge hauls are sampled to collect data on retained scallop catch, crab and halibut bycatch, scallop discards, and catch composition. Detailed logbooks completed by vessel operators are checked by observers and submitted to ADF&G along with other observer data forms. Observers send summary reports to ADF&G fishery managers thrice weekly or more frequently during the season by radio or email. Data are entered, stored, and maintained by ADF&G staff in Kodiak. Observer data are used for inseason management and in setting seasonal GHLs. Scallop observer data are released to the public in reports prepared by ADF&G (e.g., Rosenkranz and Burt, 2009).

Onboard observer coverage is funded by industry through direct payments to independent contracting agents. Scallop observers are trained by ADF&G staff in Kodiak. Observer training and deployment manuals (e.g., ADF&G, 2009) are prepared by ADF&G staff.

Observer cost for vessels limited to a single 6-ft dredge in federal waters was addressed in Amendment 10, section 6.8 of the Scallop FMP. The Council determined that given existing observer requirements

and their associated costs, the single 6-ft dredge restriction created a disproportionate economic hardship when fishing in federal waters (NPFMC, 2004). Amendment 10 allows two vessels to fish with two 10-ft dredges to capture a larger share of the total catch, thus allowing them to offset observer costs and perhaps enhance their economic viability.

## 2.5 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 NPFMC 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 is not adjusted seasonally.

In the Kodiak, Alaska Peninsula, and Dutch Harbor Registration Areas, the CBLs are set at 0.5% or 1.0% of the total crab stock abundance estimate based on the most recent survey data. Statewide CBLs by region are shown in Table 2-4. Information specific to individual regions is indicated in the sections below. In registration areas or districts where red king crab or Tanner crab abundance is sufficient to support a commercial crab fishery, the cap is set at 1.0% of the most recent red king crab or Tanner crab abundance estimate. In registration areas or districts where the red king crab or Tanner crab abundance is insufficient to support a commercial fishery, the CBL is set at 0.5% of the most recent red king crab or Tanner crab abundance estimate. Bycatch caps are expressed in numbers of crabs and include all sizes of crabs caught in the scallop fishery.

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 is fixed at 60 crabs. In 2001, ADF&G set Tanner crab bycatch caps 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. These levels have remained in place for all subsequent years.

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 1995, ADF&G recommended that CBLs be established at 0.003176 percent of the best available estimate of C. opilio (snow crab) and 0.13542 percent of the best available estimate of Tanner crab abundance in Registration Area Q. That equated to about 300,000 snow and 260,000 Tanner crabs based on 1994 crab abundance estimates in Registration area Q. In Amendment 1 of the federal scallop FMP, the NPFMC approved the CBLs established by ADF&G. The NPFMC also recommended that king crab bycatch limits be set within a range of 500 to 3,000 annually. 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.

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. 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 caps. 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. Crab bycatch limits set for 2011-12 established for management in numbers of crab are shown in Table 2-5.

Table 2-4 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 16 | NE[a] | NE | NA[b] |
| Yakutat Area D | NE | NE | NA |
| Prince William Sound | NE | 0.5% | NA |
| Cook Inlet Kamishak District | 60 crab | 0.5% | NA |
| Kodiak Northeast District | 0.5% or 1.0% | 0.5% or 1.0% | NA |
| Kodiak Shelikof District | 0.5% or 1.0% | 0.5% or 1.0% | NA |
| Kodiak Semidi District | NE | NE | NA |
| Alaska Peninsula | 0.5% or 1.0% | 0.5% or 1.0% | 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.*

Table 2-5 Crab bycatch caps by Area/District for the 2011/12 Alaska weathervane scallop fishery.

| **Area/District** | **Chionoecetes crabs** | **King crab** |
|---|---|---|
| Yakutat Area D | NE | NE |
| Yakutat District 16 | NE | NE |
| Prince William Sound | | |
| Cook Inlet | | |
| Kodiak Northeast District | 147,956 | 8 |
| Kodiak Shelikof District | 27,636 | 134 |
| Kodiak Southwest District | 12,000 | 50 |
| Dutch Harbor | 10,000 | 10 |
| Bering Sea *C. bairdi* | 65,000 | 500 |
| Bering Sea *C. opilio* and hybrids | 300,000 | NA |

NE: not established; NA: not applicable

Bycatch of snow crabs, Tanner crabs, and Bristol Bay red king crabs by scallop fisheries are shown in Table 2-6 and Figure 2-6. 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 samples crabs by registration area are available in Figure 2-7 and 2-8 for 2011/12 fisheries.

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 off of high bycatch areas. ADF&G closely monitors bycatch rates during scallop seasons and has used a rate of one crab per pound of scallop meats as a benchmark since 1993. Bycatch may affect harvest and CPUE in the Bering Sea scallop fishery as vessel operators move or cease fishing when bycatch rates meet or exceed this benchmark.

Table 2-6 Bycatch of *Chionoecetes* crabs by Area/District in the 2011/12 Alaska weathervane scallop fishery.

| Area/District | Est. number crab | Est. weight (lbs)[a] |
|---|---|---|
| Yakutat Area D | 11,558 | 162 |
| Yakutat District 16 | 53 | <1 |
| Prince William Sound | 0 | 0 |
| Cook Inlet | 551 | 50 |
| Kodiak Northeast District | 29,185 | 6,518 |
| Kodiak Shelikof District | 27,684 | 3,128 |
| Kodiak Southwest District | 8,894 | 3,742 |
| Dutch Harbor | 617 | 144 |
| Bering Sea *C. bairdi* | 22,363 | 14,687 |
| Bering Sea *C. opilio* and hybrids | 13,073 | 11,630 |
| Statewide total | 113,978 | 40,062 |

*a Weight estimation for areas outside Cook Inlet uses estimated number crab, carapace width distributions from scallop observer sampling (Figures 2-7 through 2-12), and statistical CW-weight relationship parameters from NMFS Bering Sea crab research. Cook Inlet estimate is based on sampling weight of crab by ADF&G.*

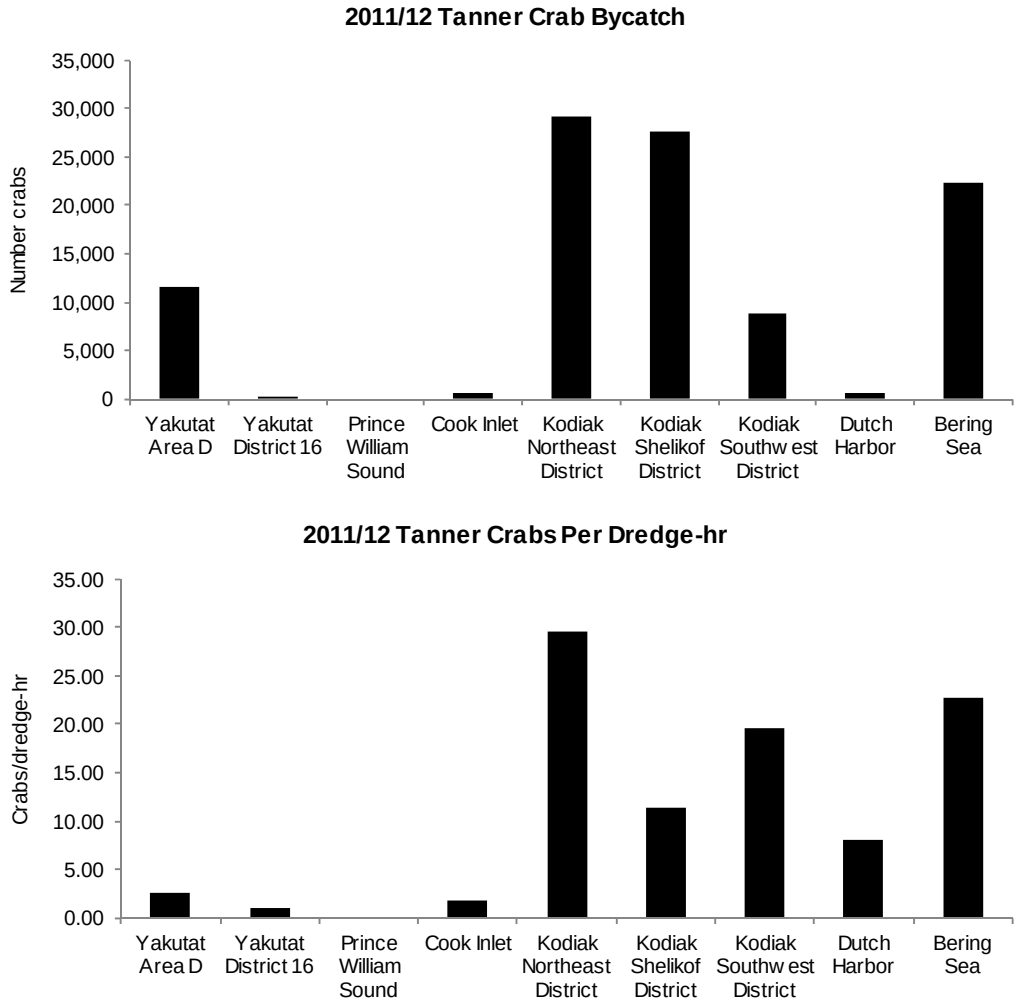



Figure 2-6 Estimated Tanner crab bycatch (top) and bycatch rate (bottom) during the 2011/12 scallop fishing season.

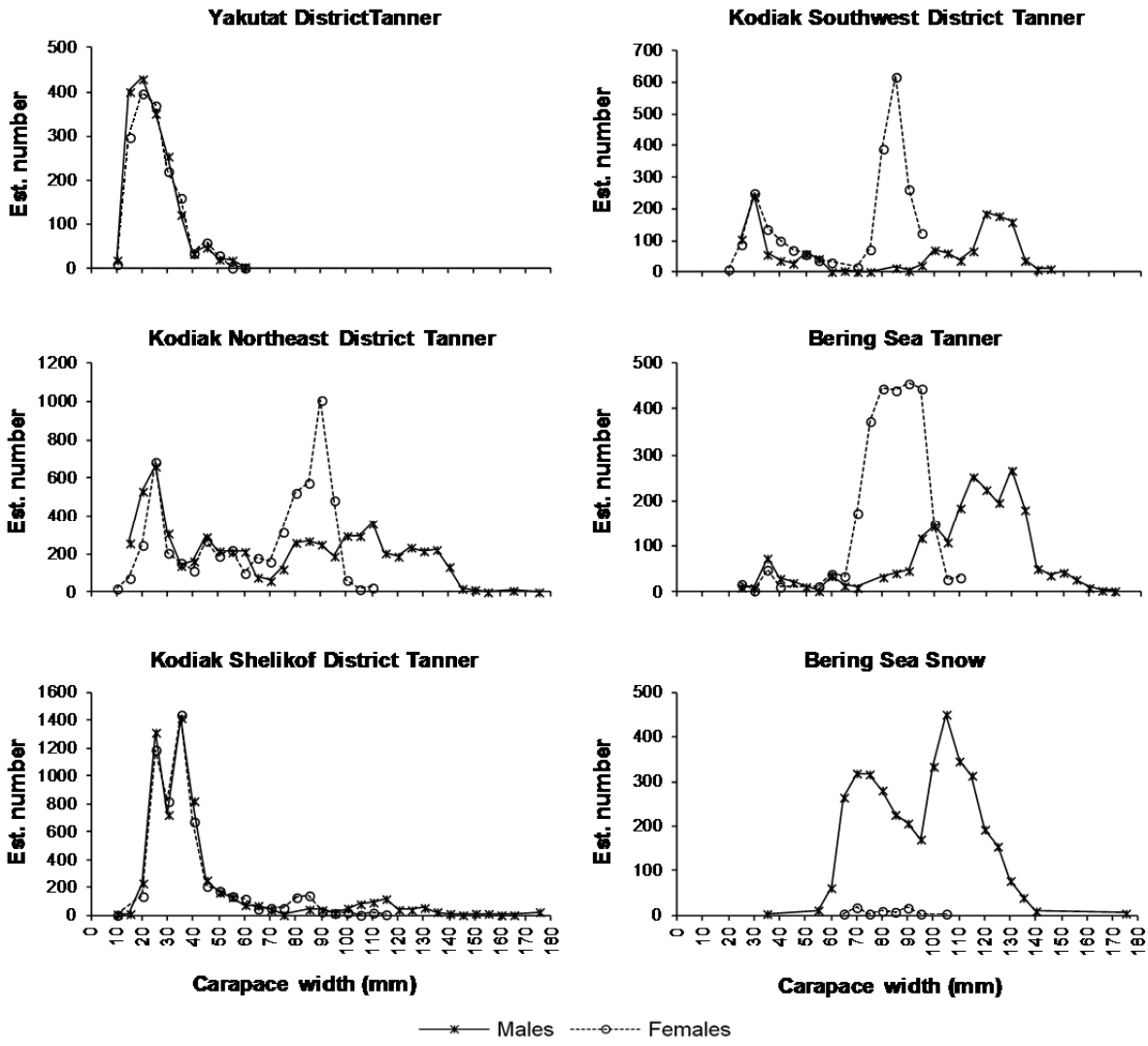
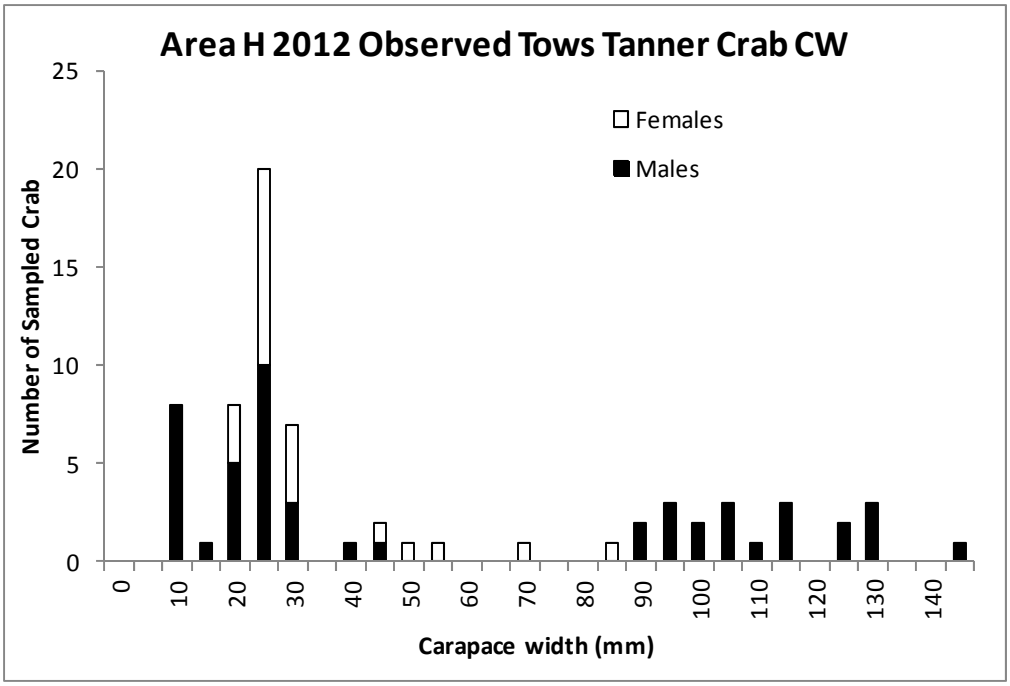



Figure 2-7 *Chionoecetes* sp. crab carapace width distributions by management unit from catch sampling during the 2011/12 scallop fishery. Fourteen Tanner crabs all with carapace width less than 26 mm were sampled during the Yakutat District 16 fishery and no plot was constructed.



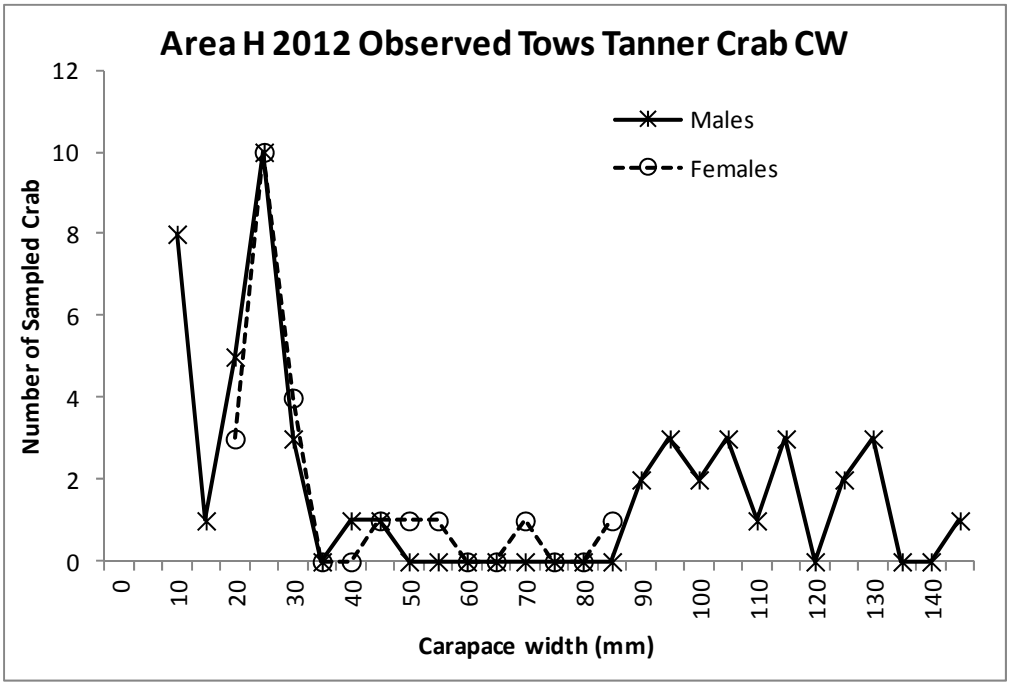




Figure 2-8 Tanner crab bycatch carapace width and frequency in Kamishak District fishery in 2012.

## 2.6 Scallop License Limitation Program

Commercial weathervane scallop fishing in federal waters off Alaska is limited by a Federal license limitation program (LLP), while participation in state waters (0-3 nautical miles) is limited by a vessel-based limited entry program. The LLP limits participation in the statewide scallop fishery in Federal waters to nine vessels.

The Federal Scallop License Limitation Program became effective in 2001. The NPFMC created the scallop LLP under Amendment 4 to the FMP to limit the number of participants and reduce fishing capacity. The LLP license is required on board any vessel deployed in the weathervane scallop fishery in federal waters off Alaska. NMFS granted 7 vessel owners licenses to fish statewide outside Cook Inlet. Originally, NMFS granted two vessel owners licenses to fish statewide utilizing a single 6-foot dredge. In August, 2005, NMFS implemented Amendment 10 to the FMP, which modified the gear restriction to allow these two licenses to be used on vessels with up to two 10-foot dredges statewide. All 9 licenses allow vessel owners to fish inside Cook Inlet with a single 6-foot dredge. Vessel length is limited to that of the qualifying period. All vessels fishing inside the Cook Inlet Registration Area are limited by state regulation to a single dredge not more than 6 feet in width. 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.

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 current 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. Therefore, the vessel permit system for scallops and hair crab will sunset on December 30, 2013. Eight vessel owners received permits to fish for weathervane scallops in state waters.

Two vessels with multiple LLP permits as well as state vessel-based limited entry permits have harvested most of the scallop catch outside Cook Inlet over the past several seasons. Three vessels 80 feet or less LOA typically participate in the Cook Inlet Registration Area fishery. Occasionally, one or more of these vessels participate in the scallop fishery outside of Cook Inlet. More information on the scallop LLP can be found on the NMFS Alaska Region web page at: http://www.fakr.noaa.gov/ram/smp.htm

## 2.7 Voluntary Scallop Cooperative

In May 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 GHR 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. More information on the voluntary scallop cooperative can be found in the EA/RIR/IRFA for Amendment 10 to the Scallop FMP available on the Council website at: www.fakr.noaa.gov/npfmc/analyses/analyses.htm.

# 3 Stock Status

The following sections provide summaries of recent scallop fishery performance for each registration area. Dredge survey summary data are provided for Prince William Sound and the Cook Inlet Registration Area. In other areas, dredge surveys are not performed. Fishery CPUE and data from the scallop observer program are the primary information sources. ADF&G camera sled image data have been collected in several management areas, but these data have not yet been used for fishery management purposes. A comparison of information compiled across all registration areas is show in Figure 3-1.

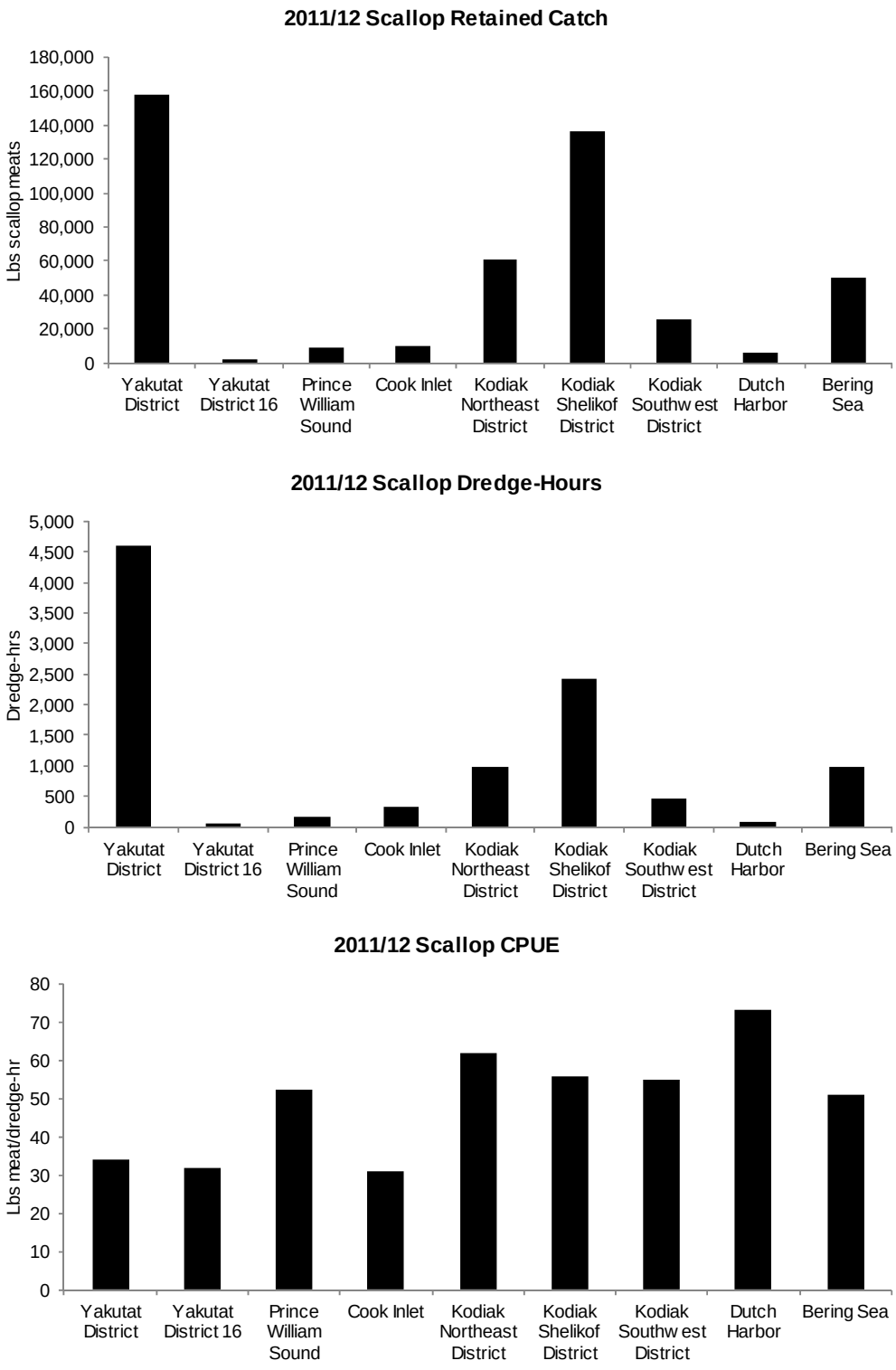



Figure 3-1 Scallop catch (top), dredge-hrs (center), and CPUE (bottom) during the 2011/12 statewide weathervane scallop fishery.

## 3.1 Yakutat Registration Areas: Area D and District 16

When considering GHLs for the Yakutat scallop fishery, data included fishery, and observer information. The GHRs in regulation for scallop harvest are 0 – 35,000 pounds in District 16 [5 AAC 38.168(1)], and 0 – 250,000 pounds in Area D [5 AAC 38.168(2)]. These GHRs were established with implementation of the scallop management plan in the 1993 season and are based on the average historic catch from 1969 to 1992, minus years when no fishery and 'fishing up effect' occurred (NPFMC, 2005). Prior to 1980, the harvest was sporadic, averaging 112,000 pounds in the 1970s, 125,000 in the 1980s, and increasing to 377,000 in the 1990s. The peak harvest of 1.1 million pounds occurred in 1992.

Declining catch rates in Area D during the 2000/01 season led to a reduction of the GHL to 200,000 pounds for the Yakutat area beginning in the 2001/02 season (
Table 2-1). Catch rates (observer data) during the first several days of fishing in individual beds of Area D were compared between years. A decline in initial catch rates was observed for most beds, and this decline was used as a proxy as a decline in scallop abundance. The GHL was reduced from the upper end of the GHR down to 200,000 pounds as a precautionary measure. For 2001/02 – 2004/05 seasons, the harvest ranged from 87,000 – 161,000 averaging 119,000 pounds. Only in the 2005/06 season was the 200,000-lb GHL reached in Area D, necessitating early season closure by emergency order. Data from this 2005/06 season noted a significantly declining commercial catch rate, poor recruitment in recent seasons, and decreases in the proportion of large scallops (Figure 3-2). For these reasons the GHL for Area D was reduced 25% to 150,000 pounds prior to the 2006/07 season.

