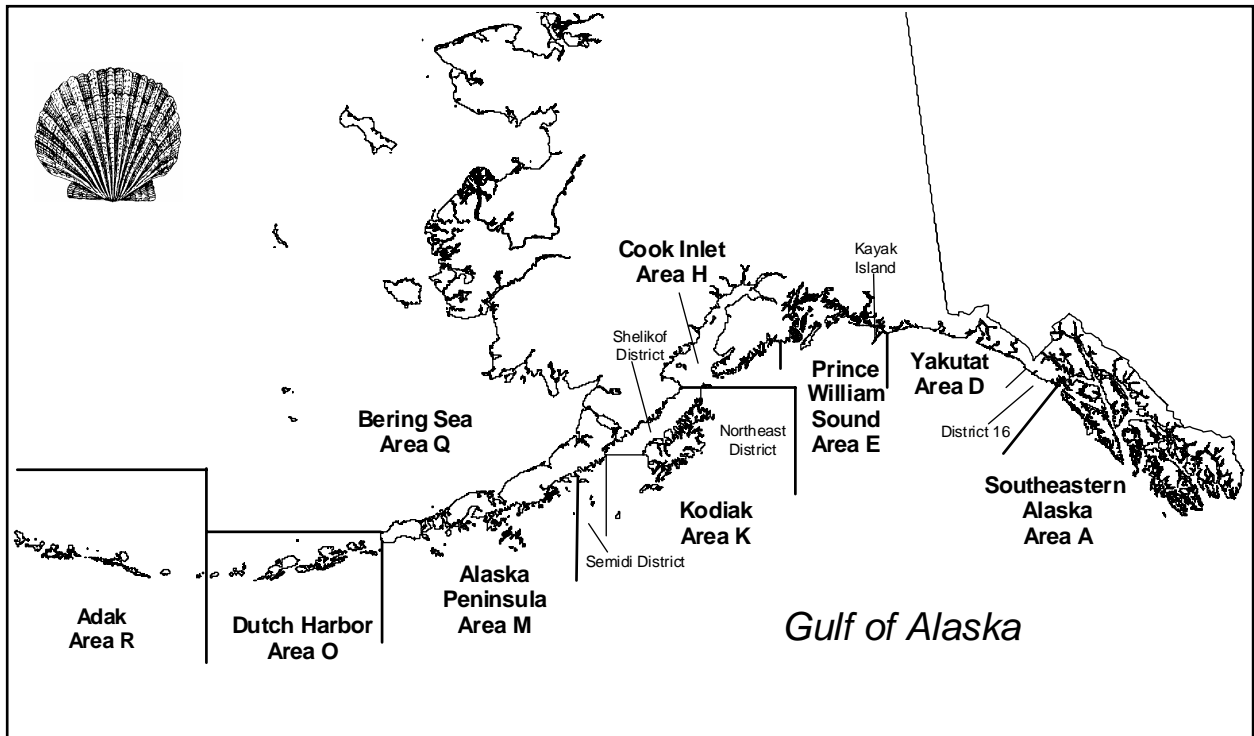


**STOCK ASSESSMENT AND FISHERY EVALUATION REPORT**  
**FOR THE WEATHERVANE SCALLOP**  
**FISHERY OFF ALASKA**



Compiled by

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# 1 Introduction

The *National Standard Guidelines for Fishery Management Plans* published by the National Marine Fisheries Service (NMFS) 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 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). 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 February 19-20, 2009 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), Gretchen Harrington, Scott Miller, Jie Zheng Richard Gustafson, Ryan Burt and Herman Savikko.

The scallop fishery in Alaska’s Exclusive Economic Zone (EEZ; 3-200 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, 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 and approved by NMFS on July 26, 1995. The NPFMC updated and adopted a revised FMP in [add date].

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 1, and general fishing locations are shown in Figure 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. Statewide scallop harvests have not exceeded OY, and scallop stocks are not overfished.

## 1.1 Responses to Comments from the SSC and Summary of New Information Included in the SAFE Report

Comments on the 2008 SAFE provided by the SSC and responses are below followed by a summary of new information included in this report.

**Comment:** The SSC requests that next year's SAFE report include an explanation in the management chapter (section 2.1) describing the process by which changes to GHLS are determined each year. Additionally, the SSC requests that an explanation be provided for all GHLS changes that have been made for each registration area, to be included in the Stock Status chapter for each registration area.

**SPT response:** The SPT has requested information on GHLS, GHLS determination, and changes to GHLS from ADF&G management biologists from the three ADF&G regions with scallop fisheries. Section 2.2 has been created with subsections for each region that have minimal information at present but will serve as placeholders until responses are received and the information incorporated into the SAFE. Information on recent changes to GHLS levels has been added to individual registration area sections where available and additional information will be added when it is received.

**Comment:** The SSC requests information be provided on predator-prey relationships, including effects on scallop predators, as well as considerations of habitat effects and of bycatch.

**SPT response:** Information has been added to sections 4.1 and 4.2 of this report to begin to address these concerns. Additional information will likely be available following the forthcoming 5 year EFH review and the habitat and related sections will be updated accordingly.

This SAFE Report includes updated information through the 2007/2008 fishing season. New information included in this report since the previous report (NPFMC 2006) includes the following:

- 1) Updated observer program summary data through 2007/2008 fishing season;
- 2) Overview section on fishery management added;
- 3) Clarification regarding definition of GHRs and GHLS;
- 4) Many sections moved, reorganized, and rewritten;
- 5) Updated information on recent regulatory actions with respect to the scallop fishery.

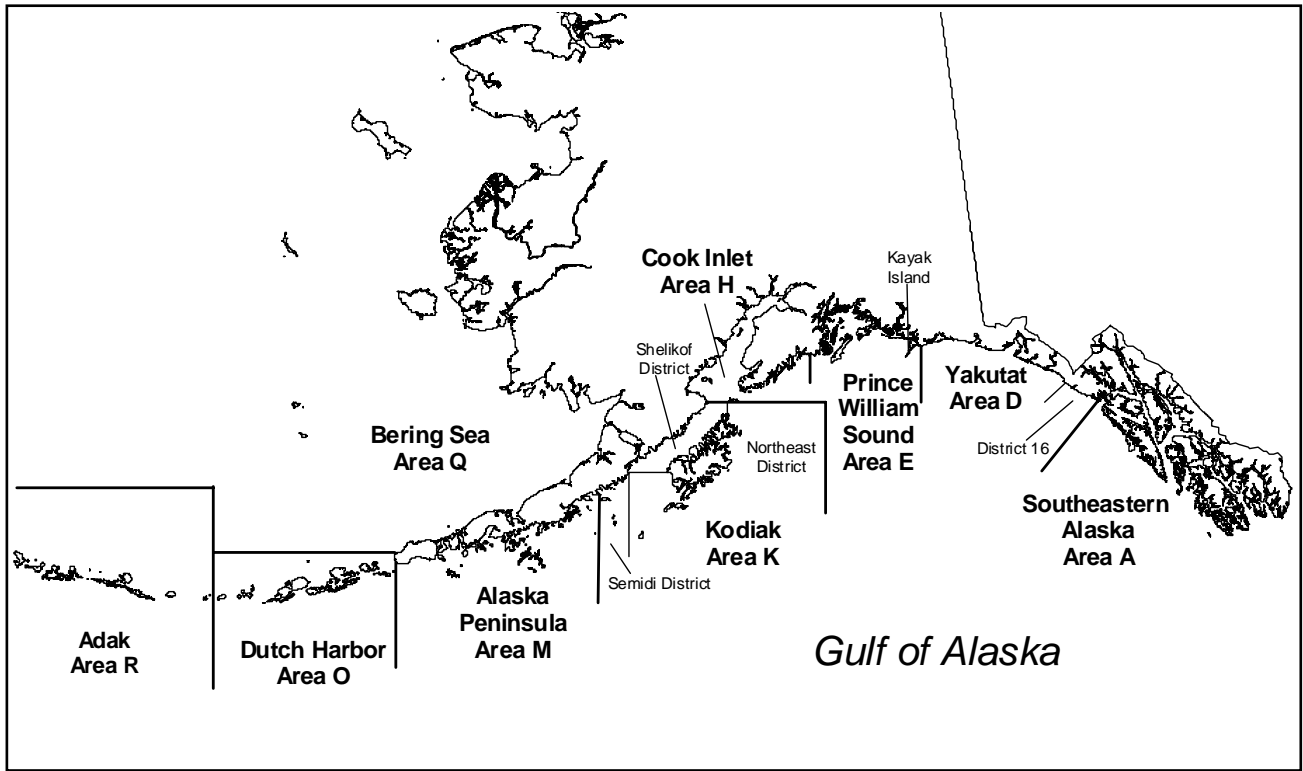


Figure 1 Alaska weathervane scallop fishing registration areas.

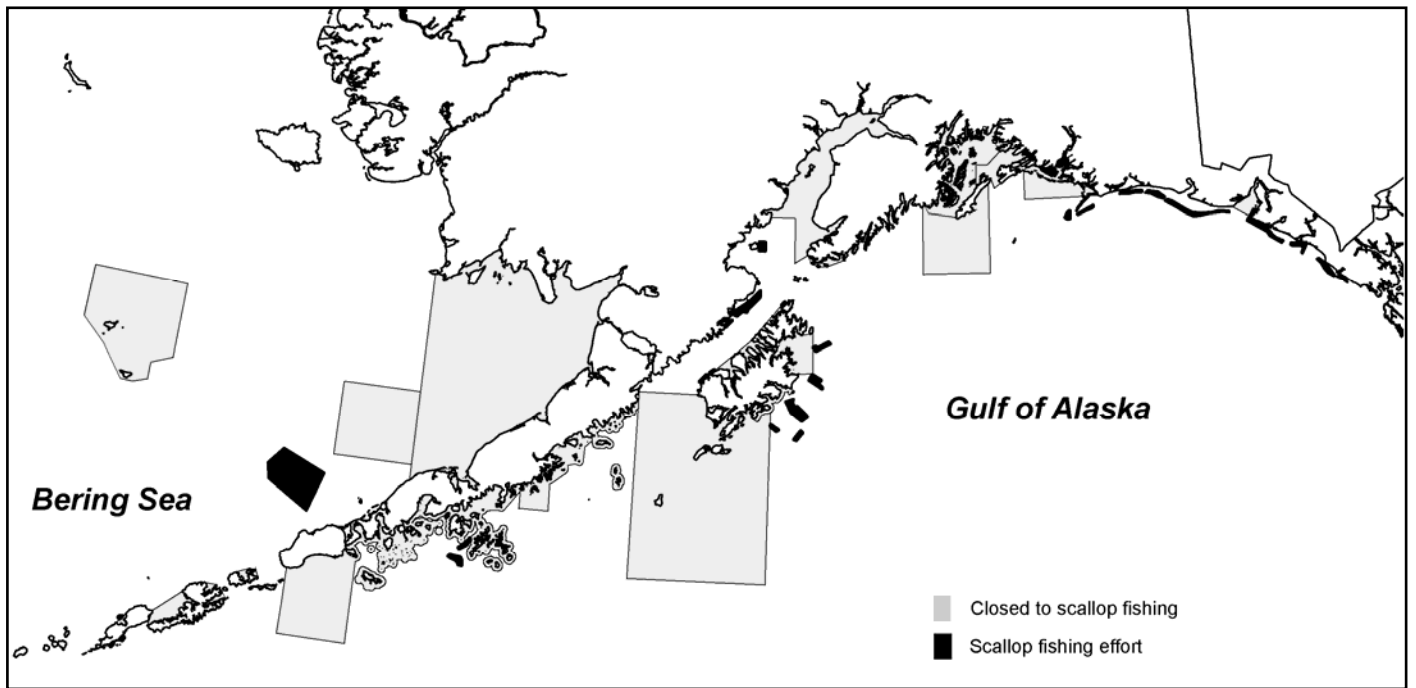


Figure 2 Scallop fishing locations (dark polygons) outside Cook Inlet during the 2033/04 season.

## 1.2 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 may have been acceptable for a sporadic, 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 an 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.

### **1.3 Weathervane Scallop Biology**

Addition of information to this section will be undertaken by new SPT member and ADF&G scallop observer program coordinator Ryan Burt. Mr. Burt will review published information on weathervane scallop biology, summarize relevant information, provide references, and identify information gaps.

Alaska weathervane scallops spawn between May and early July. Spermatozoa and eggs are released directly into the water where fertilization occurs. Fertilized eggs settle to the bottom and hatch into larvae within several days; they then rise in the water column and drift with prevailing currents for about a month while undergoing metamorphosis. Scallops then settle to the bottom as juveniles and may attach to the substrate with byssal threads. A combination of large-scale (overall spawning population size and oceanographic conditions) and small-scale (site suitability for settlement) processes influence recruitment of scallops.

### **1.4 Economic Overview of the Scallop Fishery**

An overview of Alaska weathervane scallop harvest and wholesale revenue is presented in Table 1. Some of this data is excerpted from Kruse et al. (2005) and updated with information from annual scallop harvest information contained in Chapter 3. Vessel participation in this fishery has declined in recent years due to the Federal LLP program and formation of a voluntary marketing cooperative. The Federal LLP limits the participation to 9 permit holders. Since 2000, no more than 8 vessels have participated and in recent years 4 vessels have participated.

Table 1 provides 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 2007 values so that comparisons can be made 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 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.

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. In the past, some Cook Inlet scallops have been sold fresh. The statewide scallop price calculated by the Alaska Department of Revenue (ADOR), Division of Taxation, is an average of all the reported fish tax revenue collected from the scallop fishery. Thus, the average price is likely less than the prices received for fresh product and more than those received for frozen product. In the past (1993-2004) a spot price was used that was estimated from fish ticket data and informal surveys of the fleet (Barnhardt 2006). However, that price estimation process has not occurred since the 2004/05 scallop season. Thus, the statewide average price calculated by ADOR (ADOR, 2009) is used in table 1 for the 2005/06 through 2007/08 seasons. Of note it that the ADOR prices are considerably higher



than the survey prices that were used previously but declined significantly in the 2007/08 season when there was no Cook Inlet harvest.

Adjusted price has fluctuated during the past; trending from a low of \$6.95 in 1993/94 up to \$8.13 in 1997/98, down to \$5.88 in 2003/04, up to \$8.10 by 2006/07, and then falling to \$5.94. 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 \$9.6 million was earned. Since that time, real total first wholesale revenue in the fishery has fluctuated a bit as prices have changed, but overall it has trended downward as landings have fallen from more than 1.2 million pounds down to a low in 2007/08 of 458,313 pounds. The total real first wholesale revenue of a little more than \$2.7 million in the 2007/08 season was the lowest revenue total since 1993.

**Table 1 Statewide Commercial Weathervane Scallop Real Wholesale Value, 1993/94–2007/08**

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	1.35	\$6.95	\$6,845,313
1994/95	15	1,240,775	\$5.79	1.33	\$7.70	\$9,554,836
1995/96	10	410,743 <sup>b</sup>	\$6.05	1.3	\$7.87	\$3,230,494
1996/97	9	732,424	\$6.30	1.28	\$8.06	\$5,906,267
1997/98	9	818,913	\$6.50	1.25	\$8.13	\$6,653,668
1998/99	8	822,096	\$6.40	1.24	\$7.94	\$6,524,154
1999/00	10	837,971	\$6.25	1.22	\$7.63	\$6,389,529
2000/01	8	750,617	\$5.50	1.2	\$6.60	\$4,954,072
2001/02	6	572,838	\$5.25	1.17	\$6.14	\$3,518,657
2002/03	6	509,455	\$5.25	1.15	\$6.04	\$3,075,835
2003/04	4	492,000	\$5.25	1.12	\$5.88	\$2,892,960
2004/05	5	425,477	\$5.50	1.09	\$6.00	\$2,550,735
2005/06	5	525,357	\$7.58	1.06	\$8.03	\$4,221,138
2006/07	4	487,473	\$7.86	1.03	\$8.10	\$3,946,484
2007/08	4	458,313	\$5.94	1	\$5.94	\$2,722,379

a Pounds of shucked scallop meats.

b Includes illegal harvest.

## 2 Overview of Scallop Fishery and Management

The scallop fishery is managed jointly by NMFS and ADF&G under the Federal Fishery Management Plan (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 (GHRs), guideline harvest levels (GHLs), the onboard observer program, crab bycatch limits (CBLs), and the LLP.

### 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 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 (OY) 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 (4.3) 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. GHLs for Yakutat Area D and District 16 are set prior to each fishing season after examination of recent observer program data. The fishery is managed by Joe Stratman from the Petersburg office.

***Central Region.*** ADF&G conducts biennial dredge surveys in the Kamishak District of the Cook Inlet Registration Area and near Kayak Island in the Prince William Sound Registration Area. Data from these surveys are used to set GHLs. In the Kamishak District fishery, observers are not required, but vessels are limited to a single 6 ft dredge, and ADF&G staff are 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 Bob Berceli in Cordova.

**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 9.1kg (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 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. 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 catchability of 0.83, which is based upon the relative catchability from a small amount of dredge/video comparison work conducted there in 2004. No similar comparison has been conducted at Kamishak. 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.

## 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 GHLS. Scallop observer data are released to the public in reports prepared by ADF&G (e.g., Barnhart and Rosenkranz 2003).

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 manuals (e.g., Barnhart 2003) are prepared by ADF&G staff.

Observer cost for vessels limited to a single 6-ft dredge in federal waters was addressed in Amendment 10, section 6.8 of the Scallop FMP. The Council determined that given existing observer requirements and their associated costs, the single 6-ft dredge restriction created a disproportionate economic hardship when fishing in federal waters (NPFMC 2004). Amendment 10 allows two vessels to fish with two 10-ft dredges to capture a larger share of the total catch, thus allowing them to offset observer costs and perhaps enhance their economic viability.

## 2.5 Crab Bycatch Limits

Bycatch of crabs in the scallop fishery is controlled through the use of Crab Bycatch Limits (CBLs) that are based on condition of individual crab stocks. CBLs were first instituted by the state in July 1993. Methods used to determine CBLs in 1993 and 1994 were approved by the BOF and the NPFMC and, with few exceptions, remain unchanged. Annual CBLs are established preseason by ADF&G for areas with current crab resource abundance information (surveys). For areas without crab abundance estimates, CBLs may be set as a fixed number of crabs that is not adjusted seasonally.

In the Kodiak, Alaska Peninsula, and Dutch Harbor Registration Areas, the CBLs are set at 0.5% or 1.0% of the total crab stock abundance estimate based on the most recent survey data (Table 2). 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* sp. 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 crab and 260,000 Tanner crab. 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 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 3. Bycatch of snow, king, and Tanner crabs during the Bering Sea scallop fishery tends to be much lower than for other Bering Sea fisheries. Scallop fishery closures due to attainment of CBLs have decreased over the years, in part due to decreased crab abundance (Barnhart and Rosenkranz 2003) as well as a voluntary industry cooperative which provides the fleet additional flexibility to move off of high bycatch areas. ADF&G closely monitors bycatch rates during scallop seasons and has used a rate of one crab per pound of scallop meats as a benchmark since 1993. Bycatch may affect harvest and CPUE in the Bering Sea scallop fishery as vessel operators move or cease fishing when bycatch rates meet or exceed this benchmark.

**Table 3 Bycatch of crabs (number crabs) by species in scallop fishery, 1995–2007.**

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

## 2.6 Scallop License Limitation Program

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

The Federal Scallop License Limitation Program (LLP) became effective in 2001. The NPFMC created the scallop LLP under Amendment 4 to the FMP to limit the number of participants and reduce fishing capacity. The LLP license is required on board any vessel deployed in the weathervane scallop fishery in federal waters off Alaska. NMFS granted 7 vessel owners licenses to fish statewide outside Cook Inlet. Originally, NMFS granted two vessel owners licenses to fish statewide utilizing a single 6-foot dredge. In August, 2005, NMFS implemented Amendment 10 to the FMP, which modified the gear restriction to allow these two licenses to be used on vessels with up to two 10-foot dredges statewide. All 9 licenses allow vessel owners to fish inside Cook Inlet with a single 6-foot dredge. Vessel length is limited to that of the qualifying period.

All vessels fishing inside the Cook Inlet Registration Area are limited by state regulation to a single dredge not more than 6 feet in width. Unless otherwise restricted by the LLP, vessels fishing in the remainder of the state may simultaneously operate a maximum of 2 dredges that are 15 feet or less in width.

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



2008. Therefore, the vessel permit system for scallops and hair crab will sunset on December 30, 2013. Eight vessel owners received permits to fish for weathervane scallops in state waters.

Two vessels with multiple LLP permits as well as state vessel-based limited entry permits have harvested most of the scallop catch outside Cook Inlet over the past several seasons. Three vessels 80 feet or less LOA typically participate in the Cook Inlet Registration Area fishery. Occasionally, one or more of these vessels participate in the scallop fishery outside of Cook Inlet.

More information on the scallop LLP can be found on the NMFS Alaska Region web page at <http://www.fakr.noaa.gov/ram/smp.htm>.

## 2.7 Voluntary Scallop Cooperative

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

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

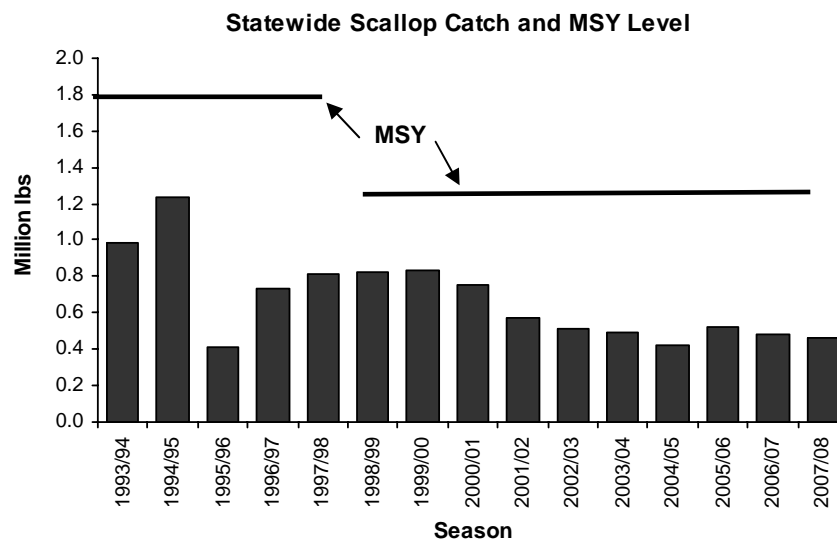
More information on the voluntary scallop cooperative can be found in the EA/RIR/IRFA for Amendment 10 to the Scallop FMP available on the Council website at: [www.fakr.noaa.gov/npfmc/analyses/analyses.htm](http://www.fakr.noaa.gov/npfmc/analyses/analyses.htm)

## 2.8 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 3 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 between 39% to 66% of MSY (Table 4, Figure 3). Control rules for other Alaskan scallop species have not been developed as no commercial harvests occurs. Catch by individual registration area is shown in Figure 4.

**Table 4 Alaska weathervane scallop harvest and Maximum Sustainable Yield from FMP, 1993/94–2007/08 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



**Figure 3 Statewide scallop harvest (pounds shucked scallop meats) and MSY levels from the FMP.**

### 1998/99 - 2007/08 Alaska Scallop Catch by Registration Area

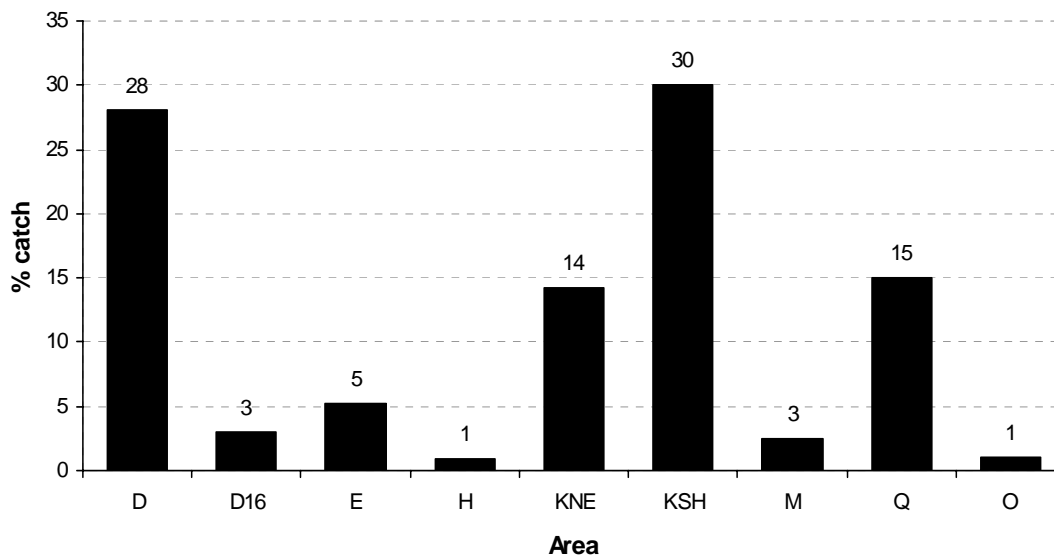


Figure 4 Catch by registration area 1998-2008

## 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 Area

Alaska state regulations limit the combined Yakutat Area D and District 16 scallop harvest to 250,000 lbs of scallop meats per season. Prior to the 2007/08 season, GHs were set at 0–150,000 lbs for Area D and 0–21,000 lbs for District 16 (Table 5, Table 6) .

Two co-op vessels participated in the 2007/08 fishery and harvested 125,960 lbs of scallop meats from Yakutat Area D and 180 lbs of scallop meats from Yakutat District 16. Fishery data from recent seasons are presented in Table 5 and Table 6 and Figure 5 through Figure 8.

For Yakutat Area D, 2007/08 CPUE was 48 lbs meat/dredge hr, close to the 2000/01–2006/07 average of 46 lbs meat/dredge hr (Table 5). SH histograms (Figure 6) indicate that a significant numbers of scallops in the 90–110 mm SH range were discarded during the fishery. ADF&G modeling work on scallop shell age data shows that growth of scallops in the eastern Gulf of Alaska is considerably slower than for Kodiak scallops with an estimated asymptotic size of 136 mm SH compared to 166 mm SH for scallops from the Kodiak area.

Effort in Yakutat District 16 during the 2007/08 season was minimal with a total of 8 tows and catch of 180 lbs of scallop meats (Table 6, Figure 7). No 2007/08 SH histogram was constructed due to small sample sizes, but data from recent years are shown in Figure 8.

When considering GHLs for the Yakutat scallop fishery, data included fishery, observer and survey information. The GHRs for Scallop harvest are 0 – 35,000 pounds in District 16 and 0 – 250,000 pounds in the Yakutat area. 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 1993). 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 the Yakutat area during the 2000/01 season led to a reduction of the GHL to 200,000 pounds for the Yakutat area beginning in the 2001/02 season. 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 upper end of the GHR was reduced as a precautionary measure.

The 2005/06 season is the first of the last 5 seasons that the 200,000-lb GHL had been reached, necessitating early season closure by emergency order of the Yakutat area to scallops. According to staff, this may have been due to improved market conditions that season. For 2001/02 – 2004/05 seasons, the harvest ranged from 87,000 – 161,000 averaging 119,000 pounds. During this period, the District 16 GHL had remained at the upper end of the 0 - 35,000 pound GHR. Harvest in this area had not reached its GHL even for the 2005/06 season. It had ranged from 1,000 – 22,000, averaging 12,000 pounds for the 2001/02 – 2004/05 season period. Data for the 2005/06 season, the department 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 notwithstanding poor recruitment.

Thus, a GHL reduction for the 2006/07 season was necessary for continued sustained harvest of this fishery.

**Table 5 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 meat per dredge hr)
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

<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.

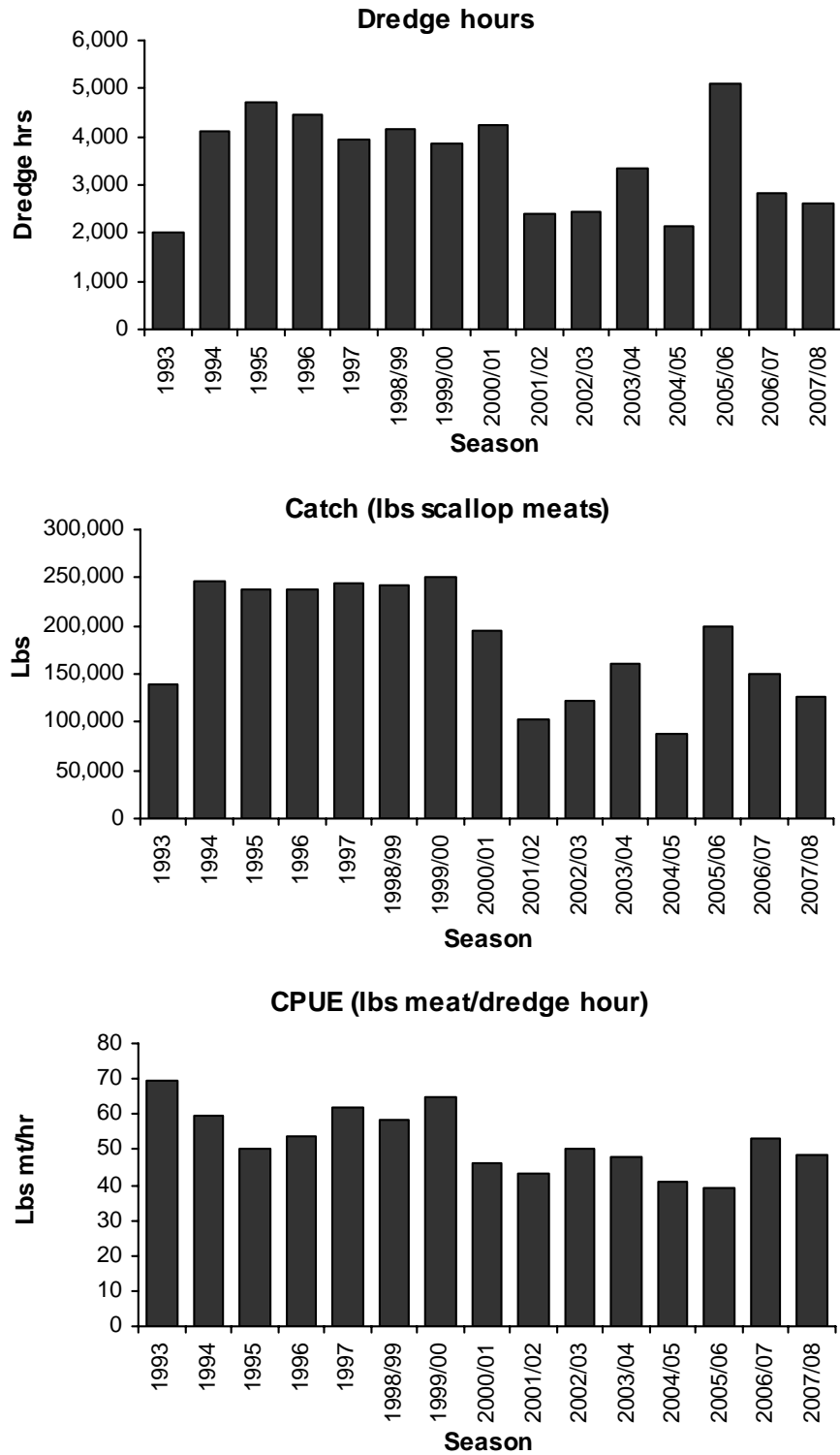
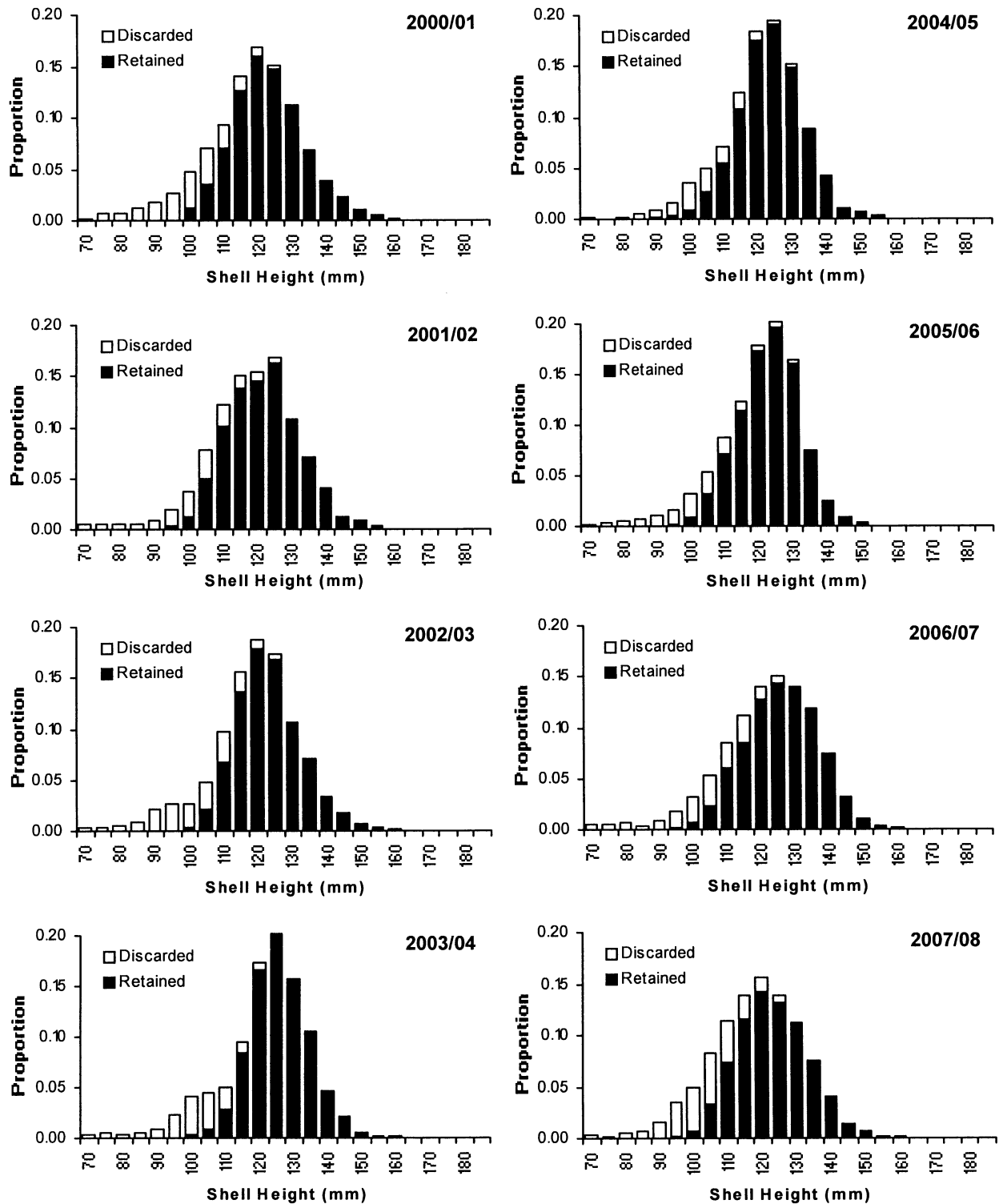


Figure 5 Barplots of Yakutat Area D scallop fishery statistics.



**Figure 6 Shell height histograms from resampling Yakutat Area D observer data, 1998/99–2006/07 seasons.**

**Table 6 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)
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

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

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



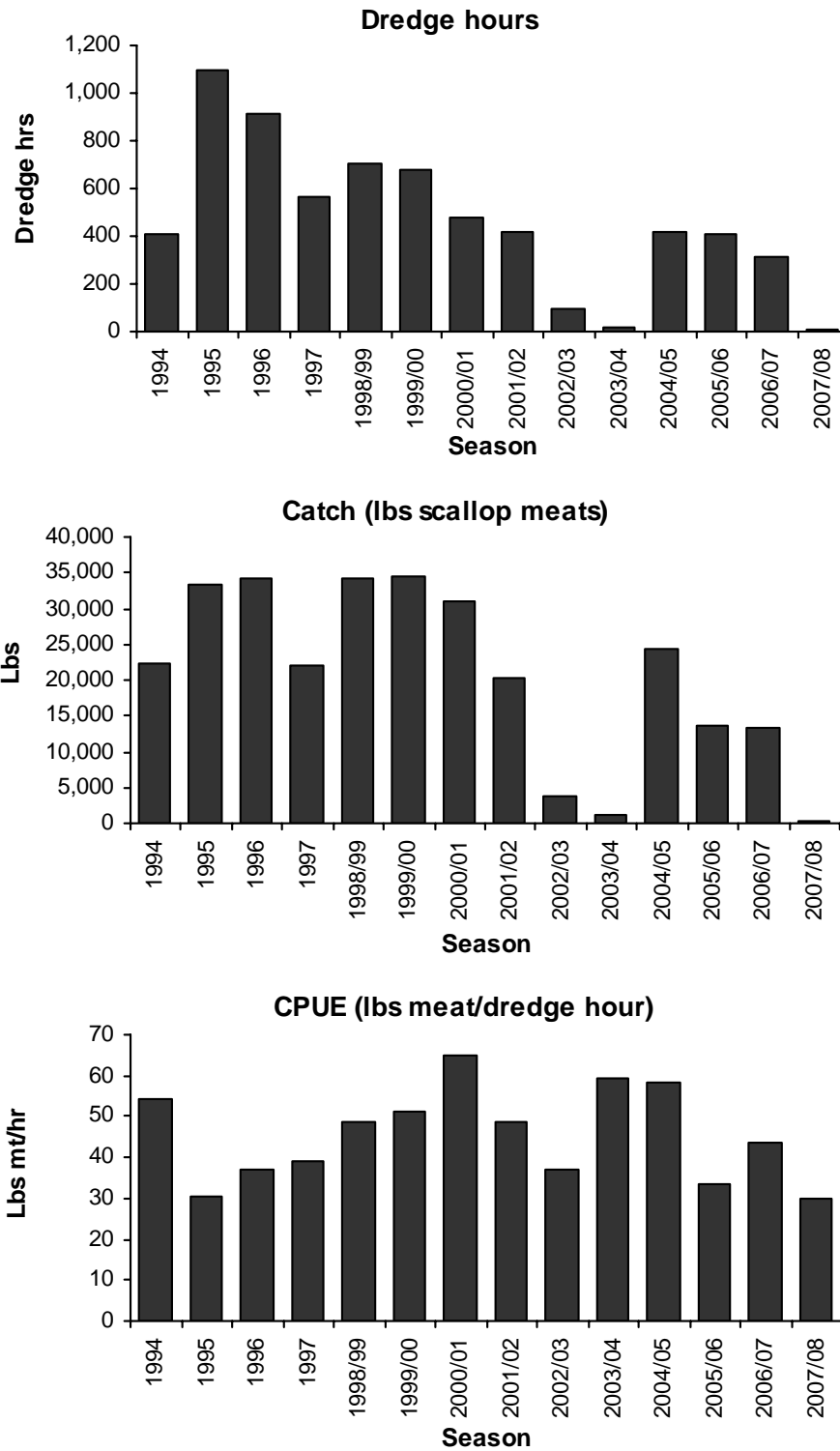
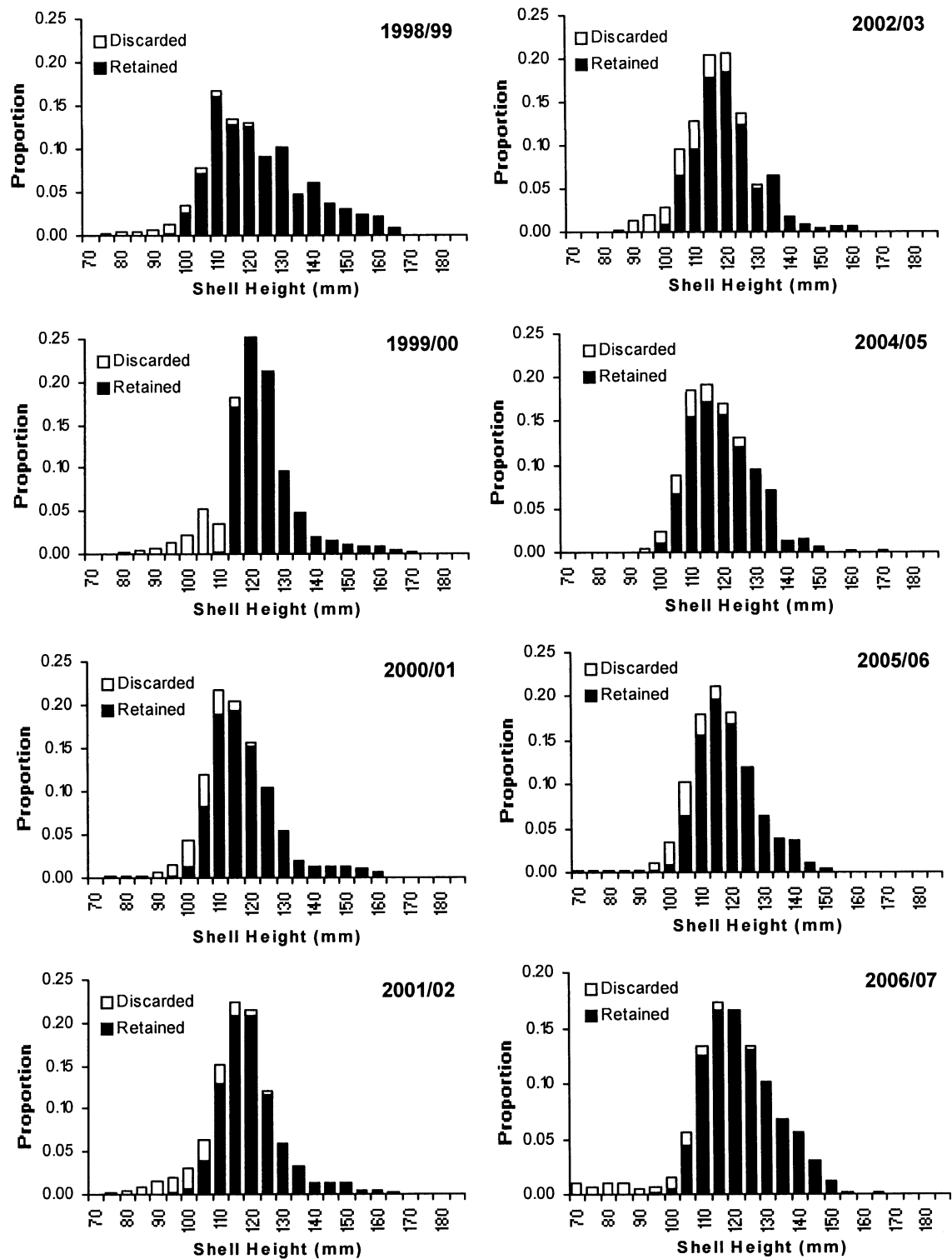


Figure 7 Barplots of Yakutat District 16 scallop fishery statistics.



