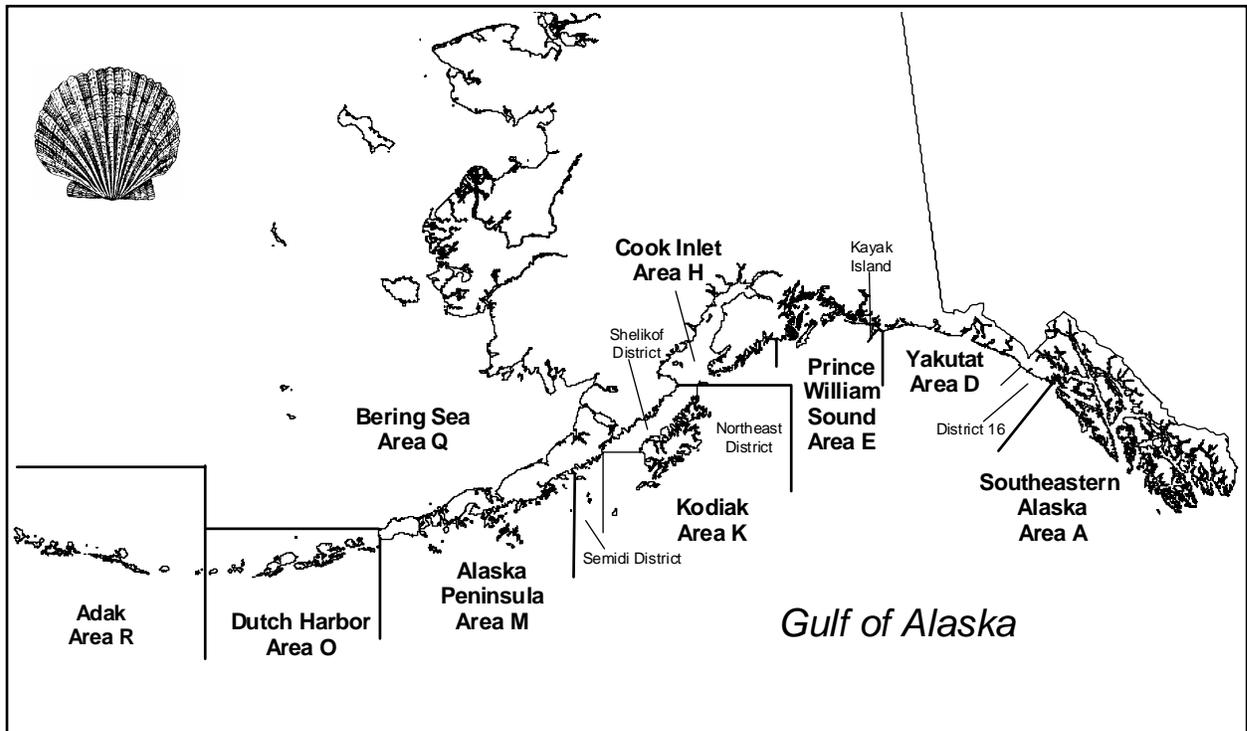


# STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

## FOR THE WEATHERVANE SCALLOP

### FISHERY OFF ALASKA



Compiled by

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# Table of Contents

List of Tables .....	iii
List of Figures .....	iv
1 Introduction .....	1
1.1 Responses to Comments from the SSC .....	1
1.2 Summary of New Information Included in the SAFE Report .....	4
1.3 Historical Overview of the Scallop Fishery .....	4
1.4 Weathervane Scallop Biology .....	5
1.5 Economic Overview of the Scallop Fishery .....	8
2 Overview of Scallop Fishery and Management .....	9
2.1 Management .....	11
2.2 Stock Assessments and GHGs .....	12
2.3 Fishery .....	14
2.4 Observer Program .....	14
2.5 CamSled Research .....	15
2.6 Crab Bycatch Limits .....	15
2.7 Scallop License Limitation Program .....	22
2.8 Voluntary Scallop Cooperative .....	22
2.9 Overfishing Definition .....	23
2.10 Annual Catch Limits and Accountability Measures .....	26
2.10.1 ACL recommendation for the 2011/12 Scallop fishing season .....	27
3 Stock Status .....	27
3.1 Yakutat Registration Areas: Area D and District 16 .....	27
3.2 Prince William Sound Registration Area .....	34
3.3 Cook Inlet Registration Area, Kamishak District .....	41
3.4 Kodiak Registration Area, Northeast District .....	49
3.5 Kodiak Registration Area, Shelikof District .....	53
3.6 Kodiak Registration Area, Southwest District .....	56
3.7 Kodiak Registration Area, Semidi District .....	57
3.8 Alaska Peninsula Registration Area .....	58
3.9 Bering Sea Registration Area .....	62
4 Ecosystem Considerations .....	70
4.1 Ecosystem Component .....	70
4.2 Ecosystem Effects on the Stock .....	72
4.3 Fishery Effects on Ecosystem .....	72
4.4 Trawl Survey Information on Scallop Stocks .....	73
5 Literature Cited .....	76

## List of Tables

Table 1-1: Statewide Commercial Weathervane Scallop Real Wholesale Value, 1993/94—2009/10.....	9
Table 2-1 Statewide crab bycatch limits in percentage of crab abundance estimates (where available) or number of crabs. ....	17
Table 2-2 Bycatch of crabs (number crabs) by species in the Bering Sea scallop fishery, 1995–2008. .	18
Table 2-3 Bycatch of Tanner crabs by Area/District in the Gulf of Alaska scallop fishery, 2009/10.....	18
Table 2-4 Alaska weathervane scallop harvest and Maximum Sustainable Yield from FMP, 1993/94—2009/10 seasons. ....	23
Table 3-1 Yakutat Area D scallop fishery summary statistics.....	29
Table 3-2 Yakutat District 16 scallop fishery summary statistics. ....	32
Table 3-3 Summary of systematic estimates for weathervane scallop survey in Kayak Island 1996-2010, .....	36
Table 3-4 Prince William Sound Area E scallop fishery summary statistics .....	37
Table 3-5 Summary of survey estimates for Kamishak surveys in Cook Inlet.....	43
Table 3-6 Cook Inlet, Kamishak District scallop fishery summary statistics .....	47
Table 3-7 Kodiak Northeast District scallop fishery summary statistics.....	50
Table 3-8 Kodiak Shelikof District scallop fishery summary statistics.....	54
Table 3-9 Kodiak Semidi District scallop fishery summary statistics.....	58
Table 3-10 Alaska Peninsula Area scallop fishery summary statistics. ....	59
Table 3-11 Bering Sea Area scallop fishery summary statistics. ....	63
Table 3-12 Dutch Harbor Area scallop fishery summary statistics.....	67
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.....	71
Table 4-2 Summary of results from scallop observer haul composition sampling (% by weight) during the 2009/10 season.....	73

## List of Figures

Figure 2-1	Alaska Weathervane Scallop Commercial Fishing Registration Area.....	10
Figure 2-2	Map showing Alaska scallop fishery registration areas. General areas of effort during the 2009/10 season are overlaid by black polygons.....	10
Figure 2-3	Estimated Tanner crab bycatch (top) and bycatch rate (bottom) during the 2009/10 scallop fishing season.....	19
Figure 2-4	Tanner crab carapace width distribution from catch sampling during the 2009/10 Yakutat Area D scallop fishery. Sample sizes were 415 males and 434 females.....	20
Figure 2-5	Tanner crab carapace width distribution from catch sampling during the 2009/10 Yakutat District 16 scallop fishery. Sample sizes were 28 males and 31 females. ....	20
Figure 2-6	Tanner crab carapace width distribution from catch sampling during the 2009/10 PrinceWilliam Sound scallop fishery. Sample sizes were 25 males and 9 females. ....	21
Figure 2-7	Tanner crab carapace width distribution from catch sampling during the 2009/10 Kodiak Northeast District scallop fishery. Sample sizes were 1,914 males and 1,785 females. ....	21
Figure 2-8	Statewide scallop harvest (pounds shucked scallop meats) and MSY levels from FMP....	24
Figure 2-9	Scallop catch (top), dredge-hrs (center), and CPUE (bottom) during the 2009/10 statewide weathervane scallop fishery.....	25
Figure 3-1	Yakutat Area D Scallop Harvest and CPUE, 1993/94—2009/10 seasons.....	30
Figure 3-2	Estimated scallop shell height distributions from the 2000/01—2009/10 Yakutat Area D fishing seasons. ....	31
Figure 3-3	Yakutat District 16 Scallop Harvest and CPUE, 1993/94—2008/09 seasons. ....	33
Figure 3-4	Estimated scallop shell height distributions from the 1999/00—2009/10 Yakutat District 16 fishing seasons. No 2003/04 plot was created due to small samples size. ....	34
Figure 3-5	Prince William Sound Scallop Harvest and CPUE, 1993/94—2008/09 seasons. ....	38
Figure 3-6	Estimated scallop shell height distributions from the 2001/02 – 2009/10 Prince William Sound fishing seasons.....	39
Figure 3-7	Age distributions during the Kayak surveys, East bed.....	40
Figure 3-8	Age distributions during the Kayak surveys, West bed. ....	41
Figure 3-9	Age distributions during the Kamishak surveys, South bed. ....	44
Figure 3-10	Age distributions during the Kamishak surveys, North bed. ....	45
Figure 3-11	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). ....	46
Figure 3-12	Barplots of Area H scallop fishery statistics.....	48
Figure 3-13	Kodiak Northeast District Harvest and CPUE, 1993/94—2008/09 seasons.....	51
Figure 3-14	Estimated scallop shell height distributions from the 2001/2002—2009/10 Kodiak Northeast District fishing seasons.....	52
Figure 3-15	Estimated scallop shell height distributions from the 2001/02—2009/10 Kodiak Shelikof District fishing seasons. ....	55
Figure 3-16	Kodiak Shelikof District Harvest and CPUE, 1993/94—2009/10 seasons.....	56
Figure 3-17	Estimated shell height distributions of scallops retained (upper plot) and discarded (lower plot) during the 2009/10 exploratory Kodiak Southwest District scallop fishery. ....	57
Figure 3-18	Alaska Peninsula harvest and CPUE, 1993/94—2009/10 seasons. ....	60
Figure 3-19	Barplots of Alaska Peninsula scallop fishery statistics. ....	61
Figure 3-20	Bering Sea Scallop Harvest and CPUE, 1993/94—2009/10 seasons. ....	64
Figure 3-21	Estimated scallop shell height distributions from the 2001/02—2009/10 Bering Sea fishing seasons.....	65
Figure 3-22	Dutch Harbor Area Scallop Harvest and CPUE, 1994/95—2009/10 seasons. ....	68

Figure 3-23 Estimated shell height distributions of scallops retained (upper plot) and discarded (lower plot) during the 2009/10 Dutch Harbor scallop fishery. .... 69

Figure 4-1 Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS trawl surveys in the eastern Gulf of Alaska. .... 74

Figure 4-2 Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS and ADF&G trawl surveys in the Kodiak Area. .... 74

Figure 4-3 Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS and ADF&G trawl. .... 75

# 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 Anchorage on March 7-8, 2011 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, Peggy Murphy and Joe Stratman.

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 are shown in Figure 2-1 and general fishing locations are shown in Figure 2-2.

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 is in the process of being redefined 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

The Scientific and Statistical Committee (SSC) reviewed the 2010 scallop SAFE at the April 2010 Council meeting and provided comments to the Scallop Plan Team (SPT). The SSC comments on the scallop SAFE and area-specific concerns were discussed at the March 7-8 SPT meeting and a summary of SPT responses is provided after each comment.

### Comments on Scallop SAFE

**Comment:** Review stock boundaries using the Stock Structure Workshop Report (P. Spencer, Alaska Fisheries Science Center) and discuss the criteria to manage the scallop population as a unit stock including the potential contribution of each bed.

**Response:** SPT discussed scallops are managed as unit stock. Scallops are broadcast spawners and larvae drift for several weeks before settling. Scallop beds occur throughout areas of known habitat and vary in size and scallop density. Fishermen indicated beds typically are found in the same geographic area from year to year but boundaries are not definitive and catches are not consistent. Concentrations of scallops can extend across regulatory area and registration boundaries. The plan team did not take up the Stock Structure Workshop Report due to time constraints. The SPT will endeavor to apply this template in next year's SAFE report and discuss this at the SPT meeting.

**Comment:** An investigation of scallop movement within beds should be a research priority, with the purpose of determining whether scallops can fill areas previously harvested.

**Response:** Research priorities were reviewed by the SPT and the objective of mark-recapture-tagging studies was more specifically defined to examine scallop movement within and between beds. The SPT discussed observations of scallop movement from divers, dredge mounted video camera, and the camera sled. Scallops can readily propel and have been observed moving synchronously. Scallops have been dredged up from the same area previously towed. It is not known if scallops in an area previously dredged had relocated or had been present but not retained by the dredge.

**Comment:** The SSC encourages efforts to develop standardized surveys in other areas similar to the approach now used to survey Kayak Island and Cook Inlet areas in the Central Region.

**Response:** The SPT notes that standardized survey of the eastern portion of the Kayak Island scallop bed could not be completed last year due to weather and mechanical difficulties. Survey of the scallops in the Yakutat area remains a priority on the SPT list of research priorities.

**Comment:** Additional information on the estimation of  $q$  derived from the underwater video techniques in the PWS area should be provided.

**Response:** Over the past year video footage from dredge surveys of Kayak Island and Kamishak was reviewed. The information will be used to estimate  $q$  for the Cook Inlet survey dredge and reported this coming year. It was noted that visibility is much better at Kamishak than Kayak Island. In April, 2011, ADF&G is partnering with industry to test deployment of the camera sled on a commercial scallop vessel and evaluate its utility as a scallop survey tool. If successful, the camera sled will be deployed in Prince William Sound in 2012, weather permitting. Results from this work contribute to estimation of  $q$  and survey design. Results will be reviewed with the SPT at future meetings.

**Comment:** The Scallop Plan Team minutes indicate that the camera sled has been deployed in seven regions off Kodiak. This information should be included in the SAFE area summaries.

**Response:** Data and estimates from the camera sled need regional and agency review and therefore are preliminary and not available for publication in the SAFE. The data are not directly input to estimation of area quotas. An overview of areas and dates surveyed with the camera sled is provided in the SAFE.

**Comment:** A careful review of table and figure references is needed throughout the document.

**Response:** The SPT made an effort to more thoroughly review the SAFE this year to avoid inconsistent references and formatting issues.

**Comment:** The SSC appreciates the authors' efforts to document how GHLS are estimated (in Section 2.2 and also in Section 3). However, there are no descriptions of how data are used in setting GHLS in Prince William Sound or Cook Inlet. The SSC requests that the methods be summarized in a table by area. Within the area summaries, the authors should indicate the process by which fishery information (e.g., fishery CPUE, age/size composition, apparent recruitment levels) is used by managers to adjust GHLS. In addition, the section describing the estimation of GHLS for the westward region mentions that staff set CPUE benchmarks. The rationale for these benchmarks should be clearly stated in the document.

**Response:** In Prince William Sound the GHL is set equal to 5 percent of the biomass estimate. The methods used to set and adjust GHGs are described in annual Emergency Orders announcing the area GHGs. This information and the rationale westward region uses to establish CPUE benchmarks has been added to the SAFE.

**Comment:** With the adoption of ACLs it is critical that formulized and consistent control rules are developed. This will aid in creating a transparent process for setting GHGs within registration areas each year.

**Response:** The SPT agrees it is important to maintain transparent, consistent, control rules to set the GHGs within registration areas. The Council adopted an acceptable biological catch (ABC) control rule for Weathervane scallops statewide that accounts for the uncertainty in the overfishing limit (OFL) point estimate by setting the maximum ABC equal to ninety percent of the OFL (ABC=90%OFL). The annual guideline harvest level (GHL) for each scallop management area would be established by the State 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 directed fishery removals (GHL) does not exceed the statewide ACL. Anytime the ACL is exceeded the overage would be accounted for through a downward adjustment to the GHL during the fishing season following the overage. Non-weathervane scallops will be reclassified into an Ecosystem Component (EC) under the FMP and would not have an ABC and therefore do not need an ACL specified. A new section has been added to the SAFE to describe known information on these non-target stocks.

**Comment:** The SSC continues to encourage the development of a statewide ageing protocol and development of an age structured model for scallop stocks in the Central Region.

**Response:** Work on the aging protocol is progressing. The Central Region staff has added a GIS component to the database. A report on scallop age work is expected this fall pending staff availability. Development of an age-structured model depends on statewide and central region biometric support. A progress report will be provided at the next SPT meeting.

### **Area-specific Concerns:**

**Comment:** The PWS area CPUE and abundance estimates are the lowest on record for the west bed. In addition, the fishery CPUE was the lowest on record in the 2008/09 season.

**Response:** Results of the most recent survey affirmed low scallop abundance in the west bed and the fishery was closed.

**Comment:** The Cook Inlet area CPUE and abundance estimates are the lowest on record for the south bed and weak meats were noted in both the north and south beds.

**Response:** The South bed fishery is closed. The north bed fishery was opened and sampling protocols for the survey and at-sea observers continued monitoring of weak meats.

**Comment:** Given reliance on CPUE for scallop assessments, the SSC encourages an evaluation of difference in dredge selectivity between fishing regions, including an analysis of the influence of bottom type on performance.

**Response:** The SPT discussed a number of factors that affect dredge performance and tow CPUE with participating members of the scallop industry. Dredge efficiency depends on bottom type; edge versus flat, mud or sand. Dredge selectivity will change between the two bottom types depending on weighting of the dredge, scope of cable, tow speed, current speed and direction, amount of tidal fluctuation, wave height and frequency. Also, there is a difference in whether the dredge(s) are set amid-ship, staggered or off the stern. Difference in the catch between side by side dredges is typically within two bushels and can be affected for example by patchiness of the bed, the number and direction of turns made during the tow. The SPT will continue to discuss these issues at subsequent meetings and would look forward to

reviewing an analysis of dredge selectivity should one be completed.

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

This SAFE Report includes updated information through the 2009/2010 fishing season. New information included in this report since the previous report (NPFMC, 2010) includes the following:

- 1) Updated observer program summary data through 2009/2010 fishing season; including shell height distributions, retained catch, discarded catch, preliminary 2010/11 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) Section on annual catch limits (ACL) requirements;
- 4) Overview of camera sled research;
- 5) Updated survey information in Prince William Sound and Cook Inlet;
- 6) Updated haul composition data indicating bycatch in directed fishery;
- 7) New section on overview of non-target scallop stocks in Ecosystem component.

## 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 and to a small extent, the pink scallop *Chlamys rubida* are commercially fished. 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.

**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 million 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.

## 1.5 Economic Overview of the Scallop Fishery

An overview of Alaska weathervane scallop harvest and wholesale revenue is presented in Table 1-1. Some of this data is excerpted from Kruse et al. (2005) and updated with information from annual scallop harvest information contained in Chapter 2.10, 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 1-1 provides the statewide average price per pound of landed scallop meats, as well as an inflation adjusted price and total value. 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 2010 values to allow for comparisons in current dollar values, after accounting for inflation.

It is important to note that landed scallop meats have been processed (shucked) and frozen at sea or delivered fresh for dock or roadside sales. Prior to 1996, almost all scallop meats were placed in muslin bags and iced (not frozen) at sea. Thus, although landed price is often referred to as an ex-vessel price, since 1996 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 value here, although some fresh product sales continue to occur at dockside in the Cook Inlet region and on Kodiak.

Also important to note is that there can be significant differences in prices for scallops that are frozen at sea compared to those that are sold fresh at the dock or on the roadside. 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 the scallop fishery. Thus, the average price is likely less than the prices received for fresh product. Fresh product prices are reportedly averaging \$10 per pound in 2010 (Pers. Comm.: Bill Harrington, FV Kilkenney, March 2011); however, fresh product deliveries are subject to local landings taxation that frozen at sea product is not charged. Thus, the statewide average price calculated by ADOR (ADOR, 2010) is used in Table 1-1 with the understanding that it may slightly undervalue the total harvest due to fresh product landings.

Adjusted price has fluctuated during the past; trending upwards from a \$7.22 in 1993/94 to \$8.43 in 1997/98, then falling to \$6.12 in 2003/04, rebounding to \$8.34 by 2006/07, and then falling to \$6.13 in 2007/08. The statewide average 2009/10 price reported by ADOR increased to \$6.48. These price fluctuations may be directly related to U.S. East coast scallop stock conditions and related market prices. The dependence of market prices in the Alaska scallop fishery on east coast markets, and imported scallop prices, is a topic for further research.