During this period, the District 16 GHL remained at the upper end of the 0 - 35,000 pound GHR. Harvest in this area ranged from 1,000 – 22,000, averaging 12,000 pounds for the 2001/02 – 2004/05 season period (Table 3-1). Harvest in the 2005/06 season did not reach the GHL of 35,000 pounds. Data from the 2005/06 season noted a significantly declining commercial catch rate, poor recruitment in recent seasons, and decreases in the proportion of large scallops (Figure 3-3, Figure 3-4). For these reasons, and since the GHL in the area had not been reached since the late 1990's, the GHL for District 16 was reduced 40% to 21,000 pounds prior to the 2006/07 season.

No adjustments were made to the Area D and District 16 GHLs prior to the 2007/08 season. The observer data compiled from the 2006/07 season noted a shift in effort to one of the beds in Area D; an overall increase in CPUE; anecdotal evidence from industry that scallop meat quality had improved overall; shell height histograms from Area D showed a more evenly distributed age structure in the harvest; and shell height histograms from District 16 showed a harvest made up of smaller scallops than Area D, and some small signs of recruitment. During the 2007/08 season the GHLs for Area D and District 16 were not reached.

Again, prior to the 2008/09 season no adjustments were made to the Area D and District 16 GHLs. The observer data compiled from the 2007/08 season noted a shift in effort to two separate beds in Area D; an overall slight decrease in CPUE; shell height histograms from Area D showed a harvest of slightly smaller scallops than the previous season; and the fourth consecutive year of increasing Tanner crab bycatch. During the 2008/09 season, GHLs were reached in both Area D and District 16 and both areas were closed by emergency order.

Adjustments to the GHLs for both Area D and District 16 were made prior to the 2009/10 season. The observer data compiled from the 2008/09 season noted stable catch rates; no evidence of localized depletion within the beds; in Area D, the mode of the shell height histogram was at its largest size in the last eight seasons; in District 16, the mode of the shell height histogram was at its largest size since the 2002/03 season; possible evidence of a larger than average recruitment event in the District 16 shell height histogram; and a drop in Tanner bycatch. An increase of <10% was proposed for Area D to take

advantage of large, high quality scallops harvested in the area, and no evidence of localized depletion or declining catch rates since the last GHL adjustment prior to the 2006/07 season. In District 16, an increase of 20% was proposed to take advantage of large, high quality scallops harvested in the area and also evidence of a larger than average recruitment event, and no evidence of localized depletion or declining catch rates since the last GHL adjustment prior to the 2006/07 season. The GHLs were set at 160,000 pounds for Area D, and 25,000 pounds for District 16. During the 2009/10 season, the GHL was reached in Area D and the area was closed by emergency order, but the GHL in District 16 was not reached.

No GHL changes were implemented for the 2010/11 and 2011/12 seasons. An adjustment to the GHL in Area D was made prior to the 2012/13 season. Total CPUE for Area D in the 2011/12 fishery was 34 lb shucked meats per dredge hour, this is 66% of the 15 year average, and the second lowest CPUE since fishery monitoring began and the lowest since the 1996 winter season. CPUE also showed a clear downward trend for the past six seasons. In particular, beds 1, 2, 3, 4, and B showed clear declines in CPUE over the last three seasons. Collectively these beds made up 82% of the 2011/2012 harvest. Daily CPUE versus cumulative catch showed a clear decline in Bed 4, which was not apparent last season. Fifty seven percent of the 2011/12 catch came from Bed 4. Lastly, shell height histograms showed a narrowing of sizes caught in the fishery on both the small and large ends.

Based on the clear and continued declines in overall CPUE, Bed specific CUPE, daily catch rates and shell height it is clear that the stock is in poorer health than in previous seasons. The Yakutat Area has no fishery independent assessment, and thus all management measures must be more conservative than they would be in the presence of more high quality data. Prior to the 2009/2010 season the GHL was increased from 150,000 lb to 160,000 lb. During the years with a 150,000lb GHL CPUE decreased in 4 out of 6 beds, and when set at 160,000 lb CPUE declined in 5 of 6 beds (bed B was first fished in the 2009/2010 season). Thus both of these harvest levels are likely excessive with the current state of the stock. In order to increase the apparent health of the stock to previous levels (as assumed by CPUE), the 2012/13 GHL was decreased 25% to 120,000 lb of shucked meats.

No GHL adjustments were made in D16 for the 2012/13 season. Although CPUE has been declining since the 2000/01 season, it is difficult to parse out an explanation. Effort is very spotty in the area with years with practically no harvest and relatively low CPUE, immediately followed by a season of high harvest and relatively high CPUE, making interannual variation analyses difficult. However when the three most recent seasons with roughly equivalent catch and effort (2004/05, 2008/09, and 20012/13) are examined there is a clear decreasing trend in CPUE (Figure 3-3). Without the inclusion of the 2012/13 season the relationship between these high harvest years was flat.

Onboard observers recorded over 20,000 SH measurements of retained and discarded scallops in Area D and 250 in D16 during the 2011/12 season. Plots from resampling Area D data (Figure 3-3**)** show a similar range of scallop sizes in the 2010/11 and 2011/12 seasons, however the magnitude of the catch if small scallops was greatly reduced in the 2011/12 season. Whether this is due to growth, fleet avoidance, or a decrease in prerecruit populations is not known. The bulk of the retained scallops remain in the 115–145 mm SH range. District 16 plots (
Figure 3-5) show a narrower range of SH caught, and a greater percentage of catch retained.

Observers sampled catch and bycatch from 522 of the 2,750 total scallop tows made during the 2011/12 Yakutat fishery. From these data, an estimated 583,400 lbs whole scallops were discarded and 2,347,800 lbs were retained, for an estimated discard rate of 24.8% of the total whole scallop catch. Average estimated Yakutat scallop discard for the 2000/01–2009/10 seasons was 454,300 lbs or 17.8% of total catch. Variation in discard proportion during recent seasons is apparent in SH plots from resampling (Figure 3-3).

Bycatch estimates calculated from 2011/12 Area D observer samples were 11,558 Tanner crabs, 117 Dungeness crabs. Estimates for D16 were 53 Tanner crabs, and no Dungeness crabs. Estimated Yakutat Tanner crab bycatch declined 22% from the 2010/11 season. Carapace width (CW) of Tanner crabs sampled by observers ranged from about 10mm to about 70mm, with the vast majority in the 20-50mm range.

Table 3-1 Yakutat Area D scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 7 | 250,000 | 139,057 | 1,999 | 70 | |
| 1994/95 | 10 | 250,000 | 246,862 | 4,130 | 60 | |
| 1995/96 | 8 | 250,000 | 237,417 | 4,730 | 50 | |
| 1996/97 | 4 | 250,000 | 238,736 | 4,438 | 54 | 295,933 |
| 1997/98 | 4 | 250,000 | 243,810 | 3,956 | 62 | 299,843 |
| 1998/99 | 8 | 250,000 | 242,929 | 4,154 | 58 | 271,506 |
| 1999/00 | 3 | 250,000 | 249,681 | 3,840 | 65 | 533,172 |
| 2000/01 | 3 | 250,000 | 195,699 | 4,241 | 46 | 588,981 |
| 2001/02 | 2 | 200,000 | 103,800 | 2,406 | 43 | 272,300 |
| 2002/03 | 2 | 200,000 | 122,718 | 2,439 | 50 | 358,200 |
| 2003/04 | 2 | 200,000 | 160,918 | 3,360 | 48 | 392,993 |
| 2004/05 | 2 | 200,000 | 86,950 | 2,132 | 41 | 219,107 |
| 2005/06 | 2 | 200,000 | 199,351 | 5,089 | 39 | 395,686 |
| 2006/07 | 2 | 150,000 | 150,041 | 2,817 | 53 | 380,250 |
| 2007/08 | 2 | 150,000 | 125,960 | 2,601 | 48 | 520,017 |
| 2008/09 | 3 | 150,000 | 150,289 | 3,286 | 46 | 416,807 |
| 2009/10 | 2 | 160,000 | 158,225 | 3,919 | 40 | 622,055 |
| 2010/11 | 3 | 160,000 | 156,984 | 3,495 | 45 | 578,494 |
| 2011/12 | 3 | 160,000 | 157,560 | 4,598 | 34 | 583,399 |
| 2012/13[b] | 3 | 120,000 | 117,725 | 3,349 | 37 | |

[a] *Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*

[b] PRELIMINARY catch data subject to change.

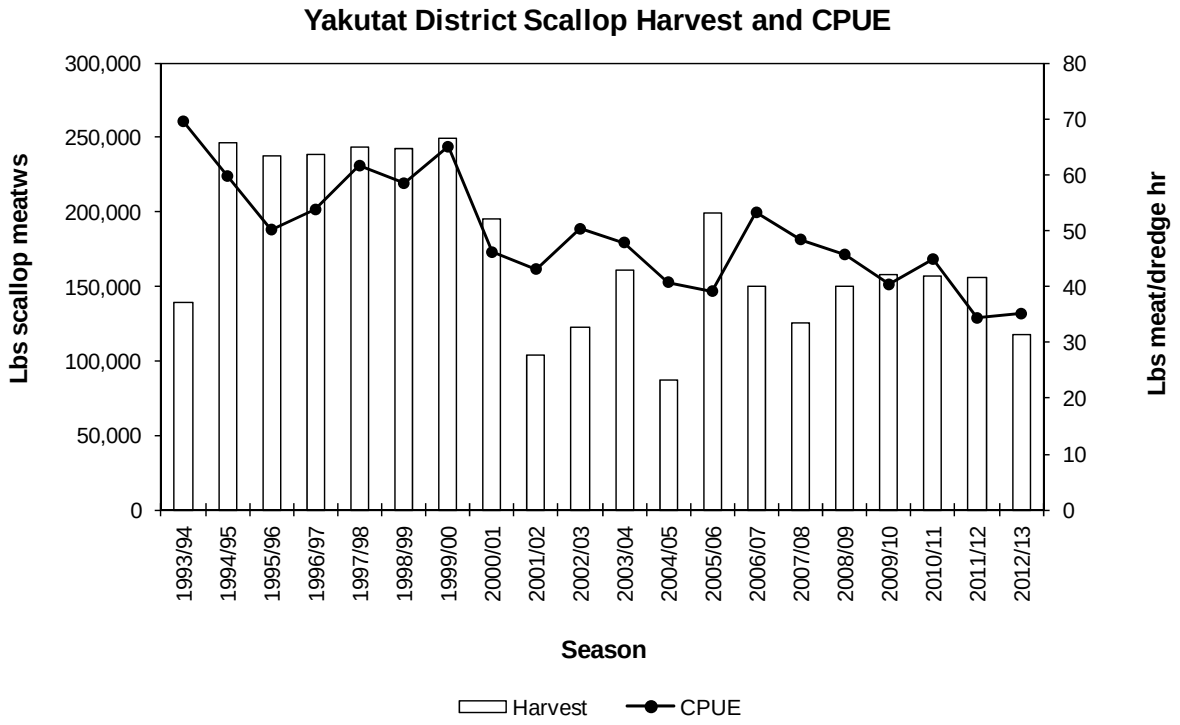



Figure 3-2 Yakutat Area D Scallop Harvest and CPUE, 1993/94-2012/13 seasons.

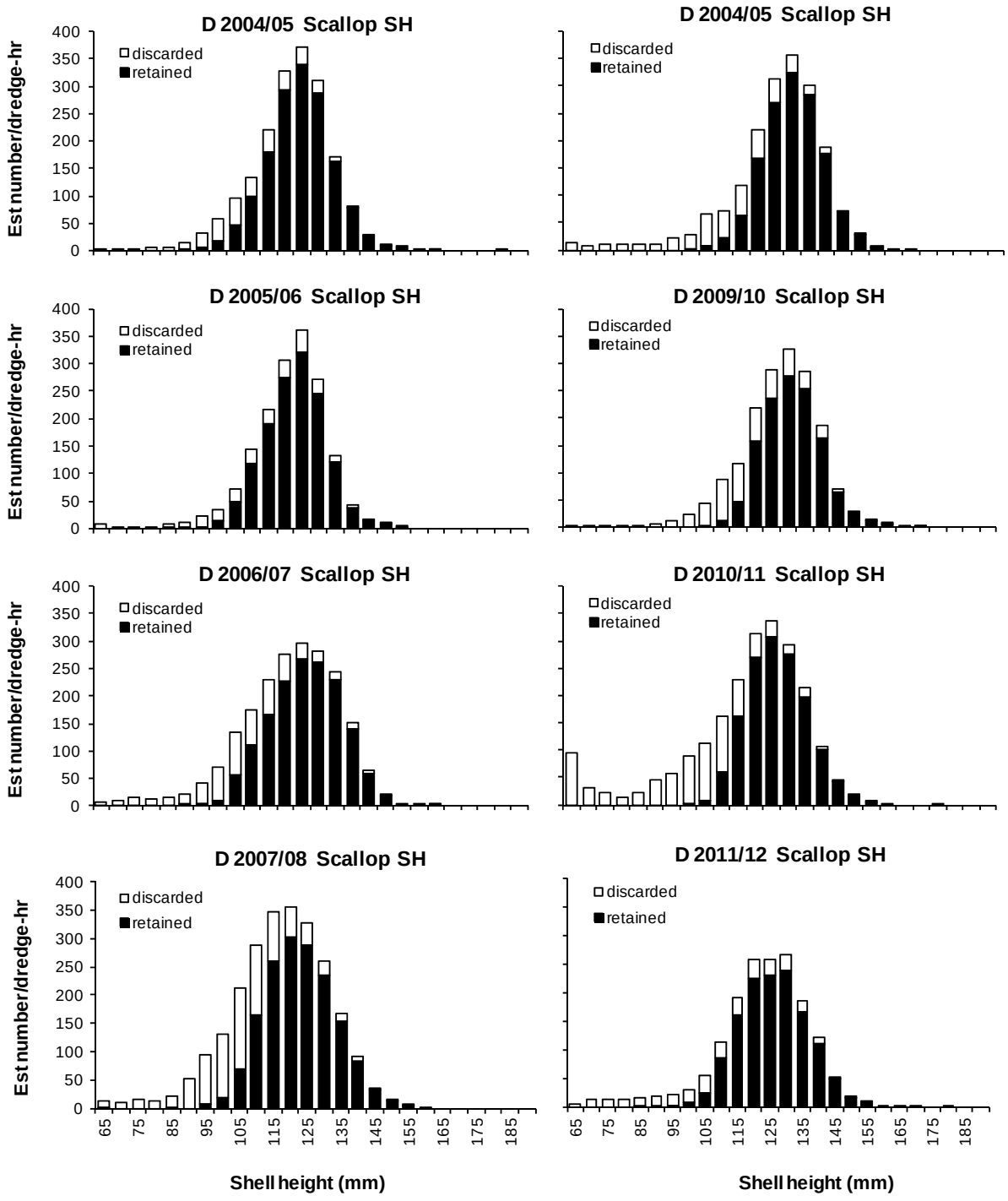



Figure 3-3 Estimated scallop shell height distributions from the 2000/01—2011/12 Yakutat District fishing seasons.

Table 3-2 Yakutat District 16 scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 1 | 35,000 | NA | | | |
| 1994/95 | 7 | 35,000 | 22,226 | 408 | 54 | |
| 1995/96 | 6 | 35,000 | 33,302 | 1,095 | 30 | |
| 1996/97 | 2 | 35,000 | 34,060 | 917 | 37 | 159,899 |
| 1997/98 | 4 | 35,000 | 22,020 | 561 | 39 | 32,764 |
| 1998/99 | 2 | 35,000 | 34,153 | 702 | 49 | 25,292 |
| 1999/00 | 2 | 35,000 | 34,624 | 674 | 51 | 57,718 |
| 2000/01 | 3 | 35,000 | 30,904 | 476 | 65 | 51,221 |
| 2001/02 | 2 | 35,000 | 20,398 | 417 | 49 | 48,879 |
| 2002/03 | 2 | 35,000 | 3,685 | 100 | 37 | 12,662 |
| 2003/04 | 2 | 35,000 | 1,072 | 18 | 60 | 1,079 |
| 2004/05 | 2 | 35,000 | 24,430 | 419 | 58 | 19,908 |
| 2005/06 | 2 | 35,000 | 13,650 | 407 | 34 | 35,791 |
| 2006/07 | 2 | 21,000 | 13,445 | 309 | 44 | 24,898 |
| 2007/08 | 1 | 21,000 | 180 | 6 | 30 | 2,020 |
| 2008/09 | 2 | 21,000 | 20,986 | 423 | 50 | 75,471 |
| 2009/10 | 2 | 25,000 | 11,637 | 437 | 27 | 104,634 |
| 2010/11 | 1 | 25,000 | 3,062 | 83 | 37 | 28,033 |
| 2011/12 | 1 | 25,000 | 1,825 | 57 | 32 | 3,076 |
| 2012/13[b] | 1 | 25,000 | 24,985 | 684 | 37 | |

[a] *Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*
[b] *PRELIMINARY data subject to change.*

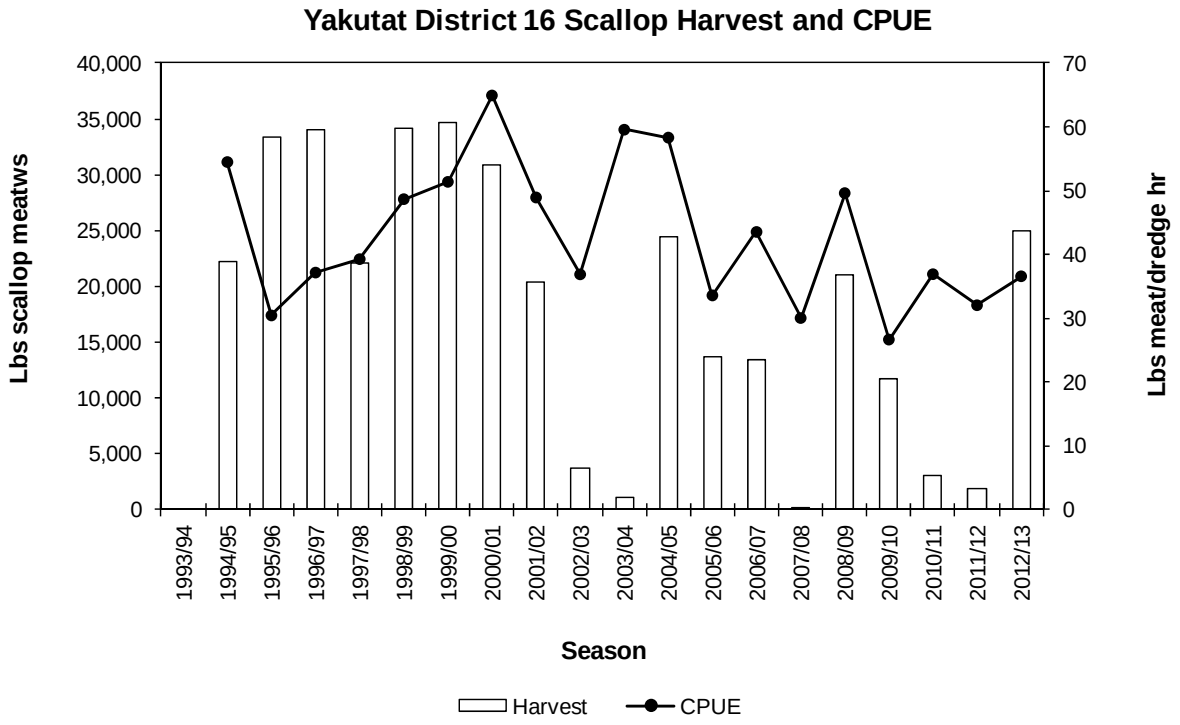



Figure 3-4 Yakutat District 16 Scallop Harvest and CPUE, 1993/94—2012/13 seasons.

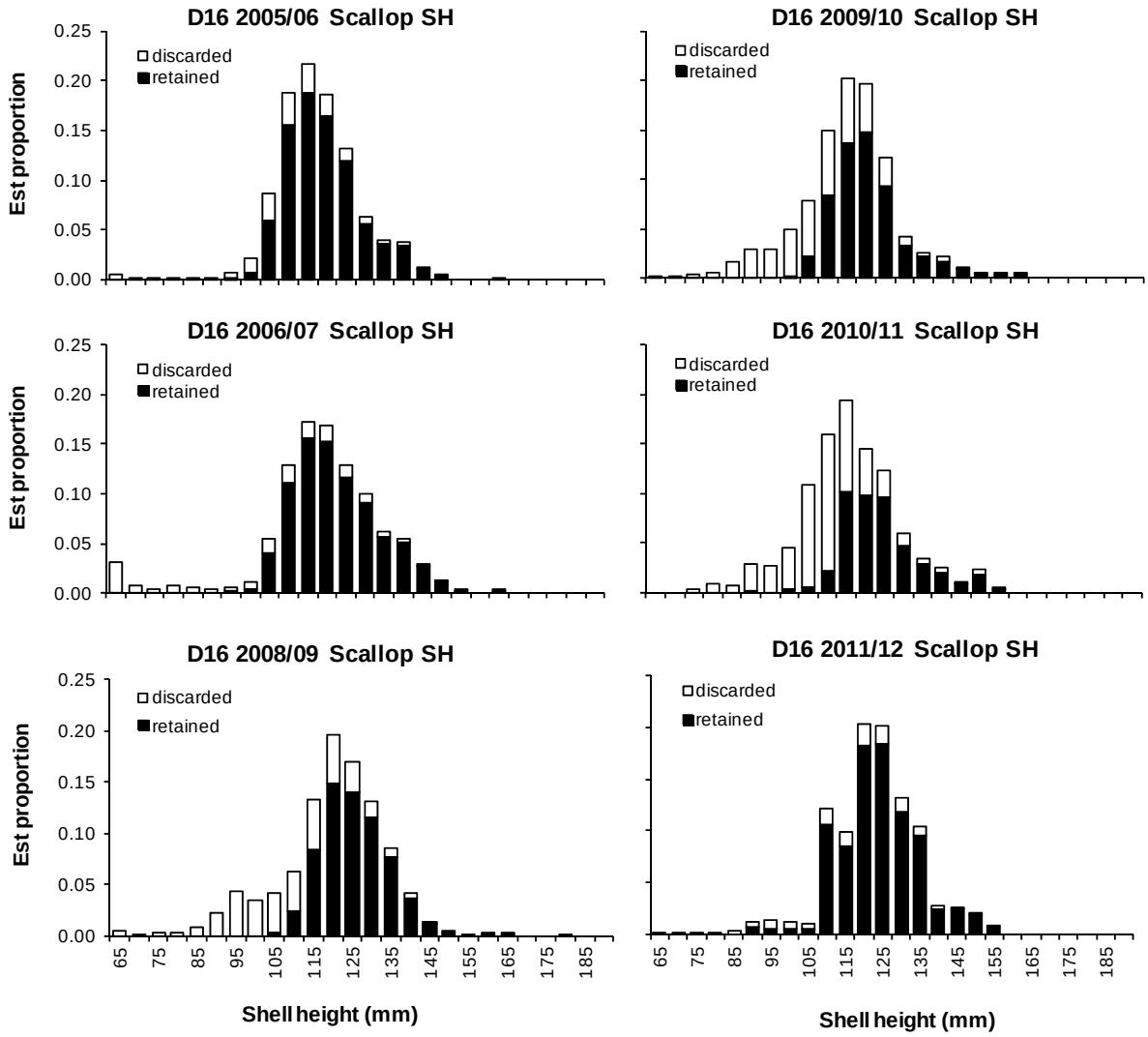



Figure 3-5 Estimated scallop shell height distributions from the 2005/06—2011/12 Yakutat District 16 fishing seasons. No 2007/08 plot was constructed due to small samples size.

## 3.2 Prince William Sound Registration Area

Scallop dredge surveys are conducted biennially in the Prince William Sound Registration Area (Area E) near Kayak Island (Figure 2-5 and Table 3-3). While the 2012 survey was conducted over the same standardized area as set in 2008, additional ancillary stations were added from the eastern boundary of the east bed to the Cape Suckling boundary of the PWS Management Area, corresponding to where the fishery occurred during the 2009-10 season. In May, 2012, a total of 32 successful 1nm dredge tows were made during the Kayak Island survey (19 in the east bed and 10 in the west bed with three ancillary stations on the eastern boundary). Since the last complete survey of the east bed was in 2008, we focused on sampling as many stations as possible in that bed. As in the 2010 survey, poor weather resulted in only sampling every other row of selected stations in both the east and west beds, with three of 10 stations sampled in the east ancillary area. Abundance and biomass estimates from all Kayak Island surveys are given in Table 3-3.

Total catch in the east bed was 1,271 weathervane scallops weighing 252 kg (555 lb). Catch abundance ranged from 6 to 318 scallops/nm resulting in a mean among all stations of 66.5 scallops/nm. Standardized catches by weight ranged from 1.8 kg/nm (4.0 lb/nm) to 84.2 kg/nm (185.7 lb/nm) with a mean catch among all stations used for the estimate of 8.2 kg/nm (18.2lb/nm). The east bed abundance estimate was 4.0 million scallops and was a 44% decrease from the last complete abundance estimate in 2008. Estimated biomass showed a 63% decline between 2012 and 2008 and a 74% decline since 2006. Survey results further indicate a change in age structure of the stock from 20% age seven and under in 2008 to 15% age seven and under in 2010 and 30% age 7 and under in 2012. East bed age data from sampled stations indicate a tri-modal distribution with prominent classes occurring at four, 12 and 20 years (Figure 3-6). Shell height distribution was bimodal with predominant peaks at 105 mm and 145mm. These age data track well with previous assessments and indicate potential recruitment to the fishery, reproductive age classes, and older age classes that are of a marketable size. Estimates of scallop abundance from previous surveys indicate a declining trend from 26,000 lb for the 2004/05 season to 15,000 lb for the 2008/09 season and further declining to 8,400 in 2010/11 season. In addition, logbook data from the observed commercial fishery indicate a declining trend of catch per unit effort (CPUE) since the 2005/06 season. With both the decline in survey abundance and biomass and CPUE and the higher percentage of younger age scallops the department closed the east bed for the 2012/13 season. Since there will not be another survey in the area until 2014, the east bed will remain closed for the 2013/2014 season.