**Figure 8** Shell height histograms from resampling Yakutat District 16 observer data. Insufficient data were collected to produce plots for the 2003/04 and 2007/08 seasons.

### 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 1 and Table 7). In 2008, the survey was set to a standardized area. A total of 47 successful 1nm dredge tows were made during the 2008 Kayak Island survey (37 in the East bed and 10 in the West bed). The slightly fewer number of tows in this year was due to inclement weather conditions. Catch in the east bed was 4,356 weathervane scallops weighing 1,340 kg (2,954 lb). Catch abundance ranged from 0 to 654 scallops/nm resulting in a mean among all stations of 117.7 scallops/nm. Standardized catches by weight ranged from 0 to 199.7 kg/nm (440.3 lb/nm) with a mean catch among all stations fished of 36.2 kg/nm (79.8 lb/nm). Catch in the west bed was 1,058 weathervane scallops weighing 196 kg (432 lb). Catch abundance ranged from three to 374 scallops/nm resulting in a mean among all stations of 105.8 scallops/nm. Standardized catches by weight ranged from 0.01kg (0.02 lb/nm) to 71.5 kg/nm (157.6 lb/nm) with a mean catch among all stations fished of 19.6 kg/nm (43.2 lb/nm). Abundance and biomass estimates from all Kayak Island surveys are given in Table 9. Preliminary efforts using underwater video techniques to evaluate survey dredge catchability in 2004 provided a mean catchability coefficient (q) of 0.83, which has been applied since 2006 (Table 7). The goal is to further assess dredge catchability and better estimate q, thereby increasing accuracy of survey estimates and resulting in more appropriate harvest limits by using a q-value less than one.

Two catcher processors participated in the 2006/07 Area E fishery and harvested approximately 37,000 lbs of scallop meats (Table 8). Fishery data from recent seasons are presented in Table 8, Figure 9 and Figure 10.

Two vessels participated in the 2007/08 Area E fishery and harvested approximately 37,000 lbs of scallop meats (Table 8). Area E CPUE was 90 lbs meat dredge hr for the 2007/08 season (Table 8, Figure 9).

Plots of Prince William Sound SH distributions from the commercial fishery (Figure 10) show the range of shell heights caught in the fishery has been very consistent over the years.

**Table 7. Standardized Kayak Island dredge survey summary.** Standardized areas are 78.99 nm<sup>2</sup> for the East bed and 48.66 nm<sup>2</sup> for the West bed. Table provides biomass estimates using catchability coefficients (q) of 1 and 0.83 (which stems from preliminary work on dredge catchability)

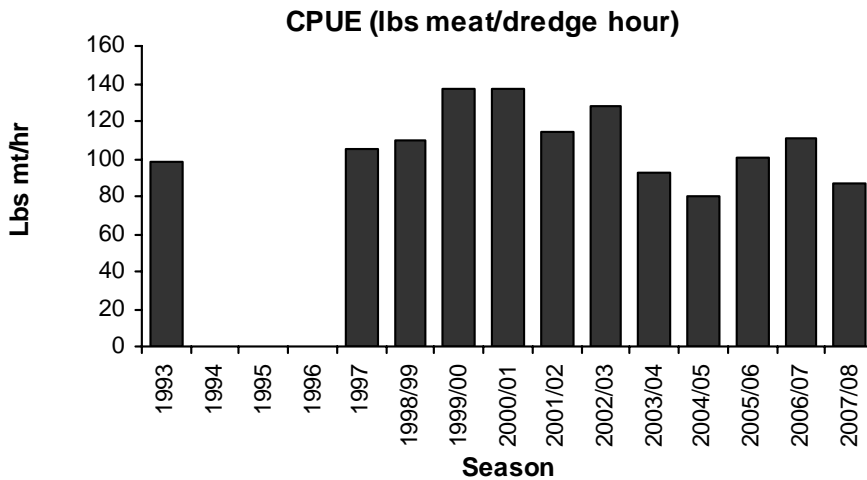
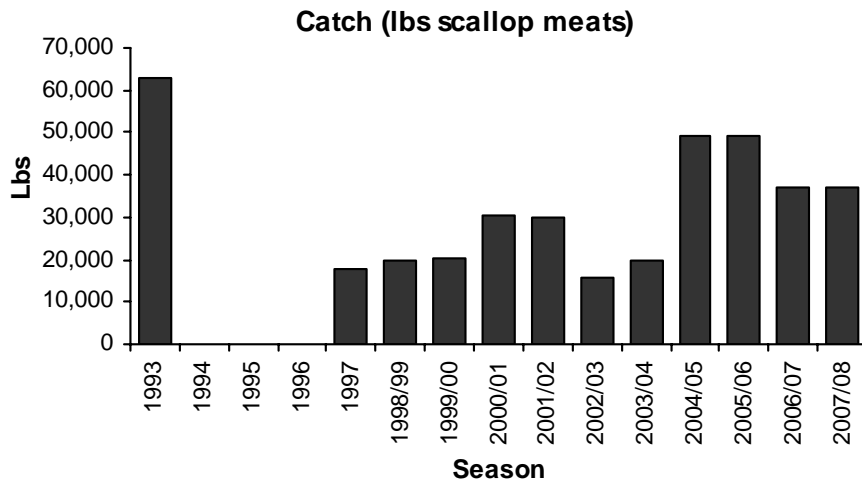
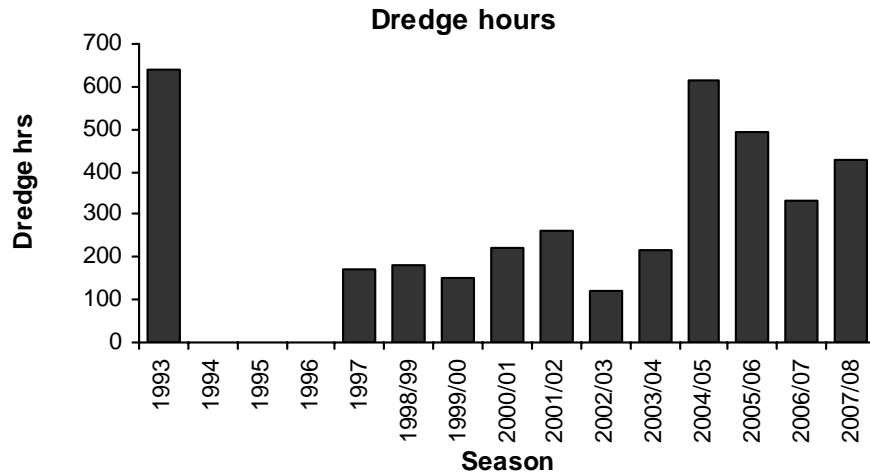
Survey Year	Number stations sampled	Mean catch kg/nm	Estimated abundance	95% CI	CV	Scallop density (scal/m <sup>2</sup> )	Average weight (g/scal)	Estimated biomass	Estimated biomass
								q = 1.0 (kg meat)	q = 0.83 (kg meat)
<b>East Bed</b>									
1996	38	29.3	7,665,330 ±	5,055,277	0.34	0.028	230	139,401	
1998	28	21.1	5,496,099 ±	1,807,737	0.16	0.020	230	96,411	
2000	33	37.6	9,513,606 ±	2,435,296	0.13	0.035	237	165,743	
2002	20	10.5	2,579,532 ±	1,163,924	0.22	0.010	245	45,304	
2004	31	77.3	17,905,822 ±	11,691,177	0.33	0.066	259	304,720	
2006	32	58.0	9,771,298 ±	5,395,445	0.28	0.036	277	194,880	228,009
2008	37	36.2	7,063,665 ±	2,860,387	0.21	0.026	308	132,311	154,804
<b>West Bed</b>									
1998	21	34.2	5,156,119 ±	2,309,193	0.21	0.031	245	96,403	
2000	20	94.0	17,777,746 ±	10,269,460	0.28	0.107	196	255,312	
2002	17	39.3	6,027,791 ±	3,104,626	0.24	0.036	241	104,133	
2004	25	84.9	14,278,296 ±	7,276,183	0.25	0.086	220	205,950	
2006	20	61.4	10,106,636 ±	6,068,318	0.29	0.061	225	163,803	191,650
2008	10	19.6	3,910,300 ±	3,129,662	0.35	0.023	185	44,071	51,563

**Table 8 Prince William Sound Area E scallop fishery summary statistics.**

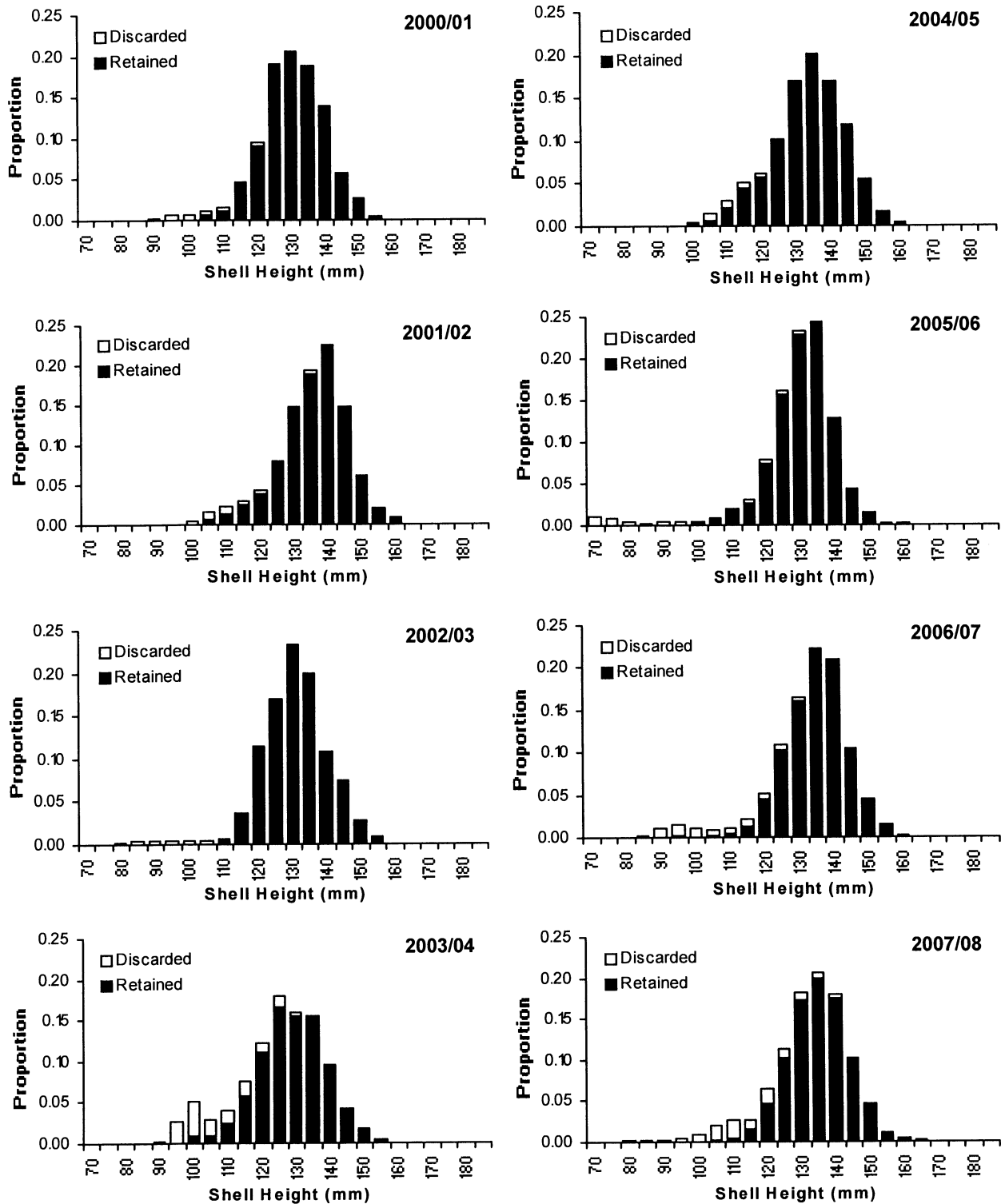
Season	Number vessels	GHL (lbs meat)	Dredge hours <sup>a</sup>	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)
1993	7	50,000	638	63,068	99
1994		Closed			
1995	3	50,000		108,000 <sup>b</sup>	
1996		Closed			
1997	1	17,200	171	18,000	105
1998/99	2	20,000	179	19,650	110
1999/00	2	20,000	149	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

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

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



**Figure 9** Barplots of Area E scallop fishery statistics.



**Figure 10 Shell height histograms from resampling Area E observer data, 2000/01–2006/07. Insufficient data were available to produce plots for earlier seasons.**

### 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 1 and Table 2). 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).

A total of 74 successful 1nm dredge tows were conducted during the 2007 Kamishak Bay weathervane scallop survey (43 in the north bed and 31 in the south bed). Catch in the north bed was 3,175 weathervane scallops weighing 1,122 kg (2,474 lb). Catch abundance ranged from 0 to 305 scallops/nm resulting in a mean among all stations of 73.8 scallops/nm. Standardized catches by weight ranged from 0 to 84.8 kg/nm (187.1lb/nm) with a mean catch among all stations fished of 26.1 kg/nm (57.5lb/nm). Catch in the south bed was 3,580 weathervane scallops weighing 728 kg (1,606 lb). Catch abundance ranged from 0 to 453 scallops/nm resulting in a mean among all stations of 115.5 scallops/nm. Standardized catches by weight ranged from 0 to 108.0 kg/nm (238.1 lb/nm) with a mean catch among all stations fished of 23.5 kg/nm (51.8 lb/nm). Abundance and biomass estimates from all Kamishak Bay surveys are given in Table 11.

The guideline harvest regulation specified by state regulation for the Kamishak District is 10,000 to 20,000 pounds of shucked meats.

During the 2004/05 season, 3 vessels participated in the fishery harvesting 6,117 lbs of scallop meats (Table 10). Participation and CPUE in this small fishery vary widely (Table 10, Figure 11) and no vessels have fished these scallop beds in the past two years.

**Table 9 Standardized Kamishak Bay dredge survey summary.** Standardized areas are 90.2 nm<sup>2</sup> for the North bed and 68.0 nm<sup>2</sup> for the South bed.

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 q = 1.0 (kg meat)	
<b>North Bed</b>									
1996	26	62.9	16,298,521 ±	6,190,250	18.4%	0.053	264	367,980	
1999	41	68.7	12,382,976 ±	4,200,007	17.3%	0.040	380	308,168	
2001	37	63.1	9,999,335 ±	3,446,756	17.6%	0.032	432	275,120	
2003	31	26.2	4,117,007 ±	1,129,507	14.0%	0.013	435	121,603	
2005	38	22.6	3,555,537 ±	1,089,195	14.8%	0.011	439	107,057	
2007	43	26.1	5,059,604 ±	1,394,499	13.3%	0.016	353	142,144	
<b>South Bed</b>									
2003	31	74.4	8,269,024 ±	3,078,303	17.9%	0.035	335	260,870	
2005	29	16.2	3,935,269 ±	1,518,843	17.7%	0.017	476	57,922	
2007	31	23.5	5,966,159 ±	2,428,242	18.7%	0.026	203	97,958	

**Table 10 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)
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	

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



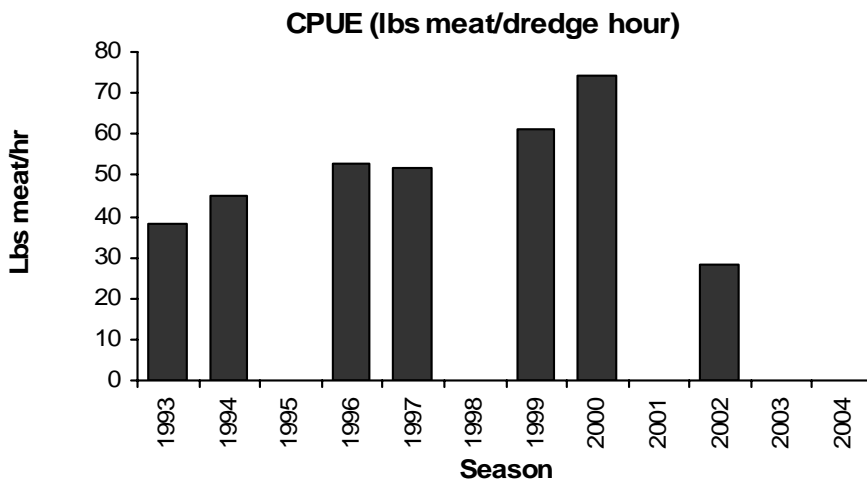
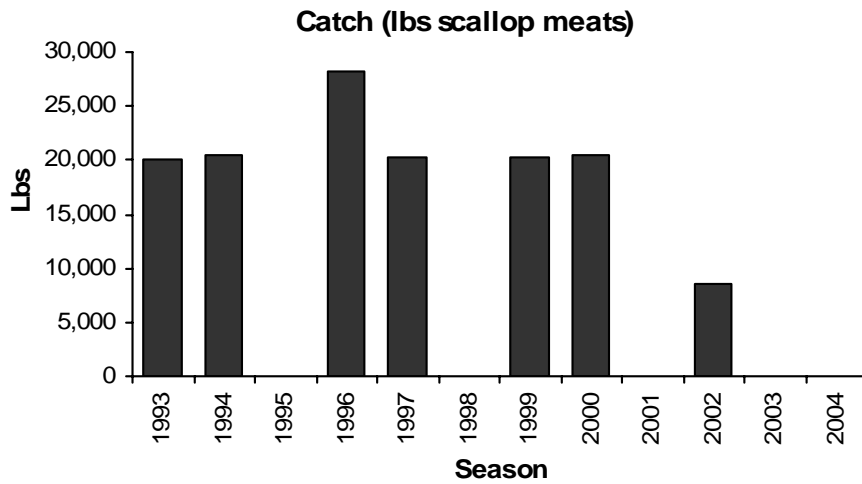
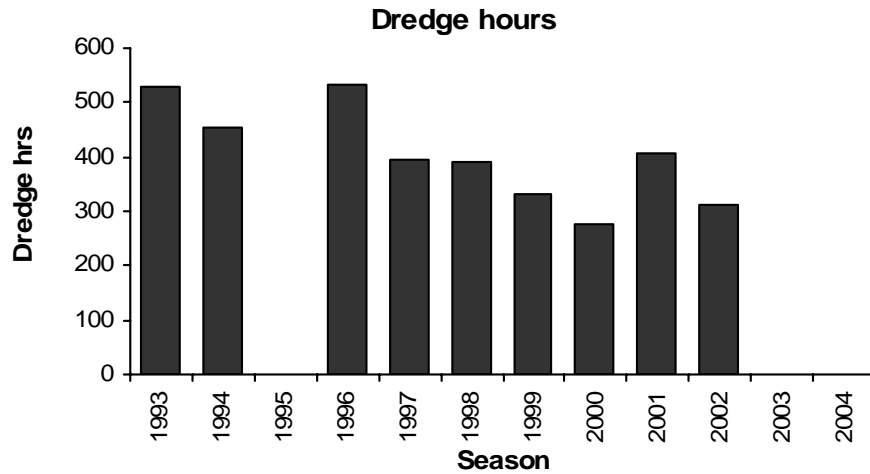


Figure 11 Barplots of Area H scallop fishery statistics.

### 3.4 Kodiak Registration Area, Northeast District

The Kodiak Northeast District GHL was set at 80,000 lbs for the 2000/01 through 2005/06 seasons. During this time period, CPUE ranged from 46 to 73 lbs meat/dredge hr (Table 11, Figure 12) and observer program SH data showed that catches contained a wide range of scallop sizes (Figure 13). To provide an opportunity for exploratory fishing in the northern portion of the district, the GHL was increased to 90,000 lbs for the 2006/07 and 2007/08 seasons through addition of 15,000 lbs that could be harvested only from an area 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.

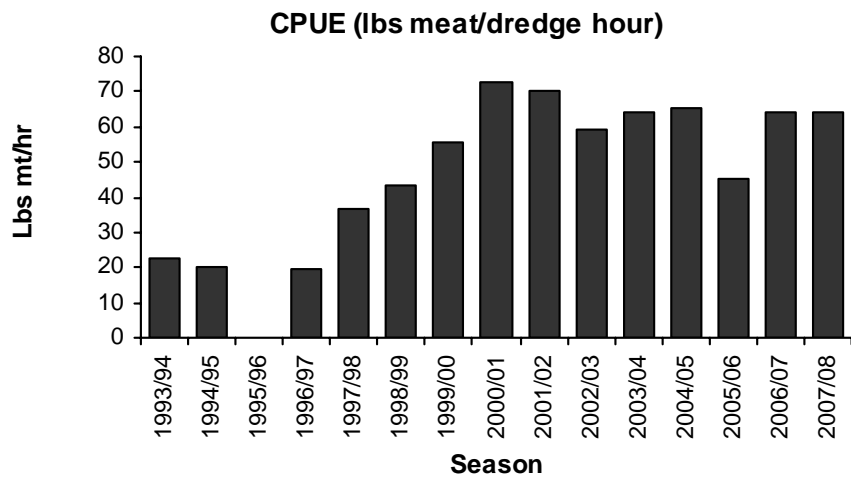
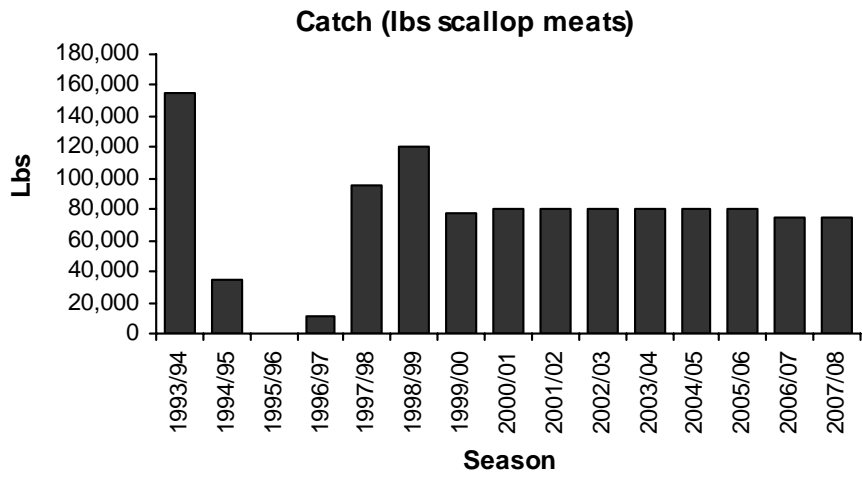
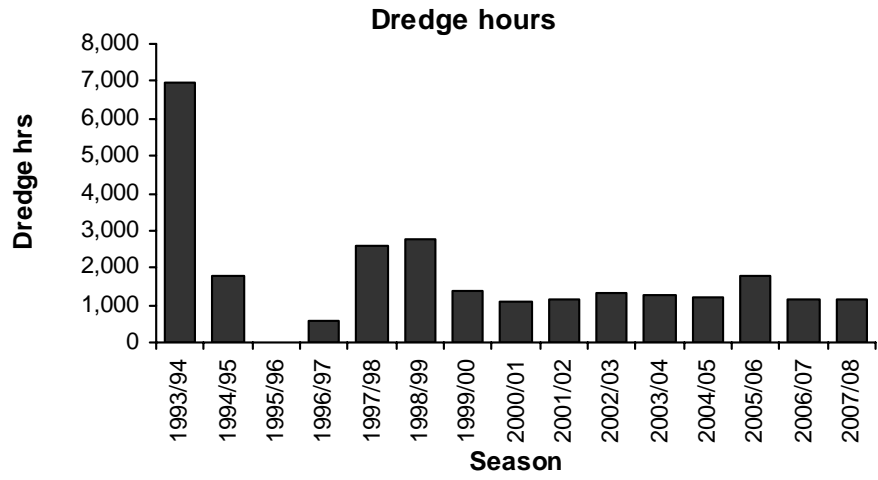
Two cooperative vessels harvested about 75,000 lbs of scallop meats from the Northeast District during the 2007/08 season. Summary statistics from recent fishery data are presented in Table 11, Figure 12 and Figure 13. Due to fuel costs and other considerations, the exploratory area saw little effort, with less than 100 lbs scallop meats harvested from 25 dredge hours during the 2007/08 season.

Northeast District catches and CPUE have remained stable since the 2000/01 fishing season (Table 11, Figure 12). Large portions of the Northeast District that contain scallops are closed to scallop dredging (Figure 2). These closures were recommended by ADF&G and adopted by the Alaska BOF over 30 years ago due to concerns about red king crab bycatch and gear conflicts.

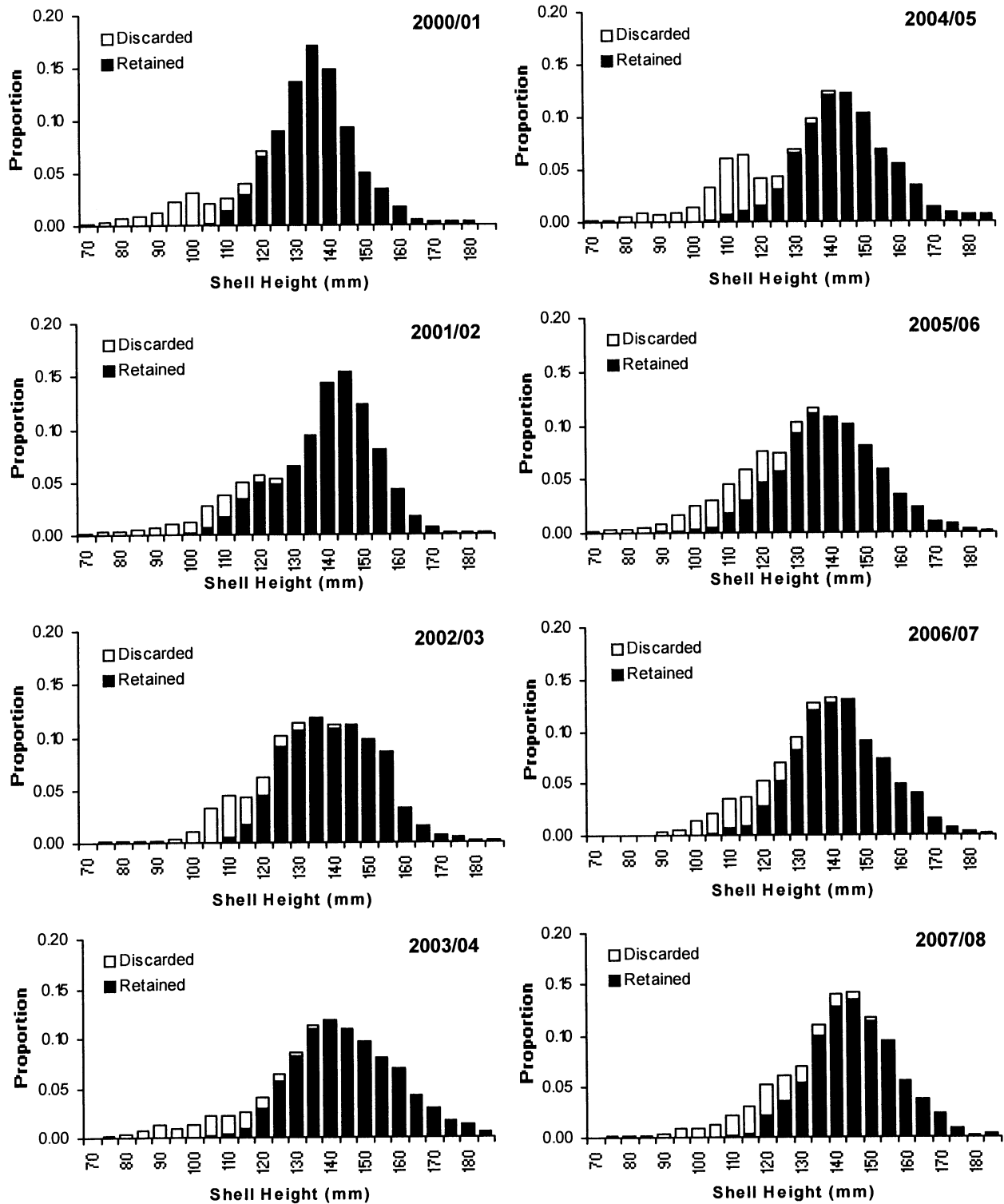
**Table 11 Kodiak Northeast District scallop fishery summary statistics.**

Season	Number vessels	GHL (lbs meat)	Dredge hours	Catch <sup>a</sup> (lbs meat)	CPUE (lbs meat per dredge hr)
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

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



**Figure 12 Barplots of Kodiak Northeast District scallop fishery statistics.**



**Figure 13 Shell height histograms from resampling Kodiak Northeast District scallop observer data, 1999/2000–2006/07.**

### **3.5 Kodiak Registration Area, Shelikof District**

A GHLL of 180,000 pounds of shucked scallop meat was established in the Shelikof District prior to the 1999/2000 season. The GHLL was reduced to 160,000 lbs meat for the 2005/06 and 2006/07 seasons due to concerns about the concentration of effort in the northern part of the main bed. This led to a split GHLL with 130,000 lbs allocated to the northern portion of the district and 30,000 lbs allocated to the southern portion. Prior to the 2007/08 season, the GHLL was set at 130,000 lbs for the northern portion of the district and increased to 40,000 lbs for the southern portion based on an increase in CPUE from 38 lbs meat/dredge hr during the 2004/05 season to 66 lbs meat/dredge hr during the 2006/07 season.

Two cooperative vessels and a smaller vessel that deployed a single 10 ft dredge participated in the 2007/08 fishery and harvested about 170,000 lbs. Summary statistics from recent fishery data are presented in Table 12 and Figure 14 and Figure 15.

Shelikof District CPUE decreased to 58 lbs meat/dredge hr for the 2007/08 season (Table 12, Figure 14). ADF&G attributes this decline at least 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 >50 lbs meat/dredge hr in each season since 2003/04. Significant numbers of scallops <120 mm SH were discarded during the 2007/08 season (Figure 15).

To protect depressed red king crab and Tanner crab populations, the BOF closed Kodiak's westside bays to scallop fishing in 1990; weathervane scallops are known to inhabit these closed waters (Figure 2).

**Table 12 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)
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

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

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

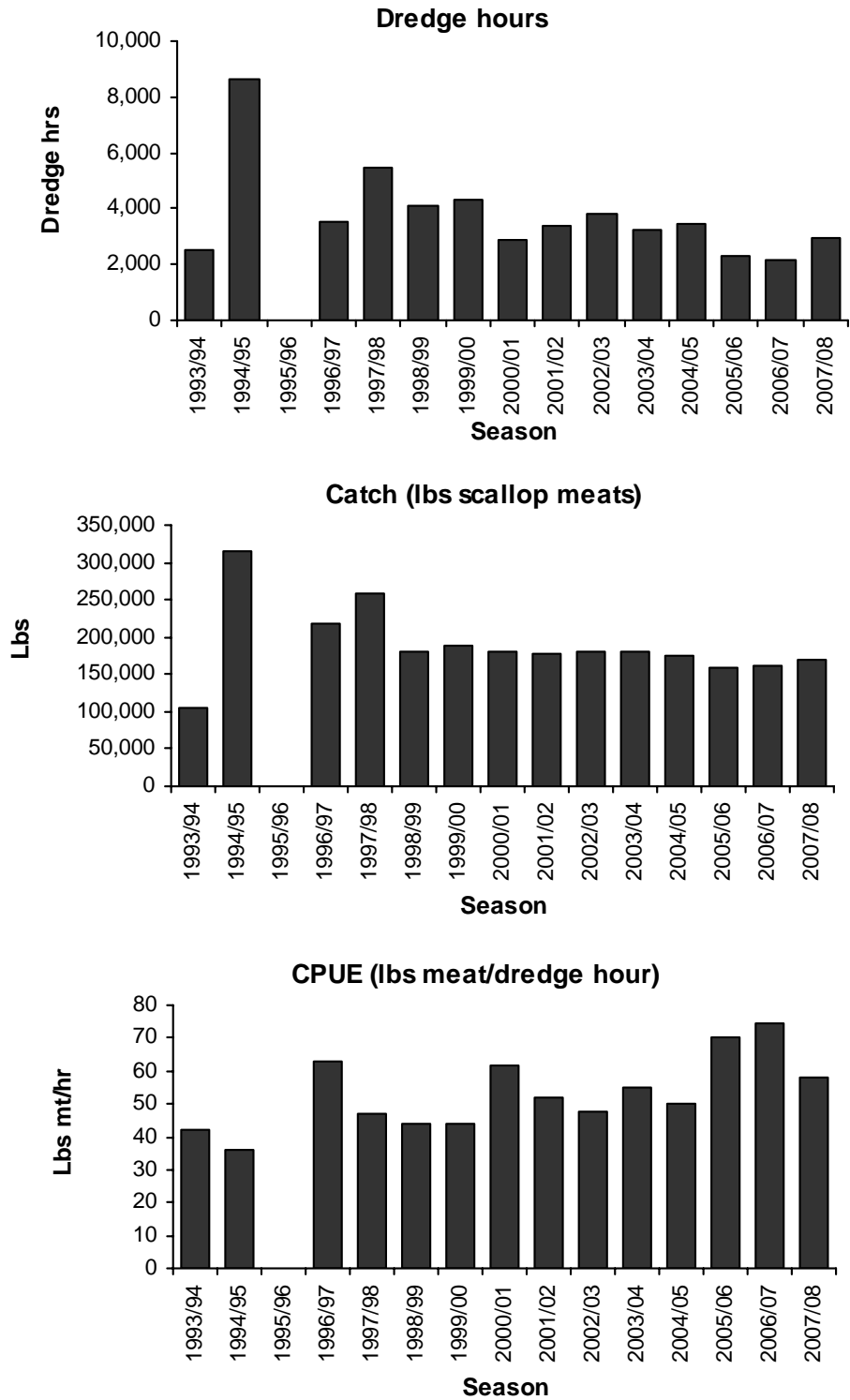
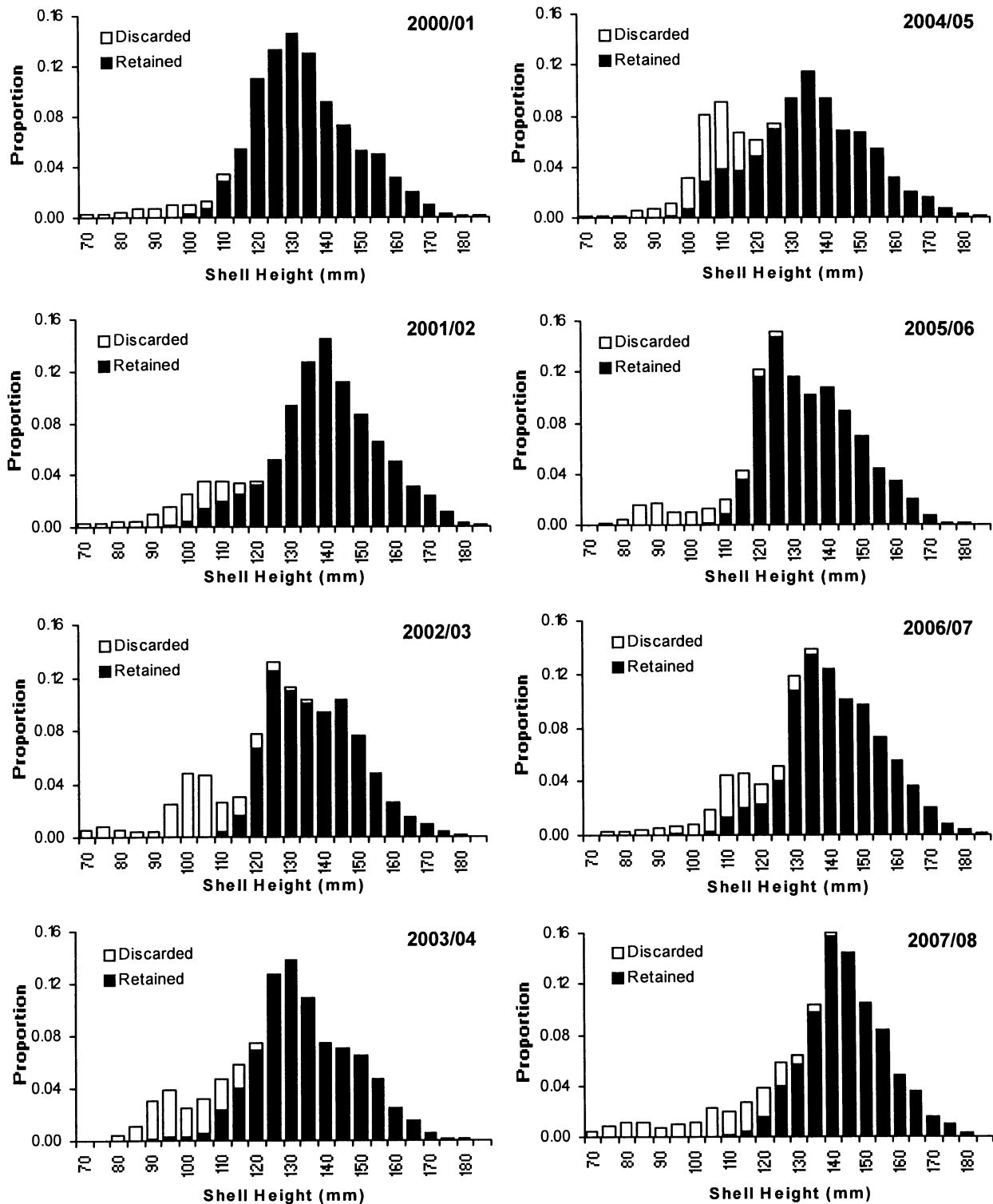


Figure 14 Barplots of Kodiak Shelikof District scallop fishery statistics.