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 about \$9.9 million was earned. Since that time, real total first wholesale revenue in the fishery has fluctuated with prices. 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 \$2.2 million in the 2008/09 season was the lowest revenue total since 1993; however, the 2009/10 wholesale revenue total improved to \$3.2 million.

**Table 1-1: Statewide Commercial Weathervane Scallop Real Wholesale Value, 1993/94—2009/10.**

Year	Vessels	Catch (lbs. meats) <sup>a</sup>	Average Price/lb.	Inflation Factor	Adjusted Price	Real Wholesale Value
1993/94	15	984,583	\$5.15	1.40	\$7.22	\$7,105,416
1994/95	15	1,240,775	\$5.79	1.37	\$7.95	\$9,859,321
1995/96	10	410,743 <sup>b</sup>	\$6.05	1.34	\$8.13	\$3,340,767
1996/97	9	732,424	\$6.30	1.32	\$8.31	\$6,087,441
1997/98	9	818,913	\$6.50	1.30	\$8.43	\$6,900,520
1998/99	8	822,096	\$6.40	1.28	\$8.20	\$6,744,512
1999/00	10	837,971	\$6.25	1.26	\$7.90	\$6,616,364
2000/01	8	750,617	\$5.50	1.24	\$6.80	\$5,104,898
2001/02	6	572,838	\$5.25	1.21	\$6.35	\$3,636,581
2002/03	6	509,455	\$5.25	1.19	\$6.25	\$3,182,663
2003/04	4	492,000	\$5.25	1.16	\$6.12	\$3,008,879
2004/05	5	425,477	\$5.50	1.13	\$6.23	\$2,650,745
2005/06	5	525,357	\$7.58	1.10	\$8.31	\$4,365,095
2006/07	4	487,473	\$7.86	1.06	\$8.34	\$4,067,463
2007/08	4	458,313	\$5.94	1.03	\$6.13	\$2,807,383
2008/09	4	342,434	\$6.34	1.01	\$6.40	\$2,190,939
2009/10	3	486,748	\$6.48	1.00	\$6.48	\$3,154,127

<sup>a</sup> Pounds of shucked scallop meats.

<sup>b</sup> Includes illegal harvest.

## 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.

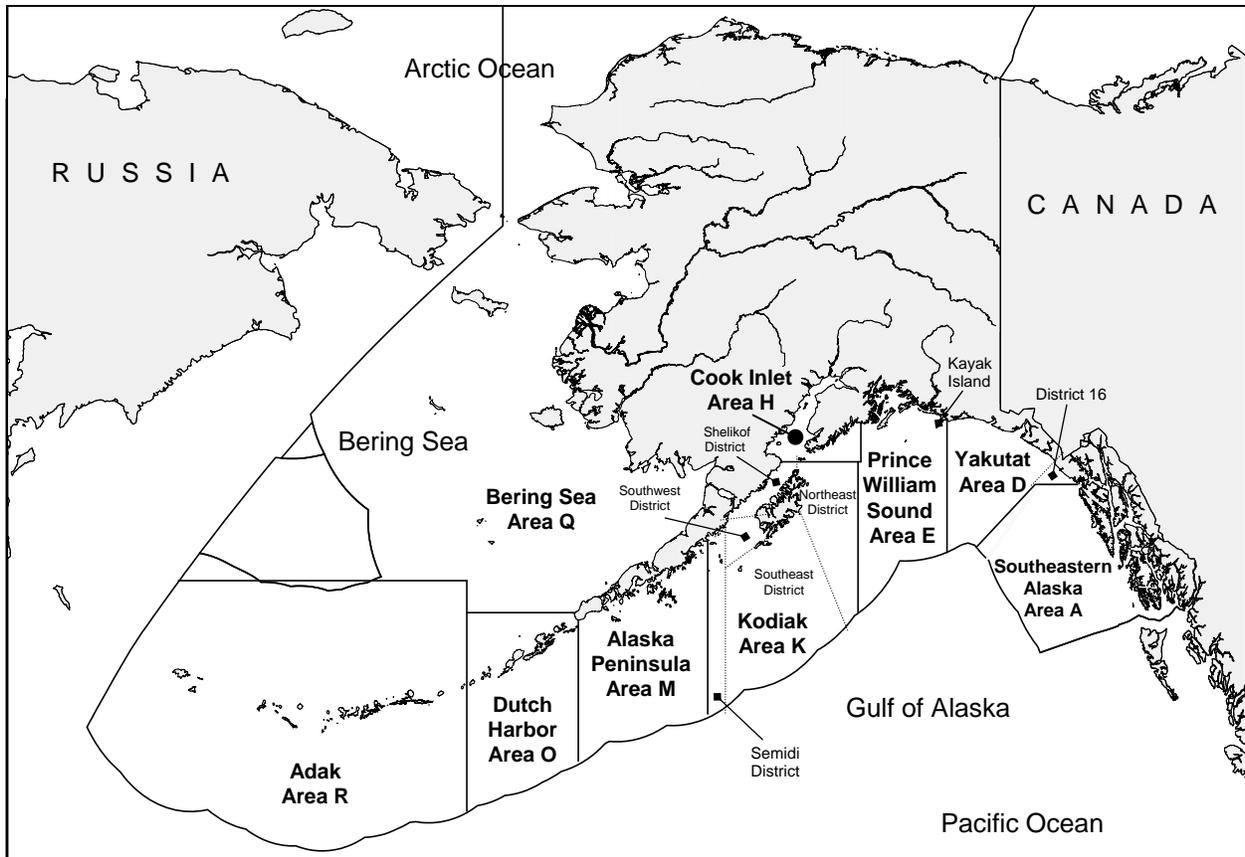


Figure 2-1 Alaska Weathervane Scallop Commercial Fishing Registration Area.

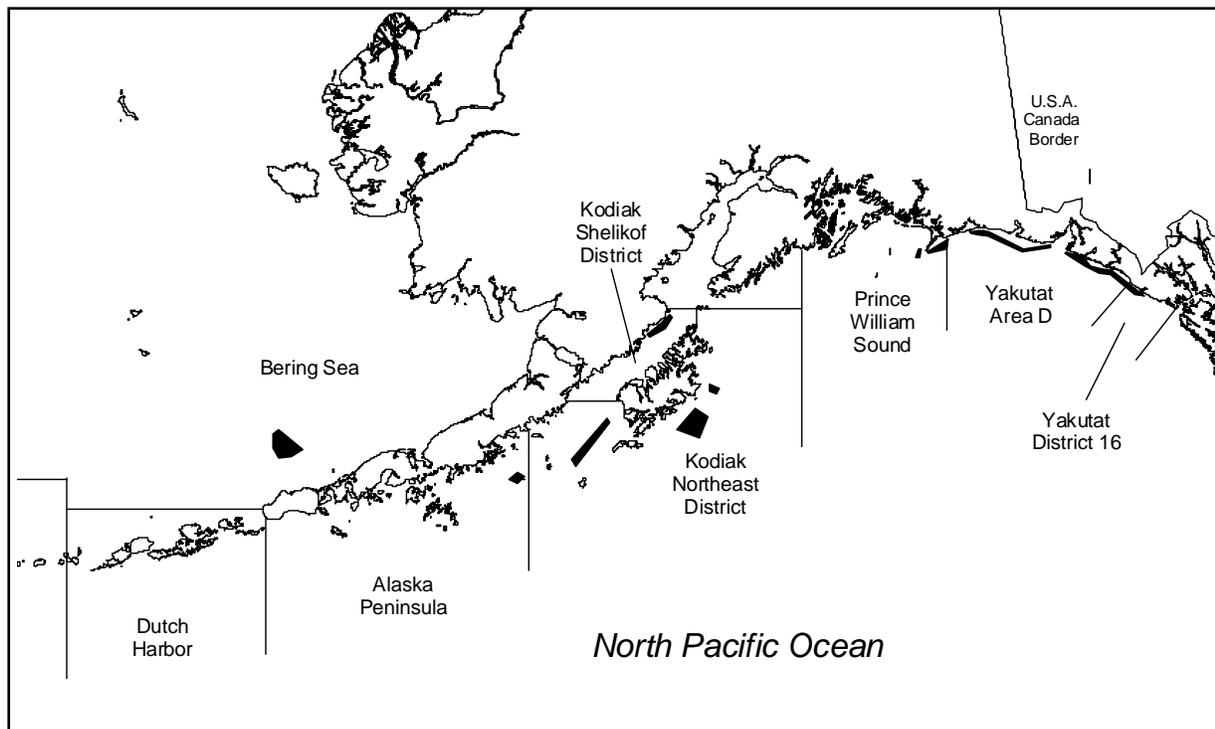


Figure 2-2 Map showing Alaska scallop fishery registration areas. General areas of effort during the 2009/10 season are overlaid by black polygons.

## 2.1 Management

**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.

**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 under conditions of an exploratory permit. 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.

**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.

**Inseason 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. Inseason 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 0) 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. 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, the 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) and training personnel to operate the equipment and to handle and review the large data sets acquired. An additional goal for the 2009 field season is to transect unexploited scallop beds in areas closed to dredging. ADF&G hopes to conduct more CamSled surveys of GOA scallop beds in the future.

***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 Joe Stratman (Petersburg office) and Adam Messmer (Douglas office).

***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. 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 Charlie Trowbridge from the Homer office and the Kayak Island fishery is managed by staff from the Cordova office or Charlie Trowbridge from the Homer office.

***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<sup>2</sup> (1.0 nmi<sup>2</sup>) squares over a chart of the study area (see Figures 1 & 2). 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 9.1 kb (20 lb). The edge of a scallop bed was considered delineated when catch in a given station was below the threshold amount.

**Surveys since 2007:** The 2007 Kamishak Bay and 2008 Kayak Island surveys were set to standardized areas, which will continue to be used. 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 also developed an additional aspect to the survey design whereby data from the systematic dredge survey can be compared to the video assessment method that continues to be developed and used by statewide scallop staff in Kodiak. The survey design accomplishes; 1) comparison of a systematic video survey to Central Region's systematic dredge survey; and 2) comparison of both the systematic video and systematic dredge surveys to a full/complete line transect video survey. These comparisons will be critical if Central Region moves to full video assessment of scallops in the future as there is a need to have a statistically valid and efficient survey design for the towed camera system and have future data comparable to current dredge data. If Central Region does move to full video assessment to obtain abundance information, some dredging (from a sub-sample of stations) will still need to be conducted in order to obtain meat weights, and scallop shells for assessing age.

**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.

**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 (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 about 900 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 in each management

area where fishing occurs 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 GHs. 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 at the University of Alaska North Pacific Fisheries Observer Training Center in Anchorage. 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 CamSled Research**

ADF&G is developing methodology for scallop stock assessment and habitat mapping through the Alaska CamSled project (Rosenkranz et al. 2008). The towed imaging system uses a single, downward-facing GigE Vision camera surrounded by six xenon-flashlamp machine vision strobe lights on the open-framed, bottom-tending vehicle to image a one-meter wide strip of seafloor with overlapping, megapixel digital images that are monitored and recorded on the tow vessel in real time. During development over the past several years, the system has proven robust and capable of producing large volumes of high-resolution imagery.

Pilot survey data were collected in the Kodiak Shelikof District and lower Cook Inlet in 2007, near Kayak Island in 2008, in the Kodiak Northeast District in 2009, and in the Kodiak Shelikof District in 2010. Additionally, images were collected in areas closed to mobile bottom contact gear around Kodiak (Type I closures in Chiniak Bay and near Cape Alitak) in 2009 and 2010.

Manual review of images by ADF&G staff has proceeded on a time-available basis, with much more data collected than can practically be reviewed. For this reason, ADF&G is examining alternatives for computer processing of images including commercially available software and further collaboration with the HabCam Project (Gallager et al. 2005). Work on statistical analysis of the data is proceeding, with results considered preliminary and not ready for release.

## **2.6 Crab Bycatch Limits**

Bycatch of crabs in the scallop fishery is controlled through the use of Crab Bycatch Limits (CBLs) that are based on condition of individual crab stocks. CBLs were first instituted by the state in July 1993. Methods used to determine CBLs in 1993 and 1994 were approved by the BOF and the NPFMC and, with few exceptions, remain unchanged. Annual CBLs are established pre-season 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 2-1. 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.

**Table 2-1 Statewide crab bycatch limits in percentage of crab abundance estimates (where available) or number of crabs.**

Area/District	Red King Crab	<i>C. bairdi</i>	<i>C. opilio</i>
Yakutat District 16	NE <sup>a</sup>	NE	NA <sup>b</sup>
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 <sup>c</sup>	3 tier approach	3 tier approach
Dutch Harbor	0.5% or 1.0%	0.5% or 1.0%	NA
Adak <sup>d</sup>	50	10,000 crab	NA

<sup>a</sup> Not established.

<sup>b</sup> Not applicable.

<sup>c</sup> Fixed CBL.

<sup>d</sup> Bycatch limit established to provide scallop fleet opportunity for exploratory fishing while protecting crab resources.

Bycatch of snow crabs, Tanner crabs, and Bristol Bay red king crabs by scallop fisheries are shown in Table 2-2 and Figure 2-8. Bycatch of snow, king, and Tanner crabs during the Bering Sea scallop fishery tends to be much lower than for other Bering Sea fisheries. Inclusion of the total weight associated with the crab bycatch was not possible in this year's SAFE, size composition data as available is presented by region (Figure 2-4 to Figure 2-7). Additional information on total weight of Tanner crab bycatch will be provided in the 2012 SAFE report.

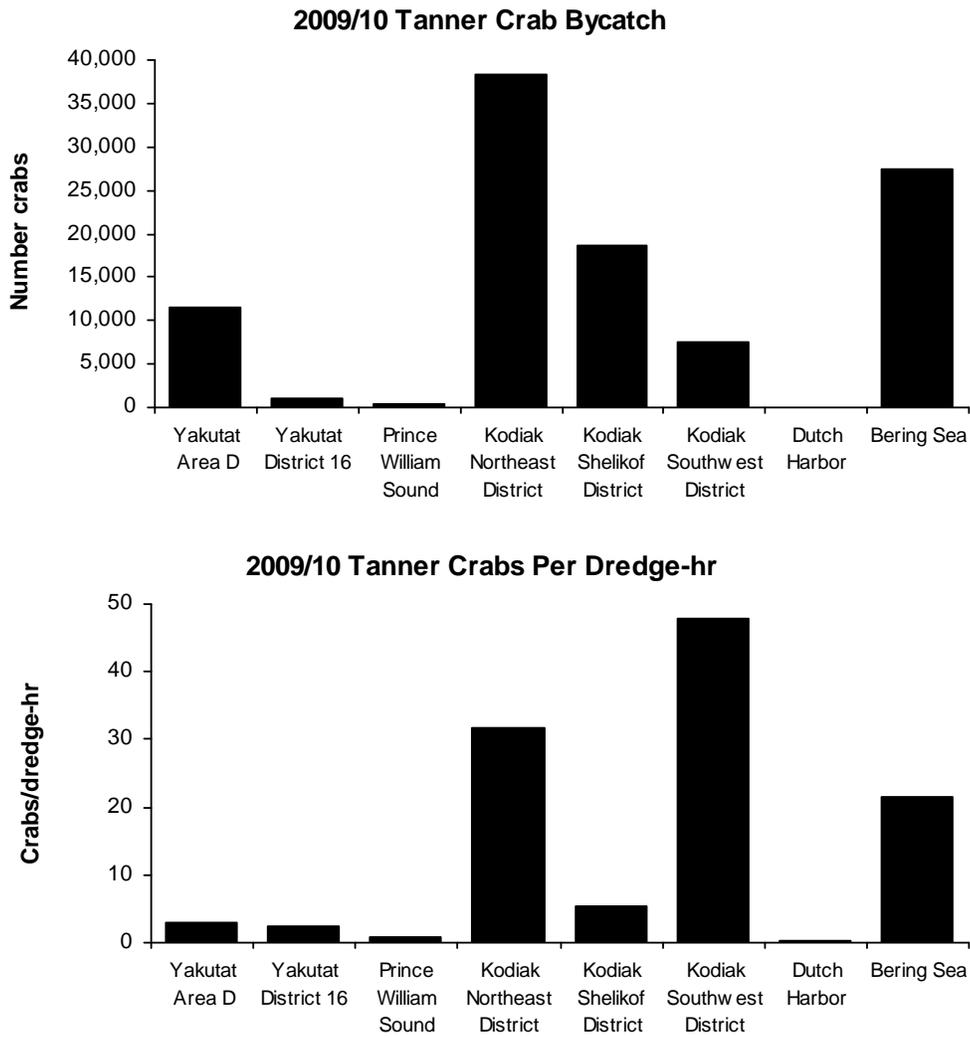
Scallop fishery closures due to attainment of CBLs have decreased over the years, in part due to decreased crab abundance (Barnhart and Rosenkranz, 2003) as well as a voluntary industry cooperative, which provides the fleet additional flexibility to move off of high bycatch areas. ADF&G closely monitors 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 2-2 Bycatch of crabs (number crabs) by species in the Bering Sea scallop fishery, 1995–2008.**

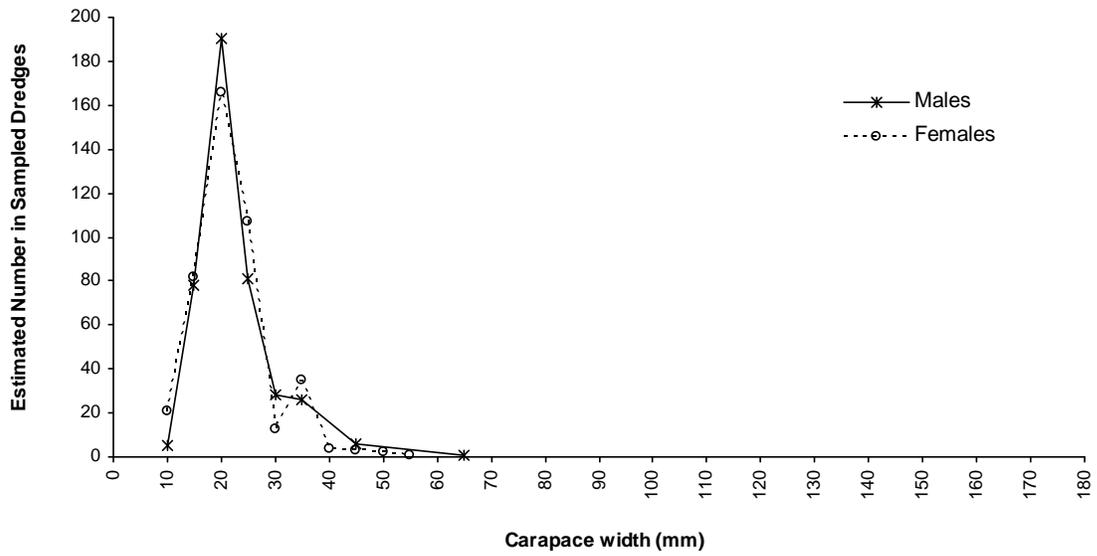
Year	Snow crab	Bristol Bay red king crab	Tanner crab
1995	0	0	0
1996	104,836	0	17,000
1997	195,345	0	28,000
1998	232,911	146	36,000
1999	150,421	1	n/a
2000	105,602	2	53,614
2001	68,458	0	48,718
2002	70,795	2	48,053
2003	16,206	0	31,316
2004	3,843	0	15,303
2005	5,211	2	15,529
2006	8,543	10	45,204
2007	19,367	1	35,288
2008	17,205	1	60,373
2009	36,786	106	27,430