Total catch in the east ancillary bed was 99 weathervane scallops weighing 23 kg (51 lb). Catch abundance ranged from 24 to 39 scallops/nm resulting in a mean among all stations of 33 scallops/nm. Standardized catches by weight ranged from 5.7 kg/nm (12.7 lb/nm) to 10.5 kg/nm (23.1 lb/nm) with a mean catch among stations of 7.7 kg/nm (17.1 lb/nm). Since only three stations were sampled no abundance or biomass estimate was calculated. Age distributions and height distributions had a major mode at age 12 and height of 140mm (Figure 3-8).

Total catch in the west bed was 766 weathervane scallops weighing 83 kg (182 lb). Catch abundance ranged from 0 to 271scallops/nm resulting in a mean among all stations of 76 scallops/nm. Standardized catches by weight ranged from 0 to 35.3 kg/nm (77.8 lb/nm) with a mean catch among all stations used for the estimate of 8.2 kg/nm (18.2 lb/nm). The west bed abundance estimate was 2.8 million scallops and was a 40% increase from the 2010 abundance estimate; however the confidence interval was much larger than the 2010 survey so change was not a significant. Survey results further indicate a change in age structure of the stock from 13% age seven and under in 2006, to 44% in 2008, to 53% age seven and under in 2010, and 58% age 7 and under in 2012. West bed age data from sampled station indicate a bimodal distribution with predominate ages at two and nine, with predominate height modes at 50mm and 90 mm (Figure 3-9). The trend for increasing number of small age scallops age track well with previous data. While potential recruitment to the fishery is a positive note for future years, scallops age seven and under would likely be discarded in the commercial fishery due to small size. The above biological information, combined with a declining trend of CPUE in the commercial fishery since 2003, causes the department to have concerns for the sustainability of the Kayak Island scallop fishery. Therefore, waters of the west bed were closed for the 2012/13 season. As with the east bed, this bed will remain closed for the 2013/2014 season.

***Weak Meats:*** During the 2009 Scallop Plan Team Meeting "weak meats" were discussed. Weak meats are characterized by adductor muscle coming off the shell when the viscera are pulled off the shell in the shucking process. These meats are off color, with a stringy consistency that makes them unacceptable for marketing by the industry. In the 2010 meeting representatives of the industry mention finding scallops with weak meats in Kayak Island fishery. To address this problem, sampling for weak meats was incorporated in to our age-height-sexual maturity sampling protocols. There was an increasing trend in east bed with 5.8% of scallops sampled in 2010 to 12.4% of scallops sampled in 2012. The west bed there

was a declining trend of weak meats with 2.5% of scallops sampled in 2010 and 1.3% of scallops sampled in 2012. The East Ancillary bed had 6.6% of scallops sampled with weak meats.

***Fishery overview:***

**2011/12 Season summary**
One vessel fished the open area east of Kayak Island from 31 July through 5 August 2011, making 91 tows to harvest 8,460 lbs of scallop meats. CPUE was 53 lbs scallop meats/dredge-hr, up from 52 lbs meat/dredge-hr in 2010/11. CPUE remained well below the 1999/2000–2010/11 average of 90 lbs meat/dredge-hr.

The observer sampled 17 of 91 tows made during the 2011/12 season. Using these data, estimates were 139,345 lbs of whole scallops retained and 11,469 lbs whole scallops discarded, for a discard rate of 7.6%.

Plots of SH distributions from resampling observer measurements (Figure 3-7) show that the 2011/12 harvest was comprised primarily of scallops 125–155 mm SH, with very few small scallops caught and discarded. The range of shell heights caught in the fishery has been very consistent over the years.

No Tanner or Dungeness crabs or halibut were encountered in sampled dredges during the season; although this was unusual, the onboard observer was highly experienced and scallop observer program staff have no reason to question these results.

**2012/13 Season summary**
Fishing was not opened in both the east and west sections of Kayak Island due to concerns about low scallop abundance levels.

Table 3-3 Summary of systematic estimates for weathervane scallop survey in Kayak Island 1996-2012, using a standardized area of 78.9 $nm^2$ east bed and 48.6 $nm^2$ west bed and Arc GIS distance for estimates. The dredge was 8 feet wide and weighed ~1600 pounds, ring size 4 inches inside diameter, and lined with 1.5 inch stretch 24 thread nylon mesh.

| Survey year | Number stations sampled | Mean catch kg/nm | Estimated abundance | | 95% CI | CV | Scallop density (scal/$m^2$) | Average weight (g/scal) | Estimated biomass q =1.0 (kg meat) | Estimated biomass q =0.83 (kg meat) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **East Bed** | | | | | | |
| 1996 | 38 | 27.9 | 7,302,813 | ± | 3,507,901 | 0.24 | 0.028 | 228 | 132,501 | |
| 1998[a] | 28 | 20.5 | 5,288,624 | ± | 1,393,135 | 0.13 | 0.020 | 231 | 89,347 | |
| 2000 | 33 | 37.6 | 9,535,026 | ± | 1,900,677 | 0.10 | 0.036 | 237 | 146,181 | |
| 2002[b] | 20 | 10.2 | 2,294,907 | ± | 910,967 | 0.19 | 0.009 | 266 | 43,367 | |
| 2004 | 31 | 77.1 | 17,441,115 | ± | 9,355,190 | 0.26 | 0.062 | 264 | 278,594 | |
| 2006 | 32 | 44.4 | 9,720,639 | ± | 4,263,246 | 0.22 | 0.036 | 274 | 190,243 | 229,208 |
| 2008 | 37 | 36.5 | 7,114,451 | ± | 2,180,486 | 0.15 | 0.026 | 307 | 130,480 | 157,204 |
| 2010 | 12 | 34.9 | † | | † | | 0.032 | 245 | † | † |
| 2012 | 19 | 13.3 | 3,987,132 | ± | 2,287,786 | 0.27 | | 200 | 48,836 | 58,838 |
| | | | | **West Bed** | | | | | | |
| 1998[a] | 21 | 33.9 | 6,382,639 | ± | 2,851,028 | 0.21 | 0.04 | 196 | 105,132 | |
| 2000 | 20 | 94.7 | 17,900,280 | ± | 7,957,941 | 0.21 | 0.11 | 195 | 302,316 | |
| 2002[b] | 17 | 39.6 | 5,745,859 | ± | 2,428,439 | 0.20 | 0.03 | 254 | 105,646 | |
| 2004 | 25 | 84.8 | 14,502,511 | ± | 5,102,276 | 0.17 | 0.09 | 216 | 235,274 | |
| 2006 | 20 | 61.0 | 10,113,094 | ± | 4,648,662 | 0.22 | 0.06 | 223 | 167,262 | 201,520 |
| 2008 | 10 | 19.7 | 3,934,444 | ± | 2,811,818 | 0.32 | 0.02 | 185 | 34,843 | 41,979 |
| 2010 | 26 | 9.1 | 2,025,382 | ± | 745,216 | 0.18 | 0.01 | 166 | 23,929 | 28,475 |
| 2012 | 10 | 8.2 | 2,828,095 | ± | 2,081,685 | 0.33 | | 108 | 18,469 | 22,251 |

[a] A smaller New Bedford dredge was used weighing ~800 pounds, 8 feet wide, with 3 inch inside diameter ring and 1.5 inch streatch 24 thread nylon mesh liner.

[b] Incorrect scope and smaller liner may have compromised the survey.

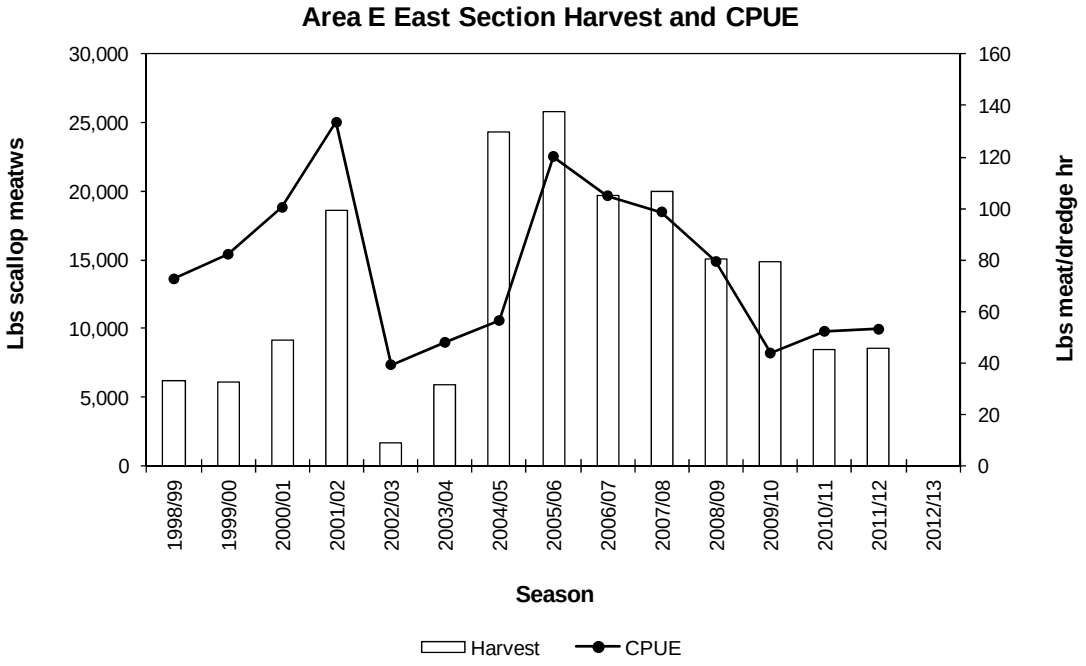
† Survey estimate not done because only parimeter stations were sampled.

Table 3-4 Commercial harvest of weathervane scallops from Prince William Sound, 1992–2013/14

| | | East Bed | | | | West Bed | | | | Total Both Beds | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Number of vessels | GHL[a] lb meat | Catch (lb) of shucked meats | Dredge hours | CPUE lb/hour | GHL[a] lb meat | Catch (lb) of shucked meats | Dredge hours | CPUE lb/hour | GHL[a] lb meat | Catch (lb) of shucked meats | Dredge hours | CPUE lb/hour |
| 1992 | 4 | | | | | | | | | 64,000 | 208,836 | NA | NA |
| 1993 | 7 | | | | | | | | | 50,000 | 63,068 | 638 | 99 |
| 1994 / 95 | | | | | | | | | | Closed | | | |
| 1995 / 96 | 3 | | | | | | | | | 50,000 | 108,000 | NA | NA |
| 1996 / 97 | | Closed | | | | Closed | | | | Closed | | | |
| 1997 / 98 | 1[b] | | | | | | | | | 17,200 | 18,000 | 171 | 105 |
| 1998 / 99 | 2[b] | 6,000 | 6,210 | 85 | | 14,000 | 13,440 | 94 | | 20,000 | 19,650 | 179 | 110 |
| 1999 / 00 | 2[b] | 6,000 | 6,065 | 74 | | 14,000 | 13,525 | 76 | | 20,000 | 20,410 | 149 | 137 |
| 2000 / 01 | 3 | 9,000 | 8,998 | 95 | | 21,000 | 21,268 | 129 | | 30,000 | 30,266 | 221 | 137 |
| 2001 / 02 | 1[b] | 9,000 | 9,060 | 140 | 65 | 21,000 | 21,030 | 124 | 170 | 30,000 | 30,090 | 263 | 114 |
| 2002 / 03 | 2[b] | 6,000 | 1,680 | 43 | 39 | 14,000 | 13,961 | 79 | 177 | 20,000 | 15,641 | 122 | 128 |
| 2003 / 04 | 1[b] | 6,000 | 5,910 | 123 | 48 | 14,000 | 14,070 | 93 | 151 | 20,000 | 19,980 | 216 | 93 |
| 2004 / 05 | 2[b] | 26,000 | 25,350 | 430 | 59 | 24,000 | 23,970 | 185 | 130 | 50,000 | 49,320 | 614 | 80 |
| 2005 / 06 | 3 | 26,000 | 24,435 | 214 | 114 | 24,000 | 24,781 | 268 | 92 | 50,000 | 49,216 | 491 | 100 |
| 2006 / 07 | 2[b] | 20,000 | 20,010 | 188 | 106 | 17,000 | 17,005 | 147 | 116 | 37,000 | 37,015 | 334 | 111 |
| 2007 / 08 | 2[b] | 20,000 | 20,015 | 203 | 99 | 17,000 | 17,090 | 225 | 76 | 37,000 | 37,105 | 428 | 87 |
| 2008 / 09 | 1[b] | 15,000 | 15,030 | 189 | 80 | 5,000 | 5,010 | 125 | 40 | 20,000 | 20,040 | 331 | 61 |
| 2009 / 10 | 2[b] | 15,000 | 15,035 | 339 | 44 | 5,000 | 4,980 | 87 | 57 | 20,000 | 20,015 | 419 | 48 |
| 2010 / 11 | 1[b] | 8,400 | 8,445 | 161 | 52 | Closed | | | | 8,400 | 8,445 | 161 | 52 |
| 2011 / 12 | 1[b] | 8,400 | 8,460 | 160 | 53 | Closed | | | | 8,400 | 8,460 | 160 | 53 |
| 2012 / 13 | | Closed | | | | Closed | | | | Closed | - | | |
| 2013 / 14 | | Closed | | | | Closed | | | | Closed | | | |

a Separate GHLs were estabolished for beds east and west of Kayak Island beginning in 2008.

b Confidential data voluntary released by vessel operators.



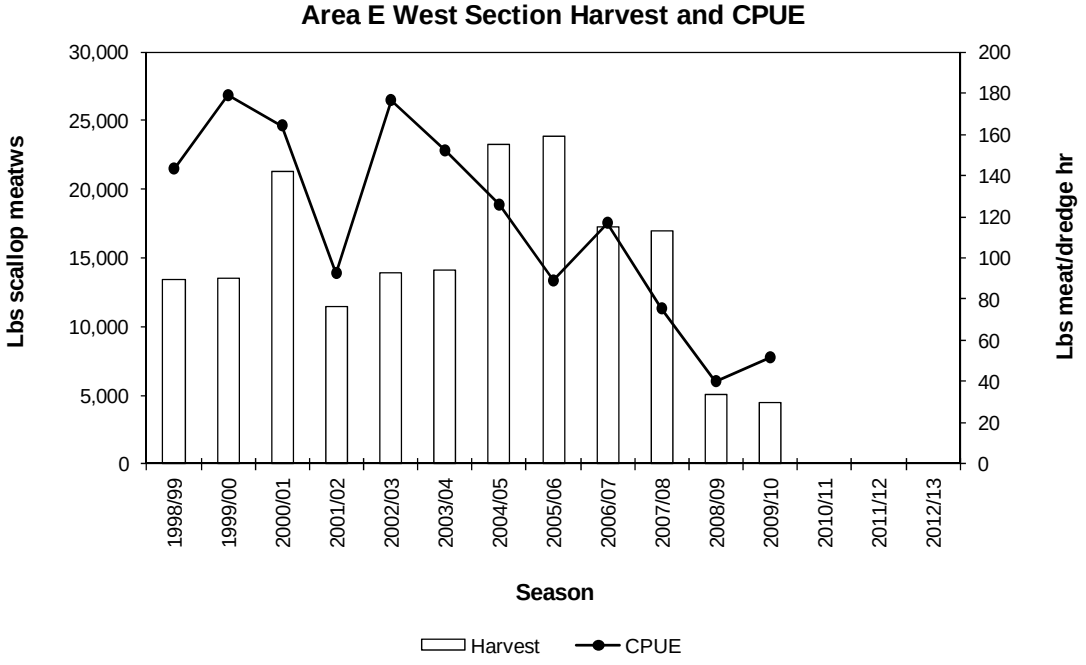




Figure 3-6 Prince William Sound Scallop Harvest and CPUE, 1993/94—2012/13 seasons.

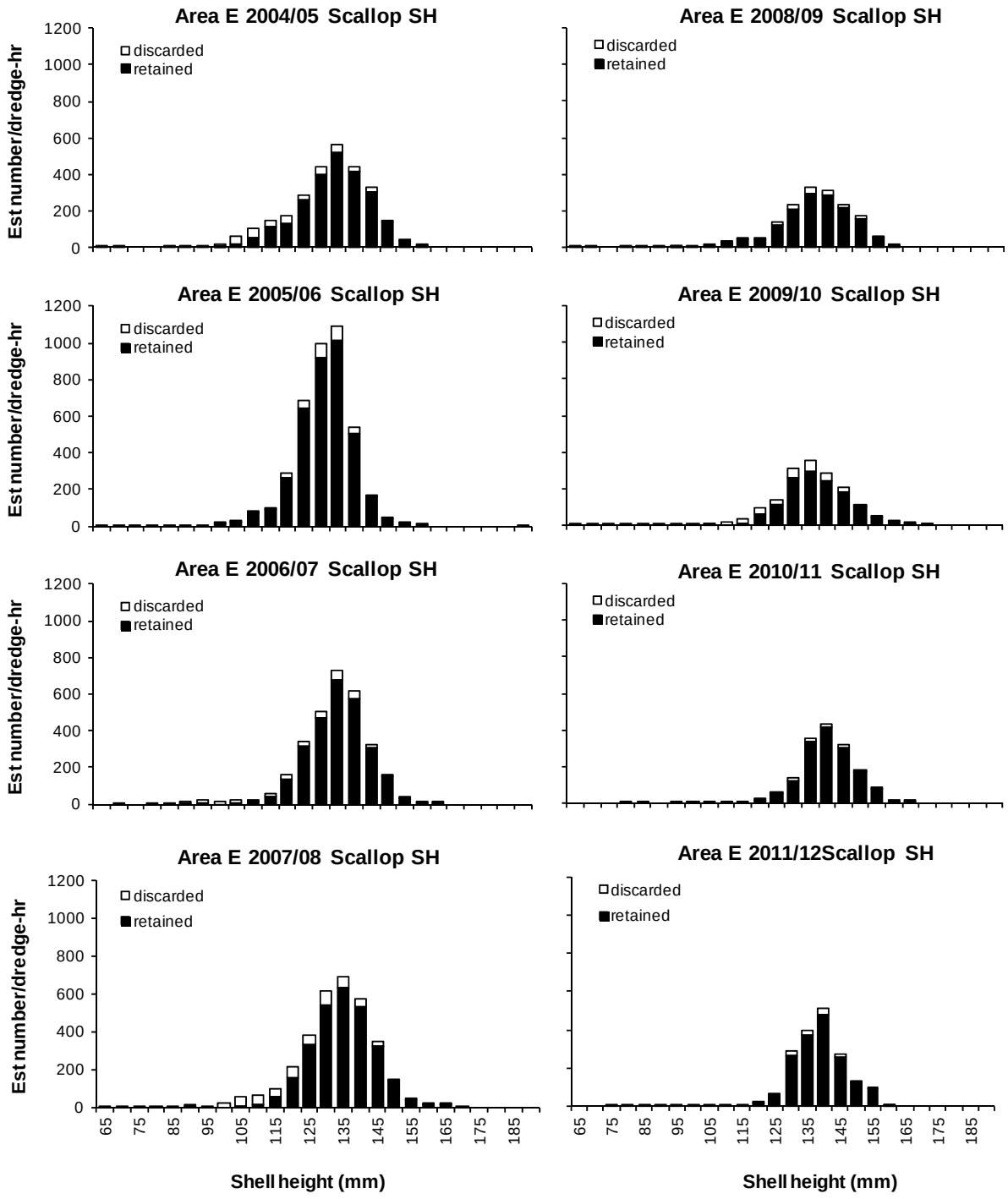



Figure 3-7 Estimated scallop shell height distributions from the 2004/05 – 2011/12 Prince William Sound fishing seasons.

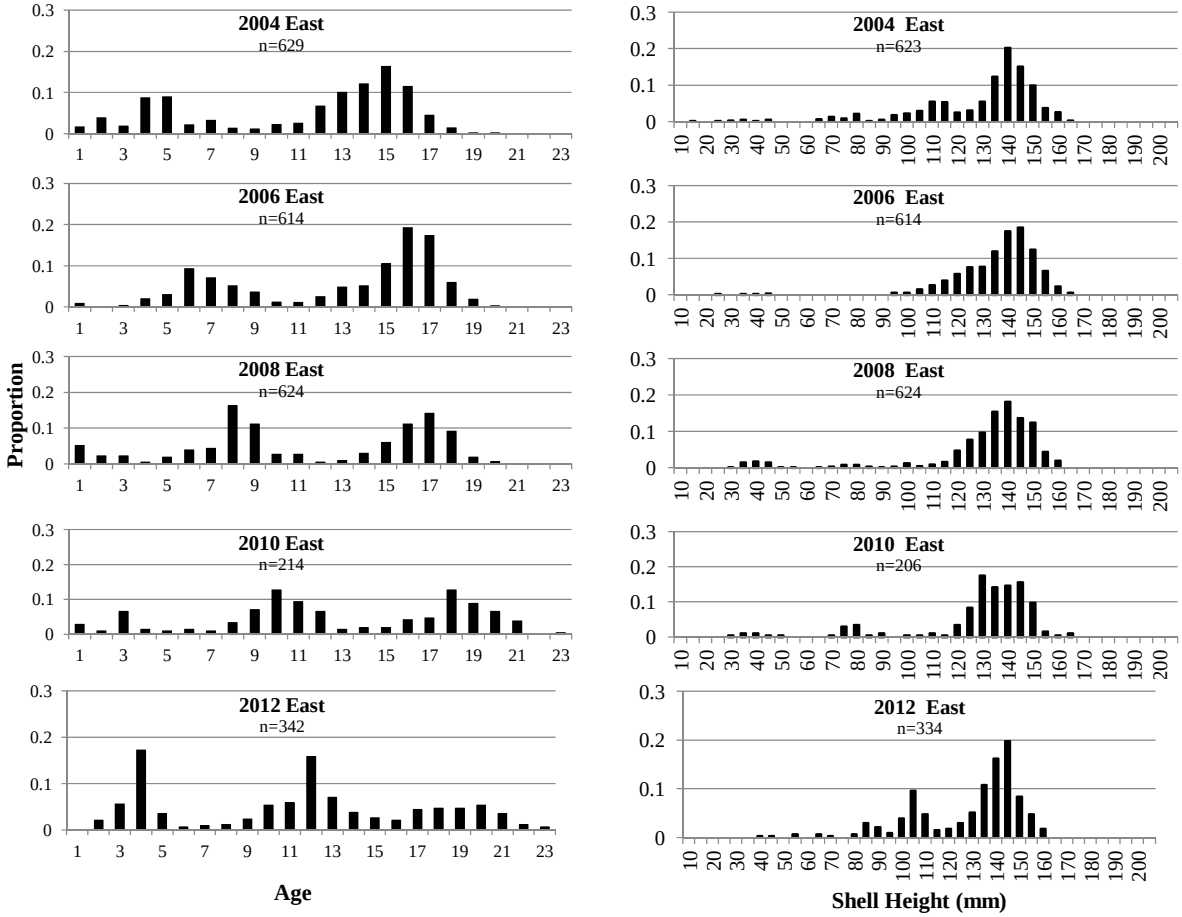



Figure 3-8 Comparison of ages and shell height distribution 2004-2012, east bed

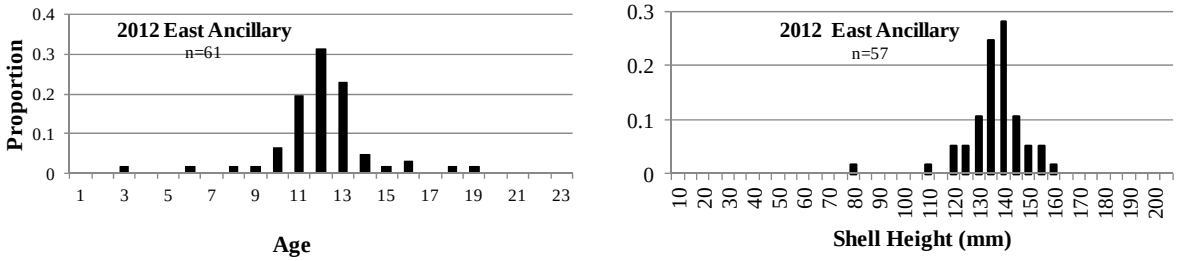



Figure 3-9 Comparison of ages and shell height distribution for 2012 East Ancillary bed.