**Figure 15** Shell height histograms from resampling Kodiak Shelikof District scallop observer data, 1992000–2006/07.



### 3.6 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 BOF in 2000 (Figure 2). Other parts of the district remain open to fishing, but no effort has occurred since the 1999/00 season (Table 13).

**Table 13 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)
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.

### 3.7 Alaska Peninsula Registration Area

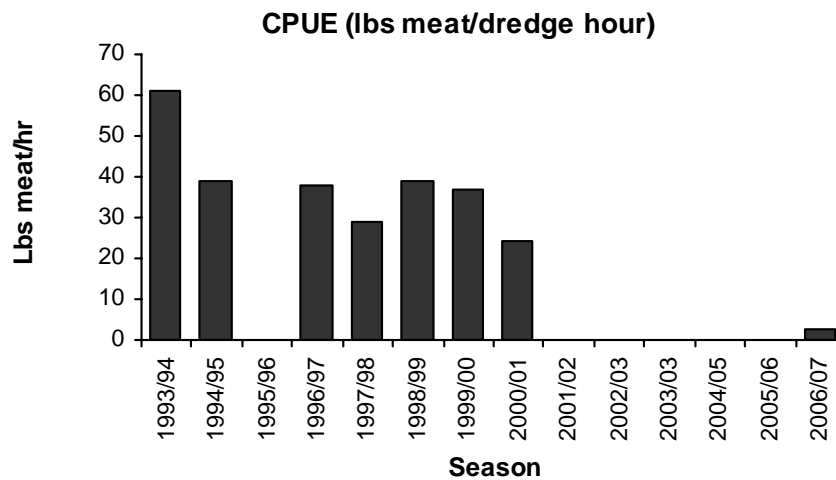
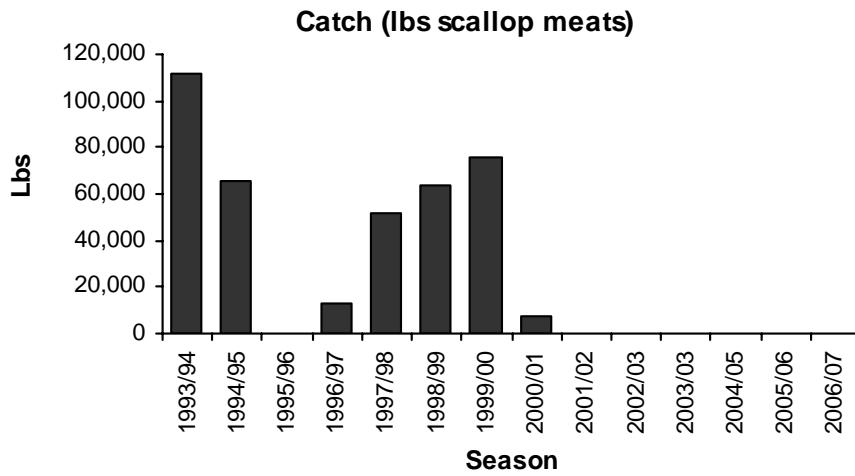
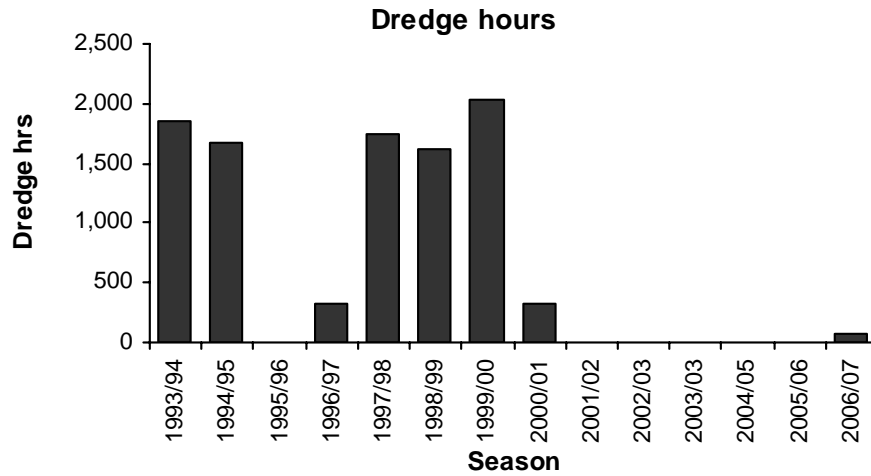
Scallop fishing in the Alaska Peninsula Registration Area (Area M) was traditionally concentrated in a small region near the Shumagin Islands between 160° and 161° W longitude. Area M was closed during the 2001/02 and 2002/03 seasons due to concerns about potential localized depletion (Table 14, Figure 16).

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 lb GHL, the remainder of the area was opened with a 10,000 lb GHL, and no effort occurred. Prior to the 2006/07 season, the GHL was increased to 25,000 lbs 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 that 5-yr of no fishing did not benefit the stock in the portion of the district open to fishing. No vessels participated in the 2007/08 fishery.

**Table 14 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)
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			

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



**Figure 16 Barplots of Alaska Peninsula scallop fishery statistics.**

### 3.8 Bering Sea Registration Area

Large Bering Sea scallop catches taken during the early 1990s (Table 15, Figure 17) did not appear to be sustainable, and GHLS were adjusted downward between 1996/97 and 2005/06 from 600,000 lbs scallop meats to 50,000 lbs. Experimental video tows conducted in the Bering Sea scallop fishing area in 2003 showed scallops distributed over a wide, poorly defined area at low densities, and raised questions about reproductive potential due to low densities. SH histograms (Figure 18) show that some recruitment to the exploited stock has occurred over the past 8 years.

Two cooperative vessels participated in the 2007/08 fishery and harvested 49,995 lbs of shucked scallop meats (Table 15, Figure 17). CPUE increased slightly in each of the past three seasons.

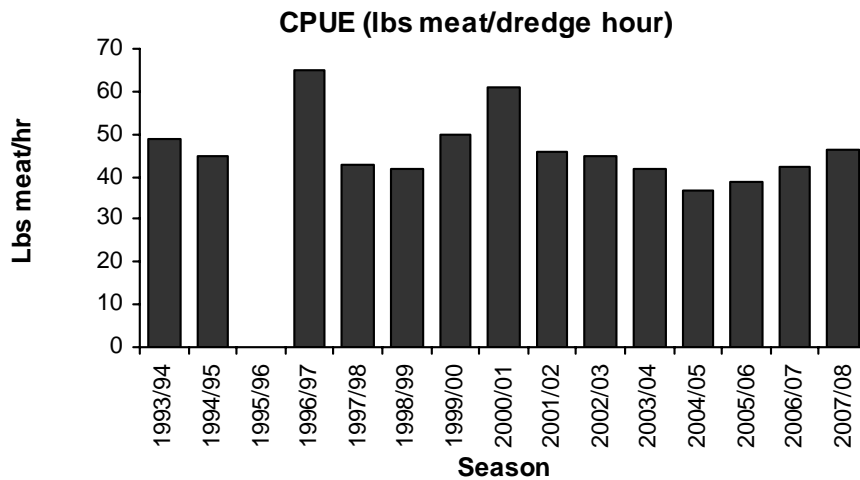
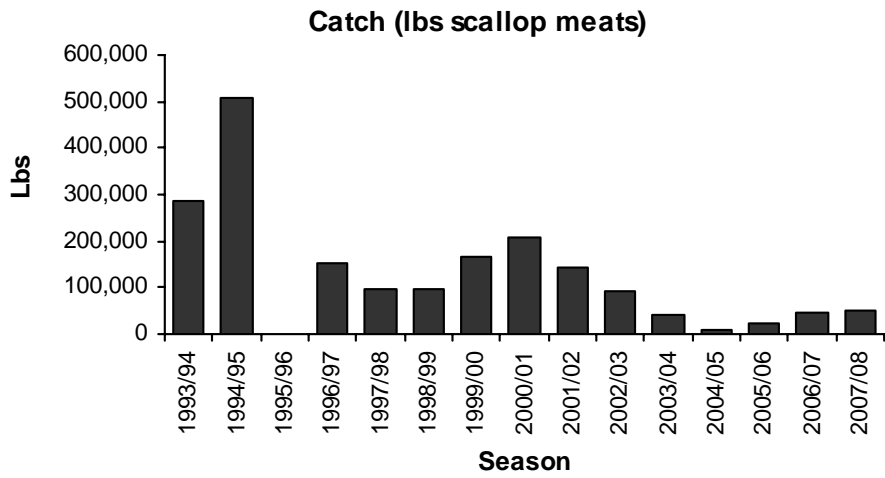
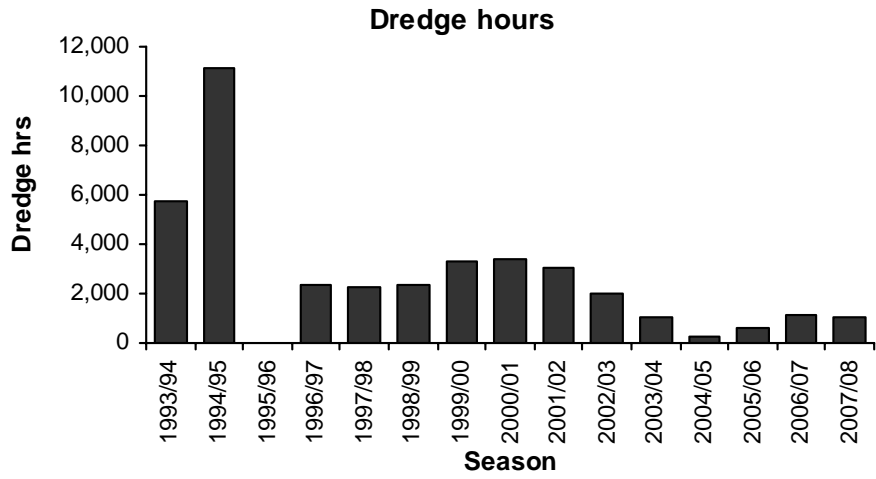
Although incidental catches of *Chionoecetes* crabs in the Bering Sea scallop fishery have remained below CBLs in recent years, concerns about *Chionoecetes* bycatch rates often alter fleet behavior in the fishery. Scallop vessels frequently move to avoid high crab bycatch areas, which may in turn reduce CPUE and profitability. Dredging operations create feeding opportunities for crabs and juvenile flatfish, so when a profitable scalloping area is found, bycatch rates tend to increase over time and may force the vessel to move. Industry attributes harvests that have fallen below the upper end of the GHR in recent seasons to bycatch avoidance.

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).

**Table 15 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)
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

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



**Figure 17 Barplots of Bering Sea scallop fishery statistics.**

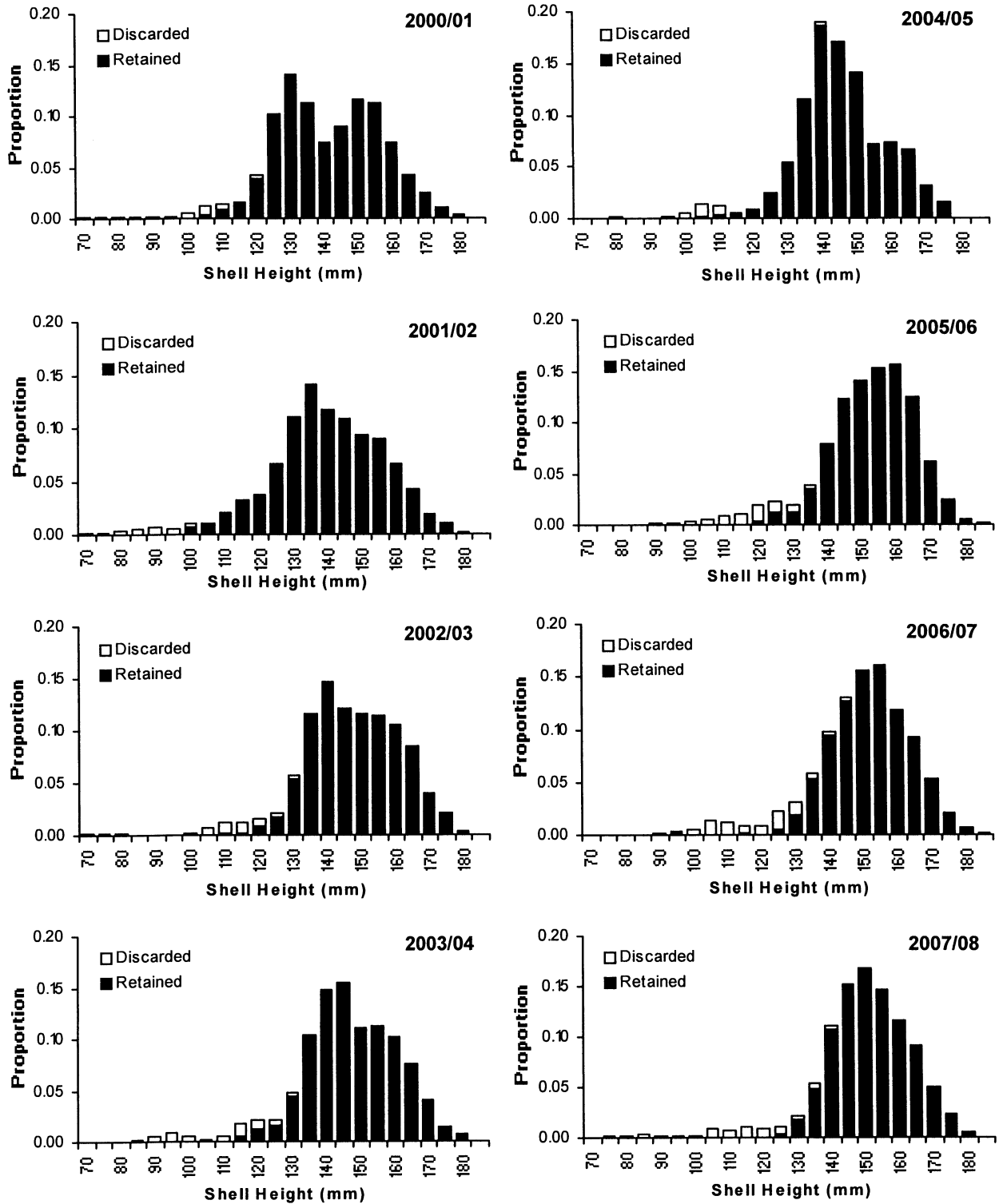


Figure 18 Shell height histograms from resampling Bering Sea scallop observer data, 1999/2000–2006/07.

### 3.9 Dutch Harbor Registration Area

The Dutch Harbor Registration Area (Area O) was opened during 2002/03 for the first time since the 1999/00 season. One vessel fished briefly and harvested about 6,000 lbs of scallop meats, with CPUE that was low but comparable to CPUE from earlier seasons (Table 16). Managers decided in 2003 to close the area for at least 3 additional years to allow for stock rebuilding. Productive scallop grounds that contributed significantly to the overall harvest were closed to scallop fishing before 1986, primarily as a protective measure for crab nursery areas (Figure 2).

The weathervane scallop population in the Dutch Harbor Registration Area is not surveyed and no estimate of abundance has been made. There are currently no plans to survey this population.

**Table 16 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)
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			

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

### 3.10 Adak Area

ADF&G records indicate that scallops were harvested from the Adak Registration Area in 1979, 1992, and 1995. Few vessels participated making catch and effort data confidential. Little is known about scallop populations in this area. The Petrel Bank between 51°30' N. latitude and 54°30' N. latitude, west of 179° W. longitude and east of 179° East longitude was closed in 1991 due to concerns about king crab bycatch during the *Chlamys* (pink scallop) fishery. ADF&G opens the area each season with a GHL of 0–75,000 pounds, but no vessels have participated since 1995.

The weathervane scallop population in the Adak Registration Area is not surveyed and no estimate of abundance has been made. There are currently no plans to survey this population. The continental shelf adjacent to the Aleutian Islands is narrow, providing limited weathervane scallop habitat.

## 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. ADF&G plans to study habitat in closed areas inhabited by scallops beginning in summer 2009.

Essential Fish Habitat (EFH) descriptions for weathervane scallops are being revised under Amendment 9 to the Scallop FMP. There is no available life history information for other scallop species (pink, spiny and rock scallops). More information on EFH designations may be found at <http://www.fakr.noaa.gov/habitat/efh.htm>.

### 4.1 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.

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

**Bycatch.** Scallop fishery bycatch is closely monitored by the onboard observer program (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 (Table 3).

Although a variety of marine vertebrates, invertebrates, and debris are caught incidentally in scallop dredges, weathervane scallops predominate catches. 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



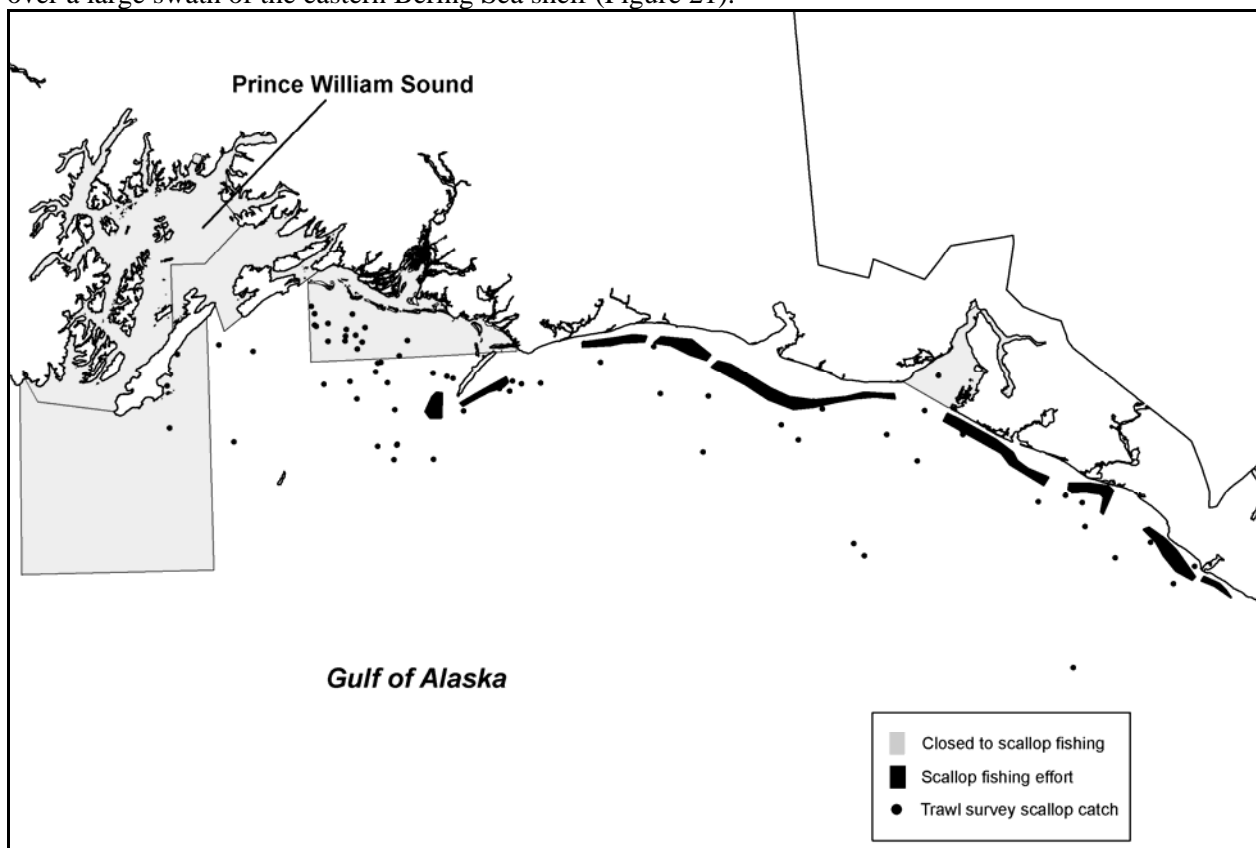
skates, 2%. Gorgonian (hard) corals are infrequently encountered by scallop observers; since 1996, corals have been observed in only 11 of the 15,836 tows sampled for catch composition and bycatch. Summaries of haul composition sampling by area are presented in observer reports prepared by ADF&G (e.g., Barnhart and Rosenkranz 2003).

**Predators.** Twentyarm sea stars are a known predator of juvenile weathervane scallops. We expect that fishery removals have little effect on sea stars and other scallop predators, but the SPT emphasize that very little is known about the topic.

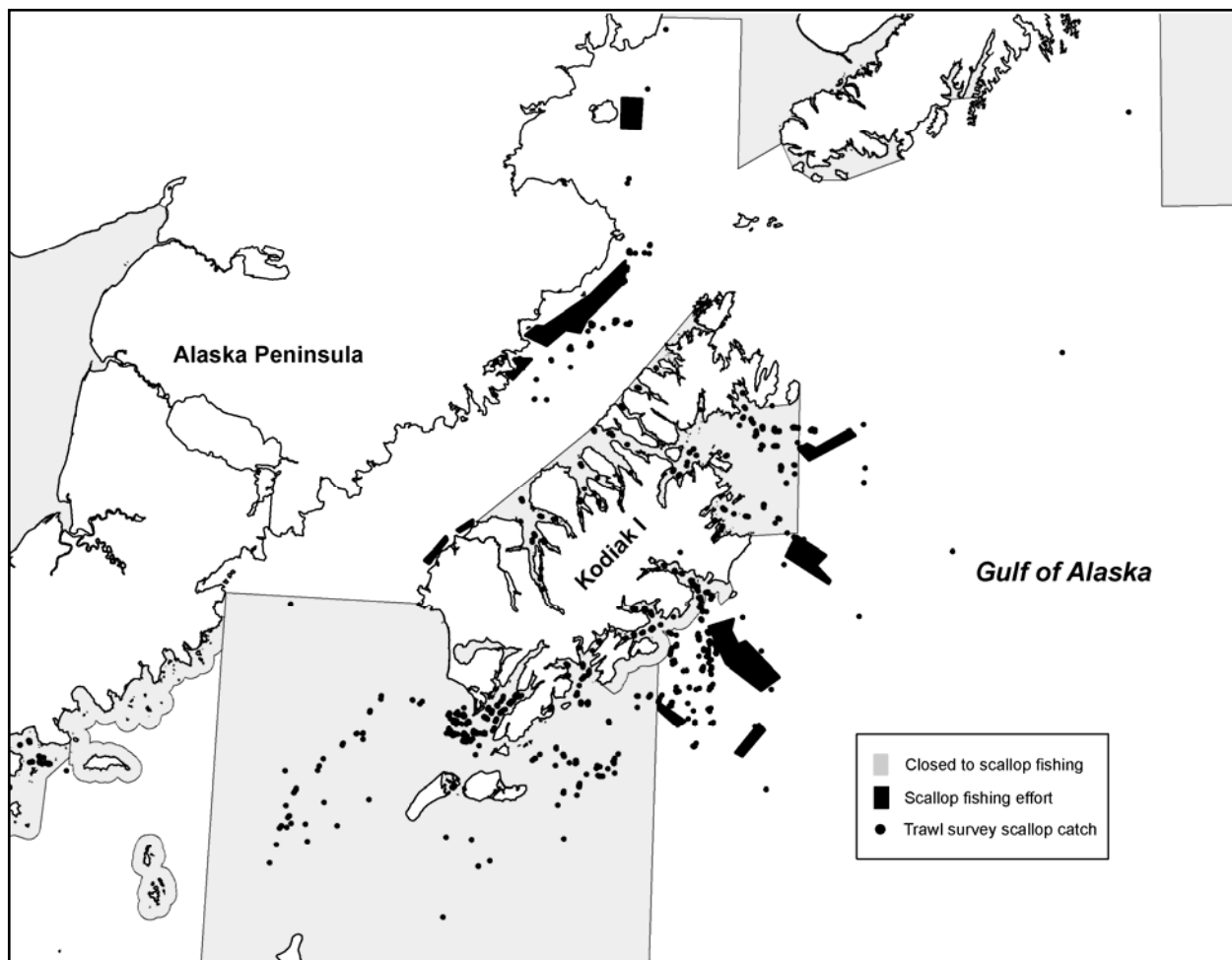
### 4.3 Trawl Survey Information on Scallop Stocks

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.

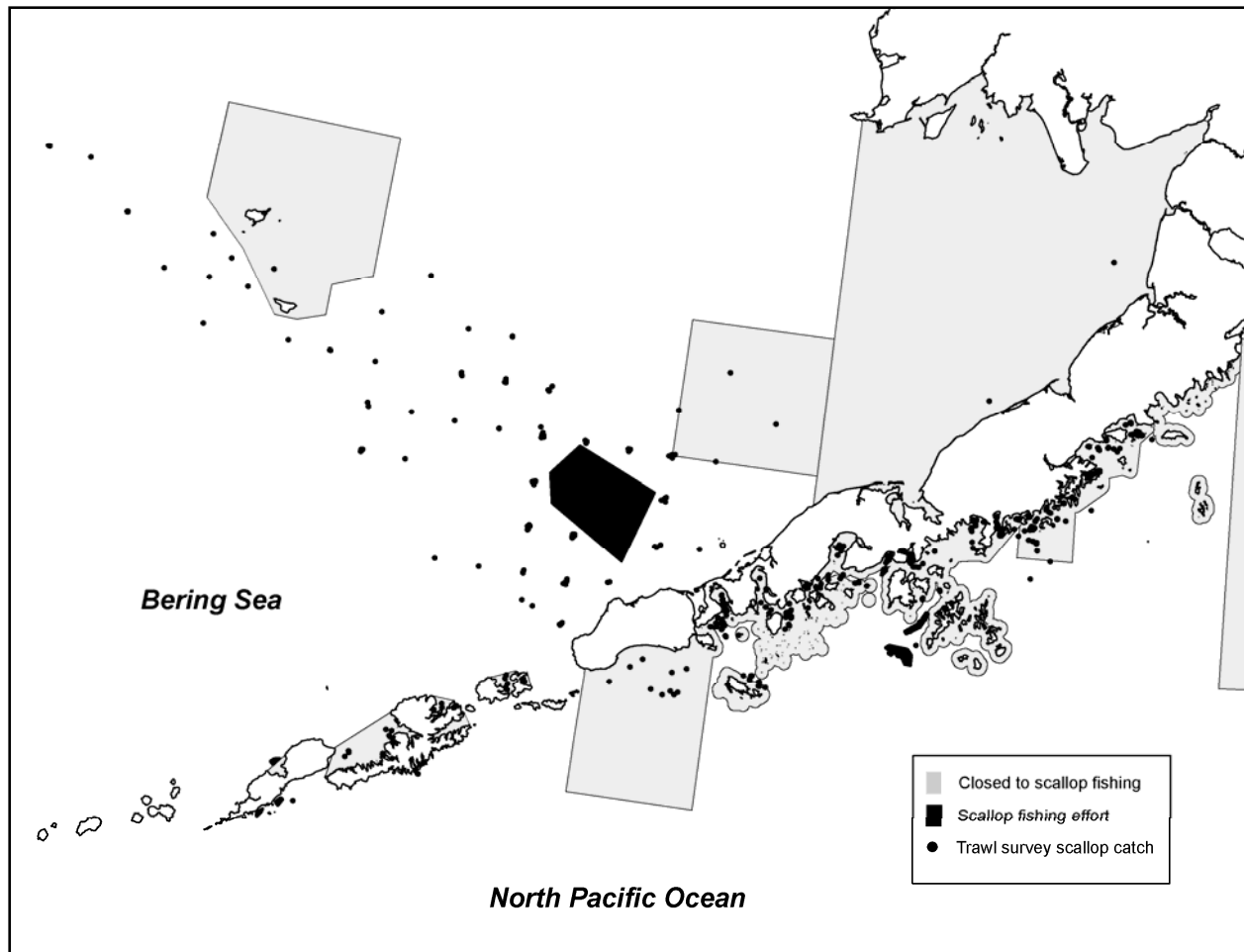
In the eastern GOA (Figure 19), weathervane scallops have been captured during trawl surveys offshore from traditional scallop fishing grounds and in closed waters adjacent to Prince William Sound. Around Kodiak Island (Figure 20), trawl surveys have captured scallops in closed waters south of the island 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 21).



**Figure 19** 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 20** 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 21** 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

## 5 Recent Regulatory Actions

### Alaska State Legislature

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.

### Alaska Board of Fisheries

During the 2008/09 Alaska Board of Fisheries schedule, several scallop proposals were introduced. The maker withdrew proposal 187, which would have moved the opening date in the Yakutat District 16 scallop fishery from July 1 to June 1, after discussions with department staff. Spawning events in this area can occur during the month of June. Therefore, no action was taken by the board.

Three of the proposals will come before the board after completion of this SAFE.

Proposal 358 requests opening closed-waters in Scallop Registration Area K. Fishing would occur under an exploratory fishing permit issued by the Commissioner. The maker of the proposal notes that this area is currently open to groundfish bottom trawling, and that there are confirmed, commercial quantities of weathervane scallops in the area. This proposal will be heard in March during the board's statewide shellfish meeting.

Proposal 359, introduced by the department, would clarify reporting requirements for statewide scallops. It will be heard in March.

Proposal 360, also introduced by the department, would repeal the Commissioner's Permit for the Kamishak District scallop fishery, and put into effect management elements previously stipulated in that permit. It will also be heard during the March, statewide shellfish meeting in Anchorage.

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# **Appendix A. Annual Management Report for the Commercial Weathervane Scallop Fisheries in Alaska, 2005/06**

**Fishery Management Report No. 08-01**

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**Annual Management Report for the Commercial  
Weathervane Scallop Fisheries in Alaska, 2005/06**

by

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February 2008

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries





## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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

***FISHERY MANAGEMENT REPORT NO. 08-01***

**ANNUAL MANAGEMENT REPORT FOR THE COMMERCIAL  
WEATHERVANE SCALLOP FISHERIES IN ALASKA, 2005/06**

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The Division of Sport Fish Fishery Management Reports series was established in 1989 for the publication of an overview of Division of Sport Fish management activities and goals in a specific geographic area. Since 2004, the Division of Commercial Fisheries has also used the Fishery Management Report series. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports are available through the Alaska State Library and on the Internet: <http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm>. This publication has undergone regional peer review.

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## ABSTRACT

The Alaska commercial weathervane scallop *Patinopecten caurinus* fishery occurs in waters of the Alaska Territorial Sea and the Exclusive Economic Zone (EEZ) bound by Cape Spencer in Southeast Alaska through the Gulf of Alaska to the western boundary at the U.S.-U.S.S.R. Maritime Boundary Agreement Line of 1990 in the Bering Sea. This report describes historic and present-day fishery management for the commercial weathervane scallop fishery occurring in the Yakutat, Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, Bering Sea, Dutch Harbor, and Adak Registration Areas. A synopsis of the 2005/06 fishing season and stock status is discussed for each scallop registration area.

Key words: Weathervane scallop, *Patinopecten caurinus*, Southeastern Region, Central Region, Westward Region, fishery observer, Yakutat, Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, Bering Sea, Dutch Harbor, Adak, Aleutian Islands, Fishery Management Plan, crab bycatch, fishery cooperative.

## INTRODUCTION

Alaskan weathervane scallop *Patinopecten caurinus* populations were identified in 1953 by the U.S. Bureau of Commercial Fisheries during one of their surveys (Kaiser 1986). However, it was not until 1967 when declines of red king crab *Paralithodes camtschaticus* catches led to the first efforts to establish a weathervane scallop fishery (Kruse et al. 2005). In 1967, two Kodiak-based vessels, were converted to scallop dredging (Turk 2000). At this same time, scallop catches were declining in the eastern U.S. and Canadian fisheries on Georges Bank. By 1968, scallop vessels arrived in Alaska from the east coast. The scallop fishery expanded to 19 vessels consisting of New Bedford type scallop vessels, converted Alaska crab boats, salmon seiners, halibut longliners, and shrimp trawlers (Kaiser 1986).

The fishery developed from 1967 through 1973 as previously unfished scallop beds were identified and harvested (Shirley and Kruse 1995). This was followed by a period of declining scallop harvests from 1974 to the end of the decade. A smaller, more stable fishery followed through the 1980s.

By 1993, the fishery was again expanding with an influx of scallop vessels from the east coast of the United States (Table 1). The influx of vessels into the weathervane scallop fishery concerned the Alaska Department of Fish and Game (ADF&G) about crab bycatch and overharvest of the scallop resource. As a result of the increased effort, the weathervane scallop fishery was designated by the state of Alaska as a high impact emerging fishery on May 21, 1993, and was closed until a conservative management plan could be developed by the ADF&G (Kruse et al. 2005). The resulting Interim Management Plan for Commercial Scallop Fisheries in Alaska was approved by the ADF&G Commissioner in 1993 and finalized as regulation 5 AAC 38.076 Alaska Scallop Fishery Management Plan by the Alaska Board of Fisheries (BOF) in 1994. It includes a provision for onboard observer coverage, measures designed to limit efficiency and slow the pace of fishing, gear regulations that reduce the capture rate of small scallops, and crab bycatch limits (Barnhart 2003).

In 1997, participation in the Alaska weathervane scallop fishery was limited by vessel moratoria in both federal and state waters. In 2001, a federal license limitation program (LLP) replaced the federal moratorium permanently limiting participation in the exclusive economic zone (EEZ). During the same year, the majority of vessel owners formed a fishing cooperative. The result of these actions, associated with a conservative management approach by the ADF&G, has been a reduction in the statewide scallop harvest since the late 1990s (Table 1).



In the 1990s the fishery changed from short trips with numerous deliveries each season to long trips with fewer deliveries, as the majority of the fleet converted from icing to freezing of product onboard vessels (Barnhart 2000). Between the 1990 and 1994/95 seasons when the product was iced on board and delivered fresh, the fleet averaged 136 deliveries per year (Table 1). Of the 136 deliveries, 114 were made by vessels participating in the statewide fishery (outside of Cook Inlet). By 1996, all scallop catcher boats participating exclusively in the statewide fishery (outside of Cook Inlet) were converted to catcher-processors with freezing capability. Freezing product onboard allowed longer trips. As a result, the annual average number of deliveries between 1996/97 and 2002/03 for the catcher-processor fleet operating exclusively in the statewide fishery (outside of Cook Inlet), decreased to 20.

Variable quantities of weathervane scallops are found in patchy distribution along the continental shelf from Southeast Alaska to the Bering Sea and Aleutian Islands. Scallop “beds” are typically elongated and oriented in a north-south direction consistent with prevailing currents parallel to Alaska’s coastline. Scallop beds typically occur in mud, clay, silt, sand, or pebble substrates. Major scallop fishing locations in Alaska coastal waters are shown in Figure 1. Scallops are typically found at depths of 20–125 fathoms, with the majority of the fishing effort occurring between 40 and 60 fathoms (Barnhart and Rosenkranz 2006).

There are nine scallop fishing registration areas within Alaska (Figure 2). This report describes fisheries within the ADF&G Southeastern Region (Yakutat, Registration Area D), Central Region (Prince William Sound, Registration Area E and Cook Inlet, Registration Area H), and Westward Region, including Kodiak (Area K), Alaska Peninsula (Area M), Bering Sea (Area Q), Dutch Harbor (Area O), and Adak (Area R) scallop registration areas. Waters of the Territorial Sea and the EEZ are encompassed within each registration area. Registration Area D includes those waters in the Gulf of Alaska (GOA) north of Cape Spencer (58° 12.27' N lat., 136° 39.75' W long.) and east of the longitude of Cape Suckling at 144° W. long. Registration Area E includes those GOA waters west of the longitude of Cape Suckling at 144° W. long. and east of the longitude of Cape Fairfield (148° 50.25' W long). Registration Area H includes those GOA waters east of Cape Fairfield (148° 50.25' W long) and north of the latitude of Cape Douglas (58° 51.10' N. Lat.). Registration Area J includes GOA waters south of Cape Douglas (58° 51.10' N lat.), west of 148° 50.25' W long and the Bering Sea to the U.S.-U.S.S.R. Maritime Boundary Agreement Line of 1990.

## **MANAGEMENT HISTORY**

### **HISTORIC MANAGEMENT MEASURES**

From inception of the fishery in 1967 until the early 1990s when scallop vessels arrived from the east coast of the United States to Alaska, the fishery was open year-round in many parts of the state, without harvest restrictions. All vessels participating in the scallop fishery were registered to fish under a commissioner’s permit, which could stipulate location and duration of harvest, limit gear and other harvest procedures, and require periodic or annual reporting. Because vessels were registered with the state of Alaska, the state regulated the fishery in federal waters. In 1993, because of increased effort, the scallop fishery was declared high impact and emerging fishery on May 21, 1993 by the Commissioner of ADF&G and was closed until a conservative management plan could be developed by the department. The resulting Interim Management Plan for Commercial Scallop Fisheries in Alaska (5 AAC 38.076) included measures designed to

limit efficiency and slow the pace of fishing, gear regulations that reduce the capture rate of small scallops, onboard observer coverage and crab bycatch limits (Kruse et al. 1992).

At the BOF meeting in March 1994, the Westward Region regulatory season was established as July 1 through February 15. At the March 1997 BOF meeting, the regulatory season in all registration areas of the state, except the Cook Inlet Registration Area, was established as July 1 through February 15. Although season dates were established to protect molting and mating crab, they have the added benefit of not disturbing scallops prior to and during their spawning period of May through early-July.

Federal regulatory actions also changed the fishery. In January 1995, the captain of a scallop vessel returned his state of Alaska 1995 scallop interim use permit card to the Commercial Fisheries Entry Commission (CFEC) and proceeded to harvest scallops in the Gulf of Alaska EEZ with disregard to harvest limits, observer coverage, and all other state regulatory and management measures. In response to the uncontrolled fishing for scallops in the EEZ by this single vessel outside the jurisdiction of the state of Alaska, the fishery was closed by the federal government from February 23, 1995 to August 1, 1996. Fishing in the EEZ was initially closed by federal emergency rule (60 FR 11054). Subsequent to expiration of the emergency rule on May 30, 1995, it was extended by the National Marine Fisheries Service (NMFS) for an additional 90 days through August 28, 1995. The emergency rule was activated to control unregulated scallop fishing in federal waters until a federal fishery management plan could be adopted closing the fishery in federal waters. Prior to the August 28, 1995 emergency rule expiration date, the North Pacific Fishery Management Council (NPFMC) submitted a draft FMP that closed federal waters to scallop fishing for up to one year, with an expiration date of August 28, 1996. Amendment 1 to the FMP became effective August 1, 1996 allowing the fishery to reopen in federal waters. Scallop fishing in state waters, scheduled to open July 1, 1996, was delayed until August 1, 1996 to coincide with the federal water opening. Amendment 2 to the Fishery Management Plan for the Scallop Fishery off Alaska (FMP) was approved on April 11, 1997 (62 FR 17749). Amendment 2 established a federal moratorium on the entry of new vessels into the fishery. The vessel moratorium remained in effect until June 30, 2000. The moratorium was replaced by the LLP that became effective on January 16, 2001. Between June 30, 2000 and January 16, 2001 the fishery was in open access status. In 1998, Amendment 3 to the federal FMP delegated authority to the state of Alaska to manage all aspects of the scallop fishery in federal waters, except limited access (Barnhart 2000). This included the authority to regulate vessels not registered under the laws of Alaska. There have been a total of 11 amendments to the scallop FMP.