**Table 2-3 Bycatch of Tanner crabs by Area/District in the Gulf of Alaska scallop fishery, 2009/10.**

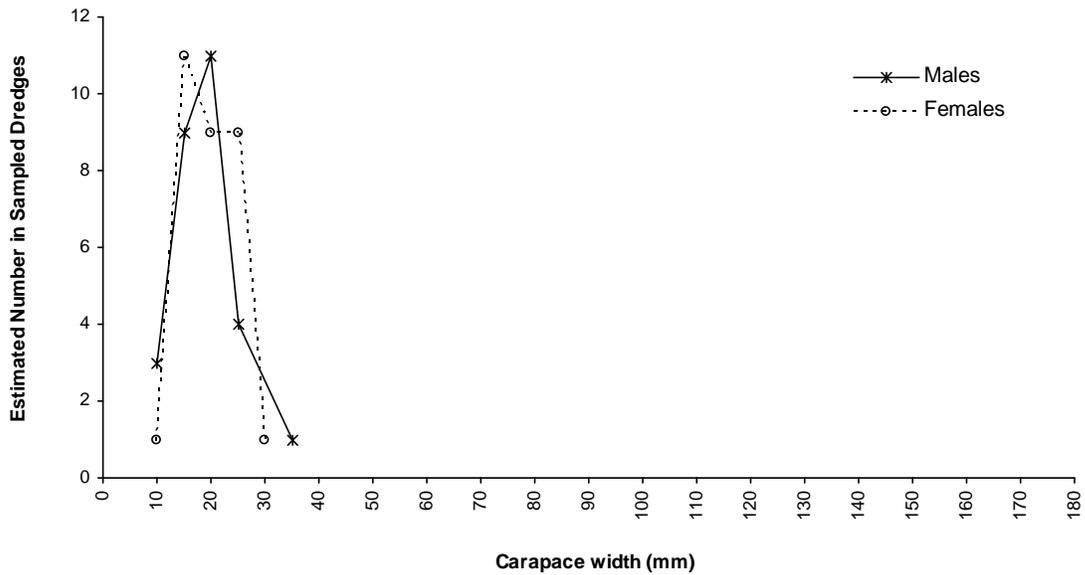
Area/District	Number of crabs
Yakutat Area D	11,609
Yakutat District 16	1,009
Prince William Sound	316
Kodiak Northeast District	38,411
Kodiak Shelikof District	18,589
Kodiak Southwest District	7,585
<b>Other Areas</b>	—
Dutch Harbor	26



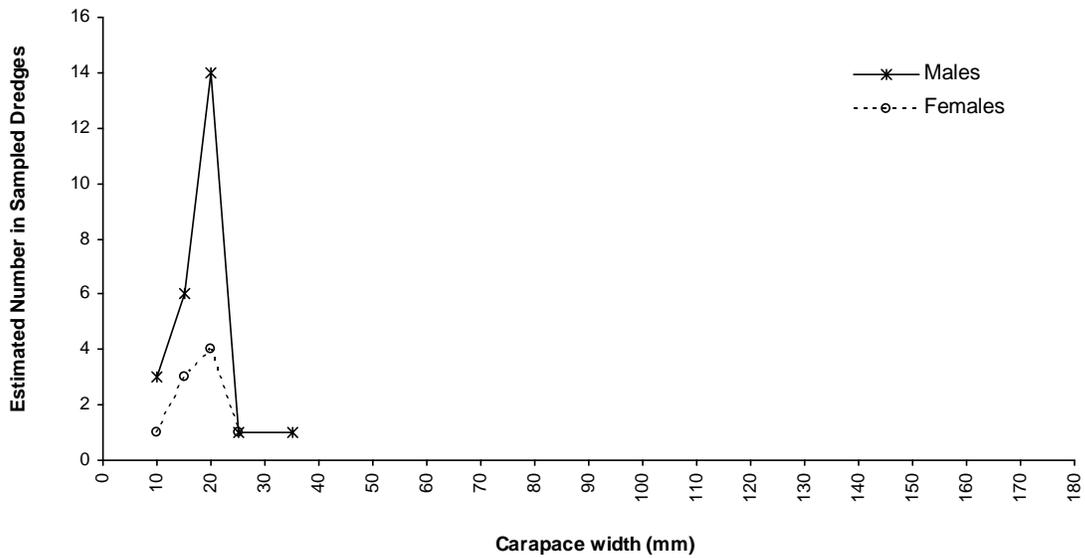
**Figure 2-3 Estimated Tanner crab bycatch (top) and bycatch rate (bottom) during the 2009/10 scallop fishing season.**



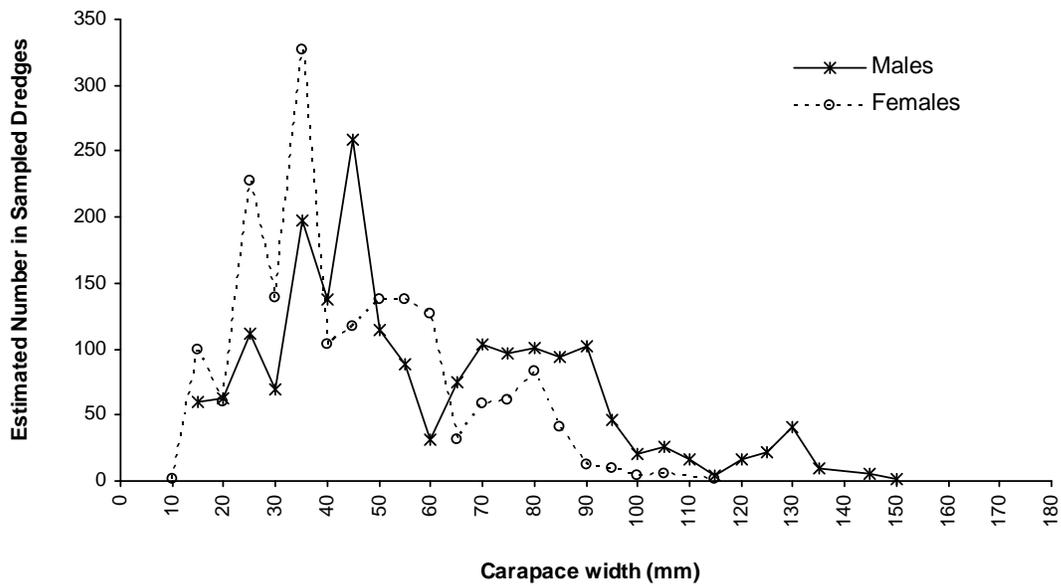
**Figure 2-4** Tanner crab carapace width distribution from catch sampling during the 2009/10 Yakutat Area D scallop fishery. Sample sizes were 415 males and 434 females.



**Figure 2-5** Tanner crab carapace width distribution from catch sampling during the 2009/10 Yakutat District 16 scallop fishery. Sample sizes were 28 males and 31 females.



**Figure 2-6** Tanner crab carapace width distribution from catch sampling during the 2009/10 PrinceWilliam Sound scallop fishery. Sample sizes were 25 males and 9 females.



**Figure 2-7** Tanner crab carapace width distribution from catch sampling during the 2009/10 Kodiak Northeast District scallop fishery. Sample sizes were 1,914 males and 1,785 females.

## **2.7 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>.

## **2.8 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](http://www.fakr.noaa.gov/npfmc/analyses/analyses.htm).

## 2.9 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  $F_{\text{overfishing}} = M = 0.13$  (12% per year) statewide. 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 2-8 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 2-4). Control rules for other Alaskan scallop species have not been developed as no commercial harvests occur. Catch by individual registration area is shown in Figure 2-9.

**Table 2-4 Alaska weathervane scallop harvest and Maximum Sustainable Yield from FMP, 1993/94—2009/10 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
1999/2000	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

### Statewide Scallop Catch and MSY

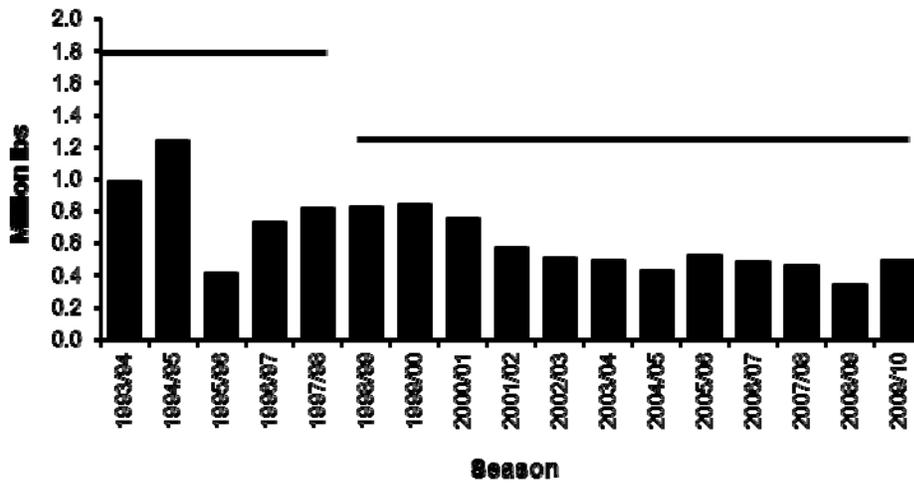
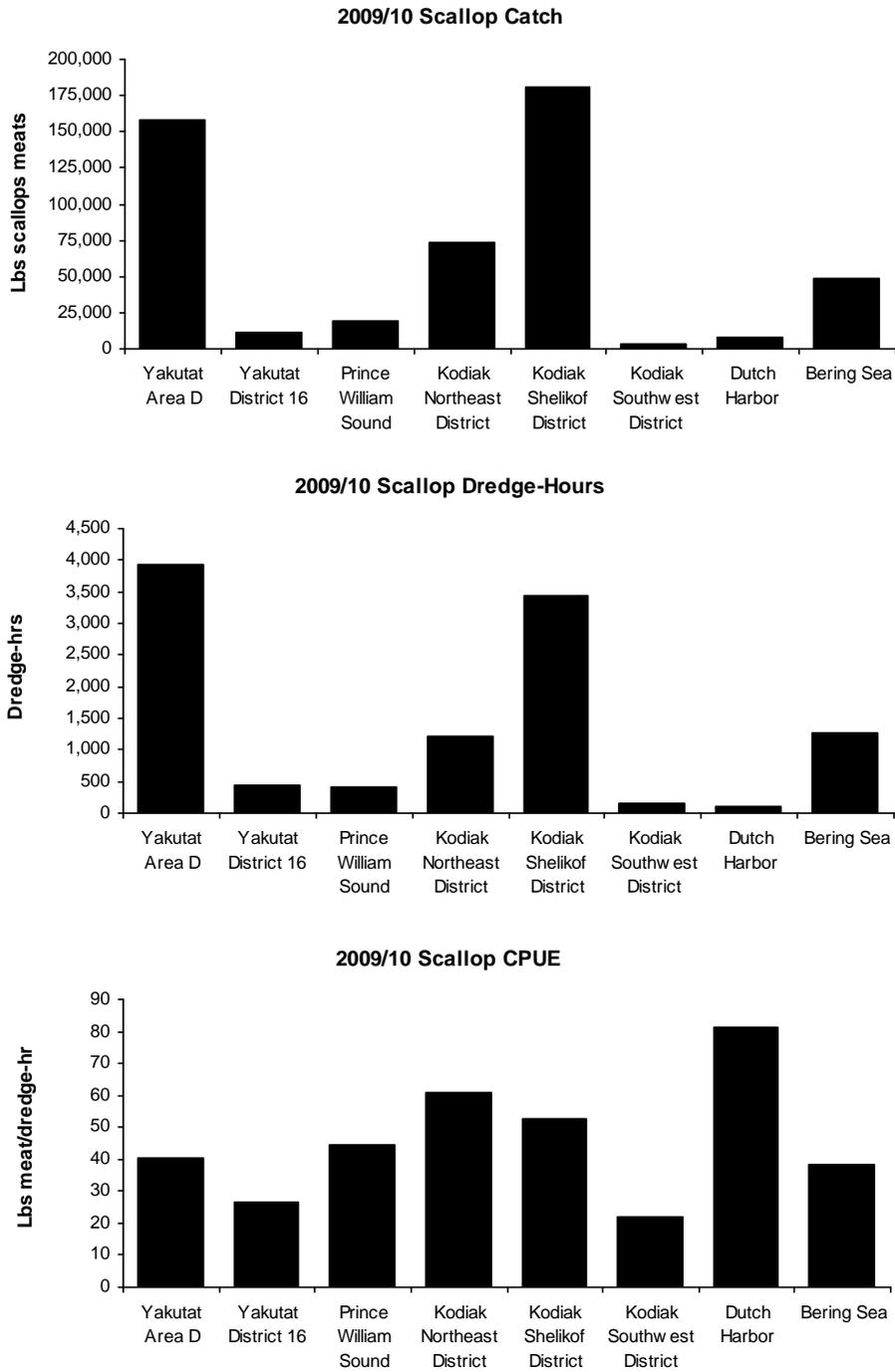


Figure 2-8 Statewide scallop harvest (pounds shucked scallop meats) and MSY levels from FMP



**Figure 2-9 Scallop catch (top), dredge-hrs (center), and CPUE (bottom) during the 2009/10 statewide weathervane scallop fishery**

## 2.10 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.

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 than a regional ACL.

In order to establish adequate accountability measures, the Council recommended that the annual GHF 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 GHF during the fishing season following the overage.

There are three other species of scallop stocks under the Alaska Scallop FMP. These include pink scallops, spiny scallops and rock scallops. 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 Council recommended moving the non-target scallop stocks (pink, spiny and rock scallops) into an Ecosystem

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 stocks should they be removed from the FMP, while acknowledging that information is not sufficient to establish ACLs for these stocks at this time, nor is harvest of these stocks 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 stocks.

- 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 non-target scallop stocks is contained in Section 4.1.

### **2.10.1 ACL recommendation for the 2011/12 Scallop fishing season**

The SPT recommended that, following Secretarial approval of the amendment to the FMP, the ACL for the weathervane scallop stock in the 2011/12 fishing year be established equal to the maxABC as 90% of the new statewide OFL understanding that total catch in 2011/12 will include discards. The SPT will evaluate total catch (including discards) against this statewide ACL level in the 2012 SAFE report for the 2013/14 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).

## **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.

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

When considering GHs for the Yakutat scallop fishery, data included fishery, observer and survey 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’ occurs (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 GH to 200,000 pounds for the Yakutat area beginning in the 2001/02 season (Table 2-4, Figure 2-9). 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 GH 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 scallops in excess of 132 mm shell height (Figure 3-1). For these reasons the GHL for Area D was reduced 25% to 150,000 pounds prior to the 2006/07 season. During the 2006/07 season, the GHL in Area D was reached and the area was closed by emergency order.

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 scallops in excess of 132 mm shell height (Figure 3-2, Figure 3-3). 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. During the 2006/07 season, the GHL in District 16 was not reached.

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 the following: 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 the following: 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 the following: 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. Observer data from the 2009/10 season indicated stable catch rates, no evidence of localized depletion in 5 out of 6 beds, a shift of effort within Area D, and a sharp increase in Tanner bycatch. Prior to the 2010/11 season, no adjustments were made to the Area D and District 16 GHLs and they remained 160,000 pounds for Area D and 25,000 pounds for District 16. During the 2010/11 season the GHLs for Area D and District 16 were not reached.

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

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs per dredge hr)	Discarded scallops <sup>d</sup>	
						Number	Weight
1993	7 <sup>b</sup>	250,000	1,999	139,057	70		
1994	10 <sup>b</sup>	250,000	4,130	246,862	60		
1995	8 <sup>c</sup>	250,000	4,730	237,417	50		
1996	4	250,000	4,438	238,736	54		
1997	4	250,000	3,956	243,810	62		
1998/99	8	250,000	4,154	242,929	58		
1999/00	3	250,000	3,840	249,681	65		
2000/01	3	250,000	4,241	195,699	46		
2001/02	2	200,000	2,406	103,800	43		
2002/03	2	200,000	2,439	122,718	50		
2003/04	2	200,000	3,360	160,918	48		
2004/05	2	200,000	2,132	86,950	41		
2005/06	2	200,000	5,089	199,351	39		
2006/07	2	150,000	2,817	150,950	53		
2007/08	2	150,000	2,601	125,960	48		
2008/09	3	150,000	3,286	150,289	46	1,383,589	417,545
2009/10	2	160,000	3,919	158,225	40		622,055
2010/11		160,000		156,534			

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

<sup>b</sup> One additional vessel fished by waiver without an observer; data not included.

<sup>c</sup> Two additional vessels fished by waiver without observers; data not included.

<sup>d</sup> Estimated from bycatch samples.

<sup>e</sup> 2010/2011 catch data is preliminary and subject to change.

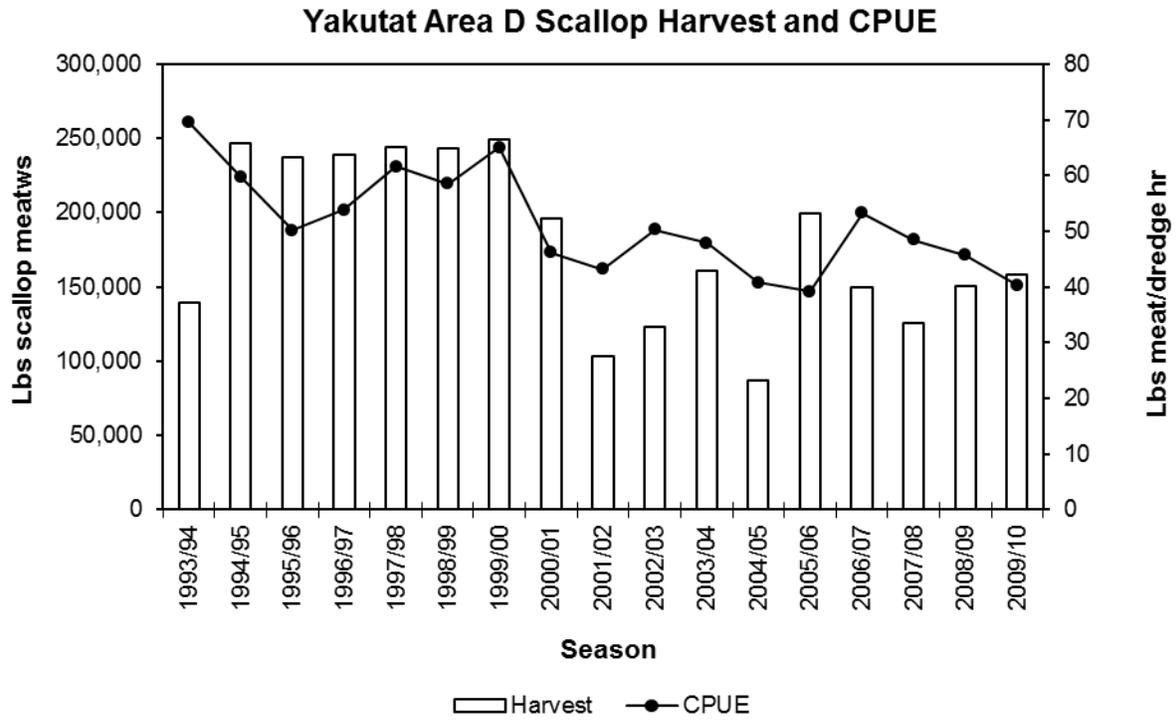
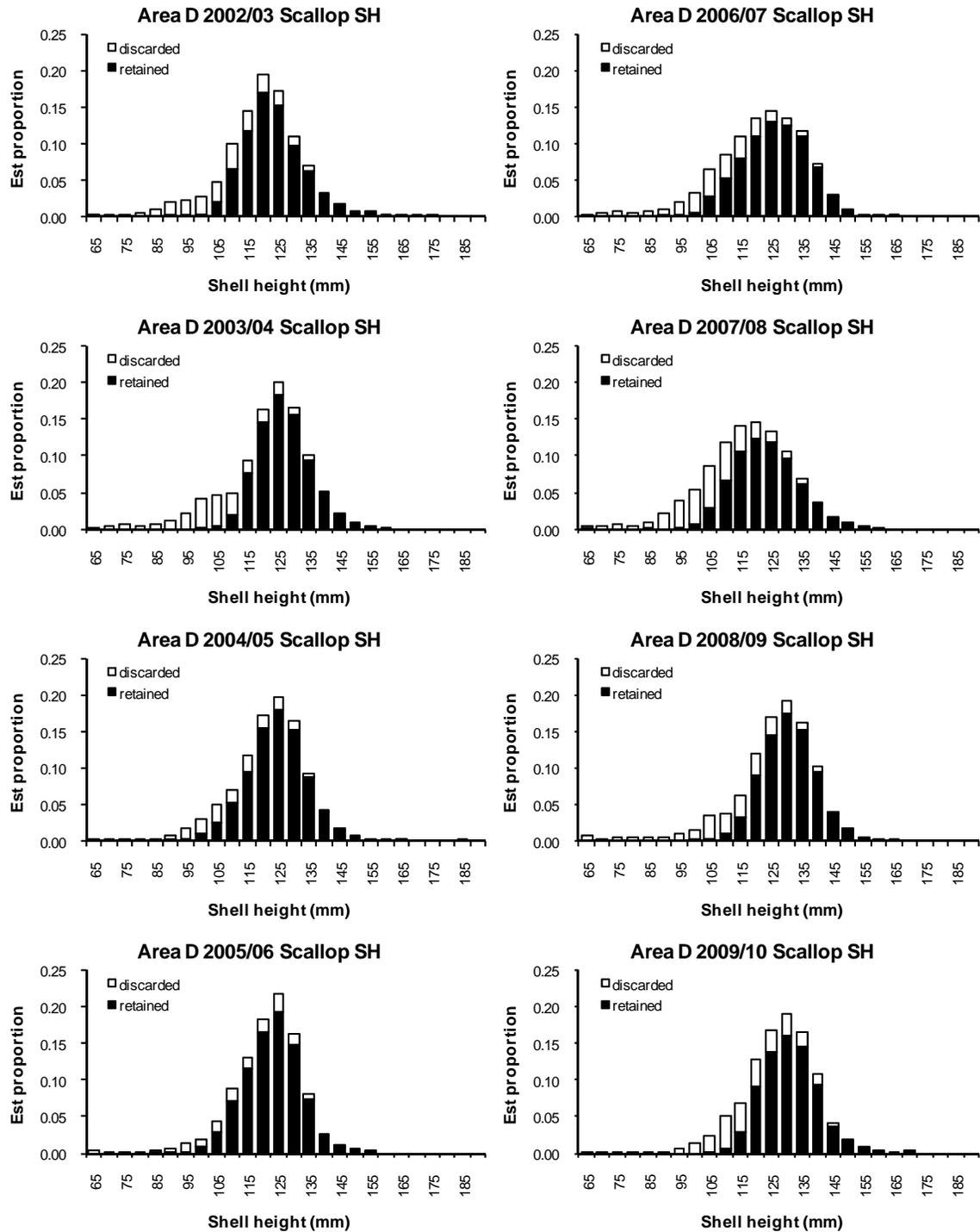


Figure 3-1 Yakutat Area D Scallop Harvest and CPUE, 1993/94—2009/10 seasons.