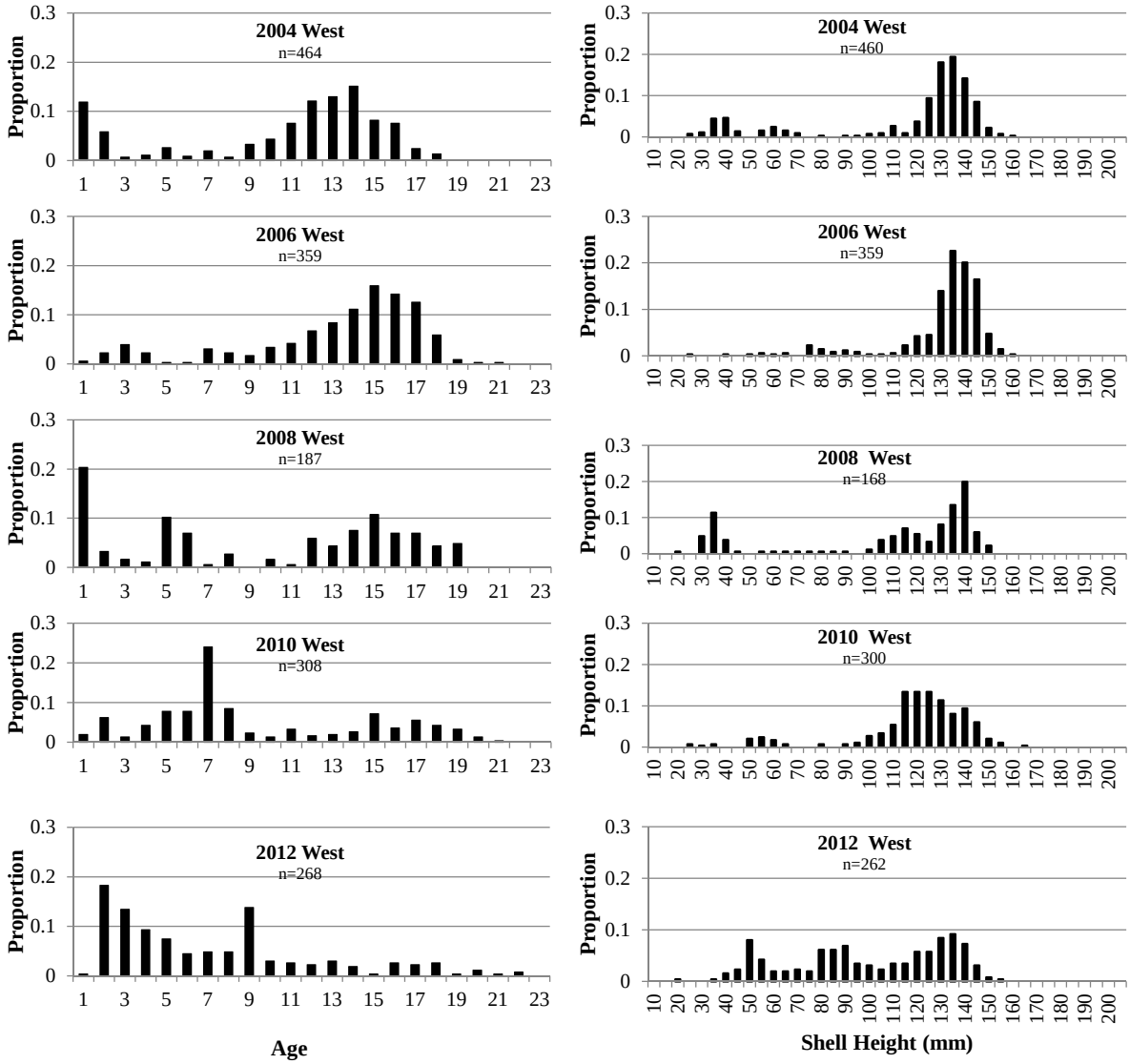



Figure 3-9 Comparison of ages and shell heights 2004-2012 west bed

## 3.3 Cook Inlet Registration Area, Kamishak District

Scallop dredge surveys are conducted biennially in the Cook Inlet Registration Area (Area H) in Kamishak Bay.

The Cook Inlet scallop fishery is prosecuted in the Kamishak District by vessels that are limited to one 6-foot dredge. The third-party contract observer requirement is waived by the ADF&G fishery manager provided that participants accommodate an ADF&G observer when requested. Other areas of Cook Inlet were explored briefly but are not currently fished (Trowbridge and Bechtol 2003). Other districts of Cook Inlet are only open under terms of a commissioner's permit.

A total of 61 successful 1nm dredge tows were conducted during the 2011 Kamishak Bay weathervane scallop survey (45 in the north bed and 16 and one ancillary in the south bed). Catch in the north bed was 1,898 weathervane scallops weighing 777 kg (1,713 lb). Standardized catch abundance ranged from 0 to 165 scallops/nm resulting in a mean among all stations of 42.1 scallops/nm. Standardized catches by

weight ranged from 0 to 63 kg/nm (140lb/nm) with a mean catch among all stations fished of 17 kg/nm (38.1lb/nm). Catch in the south bed was 870 weathervane scallops weighing 223 kg (491 lb). Standardized catch abundance ranged from 0 to 210 scallops/nm resulting in a mean among all stations of 54.2 scallops/nm. Standardized catches by weight ranged from 0 to 65 kg/nm (143 1lb/nm) with a mean catch among all stations fished of 13.9 kg/nm (30.6 lb/nm). Abundance and biomass estimates from all Kamishak Bay surveys are given in Table 3-7. Age distributions from 2003-2011 scallops collected during the Kamishak dredge survey are found on Figure 3-10 and Figure 3-11. The Central Region applies a 0.05 harvest rate to the estimate biomass derived from the survey. The justification for the use of 0.05 F rate is the following: Both survey and commercial fishery CPUE were low in recent years, however, a small surplus of scallops was still available for harvest. The department chose to use an exploitation rate that was either below or at the low end of estimates of natural mortality to provide for fishing yet allows recruitment to the adult portion of the bed to increase in biomass. Natural mortality estimates for weathervane scallops in Alaska have been reported to range from 0.04 to 0.25 (Kruse 1994, Kruse et al. 2005) with a median of 0.15 (Kruse 1994). Estimates of natural mortality from Kamishak Bay in Central Region were estimated at 0.19 (Bechtol et al. 2009). To accomplish the previously stated goals, the department chose an exploitation rate of 0.05 to apply to biomass data to set the guideline harvest limit (GHL), and to consistently apply this level of exploitation until such time as biomass levels increase and allow for greater harvest.

A gear efficiency rate of 0.83 was derived from comparative dredge and underwater video work conducted in 2004 at Kayak Island. Based on that work and continuing efforts by Central Region staff to assess the gear efficiency of the 8’ dredge, department staff felt that applying 0.83, instead of a value of 1.0, was a conservative first step to address an identified weakness in the estimate while protecting recovering biomass. Continuing work indicates that the gear efficiency is likely lower than 0.83. Until such time as current efforts to estimate gear efficiency are completed, Central Region staff will continue to apply the 0.83 value to derive GHL’s for scallops. However, current and future plans are to continue gear efficiency field tests with both the 8’ dredge and the sled dredge. Once enough data are gathered to provide quality statistical analysis, those data will be incorporated into biomass estimates and for setting GHL’s. Until that time, Central Region staff is applying the 0.83 gear efficiency estimate from Kayak Island to the Kamishak data for setting GHL’s.

Table 3-5 Summary of systematic estimates for weathervane scallop survey in Kamishak Bay 1996-2011, using a standardized area of 90.2 nm2 North Bed and 68.0 nm2 South Bed and Arc GIS distance for estimates. The dredge was 8 feet wide and weighed ~1600 pounds, ring size 4 inches inside diameter, and lined with 1.5 inch stretch 24 thread nylon mesh.

| Survey Year | Number stations sampled | Mean catch kg/nm | Estimated abundance | | 95% CI | CV | Scallop density scal/$m^2$) | Average weight (g/scal) | Estimated biomass w/ dredge efficiency =1.0 (kg meat) | Estimated biomass w/ dredge efficiency =0.83 (kg meat) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **North Bed** | | | | | | |
| 1996 | 26 | 60.0 | 15,674,085 | ± | 4,921,324 | 0.15 | 0.05 | 262 | 351,141 | |
| 1999 | 41 | 67.1 | 12,115,707 | ± | 3,032,424 | 0.12 | 0.04 | 380 | 300,950 | |
| 2001 | 37 | 62.9 | 9,980,638 | ± | 2,708,305 | 0.13 | 0.03 | 431 | 274,801 | |
| 2003 | 31 | 26.2 | 4,120,643 | ± | 948,209 | 0.11 | 0.01 | 435 | 110,137 | |
| 2005 | 38 | 22.7 | 3,535,142 | ± | 795,020 | 0.11 | 0.01 | 439 | 101,483 | |
| 2007 | 43 | 26.4 | 5,094,047 | ± | 978,442 | 0.10 | 0.02 | 354 | 139,580 | |
| 2009 | 43 | 20.5 | 3,701,402 | ± | 808,379 | 0.11 | 0.01 | 379 | 97,408 | 117,359 |
| 2011 | 45 | 17.2 | 2,885,639 | ± | 540,212 | 0.09 | 0.01 | | 94,188 | 113,479 |
| | | | | **South Bed** | | | | | | |
| 2003 | 28 | 59.7 | 9,434,220 | ± | 2,467,551 | 0.13 | 0.04 | 327 | 221,258 | |
| 2005 | 29 | 16.2 | 3,935,459 | ± | 1,069,549 | 0.13 | 0.02 | 212 | 60,881 | |
| 2007 | 31 | 23.5 | 5,988,540 | ± | 1,648,559 | 0.13 | 0.03 | 202 | 97,851 | |
| 2009 | 23 | 9.2 | 2,757,557 | ± | 1,179,705 | 0.21 | 0.01 | 172 | 18,146 | 21,863 |
| 2011 | 16 | 13.9 | 2,799,128 | ± | 1,642,687 | 0.28 | 0.01 | | 62,428 | 75,214 |

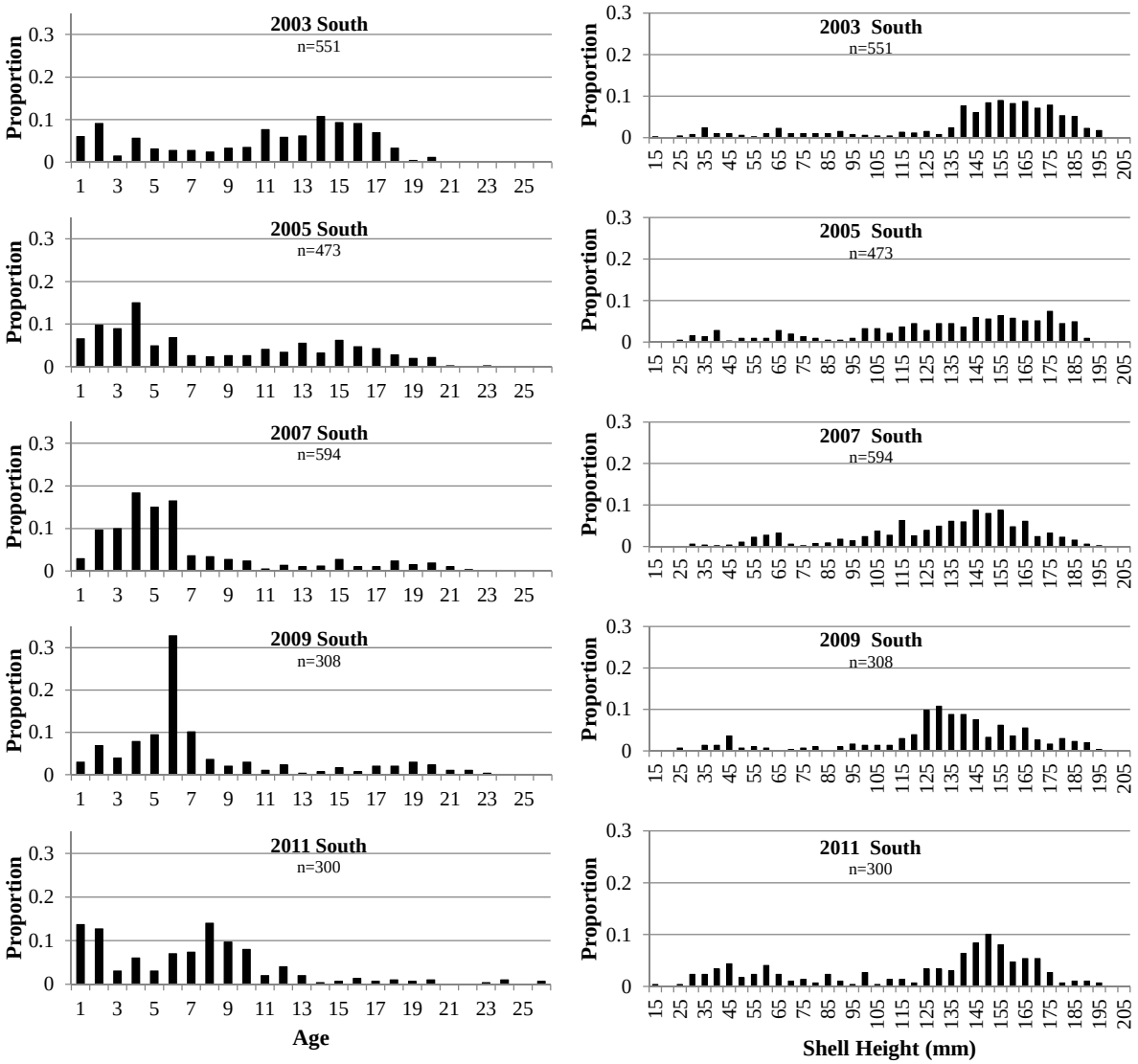



Figure 3-10 Comparison of ages and shell height distribution, Kamishak south bed

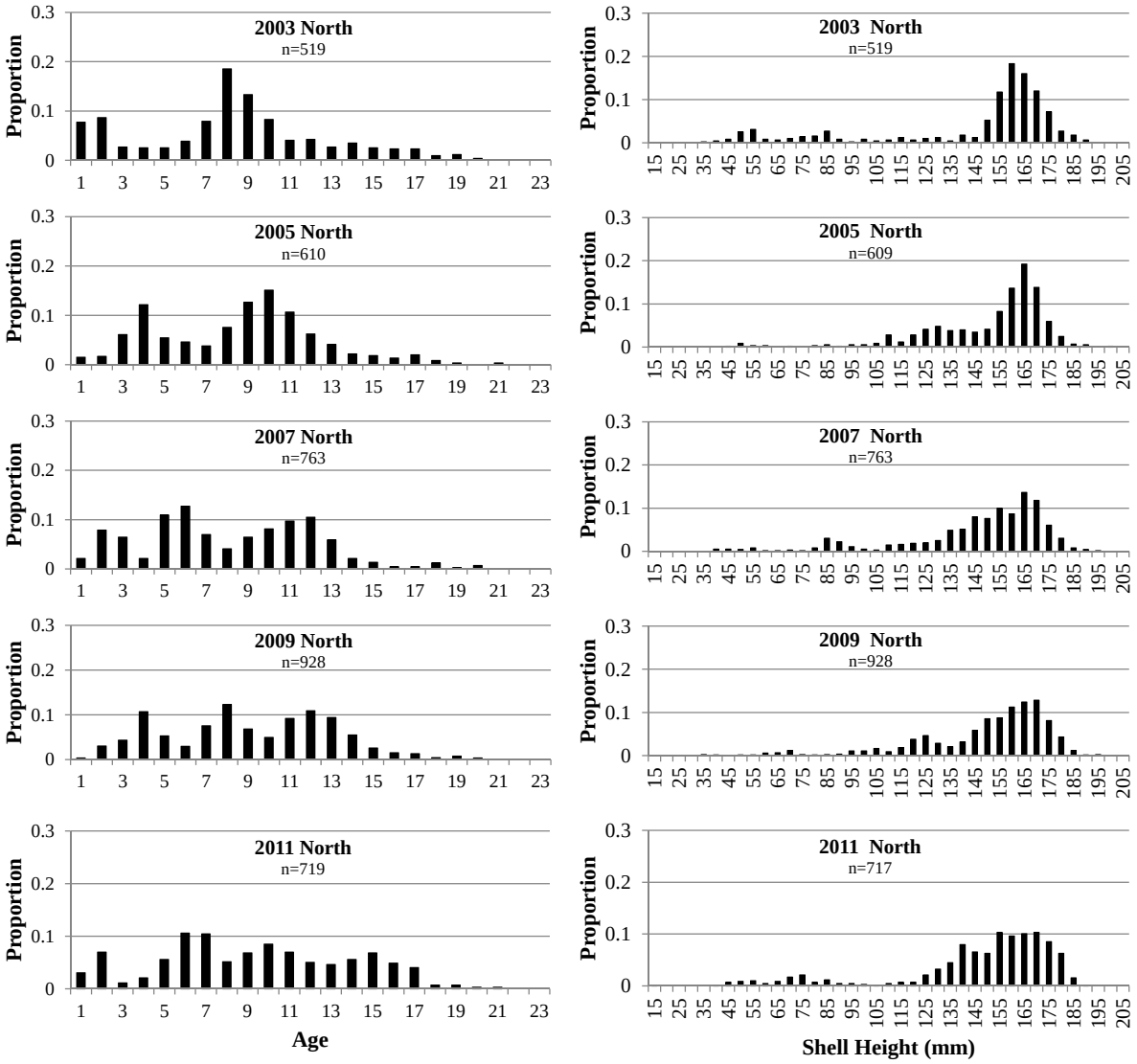



Figure 3-11 Comparison of ages and shell height distributions, Kamishak north bed

***Sled-dredge:*** Efforts continue with using underwater video techniques to evaluate survey dredge efficiency, with the goal of increasing accuracy of survey estimates resulting in more appropriate harvest limits. Because the scallop "beds" of significant aggregation appear to occur in discrete area, project results are further delineating essential habitat of weathervane scallops, a need specified in the Magnuson-Stevens Act. Central Region staff has also developed a sled-dredge (Figure 3-12). The sled is analogous to that used by the statewide scallop program in Kodiak, however instead of only allowing for video and counts to be made, this sled has a pinning system on the back to allow for an ~6' wide dredge setup to be attached. The sled-dredge setup allows for video cameras to look forward and aft to obtain counts of scallops before the sled reaches them and looking aft at the foot of the dredge bag to examine the efficiency of the gear (i.e. how many scallops go in vs. under the dredge). In the 2012 field season our goal was to get a complete survey at Kayak Island using the 8' dredge. Due to vessel scheduling and we postponed further comparisons of the sled-dredge with the 8' dredge till the 2013 Kamishak survey.

A B

Figure 3-12 A) Photo of sled-dredge onboard deck of R/V Pandalus, with 8' dredge bag in foreground; B) ADF&G sled-dredge with bag stretched out on deck after trial tow (8' dredge can be seen in background).

***Weak Meats:*** During the 2009 Scallop Planning Team Meeting "weak meats" were discussed. Weak meats are characterized by adductor muscle coming off the shell when the viscera are pulled off the shell in the shucking process. These meats are off color, with a stringy consistency that makes them unacceptable for marketing by the industry. Weathervane scallops with "weak meats" were observed while shucking the age and meat weight sample (~20 scallops/tow) from the 2009 Kamishak survey. Of scallops observed for "weak meats" 10.4% had weak meats in the north bed and 4.9% in the south bed. The sled-dredge had 14.7% weak meat scallops. The sled dredge was only trialed in the north bed during the 2009 survey. During the 2011 survey only the 8' dredge was used with the north bed having 12.9% weak meats and the south bed having 3.3% weak meats.

**Fishery overview**

The guideline harvest specified by state regulations for the Kamishak District is 10,000 to 20,000 pounds of shucked meats, with a season August 15–October 31. Harvest peaked in 1996 with five vessels harvesting 28,228 pounds of shucked meats with catch rates of 53 lb/hr. Participation and CPUE in this small fishery vary widely (Table 3-6). Since the fishery was closed in 1995 due to regulatory issues not biological issues, the manager decided that an additional 8,000 lb harvest was allowable because the 1996 survey indicated the Kamishak north bed was healthy. Allowing an additional harvest resulted in only a 3% harvest rate begin applied, which is less than the 5% harvest rate typically applied when stocks fall below the 20,000 lb GHL.

The 2012 harvest was 11,407 pounds of shucked meats and an estimated 332 pounds of deadloss, totaling 11,739 lb, with catch rates of 30 pounds/hour. (Table 3-6, Figure 3-7). The Department sent an observer out on two of four trips observed. The height distribution of the observed had tri-modal distribution with predominate modes at 65mm, 115mm and 155mm (Figure 3-6). Additionally the Department ages an approximately 200 sample from each trip. The age distribution had a tri-modal distribution with predominate ages at seven, 11, and 15 (Figure 3-6). No scallops were aged on the observer trip.

The 2013 survey is scheduled for May and results will determine the GHL and will be released to the public. During the survey ADF&G staff and Dr. Brad Harris of Alaska Pacific University will be collaborating on a discard mortality study on weathervane scallops and Tanner crab.

Table 3-6 Cook Inlet, Kamishak District scallop fishery summary statistics

| | | North Bed | | | | South Bed | | | | Total Both Beds | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Number of vessels | GHL lb meat | Catch (lb)[a] of shucked meats | Hours[b] | CPUE[c] lb/hour | GHL lb meat | Catch (lb)[a] of shucked meats | Hours[b] | CPUE[c] lb/hour | GHL lb meat | Catch (lb)[a] of shucked meats | Hours[b] | CPUE[c] lb/hour |
| 1983 [d] | 1 | | 2,346 | 109.1 | 21.5 | | | | | | 2,346 | 21.5 | 109.1 |
| 1984 | 3 | | 6,305 | 248.2 | 25.4 | | | | | | 6,305 | 25.4 | 248.2 |
| 1985 [d] | 1 | 20,000 | 11,810 | 299.0 | 39.5 | | | | | | 11,810 | 39.5 | 299.0 |
| 1986 | 3 | 20,000 | 15,364 | 424.4 | 36.2 | | | | | | 15,364 | 36.2 | 424.4 |
| 1987 [d] | 2 | 20,000 | 1,488 | 23.8 | 15.1 | | | | | | 1,488 | 15.1 | 98.5 |
| 1988 | | | | | | | | | | | | | |
| 1989 | | | | | | | | | | | | | |
| 1990 | | | | | | | | | | | | | |
| 1991 | | | | | | | | | | | | | |
| 1992 | | | | | | | | | | | | | |
| 1993 | 3 | 20,000 | 20,115 | 528.0 | 38.1 | | | | | 20,000 | 20,115 | 528.0 | 38.1 |
| 1994 | 4 | 20,000 | 20,431 | 458.1 | 44.6 | | | | | 20,000 | 20,431 | 458.1 | 44.6 |
| 1995 | | Closed | | | | | | | | Closed | | | |
| 1996 | 5 | 28,000 | 28,228 | 534.0 | 52.9 | | | | | 28,000 | 28,228 | 534.0 | 52.9 |
| 1997 | 3 | 20,000 | 20,336 | 394.0 | 51.6 | | | | | 20,000 | 20,336 | 394.0 | 51.6 |
| 1998 [d] | 1 | 20,000 | 17,246 | 390.0 | 44.2 | | | | | 20,000 | 17,246 | 390.0 | 44.2 |
| 1999 | 3 | 20,000 | 20,315 | 325 | 62.5 | | | | | 20,000 | 20,315 | 325.0 | 62.5 |
| 2000 | 3 | 20,000 | 20,516 | 275.1 | 74.6 | | | | | 20,000 | 20,516 | 275.1 | 74.6 |
| 2001 [d] | 2 | 20,000 | 20,097 | 325.0 | 61.8 | | | | | 20,000 | 20,097 | 325.0 | 61.8 |
| 2002 | 3 | 20,000 | 6,045 | 235.3 | 25.7 | | 2,546 | 76.1 | 33.5 | 20,000 | 8,591 | 311.4 | 27.6 |
| 2003 [d] | 2 | Closed | | | | 20,000 | 15,843 | 896.0 | 17.7 | 20,000 | 15,843 | 896.0 | 17.7 |
| 2004 | 3 | 6,500 | 4,519 | 197.7 | 22.9 | 13,500 | 1,598 | 165.9 | 9.6 | 20,000 | 6,117 | 363.6 | 16.8 |
| 2005 [d] | 2 | | 7,378 | 372.0 | 19.8 | 7,000 | Closed | | | 7,000 | 7,378 | 372.0 | 19.8 |
| 2006 [d] | 1 | | 50 | 10.0 | 5.0 | 7,000 | Closed | | | 7,000 | 50 | 10.0 | 5.0 |
| 2007 | 0 | 7,000 | | | | 5,000 | | | | 12,000 | | | |
| 2008 | 0 | 7,000 | | | | 5,000 | | | | 12,000 | | | |
| 2009 | 0 | 14,000 | | | | | Closed | | | 14,000 | | | |
| 2010 [e] | 1 | 14,000 | 9,460 | 365.0 | 25.9 | | Closed | | | 14,000 | 9,460 | 365.0 | 25.9 |
| 2011 [e] | 1 | 12,500 | 9,975 | 324.0 | 30.8 | | Closed | | | 12,500 | 9,975 | 324.0 | 30.8 |
| 2012 [e] | 1 | 12,500 | 11,739 | 392.0 | 29.9 | | Closed | | | 12,500 | 11,407 | | |

[a] Catch incluses harvested scallops and estimated deadloss

[b] Dredge-hours equils one dredge fished for 60 minutes.

[c] CPUE(catch per unit effort) equils pounds of scallops caught per dredge-hour.

[d] Confidential data (fewer that 3 vessels fished).

[e] Confidential data released by vessel operators.