In 1997, the Alaska legislature approved legislation (AS 16.43.906) enacting a temporary state waters (0-3 nautical miles) vessel moratorium. In 2001, the legislature authorized a 3-year extension of the moratorium, with an expiration date of July 1, 2004. During the 2002 legislative session, passage of House Bill (HB) 206 resulted in changes to the limited entry statutes allowing for a vessel-based limited entry program. The CFEC adopted regulations 20 AAC 05.1400 through 20 AAC 05.1444 to establish a vessel-based limited entry permit system for the statewide weathervane scallop fishery prior to the moratorium expiration on July 1, 2004. Eight vessel owners received permits to fish for weathervane scallops in state waters. However, the program has a sunset provision. Weathervane scallop fishing in state waters will revert to an open access fishery and vessel entry permits issued for the statewide weathervane scallop fishery will expire on December 31, 2008 unless statutory authority is extended.

## CURRENT MANAGEMENT

The weathervane scallop fishery, in both state and federal waters, is managed by the ADF&G. Provisions of the Magnuson-Stevens Act and the scallop FMP apply in federal waters. Vessels eligible to fish in the EEZ are limited by the LLP, while vessels in state waters (0-3 nautical miles) are limited by a state limited entry vessel permit (Table 2).

Section 303(a)(7) of the Magnuson-Stevens Act requires all FMPs to describe and identify Essential Fish Habitat (EFH), which it defines as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” In addition, FMPs must minimize effects on EFH caused by fishing and identify other actions to conserve and enhance EFH. These EFH requirements are detailed in Amendment 5 to the FMP for the Scallop Fishery off Alaska (NPFMC 2005). The scallop fishery does not occur on any areas designated as Habitat Areas of Particular Concern (HAPC). According to the Environmental Impact Statement (EIS) for EFH Identification and Conservation in Alaska, the potential impacts on EFH from the scallop fishery are “minimal and temporary” (NMFS 2005).

The statewide regulatory fishing season for weathervane scallops, outside of the Cook Inlet Registration Area, is July 1 through February 15, while the regulatory fishing season in the Cook Inlet Registration Area is August 15 through October 31. Fisheries may be closed at any time by emergency order. Scallop guideline harvest ranges (GHRs) and crab bycatch limits (CBLs) for the 2005/06 season, excluding Cook Inlet, were announced by news release on June 3, 2005. The scallop GHR and CBLs for Cook Inlet were announced by news release on June 22, 2005. The upper limit of the combined GHRs in the Westward Region totaled 395,000 lb of scallop meats, in the Southeastern Region combined GHRs totaled 235,000 lb of scallop meats, Prince William Sound GHR limit was 50,000 lb of scallop meats, and in Cook Inlet the GHR limit was 7,000 lb of scallop meats.

CBLs for red king crabs, Tanner crabs *Chionoecetes bairdi* and snow crabs *Chionoecetes opilio* have been established for registration areas and districts within the weathervane scallop fishery. Hybrid *Chionoecetes* crabs are included in the snow crab CBL. Each registration area or district has separate CBLs. The bycatch of crabs in the scallop fishery is controlled through the use of the CBLs. The state first instituted CBLs in July 1993. Annual CBLs are established pre-season by the ADF&G based on the most current crab resource abundance information. However, in some registration areas or districts, the CBL is a fixed number of crabs and 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 (Table 3). 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 0.5% of the total crab stock abundance and the red king crab limit is fixed at 60 crabs. In the Prince William Sound Registration Area the CBL for Tanner crab is fixed at 0.5% of the total

crab stock abundance estimated from the 2000 scallop assessment survey. This resulted in bycatch limits of 2,700 and 8,700 for the east and west harvest areas.

CBLs in the Bering Sea (Scallop 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 the ADF&G to allow the fleet opportunity to explore and harvest scallop stocks while protecting the crab resource. CBLs were established at 260,000 Tanner and snow crab combined and 17,000 red king crabs. In 1995, ADF&G recommended that CBLs be established at 0.003176% of the best available population estimate of snow crab and 0.13542% of the best available population estimate of Tanner crab abundance in the Bering Sea. That equated to 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 the ADF&G. The NPFMC also recommended that king crab bycatch limits be set within a range of 500 to 3,000 crabs annually. Beginning with the 1996/97 fishing season, ADF&G took a conservative approach and set the red king crab limit in Scallop Registration Area Q at 500 red king crabs annually.

From the 1996/97 through 1998/99 scallop fishing seasons, the CBL for Tanner and snow crabs 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 utilizing a three tier approach.

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

Closures based on the fleet reaching CBLs have decreased over the years since inception of CBLs in 1993, possibly due to decreased crab abundance (Barnhart and Rosenkranz 2003). During the 1993/94 season, four statewide areas were closed due to attainment of CBLs. Since the 2000/01 season, two areas have closed due to crab bycatch.

One management tool used by ADF&G when setting annual GHRs is evaluation of catch per unit effort (CPUE). Fishery-dependent data such as CPUE is affected by many variables and therefore must be used with caution. CPUE is expressed in two ways, scallop round weight and scallop meat weight. These are standardized to a dredge-hour, which is defined as one dredge towed for 60 minutes. Round weight represents the retained weight in pounds of the live or whole animals. The round weight of retained scallops is estimated by the vessel operator for each tow by counting the number of bushels of retained scallops and multiplying by an estimated average weight per bushel. Processed product (scallop meat in the form of adductor muscles) is typically weighed directly during the case-up process. Therefore, CPUE based on scallop meat weight vs an estimate of round weight, provides a more standard measure of fishery performance

across the fleet. Estimated round weight is used in conjunction with weighed scallop meats to determine estimated recovery rates.

## **OBSERVER PROGRAM**

The Alaska Scallop Fishery Management Plan, 5 AAC 38.076 (g), allows ADF&G to require a vessel, in a scallop fishery with a guideline harvest range established by regulation, to carry an onboard observer unless the department determines that carrying an observer in that fishery will not serve the purpose of the onboard observer program. The primary purposes of the onboard scallop observer program are to collect a variety of biological and fishery-based data, monitor bycatch, and provide for regulatory enforcement. Data are collected on crab and halibut bycatch, discarded scallop catch, retained scallop catch, catch composition, CPUE, scallop meat-weight recovery, and location, area and depth fished (Barnhart and Rosenkranz 2003). Onboard observers report scallop harvest, number of tows, area fished, and crab bycatch to ADF&G tri-weekly during the season by radio, email, or satellite phone. Observer-collected data are used to manage the fishery in-season and to set GHRs for the following season. Data are provided to local advisory committees, BOF, NPFMC, NMFS and the public to help answer a myriad of questions pertaining to the weathervane scallop fishery. These data have been invaluable for preparing EFH and HAPC documents. For analyzing fine-scale spatial and temporal impacts of the fishery, observer data are critical.

Onboard observer coverage is funded by industry through direct payments to independent contracting agents (Barnhart 2003). Independent contracting agents provide personnel that are trained at the University of Alaska North Pacific Fisheries Observer Training Center (OTC) in Anchorage, Alaska.

## **INDUSTRY**

Prior to the 2000/01 regulatory season, six of the nine LLP owners formed a cooperative under authority of the Fishermen's Cooperative Marketing Act, 48 Stat. 1213 (1934), 15 U.S.C. § 521. No federal or state regulations established the cooperative, nor is it managed by the ADF&G or any federal agency. The cooperative is a voluntary association of vessels with no legal harvest allocation. That is, there is no direct harvest allocation under state or federal regulations. Within the cooperative, vessel owners allocate themselves shares of the scallop GHRs and CBLs based on historic participation in the fishery. The majority of the owners opted to remove their boats from the fishery and arranged for their co-op shares to be caught by others members of the cooperative. The formation of the cooperative extended the fishing season over a longer time period compared to the pre-cooperative fishery.

Vessel owners and operators within the cooperative have taken an active role in developing measures aimed at reducing crab bycatch. Vessel operators provide their confidential inseason fishing information to an independent consulting company contracted by the cooperative. The independent consultant reviews the crab bycatch data, fishing location information, and scallop harvest, allowing for real-time identification of any high crab abundance areas discovered during the fishery. If at any time, an area of high crab abundance is identified, the co-op fleet is provided with location information and directed to avoid fishing in that area. This mechanism only works if vessel operators submit their fishing data and crab bycatch to the consultant in a timely fashion.

Vessel operators also voluntarily release their confidential fishing information to ADF&G so that it can be used in this and other reports to help the BOF make informed decisions on management issues in areas where few fishermen participate.

## **YAKUTAT REGISTRATION AREA**

The Yakutat Registration Area is defined as Area D, described in 5 AAC 38.160, and all waters of District 16 as described in 5 AAC 31.105(p). These descriptions include those waters in the GOA north of the latitude of Cape Spencer (58° 12.27' N lat., 136° 39.75' W long.) and east of the longitude of Cape Suckling at 144° W. long. For management purposes these waters are divided into two management areas – Area D and District 16 (Figure 3). The waters of Yakutat Bay east of a line from the easternmost tip of Ocean Cape at 59°32.05' N. lat., 139°52.03' W. long. to the southernmost tip of Point Manby at 59°41.07' N. lat., 140°18.06' W. long. are closed to the taking of scallops (Figure 3).

### **HISTORIC BACKGROUND**

The earliest years of the fishery occurred in Area D and were very productive. Previously unfished biomass supported harvests of over 900,000 pounds in 1968 and over 800,000 pounds in 1969 (Table 5). These years were followed by two decades of reduced effort and harvests. In late spring of 1991, Yakutat Bay was closed to commercial scallop dredging by the Board of Fisheries. A statewide trend of increasing interest and participation in scallop fisheries in the early 1990s culminated in a peak harvest of over one million pounds in Area D in 1992 (Table 5). In 1993, guideline harvest ranges were first established under the Interim Management Plan for Commercial Scallop Fisheries in Alaska for registration areas where scallop fishing traditionally occurred. This included the Yakutat Registration Area.

Season closures also went into effect in 1993, with separate winter and summer fisheries in 1993 and 1994 (Table 5). The Board of Fisheries formally changed the opening date for the winter fishery in late 1994 from January 1 to January 10, and from a split season to a single winter season. The single winter season lasted through 1997. At the Board of Fisheries meeting in 1997 the regulatory season was changed to July 1-February 15.

The fisheries in District 16 started in 1980 as stocks in Area D to the north and west were fished down (Table 5). Interest and harvests have been generally low and intermittent. District 16 stocks have been spared much of the roller coaster highs and lows prior to implementation of the ASFMP in 1993. Only a few vessels fished each season, with a maximum of eight vessels in 1994 (Table 5). The peak harvest of 162,888 pounds occurred in 1990 (Table 5), with an overall historical average of approximately 31,000 pounds in years when effort did occur. Prior to 1993, this fishery was open all year, with an accounting period of January 1 through December 31. Starting in 1993, the statewide management plan was implemented. For Southeast Alaska it specified a split season, with a winter fishery starting on January 1 and a summer fishery starting on July 1. In 1994, because of high anticipated effort and catch levels, the winter season opened and closed after a one-day fishery on January 20. The following summer season, which opened by regulation on July 1 and closed by emergency order on October 31, was not as intense because productive areas in other parts of the state were open concurrently. In 1995, there was only a winter fishery. There were two seasons in 1996. The first one opened in state waters only on January 10 and closed on January 20. The summer fishery opened in federal waters on August

1 and continued through the fall to close on November 29. In 1997, regulations changed so that the season was opened on July 1 and extended to February 15 (Bishop and Stratman 2006).

Mandatory observers are required on each vessel fishing for scallops in the Yakutat Registration Area. The observer program has two main goals: to monitor bycatch and to collect biological and commercial fishing information about the weathervane scallop. Observer sampling of the scallop catch and discarded scallops allows determination of the stock size composition. In addition, shells are collected for ageing in order to determine the age structure population dynamics of Yakutat Registration Area weathervane scallop populations (Bishop and Stratman 2006).

Dungeness and Tanner crab are captured incidentally in scallop dredges in the Yakutat fishery; however, there are no crab bycatch caps established. Although the Alaska State Fishery Management Plan states that bycatch limits may be required for scallop fisheries opened by permit, no bycatch limits have been established to date for the scallop fishery in the Yakutat Registration Area since there is yet no annual survey in existence to estimate the population of Tanner crab (Barnhart and Rosenkranz 2000).

## **2005/06 FISHERY**

The 2005/06 scallop fishing season in the Yakutat Registration Area was open July 1, 2005 through February 15, 2006. Two catcher-processors fished in the Yakutat Registration Area. Recent increases in scallop prices led to increased effort and harvest during the 2005/06 Yakutat scallop fishery, with a total of about 214,000 lbs of scallop meats landed from Area D and District 16 combined (Tables 6 and 7). Yakutat Registration Area-wide CPUE, which averaged 46 lbs meat/dredge hr during the 2000/01–2004/05 seasons, fell to 39 lbs meat/dredge hr for 2005/06.

Based on inseason observer reports, estimated Tanner crab bycatch increased from less than 1,000 crabs during the 2004/05 season to 5,364 crabs during the 2005/06 Yakutat scallop fishery for Area D and District 16 combined. The Tanner crab bycatch rate also increased, moving from about 1/3 crab/dredge hr during 2004/05 to about 1 crab/dredge hr during 2005/06. These rates remain low compared to other scallop fishing areas in the state. An estimated 394 Dungeness crabs and 518 halibut were also incidentally caught in the 2005/06 Yakutat Registration Area scallop fishery.

### **Area D**

Area D has as its western boundary the longitude of Cape Suckling (144° W. long.) and as its southern boundary a line extending seaward from the western tip of Cape Fairweather, at 58°47.89' N. lat., 137°56.68' W. long., to the intersection with the seaward limit of the three-nautical-mile territorial sea at 58°45.91' N. lat., 138°01.53 W. long (Figure 3).

The GHR for Area D was set at zero to 200,000 pounds of scallop meats (Table 7). Two catcher processors participated in the fishery in Area D. Based on indications from observer reports that upper-end harvest caps would be met, Area D was closed by emergency order on January 25, 2006. The Area D scallop harvest as reported on fish tickets totaled 199,351 pounds of scallop meats (Table 7).

Figure 6 depicts the estimated shell height (SH) distributions of the retained and discarded scallop catch in Area D, based on statistical resampling of the discarded and retained SH measurements in equal proportion. The histograms depict annual recruitment to the Area D

scallop population. Recruitment to the harvestable population (scallops >100 mm SH) appears to continue. Histograms of shell height distributions for Area D show few changes between the 2004/05 and 2005/06 seasons. Scallops in the 120–130 mm SH range continue to dominate harvests, with few larger animals taken. The average SH of retained scallops in Area D during the 2005/06 season was 123 mm as compared to 124 mm SH during the previous season (Table 7).

A summary of the scallop catch in round weight (lb) of retained scallops, meat weight (lb) of retained scallops, dredge hours, and CPUE expressed in lb of scallop meats per dredge-hour (meat lb/drg-hr) from the 1993/94 through 2005/06 seasons is depicted in Figure 7. The graphs depicting round weight of retained scallops, meat weight of retained scallops, and total dredge hours demonstrate the increased effort seen in the 2005/06 fishery. The graph depicting CPUE shows little change in CPUE from the 2004/05 fishery, and relatively stable catch rates for the previous six seasons.

### **Stock Status**

The weathervane scallop population in Area D of the Yakutat Registration Area is not annually surveyed and no estimate of abundance has been made. As scallop survey technology is advanced, this population will likely be surveyed. The 199,351 pounds of scallop meats harvested in the 2005/06 fishery was the highest harvest taken in the past six seasons (Table 7). However, due to fairly constant catch rates and a large increase in dredge hours (Table 7), it is more likely the increased harvest was due to an increase in effort, rather than an increased abundance of marketable sized scallops.

### **District 16**

District 16 is defined in regulation as waters that are north of a line running west from the southernmost tip of Cape Spencer (58° 12.27' N lat., 136° 39.75' W long.) and south of a line extending seaward from the western tip of Cape Fairweather, at 58°47.89' N. lat., 137°56.68' W. long., to the intersection with the seaward limit of the three-nautical-mile territorial sea at 58°45.91' N. lat., 138°01.53 W. long (Figure 3).

The GHR for District 16 was set at zero to 35,000 pounds of scallop meats (Table 6). Two catcher processors participated in the fishery in District 16. The upper end of the GHR was not reached in District 16 during the 2005/06 season and the fishery was closed by regulation on February 15, 2006. The District 16 scallop harvest as reported on fish tickets totaled 13,650 pounds of scallop meats (Table 6).

Figure 4 depicts the estimated shell height (SH) distributions of the retained and discarded scallop catch in District 16, based on statistical resampling of the discarded and retained SH measurements in equal proportion. The histograms depict annual recruitment to the District 16 scallop population. Recruitment to the harvestable population (scallops >100 mm SH) appears to continue. Histograms of shell height distributions for District 16 show slight changes from the 2004/05 to 2005/06 seasons, with a slightly higher percentage of smaller scallops taken in the 2005/06 season. Scallops in the 110–120 mm SH range continue to dominate harvests, with few larger animals taken. The average SH of retained scallops in District 16 during the 2005/06 season was 119 mm as compared to 120 mm SH during the previous season (Table 6).

A summary of the scallop catch in round weight (lb) of retained scallops, meat weight (lb) of retained scallops, dredge hours, and CPUE expressed in lb of scallop meats per dredge-hour



(meat lb/drg-hr) from the 1993/94 through 2005/06 seasons is depicted in Figure 5. The graphs depicting round weight of retained scallops, meat weight of retained scallops, and CPUE show a decrease in harvest and CPUE from 2004/05 to the 2005/06 season. The graph depicting total dredge hours in the 2005/06 season shows little change in total effort from the 2004/05 season.

### **Stock Status**

The weathervane scallop population in District 16 of the Yakutat Registration Area is not annually surveyed and no estimate of abundance has been made. As scallop survey technology is advanced, this population will likely be surveyed. The 13,650 pounds of scallop meats harvested in the 2005/06 fishery was a 45% reduction in harvest from the previous season (Table 6). With dredge hours remaining relatively stable between the 2004/05 and 2005/06 seasons, and a corresponding drop in harvest and CPUE between those same seasons (Table 6), it is possible that there was a decrease in abundance of marketable sized scallops in District 16.

## **PRINCE WILLIAM SOUND REGISTRATION AREA**

Prince William Sound (PWS) Registration Area E includes territorial waters of Alaska from 144° 00' W. long. near Cape Suckling, to Cape Fairfield at 148°50.25' W. long. (Figure 8). The PWS Area is comprised of the Inside and Outside Districts. The Outside District is subdivided into the Eastern and Western Sections at 147° W. long. Only the Eastern Section of the Outside District is open to scallop fishing.

### **HISTORIC BACKGROUND**

The commercial fishery for weathervane scallops in the PWS Area occurs in the proximity of Kayak Island and typically more than 3 miles from shore (Figure 8). From 1992 through 2004 total scallop harvests in the PWS area have ranged 18,000 lb in 1997-98 to 208,000 lb in 1992, while participation has ranged from 1 to 7 vessels (Table 8).

The initial scallop fishery in the PWS Area occurred in 1992. A harvest level of 64,000 lb for waters east of 147° 00' W. long. was determined in season using area-swept methods and a 10% harvest rate (unpublished survey data). The fishery began in February and closed in April with a harvest total of approximately 209,000 lb of meats by 4 vessels (Table 9). The discrepancy between the 1992 intended harvest level and actual harvest was attributed to a lack of timely and accurate catch reporting and insufficient data about the scallop biomass.

In 1993, the Interim Management Plan for Commercial Scallop Fisheries in Alaska established the GHR for weathervane scallops in Area E as 0-50,000 lb of scallop meats. The 1993 season opened July 15 with a 50,000 lb GHR cap and closed July 18 with seven vessels landing 63,068 lb of meats.

The Alaska Scallop Fishery Management Plan (BOF adopted in 1994) changed the season opening date from July 1 to January 10 with closure by emergency order. In addition, closure areas in eastern PWS and along the Copper River Delta to protect depressed Tanner crab and Dungeness crab stocks were identified. The 1994 commercial scallop season did not open due to the change in the season opening date as it would have resulted in doubling the harvest in a single cycle.

The 1995 weathervane scallop fishery opened January 10 and closed January 26 when the 50,000 lb GHR cap was attained. Subsequent to the closure, an unlicensed vessel fished in federal waters off of Kayak Island and harvested an additional 58,000 lb of scallop meats. Federal

fisheries managers subsequently closed all scallop fisheries in federal waters off Alaska. In August 1995, ADF&G initiated a fishery-independent scallop survey in waters east of Kayak Island to assess stock condition and effects of the postseason harvest.

The January 1996 commercial scallop season remained closed while federal fisheries regulations were restructured. However, ADF&G conducted a systematic area-swept assessment survey in the proximity of Kayak Island using an 8-ft New Bedford style dredge donated by the scallop industry. The dredge was equipped with a liner to maximize retention of scallops of all sizes to facilitate sampling for age, size, and sex. This initial effort established the precedent of a biennial survey to establish GHRs for two consecutive fishing seasons. In March of 1997, the BOF adopted a regulation changing season opening date from January 10 back to July 1.

In 1998, ADF&G expanded its assessment survey to include waters located west of Kayak Island and used these data to establish separate GHRs for waters east and west of Cape Saint Elias (Figure 9). Scallops beds were determined to occupy fairly discrete and limited areas with the highest concentrations occurring in federal waters. Based on results of this survey ADF&G announced a GHR of 6,000 and 14,000 lb of scallop meats for east and west areas respectively.

In March 2000, the BOF adopted regulations restricting the scallop fishery to the Eastern Section of the Outside District. This measure provided the opportunity for some exploration while protecting areas ADF&G did not assess. Based on improved results of the May 2000 assessment survey, GHRs were increased to 9,000 and 21,000 lb of scallop meats for areas east and west of Cape Saint Elias

The GHR for the 2002/03 and 2003/04 season scallop seasons was set at 6,000 lb and 14,000 lb for the east and west harvest areas respectively. During the 2002/03 season the west side closed on February 14 and the east side closed by regulation on February 15 with a harvest total of 15,641 lb from two vessels. Failure of the fishery to achieve the GHR was attributed to scheduling by participants. Catch rates in the fishery were comparable to previous seasons. During the 2003/04 season the west side closed on January 23 and the eastside closed on January 24 with a fishery harvest total of 19,980 lb from a single vessel.

Following the May 2004 assessment survey, The GHRs for the 2004/05 season were established at 26,000 lb and 24,000 lb for waters east and west of Cape Saint Elias. The east side closed on October 22 and the west side closed by regulation on February 15 with a fishery harvest total of 49,320 lb from two vessels.

## **2005/06 FISHERY**

The 2005/06 scallop season opened July 1 with GHRs of 26,000 and 24,000 lb of scallop meats for harvest areas east and west of Cape Saint Elias. Waters west of the longitude of Cape Saint Elias were closed to commercial scallop fishing on August 13. Waters east of the longitude of Cape Saint Elias closed to commercial scallop fishing on August 22. The total harvest from three vessels was 49,205 lb, Tanner crab bycatch estimates were 173 and 234 for the east and west areas.

Figure 10 depicts the estimated shell height (SH) distributions of the retained and discarded scallop catch in the PWS fishery based on statistical resampling of the discarded and retained SH measurements in equal proportion. The 2005/06 histogram depicts a fairly narrow range of scallop sizes that supported the fishery with scallop SH of 125–140 mm comprising

approximately 77% of the catch sample. However, recruitment to the scallop population  $SH < 120$  mm is better represented by a broader range of sizes than in other years.

A summary of the scallop catch in round weight (lb) of retained scallops, meat weight (lb) of retained scallops, dredge-hours, and CPUE expressed in lb of scallop meats per dredge hour (meat lb/drg-hr) from the 1993/94 through 2005/06 seasons is depicted in Figure 11. The 2005/06 fishery CPUE of 100 meat lb/drg-hr is slightly below average. However, a decline in CPUE was anticipated as two vessels each fished with a single six-ft dredge.

## **STOCK STATUS**

The Central Region commercial fisheries research staff conducts scallop surveys via a systematic area-swept assessment. The survey conducts 1 nautical mile tows with an 8-foot scallop dredge equipped with a fine mesh liner to maximize retention of scallop samples that are used for assessing age and size composition and sexual maturity. Central Region staff is also conducting a dredge catchability study using cameras on the dredge and combining it with some preliminary video scallop work. Fishery-independent surveys of the east and west scallop beds adjacent to Kayak Island (Figure 9) were conducted in 1996, 1998, 2000, 2002 and 2004.

The 2002 assessment survey yielded poor results. Available age composition data indicated poor recruitment for this population. A decline in stock biomass would be expected given the relatively poor recruitment observed in recent years. However, it is likely that population biomass estimates were artificially low due to difficulties with the survey gear. As a precaution, ADF&G applied the GHR from the 1998 assessment levels to the 2002/03 and 2003/04 season scallop seasons.

Results of the 2004 assessment survey were substantially improved and GHRs of 26,000 lb and 24,000 lb for waters east and west of Cape Saint Elias were established by applying harvest rates of 5.2% and 5.3% to the respective population estimates. The combined GHRs are currently at the limit of the guideline harvest range cap established in regulation (0 - 50,000 lb). The GHL established in regulation appears to be appropriate for a long-lived species such as weathervane scallops with a maximum age in excess of 20 years.

Survey age composition has ranged from age-1 zero to age-20. The progression of strong cohorts is somewhat difficult to see in the data. The dominant age classes in most years are between seven and 12 years old, but the full range of age and size classes are observed in the survey data (Table 10). In 67% of the surveys, weighted age composition data indicated that well over ½ of the surveyed population was between ages seven and 12; however the catch of younger and older scallops is still good (Table 10). Such diversity in the age composition of the survey catch as well as in the fishery indicates relatively strong resilience to population disturbances.

## **COOK INLET REGISTRATION AREA**

The Cook Inlet Management Area (Area H) as it applies to the commercial scallop fishery, is defined as those waters of Cook Inlet and the outer Kenai Peninsula located north of the latitude of Cape Douglas (58° 51.10' N. lat.) on the Alaska Peninsula and west of the longitude of Cape Fairfield (148° 50.25' W. long.) (Figure 12). The management area is divided into seven shellfish districts: Northern, Central, Kamishak, Southern, Barren Islands, Outer, and Eastern.

## **HISTORIC BACKGROUND**

The commercial Pacific weathervane scallop fishery in the Cook Inlet Management Area dates to 1983 when the department first issued commissioner's permits for fishing (Table 11). Permits stipulated fishing in the Kamishak District only, with a single 6-foot dredge with 4-inch rings, logbooks, contact with ADF&G prior to and at the completion of each trip, and accommodation of a department observer upon request. By 1984, the dredge and ring size restrictions and a Southern District scallop closure were in regulation. In 1985, the BOF established an August 15 through October 31 regulatory season in the Kamishak District and a GHR of 10,000 to 20,000 pounds of scallop meats. Currently, the Southern District is closed to scallop fishing by regulation to protect crab stocks, while the Outer and Eastern Districts are open to exploratory fishing under a permit issued by ADF&G.

With the exception of a single landing from the Outer District in 1987, the "north" scallop bed, located east of Augustine Island in the Kamishak District produced all harvests from 1983 through 2001 (Table 11; Figure 13). Beginning in 2002 the "south bed" accounted for some or all of a given year's harvest.

## **2005 FISHERY**

The 2005 scallop season in the Cook Inlet Area opened at noon August 15 with a 7,000 lb GHR. Fishing was restricted to the north bed based upon the May 2005 survey results that indicated a stable biomass for this area from the previous survey. The south bed remained closed due to a sharp decline in biomass apparent from the 2005 survey. Bycatch caps of 35,000 Tanner crab and 60 king crab were set based upon the dredge survey's Tanner crab catches and a static king crab bycatch level. Two vessels participated and catch data are confidential. The season closed at 0730 hours August 31 based upon catch projections indicating the GHR would be achieved at that time.

## **Kamishak District**

The Kamishak Bay District is defined as all waters enclosed by a line from 59° 46.15' N. lat., 153° 00.70' W. long., then east to 59° 46.15' N. lat., 152° 20.00' W. long., then south to 59° 03.42' N lat., 152° 20.00' W. long., then southwesterly to Cape Douglas (58° 51.10' N. lat.; Figure 12).

Initial fishing in the Kamishak District began in 1983. In 1987, ADF&G closed the Kamishak scallop fishery by emergency order when the stock declined dramatically. Although the fishery reopened in 1988, no commercial effort occurred in Cook Inlet from 1988 through 1992 because fishermen anticipated poor fishery performance would result in further closure of the fishery. In 1993, the fishery "redeveloped" when three boats harvested 20,115 lb. Logbooks, shell samples, and fishery performance data revealed a small, but healthy, stock of scallops in the Kamishak District.

In early 1995, efforts of a single vessel commercially fishing scallops off the Prince William Sound Management Area exposed a regulatory loophole that resulted in a scallop fishing closure in all federal waters for the balance of 1995. This action effectively closed the Kamishak Bay fishery, which occurs almost exclusively in federal waters. Based on the 1995 closure and results of a 1996 survey, ADF&G set a 1996 fishery GHR of 28,000 lb. Subsequent fishery GHRs from 1997 to 2002 remained at the maximum 20,000 lb level and with the exception of 1998, when inclement weather restricted fishing by the single participating vessel, have been achieved prior to the regulatory

closure date (Table 12). ADF&G has monitored the fishery via logbooks, shell samples, onboard observations, and skipper interviews. Fishery CPUE in pounds of scallop meats caught per hour towed (lb/hr), increased steadily from approximately 50 lb/hr in 1996 to 1998 to a high of 73 lb/hr in 2000 and declined again in 2001. Effort has ranged from one to five vessels. Tanner crab bycatch caps, equal to 0.5% of the estimated Tanner crab abundance, have been set annually and have ranged from 20,000 to 35,000 crab. For king crab, the annual bycatch level has been set at 60, due to continued depression of those stocks. Annual crab bycatch has ranged from 205 to 10,200 Tanner crab and 9 to 53 king crab.

During the 2002 fishery, CPUE declined dramatically to 25 lb/hr and the incidence of “cluckers”, dead scallops with the valves connected but lacking soft tissues, increased to a level previously unobserved in Cook Inlet. Ages of cluckers sampled in the commercial fishery ranged from 2 to 16 years with the majority being age 6 to 8 years. Although age distributions of cluckers compared to live samples appeared similar, a Chi-square test showed a statistically significant difference ( $\chi^2 < .01$ , 15 d.f.). This difference may be partially attributable to the small sample size of cluckers (n = 110) relative to the live scallop sample size (n = 476) and natural mortality.

Scallops sampled from the 2002 fishery and analyzed by ADF&G’s pathology laboratory provided no conclusive explanation for the increased mortality in the stock but did suggest infestation by a polychaete worm *Polydora sp.* that can burrow through the scallop shell and cause toxic mortality. Typically, this occurs through formation of a “mud blister” or pustular abscess along the inner layer of the shell. Anecdotal information suggests that fishermen observed a greater incidence of mud blisters during the 2002 season. Salinity, water temperature, and substrate composition appear to be the determining factors in worm abundance.

Due to a low fishery CPUE and the time-intensive process of sorting live from dead scallops, fishery participants shifted to the “south” bed, located southeast of Augustine Island (Figure 13). Still within the Kamishak District, but previously unsurveyed by ADF&G, the new bed yielded a slightly higher CPUE of 33 lb/hr and a lower incidence of cluckers, reducing the catch sorting time. Age structure in the newly fished area was older with 50% of the scallop fishery samples being older than age 11. In response to the decline in CPUE, the unexplained mortality in the traditional fishing area, and the lack of assessment data for the new bed, ADF&G reduced the 2002 fishery GHLL to 9,000 lb.

Following a survey and stock assessment of both beds in May 2003, ADF&G announced the entire 20,000 lb GHLL would be harvested from the south bed (Table 12). This harvest level equated to approximately a 5.5% harvest rate. Although harvest data are confidential, catch rates in the fishery were approximately half those observed in 2002. In 2004, the fishery was also managed for a 20,000 lb GHLL. Although both beds were open to fishing, a maximum allowable harvest of 6,500 lb of meat was set for the north bed. In the preseason news release, ADF&G announced intent to use this opportunity to assess the status of scallops in the north bed. Catch rates in the north bed were less than half those observed in 2002 and fishing closed on August 19, approximately 4 days after opening. Fishing in the south bed closed September 9 due to catch rates below those observed in the 2003 fishery.

## **STOCK STATUS**

Fishery-independent surveys of the north and south scallop beds in Kamishak Bay (Figure 13) were conducted in 2003, and 2005. In the years prior to 2003 (1984, 1996, 1998, 1999 and

2001), the survey covered only the north scallop bed (as the south bed had not yet been detected).

The survey conducts 1 nautical mile tows with an 8-foot scallop dredge equipped with a fine mesh liner to maximize retention of scallop samples that are used for assessing age and size composition and sexual maturity (Bechtol and Gustafson 2002). The survey involves a quasi-adaptive systematic sampling design using a grid of 1.0 by 1.0 nautical mile squares placed over a chart of the northern and southern weathervane scallop beds located directly east of Augustine Island (Figure 13). This survey is now conducted on a biennial basis with the next survey in 2007, and upcoming modifications to the sampling design will allow extrapolation of dredge tow data to be expanded to a standardized area.

The 2005 scallop biomass estimate for the north bed was 2.7 million lb and for the south bed, 1.37 million lb. Meat recoveries were 6.9% of whole scallop weight. The steep decline in biomass experienced by Kamishak District scallops has been reflected in both ADF&G's survey and fishery CPUE. The north bed declined by approximately 67% between the 2001 and 2003 surveys and appeared to stabilize based upon the 2005 survey. Similarly, the south bed declined by approximately 75% between the 2003 and 2005 surveys.

Survey age composition has ranged from young-of-the-year age zero to age 24 (Bechtol 2000; Bechtol and Gustafson 2002). The progression of strong cohorts can be seen growing across some calendar years, and young age classes tend to be the most abundant age classes in the survey. In 56% of the surveys, weighted age composition data indicated that over ½ of the surveyed population were between ages zero and seven; however the catch of older scallops is still quite good (Table 13). Such diversity in the age composition of the survey catch as well as in the fishery indicates relatively strong resilience to population disturbances. This is likely due to the fact that: (1) the population is supported by a wide range of age classes; and (2) the fishery is not strictly dependent upon recruitment pulses. Size-at-age indicates asymptotic growth for the Kamishak Bay scallop population. The greatest annual growth in height occurs during the first 5 years of life, with growth rates decreasing rapidly to less than 1% per year after about age 13. Annual growth in weight is greatest from about age 2 to age 5.

The regulatory maximum GHL for the Kamishak Bay scallop fishery is 20,000 lb of meats. A retrospective analysis using a preliminary age-structured model suggested that harvest rates of the Kamishak Bay population ranged from 2.6 to 4.7% of the estimated population (Bechtol 2000). These harvest rates are substantially less than the instantaneous natural mortality rate of 14% estimated by the age-structured model, and also less than the median natural mortality estimate of 15% calculated by several methods for weathervane scallops off Alaska. Thus, the 20,000 lb GHL established in regulation is moderately conservative, which is probably appropriate for a long-lived species such as weathervane scallops with a maximum age in excess of 20 years.

### **All other Districts**

Aside from some exploratory fishing in the Outer District in 1987, there has been no interest in fishing for scallops in districts other than the Kamishak District. No concentrations of scallops have been identified during either department surveys or in anecdotal reports from fishermen. Although regulations provide for a permit fishery in the Outer and Eastern Districts, including an observer requirement, it is unlikely ADF&G would issue a permit for exploratory fishing without first

obtaining information on scallop abundance. ADF&G does not anticipate any interest in fishing these districts.

## **KODIAK REGISTRATION AREA**

The Kodiak Registration Area (Area K) includes the waters of the Pacific Ocean south of the latitude of Cape Douglas (58° 51.10' N lat.), east of the longitude of Cape Kumlik (157° 27' W long.) and west of 149° W long. (Figure 16). The Kodiak Registration Area is comprised of the Northeast, Shelikof, and Semidi Island Districts. Extensive areas are closed to scallop fishing to protect crab habitat.

### **HISTORIC BACKGROUND**

In 1967, when commercial fishing for weathervane scallops originated in Alaska, vessel operators targeted fishing grounds along the east side of Kodiak Island. By 1968, 734,084 lb of scallop meats were landed from eight vessels (Table 14). The Kodiak scallop fishery peaked in 1970 when 1.4 million lb of scallop meats were landed from seven vessels. Catches declined by the mid-1970s with no participation in 1977 or 1978. Since 1979, landings have fluctuated from 24,826 lb to 689,497 lb of scallop meats, excluding 1995/96 when all federal waters within Alaska were closed to scallop fishing by federal emergency rule and state waters of the Kodiak Registration Area were closed by an ADF&G emergency order.

When the Alaska weathervane scallop fishery began in 1967, there were no closed seasons. Within two years from inception of the scallop fishery, concerns about dredging impacts on crab resources, specifically red king crab, began to develop. In 1969, by emergency order, the ADF&G closed extensive areas off the south end of Kodiak Island as well as Marmot Bay at the north end of Kodiak Island, to scallop fishing. These areas were closed due to concerns about crab bycatch and conflict with other gear types. Subsequently, the BOF adopted the department's recommendation, and closed both areas by regulation. During the early 1970s, to protect spawning, molting, or softshell red king crab, regulatory season opening dates of either June 1 or July 15 (depending upon geographical area) through March 31 were established by the BOF (Barnhart 2003). In 1990, to protect depressed red king and Tanner crab populations, the BOF closed scallop fishing in Kodiak's westside bays which had been previously closed to non-pelagic trawling. With development of the interim Alaska Scallop Fishery Management Plan in 1993, crab bycatch limits were developed for the Kodiak Area. In 1994, with passage of the Alaska Scallop Fishery Management Plan, the regulatory season for weathervane scallops in the Westward Region was established by the BOF as July 1 through February 15.

### **2005/06 FISHERY**

The 2005/06 scallop fishing season was open July 1, 2005 through February 15, 2006. Two catcher-processors fished in the Kodiak Registration Area. To facilitate distribution of fishing effort and crab bycatch limits, red king crab districts as described in 5 AAC 34.405 were utilized.

### **Northeast District**

The Northeast District (Figure 16) of the Kodiak Registration Area as applied to the scallop fishery includes all waters northeast of a line extending 180° from the easternmost tip of Cape Barnabas, east of a line from the northernmost tip of Inner Point on Kodiak Island to the southernmost tip of Afognak Point, east of 152° 30' W long. in Shuyak Strait, and east of the longitude of the northernmost tip of Shuyak Island at 152° 20' W. long.

The GHR for the Northeast District was set at zero to 80,000 lb of scallop meats (Table 15). For a second consecutive year, the GHR for the Northeast District of the Kodiak Registration Area was subdivided into harvest caps by individual statistical area or group of statistical areas. A statistical area is a defined block 30' of latitude by 1° of longitude in offshore waters, and smaller irregular areas inshore which are used as catch reporting areas for shellfish harvest (Urban 1996). The harvest cap in statistical area 525702 was 30,000 lb of scallop meats while the harvest cap in statistical area 525630 was 25,000 lb of scallop meats. The remaining 25,000 lb of the overall GHR was allocated to any other waters open to scallop fishing in the Northeast District.

Three catcher-processors participated in the fishery with initial effort in early July. Based on inseason observer reports, an estimated 28,543 Tanner crabs and no red king crabs were caught from a bycatch limit of 449,403 Tanner crabs and 45 red king crabs. Based on indications from observer reports that upper-end harvest caps would be met, statistical area 525630 was closed on December 11, 2005, the remainder of the Northeast District except statistical area 525702 was closed on December 19, 2005, and statistical area 525702 was closed on January 17, 2006. The Northeast District scallop harvest as reported on fish tickets, totaled 79,990 lb of scallop meats (Table 15).