**Figure 3-2** Estimated scallop shell height distributions from the 2000/01—2009/10 Yakutat Area D fishing seasons.

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

Season	Number vessels	GHL ceiling (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>c</sup>	
						Number	Weight (lbs)
1993	1	35,000		confidential			
1994	7 <sup>b</sup>	35,000	408	22,226	54		
1995	6 <sup>b</sup>	35,000	1,095	33,302	30		
1996	2	35,000	917	34,060	37		
1997	4	35,000	561	22,020	39		
1998/99	2	35,000	702	34,153	49		
1999/00	2	35,000	674	34,624	51		
2000/01	3	35,000	476	30,904	65		
2001/02	2	35,000	417	20,398	49		
2002/03	2	35,000	100	3,685	37		
2003/04	2	35,000	18	1,072	59		
2004/05	2	35,000	419	24,430	58		
2005/06	2	35,000	407	13,650	34		
2006/07	2	21,000	309	13,445	44		
2007/08	1	21,000	6	180	30		
2008/09	2	21,000	423	20,986	50	248,117	68,819
2009/10	2	25,000	437	11,637	27		104,634
2010/11 <sup>d</sup>		25,000		2,656			

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

<sup>b</sup> One additional vessel fished by waiver without an observer; data not included.

<sup>c</sup> Estimated from bycatch samples.

<sup>d</sup> 2010/2011 catch data is preliminary and subject to change.

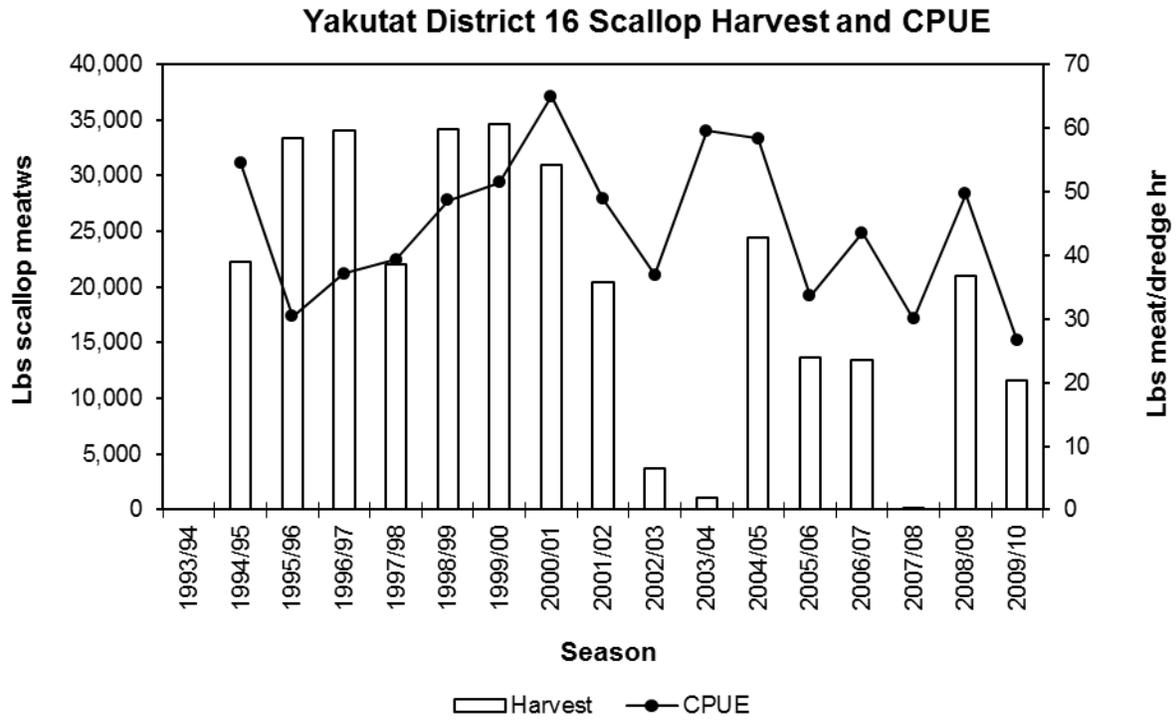
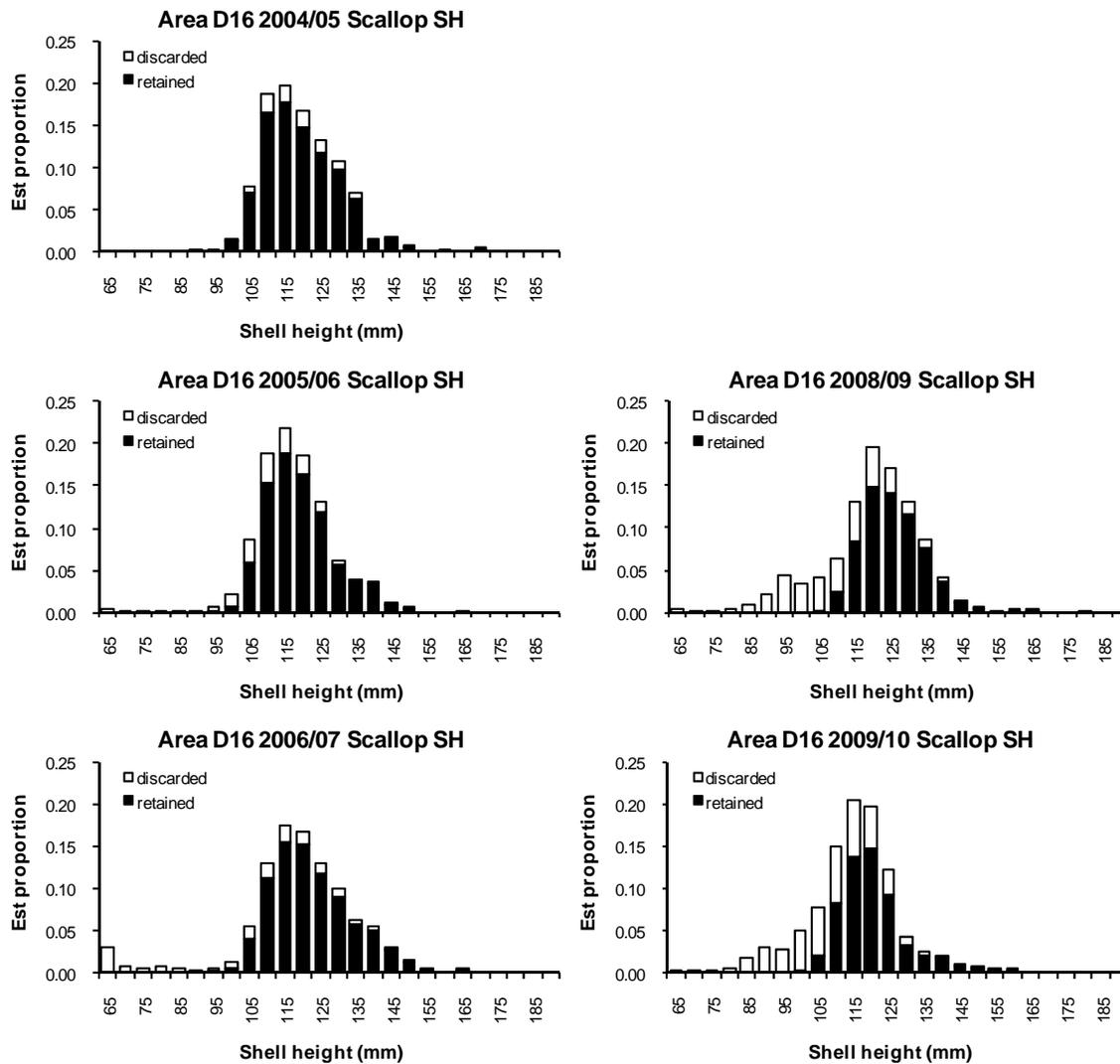


Figure 3-3 Yakutat District 16 Scallop Harvest and CPUE, 1993/94—2008/09 seasons.



**Figure 3-4 Estimated scallop shell height distributions from the 1999/00—2009/10 Yakutat District 16 fishing seasons. No 2003/04 plot was created 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 2-1 and Table 3-3 Summary of systematic estimates for weathervane scallop survey in Kayak Island 1996-2010, using a standardized area of 78.99 nm<sup>2</sup> East Bed and 48.66 nm<sup>2</sup> 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.). In 2010, the survey was set to a standardized area. Additional ancillary stations were added in the eastern boundary of the East bed corresponding to where the fishery occurred in 2009-10 season to the Cape Suckling boundary of the PWS Management Area. However high seas and a failure of a seal on the dredge winch caused an incomplete survey of the East bed and ancillary stations were not sampled. In May and July a total of 38 successful 1nm dredge tows were made during the 2010 Kayak Island survey (12 in the East bed and 29 in the West bed). May 8-10 the West

bed was surveyed and a series of large storms with forecast winds in excess of 50 knots resulted in postponing surveying the East bed until July. Abundance and biomass estimates from all Kayak Island surveys are given in Table 9

Catch in the west bed was 1,520 weathervane scallops weighing 259.5 kg (572.1 lb). Catch abundance ranged from 0 to 266 scallops/nm resulting in a mean among all stations of 54.8 scallops/nm. Standardized catches by weight ranged from 0 to 93.0 kg/nm (205.1 lb/nm) with a mean catch among all stations used for the estimate of 9.1 kg/nm (20.0lb/nm). The West bed abundance estimate was 2 million scallops and was a 49% decrease from the 2008 abundance estimate and considerably less than the estimates of previous biennial surveys. Survey results further indicate a change in age structure of the stock from 21% age seven and under in 2006 to 55% age seven and under in 2010 (Figure 3-8). 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 catch per unit effort (CPUE) in the commercial fishery since 2003, causes the department to have concerns for the sustainability of the Kayak Island scallop fishery. Therefore waters the West bed closed for the 2010 and 2011 seasons.

In July high seas and mechanical winch problems were encountered resulting in only 12 stations sampled with none of the eastern ancillary stations were not sampled. Since the sampled stations East bed were located mainly on the outer edge of the bed abundance and biomass estimates were not presented for 2010. Total catch was 1,733 weathervane scallops weighing 424.8 kg (936.4 lb). Standardized catch abundance ranged from 5.7 to 646.7 scallops/nm resulting in a mean among all stations of 142.7 scallops/nm. Standardized catches by weight ranged from 0.1kg (0.3 lb/nm) to 192.3 kg/nm (424.0 lb/nm) with a mean catch among all stations fished of 34.9 kg/nm (76.9 lb/nm).. Age data from sampled stations indicate a tri-modal distribution with prominent classes occurring at three, 10 and 18 years. Figure 3-7 and Figure 3-8). 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. In addition, logbook data from the observed commercial fishery indicate a declining trend of catch per unit effort (CPUE) since the 2005/06 season. The CPUE in this area declined 44% from the 2008/09 to the 2009/10 season. The department was concerned with the declining trend in CPUE in both the fishery and assessment surveys. However, the department determined that there is a harvestable surplus. Reducing the previous east side GHLL of 15,000 lb by the 44% decline in fishery CPUE yields an allowable harvest of 8,400 pounds for the 2010-11 season. The next survey is scheduled for spring 2012.

Preliminary efforts using underwater video techniques to evaluate survey dredge efficiency in 2004 provided a mean gear efficiency coefficient of 0.83, which has been applied since 2006 (Table 7). The goal is to further assess dredge efficiency, thereby increasing accuracy of survey abundance and biomass estimates resulting in more appropriate harvest limits (by using a value less than one).

**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. Weak meats were found in 2.5% of scallops sampled in the West bed and 5.8% in the East bed.

**Sled-dredge:** Sled-dredge comparison tows were scheduled for the 2010 Kayak Island survey however due to the high winds and subsequent sea were not conducted. These are planned to be conducted during the 2011 Kamishak survey.

Two catcher processors participated in the 2006/07 Area E fishery and harvested approximately 37,000 lbs of scallop meats (Table 3-4). Fishery data from recent seasons are presented in Table 3-4, Figure 3-5 and Figure 3-6.

Two vessels participated in the 2007/08 Area E fishery and harvested approximately 37,000 lbs of scallop meats (Table 3-4). Area E CPUE was 90 lbs meat dredge hr for the 2007/08 season (Table 3-4, Figure 3-5).

Plots of Prince William Sound SH distributions from the commercial fishery (Figure 3-6) show the range of shell heights caught in the fishery has been very consistent over the years.

**Table 3-3 Summary of systematic estimates for weathervane scallop survey in Kayak Island 1996-2010, using a standardized area of 78.99 nm<sup>2</sup> East Bed and 48.66 nm<sup>2</sup> 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 of stations sampled	Mean catch (kg/nm <sup>2</sup> )	Estimated abundance	95% CI	CV	Scallop density (scal/m <sup>2</sup> )	Average weight (g/scal)	Estimated biomass	Estimated biomass
								q = 1.0 (kg meat)	q = 0.83 (kg meat)
<b>East Bed</b>									
1996	38	27.85	7,302,257 ±	4,894,454	0.33	0.028	228	132,491	
1998	28	20.45	5,288,222 ±	1,738,890	0.16	0.020	231	196,960	
2000	33	37.62	9,534,300 ±	2,500,602	0.13	0.036	237	322,247	
2002	20	10.17	2,294,732 ±	1,055,631	0.22	0.009	266	95,601	
2004	31	77.1	17,439,786 ±	12,041,316	0.34	0.062	264	614,143	
2006	32	44.44	9,719,899 ±	5,548,726	0.28	0.036	274	419,377	222,567
2008	37	36.46	7,113,909 ±	3,005,172	0.21	0.026	307	287,633	152,649
2010	12	34.87				0.032	245		
<b>West Bed</b>									
1998	21	33.86	6,377,024 ±	3,795,593	0.29	0.039	196	105,039	
2000	20	94.66	17,884,533 ±	10,403,252	0.28	0.108	195	302,050	
2002	17	39.56	5,740,805 ±	3,017,298	0.25	0.035	254	105,553	
2004	25	84.78	14,489,753 ±	7,359,932	0.25	0.087	216	235,067	
2006	20	60.98	10,104,198 ±	6,077,100	0.29	0.061	223	167,115	195,524
2008	10	19.72	3,930,982 ±	3,155,133	0.35	0.023	185	34,812	40,730
2010	26	9.07	2,023,600 ±	1,099,311	0.26	0.012	166	23,908	27,973

**Table 3-4 Prince William Sound Area E scallop fishery summary statistics**

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>c</sup>	
						Number	Weight (lbs)
1993	7	50,000	638	63,068	99		
1994		Closed					
1995	3	50,000		108,000 <sup>b</sup>			
1996		Closed					
1997	1	17,200	171	18,000	105		
1998/99	2	20,000	179	19,650	110		
1999/00	2	20,000	149	20,410	137		
2000/01	3	30,000	221	30,266	137		
2001/02	1	30,000	263	30,090	114		
2002/03	2	20,000	122	15,641	121		
2003/04	1	20,000	216	19,980	93		
2004/05	2	50,000	614	49,320	80		
2005/06	3	50,000	491	49,205	100		
2006/07	2	37,000	334	36,990	111		
2007/08	2	37,000	428	37,105	87		
2008/09	1	20,000	313	20,040	64	50,577	29,663
2009/10	2	20,000	419	18,711	455		59,010
2010/11 <sup>d</sup>		8,400		8,445			

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

<sup>b</sup> Total includes illegal fishing by one vessel; effort data not available.

<sup>c</sup> Estimated from bycatch samples.

<sup>d</sup> 2010/2011 catch data is preliminary and subject to change.

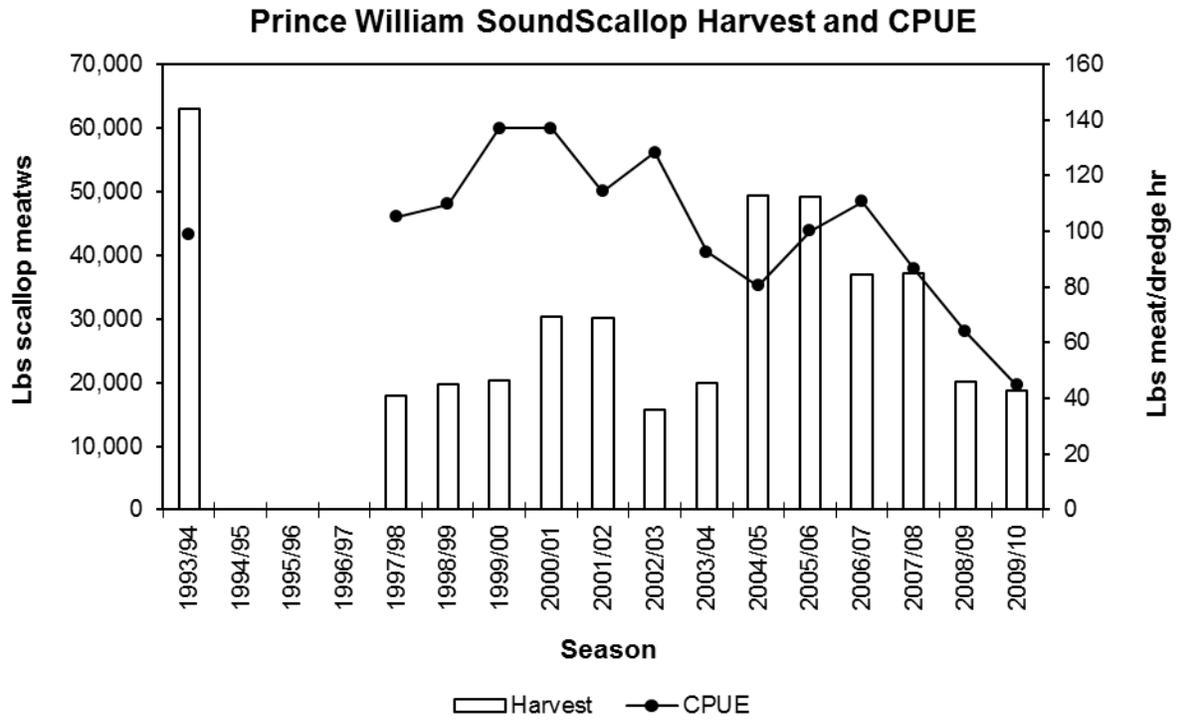
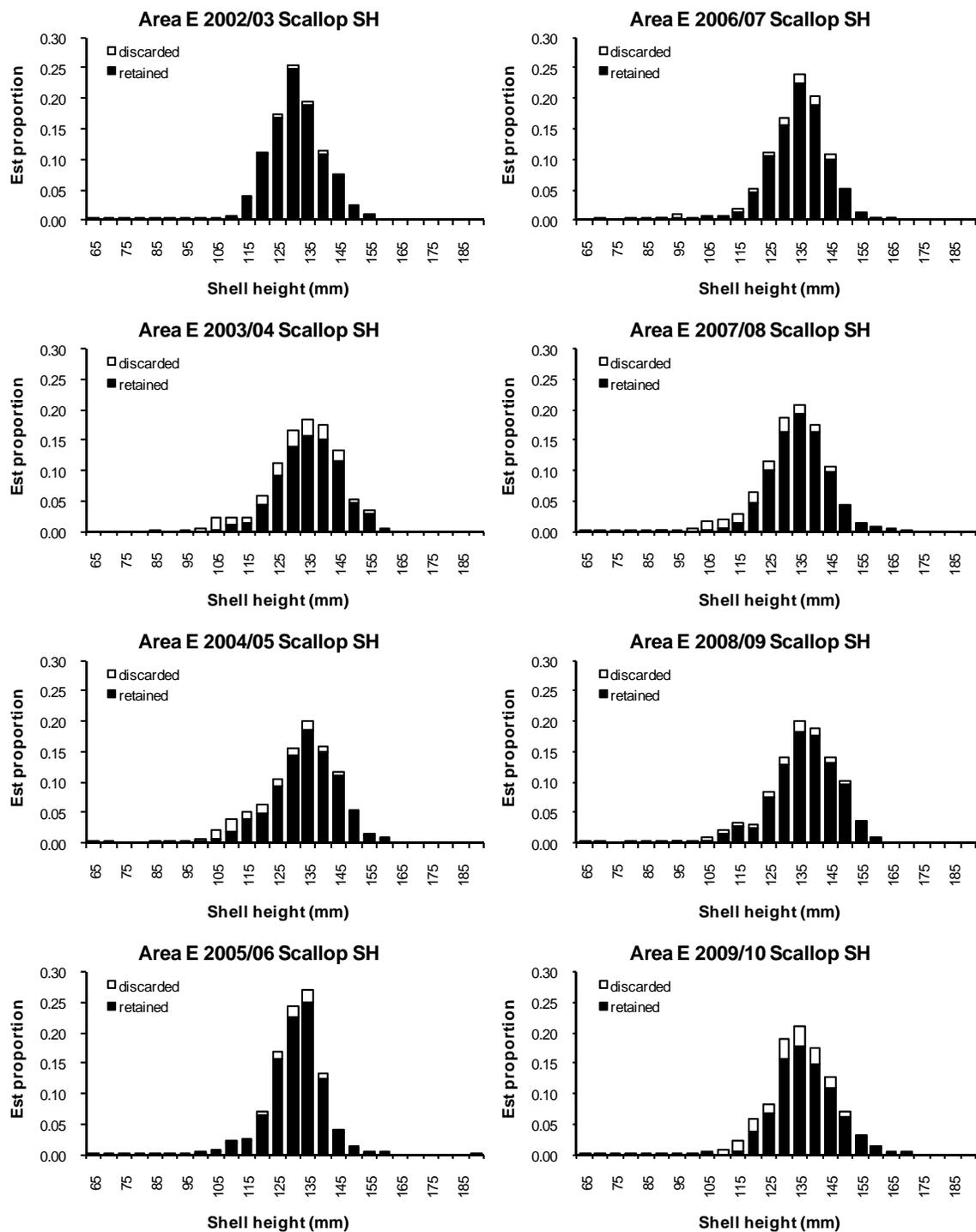


Figure 3-5 Prince William Sound Scallop Harvest and CPUE, 1993/94—2008/09 seasons.