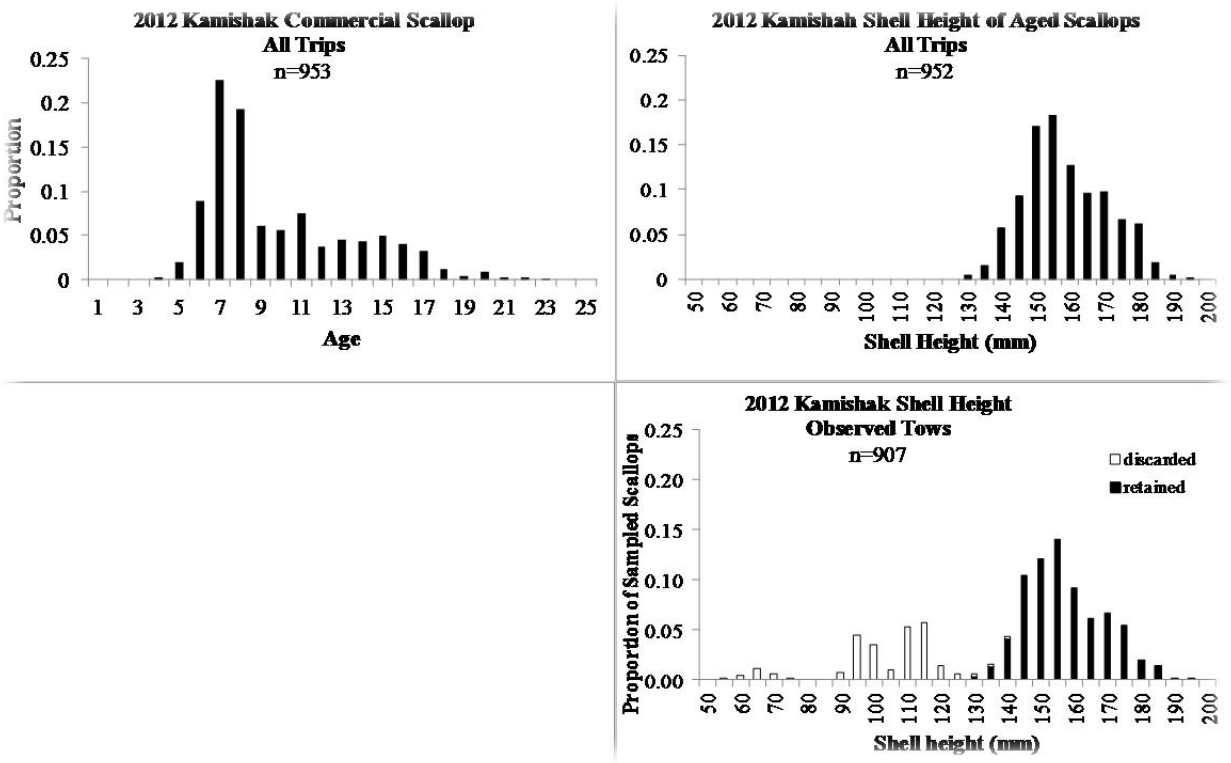



Figure 3-6 Age and height distribution comparing all trips shell height distribution to observed trips.

## Age Structured Model

Central region staff biometrician, Dr. Xinxian Zhang, has started working on an age structured model using Kamishak Bay data. Currently he has finished the frame work and is starting to input data and begin preliminary model runs. Additionally all previous model attempts conducted by Dr. Bill Bechtol (from Bechtol 2000) have been supplied to Dr. Zhang.

## 3.4 Kodiak Registration Area, Northeast District

Guideline Harvest Levels (GHL) must be in compliance with harvest ranges established by the Alaska Board of Fisheries, 5 AAC 38.430 Guideline Harvest Range for the Taking of Scallops. Harvest levels for the weathervane scallop fishery in the Northeast District are set by reviewing fishery-dependent data collected from the onboard observer program. Data available consist of effort (dredge hours), size frequency of retained and discarded scallops (discarded scallops are smaller size than retained scallops and indicate recruitment trends), harvest location and depth. ADF&G tracks catch per unit effort (CPUE) by vessel throughout the season.

Large portions of the Kodiak Registration Area that contain scallops are closed to scallop dredging. These closures were recommended by ADF&G and adopted by the Alaska Board of Fisheries over 30 years ago due to concerns about red king crab bycatch and gear conflicts.

The management program employs an overall guideline harvest level for the district, with individual scallop bed harvest caps within the district, coupled with inseason tracking of CPUE against predetermined CPUE benchmarks. The management program annually reviews recent fishery performance against historical trends in the fishery. Prior to 1999, weathervane scallop harvests in the Northeast District were not constrained by a GHL (Table 3-7; Figure 3-13). The 1999/00 season was the first in which a GHL was established. The 1999/00 season GHL was based on 75% of the average harvest from the 1997/98 and 1998/99 seasons, and further reduced by 5,000 pounds as a precautionary approach; the initial GHL range was 0-75,000 pounds.

Along with implementing a GHL during the 1999/00 season, ADF&G also established individual harvest caps for scallop beds within the district. This management measure was aimed to distribute effort across the three known scallop beds. For the 2000/01 season the GHL was increased to 80,000 lbs based on improving fishery performance during the 1999/00 season. The 80,000 pound GHL remained in effect from the 2000/01 through the 2005/06 seasons. During this time period, CPUE ranged from 46 to 73 pounds meat/dredge hr (Table 3-7, Figure 3-13) and observer program shell height data demonstrated catches contained a wide range of scallop sizes (Figure 3-14) suggesting sustained recruitment through that time period.

Beginning in the 2003/04 season ADF&G tracked inseason fishery performance, by individual scallop bed, against a preseason established benchmark. The benchmark was established as the lowest recent annual cumulative CPUE. The benchmark was used to assess inseason fishery performance after the scallop participants had harvested one-half the GHL. The performance thresholds are used to assess if the upper end of the GHL range should be taken or if harvests should be limited below the upper end of the GHL range.

Prior to the start of the 2006/07 season, the harvest cap for Statistical Area 525630 was reduced by 5,000 pounds due to a decline in CPUE during the previous season. To provide an opportunity for exploratory fishing in the northern portion of the district, the GHL was increased by 15,000 pounds. The GHL for the 2006/07 season was 90,000 pounds, and remained at this level through the 2008/09 season. The exploratory addition of 15,000 pounds could only be harvested north of Cape Izhut (58.1° N latitude). This area lies east of Afognak Island and north of areas fished since inception of the observer program in 1993. Scallops were last harvested in this area during the 1980s. Due to fuel costs and other considerations, the exploratory area saw little effort, with less than 100 pounds of scallop meats harvested from 2006/07 through the 2008/09 season. Prior to the 2009/10 season the exploratory harvest level of 15,000 pounds was removed from the Northeast District GHL reducing the overall GHL to 75,000 pounds.

Two vessels harvested about 75,000 pounds of scallop meats from the Northeast District during the 2008/09 season. Summary statistics from recent fishery data are presented in Table 3-7. Northeast District catches and CPUE have remained stable since the 2000/01 fishing season (Table 3-7, Figure 3-13). One vessel harvested about 73,000 pounds of scallop meats from the Northeast District in 2009/10 season.

Three vessels fished the Northeast District during the 2010/11 season, harvesting 64,465 lbs scallop meats from 618 tows for overall CPUE 64 lbs meat/dredge-hr (Table 3-7, Figure 3-13). Average CPUE from the previous ten scallop seasons was 62 lbs meat/dredge-hr.

Four vessels fished the Northeast District during the 2011/12 season, harvesting 61,209 lbs scallop meats from 699 tows for overall CPUE 62 lbs meat/dredge-hr (Table 3-7, Figure 3-13). Average CPUE from the previous ten scallop seasons was 60 lbs meat/dredge-hr. One vessel made 25 exploratory tows north of Cape Izhut but found few scallops and harvested only 43 lbs.

Observers measured shell height of about 10,000 retained and discarded scallops during the 2011/12 Northeast District scallop season. Plots from resampling these data (Figure 3-17) show that scallops between 125 mm SH and 165 mm SH provided most (~75%) of the 2011/12 retained catch. Results from visual shell aging of retained Northeast District scallops indicate that an increased proportion of scallops aged 5 and 6 years were found in the 2011/12 harvest along with many scallops aged 8 to 10 years.

Observers sampled 147 (21%) of the tows made during the 2011/12 Northeast District scallop season. From these data, an estimated 95,885 lbs round weight of scallops were discarded; discards accounted for about 12.5% of total catch, with 5.7% broken and the remainder intact. Estimated Tanner crab bycatch in the district for 2011/12 (Table 2-6) was 29,185 crab from a cap of 147,956.

Table 3-7 Kodiak Northeast District scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 10 | NA | 155,187 | 6,940 | 22 | |
| 1994/95 | 7 | NA | 35,207 | 1,773 | 20 | |
| 1995/96 | | closed | | | | |
| 1996/97 | 3 | NA | 11,430 | 581 | 20 | 8,355 |
| 1997/98 | 3 | NA | 95,858 | 2,604 | 37 | 41,615 |
| 1998/99 | 4 | NA | 120,010 | 2,749 | 44 | 190,480 |
| 1999/00 | 3 | 75,000 | 77,119 | 1,384 | 56 | 113,349 |
| 2000/01 | 4 | 80,000 | 79,965 | 1,101 | 73 | 113,422 |
| 2001/02 | 3 | 80,000 | 80,470 | 1,142 | 70 | 108,835 |
| 2002/03 | 2 | 80,000 | 80,000 | 1,350 | 59 | 166,547 |
| 2003/04 | 2 | 80,000 | 79,965 | 1,248 | 64 | 113,536 |
| 2004/05 | 2 | 80,000 | 80,105 | 1,227 | 65 | 262,976 |
| 2005/06 | 3 | 80,000 | 79,990 | 1,759 | 45 | 209,906 |
| 2006/07 | 2 | 90,000 | 75,150 | 1,168 | 64 | 135,343 |
| 2007/08 | 2 | 90,000 | 75,105 | 1,170 | 64 | 203,059 |
| 2008/09 | 3 | 90,000 | 74,863 | 1,363 | 55 | 110,869 |
| 2009/10 | 1 | 75,000 | 69,360 | 1,210 | 57 | 121,021 |
| 2010/11 | 3 | 65,000 | 64,475 | 1,015 | 64 | 85,890 |
| 2011/12 | 4 | 70,000 | 61,209 | 986 | 62 | 95,885 |
| 2012/13[b] | 4 | 60,000 | 62,391 | 1,317 | 47 | |

*a Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*
*b PRELIMINARY catch data subject to change.*

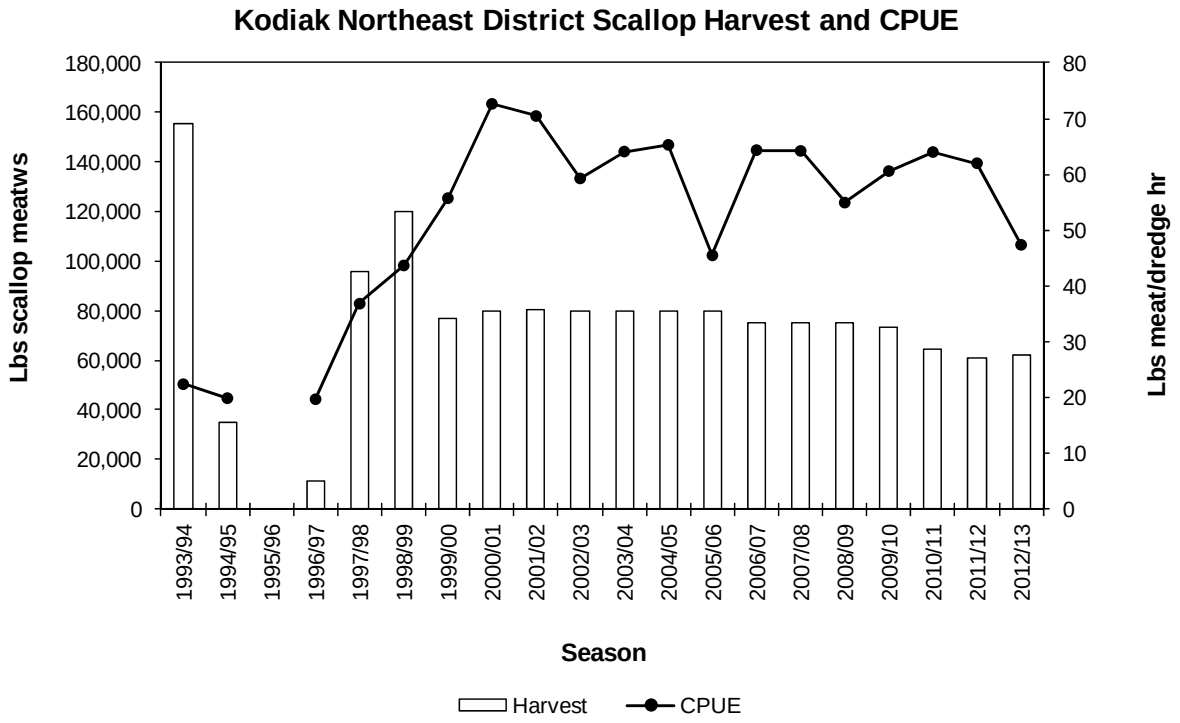



Figure 3-13 Kodiak Northeast District Harvest and CPUE, 1993/94—2012/13 seasons.

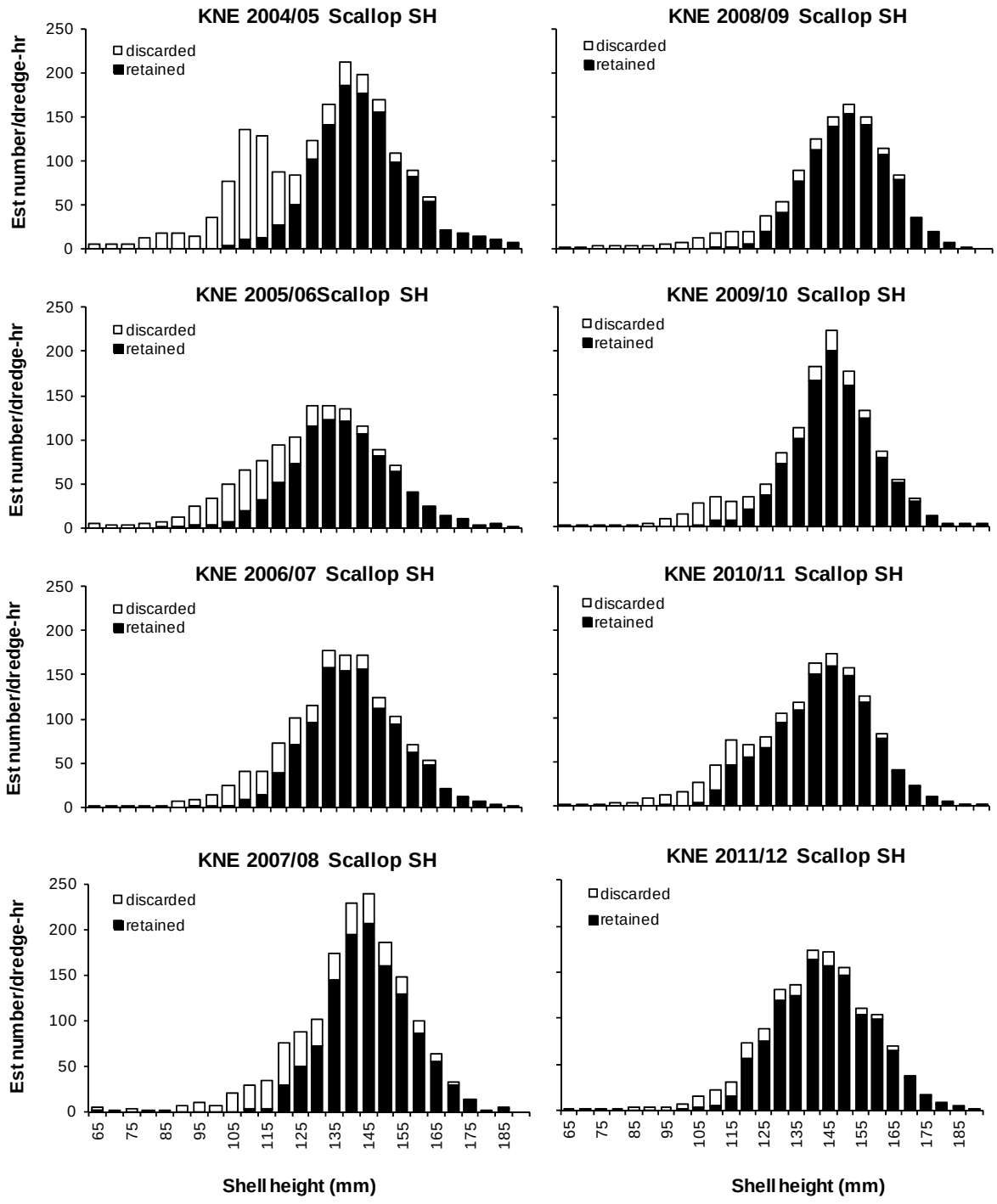



Figure 3-14 Estimated scallop shell height distributions from the 2004/2005—2011/12 Kodiak Northeast District fishing seasons.

## 3.5 Kodiak Registration Area, Shelikof District

Similar the Northeast District, managers use fishery dependent data and information obtained through the observer program to establish Shelikof District GHLs and manage harvests inseason.

A GHL of 180,000 pounds of shucked scallop meat was established in the Shelikof District prior to the 1999/2000 season. The initial GHL was calculated by applying a tier 6 calculation to the historic (1990-1997) proportion of weathervane scallops harvested in the Shelikof District relative to the total upper limit of the Kodiak Registration Area Guideline Harvest Range (GHR). Between 1990 and 1997 the total Kodiak Area weathervane scallop GHR was 300,000 pounds and 72% of all weathervane scallops in the Kodiak Area were harvested in the Shelikof District resulting in an average Shelikof District harvest of 216,000 pounds. Appling a tier 6 calculation (216,000 lbs x .75) resulted in a precautionary GHL of 162,000 pounds which was revised up to 180,000 pounds to match the amount of scallops harvested during the 1998/99 season.

The GHL was reduced to 160,000 pounds for the 2005/06 and 2006/07 seasons due to concerns about the concentration of effort in the northern part of the main Shelikof bed. This action led to a split GHL with 130,000 pounds allocated to the northern portion (north of 58° 30' N Lat.) of the district and 30,000 pounds allocated to the southern portion. Prior to the 2007/08 season, the GHL was set at 130,000 pounds for the northern portion of the district and increased to 40,000 pounds for the southern portion based on an increase in CPUE from 38 pounds meat/dredge hr during the 2004/05 season to 66 pounds meat/dredge hr during the 2006/07 season.

Two vessels using 15 foot dredges and a smaller vessel that deployed a single 10 foot dredge participated in the 2007/08 fishery and harvested about 170,000 pounds. Summary statistics from recent fishery data are presented in Table 3-8, Figure 3-13, and Figure 3-14. Shelikof District CPUE decreased to 58 pounds meat/dredge hr for the 2007/08 season (Table 3-8, Figure 3-13) ADF&G attributes this decline in part, to participation of a smaller vessel deploying a smaller dredge. ADF&G does not account for dredge width in CPUE calculations. Overall Shelikof District CPUE has been greater than 50 pounds meat/dredge-hr in each season since 2003/04. Significant numbers of scallops less than 120 mm shell height were discarded during the 2007/08 season (Figure 3-14).

During the 2008/09 season the Shelikof District was closed prior to the GHL being achieved when the Tanner crab bycatch cap was exceeded. Tanner crab bycatch limits for the Shelikof District were set preseason at 16,900 crabs. Only 12,700 pounds of scallop meats were harvested district-wide before the fishery was closed in July 2008.

For the 2009/10 season, the GHL was set at 170,000 lbs scallop meats. Three vessels participated in the fishery, harvesting 169,877 lbs scallop meats from 1,921 hauls with overall CPUE 49 lbs meat/dredge-hr (Table 3-8 and Figure 3-16). CPUE for 2009/10 was the similar to 2008/09 but remained below the 2000/01–2008/09 average of 58 lbs meat/dredge-hr.

Kodiak Shelikof District GHL was set at 170,000 lbs scallop meats for the 2010/11 season, with harvest limited to a maximum of 130,000 lbs from the KSH North section (north of 58.5º N.). Four vessels participated in the fishery, harvesting 171,065 lbs scallop meats from 2,218 hauls with overall CPUE 49 lbs meat/dredge-hr (Table 3-8 and Figure 3-16). CPUE for 2010/11 was the same as for 2009/10 but remained below the 2000/01–2009/10 average of 58 lbs meat/dredge-hr.

Kodiak Shelikof District GHL was set at 135,000 lbs for the 2011/12 season with harvest limited to 130,000 lbs from the main bed east of 154º W between Hallo Bay and Cape Douglas. Four vessels

participated in the fishery, harvesting 133,079 lbs meat from 1,660 hauls, resulting in a CPUE of 55 lbs meat/dredge-hr (Table 3-8 and Figure 3-16).

Observers sampled 376 (23%) of the tows made during the 2011/12 season and measured shell height of over 14,000 scallops. Plots from resampling these data (Figure 3-18) reflect the low 2011/12 discard rate and show that scallops 120–155 mm provided the bulk (>85%) of the retained harvest. Plots of results from visual shell aging show that 5- and 6-year old scallops were prevalent in the 2011/12 catch.

Estimated Tanner crab bycatch in the 2011/12 Shelikof District fishery was 27,684 crab, close to the cap of 27,636. Fishermen reported that efforts to avoid Tanner crab led to reduced CPUE as the season progressed. An estimated 128,448 lbs of whole scallops, or 8.5% of total, were discarded during the season.

Table 3-8 Kodiak Shelikof District scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 5 | NA | 105017 | 2491 | 42 | |
| 1994/95 | 11 | NA | 314,051 | 8,662 | 36 | |
| 1995/96 | | closed | | | | |
| 1996/97 | 3 | NA | 219,305 | 3,491 | 63 | 197,174 |
| 1997/98 | 4 | NA | 258,346 | 5,492 | 47 | 93,221 |
| 1998/99 | 8 | NA | 179,870 | 4,081 | 44 | 216,354 |
| 1999/00 | 6 | 180,000 | 187,963 | 4,304 | 44 | 289,867 |
| 2000/01 | 5 | 180,000 | 180,087 | 2,907 | 62 | 128,614 |
| 2001/02 | 4 | 180,000 | 177,112 | 3,398 | 52 | 239,459 |
| 2002/03 | 3 | 180,000 | 180580 | 3,799 | 48 | 496,577 |
| 2003/04 | 2 | 180,000 | 180011 | 3,258 | 55 | 402,800 |
| 2004/05 | 2 | 180,000 | 174,622 | 3,467 | 50 | 435,844 |
| 2005/06 | 2 | 160,000 | 159,941 | 2,280 | 70 | 233,911 |
| 2006/07 | 3 | 160,000 | 162,537 | 2,183 | 74 | 234,979 |
| 2007/08 | 3 | 170,000 | 169,968 | 2,937 | 58 | 377,063 |
| 2008/09 | 2 | 170,000 | 13,761 | 263 | 52 | 32,301 |
| 2009/10 | 3 | 170,000 | 169,877 | 3,447 | 49 | 349,952 |
| 2010/11 | 4 | 170,000 | 171,076 | 3,507 | 49 | 423,118 |
| 2011/12 | 4 | 135,000 | 136,491 | 2,437 | 56 | 128,448 |
| 2012/13[b] | 4 | 105,000 | 105,902 | 2,023 | 52 | |

*a Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*
*b PRELIMINARY catch data subject to change.*

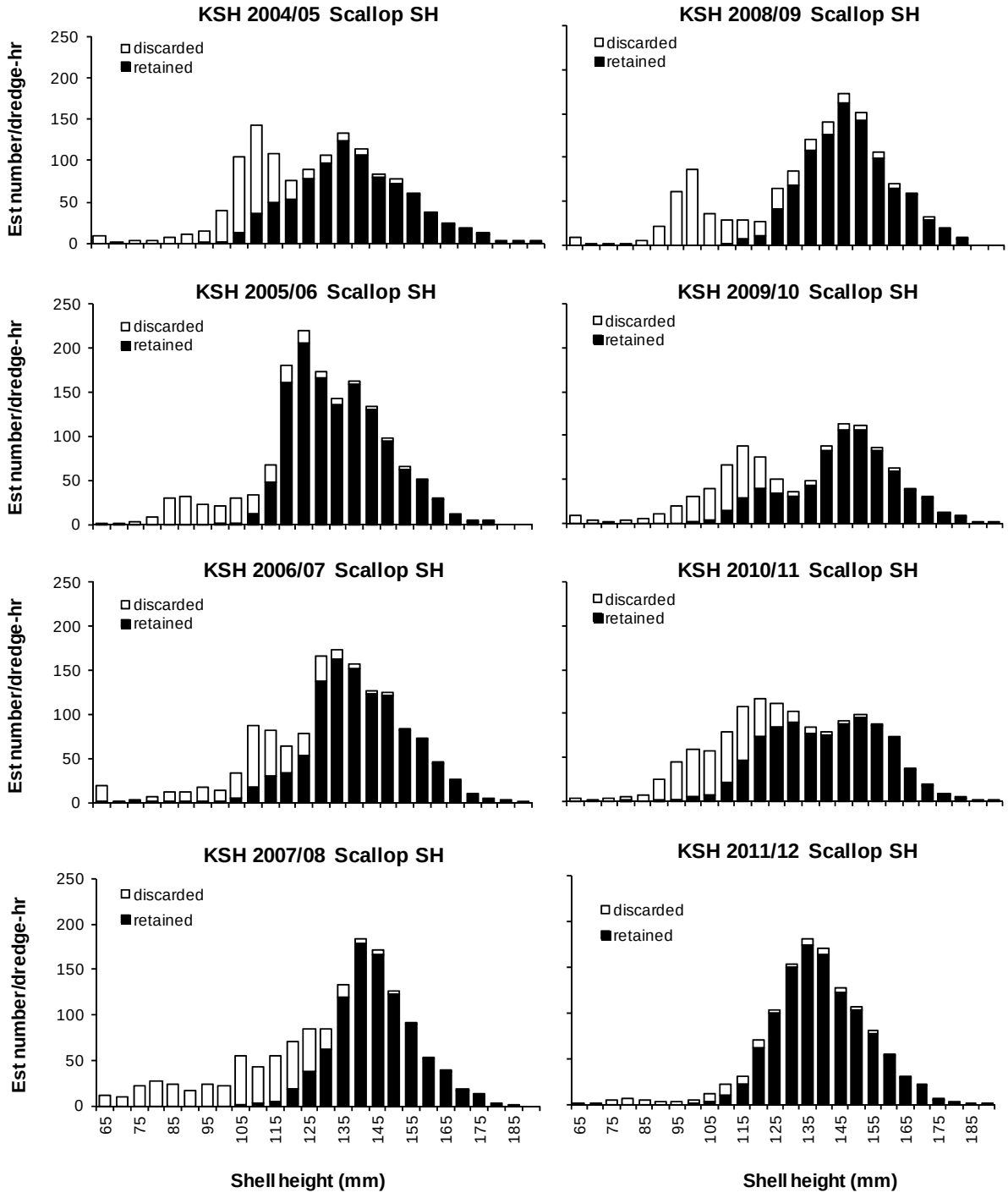



Figure 3-15 Estimated scallop shell height distributions from the 2004/2005 – 2011/12 Kodiak Shelikof District fishing seasons.