Figure 17 depicts the estimated SH distributions of the retained and discarded scallop catch in the Northeast District, based on statistical resampling of the discarded and retained SH measurements in equal proportion. The histograms depict annual recruitment to the Northeast District scallop population with above average recruitment in 2005/06, based on the estimated frequency of scallops <115 mm SH in the size distribution. A broad range of scallop sizes supports the fishery. The average SH of retained scallops in the Northeast District during the 2005/06 season was 139 mm as compared to 144 mm SH during the previous season (Table 16).

A summary of the scallop catch in round weight (lb) of retained scallops, meat weight (lb) of retained scallops, dredge hours, and CPUE expressed in lb of scallop meats per dredge-hour (meat lb/drg-hr) from the 1993/94 through 2005/06 seasons is depicted in Figure 18. Between the 1999/2000 and 2004/05 seasons, the fishery in this district was characterized by relatively steady effort (dredge hours), level harvest of meats, and stable to increasing fishery performance as measured by CPUE in meat lb/drg-hr. However, during the 2005/06 season, dredge hours increased and CPUE decreased with the entry of a participant unfamiliar with the fishing grounds.

### **Stock Status**

The weathervane scallop population in the Northeast District of the Kodiak Registration Area is not currently surveyed and no estimate of abundance has been made. As scallop survey technology is advanced, this population will likely be surveyed. Since the 1999/2000 season, the commercial catch has remained level, ranging from 77,119 to 80,470 lb of scallop meats (Table 16). Over the same time period, the estimated round weight of the retained scallop catch ranged from 681,192 lb to 952,972 lb (Table 17).

### **Shelikof District**

The Shelikof District of the Kodiak Registration Area includes all waters north of a line from the westernmost tip of Cape Ikolik to the southernmost tip of Cape Kilokak, west of a line from the northernmost tip of Inner Point on Kodiak Island to the southernmost tip of Afognak Point, west



of 152° 30' W long. in Shuyak Strait, and west of the longitude of the northernmost tip of Shuyak Island at 152° 20' W long. (Figure 16).

The GHR for the Shelikof District was set at zero to 160,000 lb of scallop meats (Table 18). The district was divided into north and south zones at the latitude of Cape Chiniak, 58° 30' N lat., with a harvest cap in the north zone of 130,000 lb of scallop meats and a harvest cap in the south zone of 30,000 lb of scallop meats. Two catcher-processors participated in the fishery with initial effort in early-July. Based on inseason observer reports, an estimated 17,149 Tanner crabs and no red king crabs were caught from a bycatch limit of 51,822 Tanner crabs and 1,345 red king crabs. Based on indications from observer reports that upper-end harvest caps would be met, the north zone was closed on December 9, 2005. The remainder of the district including the south zone, closed on December 11, 2005. The Shelikof District scallop harvest as reported on fish tickets, totaled 159,941 lb of scallop meats (Table 16, 18).

Figure 19 depicts the estimated SH distributions of the retained and discarded scallop catch in the Shelikof District, based on statistical resampling of the discarded and retained SH measurements in equal proportion. The histograms depict annual recruitment to the Shelikof District scallop population with below average recruitment in 2005/06 based on the estimated frequency of scallops <115 mm SH in the size distribution. A broad range of scallop sizes has historically supported the fishery. The average SH of retained scallops in the Shelikof District during the 2005/06 season of 136 mm was similar to the average SH of 137mm recorded during the previous season. Since the 1993/94 season, the average annual SH has ranged from 128 mm to 140 mm (Table 16).

A summary of the scallop catch in round weight (lb) of retained scallops, meat weight (lb) of retained scallops, dredge hours, and CPUE (meat lb/drg-hr) in the Shelikof District from 1994/95 through 2005/06 is depicted in Figure 20. CPUE increased from 50 meat lb/drg-hr during the 2004/05 season to 70 meat lb/drg-hr in 2005/06 season (Table 18).

### **Stock Status**

The weathervane scallop population in the Shelikof District of the Kodiak Registration Area is not currently surveyed. Experimental scallop video research was conducted in the Shelikof District in 2004. A scallop video stock assessment is planned for 2007. Between the 1998/1999 and 2003/04 seasons, the commercial catch remained level, as the department allowed the annual harvest to reach the upper limit of the GHR, set at 180,000 lb of scallop meats. However, in 2004/05, the season was closed prior to reaching the GHR cap due to the attainment of the CBL, and in the 2005/06 season, the GHR cap was lowered from 180,000 lb of scallop meats to 160,000 lb of scallop meats. The estimated round weight of the retained scallop catch between 1998/1999 and 2005/06 ranged from 1,454,806 lb to 2,129,025 lb, averaging 1,788,673 lb each season (Table 17).

### **Semidi Island District**

The Semidi Island District of the Kodiak Registration Area includes all Pacific Ocean waters west of the longitude of Cape Kilokak (156° 20.22' W long.) and east of the longitude of Cape Kumlik at 157° 27' W long. (Figure 16). A GHR has not been developed for this district.

State waters of the Semidi Island District were closed to scallop dredging by the BOF at the March 2000 meeting; however, federal waters (EEZ) remain open. No fishing activity occurred

in the Semidi Island District during the 2005/06 fishing season, although it was open from July 1, 2005 to February 15, 2006.

Since the 1993/94 season, harvest has ranged from zero to 55,487 lb of scallop meats (Table 16, 19). Considering years when fishing occurred, CPUE ranged from 16 to 37 meat lb/drg-hr, which is lower than any other registration area or district within the Westward Region (Table 16, 19).

### **Stock Status**

The weathervane scallop population in the Semidi Island District is not surveyed and no estimate of abundance has been made. There are currently no plans to survey this population. No fishing effort has occurred since the BOF closed state waters to scallop fishing in 2000.

## **ALASKA PENINSULA REGISTRATION AREA**

The Alaska Peninsula Registration Area (Area M) includes waters of the Pacific Ocean west of the longitude of Cape Kumlik (157° 27' W long.) and east of the longitude of Scotch Cap Light at 164° 44' W long. (Figure 21).

Areas closed to fishing include all state waters and offshore waters of Unimak Bight and Mitrofanina Island. Justification for the Unimak Bight closure adopted in the early 1970s was to protect king crab habitat. Closing the area to weathervane scallop fishing removed potential conflict with other gear types such as crab pots. The Mitrofanina Island closure was adopted in the mid-1980s to protect Tanner crabs.

### **HISTORIC BACKGROUND**

Historic fishing effort for scallops in the Alaska Peninsula Registration Area was sporadic. Most catch and effort information prior to 1993 is confidential because few fishermen participated in any given year. However, the average annual harvest during the nine years of participation prior to 1993 was 41,888 lb of scallop meats. The highest harvest occurred in 1982 when a reported 205,691 lb of scallop meats were landed from six vessels (Table 18). Since the 1993/94 season, CPUE has ranged from 24 to 61 meat lb/drg-hr (Table 19). Commercial harvest data from this registration area was misreported in the 1980s as evidenced in logbooks seized by Fish and Wildlife Protection agents. The extent of misreporting in the 1980s is unknown, but may have lead to artificially high catch data attributed to the Alaska Peninsula Registration Area in some years.

### **2005/06 FISHERY**

In the Alaska Peninsula Registration Area, the historically important scallop grounds between 160° W long. and 161° W long. were open for a small exploratory fishery with a GHR of 0 to 10,000 lb of scallop meat (Table 19). The GHR for the remainder of the registration area, outside of 160° W long. and 161° W long. was 0 to 10,000 lb of scallop meat, for a total GHR of 0 to 20,000 lb for the area (Table 21).

There was no effort in this fishery during the 2005/06 season (Table 20).

### **STOCK STATUS**

The weathervane scallop population in the Alaska Peninsula Registration Area is not currently surveyed and no estimate of abundance has been made. There are currently no plans to survey this population.

## BERING SEA REGISTRATION AREA

The Bering Sea Registration Area (Area Q) includes waters of the Bering Sea north of a line extending from the latitude of Cape Sarichef at 54° 36' N lat. to 171° W long., north to 55° 30' and west to the U.S.-U.S.S.R. Maritime Boundary Agreement Line of 1990 (Figure 22). Large portions of the eastern Bering Sea shelf and the Pribilof Islands Habitat Conservation Area are closed to scallop fishing to protect blue king crab *Paralithodes platypus*, red king crab, juvenile Pacific halibut *Hippoglossus stenolepis*, and to provide for habitat conservation.

### HISTORIC BACKGROUND

ADF&G records indicate that scallops were first harvested from the Bering Sea in 1987, and then again in 1990 and 1991 (Table 22). During those years, few fishermen participated in any given year, so catch and effort information is confidential. However, the average annual catch for the three confidential years was 68,189 lb of scallop meats. No additional landings were made from this area until calendar year 1993 (January 1-June 30, 1993 and 1993/94 regulatory seasons combined) when 605,953 lb of scallop meats were landed from ten different vessels. During the 1994/95 fishery, 505,439 lb of scallop meats were landed from eight different vessels. The 1995/96 fishery was closed by federal emergency rule which closed all federal waters within Alaska. Between the 1993/94 and 1999/2000 regulatory seasons, scallop catches were constrained by Tanner crab or snow crab CBLs. Over this same time period, catches averaged 127,000 lb of scallop meats per season. Since the 2000/01 season, the Bering Sea fishery has not been constrained by CBLs.

### 2005/06 FISHERY

The GHR for the Bering Sea Registration Area was set at zero to 50,000 lb of scallop meat (Table 23). One catcher-processor participated in the Bering Sea fishery during December 2005. Inseason observer reports showed that an estimated 16,618 Tanner crabs, 5,532 snow and hybrid crabs, and zero red king crabs were caught from a bycatch limit of 65,000 Tanner crabs, 150,000 snow and hybrid crabs and 500 red king crabs. The 2005/06 fishery closed by regulation on February 15, 2006. The Bering Sea scallop harvest as reported on fish tickets, totaled 23,220 lb of scallop meats (Table 22, 23).

Figure 23 depicts the estimated SH distributions of the retained and discarded scallop catch in the Bering Sea Registration Area, based on statistical resampling of the discarded and retained SH measurements in equal proportion. With exception of the 1998/99 and 2001/02 seasons, there has been little recruitment to the population. Predominately large, old animals support the fishery. Since the 1993/94 season when onboard observers began collecting data, average scallop SH has ranged from 141 mm to 154 mm (Table 16). The 2005/06 average SH of 154 mm is the largest since record keeping began in 1993. Bering Sea scallops are among the largest scallops harvested in the Westward Region.

A summary of the scallop catch in round weight (lb) of retained scallops, scallop meat weight (lb) of retained scallops, dredge hours, and CPUE (meat lb/drg-hr) is depicted in Figure 24. The 2005/06 season CPUE of 39 meat lb/drg-hr was slightly higher than the previous season's CPUE of 36 meat lb/drg-hr, the lowest since onboard data collection was initiated during the 1993/94 season (Table 23).

## **STOCK STATUS**

Experimental scallop video stock assessment research was conducted in May 2003. The video stock assessment survey methodology is in a developmental phase; however, there are some interesting results with regard to scallop distribution in the Bering Sea. Typically, scallop beds in the Gulf of Alaska are elongated, have well defined margins and are oriented in a north-south direction consistent with the prevailing coastal currents. However, the Bering Sea scallop bed does not exhibit those same characteristics. The margins are not well defined; nor is it oriented in a north-south direction. The scallops are distributed over a large area at low densities; however, at least one weathervane scallop was counted from each video tow. This is consistent with the low CPUE in this fishery. Small scale aggregations of weathervane scallops necessary for successful broadcast spawning were infrequently observed on the video. This is consistent with data collected from the onboard observer program.

The 2005/06 harvest of 23,220 lb of scallop meats was double that of the previous season, when the harvest was the lowest since observers began collecting data (Table 23). The highest catch occurred in calendar year 1993 when 605,953 lb of scallop meats were harvested. Calendar year 1993 includes the pre-scallop management plan harvest of 321,539 lb taken from January 1, 1993 – June 30, 1993 and the post-scallop management plan harvest of 284,414 lb beginning July 1, 1993 (recorded as the 1993/94 regulatory season; Table 22).

Since inception of the onboard observer program in July 1993 (1993/94 season), the estimated round weight of the retained scallop catch ranged from 129,220 lb in 2004/05 to 5,942,912 lb in 1994/95 (Table 17).

## **DUTCH HARBOR REGISTRATION AREA**

The Dutch Harbor Registration Area (Area O) includes Aleutian Island waters west of the longitude of Scotch Cap Light (164° 44' W long.), east of 171°W. long. and south of the latitude of Cape Sarichef at 54° 36' N lat. (Figure 25).

### **HISTORIC BACKGROUND**

In the Dutch Harbor Registration Area, closed waters were established in 1986 to protect crab nursery areas (Figure 25). Prior to the 1993 season, the registration area was open year-round to scallop dredging. At the March 1994 BOF meeting, the regulatory season date for this registration area was established as July 1 through February 15.

The first harvest of weathervane scallops from the Dutch Harbor Registration Area was in 1982 when 62,105 lb of scallop meats were landed from five vessels (Table 24). Catch data for most years between 1985 and 1992 is confidential, because few vessels participated; however, the average annual catch for those years was 203,695 lb of scallop meats. Commercial harvest data from this registration area was misreported in the 1980s as evidenced in logbooks seized by Fish and Wildlife Protection agents. The extent of misreporting in the 1980s is unknown, but may have lead to artificially high catch data attributed to the Dutch Harbor Registration Area in some years. In addition, productive grounds that contributed significantly to the overall harvest were closed by 1986. Since the 1993/94 season, catches have ranged from zero to 46,432 lb of scallop meats per regulatory season (Table 25). Scallop fishing was limited to state waters during the 1995/96 season because federal waters statewide were closed to scallop fishing by federal emergency rule.

## **2005/06 FISHERY**

The Dutch Harbor Registration Area remained closed for stock conservation.

### **STOCK STATUS**

The Dutch Harbor Registration Area was open one season, 2002/03, out of the last six seasons (Table 24, 25). During that open season one vessel participated, but stopped fishing due to low catches, prior to achieving the upper-end of the GHR. The Dutch Harbor Registration Area may remain closed for up to five years to allow adequate time for juvenile scallops to mature and spawn prior to reopening the fishery under a conservative GHR.

The weathervane scallop population in the Dutch Harbor Registration Area is not surveyed and no estimate of abundance has been made. There are currently no plans to survey this population.

## **ADAK REGISTRATION AREA**

The Adak Registration Area (Area R) includes Aleutian Island and Bering Sea waters west of 171°W. long., and east of the U.S.- Russia Convention Line of 1867 and south of 55° 30' N. lat. (Figure 26).

### **HISTORIC BACKGROUND**

ADF&G records indicate that weathervane scallops were first harvested from the Adak Registration Area in 1979, and then again in 1992, and 1995. During those years few fishermen participated in any given year, so catch and effort information is confidential. Little is known about scallop populations in this area.

The Petrel Bank, between 51°30' N lat. and 54° 30' N lat., west of 179° W long. and east of 179° E long. was closed by emergency order on March 21, 1991 due to concerns about king crab bycatch in the pink scallop *Chlamys* fishery (Figure 26). On November 1, 1991, before the initial emergency order expired, a second emergency order was issued closing this area until June 1, 1994. This allowed time for ADF&G to bring the conservation concerns to the attention of the BOF. In 1993, the BOF adopted the department's recommendation, and closed the area by regulation.

## **2005/06 FISHERY**

The 2005/06 fishery opened July 1, 2005 and closed by regulation on February 15, 2006. The GHR for the Adak Registration Area was set at zero to 75,000 lb of scallop meat. No vessels participated in the fishery during 2005/06 season.

### **STOCK STATUS**

The weathervane scallop population in the Adak Registration Area is not surveyed and no estimate of abundance has been made. There are currently no plans to survey this population. The continental shelf adjacent to the Aleutian Islands is narrow, providing limited weathervane scallop habitat.

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## **TABLES AND FIGURES**



**Table 1.**—Historic statewide commercial weathervane scallop number of vessels, number of landings, and harvest, 1967–2005/06.

Year	Number Vessels	Number Landings <sup>a</sup>	Harvest <sup>b</sup>
1967	2	6	778 <sup>c</sup>
1968	19	125	1,677,268
1969	19	157	1,849,947
1970	7	137	1,440,338
1971	5	60	931,151
1972	5	65	1,167,034
1973	5	45	1,109,405
1974	3	29	504,438
1975	4	56	435,672
1976	7	21	264,788
1977		No Effort	
1978		No Effort	
1979	1	4	24,826 <sup>c</sup>
1980	8	56	616,717 <sup>c</sup>
1981	18	101	924,441
1982	13	120	913,996
1983	5	30	192,310
1984	6	52	383,512
1985	7	47	615,564
1986	8	74	667,258 <sup>d</sup>
1987	4	54	599,947 <sup>d</sup>
1988	4	47	341,070
1989	7	55	534,763
1990	9	144	1,481,136
1991	6	136	1,136,649
1992	8	136	1,785,673
1993 <sup>e</sup>	7	51	568,077
1993/94	15	111	984,583
1994/95	15	104	1,229,384 <sup>d</sup>
1995/96	10	29	410,753 <sup>d</sup>
1996/97	9	30	732,424
1997/98	9	31	818,913
1998/99	8	35	820,845
1999/2000	10	22	838,046

-continued-

**Table 1.**—Page 2 of 2

Year	Number Vessels	Number Landings <sup>a</sup>	Harvest <sup>b</sup>
2000/01	8	20	750,617
2001/02	6	26	572,838
2002/03	6	28	509,455
2003/04	4	32	500,379
2004/05	5	22	431,594
2005/06	4	23	532,741

AVERAGE 1990-1994/95 was 136 deliveries per year. January 1-June 30, 1993 deliveries were combined with 1993/94 deliveries and considered a single year. AVERAGE 1995/96-2002/03 was 28 deliveries per year.

<sup>a</sup> Prior to and including 1994/95, reported number of landings equals number of fish tickets. After 1995/96, the reported number of landings equals number of off-loads. An off-load typically includes multiple fish tickets, normally one fish ticket per week.

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

<sup>c</sup> Deliveries of unshucked scallops were converted to shucked meats using a 10% conversion factor.

<sup>d</sup> Includes illegal harvest of 59,720 pounds.

<sup>e</sup> January 1 through June 30.

**Table 2.**—Federal and State Weathervane Scallop Permits, 2005/06.

<u>Federal Scallop License Limitation Permits</u>			
<u>License Holder</u>	<u>Vessel Name</u>	<u>MLOA<sup>a</sup></u>	<u>Dredge-Size Restriction</u>
Ocean Fisheries, LLC <sup>b</sup>	Ocean Hunter	102	None
Alaska Scallop, LLC <sup>c</sup>	Provider	96	None
Forum Star, Inc.	Forum Star	97	None
Hogan, Thomas C.	Kilkenny	75	2 scallop dredges combined width less than or equal to 20 feet (6.1m)
Hulse, Max et al.	Wayward Wind	79	2 scallop dredges combined width less than or equal to 20 feet (6.1m)
Gilmartin, Thomas <sup>d</sup>	Arctic Storm	70	None
Provider, Inc	Provider	124	None
Pursuit, Inc	Pursuit	101	None

<u>State Scallop Limited Entry Vessel Permits<sup>e</sup></u>			
<u>License Holder</u>	<u>Vessel Name</u>	<u>Vessel Length</u>	<u>Permitted Vessel Size</u>
Ocean Fisheries, LLC	Ocean Hunter	102	Over 80'
Provider, Inc	Provider	123	Over 80'
Carolina Boy, Inc	Carolina Boy	95	Over 80'
Forum Star, LLC	Forum Star	96	Over 80'
Future Fisheries	Pursuit	101	Permit Cancelled
La Brisa, Inc	Wayward Wind	79	80' or less
Hogan, Thomas C.	Kilkenny	75	80' or less
Gilmartin, Thomas	Arctic Storm	57	80' or less

<sup>a</sup> Maximum length overall measured in feet

<sup>b</sup> Original permit holder was Carolina Boy, Inc.

<sup>c</sup> Original permit holder was Carolina Girl, Inc.

<sup>d</sup> Original permit holder was Oceanic Research Services

<sup>e</sup> State limited entry vessel permits do not have gear restrictions.

Gear restrictions are contained in Alaska Administrative Code Chapter 38.

**Table 3.**—Crab bycatch limits by registration area and district, in percent of the crab abundance estimate or number of crab.

Scallop Registration Areas	Red King Crab	Tanner Crab	Snow Crab
Yakutat (D)			
District 16	a	a	NA
Remainder of Area D	a	a	NA
Prince William Sound (E)			
Eastern Section of outside District	a	East = 2,700; West = 8,700	NA
Cook Inlet (H)			
Kamishak District	60 crabs <sup>b</sup>	0.5%	NA
Outer/Easter/Barren Island Districts	a	a	NA
Kodiak (K)			
Northeast District	0.5% or 1.0%	0.5% or 1.0%	NA
Shelikof District	0.5% or 1.0%	0.5% or 1.0%	NA
Semidi District	Regulated inseason	Regulated inseason	NA
Alaska Peninsula (M)	0.5% or 1.0%	0.5% or 1.0%	NA
Bering Sea (Q)	500 crabs <sup>b</sup>	3 Tier Approach	3 Tier Approach
Dutch Harbor (O)	0.5% or 1.0%	0.5% or 1.0%	NA
Adak (R)	50 <sup>c</sup>	10,000 <sup>c</sup>	NA

<sup>a</sup> Bycatch caps not established.

<sup>b</sup> Based on 0.5% of the Tanner crab population estimated from the 2000 scallop assessment survey

<sup>c</sup> Bycatch limit set to allow scallop fleet opportunity to explore and harvest scallop stocks while protecting the crab resource.

NA = Not applicable

**Table 4.**– Historic commercial catch, effort, and value of weathervane scallops, Yakutat, Area D, 1969–2005/06.

Season	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>c</sup>	Average Price/lb	Est. Value (dollars)	Number Tows <sup>d</sup>
1969	14	59	837,087	14,188	0.85	711,524	<sup>e</sup>
1970	2	2	22,726	11,363	1.00	22,726	<sup>e</sup>
1971	3	10	84,948	8,475	1.05	89,195	<sup>e</sup>
1972	4	6	128,241	21,374	1.15	147,477	<sup>e</sup>
1973	4	4	173,700	43,425	1.20	208,440	<sup>e</sup>
1974	2	15	356,493	23,766	1.30	463,441	<sup>e</sup>
1975	6	11	122,853	11,168	1.40	171,994	<sup>e</sup>
1976	6	15	189,543	12,636	1.59	301,373	<sup>e</sup>
1977	2	3	22,121	7,374	<sup>e</sup>	<sup>e</sup>	<sup>e</sup>
1978				No Effort			
1979	1	1	30	30	2.78	83	<sup>e</sup>
1980	6	22	255,667	18,262	3.60	920,401	<sup>e</sup>
1981	10	36	455,858	12,663	4.00	1,823,432	<sup>e</sup>
1982	6	26	181,939	7,015	3.25	591,302	<sup>e</sup>
1983				No Effort			
1984	2			Confidential			
1985	2			Confidential			
1986	2			Confidential			
1987	1			Confidential			
1988	1			Confidential			
1989	1			Confidential			
1990	8	48	428,046	8,918	3.43	1,468,198	3,203
1991	5	55	402,571	7,319	3.82	1,537,821	3,849
1992	7	60	1,063,838	17,731	3.96	4,212,798	8,023
1993 <sup>f</sup>	5	7	122,770	17,539	5.15	632,266	1,039
1993 <sup>g</sup>	8	9	141,423	15,714	5.15	728,328	1,160
1994	11	18	253,060	14,059	5.79	1,465,217	2,096
1995	10	18	242,491	13,472	<sup>e</sup>	<sup>e</sup>	2,597
1996	4	15	238,736	15,916	6.30	1,504,037	2,102
1997	4	8	242,940	30,368	6.50	1,579,110	1,958
1998/99	8	49	241,678	4,932	6.40	1,546,739	2,193
1999/2000	3	22	249,681	11,349	6.25	1,560,506	1,720
2000/01	3	34	195,699	5,756	5.50	1,076,345	2,111

-continued-

**Table 4.**—page 2 of 2.

Season	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>c</sup>	Average Price/lb	Est. Value (dollars)	Number Tows <sup>d</sup>
2001/02	2 <sup>h</sup>	20	103,800	5,190	5.50	570,900	1,096
2002/03	2 <sup>h</sup>	20	122,718	6,136	5.20	638,134	1,243
2003/04	2 <sup>h</sup>	23	160,918	6,996	5.25	844,820	1,716
2004/05	2 <sup>h</sup>	16	86,950	5,434	5.50	478,225	1,194
2005/06	2 <sup>h</sup>	38	199,351	5,246	8.50	1,694,484	2,585

<sup>a</sup> Reported number of landings equals number of fish tickets.

<sup>b</sup> Pounds of scallop meats as reported on fish tickets.

<sup>c</sup> Pounds of scallop meats.

<sup>d</sup> July 1, 1993-2005/06, number of tows are from vessel logbook data contained in the observer database.

<sup>e</sup> Not available.

<sup>f</sup> January 1, 1993-June 30, 1993, prior to onboard observer requirement.

<sup>g</sup> July 1, 1993-December 31, 1993.

<sup>h</sup> Confidential data voluntarily released by vessel operators.

**Table 5.**—Historic commercial catch, effort, and value of weathervane scallops, Yakutat, District 16, 1980–2005/06.

Season	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>c</sup>	Average Price/lb	Est. Value (dollars)	Number Tows <sup>d</sup>
1980	2	2	5,850	2,925	e	e	e
1981	1	1	7,693	7,693	e	e	e
1982	2	3	26,915	8,972	e	e	e
1983	1			Confidential			
1984	2			Confidential			
1985				No Effort			
1986				No Effort			
1987				No Effort			
1988				No Effort			
1989				No Effort			
1990	4	9	162,888	18,099	3.43	558,706	718
1991	3	9	39,817	4,424	3.82	152,101	665
1992	2			Confidential			
1993 <sup>f</sup>	1			Confidential			
1993	1			Confidential			
1994	8	10	27,613	2,761	5.79	159,879	241
1995	7	8	33,302	4,163	e	e	599
1996	2 <sup>g</sup>	4	34,060	8,515	6.30	214,578	554
1997	4	5	22,890	4,578	6.50	148,785	299
1998/99	3	6	34,153	5,692	6.40	218,579	359
1999/2000	2 <sup>g</sup>	5	34,624	6,925	6.25	216,400	291
2000/01	3	11	30,904	2,809	5.50	169,972	244
2001/02	2 <sup>g</sup>	7	20,398	2,914	5.50	112,189	193
2002/03	2 <sup>g</sup>	3	3,685	1,228	5.20	19,162	55
2003/04	2 <sup>g</sup>	2	1,072	536	5.25	5,628	12
2004/05	2 <sup>g</sup>	6	24,430	4,072	5.50	134,365	213
2005/06	2 <sup>g</sup>	4	13,650	3,413	8.50	116,025	197

<sup>a</sup> Reported number of landings equals number of fish tickets.

<sup>b</sup> Pounds of shucked scallop meats as reported on fish tickets.

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

<sup>d</sup> 1994-2005/06, number of tows are from vessel operator logbook/observer database.

<sup>e</sup> Not available.

<sup>f</sup> January 1, 1993-June 30, 1993, prior to onboard observer requirement.

<sup>g</sup> Confidential data voluntarily released by vessel operators.

**Table 6.**–Yakutat, District 16 scallop fishery summary statistics, 1993–2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Commercial Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)	Estimated round weight of scallop catch	CPUE (Estimated round weight of scallops per dredge hr)	Average Shell Height <sup>d</sup>
1993	1	35,000				Confidential		
1994	7 <sup>e</sup>	35,000	408	27,613	68	239,867	587	147 <sup>f</sup> /151 <sup>g</sup>
1995	6 <sup>e</sup>	35,000	1,095	33,302	30	447,469	409	132
1996	2 <sup>h</sup>	35,000	917	34,060	37	422,064	460	126 <sup>f</sup> /133 <sup>g</sup>
1997	4	35,000	561	22,890	41	265,882	474	128
1998/99	3	35,000	702	34,153	49	384,286	547	123
1999/2000	2 <sup>h</sup>	35,000	674	34,624	51	292,625	434	125
2000/01	3	35,000	476	30,904	65	310,370	652	118
2001/02	2 <sup>h</sup>	35,000	417	20,398	49	245,319	588	119
2002/03	2 <sup>h</sup>	35,000	100	3,685	37	60,928	609	120
2003/04	2 <sup>h</sup>	35,000	18	1,072	59	16,780	839	121
2004/05	2 <sup>h</sup>	35,000	419	24,430	58	326,228	780	120
2005/06	2 <sup>h</sup>	35,000	407	13,650	34	209,487	515	119

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Average scallop shell heights (SH) in mm.

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

<sup>f</sup> Winter season.

<sup>g</sup> Summer season.

<sup>h</sup> Confidential data voluntarily released by vessel operator.



**Table 7.**—Yakutat, Area D scallop fishery summary statistics, 1993–2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Commercial Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)	Estimated round weight of scallop catch	CPUE (Estimated round weight of scallops per dredge hr)	Average Shell Height <sup>d</sup>
1993 <sup>e</sup>	7 <sup>f</sup>	250,000	1,999	141,423	71	2,082,824	1,042	118
1994	10 <sup>f</sup>	250,000	4,130	253,060	61	3,337,283	808	121 <sup>g</sup> /122 <sup>h</sup>
1995	8 <sup>i</sup>	250,000	4,730	242,491	51	3,214,968	680	124
1996	4	250,000	4,438	238,736	54	3,195,254	720	121 <sup>g</sup> /122 <sup>h</sup>
1997	4	250,000	3,956	242,940	61	3,282,860	830	119
1998/99	8	250,000	4,192	241,678	58	3,475,996	829	123
1999/2000	3	250,000	3,840	249,681	65	3,119,103	812	124
2000/01	3	250,000	4,241	195,699	46	2,734,559	645	123
2001/02	2 <sup>j</sup>	200,000	2,406	103,800	43	1,521,537	632	121
2002/03	2 <sup>j</sup>	200,000	2,439	122,718	50	1,541,867	632	123
2003/04	2 <sup>j</sup>	200,000	3,358	160,918	48	1,939,004	577	126
2004/05	2 <sup>j</sup>	200,000	2,134	86,950	41	1,262,499	592	124
2005/06	2 <sup>j</sup>	200,000	5,089	199,351	39	2,662,031	523	123

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Average scallop shell height (SH) in mm.

<sup>e</sup> July 1, 1993-December 31, 1993, after onboard observer requirement.

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

<sup>g</sup> Winter season.

<sup>h</sup> Summer season.

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

<sup>j</sup> Confidential data voluntarily released by vessel operators.

**Table 8.**—Historic commercial catch, effort, and value of weathervane scallops, Prince William Sound Registration Area, 1992–2005/06.

Season	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>c</sup>	Average Price/lb	Est. Value (dollars)	Number Tows <sup>d</sup>
1992	4	14	208,836	52,209	3.96	826,991	1,925
1993 <sup>e</sup>			No Effort				
1993 <sup>f</sup>	7	7	63,068	9,009	5.15	324,800	379
1994/95	Season closed due to regulatory change						
1995/96	3	5	108,000 <sup>g</sup>	21,600 <sup>h</sup>		<sup>h</sup>	243
1996/97	Season closed due to overharvest in 1995/96 from illegal fishing						
1997/98	1 <sup>i</sup>	1	18,000	18,000	6.50	117,000	99
1998/99	2 <sup>i</sup>	2	19,650	9,825	6.40	125,760	104
1999/2000	2 <sup>i</sup>	2	20,410	10,205	6.25	127,562	65
2000/01	3	8	30,266	3,783	5.50	166,463	201
2001/02	1 <sup>i</sup>	7	30,090	4,299	5.50	165,495	138
2002/03	2 <sup>i</sup>	5	15,641	3,128	5.20	81,333	150
2003/04	1 <sup>i</sup>	4	19,980	4,995	5.25	104,895	114
2004/05	2 <sup>i</sup>	6	49,320	8,220	5.50	271,260	336
2005/06	3	9	49,205	5,467	8.50	418,242	549

<sup>a</sup> Reported number of landings equals number of fish tickets.

<sup>b</sup> Pounds of scallop meats as reported on fish tickets.

<sup>c</sup> Pounds of scallop meats.

<sup>d</sup> July 1, 1993-2005/06, number of tows are from vessel logbook data contained in the observer database.

<sup>e</sup> January 1, 1993-June 30, 1993, prior to onboard observer requirement.

<sup>f</sup> July 1, 1993-December 31, 1993.

<sup>g</sup> Catch includes illegal harvest by one vessel; effort data not available for that vessel.

<sup>h</sup> Not available.

<sup>i</sup> Confidential data voluntarily released by vessel operators.

**Table 9.**—Prince William Sound Registration Area scallop fishery summary statistics, 1992–2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Commercial Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)	Estimated round weight of scallop catch	CPUE (Estimated round weight of scallops per dredge hr)	Average Shell Height <sup>d</sup>
1992 <sup>e</sup>	4	<sup>f</sup>	<sup>g</sup>	208,836	<sup>g</sup>	<sup>g</sup>	<sup>g</sup>	<sup>g</sup>
1993 <sup>h</sup>	1				No Effort			
1993 <sup>i</sup>	7	50,000	638	63,068	99	850,718	1,333	124
1994/95				Season closed due to regulatory change				
1995/96	3	50,000	<sup>j</sup>	108,000 <sup>k</sup>	<sup>j</sup>	<sup>j</sup>	<sup>j</sup>	125
1996/97				Season closed due to overharvest in 1995/96 from illegal fishing				
1997/98	1 <sup>l</sup>	17,200	171	18,000	105	257,230	1,504	123
1998/99	2 <sup>l</sup>	20,000	179	19,650	110	334,152	1,867	132
1999/2000	2 <sup>l</sup>	20,000	149	20,410	137	211,140	1,417	132
2000/01	3	30,000	221	30,266	137	361,032	1,634	131
2001/02	1 <sup>l</sup>	30,000	263	30,090	114	511,761	1,946	136
2002/03	2 <sup>l</sup>	20,000	122	15,641	121	231,140	1,895	131
2003/04	1 <sup>l</sup>	20,000	216	19,980	93	261,720	1,212	136
2004/05	2 <sup>l</sup>	50,000	614	49,320	80	407,617	664	134
2005/06	3	50,000	491	49,205	100	818,741	1,667	131

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Average scallop shell height (SH) in mm.

<sup>e</sup> Prior to onboard observer requirement.

<sup>f</sup> Not established.

<sup>g</sup> Not available.

<sup>h</sup> January 1, 1993-June 30, 1993, prior to onboard observer requirement.

<sup>i</sup> July 1, 1993-December 31, 1993

<sup>j</sup> Confidential.

<sup>k</sup> Catch includes illegal harvest by one vessel.

<sup>l</sup> Confidential data voluntarily released by vessel operators.

**Table 10.**—Assigned ages of weathervane scallops from research surveys at Kayak Island, Prince William Sound Management Area, 1996-2004.

Year	Bed	Number Aged	Number of scallops at age (years) <sup>a</sup>															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
1996	East	5,050	198	7	13	115	24	149	682	1,609	1,844	177	72	66	31	25	12	26
1998	East	2,564	290	8	12	3	11	15	37	77	405	707	529	175	113	59	65	58
1998	West	2,953	47	8	40	42	144	264	277	392	687	598	312	63	45	13	9	12
2000	East	5,240	418	58	165	94	25	28	71	123	203	791	1,339	1,090	566	114	109	46
2000	West	9,701	32	43	140	69	101	186	513	899	1,467	1,607	2,196	1,835	494	61	17	41
2002	East	697	4	34	10	12	19	7	1	6	3	33	43	123	126	161	100	15
2002	West	3,168	7	8	6	19	124	28	63	105	111	353	588	601	619	378	129	29
2004	East	593	12	24	12	53	54	12	19	9	13	24	29	42	60	63	85	82
2004	West	465	57	26	3	5	14	3	9	5	22	23	50	57	63	57	33	38

<sup>a</sup> Survey ages were assigned to all measured scallops using a height-at-age matrix developed from aged shells, except for scallops in 2004. Scallops in 2004 are only those that were aged.

**Table 11.**—Historic commercial catch, effort, value of weathervane scallops, Cook Inlet Registration Area, 1983–2005.

Season	Number Vessels	Number Landings <sup>a</sup>	Commercial Catch (lb) <sup>b</sup>	Estimated deadloss discarded at sea (lb) <sup>c</sup>	Average Landing (lb) <sup>d</sup>	Average Price/lb	Est. Value (dollars)	Number Tows
1983				Confidential				
1984	3	9	6,305	<sup>e</sup>	701	3.64	22,950	<sup>e</sup>
1985				Confidential				
1986	3	12	15,364	<sup>e</sup>	1,280	6.34	97,408	<sup>e</sup>
1987				Confidential				
1988				No Effort				
1989				No Effort				
1990				No Effort				
1991				No Effort				
1992				No Effort				
1993	3	15	20,115	<sup>e</sup>	1,341	4.63	93,132	543
1994	4	11	20,431	<sup>e</sup>	1,857	5.85	119,521	467
1995			Federal waters closed - no effort in State waters					
1996	5	21	28,228	<sup>e</sup>	1,344	7.00	197,596	514
1997	3	10	20,336	<sup>e</sup>	2,034	6.16	125,270	<sup>e</sup>
1998				Confidential				
1999	3	14	20,086	229	1,435	7.82	157,072	304
2000	3	5	20,030	486	4,006	3.94	78,918	249
2001				Confidential				
2002	3	5	8,383	208	1,677	6.39	53,567	219
2003				Confidential				
2004	3	6	5,891	226	982	9.58	56,436	180
2005				Confidential				

<sup>a</sup> Reported number of landings equals number of fish tickets.

<sup>b</sup> Pounds of scallop meats as reported on fish tickets.

<sup>c</sup> Estimated pounds of scallop meats based on an estimate of broken-shell scallops discarded at sea, not included in Commercial Catch column.

<sup>d</sup> Pounds of scallop meats.

<sup>e</sup> Not available.

**Table 12.**—Cook Inlet Registration Area scallop fishery summary statistics, 1993–2005.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c,d</sup>	Estimated deadloss discarded at sea (lb meat) <sup>e</sup>	CPUE (lb meat per dredge hr)
1993	3	f	529	20,115	e	38
1994	4	f	454	20,431	e	45
1995		Federal waters closed, no effort in State waters				
1996	5	28,000	534	28,228	e	53
1997	3	20,000	394	20,336	e	52
1998	1	20,000			Confidential	
1999	3	20,000	333	20,086	229	60
2000	3	20,000	276	20,030	486	73
2001	2	20,000			Confidential	
2002	3	20,000	311	8,383	208	27
2003	2	20,000			Confidential	
2004	3	20,000	364	5,891	226	16
2005	2	7,000			Confidential	

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Does not include estimated deadloss discarded at sea.

<sup>d</sup> Pounds of scallop meats as reported on fish tickets.

<sup>e</sup> Estimated pounds of scallop meats based on an estimate of broken-shell scallops discarded at sea.

<sup>f</sup> Not available.

**Table 13.**—Assigned ages of weathervane scallops from research surveys in Kamishak Bay, Cook Inlet Management Area, 1984-2005.