**Figure 3-6** Estimated scallop shell height distributions from the 2001/02 – 2009/10 Prince William Sound fishing seasons.

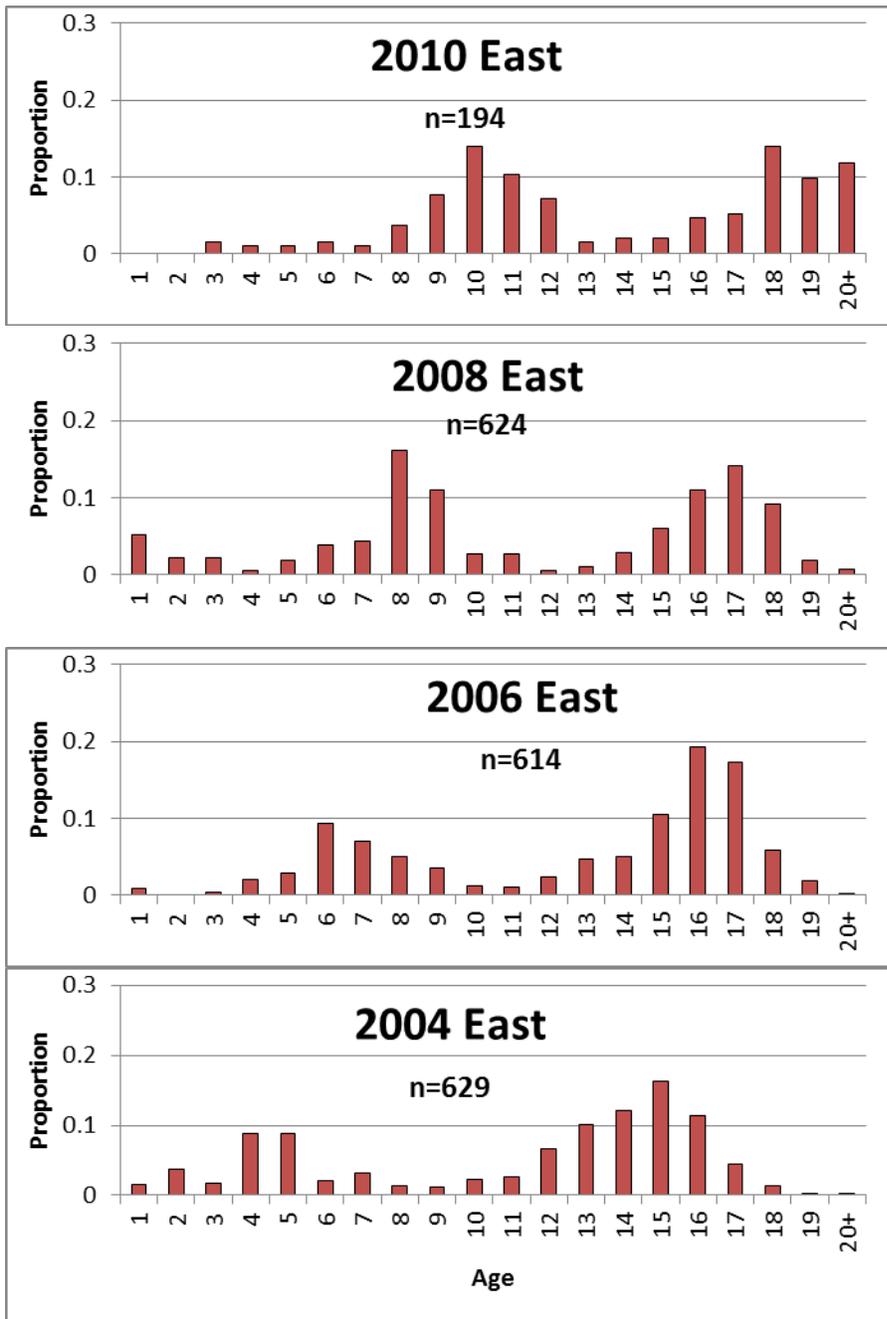


Figure 3-7 Age distributions during the Kayak surveys, East bed.

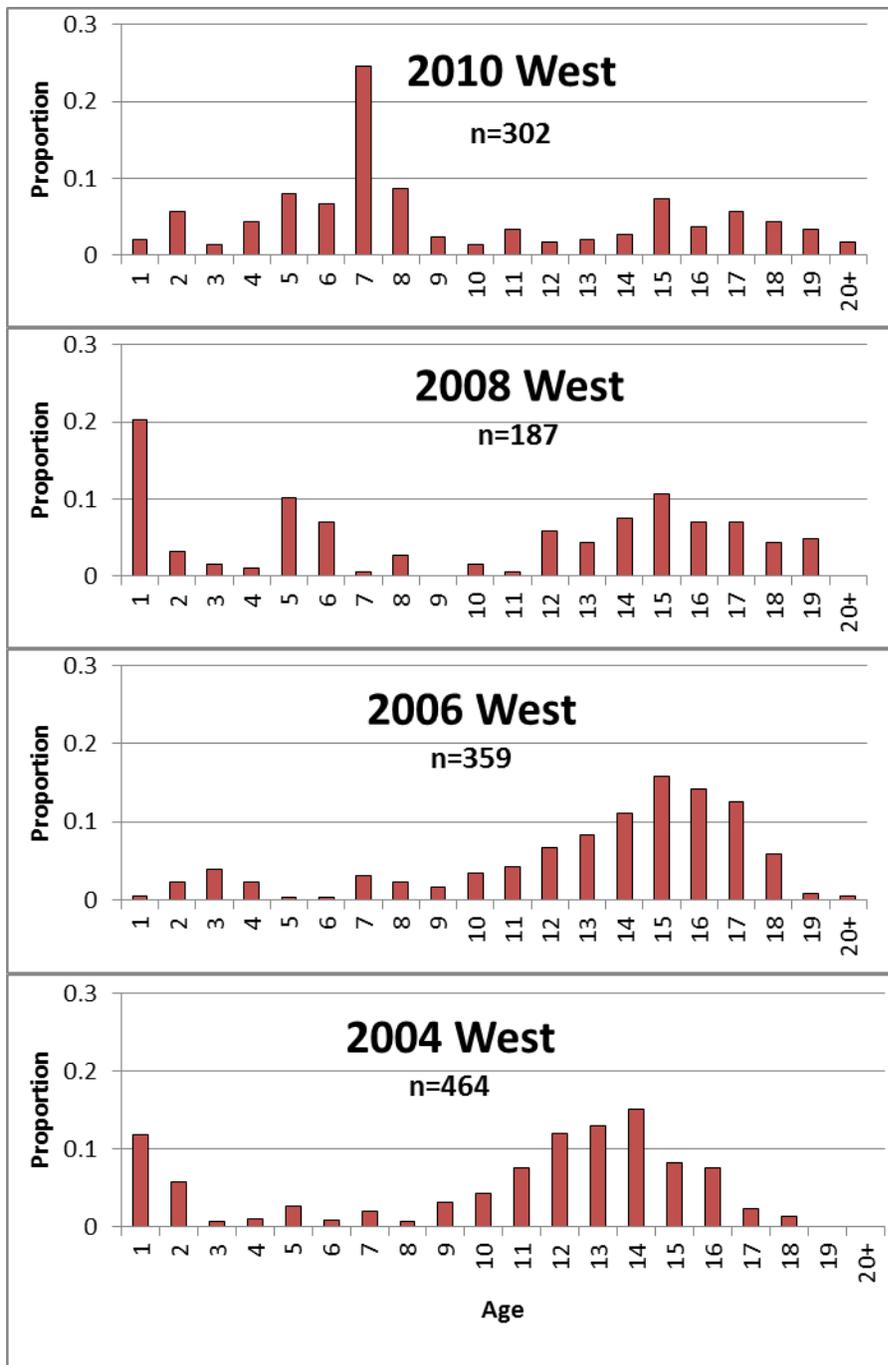


Figure 3-8 Age distributions during the Kayak surveys, West bed.

### 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 (Figure 2-1 and Table 3-5). 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). Much of Cook Inlet is closed to scallop dredging (Figure 2-1).

A total of 66 successful 1nm dredge tows were conducted during the 2009 Kamishak Bay weathervane scallop survey (43 in the north bed and 23 in the south bed). Catch in the north bed was 2,319 weathervane scallops weighing 879.4 kg (1,938.7 lb). Standardized catch abundance ranged from 0 to 207 scallops/nm resulting in a mean among all stations of 54.0 scallops/nm. Standardized catches by weight ranged from 0 to 69.5 kg/nm (153.2lb/nm) with a mean catch among all stations fished of 20.5 kg/nm (45.1lb/nm). Catch in the south bed was 1,231 weathervane scallops weighing 211.8 kg (466.9 lb). Standardized catch abundance ranged from 0 to 197 scallops/nm resulting in a mean among all stations of 53.4 scallops/nm. Standardized catches by weight ranged from 0 to 27.0 kg/nm (59.5 lb/nm) with a mean catch among all stations fished of 9.2 kg/nm (20.3 lb/nm). Abundance and biomass estimates from all Kamishak Bay surveys are given in Table 3-5. Age distributions from 2003-2009 scallops collected during the Kamishak dredge survey are found on Figure 3-9 and Figure 3-10.

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.

In 2007, Central Region and statewide scallop staff conducted a gear efficiency experiment in Kamishak Bay using the 8' dredge and an underwater video sled. That work as well as continuing efforts by Central Region staff to assess the gear efficiency of the 8' dredge has not been applied to Kamishak scallop data. However, plans are to attempt to incorporate those data into setting GHL's for the area in the near future. 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 1996-2009, using a standardized area of 90.21 nm<sup>2</sup> North Bed and 60.03 nm<sup>2</sup> 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 <sup>2</sup>	Average weight (g/scal)	Estimated biomass	Estimated biomass
								q =1.0 (kg meat)	q =0.83 (kg meat)
<b><u>North Bed</u></b>									
1996	26	60.0	15,675,797 ±	5,861,195	0.18	0.05	262	351,179	
1999	41	67.1	12,117,030 ±	4,146,938	0.17	0.04	380	300,983	
2001	37	62.9	9,981,727 ±	3,555,454	0.18	0.03	431	274,831	
2003	31	26.2	4,121,093 ±	1,177,366	0.14	0.01	435	110,149	
2005	38	22.7	3,535,528 ±	1,054,034	0.15	0.01	439	101,494	
2007	43	26.4	5,094,603 ±	1,367,458	0.13	0.02	354	139,596	
2009	43	20.5	3,701,806 ±	1,129,780	0.15	0.01	379	97,419	113,980
<b><u>South Bed</u></b>									
2003	28	59.7	9,438,307 ±	3,251,505	0.17	0.04	327	221,354	
2005	29	16.2	3,937,164 ±	1,427,866	0.18	0.02	212	60,907	
2007	31	23.5	5,991,135 ±	2,263,011	0.19	0.03	202	97,893	
2009	23	9.2	2,758,752 ±	1,461,302	0.26	0.01	172	18,154	21,240

The guideline harvest regulation specified by state regulation for the Kamishak District is 10,000 to 20,000 pounds of shucked meats. The most recent harvest occurred in the 2004/05 season, 3 vessels participated in the fishery harvesting 6,117 lbs of scallop meats (During the 2009 Scallop Planning Team Meeting “weak meats” were discussed. Weak meats are characterized by adductor muscle commig 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.

Table 3-6). Participation and CPUE in this small fishery vary widely (During the 2009 Scallop Planning Team Meeting “weak meats” were discussed. Weak meats are characterized by adductor muscle commig 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.

Table 3-6, Figure 3-6) and no vessels have fished these scallop beds in the past four years.

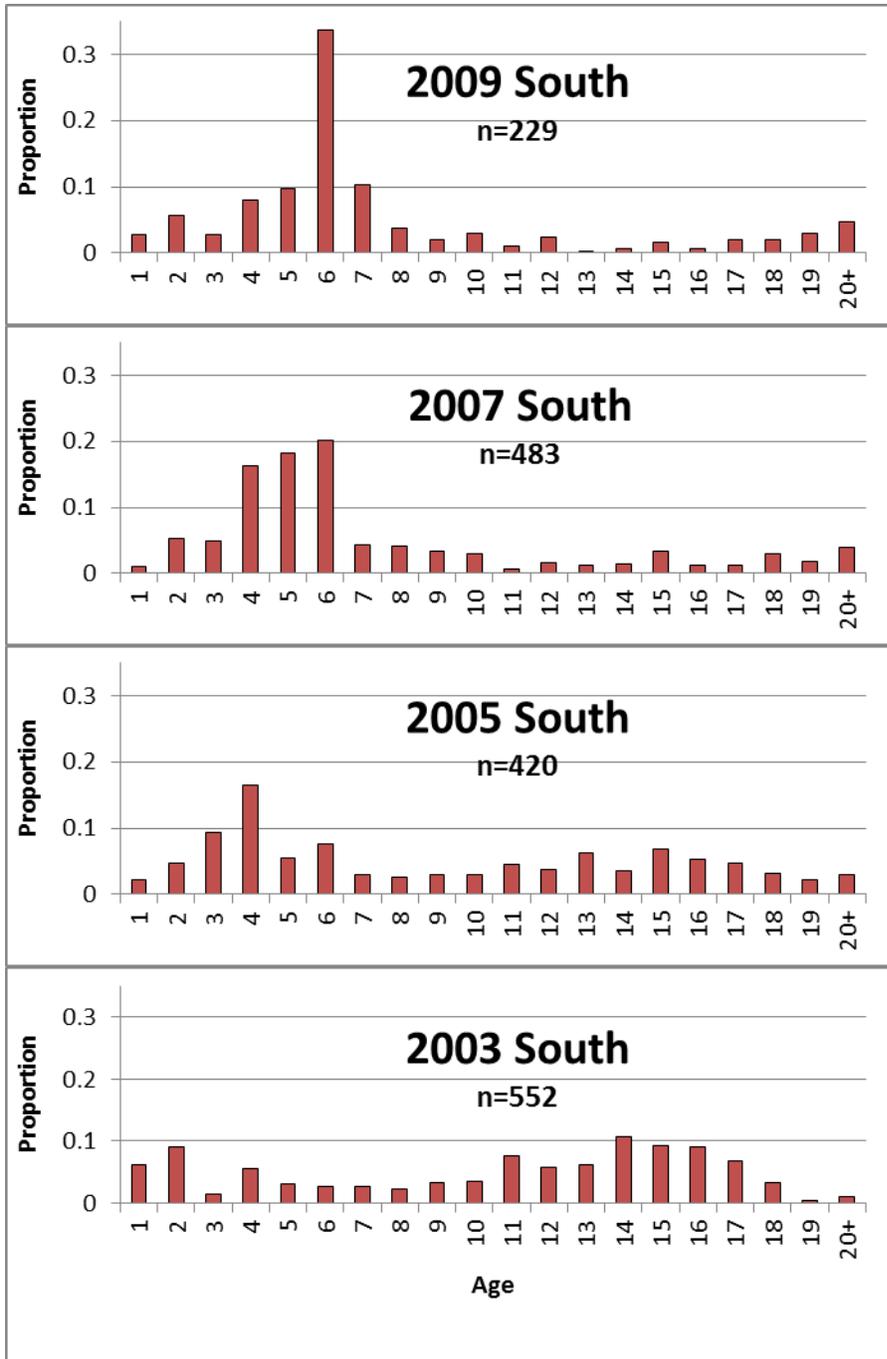
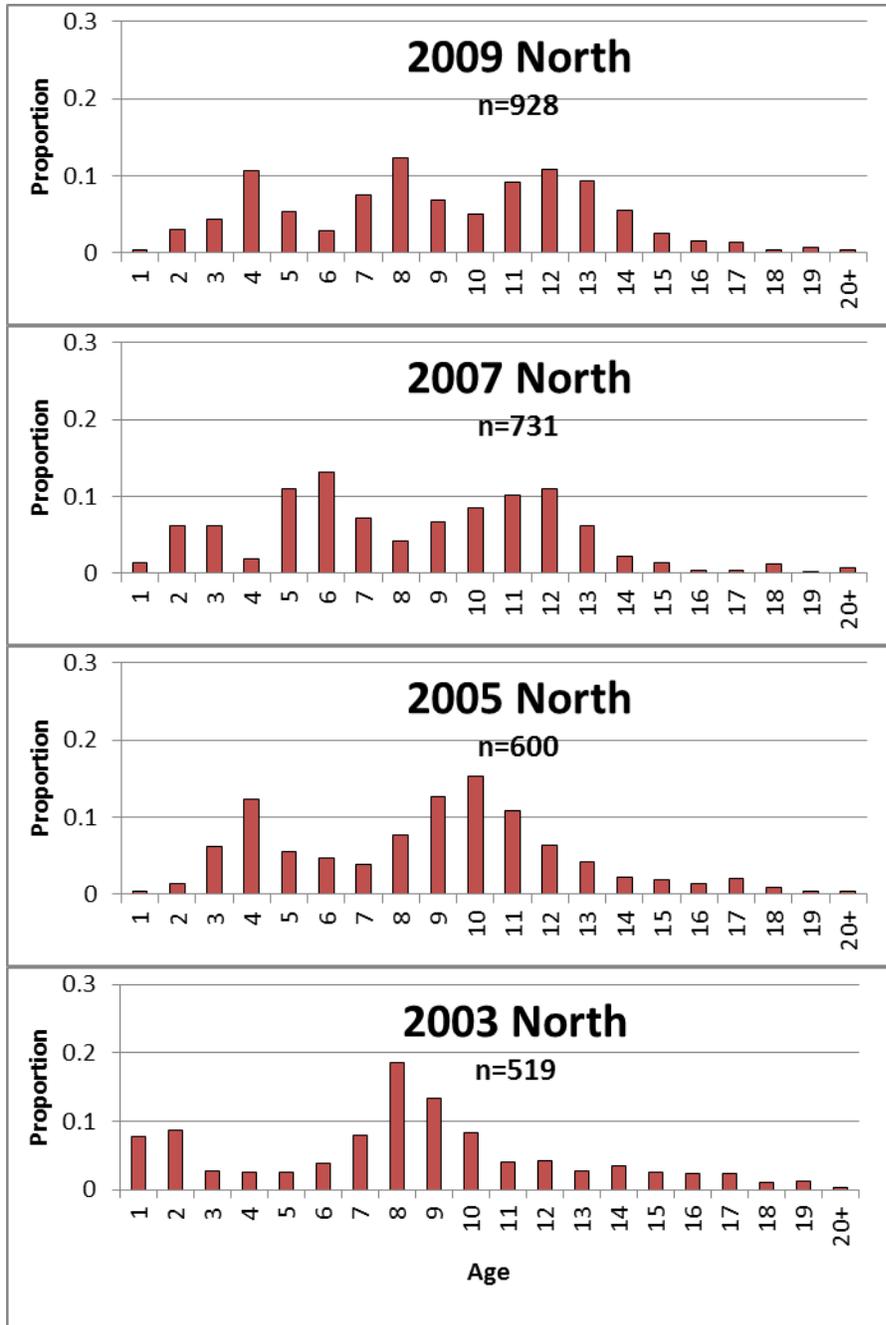


Figure 3-9 Age distributions during the Kamishak surveys, South bed.