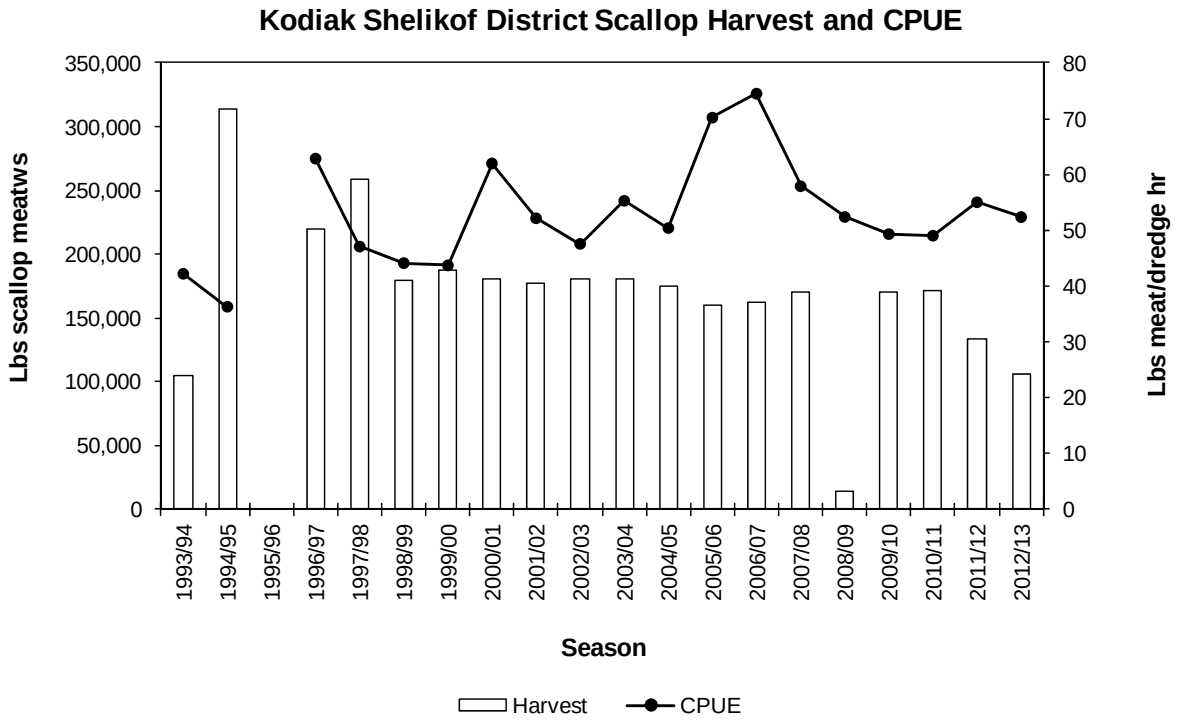



Figure 3-16 Kodiak Shelikof District Harvest and CPUE, 1993/94—2012/13 seasons.

## 3.6 Kodiak Registration Area, Southwest District

In March 2009, the Alaska Board of Fisheries opened, on an experimental basis, previously closed waters for scallops in the Southwest District south of a line from the westernmost tip of Cape Ikolik to the southernmost tip of Cape Kilokak, and west of 155° W Long., north of 56° 07' N Lat., and east of 156° 20.22' W Long. The Southwest District was closed to scallop fishing in 1969 due to king and Tanner crab bycatch concerns.

Participation in this area is allowed only by ADF&G commissioner's permit as specified in 5 AAC 38.420 Fishing Seasons for Scallops in Registration Area J. During the board meeting, managers recommended a 25,000 pound GHL for the Southwest District to encourage participants to distribute effort to help delineate scallop beds. ADF&G plans to conduct video surveys in this area to further assess the resource.

Kodiak Southwest District GHL was set at 25,000 lbs for the 2009/10 season. One vessel participated in the fishery, harvesting 3,480 lbs meat from 125 hauls, resulting in a CPUE of 22 lbs meat/dredge-hr (Table 3-9). Scallop catches were in general poor and Tanner crab bycatch high with an estimated 7,052 crabs taken.

Kodiak Southwest District GHL was set at 25,000 lbs for the 2010/11 season but no vessels participated in the fishery.

Kodiak Southwest District GHL was set at 25,000 lbs for the 2011/12 season. One vessel participated in the fishery, harvesting 25,110 lbs meat from 311 hauls, resulting in a CPUE of 55 lbs meat/dredge-hr (Table 3-9 and Figure 3-16).

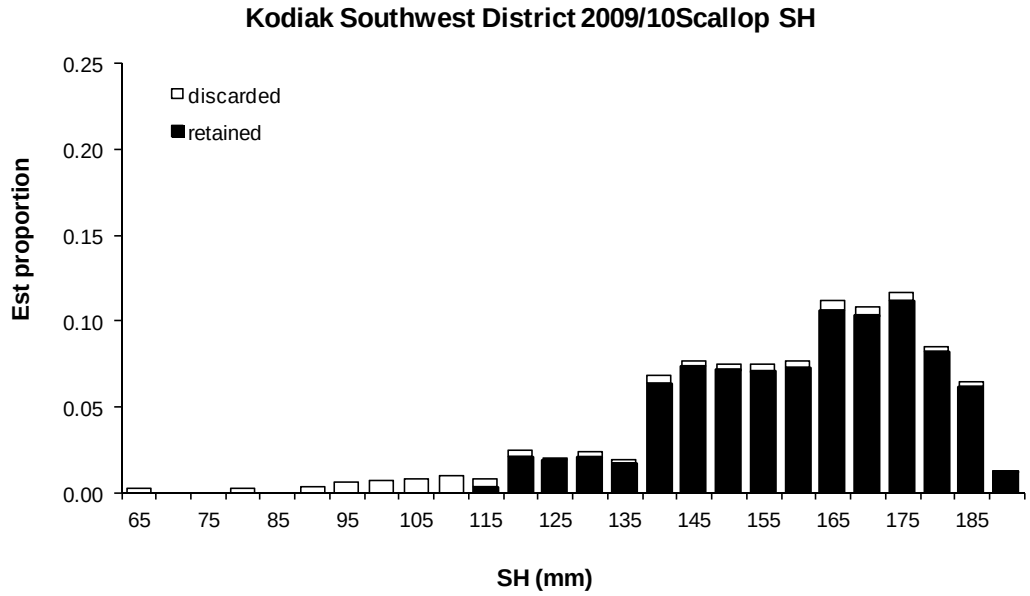
The onboard observer sampled 56 (18%) of the tows made during the 2011/12 season and measured shell height of over 1,800 retained and discarded scallops. Plots from resampling these data (Figure 3-17) shows that large scallops with SH >140 mm comprised the bulk of the harvest, with few small scallops encountered. Results from visual shell aging 110 specimens showed that many scallops >20 years of age were harvested with little contribution to the harvest from scallops <9 years old.

Estimated Tanner crab bycatch in the 2011/12 Southwest District fishery was 8,894 crab. An estimated 17,842 round lbs of scallops or 5.0% of total scallops landed were discarded, with about 4.2% of the total broken and the remainder intact

Table 3-9 Kodiak Southwest District scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours | CPUE (lbs meat per dredge hr) |
|---|---|---|---|---|---|
| 2009/10 | 1 | 25,000 | 3,480 | 158 | 22 |
| 2010/11 | 0 | 25,000 | | | |
| 2011/12 | 1 | 25,000 | 25,110 | 454 | 55 |
| 2012/13[a] | 2 | 25,000 | 25,014 | 670 | 37 |

*a PRELIMINARY catch data subject to change.*



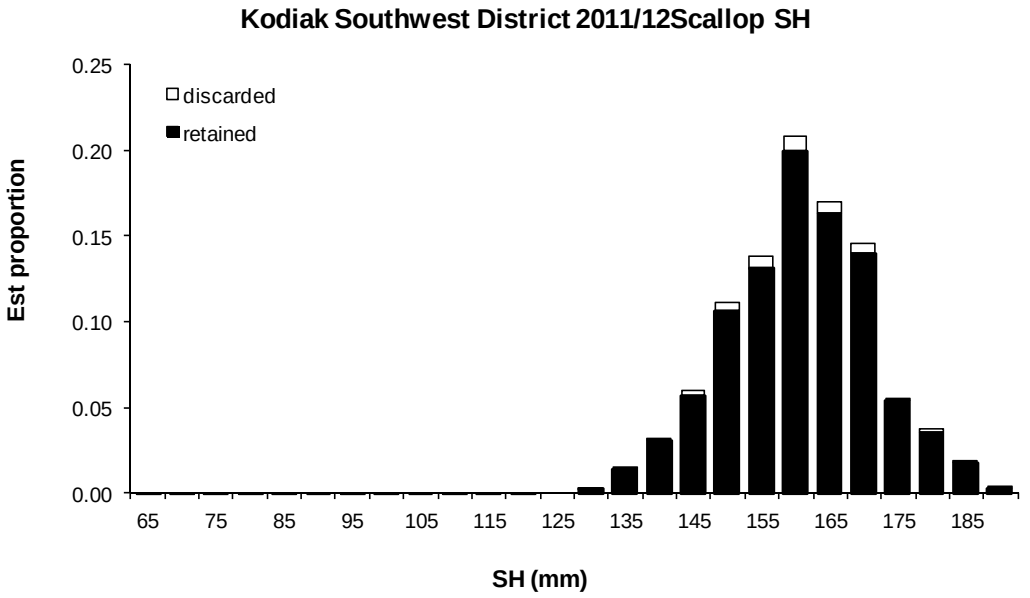




Figure 3-17 Estimated shell height distributions from the exploratory 2009/10 and 2011/12 Kodiak Southwest District scallop fisheries.

## 3.7 Kodiak Registration Area, Semidi District

Traditional scallop fishing areas of the Semidi District are located in state waters that were closed to scallop dredging by the Alaska Board of Fisheries in 2000 (Figure 2-1). Offshore waters of the district remain open to fishing, but no effort has occurred since the 1999/00 season (Table 3-10).

Table 3-10 Kodiak Semidi District scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Dredge hours[a] | Catch[a] (lbs meat) | CPUE (lbs meat per dredge hr) |
|---|---|---|---|---|---|
| 1993/94 | 6[b] | NA | 1,819 | 55,487 | 32 |
| 1994/95 | 2 | NA | 272 | confidential | |
| 1995/96 | | closed | | | |
| 1996/97 | 3 | NA | 1,017 | 37,810 | 37 |
| 1997/98 | 1 | NA | 349 | 6,315 | 18 |
| 1998/99 | 2 | NA | 106 | 1,720 | 16 |
| 1999/00 | 1 | NA | 45 | 930 | 21 |

*a Confidential data released by vessel operators.*
*b Two additional vessel fished but data are not available.*
*c Estimated from bycatch samples.*

## 3.8 Alaska Peninsula Registration Area

Similar the Northeast District, managers use fishery dependent data and information obtained through the observer program to establish Alaska Peninsula GHLs and manage harvests inseason. Scallop fishing in the Alaska Peninsula Registration Area (Area M) was traditionally concentrated in a small region near the Shumagin Islands between 160° and 161° W longitude. Area M was closed during the 2001/02 and 2002/03 seasons due to localized depletion (Table 3-11,Figure 3-18).

For the 2003/04 and 2004/05 seasons, the area between 160° and 161° W longitude remained closed to promote stock rebuilding, while the remainder of the area was opened with a 10,000 pound GHL. For the 2005/06 season, the area between 160° and 161° W. longitude was opened with a 10,000 pound GHL, the remainder of the area was opened with a 10,000 pound GHL, and no effort occurred. Prior to the 2006/07 season, the GHL was increased to 25,000 pounds for the area to increase incentive for participation, and two cooperative vessels fished traditional areas and adjacent waters on an experimental basis. Catches were very poor, indicating 5-yrs of no fishing did not rebuild the scallop stock.

In response, the GHL for the 2007/08 and 2008/09 seasons was lowered to 10,000 pounds and waters between 160°-161° W longitude were closed to scallop fishing. Total harvest from the 2007/08 season was 2,460 pounds, CPUE was low, and crab bycatch was relatively high. No vessels participated in the 2008/09 fishery.

The Alaska Peninsula scallop fishery was not opened during the 2009/10 or 2010/11 seasons. Limited effort, poor fishery performance, and high crab bycatch were observed when fishing occurred during the 2008/09 season. Below is a brief summary of the fishery over the past 10 years.

The Area M scallop fishery was closed during the 2000/01 season due to concerns about localized depletion. Waters between 160°–161° W longitude that provided the bulk of the catch during the 1990s remained closed until 2005/06 to allow the stock to rebuild.

No effort occurred during the 2003/04–2005/06 seasons.

Prior to the 2006/07 season, the GHL was set at 25,000 lbs with a maximum of 15,000 lbs to come from waters between 160°–161° W longitude. Two co-op vessels participated in the 2006/07 fishery and harvested approximately 155 lbs meat from 73 hauls for a CPUE of 2 lbs meat/dredge hr.

A GHL of 10,000 lbs of scallop meats with all waters between 160°–161° W longitude closed was set prior to the 2007/08 season, and no fishing effort occurred.

The 2008/09 GHL was also set at 10,000 lbs with all waters between 160°–161° W longitude closed. One vessel fished the area September 5–12, 2008 and harvested 2,460 lbs of scallop meats from statistical area 575531 near Lighthouse Rocks; twenty-three tows in other parts of the area produced zero lbs scallop meats. Tanner crab bycatch for the 2008/09 Alaska Peninsula scallop fishery was estimated at 18,302 crabs.

Beginning in 2009/10, the entire Alaska Peninsula Area was closed for a period of 5 years to allow stocks to recover. Staff recommend keeping the area closed for an additional 4 years.

Table 3-11 Alaska Peninsula Area scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole) |
|---|---|---|---|---|---|---|
| 1993/94 | 8 | NA | 112152 | 1847 | 61 | |
| 1994/95 | 7 | NA | 65,282 | 1,664 | 39 | |
| 1995/96 | | closed | | | | |
| 1996/97 | 2 | 200,000 | 12,560 | 327 | 38 | 7,384 |
| 1997/98 | 4 | 200,000 | 51,616 | 1,752 | 29 | 38,219 |
| 1998/99 | 4 | 200,000 | 63,290 | 1,612 | 39 | 43,129 |
| 1999/00 | 5 | 200,000 | 75,535 | 2,025 | 37 | 59,077 |
| 2000/01 | 3 | 33,000 | 7,660 | 320 | 24 | 4,538 |
| 2001/02 | | closed | | | | |
| 2002/03 | | closed | | | | |
| 2003/04 | | closed | | | | |
| 2004/05 | | closed | | | | |
| 2005/06 | 0 | 20,000 | | 0 | | |
| 2006/07 | 2 | 25,000 | 155 | 64 | 2 | 794 |
| 2007/08 | 0 | 10,000 | | | | |
| 2008/09 | | 10,000 | 2,460 | 151 | 16 | 4,101 |
| 2009/10 | | closed | | | | |
| 2010/11 | | closed | | | | |
| 2011/12 | | closed | | | | |
| 2012/13[b] | 1 | 15,000 | 15,040 | 255 | 59 | |

*a Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*

*b Exploratory fishery in Unimak Bight via ADF&G Commissioner's Permit.*

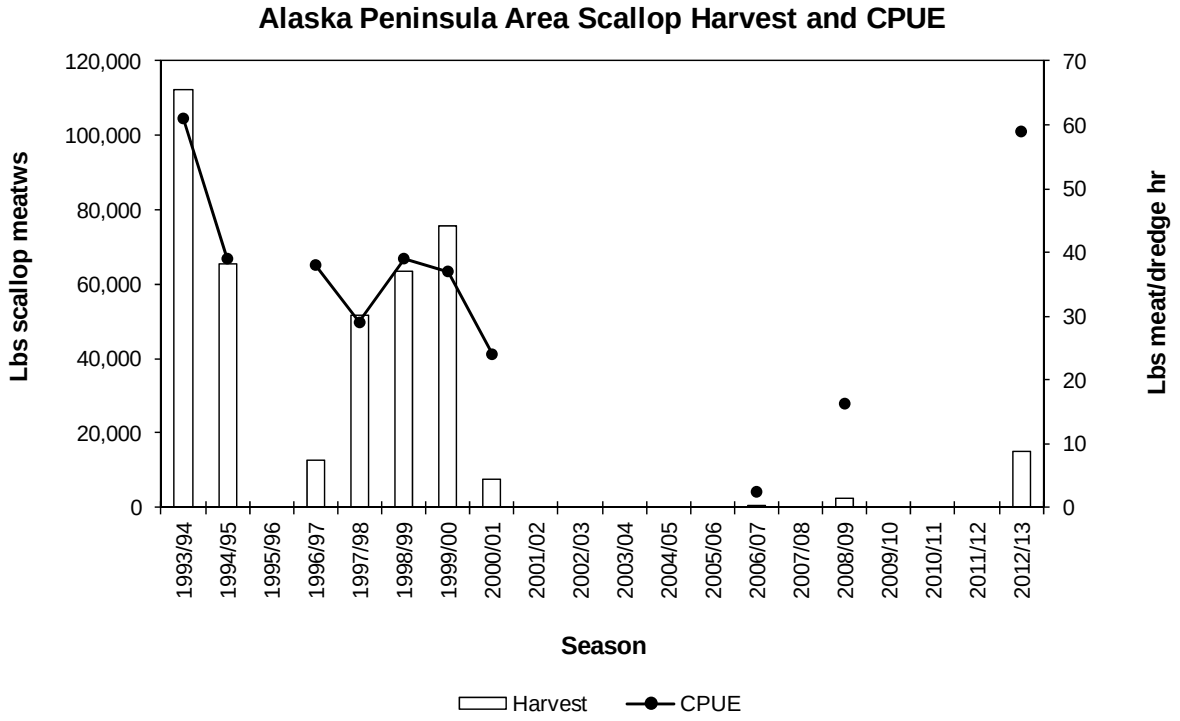



Figure 3-18 Alaska Peninsula harvest and CPUE, 1993/94–2012/2013 seasons.

## 3.9 Bering Sea Registration Area

Weathervane scallop fisheries in the Bering Sea Registration Area (BSRA) were unconstrained by a GHL prior to the 1996/97 season (Table 3-12, Figure 3-16). Once established, early GHL ranges were set optimistically, with upper bounds of 400,000 to 600,000 pounds of shucked scallop meats. Catch rates were relatively high during the mid to late-1990s, but annual harvests never exceeded half the upper bound of the GHL range. Scallop catches in the mid to late 1990s were often restricted by Tanner crab bycatch limits.

The upper bound of the BSRA weathervane scallop GHL was adjusted downward to 200,000 pounds beginning with the 2000/01 season and that level was retained for the following season when CPUE dropped by approximately 25% and total harvest was 70% of the upper limit of the GHL range. In response to diminishing fishery performance during the 2000/01 and 2001/02 seasons, managers set a GHL range of zero to 105,000 pounds of shucked scallop meats for the 2002/03 and 2003/04 seasons. The 2002/03 season performed reasonably well, but catch rates and overall catch continued to decrease in 2003/04.

Experimental video survey tows conducted in 2003 showed scallops distributed over a wide, poorly defined area at low densities. BSRA scallop density was low enough to raise concerns for reproductive potential of the stock. The absence of smaller size scallops during the video survey is partially confounded by shell height data from the commercial fishery indicating periodic recruitment events (Figure 3-20).

In addition to the incorporation of video survey data into the stocks assessment process, the 2003/04 season was the first in which managers established a CPUE threshold below which the fishery would be

closed. Inseason fishery performance data was evaluated against the threshold mid-way to the GHL. The threshold was somewhat arbitrarily set at the CPUE level of the 2002/03 season, or 44 pounds of shucked scallop meats per dredge hour. The CPUE threshold was not met during both the 2003/04 and 2004/05 seasons thereby triggering fishery closures before the GHL upper bound was achieved.

Fishery performance has improved since the mid-2000s. Season average CPUE levels are well above the threshold, the upper bound of the GHL range is regularly met, and scallop shell-height data shows moderate recruitment (Figure 3-20). The current 50,000 pound GHL upper bound appears to be sustainable under prevailing conditions.

CPUE data may be skewed by fleet behavior and weather effects, and in the BSRA may be influenced, in part, by crab bycatch rates. Incidental catches of *Chionoecetes* crabs in the Bering Sea scallop fishery have remained below established limits in recent years, but concerns about *Chionoecetes* bycatch rates may alter fleet behavior in the fishery.

Large portions of the eastern Bering Sea shelf and the Pribilof Islands Habitat Conservation Area are closed to scallop fishing to protect red and blue king crab habitat and to provide for habitat conservation .

A GHL of 50,000 lbs of was established for the BSRA prior to the 2010/11 season. Two vessels completed a total of 597 tows, harvesting 50,063 lbs scallop meats with CPUE 52 lbs meat/dredge-hr. Average CPUE over the previous 10 seasons was 45 lbs meat/dredge-hr.

A GHL of 50,000 lbs of was established for the BSRA prior to the 2011/12 season. Two vessels completed a total of 626 tows, harvesting 50,275 lbs scallop meats with CPUE 51 lbs meat/dredge-hr (Table 3-12 and Figure 3-16).

Observers measured shell height of over 3,200 retained and discarded scallops during the 2011/12 season. Plots from resampling these data (Figure 3-24) show that retained scallops were primarily between 155 mm and 170 mm shell height with few small scallops encountered.

Observers sampled 90 (14%) of the tows made during the 2011/12 BSRA scallop season. From these data, an estimated 30,837 lbs round weight of scallops were discarded; discards accounted for about 5.5% of the total catch. Estimated bycatch during the season was 22,363 Tanner crab from a cap of 65,000 crab and 13,073 snow crab from a cap of 300,000 (Table 2-6). Additionally, 135 red king crab from a cap of 500 crab were incidentally caught during the season.

Table 3-12 Bering Sea Area scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 9 | NA | 284,414 | 5,764 | 49 | |
| 1994/95 | 8 | NA | 505,439 | 11,113 | 45 | |
| 1995/96 | | closed | | | | |
| 1996/97 | 1 | 600,000 | 150,295 | 2,313 | 65 | 16,188 |
| 1997/98 | 2 | 600,000 | 97,002 | 2,246 | 43 | 38,262 |
| 1998/99 | 4 | 400,000 | 96,795 | 2,319 | 42 | 127,607 |
| 1999/00 | 2 | 400,000 | 164,929 | 3,294 | 50 | 68,406 |
| 2000/01 | 3 | 200,000 | 205,520 | 3,355 | 61 | 97,994 |
| 2001/02 | 3 | 200,000 | 140,871 | 3,072 | 46 | 76,261 |
| 2002/03 | 2 | 105,000 | 92,240 | 2,038 | 45 | 55,197 |
| 2003/04 | 2 | 105,000 | 42,590 | 1,020 | 42 | 34,327 |
| 2004/05 | 1 | 105,000 | 10,050 | 275 | 37 | 5,639 |
| 2005/06 | 1 | 50,000 | 23,220 | 602 | 39 | 17,433 |
| 2006/07 | 1 | 50,000 | 48,246 | 1,138 | 42 | 54,503 |
| 2007/08 | 2 | 50,000 | 49,995 | 1,084 | 46 | 49,356 |
| 2008/09 | 1 | 50,000 | 49,995 | 962 | 52 | 58,417 |
| 2009/10 | 1 | 50,000 | 48,855 | 1,270 | 38 | 57,984 |
| 2010/11 | 2 | 50,000 | 50,099 | 972 | 52 | 73,178 |
| 2011/12 | 2 | 50,000 | 50,275 | 984 | 51 | 30,837 |
| 2012/13[b] | 1 | 50,000 | 50,025 | 941 | 53 | |

*a Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*
*b PRELIMINARY catch data subject to change.*

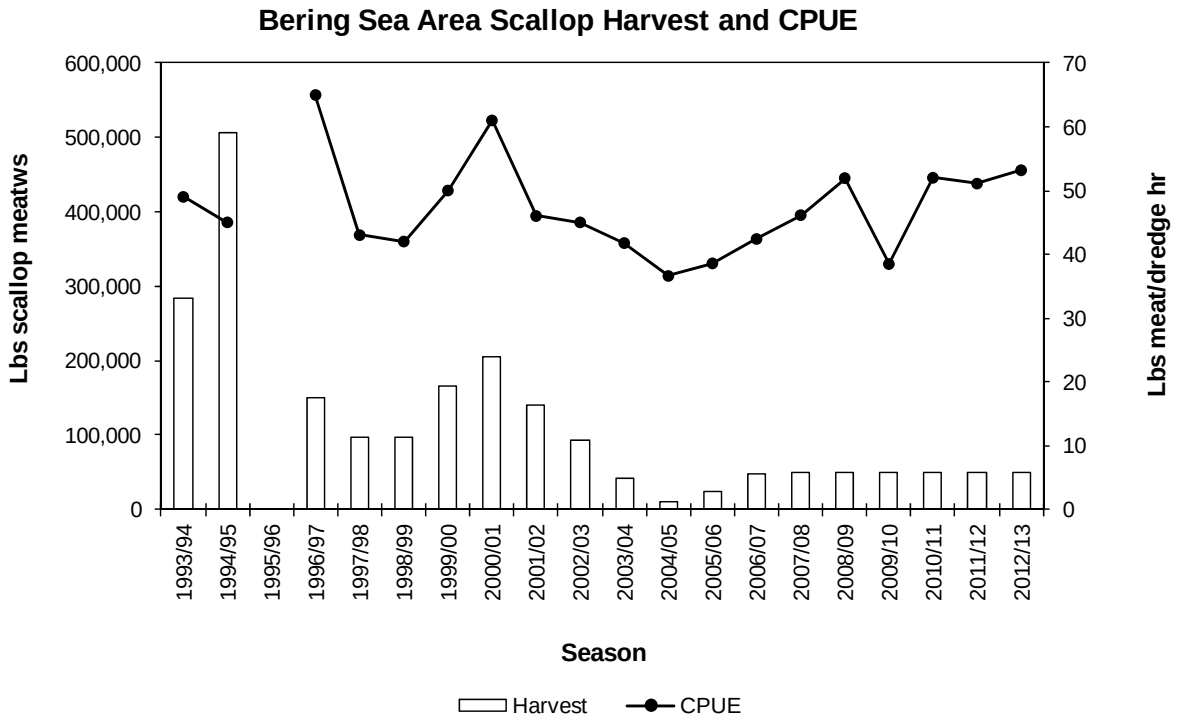



Figure 3-19 Bering Sea Scallop Harvest and CPUE, 1993/94—2012/13 seasons.