Year	Heights		No.Aged	Number of scallops at age (years) <sup>a</sup>																	
	No. measured	Mean (mm)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18+
1984	1,989	not calculated	1,999	256	302	787	91	3	13	82	65	18	41	62	99	86	58	18	15	2	1
1996	1,942	120.6	798	769	227	846	948	341	70	129	197	231	316	473	692	507	178	74	38	55	83
1998	2,770	139.8	323	32	69	481	381	306	360	236	123	62	87	89	99	155	105	95	44	16	30
1999	7,424	144.3	565	250	154	272	1,228	781	1,090	713	396	183	282	288	302	464	352	322	167	66	114
2001	5,402	153.3	588	60	129	201	110	156	1,128	364	825	443	323	152	252	321	242	245	217	138	96
2003-North	1,874	144.6	518	105	145	52	81	69	82	150	250	193	125	84	100	130	127	59	44	47	20
2003-South	3,388	136.6	552	306	568	115	345	187	147	208	416	307	248	311	219	146	329	326	344	213	225
2005-North	2,234	149.0	600	22	63	134	273	88	128	92	189	291	334	270	152	116	68	87	59	76	74
2005-South	2,194	110.5	420	131	838	189	295	80	88	51	62	80	87	81	85	65	40	59	58	54	85

<sup>a</sup> In the 1984 survey all scallops caught less 4" (age1-3) were aged, with up to 20 greater than 4" (age 4 and older) shells per tow were aged. Between 1996-2005 surveys ages were assigned to all measured scallops using height-at-size matrix developed from aged shells.

**Table 14.**—Historic commercial catch, effort, and value of weathervane scallops, Kodiak Registration Area, 1967–2005/06.

Year	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>b</sup>	Average Price/lb	Est. Value (dollars)	Number Tows
1967 <sup>c</sup>	2	6	778	130	0.70	545	<sup>d</sup>
1968 <sup>c</sup>	8	89	734,084	8,248	0.85	623,971	<sup>d</sup>
1969	11	86	1,012,860	11,777	0.85	861,000	<sup>d</sup>
1970	7	102	1,417,612	13,898	1.00	1,500,000	<sup>d</sup>
1971	5	48	841,211	17,525	1.05	883,000	<sup>d</sup>
1972	5	68	1,038,793	15,276	1.15	1,200,000	<sup>d</sup>
1973	4	42	935,705	22,279	1.20	1,123,000	<sup>d</sup>
1974	3	14	147,945	10,568	1.30	192,000	<sup>d</sup>
1975	3	29	294,142	10,143	1.40	412,000	<sup>d</sup>
1976	1	6	75,245	12,541	1.59	119,000	<sup>d</sup>
1977				No Effort			
1978				No Effort			
1979	1	4	24,826	6,206	2.78	69,000	<sup>d</sup>
1980 <sup>c</sup>	7	33	355,200	10,763	3.60	1,278,720	<sup>d</sup>
1981	15	62	439,804	7,094	4.00	1,759,216	<sup>d</sup>
1982	8	62	435,645	7,026	3.25	1,416,000	<sup>d</sup>
1983	4	24	147,747	6,156	5.00	739,000	<sup>d</sup>
1984	7	37	309,502	8,365	4.00	1,238,000	<sup>d</sup>
1985	3	10	46,971	4,697	4.00	188,000	<sup>d</sup>
1986	5	21	180,600	8,600	4.25	767,550	<sup>d</sup>
1987	3	25	253,451	10,138	3.45	874,406	<sup>d</sup>
1988	3	21	195,811	9,324	3.68	720,584	<sup>d</sup>
1989	5	29	242,557	8,364	3.87	938,696	<sup>d</sup>
1990	7	73	689,497	9,445	3.43	2,364,974	10,950
1991	4	61	514,348	8,432	3.82	1,964,809	12,884
1992	3	43	389,854	9,066	3.96	1,543,822	8,328
1993 <sup>e,f</sup>	4	16	88,279	5,517	5.15	454,637	1,708
1993/94	10	48	315,626	6,576	5.15	1,625,474	7,028
1994/95	10	32	355,628	11,113	5.79	2,052,543	6,449
1995/96				Closed			
1996/97	4	13	268,545	20,657	6.30	1,691,833	2,760
1997/98	5	14	360,339	25,739	6.50	2,342,203	4,757

-continued-



**Table 14.-Page 2 of 2**

Year	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	First Wholesale		
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>b</sup>	Average Price/lb	Est. Value (dollars)	Number Tows
1998/99	8	12	301,600	25,133	6.40	1,930,240	3,515
1999/2000	6	9	266,012	29,557	6.25	1,662,575	2,673
2000/01	5	7	260,052	37,150	5.50	1,430,286	1,989
2001/02	4	8	257,582	32,459	5.50	1,428,196	2,439
2002/03	3	11	260,580	23,689	5.20	1,355,016	2,779
2003/04	2 <sup>g</sup>	13	259,976	19,998	5.25	1,364,874	2,397
2004/05	2 <sup>g</sup>	9	254,727	28,303	5.50	1,400,998	2,454
2005/06	3	12	239,931	19,994	5.50	1,319,620	2,101

<sup>a</sup> Prior to 1995/96, reported number of landings equals number of fish tickets. After 1995/96, the reported number of landings equals number of off-loads.

<sup>b</sup> Pounds of scallop meats as reported on fish tickets.

<sup>c</sup> Deliveries of unshucked scallops were converted to scallop meats using a 10% conversion factor.

<sup>d</sup> Not available.

<sup>e</sup> January 1-June 30.

<sup>f</sup> Includes harvest from exploratory fishery.

<sup>g</sup> Confidential data voluntarily released by vessel operators.

**Table 15.**—Kodiak Registration Area, Northeast District, scallop fishery summary statistics, 1993/94-2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	10	<sup>d</sup>	6,940	155,122	22
1994/95	7	<sup>d</sup>	1,773	35,207	20
1995/96			Closed		
1996/97	3	<sup>d</sup>	581	11,430	20
1997/98	3	<sup>d</sup>	2,604	95,858	37
1998/99	4	<sup>d</sup>	2,749	120,010	44
1999/2000	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 <sup>e</sup>	80,000	1,350	80,000	59
2003/04	2 <sup>e</sup>	80,000	1,248	79,965	64
2004/05	2 <sup>e</sup>	80,000	1,227	80,105	65
2005/06	3	80,000	1,759	79,990	45

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Not established.

<sup>e</sup> Confidential data voluntarily released by vessel operators.

**Table 16.**—Commercial harvest, average shell height from retained catch, and catch per unit effort from observer data, Westward Region, 1993/94–2005/06.

Year	REGISTRATION AREA/DISTRICT <sup>a</sup>																			
	Kodiak Area									Alaska Peninsula			Bering Sea			Dutch Harbor				
	Northeast District			Shelikof District			Semidi District			Harvest <sup>b</sup>	SH <sup>c</sup>	CPUE <sup>d</sup>	Harvest <sup>b</sup>	SH <sup>c</sup>	CPUE <sup>d</sup>	Harvest <sup>b</sup>	SH <sup>c</sup>	CPUE <sup>d</sup>	Harvest <sup>b</sup>	SH <sup>c</sup>
1993/94	155,122	144	22	105,017	128	42	55,487	145	32	112,152	119	61	284,414	146	49	38,731	128	46		
1994/95	35,207	151	20	313,741	131	36	<sup>e</sup>	153	<sup>e</sup>	65,282	127	39	505,439	147	45	1,931	158	24		
1995/96	Closed			Closed			Closed			Closed			Closed			26,950	134	26		
1996/97	11,430	144	20	219,305	136	63	37,810	154	37	12,560	126	38	150,295	147	65	No Effort				
1997/98	95,858	140	37	258,346	139	47	6,135	147	18	51,616	135	29	97,002	151	43	5,790	127	34		
1998/99	120,010	127	44	179,870	137	44	1,720	151	16	63,290	128	39	96,795	147	42	46,432	128	45		
1999/2000	77,119	131	56	187,963	130	44	930	152	21	75,610	124	37	164,929	145	50	6,465	134	24		
2000/01	79,965	135	73	180,087	134	62	No Effort			7,660	119	24	205,520	142	61	Closed				
2001/02	80,470	140	70	177,112	140	52	No Effort			Closed			140,871	141	46	Closed				
2002/03	80,000	140	59	180,580	138	48	No Effort			Closed			92,240	149	45	6,000	133	33		
2003/04	79,965	145	64	180,011	135	55	No Effort			No Effort			42,590	148	42	Closed				
2004/05	80,105	144	65	174,622	137	50	No Effort			No Effort			10,050	144	36	Closed				
2005/06	79,990	139	45	159,941	136	70	No Effort			No Effort			23,220	154	39	Closed				

<sup>a</sup> Confidential data voluntarily released by vessel operators.  
<sup>b</sup> Harvest in pounds of scallop meats.  
<sup>c</sup> Average scallop shell height (SH) in mm.  
<sup>d</sup> Catch per unit effort (CPUE) in pounds of scallop meats per dredge hour.  
<sup>e</sup> Confidential.

**Table 17.**—Estimated round weight of the retained commercial scallop catch and catch per unit effort, Westward Region, 1993/94–2005/06.

REGISTRATION AREA/DISTRICT <sup>a</sup>													
Year	Kodiak Area						Alaska Peninsula		Bering Sea		Dutch Harbor		Total
	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>	CPUE <sup>c</sup>	Harvest <sup>b</sup>
1993/94	2,214,427	319	1,169,664	467	579,836	319	1,061,925	575	3,447,681	598	432,970	517	8,906,503
1994/95	389,202	220	3,522,517	404	<sup>d</sup>	<sup>d</sup>	619,473	372	5,942,912	535	23,590	291	10,497,694
1995/96	Closed		Closed		Closed		Closed		Closed		289,398	276	289,398
1996/97	147,269	253	1,878,268	537	288,117	283	130,235	398	1,432,160	619	No Effort		3,876,049
1997/98	1,143,926	439	3,101,152	565	61,320	176	654,960	374	1,082,825	482	55,725	326	6,099,908
1998/99	1,365,836	497	2,129,025	522	15,806	149	617,120	383	1,193,071	514	427,422	417	5,748,280
1999/2000	952,972	689	1,903,345	442	11,310	253	781,596	386	1,851,620	562	68,070	249	5,568,913
2000/01	681,192	619	1,768,376	608	No Effort		95,510	299	2,376,601	708	Closed		4,921,679
2001/02	822,110	720	1,830,265	539	No Effort		Closed		1,700,578	554	Closed		4,352,953
2002/03	871,918	646	1,857,466	489	No Effort		Closed		952,958	468	59,116	322	3,741,458
2003/04	747,517	600	1,724,498	529	No Effort		No Effort		537,552	527	Closed		3,009,567
2004/05	848,527	692	1,641,608	473	No Effort		No Effort		129,220	470	Closed		2,619,355
2005/06	831,378	473	1,454,806	638	No Effort		No Effort		231,700	385	Closed		2,517,884

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

<sup>b</sup> Harvest in pounds of round scallops.

<sup>c</sup> Catch per unit effort (CPUE) in estimated round weight of retained scallops per dredge-hour.

<sup>d</sup> Confidential.

**Table 18.**—Kodiak Registration Area, Shelikof District, scallop fishery summary statistics, 1993/94–2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	5	d	2,491	105,017	42
1994/95	11	d	8,662	314,051	36
1995/96			Closed		
1996/97	3 <sup>e</sup>	d	3,491	219,305	63
1997/98	4	d	5,492	258,346	47
1998/99	8	d	4,081	179,870	44
1999/2000	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 <sup>f</sup>	180,000	3,258	180,011	55
2004/05	2 <sup>f</sup>	180,000	3,467	174,622	50
2005/06	2 <sup>f</sup>	160,000	2,280	159,941	70

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Not established.

<sup>e</sup> One additional vessel fished but data are not available.

<sup>f</sup> Confidential data voluntarily released by vessel operators.

**Table 19.**—Kodiak Registration Area, Semidi Island District, scallop fishery summary statistics, 1993/94–2004/05.

Season	GHR				
	Number vessels	ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	6 <sup>d</sup>	e	1,819	55,487	32
1994/95	2	e	272	Confidential	
1995/96				Closed	
1996/97	3	e	1,017	37,810	37
1997/98	1 <sup>f</sup>	e	349	6,135	18
1998/99	2 <sup>f</sup>	e	106	1,720	16
1999/2000	1 <sup>f</sup>	e	45	930	21
2000/01		e		No Effort	
2001/02		e		No Effort	
2002/03		e		No Effort	
2003/04		e		No Effort	
2004/05		e		No Effort	
2005/06		e		No Effort	

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Two additional vessels registered but did not fish.

<sup>e</sup> Not established.

<sup>f</sup> Confidential data voluntarily released by vessel operators.

**Table 20.**—Historic commercial catch, effort and value of weathervane scallops, Alaska Peninsula Registration Area, 1975–2005/06.

Year	Number Vessels	Number Landings <sup>a</sup>	Commercial	Average	Average Price/lb	First Wholesale	Number Tows
			Catch (lb) <sup>b</sup>	Landing (lb) <sup>b</sup>		Est. Value (dollars)	
1975	1	1	2,508	2,508	1.40	3,511	<sup>c</sup>
1976			No Effort				
1977			No Effort				
1978			No Effort				
1979			No Effort				
1980			No Effort				
1981			Confidential				
1982	6	20	205,691	10,284	3.35	689,064	<sup>c</sup>
1983			Confidential				
1984			No Effort				
1985			Confidential				
1986			No Effort				
1987			Confidential				
1988			Confidential				
1989			No Effort				
1990			Confidential				
1991			Confidential				
1992			No Effort				
1993 <sup>d</sup>			Confidential				
1993/94	8	7	112,152	16,012	5.15	577,583	949
1994/95	7	11	65,282	5,935	5.79	377,983	1,006
1995/96			Closed				
1996/97	2 <sup>e</sup>	2	12,560	6,280	6.30	79,128	185
1997/98	4	6	51,616	8,603	6.50	335,504	1,054
1998/99	4	4	63,290	15,822	6.40	405,056	684
1999/2000	5	5	75,610	15,122	6.25	472,563	1,107
2000/01	3	3	7,660	2,553	5.50	42,130	189
2001/02			Closed				
2002/03			Closed				
2003/04			No Effort				
2004/05			No Effort				
2005/06			No Effort				

-continued-

**Table 20.**—Page 2 of 2

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<sup>a</sup> Prior to 1995/96, the reported number of landings equals number of fish tickets. After 1995/96, the reported number of landings equals number of offloads.

<sup>b</sup> Pounds of scallop meats.

<sup>c</sup> Not available.

<sup>d</sup> January 1-June 30.

<sup>e</sup> Confidential data voluntarily released by vessel operators.



**Table 21.**—Alaska Peninsula Registration Area scallop fishery summary statistics.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	8	<sup>d</sup>	1,847	112,152	61
1994/95	7	<sup>d</sup>	1,664	65,282	39
1995/96			Closed		
1996/97 <sup>e</sup>	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
1999/2000	5	200,000	2,025	75,610	37
2000/01	3	33,000	320	7,660	24
2001/02			Closed		
2002/03			Closed		
2003/04 <sup>f</sup>		10,000	No Effort		
2004/05 <sup>f</sup>		10,000	No Effort		
2005/06 <sup>g</sup>		20,000	No Effort		

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Not established.

<sup>e</sup> Confidential data voluntarily released by vessel operators.

<sup>f</sup> The area between 160° W long. and 161° W long. was closed. The remainder of the registration area was open to fishing.

<sup>g</sup> The area between 160° W long. and 161° W long. was open for 0 to 10,000 pounds. The remainder of the district was open to an additional 0 to 10,000 pounds.

**Table 22.**—Historic commercial catch, effort and value of weathervane scallops, Bering Sea Registration Area, 1987–2006/07.

Year	Number Vessels	Number Landings <sup>a</sup>	Commercial Catch (lb) <sup>b</sup>	Average Landing (lb) <sup>b</sup>	Average Price/lb	First Wholesale Est. Value (dollars)	Number Tows
1987				Confidential			
1988				No Effort			
1989				No Effort			
1990				Confidential			
1991				Confidential			
1992				No Effort			
1993 <sup>c</sup>	6	22	321,539	14,615	5.22	1,678,434	3,711
1993/94	9	16	284,414	17,776	5.22	1,484,641	3,578
1994/95	8	29	505,439	17,429	6.00	3,032,634	6,619
1995/96				Closed			
1996/97	1 <sup>e</sup>	2	150,295	75,147	<sup>d</sup>	<sup>d</sup>	952
1997/98	2 <sup>e</sup>	5	97,002	19,400	7.05	683,864	1,276
1998/99	4	4	96,795	24,198	6.30	609,808	1,175
1999/2000	2 <sup>e</sup>	4	164,929	41,232	6.25	1,030,806	1,736
2000/01	3	4	205,520	51,380	5.50	1,130,360	1,608
2001/02	3	5	140,871	28,174	5.25	739,572	1,406
2002/03	2 <sup>e</sup>	5	92,240	18,448	5.20	479,648	1,012
2003/04	2 <sup>e</sup>	3	42,590	14,197	5.25	223,597	517
2004/05	2 <sup>e</sup>	2	10,050	5,025	5.25	52,762	145
2005/06	1 <sup>e</sup>	1	23,220	23,220	8.50	197,370	303

<sup>a</sup> Prior to 1995/96, reported number of landings is equal to number of fish tickets. After 1995/96, the reported number of landings is equal to the number of off-loads.

<sup>b</sup> Pounds of scallop meats.

<sup>c</sup> January 1- June 30.

<sup>d</sup> Not available.

<sup>e</sup> Confidential data voluntarily released by vessel operators.

**Table 23.**—Bering Sea Registration Area scallop fishery summary statistics, 1993/94–2005/06.

Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	9	<sup>d</sup>	5,764	284,414	49
1994/95	8	<sup>d</sup>	11,113	505,439	45
1995/96			Closed		
1996/97	1 <sup>e</sup>	600,000	2,313	150,295	65
1997/98	2 <sup>e</sup>	600,000	2,246	97,002	43
1998/99	4	400,000	2,319	96,795	42
1999/2000	2 <sup>e</sup>	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 <sup>e</sup>	105,000	2,038	92,240	45
2003/04	2 <sup>e</sup>	105,000	1,020	42,590	42
2004/05	1 <sup>e</sup>	50,000	275	10,050	37
2005/06	1 <sup>e</sup>	50,000	602	23,220	39

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Not established.

<sup>e</sup> Confidential data voluntarily released by vessel operators.

**Table 24.**—Historic commercial catch, effort, and value of weathervane scallops, Dutch Harbor Registration Area, 1982–2005/06.

Year	Number Vessels	Number Landings <sup>a</sup>	Commercial Catch (lb) <sup>b</sup>	Average Landings (lb) <sup>b</sup>	Average Price/lb	First Wholesale Est. Value (dollars)	Number Tows <sup>c</sup>
1982	5	8	62,105	7,763	3.11	193,147	<sup>c</sup>
1983				No Effort			
1984				No Effort			
1985				Confidential			
1986	5	37	406,642	10,990	3.50	1,423,247	8,752
1987				Confidential			
1988				Confidential			
1989				Confidential			
1990				Confidential			
1991				Confidential			
1992				Confidential			
1993/94	3	6	38,731	6,558	5.15	199,465	572
1994/95	3	3	1,931	644	5.79	11,180	52
1995/96	1 <sup>d</sup>	2	26,950	13,475	<sup>c</sup>	<sup>c</sup>	747
1996/97				No Effort			
1997/98	1 <sup>d</sup>	1	5,790	5,790	7.05	40,819	105
1998/99	4	5	46,432	9,286	6.30	295,522	479
1999/2000	1 <sup>d</sup>	1	6,465	6,465	6.25	40,500	167
2000/01				Closed			
2001/02				Closed			
2002/03	1 <sup>d</sup>	1	6,000	6,000	5.20	31,200	115
2003/04				Closed			
2004/05				Closed			
2005/06				Closed			

<sup>a</sup> Prior to 1995/96, reported number of landings is equal to number of fish tickets. After 1995/96, the reported number of landings is equal to the number of off-loads.

<sup>b</sup> Pounds of scallop meats.

<sup>c</sup> Not available.

<sup>d</sup> Confidential data voluntarily released by vessel operators.

**Table 25.**—Dutch Harbor Registration Area scallop fishery summary statistics, 1993/94–2005/06.

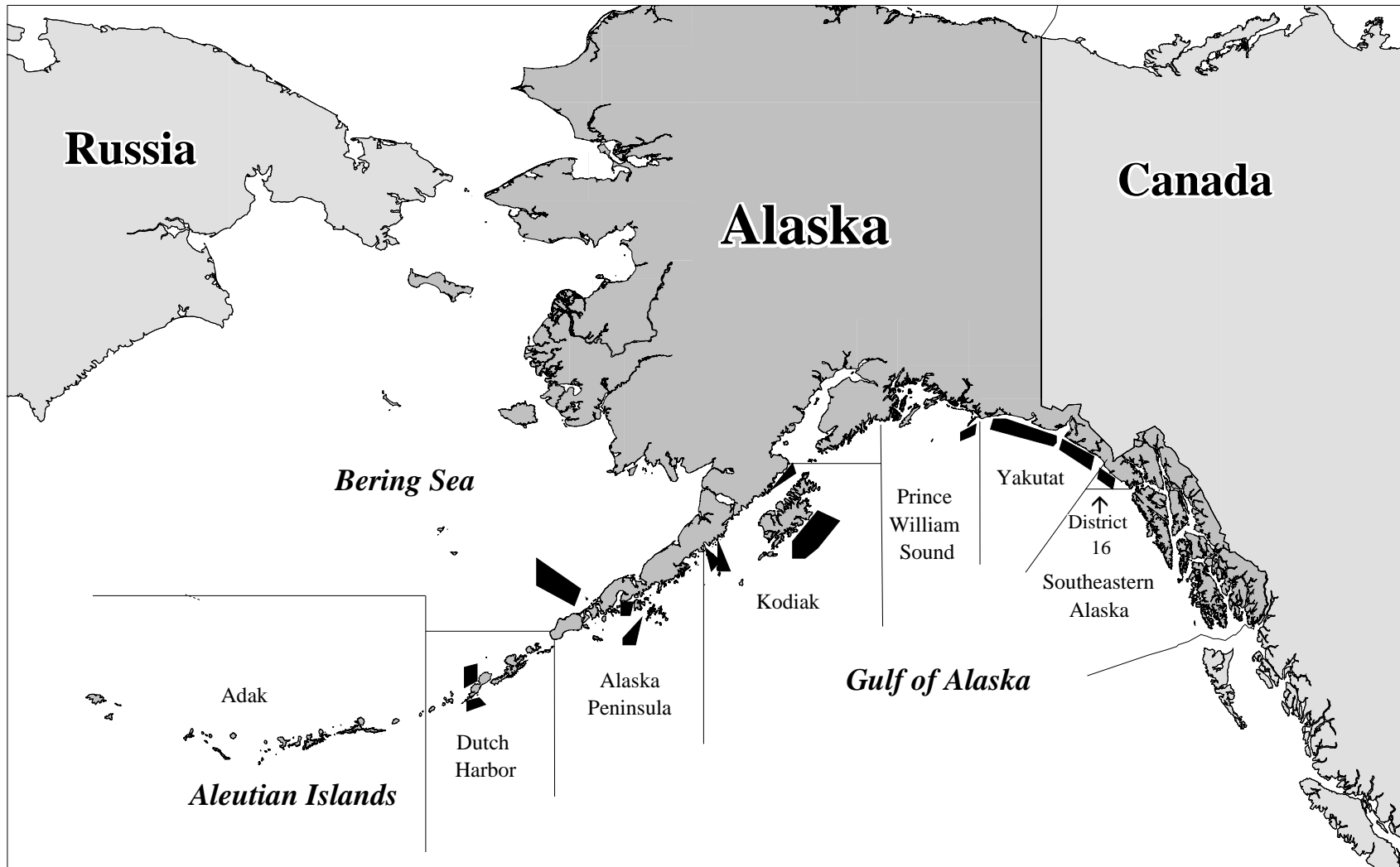
Season	Number vessels	GHR ceiling (lb meat) <sup>a</sup>	Dredge hours <sup>b</sup>	Catch (lb meat) <sup>c</sup>	CPUE (lb meat per dredge hr)
1993/94	3	170,000	838	38,731	46
1994/95	3	170,000	81	1,931	24
1995/96	1 <sup>d</sup>	170,000	1,047	26,950	26
1996/97		170,000		No Effort	
1997/98	1 <sup>d</sup>	170,000	171	5,790	34
1998/99	4	110,000	1,025	46,432	45
1999/2000	1 <sup>d</sup>	110,000	273	6,465	24
2000/01				Closed	
2001/02				Closed	
2002/03	1 <sup>d</sup>	10,000	184	6,000	33
2003/04				Closed	
2004/05				Closed	
2005/06				Closed	

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

<sup>b</sup> Dredge-hour is one dredge fished for 60 minutes.

<sup>c</sup> Pounds of scallop meats as reported on fish tickets.

<sup>d</sup> Confidential data voluntarily released by vessel operators.



**Figure 1.**—Major weathervane scallop fishing locations in coastal waters of Alaska.

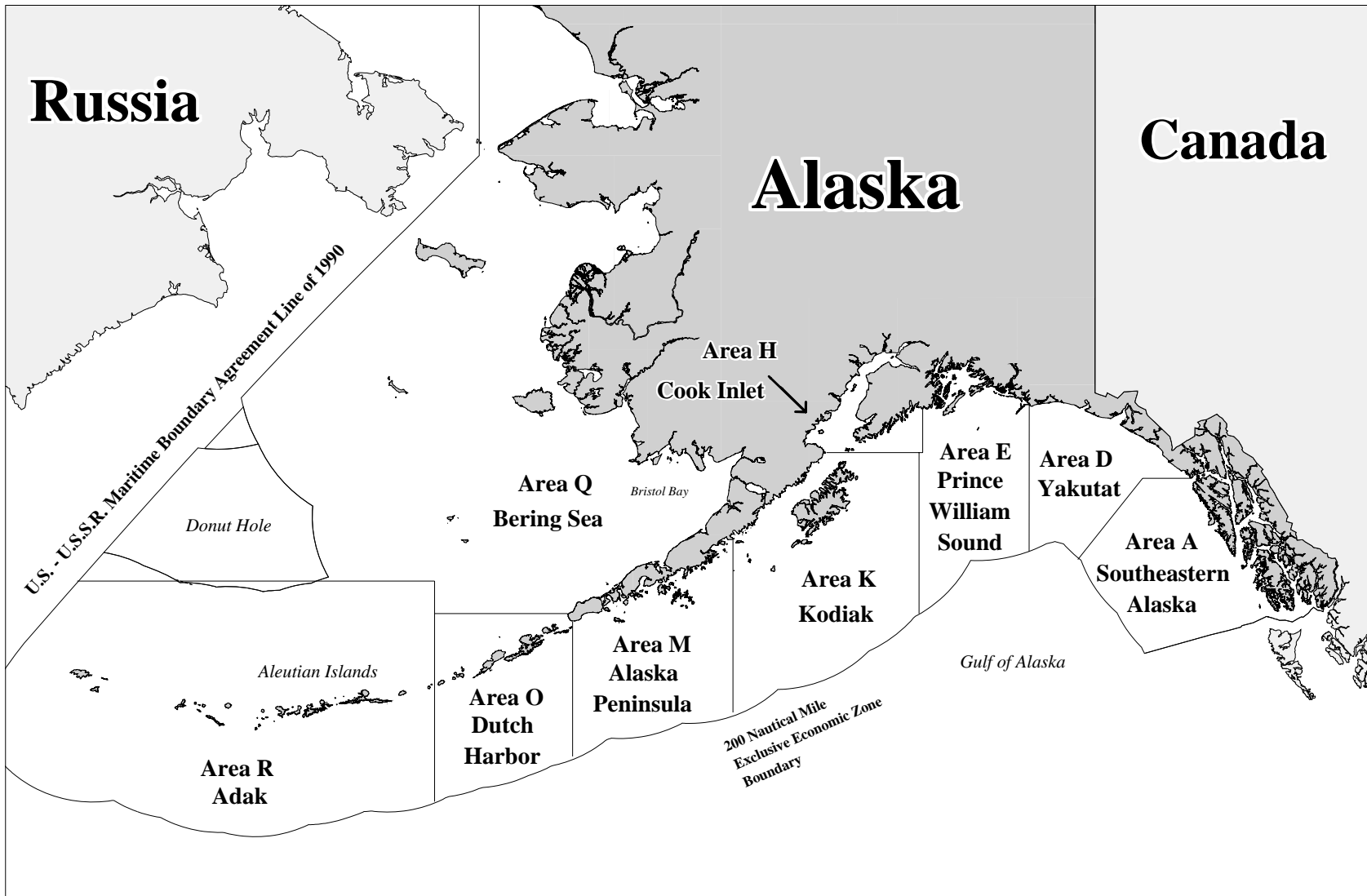


Figure 2.—State of Alaska weathervane scallop fishing registration areas.

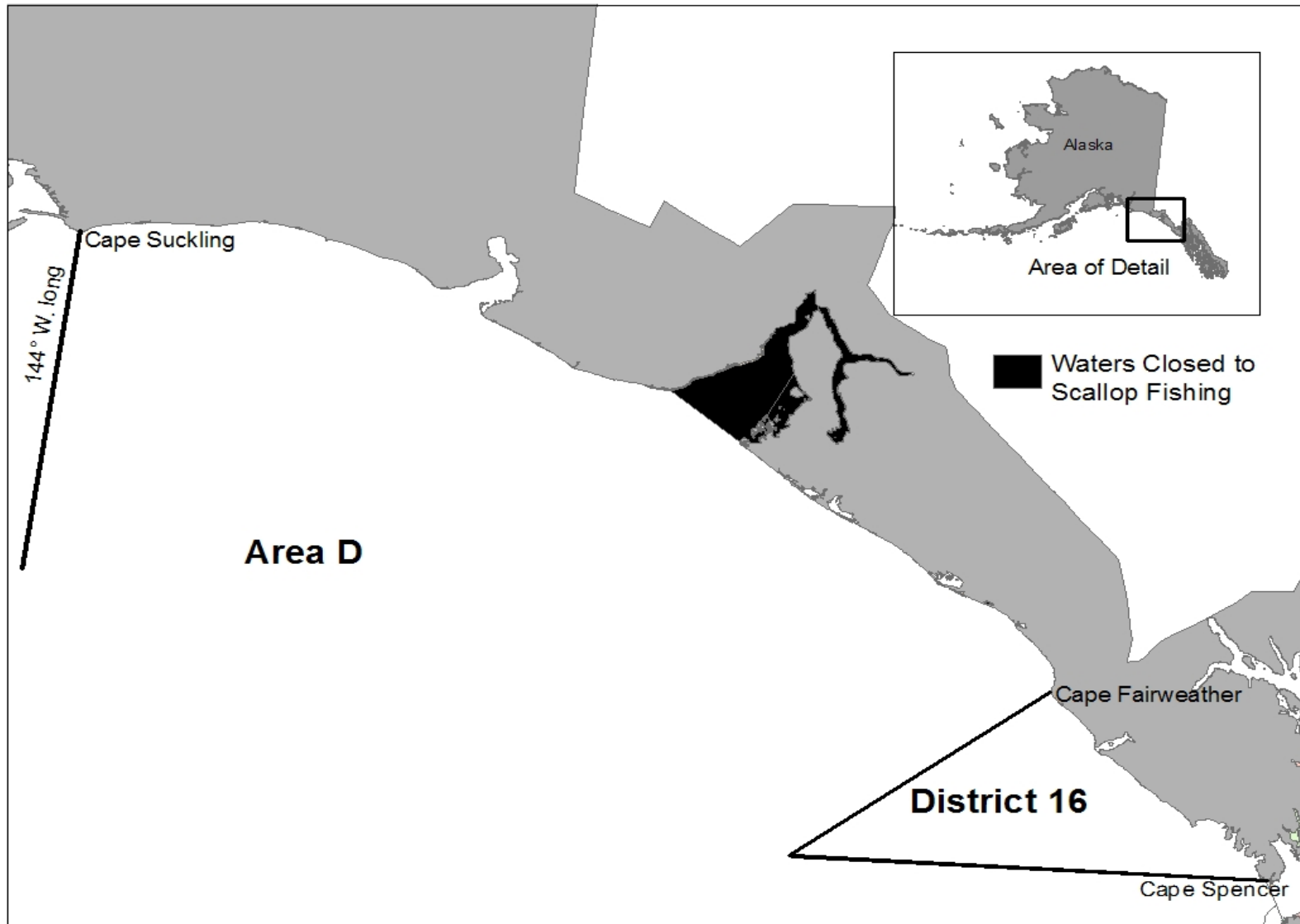
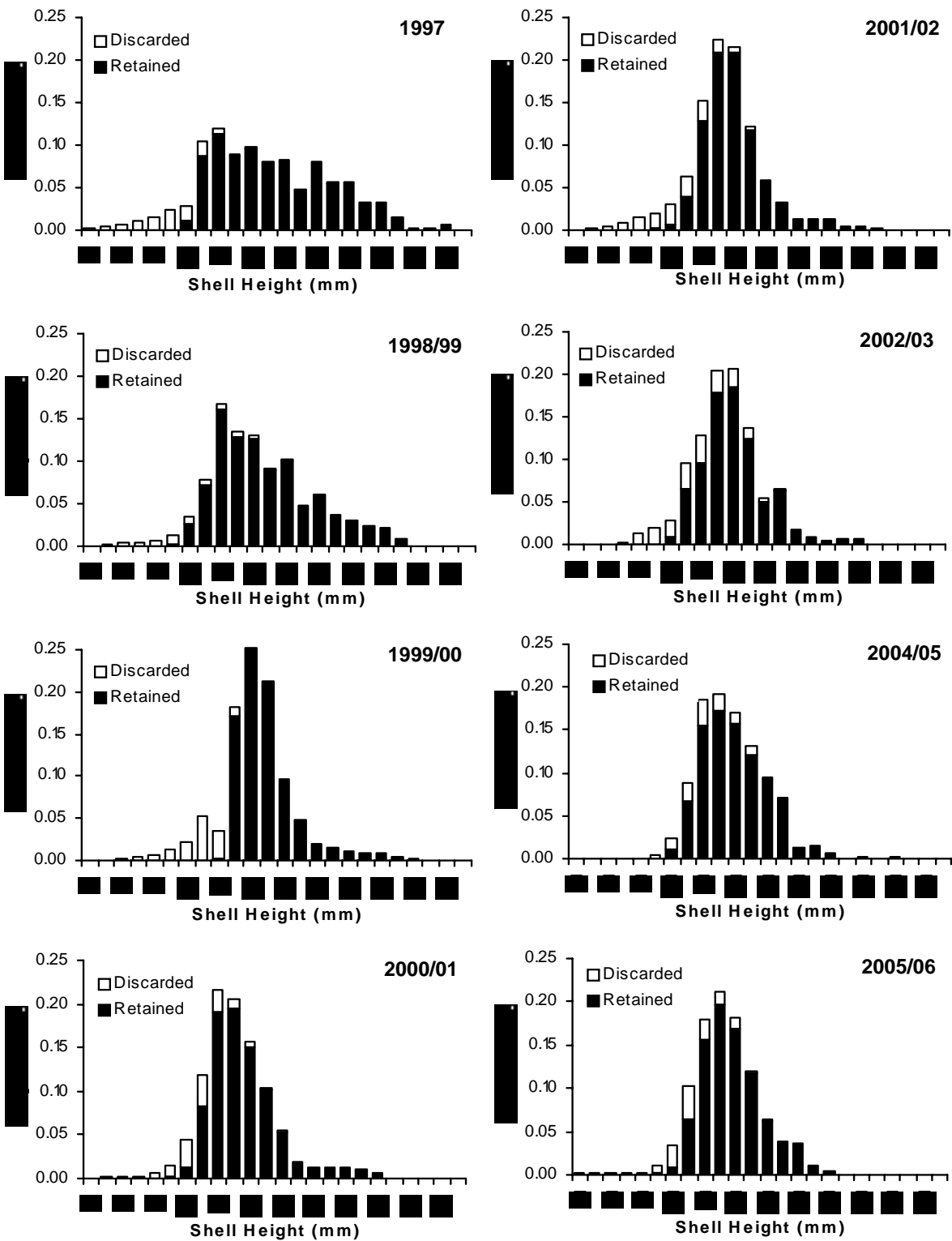
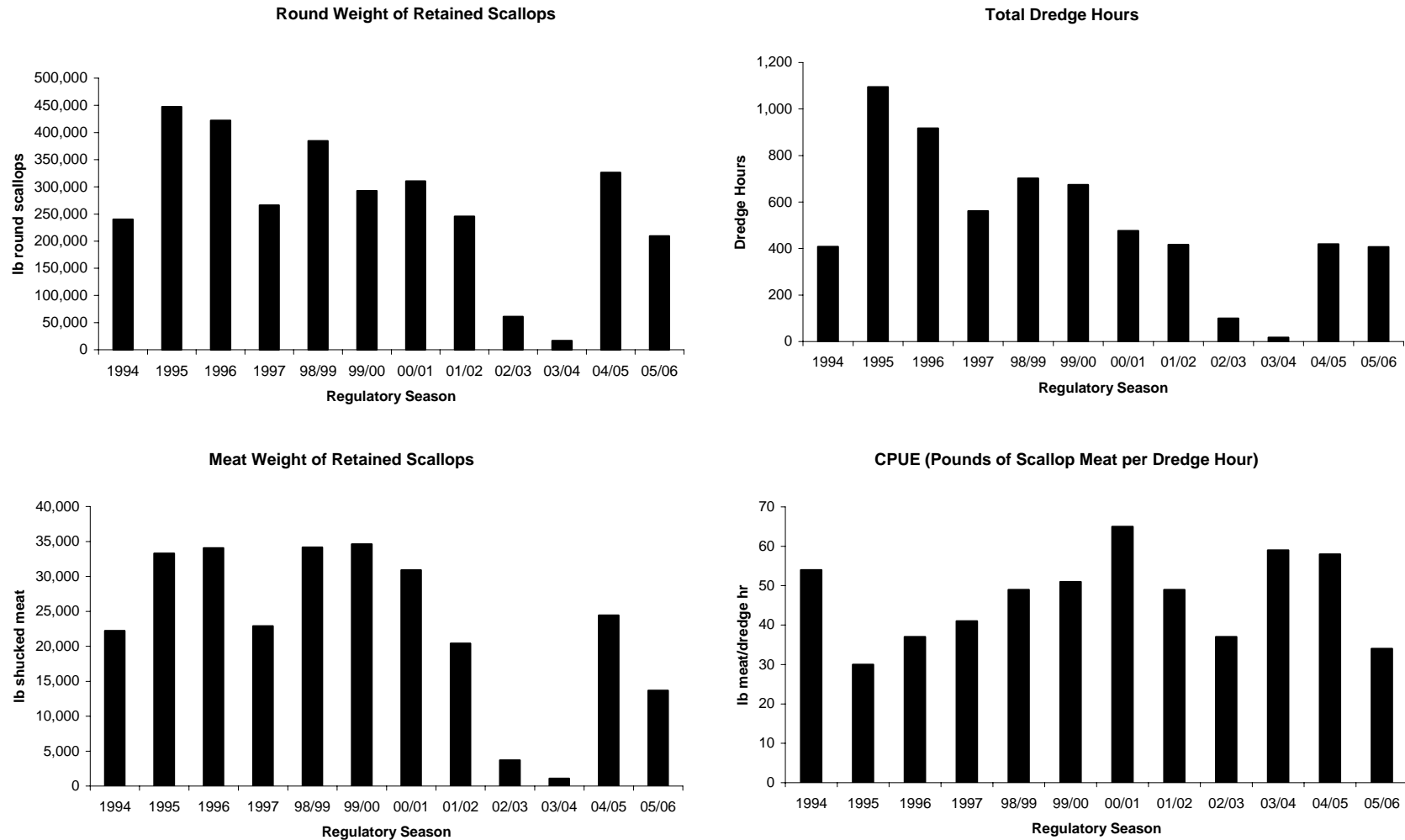


Figure 3.—Yakutat weathervane scallop fishing registration area and closed waters.