**Figure 3-10 Age distributions during the Kamishak surveys, North bed.**

**Sled-dredge:** Preliminary efforts have been made using underwater video techniques to evaluate survey dredge efficiency, thereby increasing accuracy of the survey estimates and 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 3-11). The sled is analogous to that used by the statewide scallop program in Kodiak, but 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). The sled-dredge underwent initial field trials comparing catches to the 8' dredge during the 2009 Kamishak survey with the goal of eventually replacing the 8' dredge with the sled dredge for all scallop surveys in Central Region. These tests indicated modifications need to be made to the sled and camera system. The modifications will be made and testing will continue in the 2010 field season.



**Figure 3-11 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 commig 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.

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

Season	Number vessels	GHL (lbs meat)	Dredge hours	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>b</sup>	
						Numbers	Weight (lbs)
1993	3		529	20,115	38		
1994	4		454	20,431	45		
1995		closed					
1996	5		534	28,228	53		
1997	3	20,000	394	20,336	52		
1998	1	20,000	390	confidential			
1999	3	20,000	333	20,315	61		
2000	3	20,000	276	20,516	74		
2001	2	20,000	406	confidential			
2002	3	20,000	311	8,591	28		
2003	2	20,000	862	confidential			
2004	3	20,000	364	6,117	17		
2005	2	7,000	199	confidential			
2006	1	7,000	10	confidential			
2007	1	12,000		confidential			
2008	0	12,000	No effort				
2009	0	14,000	No effort				
2010	1	14,000		confidential			

<sup>a</sup> Includes estimated dead loss.

<sup>b</sup> Estimated from bycatch samples.

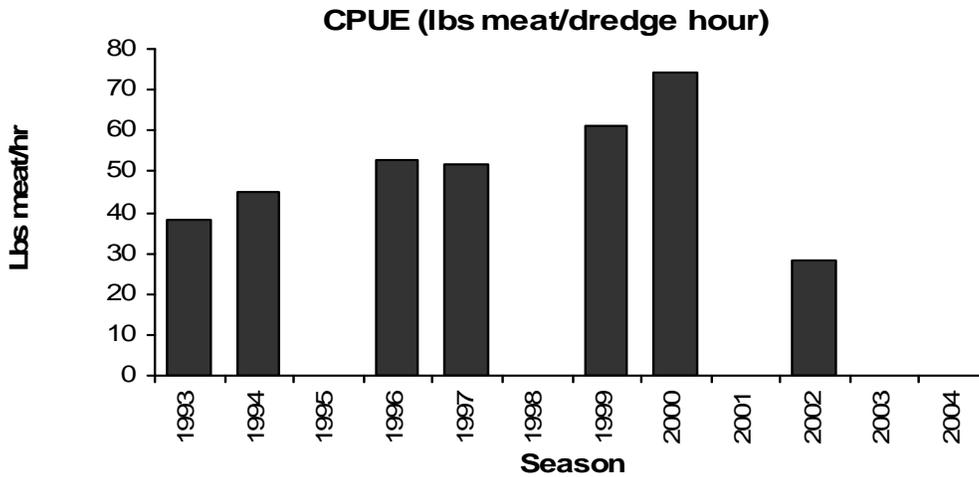
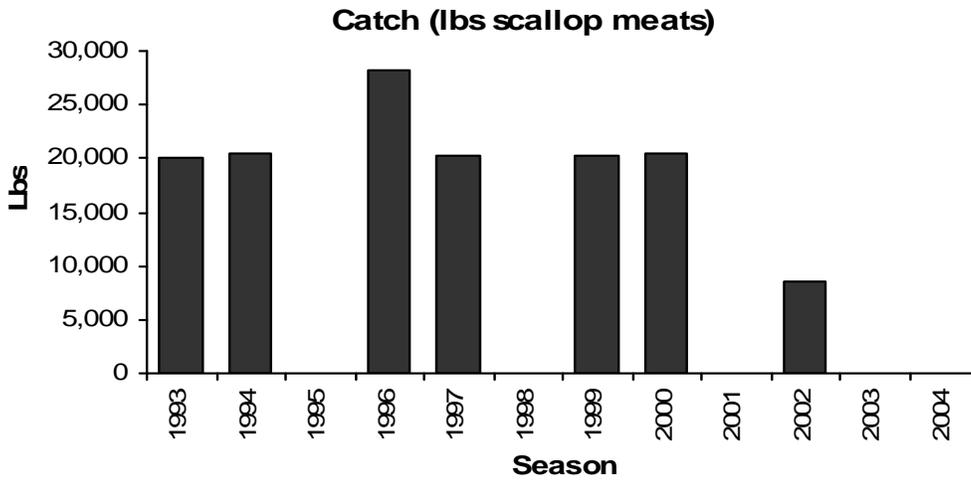
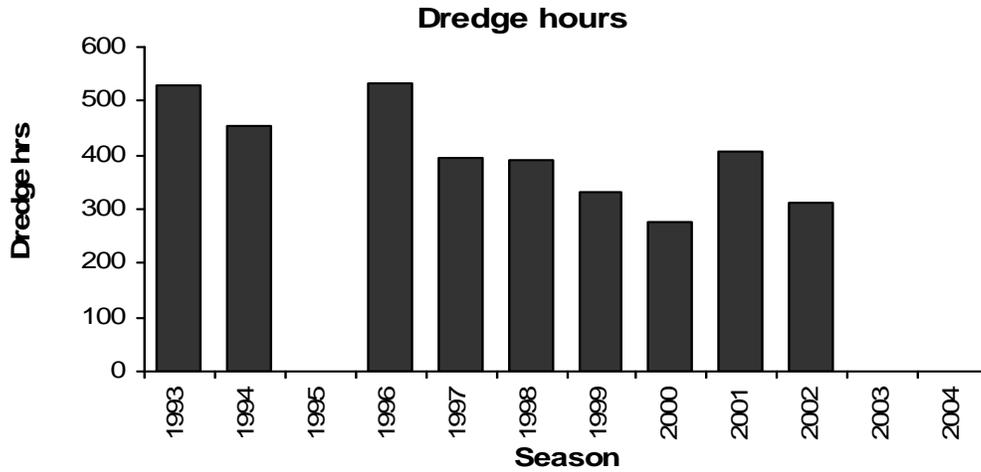


Figure 3-12 Barplots of Area H scallop fishery statistics.

### 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.

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 3-11). 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 3-11) and observer program shell height data demonstrated catches contained a wide range of scallop sizes (Figure 3-12) 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, Figure 3-11, and Figure 3-12. Northeast District catches and CPUE have remained stable since the 2000/01 fishing season (Table 3-7, Figure 3-11). One vessel harvested about 73,000 pounds of scallop meats from the Northeast District in 2009/10 season. Large portions of the Northeast District that contain scallops are closed to scallop dredging (Figure 2-2). 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.

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

Season	Number vessels	GHL (lbs meat)	Dredge hours	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>b</sup> Number	Weight (lbs)
1993/94	10	NA	6,940	155,187	22		
1994/95	7	NA	1,773	35,207	20		
1995/96		closed					
1996/97	3	NA	581	11,430	20		
1997/98	3	NA	2,604	95,858	37		
1998/99	4	NA	2,749	120,010	44		
1999/00	3	75,000	1,384	77,119	56		
2000/01	4	80,000	1,101	79,965	73		
2001/02	3	80,000	1,142	80,470	70		
2002/03	2	80,000	1,350	80,000	59		
2003/04	2	80,000	1,248	79,965	64		
2004/05	2	80,000	1,227	80,105	65		
2005/06	3	80,000	1,759	79,990	45		
2006/07	2	90,000	1,168	75,150	64		
2007/08	2	90,000	1,170	75,105	64		
2008/09	3	90,000	1,363	74,863	55	308,758	110,457
2009/10	1	75,000	1,210	73,320	61		121,021
2010/11 <sup>c</sup>		65,000		64,475			

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

<sup>b</sup> Estimated from bycatch samples.

<sup>c</sup> 2009/2010 catch data is preliminary and subject to change.

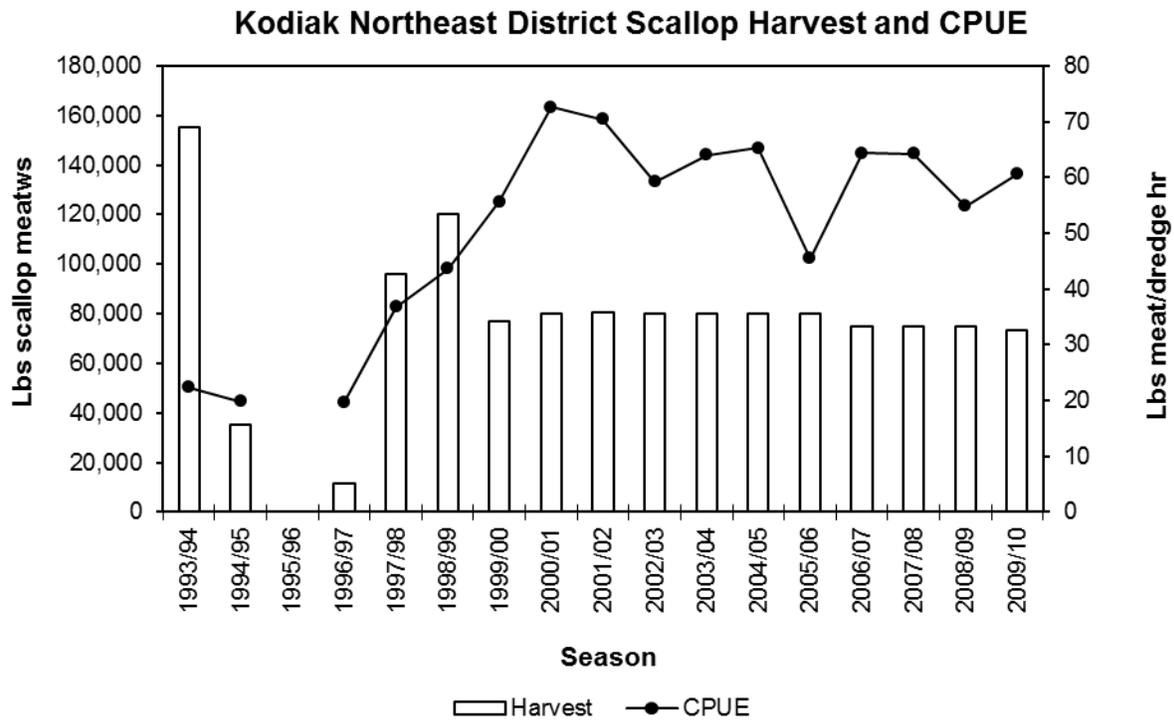
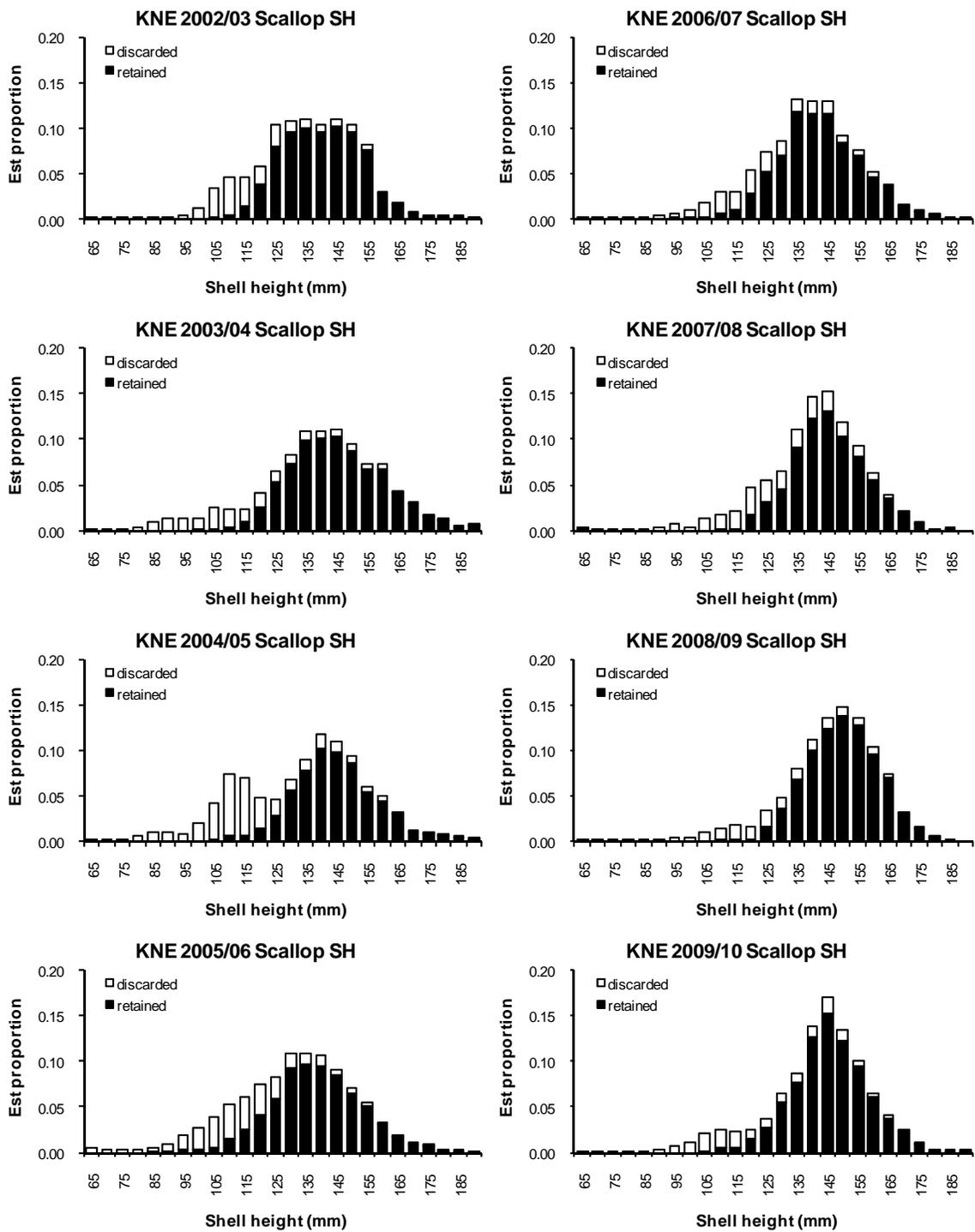


Figure 3-13 Kodiak Northeast District Harvest and CPUE, 1993/94—2008/09 seasons.



**Figure 3-14** Estimated scallop shell height distributions from the 2001/2002—2009/10 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. Applying 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 2009. In 2009/10 season the GHL was achieved and Tanner crab bycatch was lower.

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

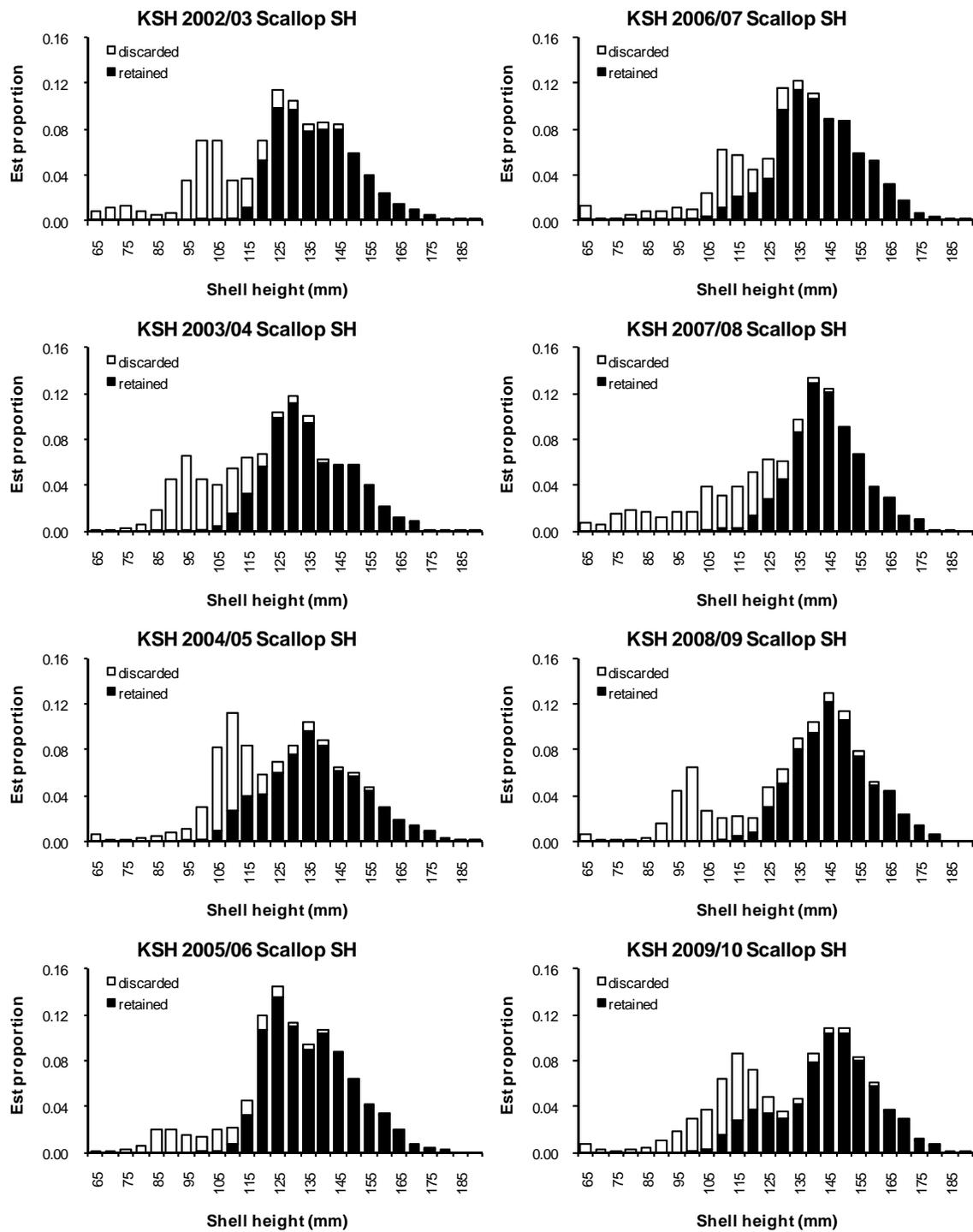
Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>c</sup> Numbers	Weight
1993/94	5	NA	2,491	105,017	42		
1994/95	11	NA	8,662	314,051	36		
1995/96		closed					
1996/97	3 <sup>b</sup>	NA	3,491	219,305	63		
1997/98	4	NA	5,492	258,346	47		
1998/99	8	NA	4,081	179,870	44		
1999/00	6	180,000	4,304	187,963	44		
2000/01	5	180,000	2,907	180,087	62		
2001/02	4	180,000	3,398	177,112	52		
2002/03	3	180,000	3,799	180,580	48		
2003/04	2	180,000	3,258	180,011	55		
2004/05	2	180,000	3,467	174,622	50		
2005/06	2	160,000	2,280	159,941	70		
2006/07	3	160,000	2,183	162,537	74		
2007/08	3	170,000	2,937	169,968	58		
2008/09	2	170,000	263	13,761	52	127,995	33,442
2009/10	3	170,000	3,447	169,877	49		349,952
2010/11 <sup>d</sup>		170,000		171,076			

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

<sup>b</sup> One additional vessel fished but data were not available.