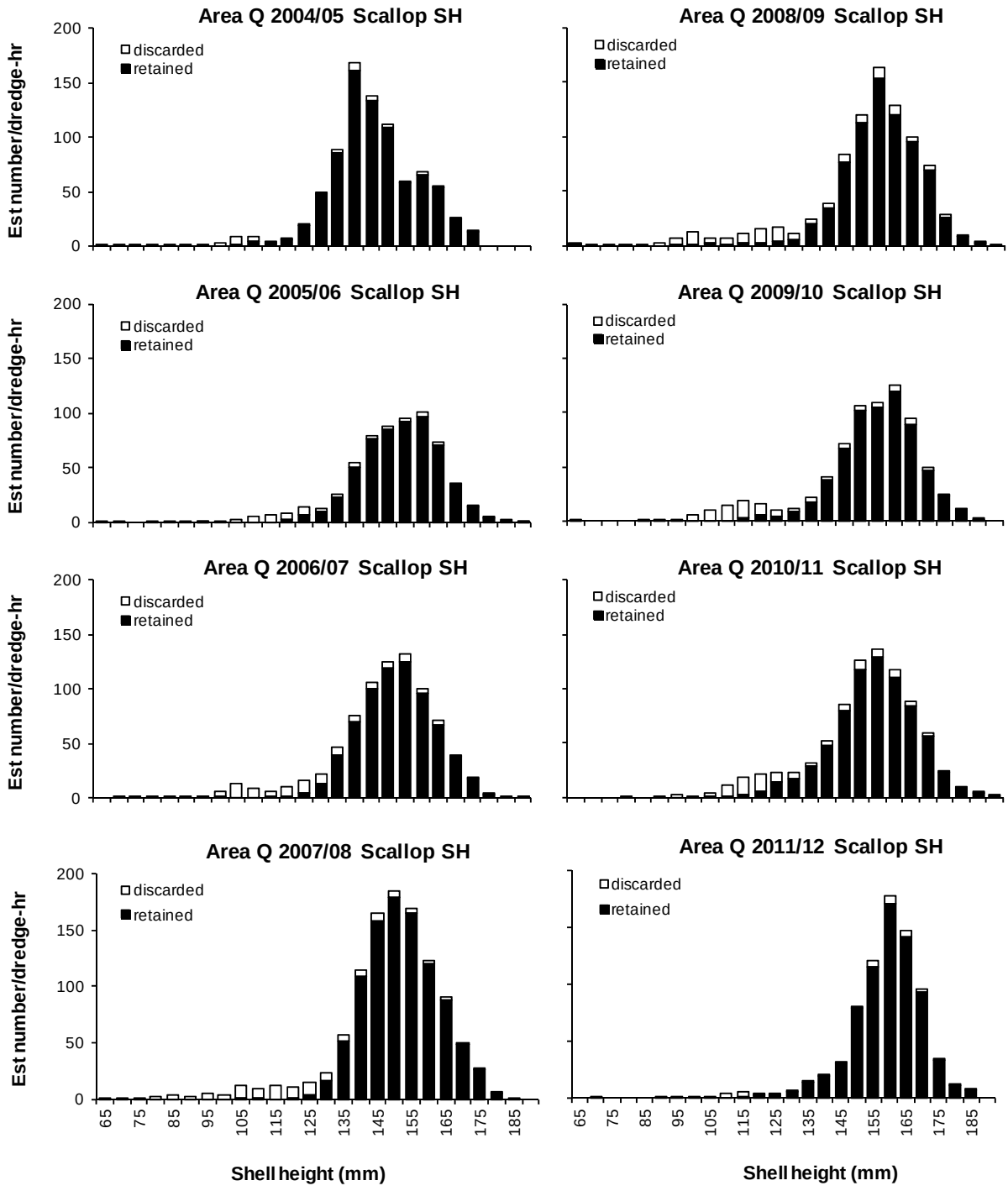



Figure 3-20 Estimated scallop shell height distributions from the 2004/05—2011/12 Bering Sea fishing seasons.

## 3.10 Dutch Harbor Registration Area

The first landings of weathervane scallops from the Dutch Harbor Registration Area (DHRA) occurred in 1982, however GHL ranges were not established until 1993. The initial DHRA GHL range was zero to

170,000 pounds of shucked scallop meats and was lowered to a range of zero to 110,000 pounds of shucked scallop meats for the 1998/99 and 1999/00 seasons Table 3-13. The DHRA scallop fishery failed to meet preseason performance expectations when GHL ranges included levels above 100,000 pounds: under those scenarios catch rates were often less than half that observed on other, more productive scallop beds and annual harvests consistently fell short of even half of the upper bound of the GHL range.

ADF&G closed the DHRA to commercial fishing for weathervane scallops for the 2000/01 and 2001/02 fishing seasons and reopened the area in 2002/03 with a GHL range of zero to 10,000 pounds of shucked meats. In setting this GHL range, managers established that the fishery would be closed inseason if preseason expectations of catch rate, effort distribution, and overall harvest were not met. The 10,000 pound upper bound was crafted to provide sufficient economic incentive for industry to cautiously pursue the fishery and generate information needed to assess stock status. In addition, the 10,000 pound upper bound is indicative of a change in fishery managers' perception of DHRA scallop abundance relative to the previous decade. Fishery performance during the 2002/03 season was not markedly improved from those of the 1990s resulting in closure of the DHRA for the next five fishing seasons to allow for stock rebuilding.

The DHRA was reopened to commercial fishing for weathervane scallops during the 2008/09 season with a GHL range of zero to 10,000 pounds of shucked scallop meats. Justification for the GHL was the same as that applied in setting the 2002/03 GHL. Fishery performance was greatly improved during the 2008/09 season (see Figure 3-21): the upper limit of the GHL range was met, catch per unit of effort was among the highest on record, catches showed reasonable spatial and temporal distribution, and size-frequency data indicated potential for future scallop recruitment.

Based on positive results of the 2008/09 season ADF&G set a 2009/10 GHL range of zero to 10,000 pounds of shucked scallop meats for the DHRA. Fishery information suggests that scallop beds in the DHRA are small and isolated, so the 2009/10 GHL was set with the limitation that no more than 5,000 pounds of shucked scallop meats could be taken from either waters of the Bering Sea or Pacific Ocean waters. This restriction was intended to spatially distribute fishing effort and reduce the chance of overharvesting a single bed. Fishery performance for the Bering Sea portion of the 2009/10 DHRA fishery was among the best on record; catches were sporadic in Pacific Ocean waters.

Prior to the 2010/11 season, a GHL of 10,000 lbs scallop meats was established for the area with 5,000 lbs each assigned to the Bering Sea and Pacific Ocean sections. One vessel fished the area from 30 September to 3 October 2010, harvesting 5,640 lbs from the bed outside Inanudak Bay on the Bering Sea side with a CPUE of 95 lbs meat/dredge-hr and 602 lbs from the Pacific side with CPUE 20 lbs meat/dredge-hr. Overall CPUE for 2010/11 was 67 lbs meat/dredge-hr.

For the 2011/12 season, the DHRA GHL was set at 10,000 lbs. with 5,000 lbs each assigned to the Bering Sea and Pacific Ocean sections. One vessel participated in the fishery, harvesting a total of 5,640 lbs from 60 hauls. A harvest of 5,070 lbs came from the bed outside Inanudak Bay on the Bering Sea side with a CPUE of 82 lbs meat/dredge-hr and 500 lbs from the Pacific Ocean side with a CPUE of 34 lbs meat/dredge-hr. Overall CPUE for 2011/12 was 73 lbs meat/dredge-hr (Table 3-13 and Figure 3-21).

The onboard observer sampled 14 (23%) tows made during the 2011/12 season. Estimates from these data were 47,630 lbs of whole scallops retained and 2,567 lbs discarded (5.1% discard rate). Estimated bycatch during the season was 617 Tanner crab from a cap of 10,000 crab as well as 16 halibut incidentally caught.

**Bering Sea – Inanudak Bay**

The onboard observer measured 295 retained and discarded scallop shells from the 2011/12 season Inanudak Bay tows. The plot from resampling these data (Figure 3-22) shows that retained scallops were primarily 145–155 mm shell height. Average shell height of retained and discarded scallops was 152 mm and 115 mm. Results from visual aging of 16 Inanudak Bay shells collected by the observer showed rapid growth and suggested that 5- and 6-year-old scallops were important in the retained catch.

**Pacific Ocean**

The onboard observer measured 94 retained and discarded scallop shells from the 2011/12 season Pacific Ocean management unit tows. Average shell height of retained scallops was 138 mm and average shell height of discarded scallops was 109 mm.

Table 3-13 Dutch Harbor Area scallop fishery summary statistics.

| Season | Number vessels | GHL (lbs meat) | Catch (lbs meat) | Dredge hours[a] | CPUE (lbs meat per dredge hr) | Scallop Discards (lbs whole)[a] |
|---|---|---|---|---|---|---|
| 1993/94 | 2 | 170,000 | | 838 | 46 | |
| 1994/95 | 3 | 170,000 | 1,931 | 81 | 24 | |
| 1995/96 | 1 | 170,000 | 26,950 | 1,047 | 26 | |
| 1996/97 | | 170,000 | | | | |
| 1997/98 | 1 | 170,000 | 5,790 | 171 | 34 | 18,561 |
| 1998/99 | 4 | 110,000 | 46,432 | 1,025 | 45 | 29,348 |
| 1999/00 | 1 | 110,000 | 6,465 | 273 | 24 | 4,284 |
| 2000/01 | | closed | | | | |
| 2001/02 | | closed | | | | |
| 2002/03 | 1 | 10,000 | 6,000 | 184 | 33 | 4,346 |
| 2003/04 | | closed | | | | |
| 2004/05 | | closed | | | | |
| 2005/06 | | closed | | | | |
| 2006/07 | | closed | | | | |
| 2007/08 | | closed | | | | |
| 2008/09 | 1 | 10,000 | 10,040 | 225 | 45 | 32,584 |
| 2009/10 | 1 | 10,000 | 8,445 | 104 | 81 | 2,082 |
| 2010/11 | 1 | 10,000 | 5,640 | 83 | 67 | 3,237 |
| 2011/12 | 1 | 10,000 | 5,570 | 76 | 73 | 2,567 |
| 2012/13[b] | 1 | 10,000 | 5,100 | 64 | 79 | |

*a Whole lbs estimated from observer samples; meat recovery from whole scallops varies from 7–12%; estimates of discard mortality are not currently available.*

*b PRELIMINARY 2011/2012 catch data subject to change.*

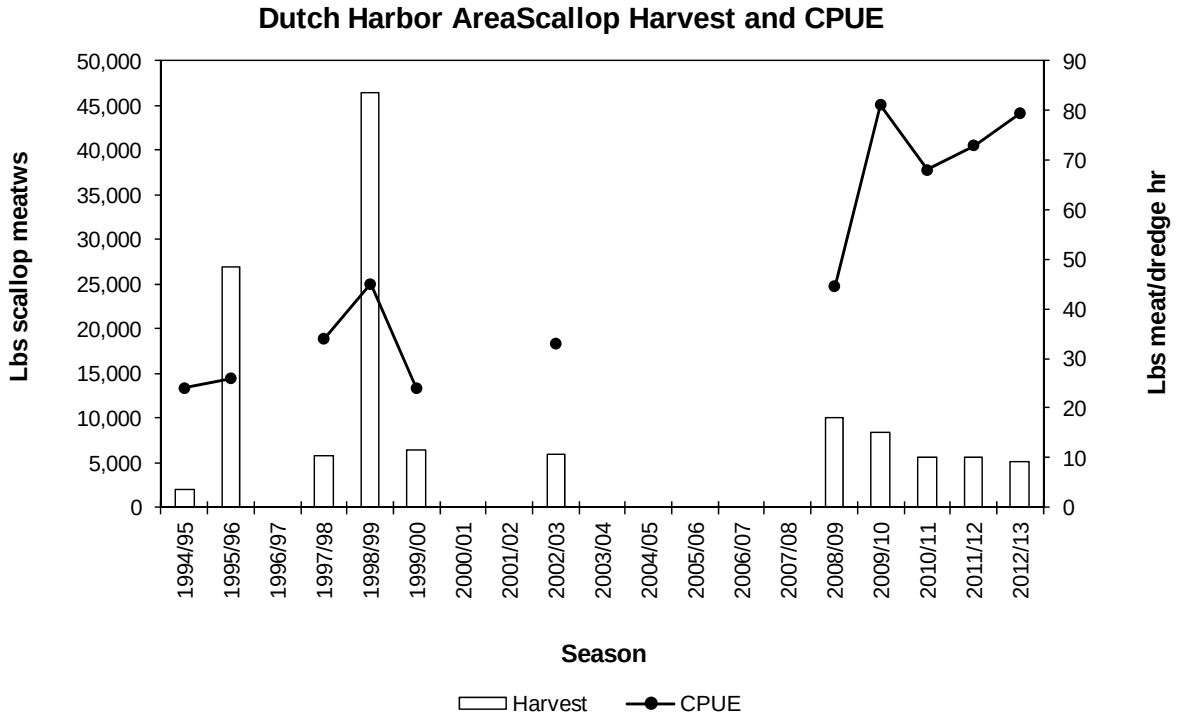
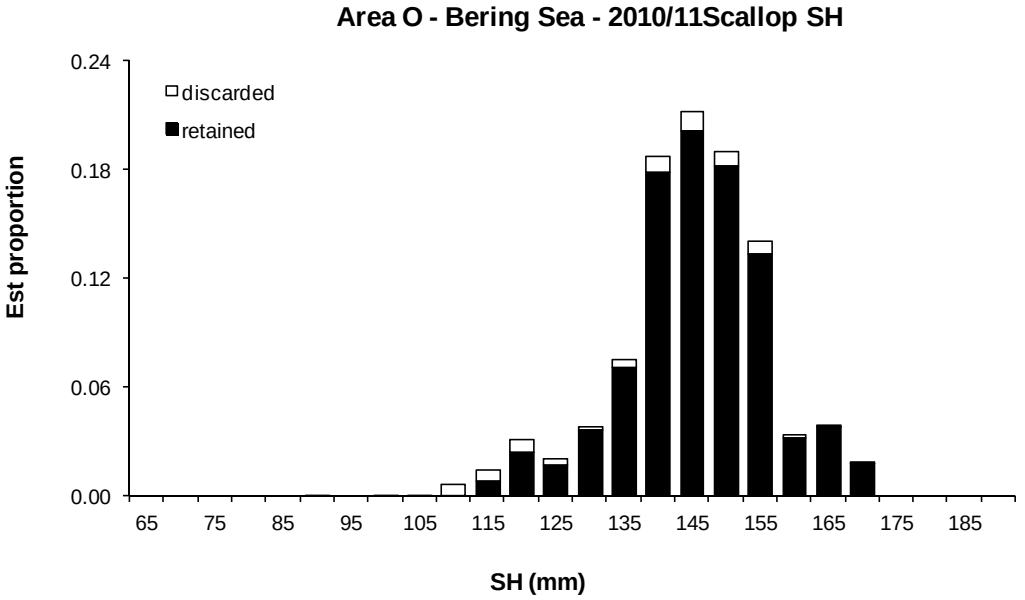



Figure 3-21 Dutch Harbor Area Scallop Harvest and CPUE, 1994/95—2012/13 seasons.



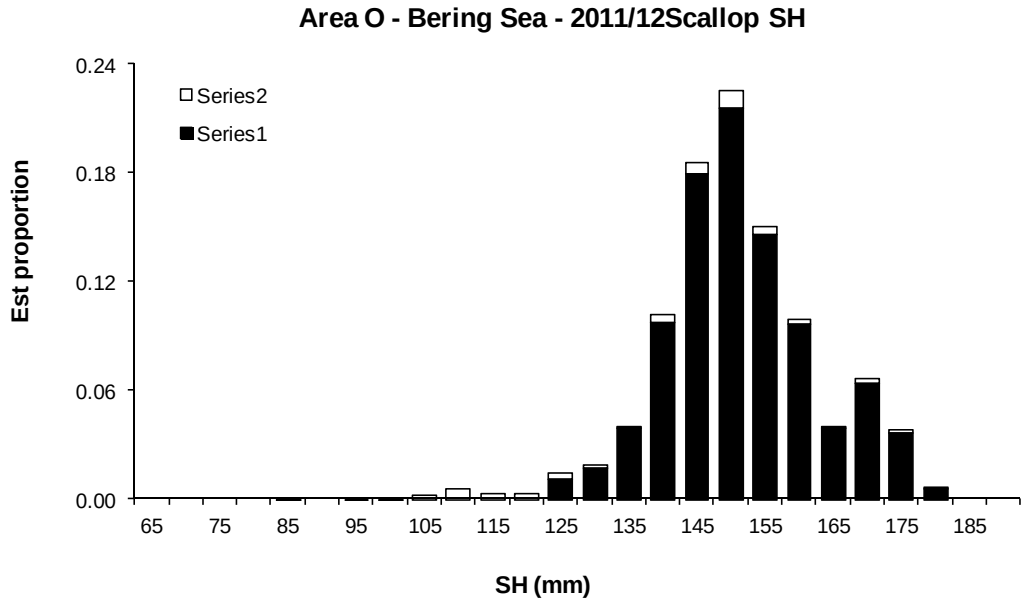




Figure 3-22 Estimated scallop shell height distributions from the 2010/11—2011/12 Dutch Harbor Area, Bering Sea side, fishing seasons

## 3.11 Adak Registration Area

Scallops were first harvested from the Adak Registration Area (ARA) in 1979 with subsequent fishing periods in 1992 and 1995; all harvest information from the ARA is confidential due to limited participation in the fishery. Bathymetry of the Aleutian Islands, with a narrow continental shelf edge,

provides limited scallop habitat; however, a major 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, waters between 51º 30' N. latitude and 54º 30' N. latitude, and between 179º W. longitude and 179º E. longitude were closed to commercial scallop fishing in 1991.

Scant information is available for scallop populations in the ARA; both weathervane and pink scallops are known to occur in the area, but distribution and abundance are unknown. No scallop assessment surveys have been conducted in the ARA and future stock status information will likely be limited. Previous ADF&G management action set a GHL range of zero to 75,000 pounds of shucked scallop meats for the ARA, but that GHL range was poorly justified. Under the current management approach ADF&G does not set a GHL for the ARA scallop fishery and is unlikely to allow future commercial scallop fishing there due to ongoing concerns for red king crab bycatch mortality and limited information on the scallop resource.

# 4 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: http://www.fakr.noaa.gov/npfmc/SAFE/SAFE.htm.

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 from where scallop fishing occurs. ADF&G is beginning to use CamSled data to document and map habitat in the vicinity of scallop fishing areas.

Essential Fish Habitat (EFH) descriptions for scallops may be revised in conjunction with the EFH 5-year review. More information on the current EFH designations may be found at: http://www.fakr.noaa.gov/habitat/efh.htm. The Council is scheduled to take action to initiate EFH amendment analyses to the April 2010 meeting.

## 4.1 Ecosystem Component

In conjunction with the proposed amendment to the Scallop FMP to comply with ACL requirements, a new category is to be created within the FMP for the 'Ecosystem Component"(EC). The non-target scallop stocks (pink, rock and spiny scallops) are to be moved into this EC under the FMP. Stocks contained under this category of the FMP are intended to be 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 would be intended to discourage uncontrolled fishing on these species without applicable management measures in place should they become economically viable in the future. There is currently is a low-level personal use/subsistence fisheries for some of these species.

The EC species may be identified at the species or stock level, and may be grouped into complexes. Determination of conformity to the above criteria may require more in-depth analysis, with contributions by ADF&G and NMFS, than is provided in this document. In addition, a periodic assessment of these

non-target stocks would be beneficial. The EC species may be included in an FMP or FMP amendment for any of the following reasons:

> "…for data collection purposes; for ecosystem considerations related to specification of OY for the associated fishery; as considerations in the development of conservation and management measures for the associated fishery; and/or to address other ecosystem issues. While EC species are not considered to be "in the fishery," a Council should consider measures for the fishery to minimize bycatch and bycatch mortality of EC species consistent with National Standard 9, and to protect their associated role in the ecosystem. EC species do not require specification of reference points but should be monitored on a regular basis, to the extent practicable, to determine changes in their status or their vulnerability to the fishery. If necessary, they should be reclassified as in the fishery."

Limited data exists currently to assess the spatial extent or biomass of these non-target 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 minor (Table 4-1). Data on non-target species was summarized according to whole weight (lbs). 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 lbs (whole weight; CV = 84%) annually, ranging from <1 to 53 lbs, whereas NMFS surveys caught an average of 4 lbs annually. For Region 4, annual catch of *Chlamys* among ADF&G trawl surveys ranged from 3 to 109 lbs, averaging 35 lbs (CV = 97%), whereas NMFS survey catches averaged 70 lbs (CV = 50%) annually.

Table 4-1 Annual biomass (whole lbs) 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 |
| Non-target scallop species | | | | | | | | | |
| | Survey Catch (whole lbs) | | | | | | | | |
| 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 |

*a Meat weight based on a median meat recovery of 10% statewide.*
*b Discard mortality assumes a 20% mortality on scallops that were captured, but nor retained.*

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 becomes 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.

## 4.2 Ecosystem Effects on the Stock

Little is known about how changes in marine ecosystems affect the Alaska scallop stock. The fishery began in the 1960s, but data from the period before inception of the observer program in 1993 are scarce. Hence, there is no basis for comparison of stock dynamics in response to, for example, the 1977 regime shift. The bivalve mollusk design appears to be extremely robust, as scallops with morphology similar to weathervane scallops have inhabited oceans around the world for millions of years.

## 4.3 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 2-1). Because the fishery footprint is confined to these areas and because many areas of similar habitat are closed to scallop dredging, we expect the effects of the scallop fishery on the GOA and Bering Sea ecosystems to be minor.

***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 and crabs,

starfish, shell boring worms and sponges may also be scallop predators. Twentyarm sea stars and giant octopus are known predators of weathervane scallops.

***Bycatch***: Scallop fishery bycatch is closely monitored by the onboard observer program (see Section 2.4). 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. 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).

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%), twentyarm 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 2011/12 season is shown in Table 4-2.

Table 4-2 Summary of results from scallop observer haul composition sampling (% by weight) during the 2011/12 season.

| Area/District | weathervane scallops | flatfish[a] | skates[b] | sea stars[c] | sea anemone | shellls/ debris | *Chionoecetes* crab[d] |
|---|---|---|---|---|---|---|---|
| Yakutat District | 78.6 | 1.1 | 3.4 | 5.2 | 2.1 | 7.5 | 0.1 |
| Prince William Sound Area | 91.5 | 1.7 | 0.7 | 1.2 | 1.9 | 3.0 | 0.0 |
| Cook Inlet | 81.0 | 0.5 | 0.5 | 2.2 | 0.0 | 15.6 | 0.1 |
| Kodiak Northeast District | 72.2 | 2.1 | 2.3 | 12.5 | 3.7 | 6.5 | 0.7 |
| Kodiak Shelikof District | 76.7 | 2.0 | 4.5 | 3.7 | 2.9 | 10.0 | 0.2 |
| Kodiak Southwest District | 80.8 | 1.5 | 3.8 | 0.0 | 1.9 | 1.8 | 1.2 |
| Dutch Harbor Area | 70.9 | 6.1 | 1.8 | 10.1 | 7.4 | 3.4 | 0.2 |
| Bering Sea Area | 86.1 | 3.0 | 1.0 | 0.0 | 4.7 | 1.8 | 3.4 |
| Statewide Total | 79.7 | 2.3 | 2.3 | 4.4 | 3.1 | 6.2 | 0.7 |

[a] Miscellaneous flatfish including arrowtooth flounder Atheresthes stomias, Alaska plaice Pleuronectes quadrituberculatus, flathead sole Hippoglossoides elassodon, English sole Parophrys vetulus, rex sole Glyptocephalus zachirus, Dover sole Microstomus pacificus, and yellowfin sole Limanda aspera; Pacific halibut Hippoglossus stenolepis are accounted separately.
[b] Includes all skate species and skate egg cases.
[c] Includes sunflower sea stars *Pycnopidia helianthoide*, brittle stars *Ophiura* sp., basket stars *Gorgonocephalus* sp., and sun sea stars *Solaster* sp.
[d] Includes snow crab, Tanner crab, and snow crab x Tanner crab hybrids.

## 4.4 Trawl Survey Information on Scallop Stocks

Trawl surveys for fisheries stock assessment are conducted annually in the Gulf of Alaska and the Bering Sea by NMFS and ADF&G. Although these surveys target crab and groundfish and the gear is not designed to efficiently capture scallops, weathervane scallops are caught in some areas and survey data provide information on the range of the species.