**Figure 4.**—Yakutat, District 16, scallop shell heights from resampling observer data, 1997–2005/06.



**Figure 5.**—Weathervane scallop harvest by round weight, dredge hours, and CPUE, District 16, Yakutat Registration Area, 1994–2005/06.

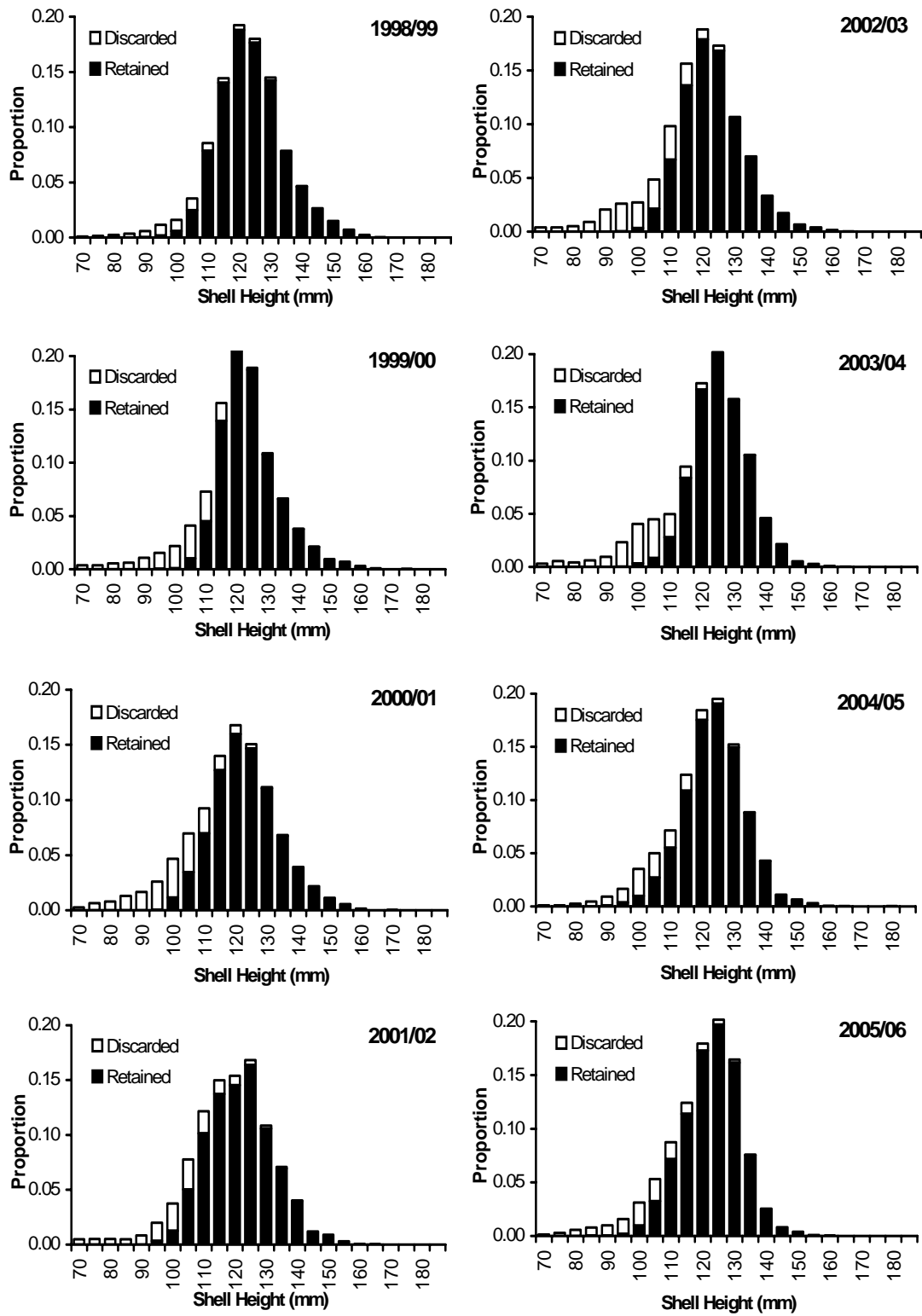
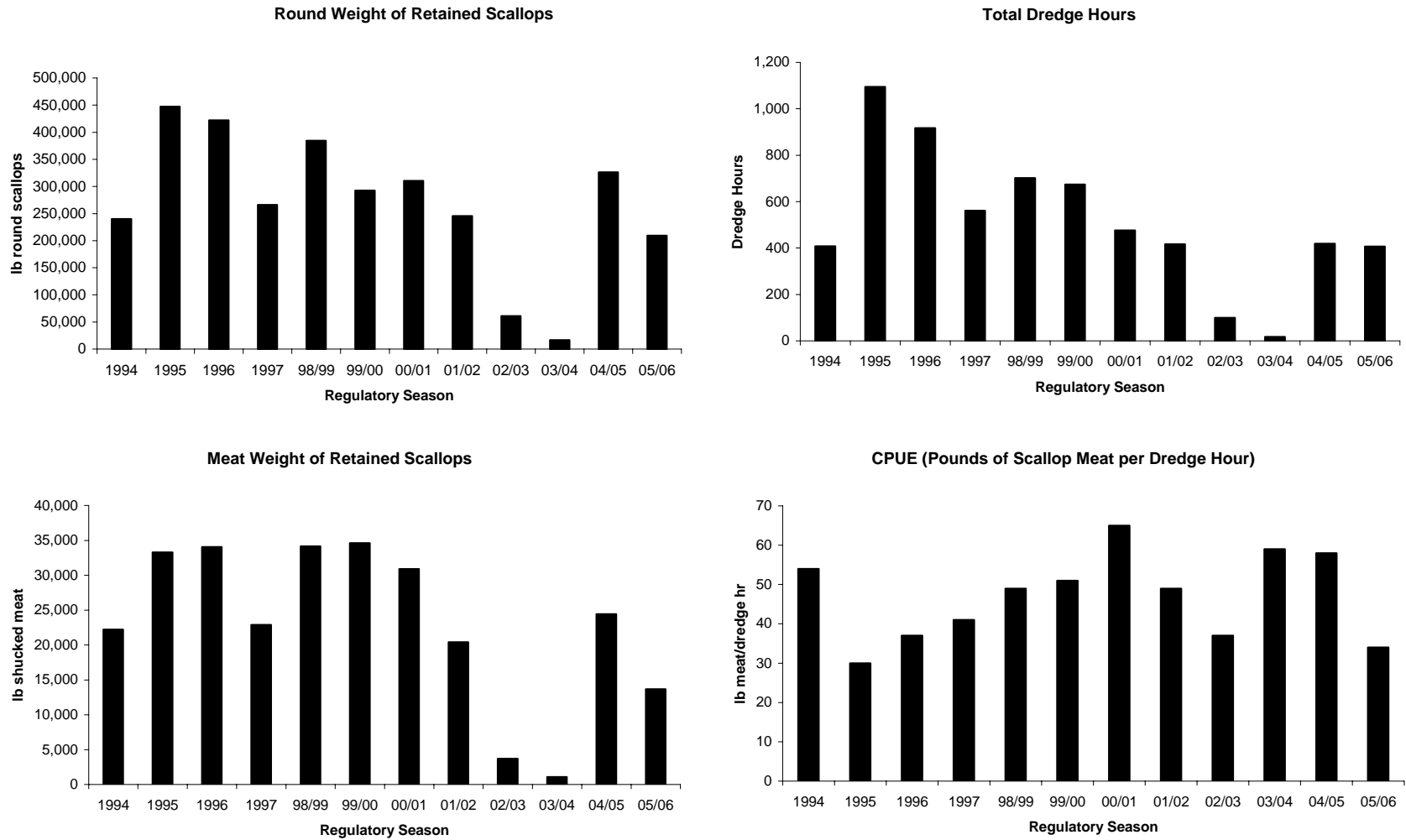
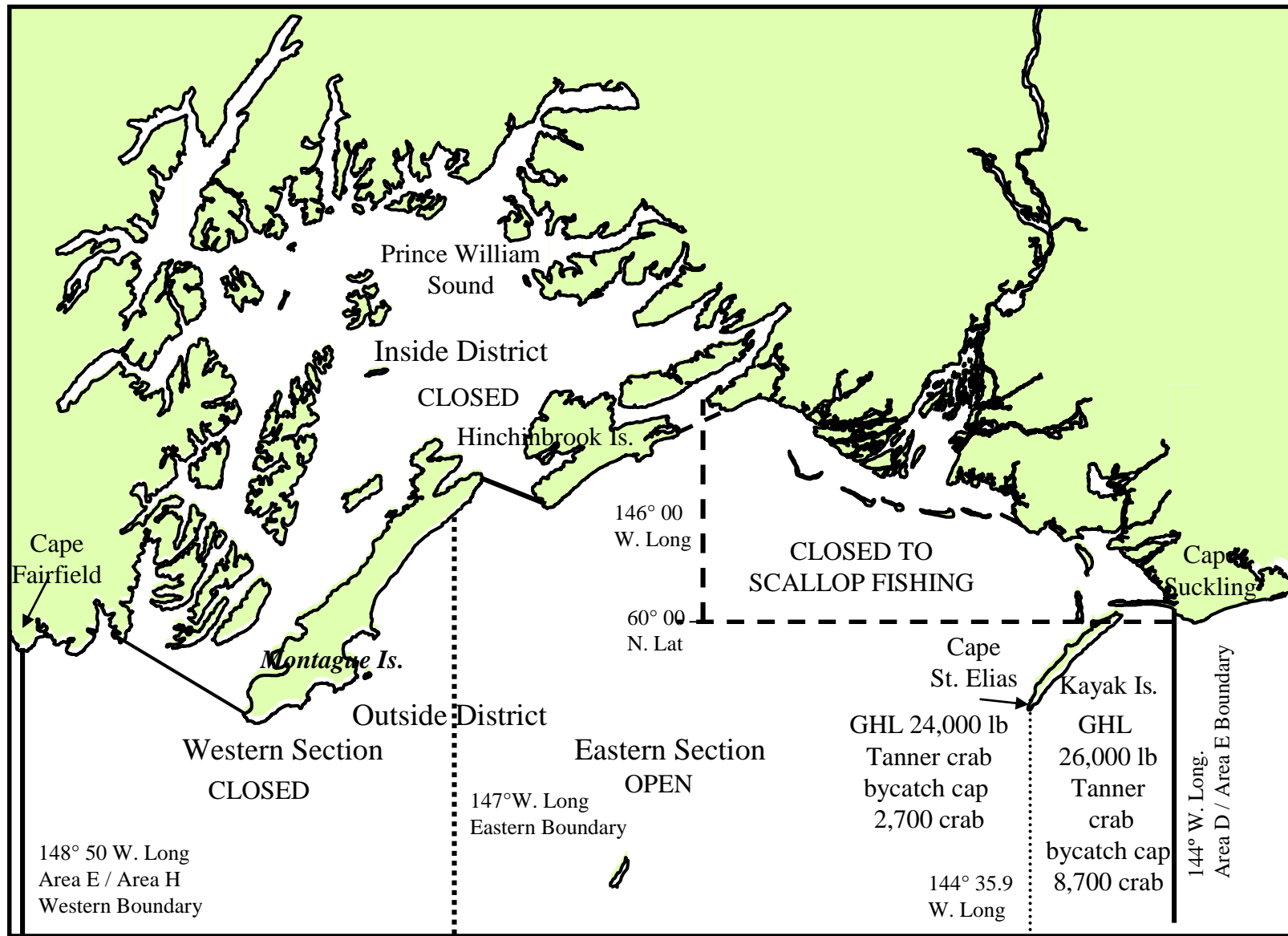


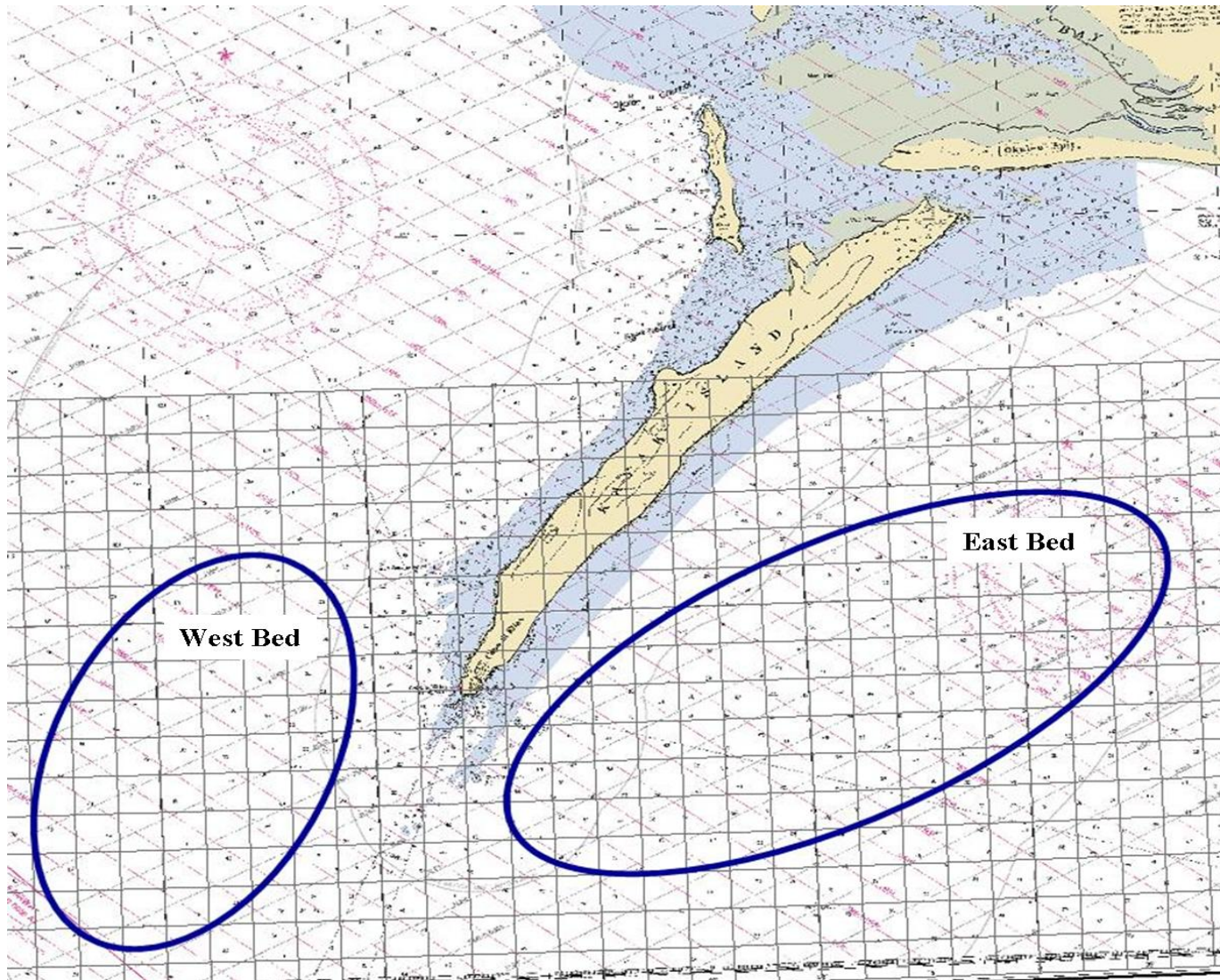
Figure 6.—Yakutat Area D, Scallop shell heights from resampling observer data, 1998/99–2005/06.



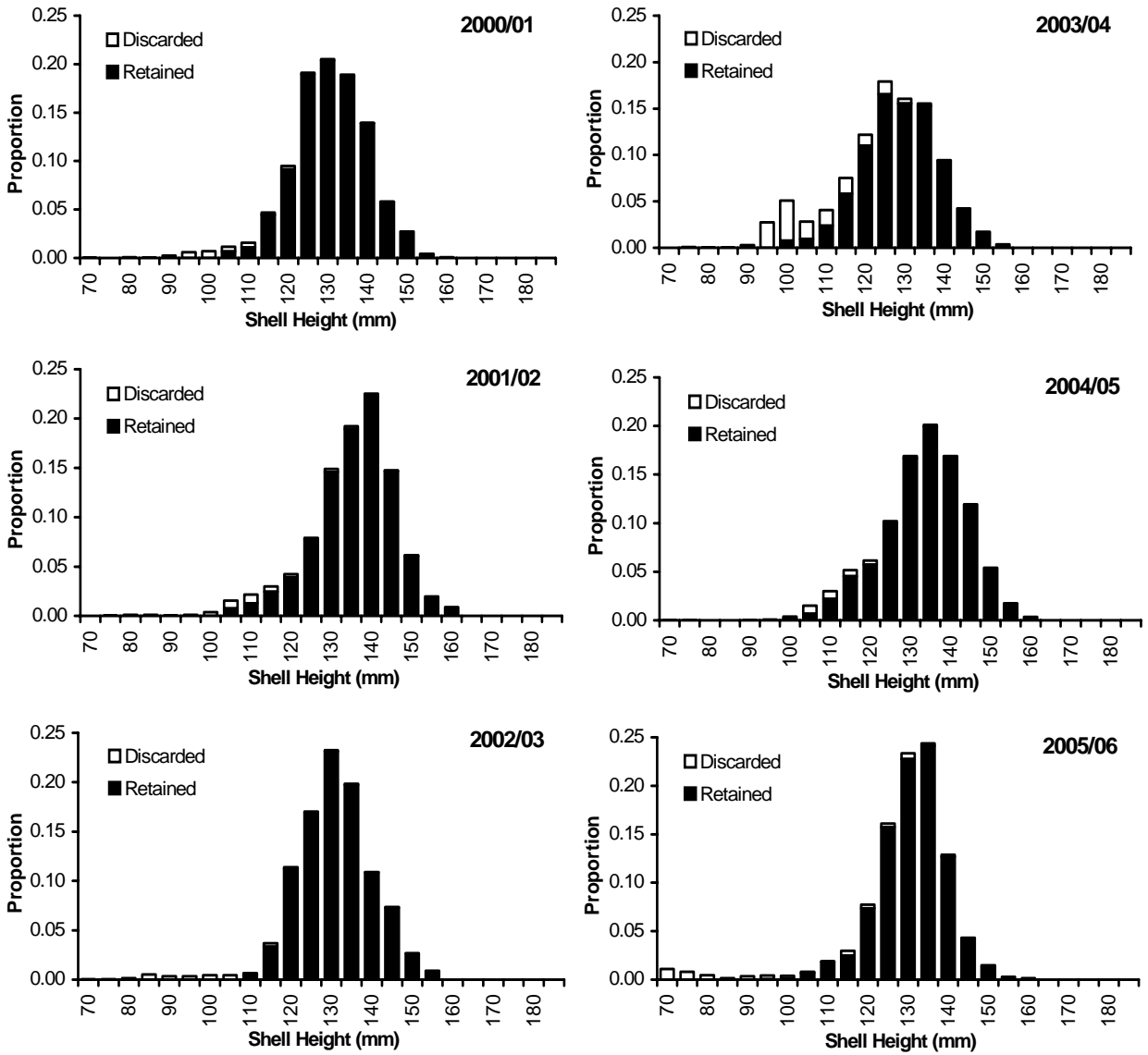
**Figure 7.**—Weathervane scallop harvest by round weight, scallop meat weight, dredge hours, and CPUE, Area D, Yakutat Registration Area, 1993–2005/06.



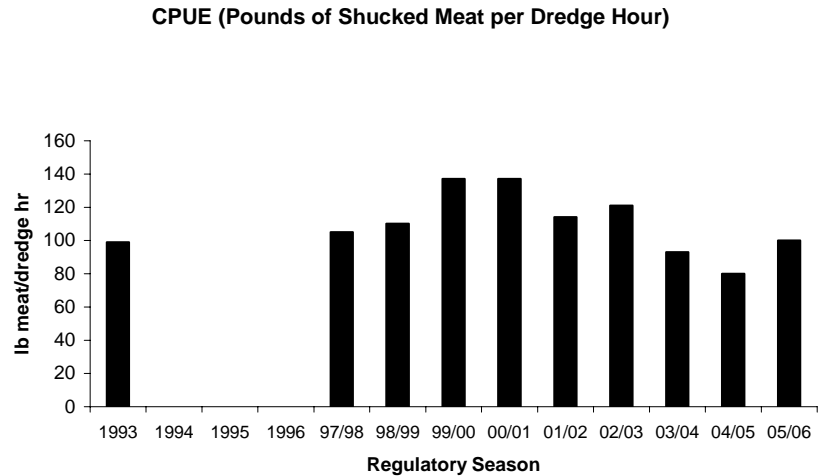
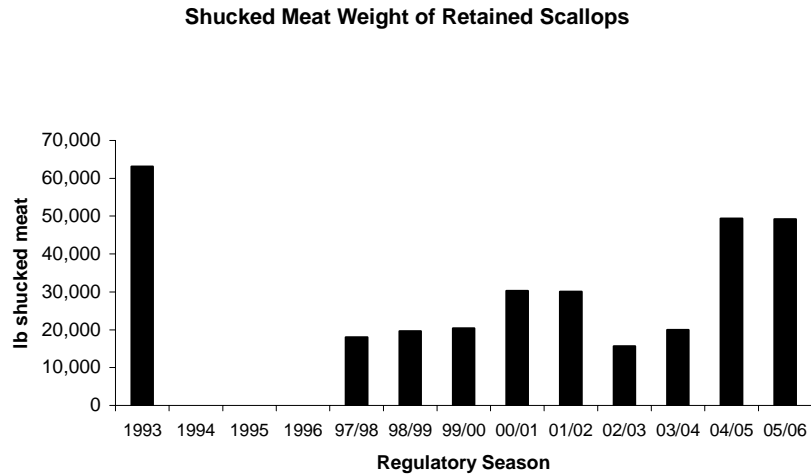
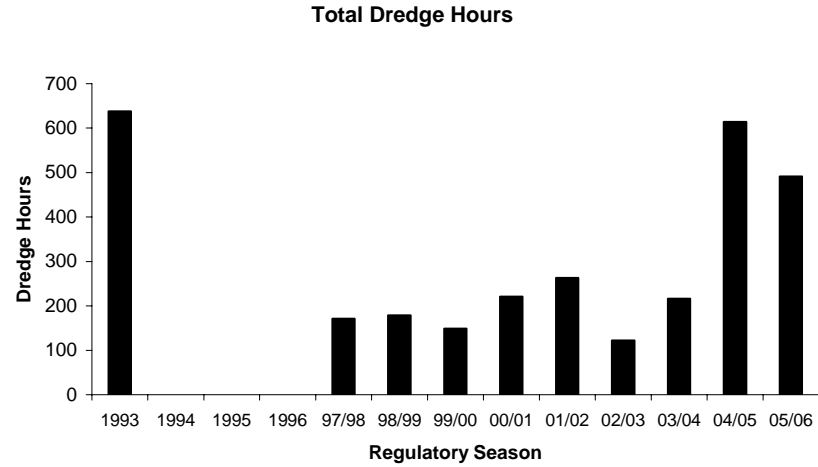
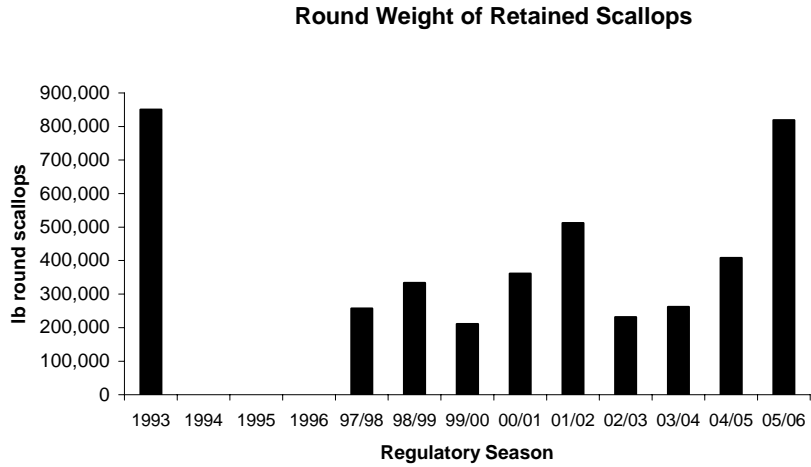
**Figure 8.**-Prince William Sound scallop fishing registration area and closed waters, 2005/06.



**Figure 9.**—Approximate location of weathervane scallop beds located east and west of Kayak Island, Prince William Sound Management Area.

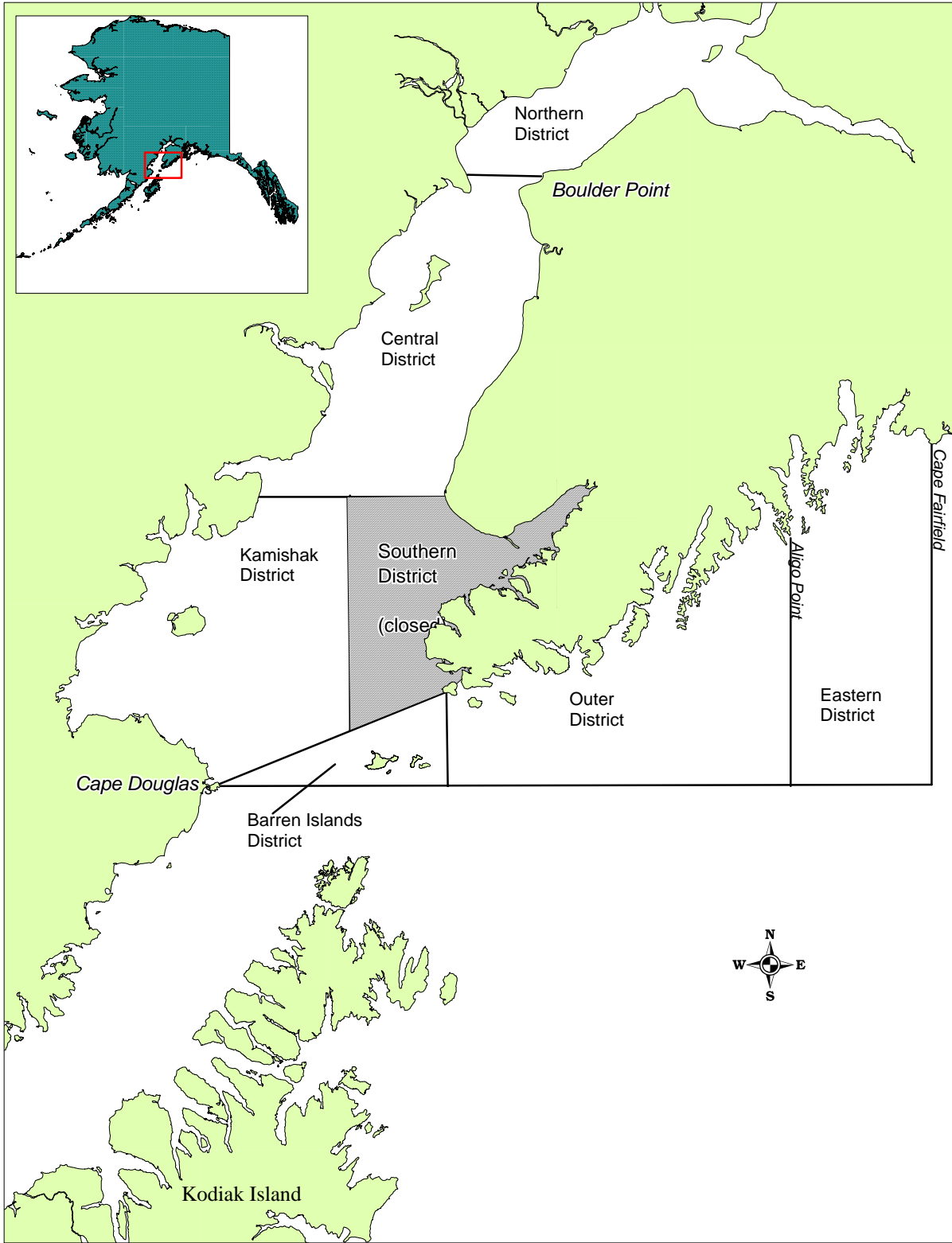


**Figure 10.**—Prince William Sound Registration Area scallop shell heights from resampling observer data, 2000/01–2005/06.



**Figure 11.**—Weathervane scallop harvest by round weight, scallop meat weight, dredge hours, and CPUE, Prince William Sound Registration Area, 1993–2005/06.





**Figure 12.**–Cook Inlet weathervane scallop registration area.

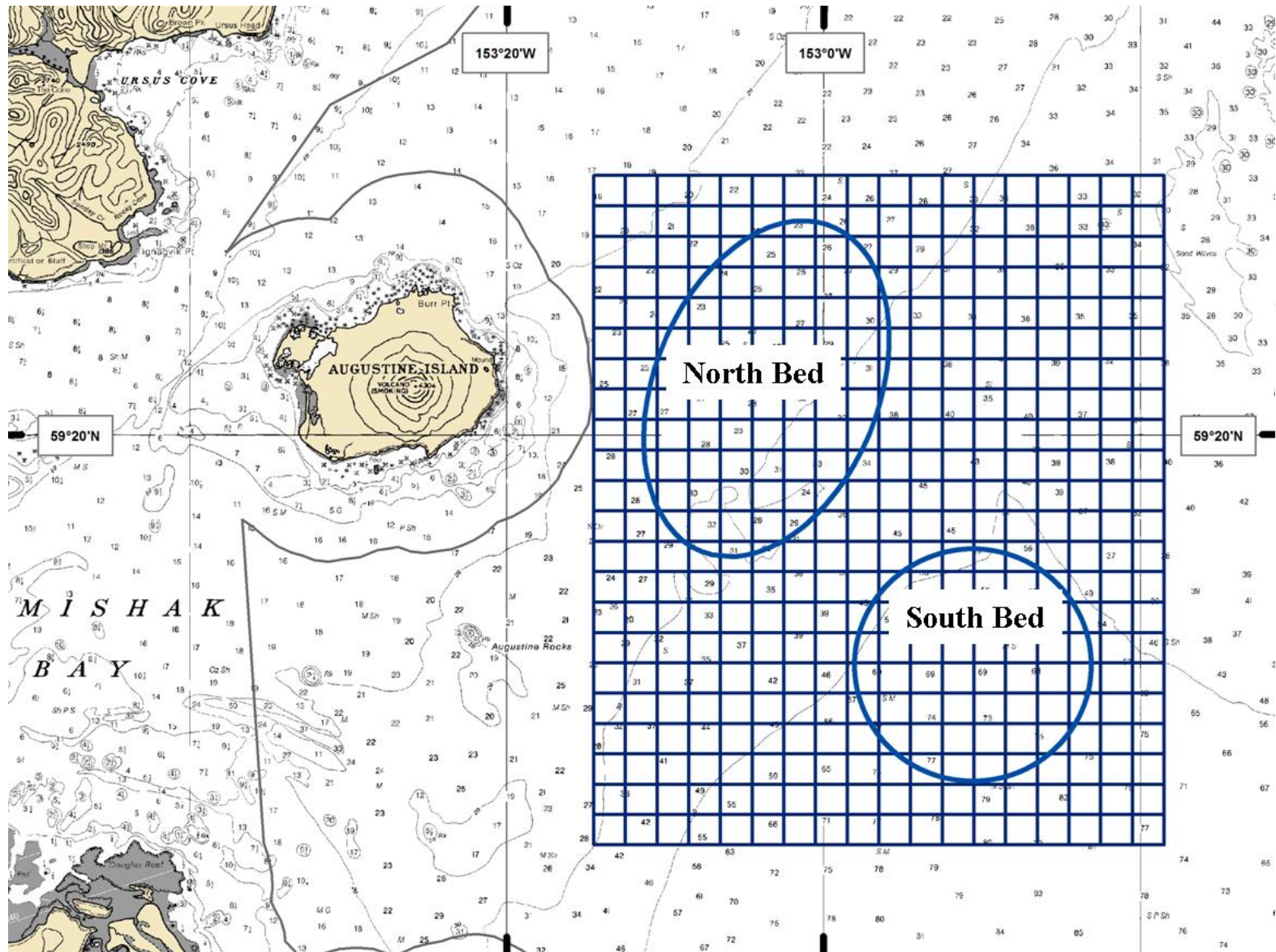
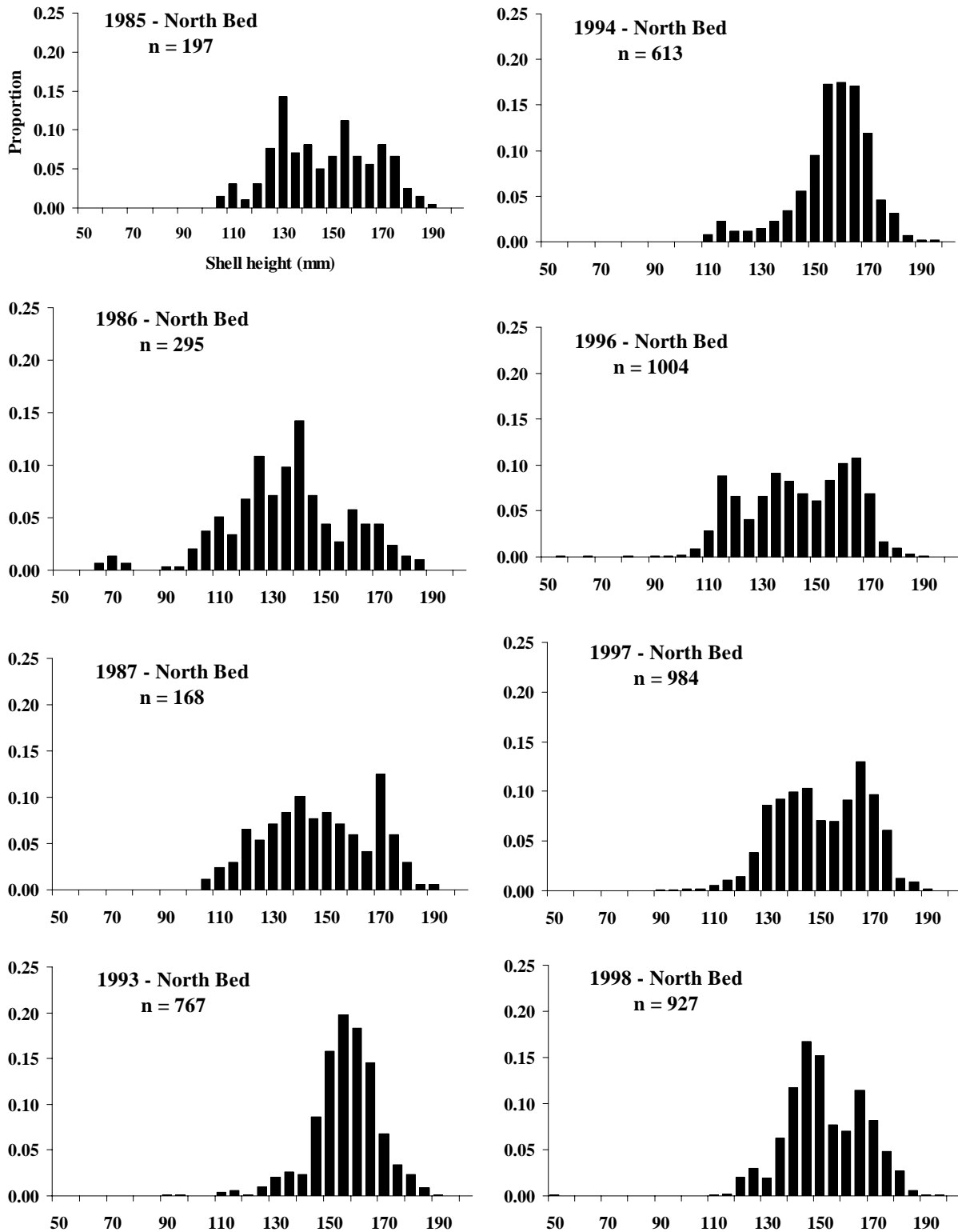
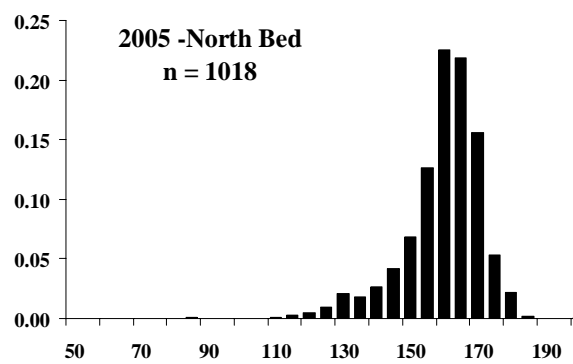
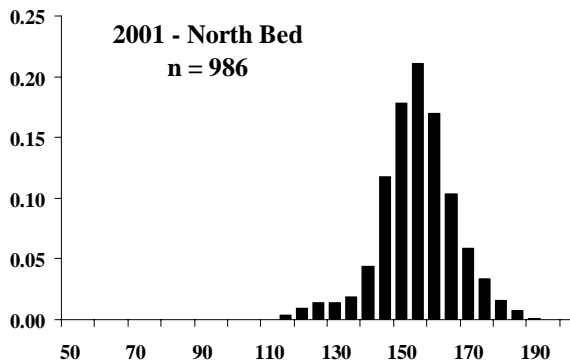
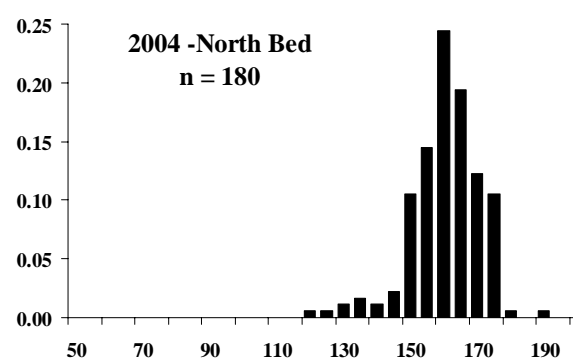
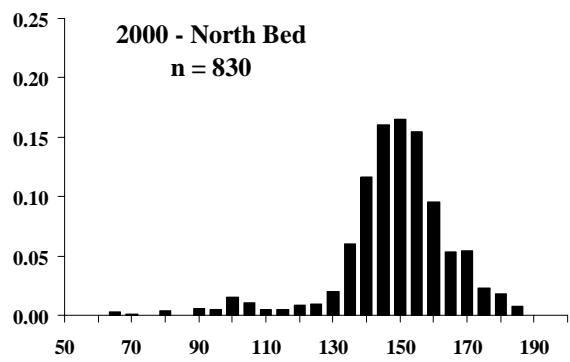
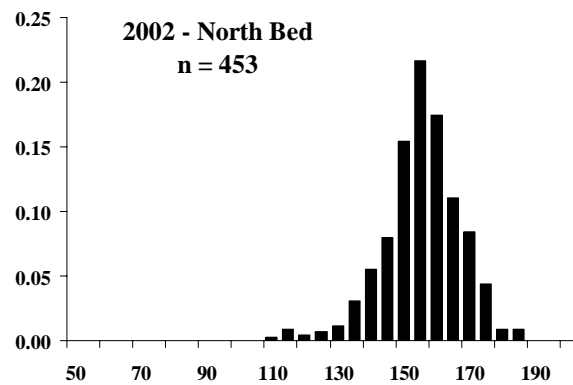
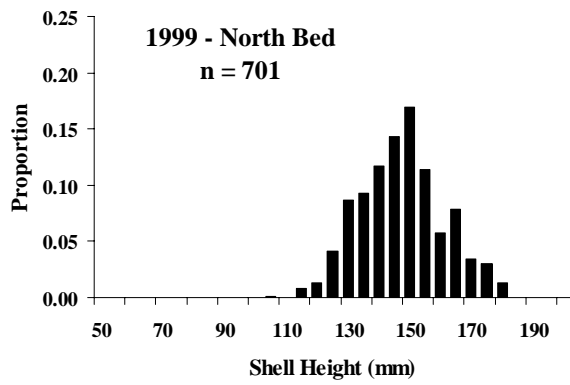


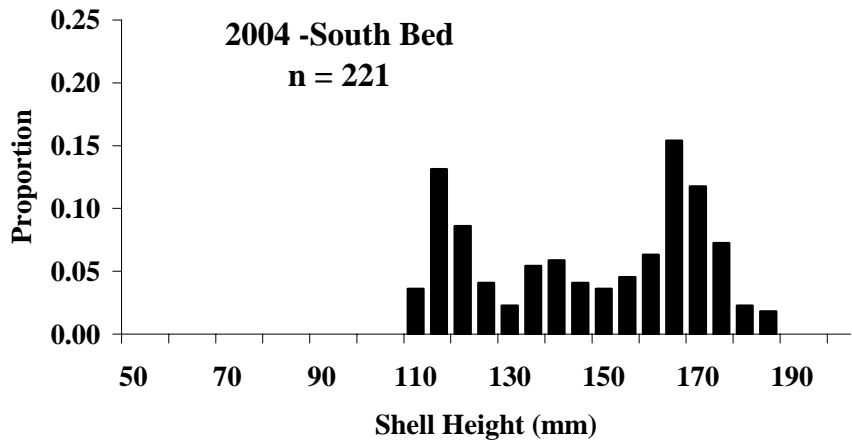
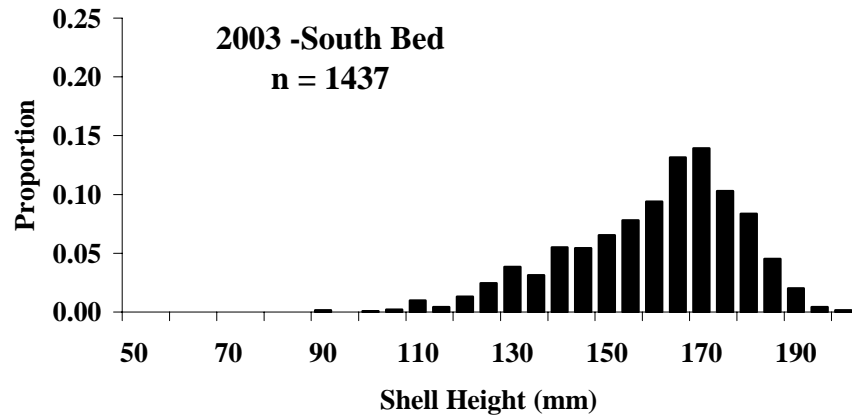
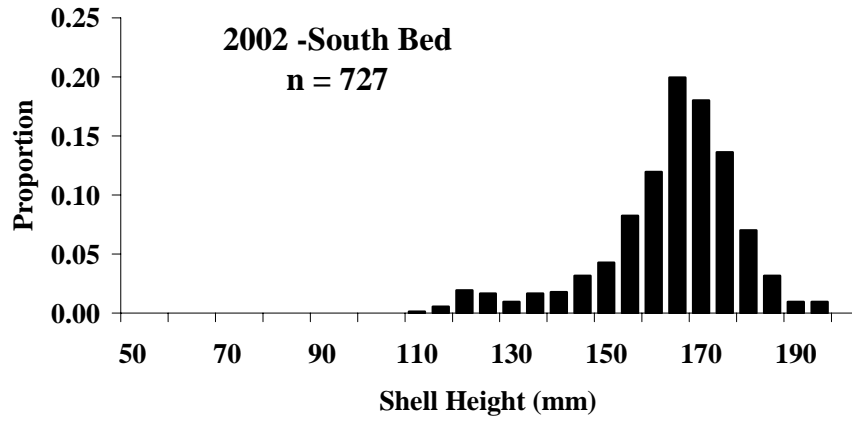
Figure 13.—Approximate locations of the north and south weathervane scallop beds in the Kamishak District of Cook Inlet.