<sup>c</sup> Estimated from bycatch samples.

<sup>d</sup> 2010/11 catch data is preliminary and subject to change.



**Figure 3-15 Estimated scallop shell height distributions from the 2001/02—2009/10 Kodiak Shelikof District fishing seasons.**

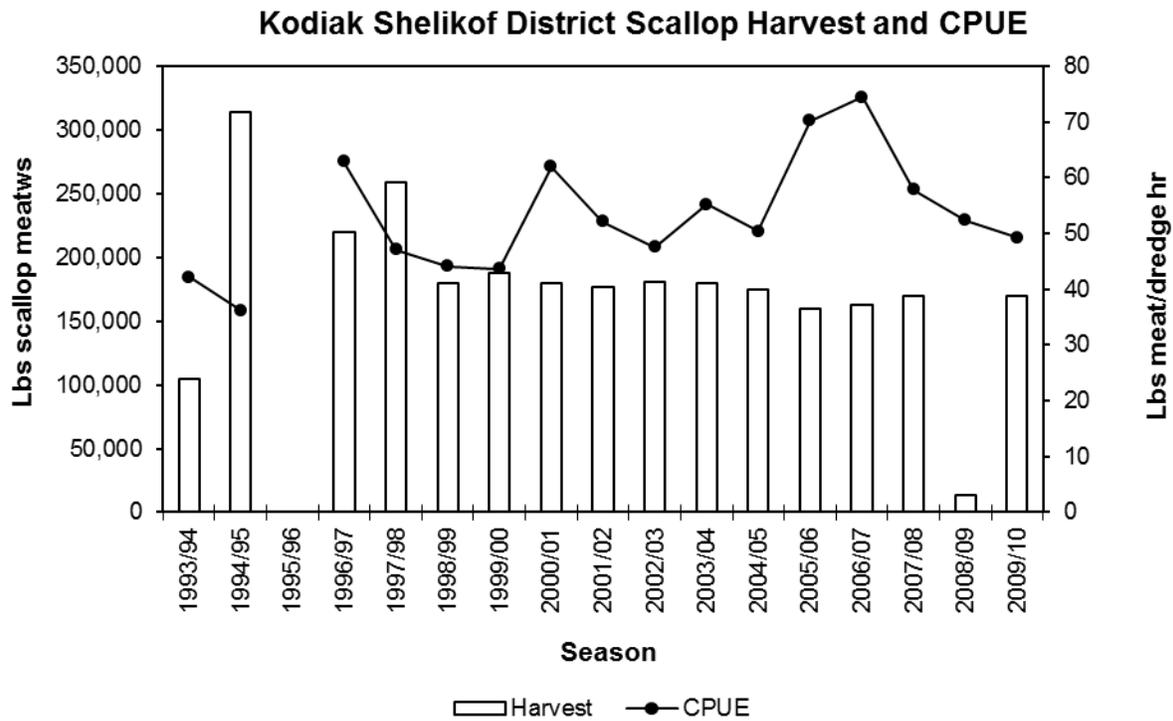
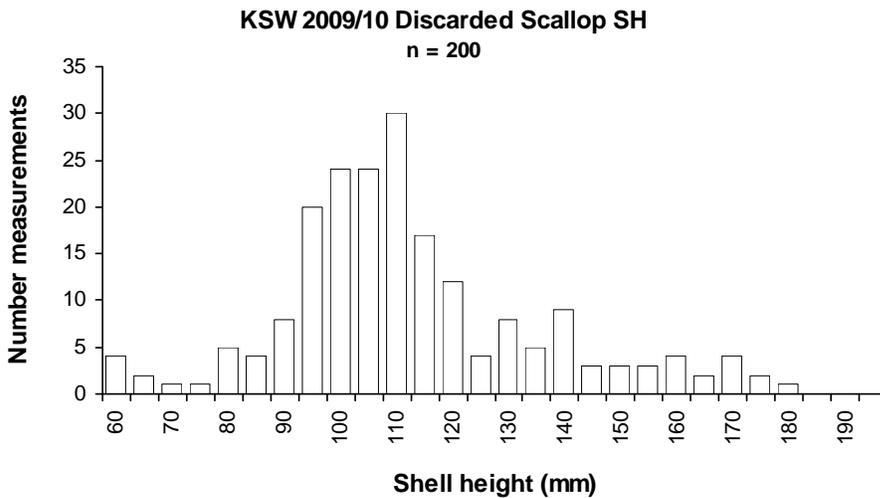
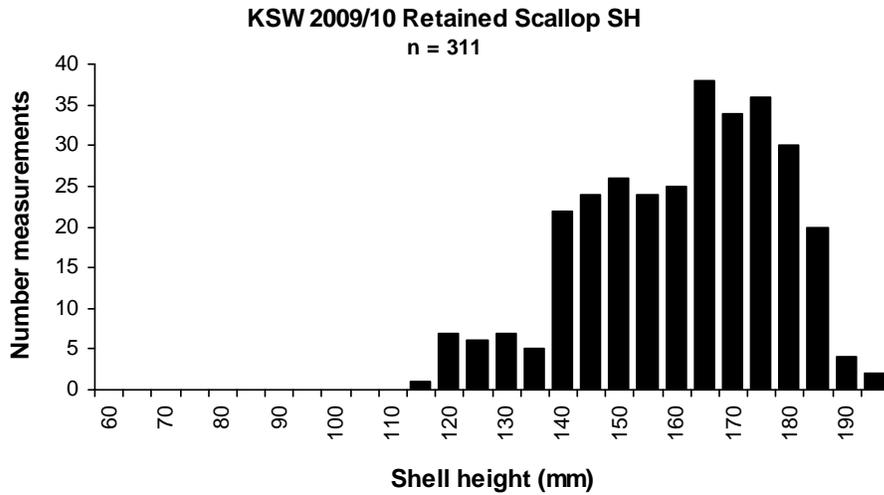


Figure 3-16 Kodiak Shelikof District Harvest and CPUE, 1993/94—2009/10 seasons.

### 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 GHF 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.



**Figure 3-17** Estimated shell height distributions of scallops retained (upper plot) and discarded (lower plot) during the 2009/10 exploratory Kodiak Southwest District scallop fishery.

### 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 2-2). Offshore waters of the district remain open to fishing, but no effort has occurred since the 1999/00 season (Table 3-9).

**Table 3-9 Kodiak Semidi District scallop fishery summary statistics.**

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>c</sup> Numbers Wright (lbs)
1993/94	6 <sup>b</sup>	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	

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

<sup>b</sup> Two additional vessel fished but data are not available.

<sup>c</sup> 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 3-10, Figure 3-15).

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.

**Table 3-10 Alaska Peninsula Area scallop fishery summary statistics.**

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>b</sup>	
						Numbers	Weight (lbs)
1993/94	8	NA	1,847	112,152	61		
1994/95	7	NA	1,664	65,282	39		
1995/96		closed					
1996/97	2	200,000	327	12,560	38		
1997/98	4	200,000	1,752	51,616	29		
1998/99	4	200,000	1,612	63,290	39		
1999/00	5	200,000	2,025	75,535	37		
2000/01	3	33,000	320	7,660	24		
2001/02		closed					
2002/03		closed					
2003/04		10,000					
2004/05		10,000					
2005/06		20,000					
2006/07	2	25,000	64	155	2		
2007/08		10,000					
2008/09	1	10,000	151	2,460	16	16,801	4,120
2009/10		10,000		0			
2010/11		closed					

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

<sup>b</sup> Estimated from bycatch samples.

<sup>c</sup> 2010/11 catch data is preliminary and subject to change.

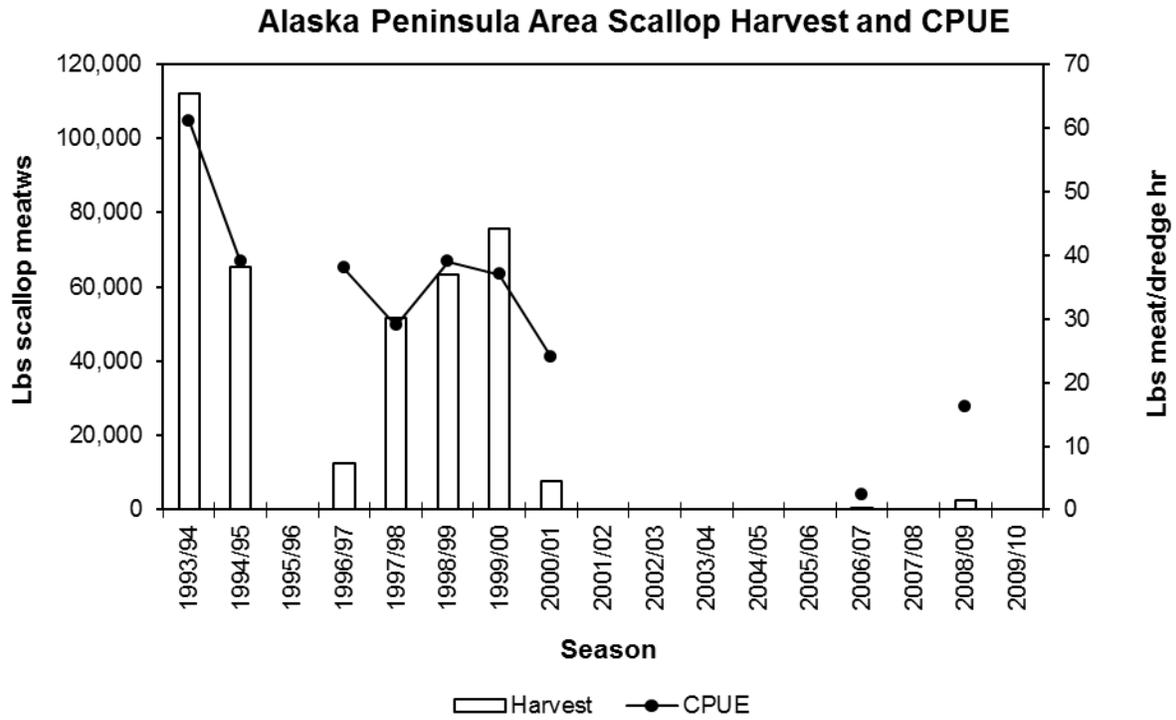


Figure 3-18 Alaska Peninsula harvest and CPUE, 1993/94—2009/10 seasons.

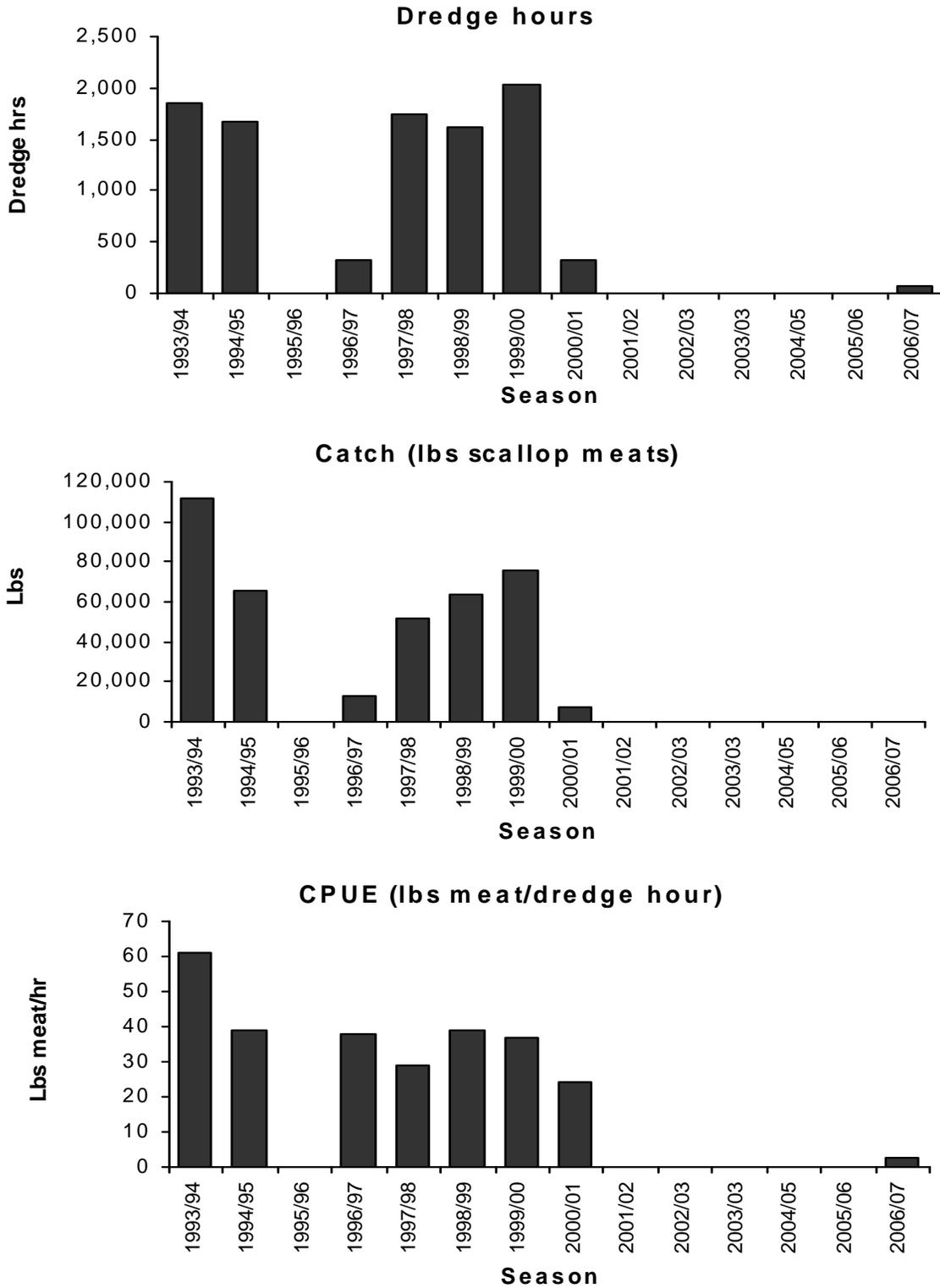


Figure 3-19 Barplots of Alaska Peninsula scallop fishery statistics.

### 3.9 Bering Sea Registration Area

Weather-vane scallop fisheries in the Bering Sea Registration Area (BSRA) were unconstrained by a GHL prior to the 1996/97 season (Table 3-11, 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 weather-vane 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 3-19).

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 hard threshold below which the fishery would be closed.

Inseason fishery performance data was evaluated against the hard 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 hard 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 hard threshold, the upper bound of the GHL range is regularly met, and scallop shell-height data shows moderate recruitment (Figure 3-21). The current 50,000 pound GHL upper bound appears to be sustainable under prevailing conditions.

Given the paucity of stock status data available for weather-vane scallop populations, managers place a heavy reliance on the imperfect metric of fishery dependent CPUE data. 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 (Figure 2-2).

**Table 3-11 Bering Sea Area scallop fishery summary statistics.**

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallops <sup>b</sup> Number	Weight (lbs)
1993/94	9	NA	5,764	284,414	49		
1994/95	8	NA	11,113	505,439	45		
1995/96		closed					
1996/97	1	600,000	2,313	150,295	65		
1997/98	2	600,000	2,246	97,002	43		
1998/99	4	400,000	2,319	96,795	42		
1999/00	2	400,000	3,294	164,929	50		
2000/01	3	200,000	3,355	205,520	61		
2001/02	3	200,000	3,072	140,871	46		
2002/03	2	105,000	2,038	92,240	45		
2003/04	2	105,000	1,020	42,590	42		
2004/05	1	105,000	275	10,050	37		
2005/06	1	50,000	602	23,220	39		
2006/07	1	50,000	1,138	48,246	43		
2007/08	2	50,000	1,084	49,995	46		
2008/09	1	50,000	962	49,995	52	139,564	60,894
2009/10	1	50,000	1,270	48,855	38		57,984
2010/11 <sup>c</sup>		50,000		50,100			

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

<sup>b</sup> Estimated from bycatch samples.

<sup>c</sup> 2010/2011 catch data is preliminary and subject to change.

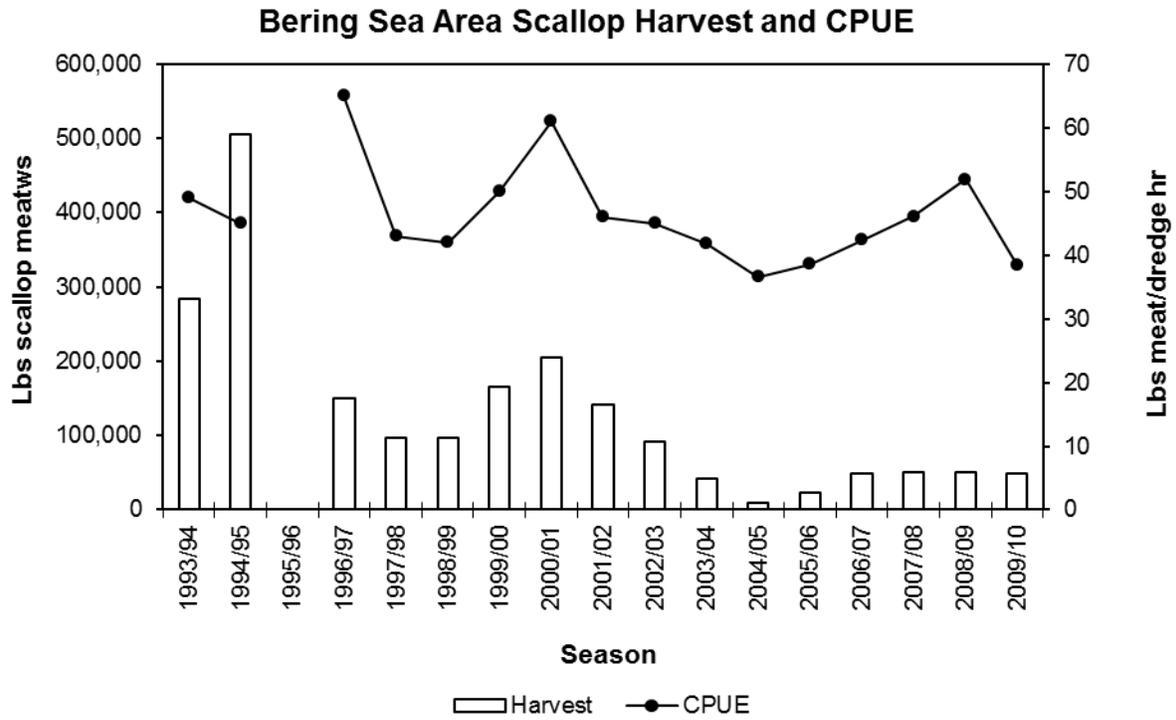
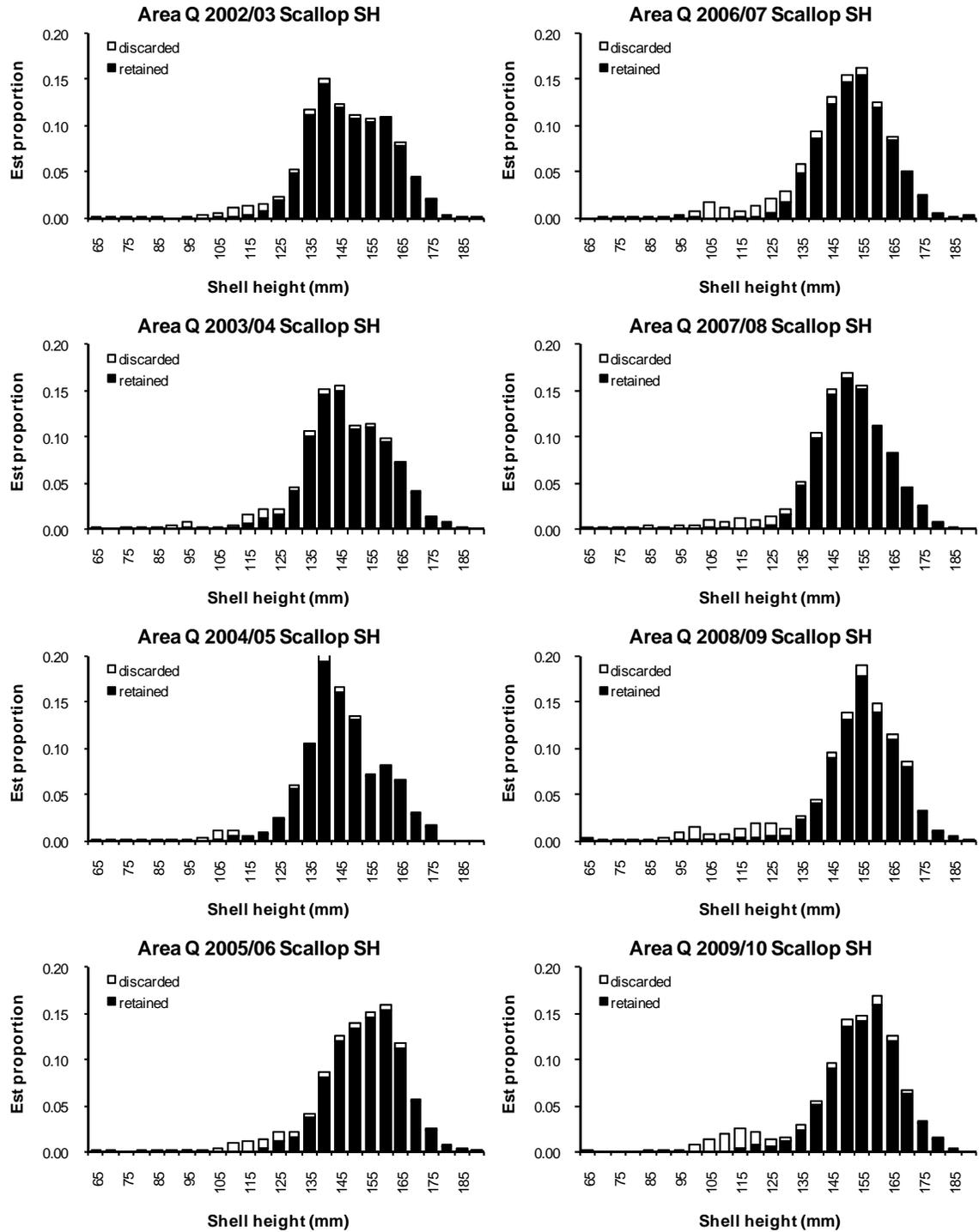


Figure 3-20 Bering Sea Scallop Harvest and CPUE, 1993/94—2009/10 seasons.