In the eastern GOA (Figure 4-1), weathervane scallops have been captured during trawl surveys offshore from traditional scallop fishing grounds and in closed waters adjacent to Prince William Sound. Around Kodiak Island (Figure 4-2 ), trawl surveys have captured scallops in closed waters south of the island and in many bays and inlets. Along the south side of the Alaska Peninsula, trawl survey data indicate that most scallop habitat lies in coastal waters that are closed to scallop fishing, while scallops have been captured during trawl surveys over a large swath of the eastern Bering Sea shelf Figure 4-3.

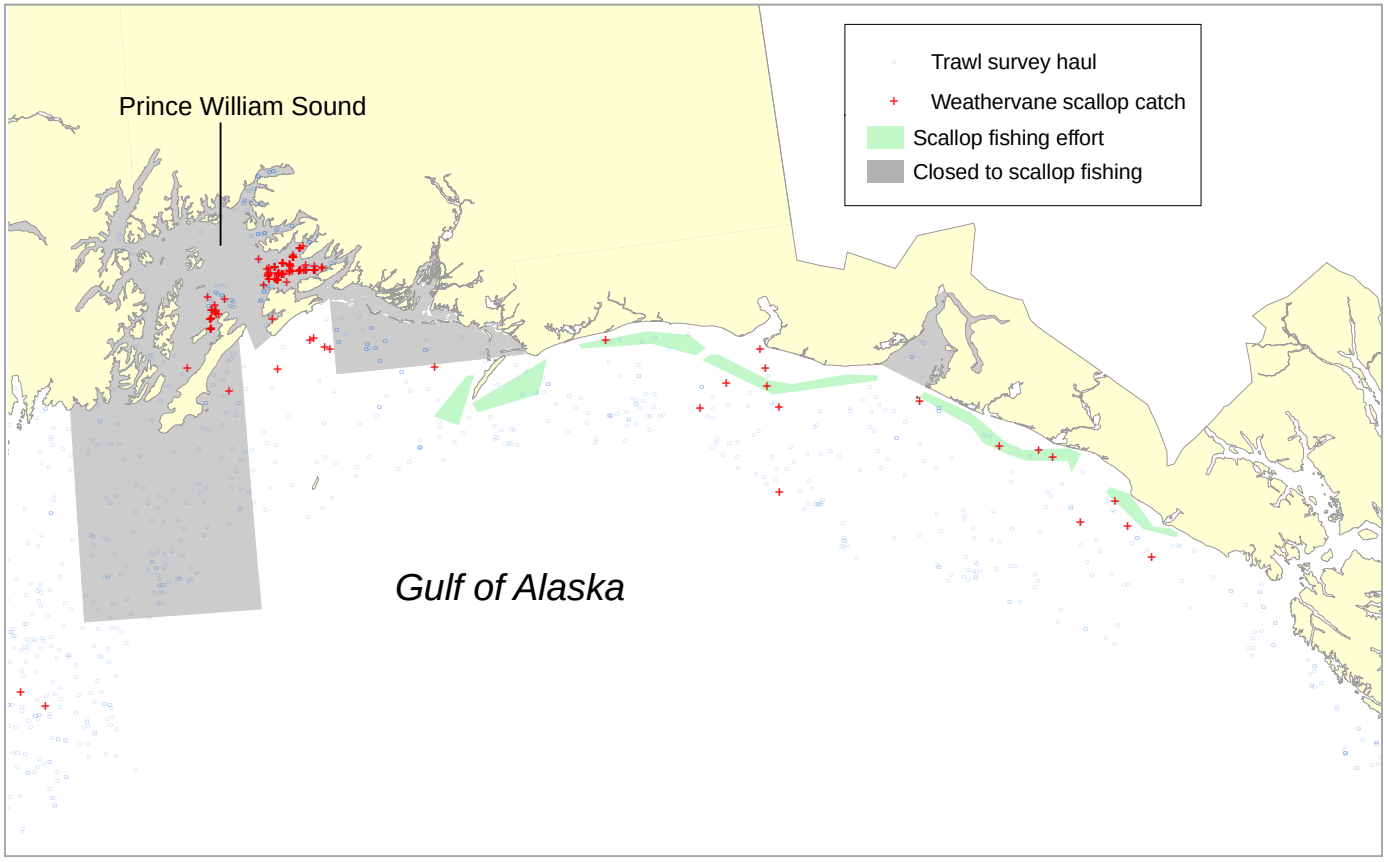



Figure 4-1 Map showing trawl survey haul locations (blue circles), survey locations with weathervane scallop catch (red crosses) in the eastern Gulf of Alaska, 2001-2010.

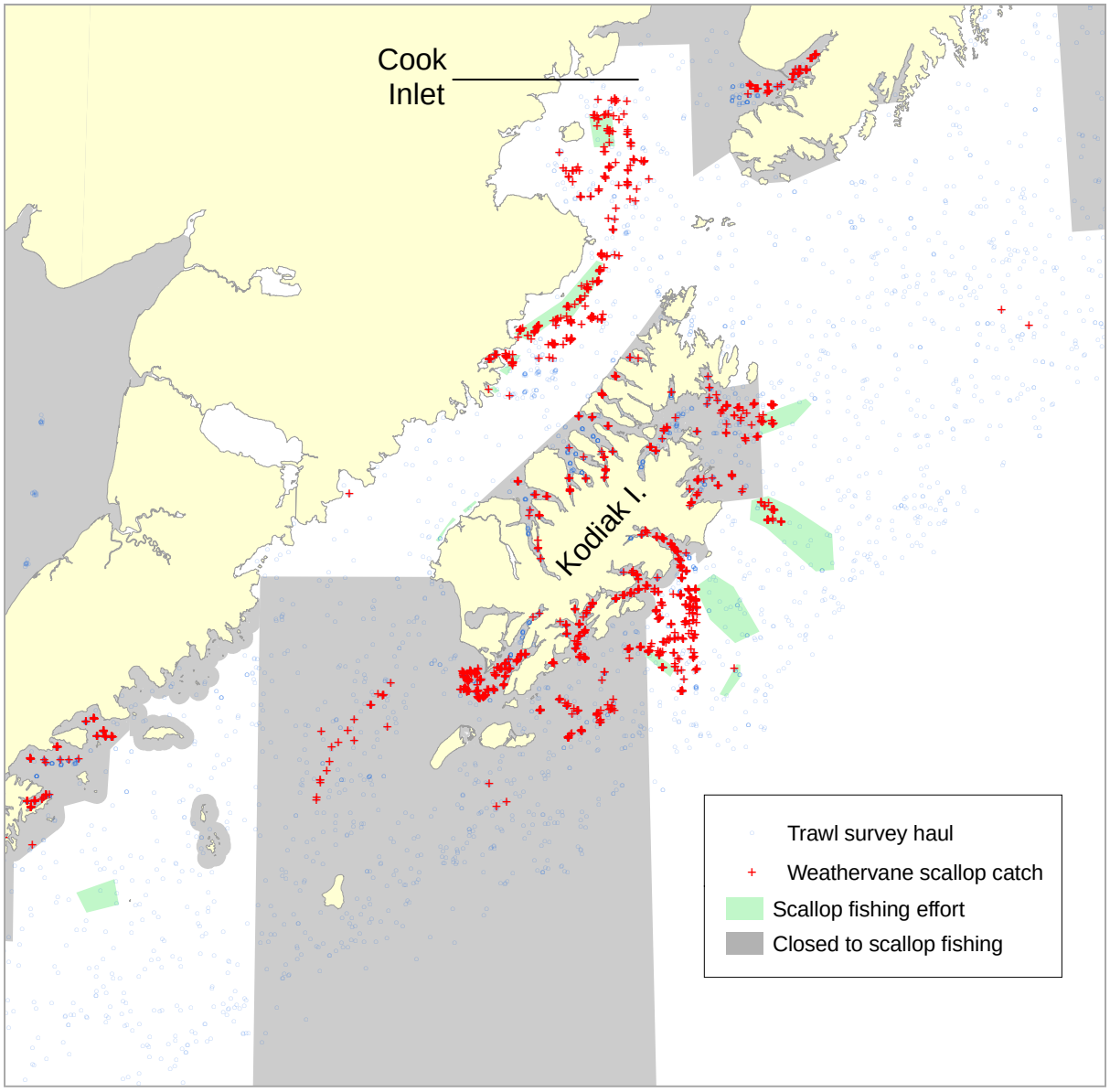



Figure 4-2 Map showing trawl survey haul locations (blue circles) and locations with weathervane scallop catch (red crosses) in the Lower Cook Inlet and Kodiak Island vicinity, 2001-2010.

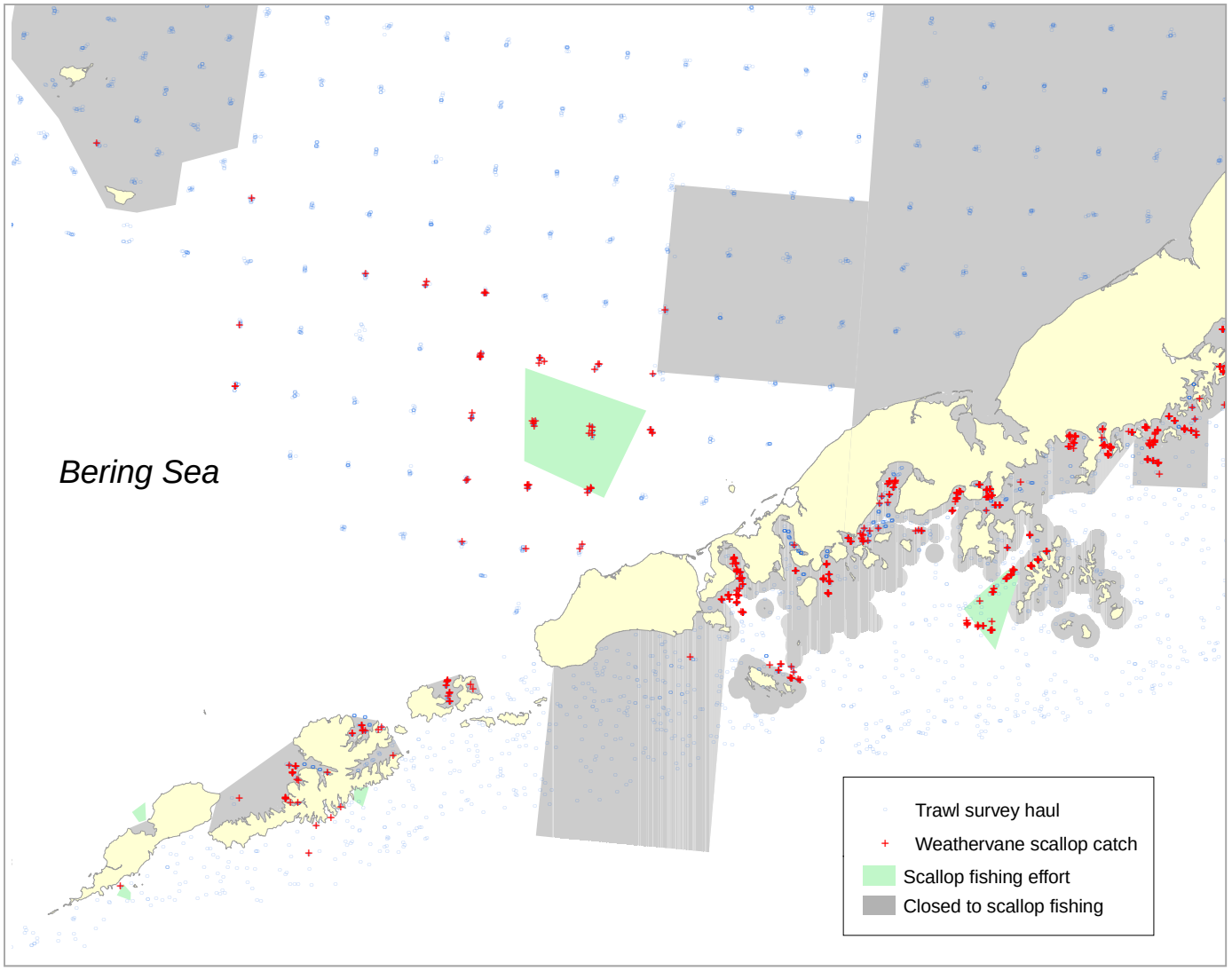



Figure 4-3 Map showing trawl survey haul locations (blue circles) and locations with weathervane scallop catch (red crosses) in western Alaska, 2001-2010.

# 5 Economic Overview of the Scallop Fishery

An overview of Alaska weathervane scallop harvest and wholesale revenue is presented in Table 5-1. The underlying data used to calculate fishery economic value is from annual scallop harvest information contained in Chapter 3, Stock Status. Vessel participation in this fishery has declined in recent years due to the Federal LLP and formation of a voluntary marketing association. The Federal LLP limits the participation to 9 permit holders. Since 2000, no more than 8 vessels have participated, and in recent years no more than 4 vessels have participated.

Table 5-1 provides the statewide average price per pound of landed scallop meats, as well as an inflation adjusted price and total value. Inflation adjustment is made to 2013 values using the Producer Price Index for Intermediate Commodities tabulated by the U.S. Bureau of Labor Statistics[1]. 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 2013 values to allow for comparisons in current dollar values, after accounting for inflation.

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, some shucked meats are delivered fresh to dockside processors who then freeze and market the scallops at the first wholesale level (pers. comm, Bill Harrington, February 2013). 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. 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 State fish tax revenue collected from all participants in the scallop fishery through 2012.

Nominal Alaska scallop prices have shown considerable variability over time and have increased dramatically in recent years. 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 scallop price has increased in each year and reached $10.39 per pound of shucked meats in 2012. 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 an upward trend in the prices it receives for the scallops landed by the three vessels that are associated with the cooperative. The present strength in Alaska scallop pries is expected to continue, and may be enhanced by market forces as landings of east coast scallops are expected to decline in the coming years (pers. comm, Jim Stone, February 2013). Operators of the fourth vessel presently fishing Alaska scallops report receiving a price similar to the statewide average price for 2012 (pers. comm, Bill Harrington, February 2013).

Adjusted price has fluctuated considerably during the past. After trending upwards from $8.87 in 1993/94 to $10.59 in 1998/99, adjusted price then fell to $7.43 in 2004/05, rebounded to $9.61 by 2006/07, and then fell to $6.65 in 2007/08. Since 2007/08, adjusted price has trended upwards along with nominal price.

1 SOURCE: http://data.bls.gov/pdq/SurveyOutputServlet

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, since 1993, occurred in 1994/95 season when inflation adjusted $11.8 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 low in 2008/09 of 342,434 pounds. The total real first wholesale revenue of a little less than $2.5 million in the 2008/09 season was the lowest revenue total since 1993; however, with increased prices in recent years the total revenue increased to $4.7 million in 2011/12, and is estimated to have been $4.3 million in 2012/13.

Table 5-1 Statewide Commercial Weathervane Scallop Real Wholesale Value, 1993/94—2012/13.

| Year | Vessels | Catch (lbs. shucked meats)[a] | Nominal Average Price/lb. | Inflation Factor[b] | Real Average Price/lb | Real Wholesale Value |
|---|---|---|---|---|---|---|
| 1993/94 | 15 | 984,583 | $5.15 | 1.72 | $8.87 | $8,731,012 |
| 1994/95 | 15 | 1,240,775 | $5.79 | 1.63 | $9.46 | $11,735,569 |
| 1995/96 | 10 | 410,743 | $6.05 | 1.60 | $9.67 | $3,972,032 |
| 1996/97 | 9 | 732,424 | $6.30 | 1.58 | $9.98 | $7,311,397 |
| 1997/98 | 9 | 818,913 | $6.50 | 1.61 | $10.46 | $8,569,668 |
| 1998/99 | 8 | 822,096 | $6.40 | 1.66 | $10.59 | $8,708,249 |
| 1999/00 | 10 | 837,971 | $6.25 | 1.59 | $9.92 | $8,311,757 |
| 2000/01 | 8 | 750,617 | $5.50 | 1.52 | $8.35 | $6,269,158 |
| 2001/02 | 6 | 572,838 | $5.25 | 1.60 | $8.38 | $4,799,398 |
| 2002/03 | 6 | 509,455 | $5.25 | 1.53 | $8.01 | $4,083,200 |
| 2003/04 | 4 | 492,000 | $5.25 | 1.47 | $7.71 | $3,793,190 |
| 2004/05 | 5 | 425,477 | $5.50 | 1.35 | $7.43 | $3,161,137 |
| 2005/06 | 5 | 525,357 | $7.58 | 1.24 | $9.36 | $4,918,907 |
| 2006/07 | 4 | 487,473 | $7.86 | 1.22 | $9.61 | $4,683,769 |
| 2007/08 | 4 | 458,313 | $5.94 | 1.12 | $6.65 | $3,047,485 |
| 2008/09 | 4 | 342,434 | $6.34 | 1.16 | $7.39 | $2,529,088 |
| 2009/10 | 3 | 488,059 | $6.48 | 1.11 | $7.21 | $3,516,752 |
| 2010/11 | 3 | 459,759 | $8.35 | 1.05 | $8.74 | $4,019,316 |
| 2011/12 | 4 | 451,183 | $10.39 | 1.00 | $10.43 | $4,704,207 |
| 2012/13 | 4 | 417,551 | $10.39 | 1.00 | $10.39 | $4,338,355 |

[a] Pounds of shucked scallop meats are reported by the State Observer Program.

[b] inflation adjustment uses the Bureau of Labor Statistics, Intermediate Commodities Producer Price Index through 2013. Note that there was an imperceptible, at two decimal places, change in the PPI between 2012 and 2013.

**Crew Usage and Wages**

Scallop vessels in the Alaska Weathervane Scallop fishery are allowed, by State of Alaska regulation, to carry 12 crew including the skipper. In the past, prior to formation of the scallop cooperative and when many more vessels participated, it was commonplace for vessels to carry the maximum allowed crew. This was largely due to the fact that, even under the license limitation program, there was still a "race for

fish" approach of attempting to capture as much of the unallocated GHL as possible in the shortest time possible. To do this, a vessel would use the full complement of crew allowed by regulation in order to speed up the processing time (shucking, freezing, and packaging) and allow continued deployment of the gear, especially in instances of high CPUE. (Pers. Comm. Jim Stone and Brendan Harrington, March 2012)

The formation of the scallop cooperative, along with declining CPUE in several areas has had some impacts on crew positions. The scallop cooperative reports 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, is presently fishing the Kamishak Bay beds and areas near Kodiak Island. They are delivering 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). Thus, the current Alaska scallop fishery is likely using fewer crew due to the efficiency gains they have created through the cooperative and through the ability of the Kilkenny to sell fresh product.

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.

Participants were asked to voluntarily submit information on the percent of total revenue paid to crew during the 2012/13 season. However, three quarters of the present participants declined to provide crew payment data due to the information being highly proprietary to each fishing business. One operator did provide an estimate of crew wages paid; however, this information is somewhat unique to that fishing operation and not necessarily indicative of crew wage percentage for the entire fishery. Further, were that information divulged here, it would allow a straightforward back calculation of total revenue earned by that operation, which could then be used to calculate landed pounds. Since that operation delivers product to two processors in two ports, divulging information that could then be used to calculate landed pounds delivered to fewer than three processors would violate confidentiality restrictions. Thus, it is not possible to address current crew compensation, or changes in crew compensation, with existing sources of data.

**Port of Landing and Impacts on Communities**

At the present time all Alaska scallop harvests are landed in ports within Alaska. The vessels that fish within the Alaska Scallop Association make landings of frozen product in several ports including, but not limited to, Dutch Harbor, Kodiak, Yakutat, Juneau, and Sitka (pers. comm, Jim Stone, February 2013). Given that these landings are often made by a single vessel in a port, these landings are confidential. In addition to the cooperative vessels, one vessel makes landings of fresh product in Homer and Kodiak. However, these landings are made to too few processors for the data to be released due to confidentiality restrictions. Thus, it is not possible to release landings by port. Furthermore, there is no economic data collection program in place to collect vessel expenditure data while vessels, and crew, are in port. Unfortunately, the limits of confidentiality and limited expenditure data make it difficult to establish the potential importance of this fishery to dependent communities.

There have been several developments in this fishery with regard to the permanent location of vessels and with maintenance and repair of these vessels. All three cooperative associated vessels, that are presently fishing, are now permanently home ported in Kodiak. In addition, the one non-cooperative vessel presently fishing is also permanently home ported in Kodiak.

With the installation of a new 600 ton Marine Travelift, virtually all maintenance and repair work is now done in Kodiak (pers. comm, Bill Harrington and Jim Stone, Tom Minio, February 2013). Thus, at present, all landings of Alaska scallops are made in Alaska ports, all vessels presently operating in the fishery are home ported in Kodiak, Alaska, and the Port of Kodiak is able to provide the necessary facilities for haul out, repair, and annual maintenance that these vessels require.

# 6 Literature Cited


Alaska Department of Fish and Game Shellfish Observer Program (ADF&G). 2012. Scallop Observer Training and Deployment Manual. Alaska Department of Fish and Game, Division of Commercial Fisheries. Not published.

Alaska Department of Revenue [ADOR], Division of Taxation website accessed on 2-26-2009 at: http://www.tax.alaska.gov/programs/programs/archives/index.aspx?60620.

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. 2004. Weathervane scallop observer manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K04-39, Kodiak.

Barnhart, J.P. and S.J. Carpenter. 2003. Warm-water annual checks in weathervane scallops, Patinopecten caurinus. 14th International Pectinid Workshop Abstracts with Programs, April 2003, p.122.

Bechtol, W.R. 2000. Preliminary evaluation of multiple data sources in an age-structured model for weathervane scallops in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A00-03, Anchorage.

Bechtol, W.R. 2003. Assessment of weathervane scallops near Kayak Island, Alaska, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-22, Anchorage.

Bechtol, W.R. and R Gustafson. 2002. A survey of weathervane scallops in Kamishak Bay, Alaska, 1998 and 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A02-21, Anchorage.

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.

Berceli, R., W.R. Bechtol, and C.E. Trowbridge. 2003 Review of the Dungeness crab, shrimp, and miscellaneous shellfish fisheries in Prince William Sound. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-08, Anchorage.

Carpenter S.J. and Barnhart J. 2000. Seasonality and physiological changes observed in the carbon and oxygen isotope ratios in modern weathervane scallops (Patinopecten caurinus) from the Alaskan Coast. Geological Society of America Annual Meeting Abstracts w. Programs, v. 32, p. 93.

Hammarstrom, L. F., and M. F. Merritt. 1985. A survey of Pacific weathervane scallops (Pecten caurinus) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Informational Leaflet 252, Juneau.

Hennick, D. P. 1973. Sea scallop, Patinopecten caurinus, investigations in Alaska. Alaska Department of Fish Game, Division of Commercial Fisheries, Completion Report 5-23 R, Juneau.

Gallager, SM, H Singh, S Tiwari, J Howland, P Rago, W Overholtz, R Taylor and N Vine. 2005. High resolution underwater imaging and image processing for identifying essential fish habitat. Report of the National Marine Fisheries Service Workshop on Underwater Video analysis. DA Somerton and CT Glendill (eds) NOAA Technical Memorandum NMFS-F/SPO-68. pp. 44-54.

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.

Kaiser, R. J. 1986. Characteristics of the Pacific weathervane scallop (Pecten [Patinopecten] caurinus, Gould 1850) fishery in Alaska, 1967–1981. Alaska Department of Fish and Game, Division of Commercial Fisheries, RUR No. 4K86-09, Kodiak.

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

Kandianis, Theresa. 2007. Public testimony at the 2007 Scallop Plan Team meeting, February 23, 2007, Anchorage, AK.

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.

Rosenkranz, G.E. 2002. Mortality of Chionoecetes crabs incidentally caught in Alaska's weathervane scallop fishery. Crabs in Cold Water Regions: Biology, Management, and Economics. Alaska Sea Grant College Program Report AK-SG-02-01, University of Alaska, Fairbanks.

Rosenkranz, G. and R. Burt. 2009. Summary of Observer Data Collected during the 2008/09 Alaska Weathervane Scallop Fishery. Alaska Department of Fish and Game Fishery Data Series.

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

NPFMC. 2010a. Stock Assessment and Fishery Evaluation (SAFE) Report for the Scallop Fishery off Alaska. Compiled by the Scallop Plan Team. North Pacific Fishery Management Council, 605 West 4th Ave, Ste 306. Anchorage, AK 99587.

NPFMC. 2010b. EA for Amendment 12 to the FMP for the Scallop Fishery Off Alaska to comply with Annual Catch Limit requirements. North Pacific Fishery Management Council, 605 West 4th Ave, Ste 306. Anchorage, AK 99587.

NPFMC. 2003. Stock Assessment and Fishery Evaluation (SAFE) Report for the Scallop Fishery off Alaska. Compiled by the Scallop Plan Team. North Pacific Fishery Management Council, 605 West 4th Ave, Ste 306. Anchorage, AK 99587.

NPFMC. 2004. EA/RIR/IRFA for Amendment 10 to the FMP for the Scallop Fishery Off Alaska to modify the License Limitation Program. North Pacific Fishery Management Council, 605 West 4th Ave, Ste 306. Anchorage, AK 99587.

NPFMC. 2005. Fishery Management Plan for the Scallop Fishery Off Alaska. North Pacific Fishery Management Council, 605 West 4th Ave, Ste 306. Anchorage, AK 99587.

Stone, Jim. 2007. Public testimony at the 2007 Scallop Plan Team meeting, February 23, 2007, Anchorage, AK.

Trowbridge, C.E., and W.R. Bechtol. 2003. Review of commercial fisheries for Dungeness crab, shrimp, and miscellaneous shellfish in Lower Cook Inlet: Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-09, Anchorage, AK.