**Figure 3-21** Estimated scallop shell height distributions from the 2001/02—2009/10 Bering Sea fishing seasons.

### 3.9 Dutch Harbor Registration Area

The first landings of weathervane scallops from the Dutch Harbor Registration Area (DHRA) occurred in 1982, however GHM ranges were not established until 1993. The initial DHRA GHM 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 3-12. The DHRA scallop fishery failed to meet preseason performance expectations when GHM 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 GHM 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 GHM range of zero to 10,000 pounds of shucked meats. In setting this GHM 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 GHM range of zero to 10,000 pounds of shucked scallop meats. Justification for the GHM was the same as that applied in setting the 2002/03 GHM. Fishery performance was greatly improved during the 2008/09 season (see Figure 3-22): the upper limit of the GHM 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 GHM 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 GHM 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.

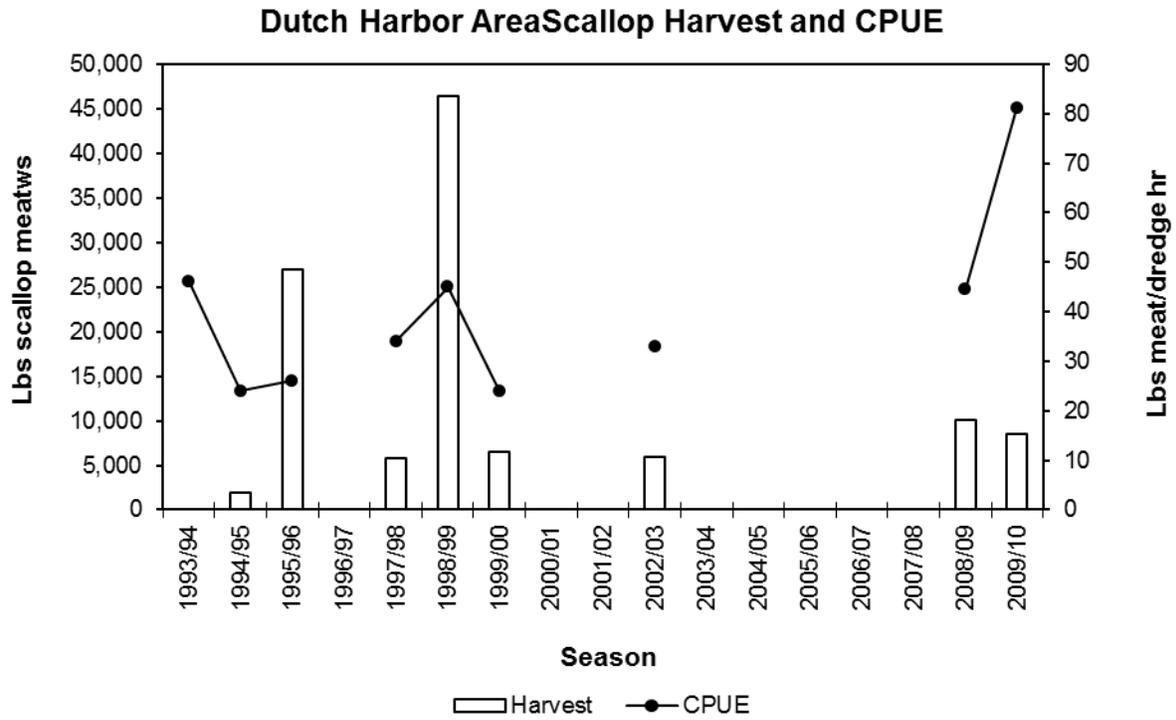
**Table 3-12 Dutch Harbor Area scallop fishery summary statistics.**

Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)	Discarded scallop <sup>b</sup>	
						Number	Weight
1993/94	2	170,000	838	confidential	46		
1994/95	3	170,000	81	1,931	24		
1995/96	1	170,000	1,047	26,950	26		
1996/97		170,000					
1997/98	1	170,000	171	5,790	34		
1998/99	4	110,000	1,025	46,432	45		
1999/00	1	110,000	273	6,465	24		
2000/01		closed					
2001/02		closed					
2002/03	1	10,000	184	6,000	33		
2003/04		closed					
2004/05		closed					
2005/06		closed					
2006/07		closed					
2007/08		closed					
2008/09	1	10,000	225	10,040	45	82,188	32,209
2009/10	1	10,000	104	8,445	81		2,082
2010/11 <sup>c</sup>		10,000		5,640			

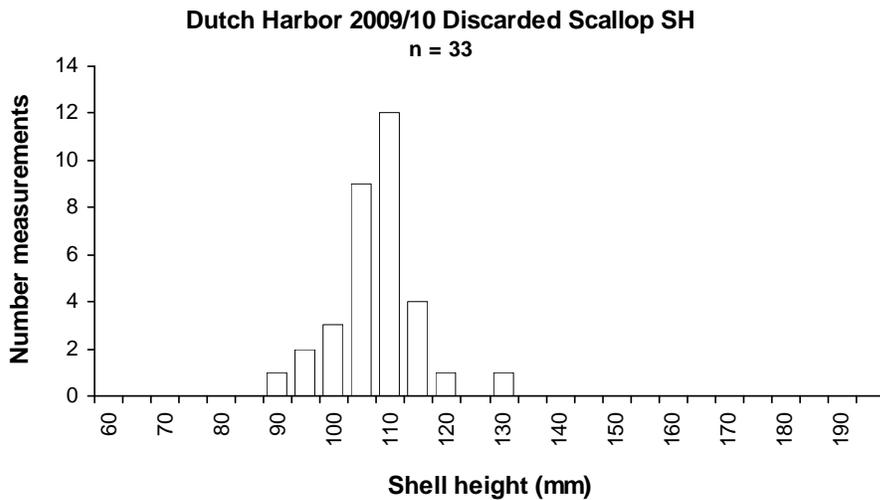
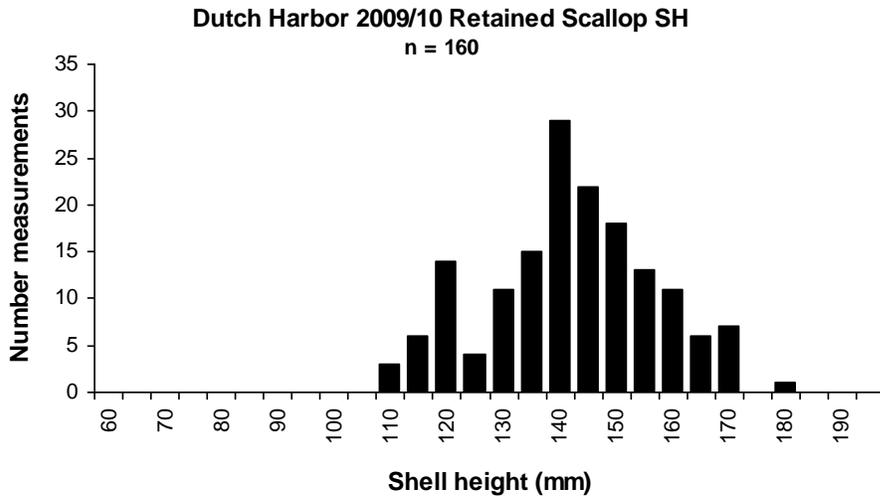
<sup>a</sup> Confidential data released by vessel operators.

<sup>b</sup> Estimated from bycatch samples.

<sup>c</sup> 2009/2010 catch data is preliminary and subject to change.



**Figure 3-22 Dutch Harbor Area Scallop Harvest and CPUE, 1994/95—2009/10 seasons.**



**Figure 3-23 Estimated shell height distributions of scallops retained (upper plot) and discarded (lower plot) during the 2009/10 Dutch Harbor scallop fishery.**

### 3.10 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 51° 30' N. latitude and 54° 30' N. latitude, and between 179° W. longitude and 179° 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 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.**

Year	Region 1		Region 2		Region 3		Region 4		
	NMFS Trawl	Region Total	ADF&G Dredge	ADF&G Trawl	NMFS Trawl	Region Total	ADF&G Trawl	NMFS Trawl	Region Total
<b>Non-target scallop species</b>									
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

<sup>a</sup> Meat weight based on a median meat recovery of 10% statewide.

<sup>b</sup> Discard mortality assumes a 20% mortality on scallops that were captured, but not 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 2-2). 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 may also be scallop predators. Starfish, shell boring worms and sponges may also prey upon scallops. Twentyarm sea stars are a known predator of juvenile 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 *Pycnopodia helianthoides* (4%), natural debris (kelp, wood, etc., 3%), and several species of skates (2%). A comparison of the statewide incidental catch and the incidental catch for each scallop fishery area/district for the 2009/2010 season are listed in Table 4-2.

**Table 4-2 Summary of results from scallop observer haul composition sampling (% by weight) during the 2009/10 season.**

Species category	Statewide	Yakutat		Kodiak					
		Area D	District 16	Prince William Sound	Northeast District	Shelikof District	Southwest District	Dutch Harbor	Bering Sea
Weathervane scallops	79.1	79.3	83.6	89.5	67.5	80.8	80.7	74.3	85.2
<sup>a</sup> Flatfish	5.0	3.0	3.4	1.3	1.6	2.1	5.1	1.0	1.1
<sup>b</sup> Sea stars	3.1	4.6	7.6	3.4	8.0	2.7	3.9	2.1	0.2
<sup>c</sup> Skates	2.4	2.3	2.1	1.3	1.3	4.0	2.4	<0.1	1.9
<sup>d</sup> <i>Chionoecetes</i> crabs	0.4	<0.1	<0.1	<0.1	0.3	0.2	0.2	<0.1	4.4
Pacific halibut	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

<sup>a</sup> 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.

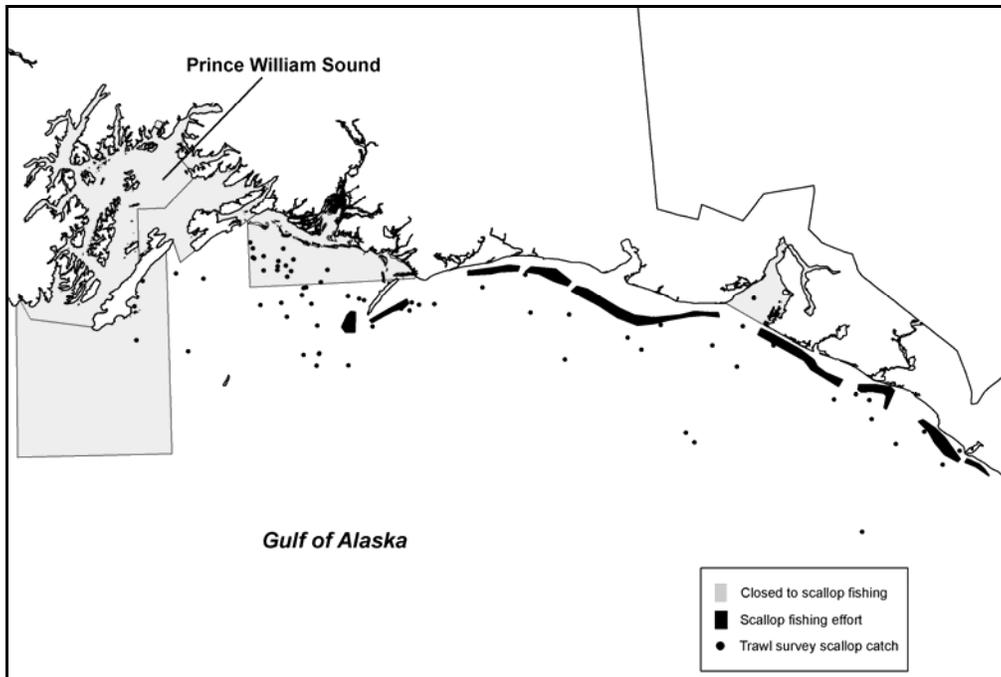
<sup>b</sup> Includes sunflower sea stars *Pycnopodia helianthoide*, brittle stars *Ophiura* sp., basket stars *Gorgonocephalus* sp., and sun sea stars *Solaster* sp.

<sup>c</sup> Includes Alaska skate *Bathyraja parmifera*, big skate *Raja binoculata*, longnose skate *Raja rhina*, Bering skate *Bathyraja interrupta*, and unspecified skate species.

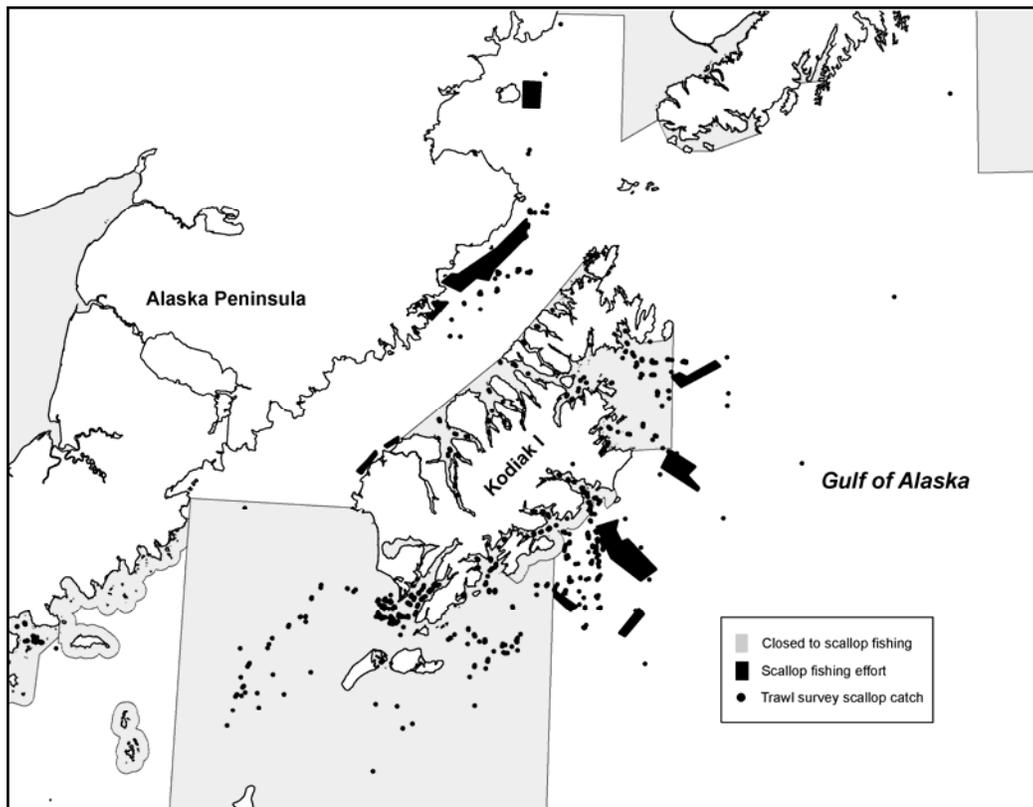
#### 4.4 Trawl Survey Information on Scallop Stocks

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.

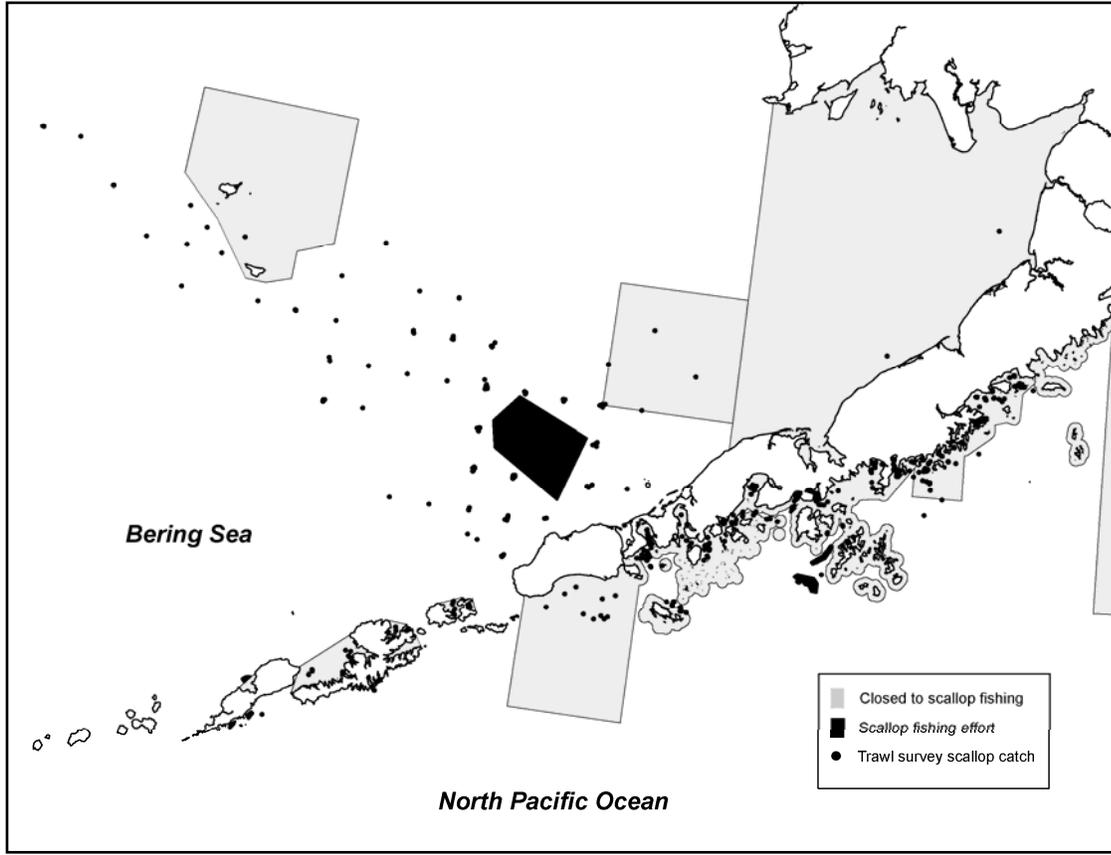
In the eastern GOA (Figure 2-2), weathervane scallops have been captured during trawl surveys offshore from traditional scallop fishing grounds and in closed waters adjacent to Prince William Sound. Around Kodiak Island (Figure 4-2), trawl surveys have captured scallops in closed waters south of the 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 scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS trawl surveys in the eastern Gulf of Alaska.



**Figure 4-2** Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS and ADF&G trawl surveys in the Kodiak Area.



**Figure 4-3 Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS and ADF&G trawl.**

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