**Figure 14.**—Shell height frequencies of commercial weathervane scallop harvest samples from the north bed Kamishak District of Cook Inlet, 1983 - 2005.



**Figure 14.**—Page 2 of 2.



**Figure 15.**—Shell height frequencies of commercial weathervane scallop harvest samples from the south bed, Kamishak District of Cook Inlet, 2002 - 2004.

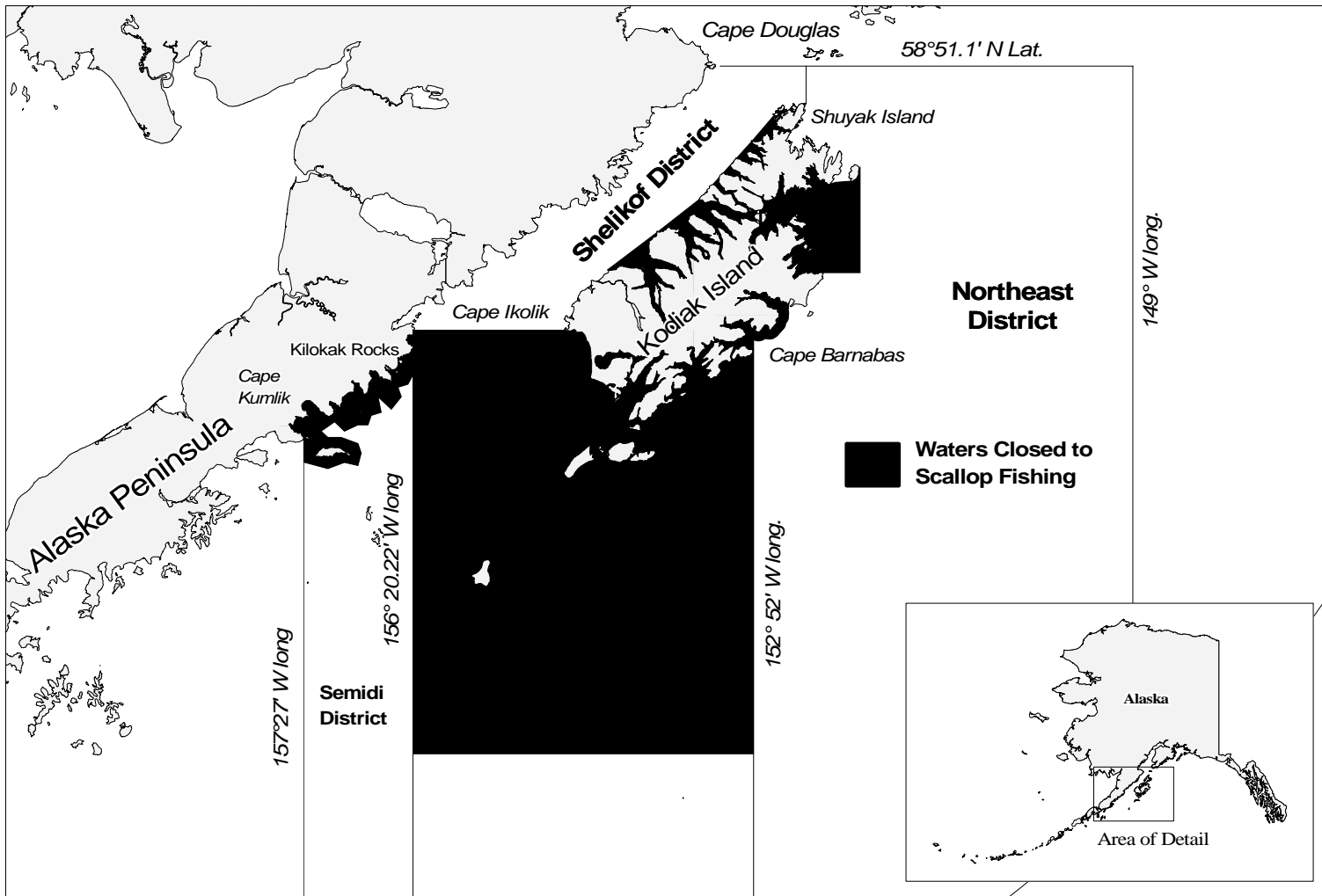
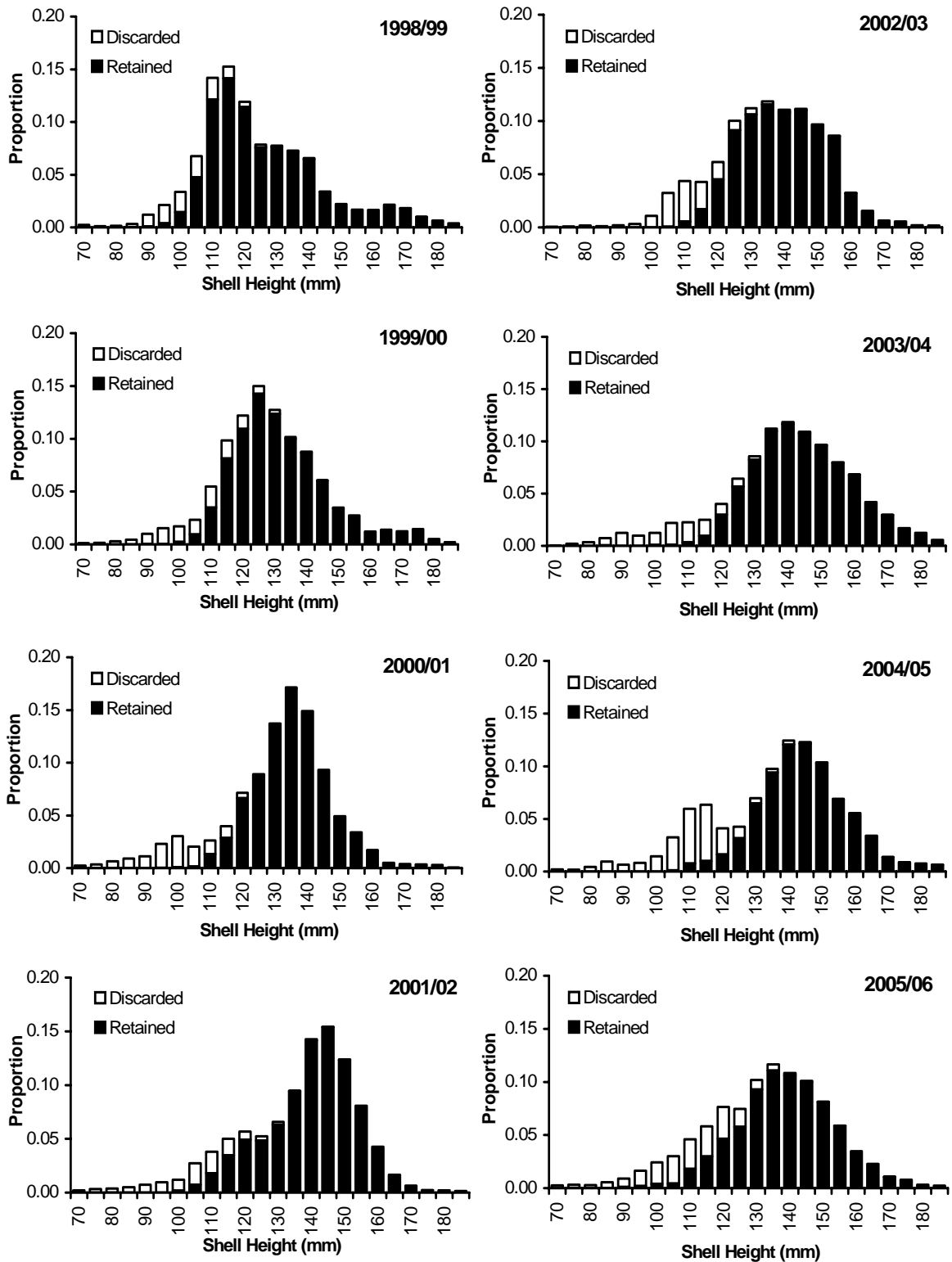
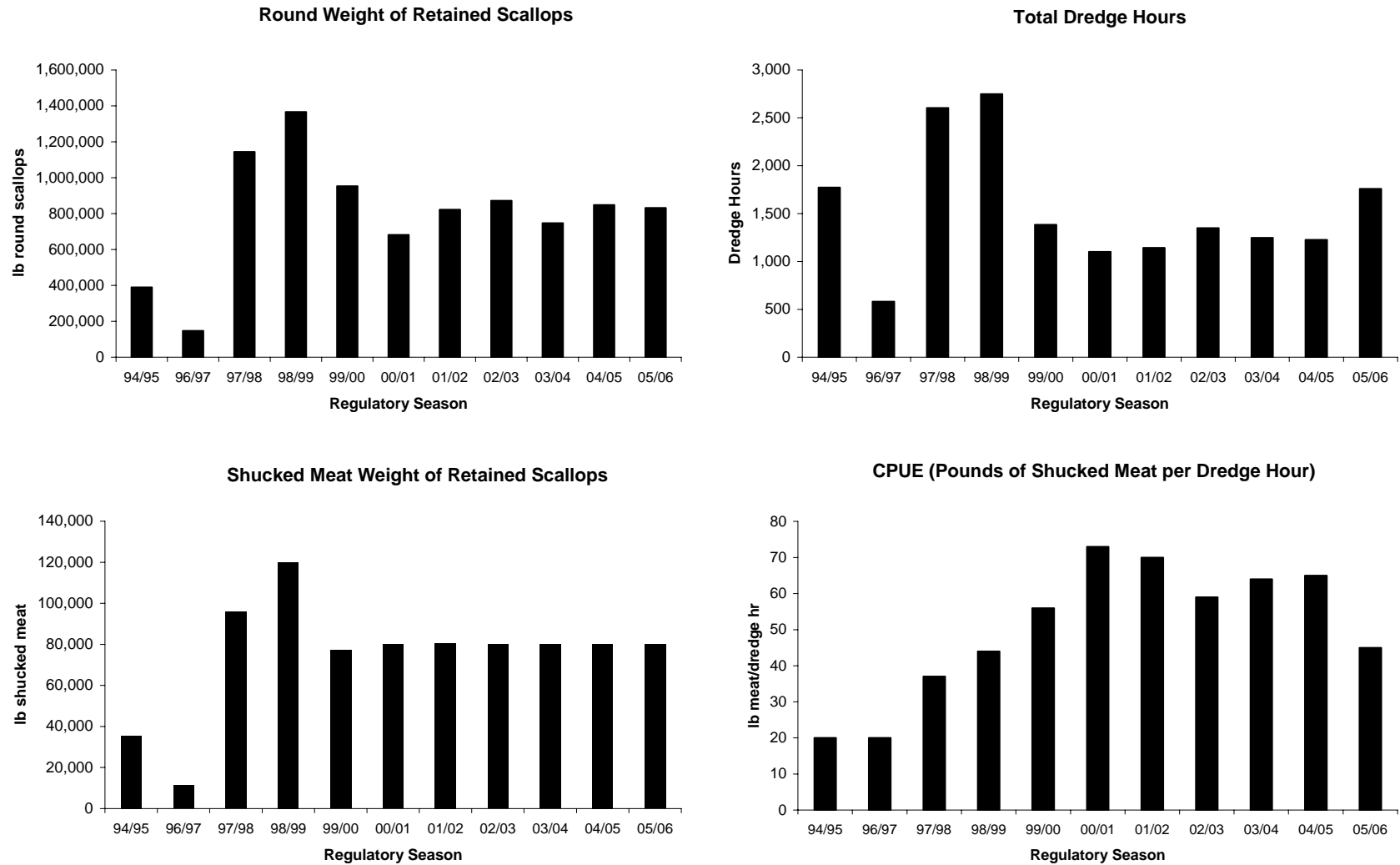


Figure 16.—Kodiak weathervane scallop registration area and closed waters.

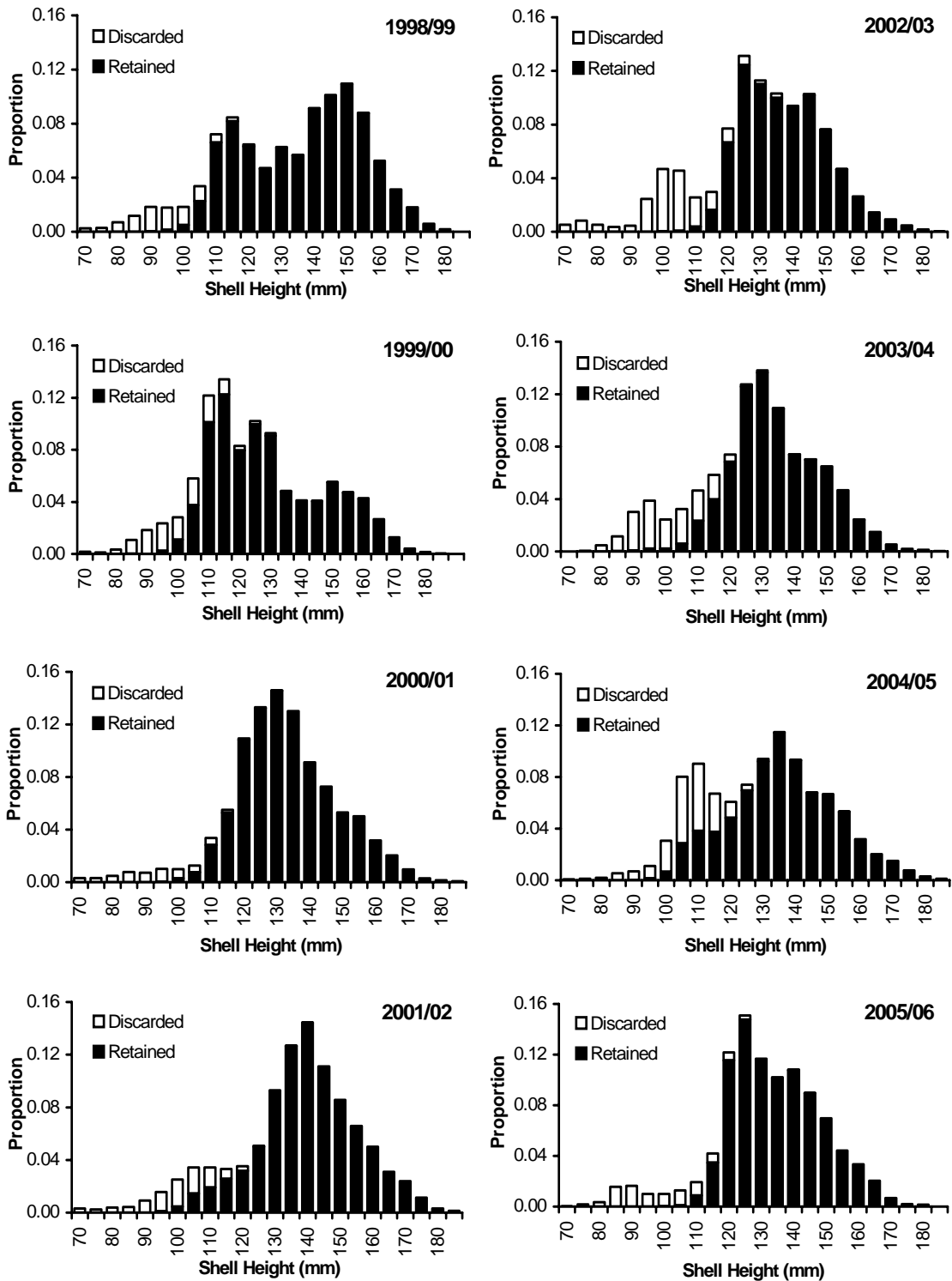


**Figure 17.**—Kodiak Northeast District scallop shell heights from resampling observer data, 1998/99–2005/06.

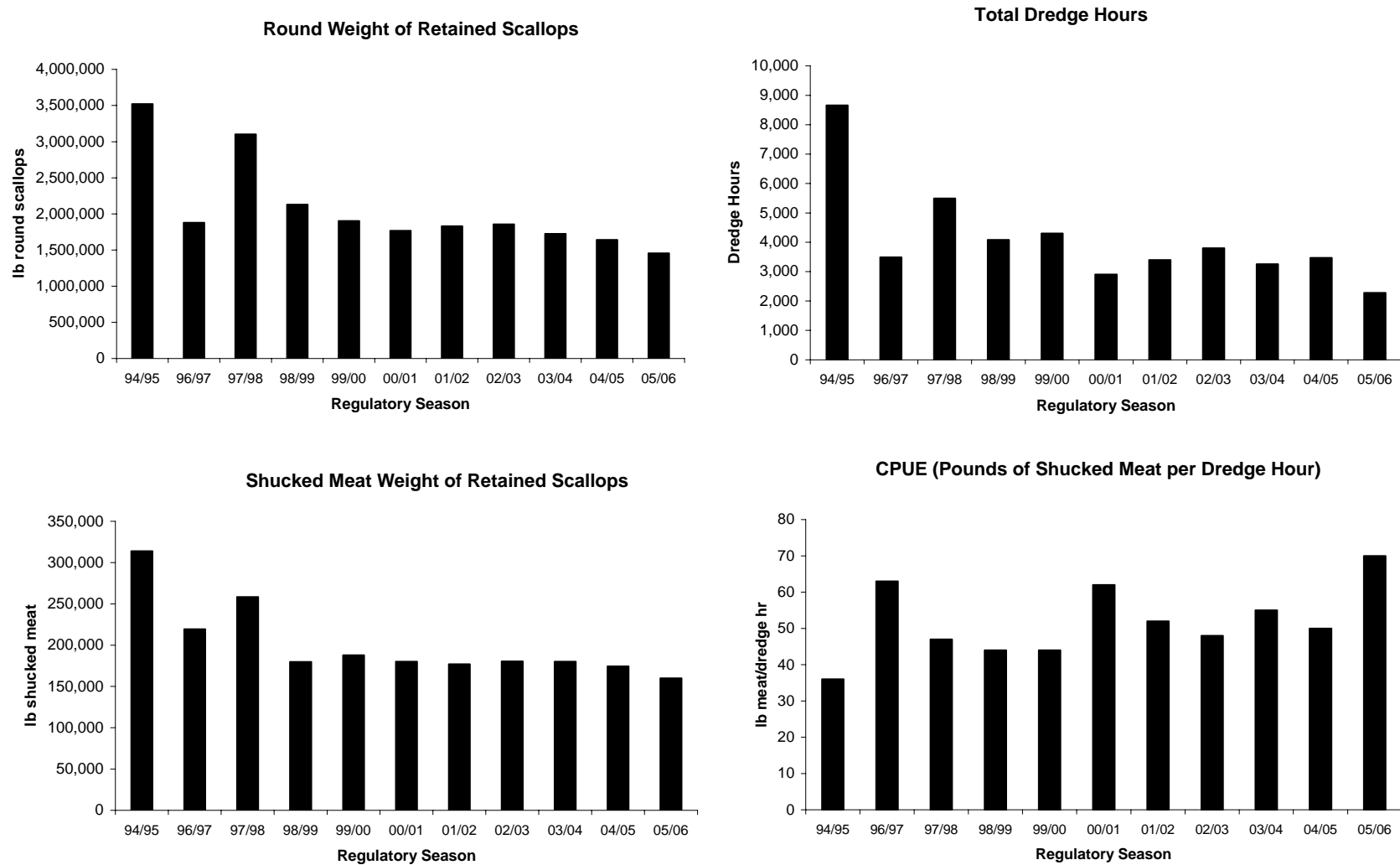


**Figure 18.**—Weathervane scallop harvest by round weight, scallop meat weight, dredge hours, and CPUE, Northeast District, Kodiak Registration Area, 1994/95–2005/06.

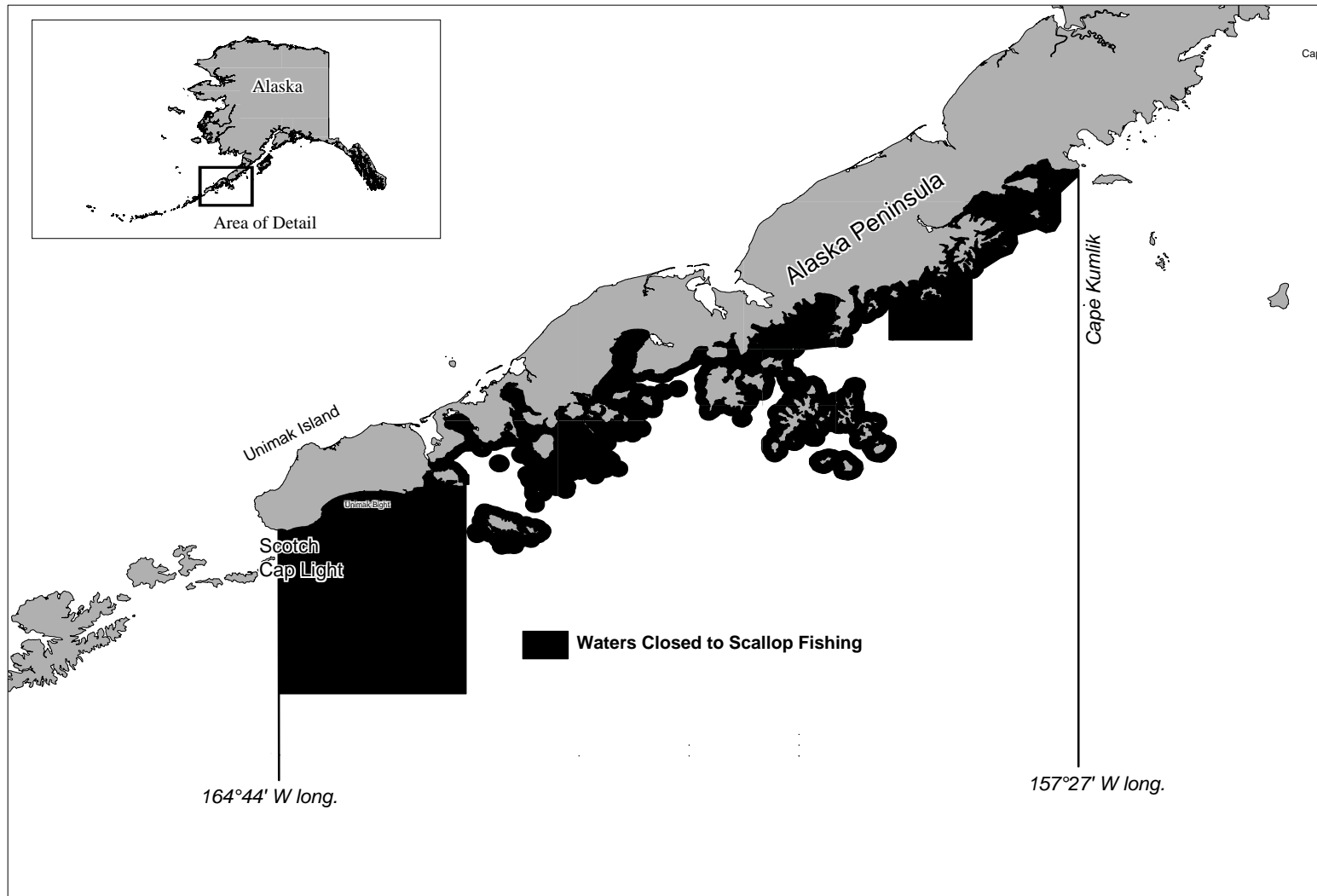




**Figure 19.**—Kodiak Shelikof District scallop shell heights from resampling observer data, 1998/99–2005/06.



**Figure 20.**—Weathervane scallop harvest by round weight, scallop meat weight, dredge hours, and CPUE, Shelikof District, Kodiak Registration Area, 1994/95–2005/06.



**Figure 21.**—Alaska Peninsula weathervane scallop registration area and closed waters.

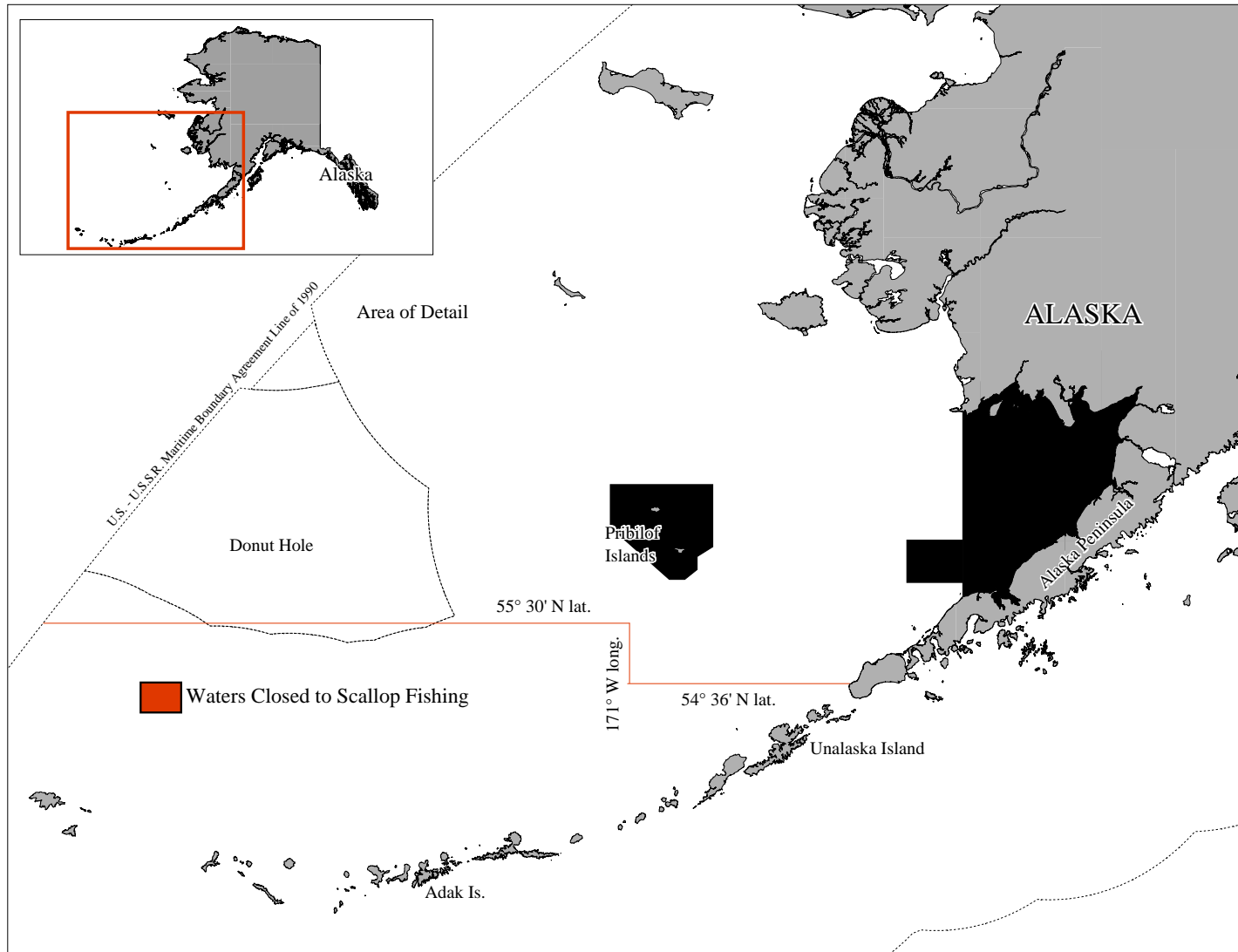
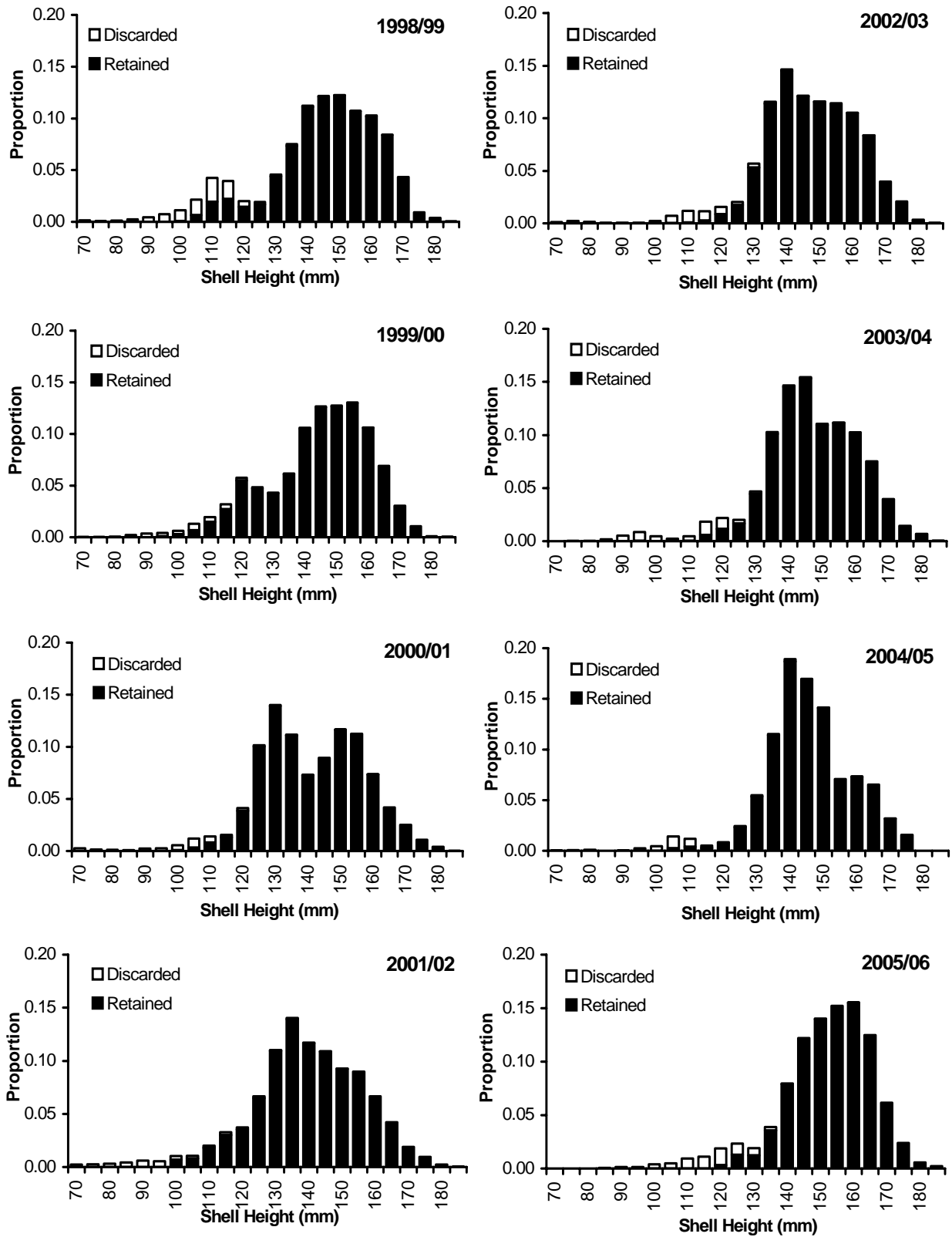
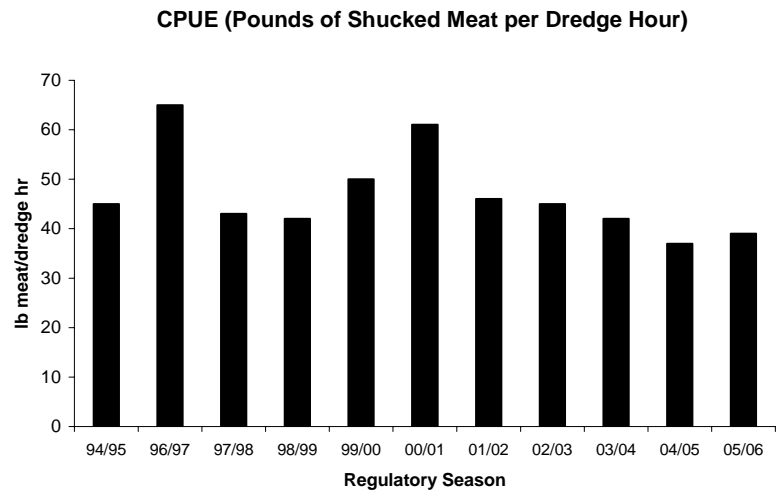
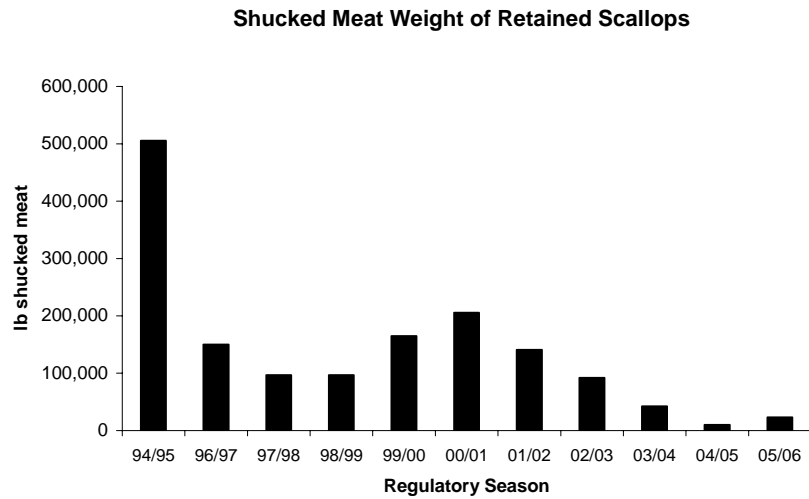
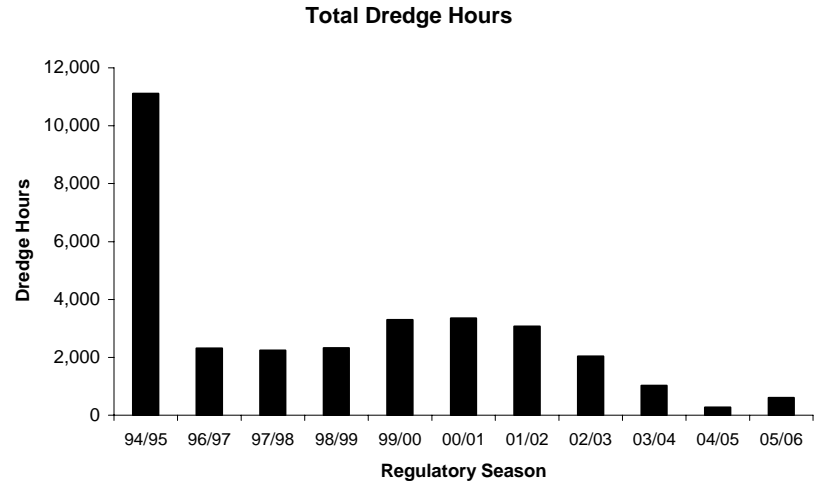
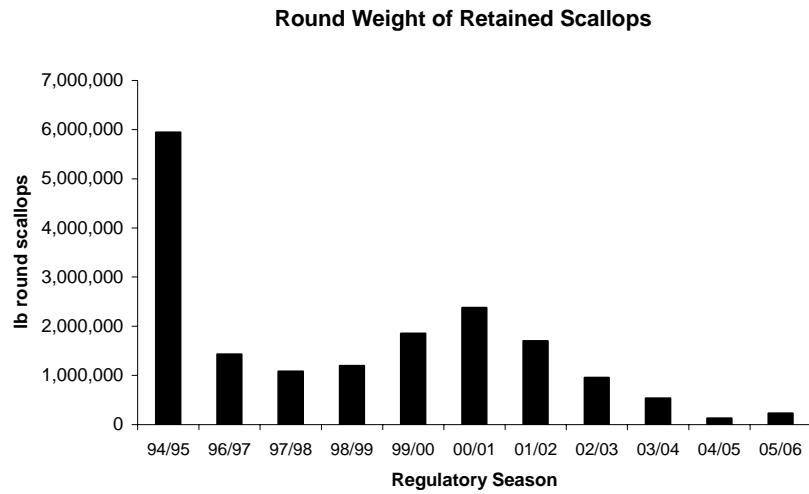


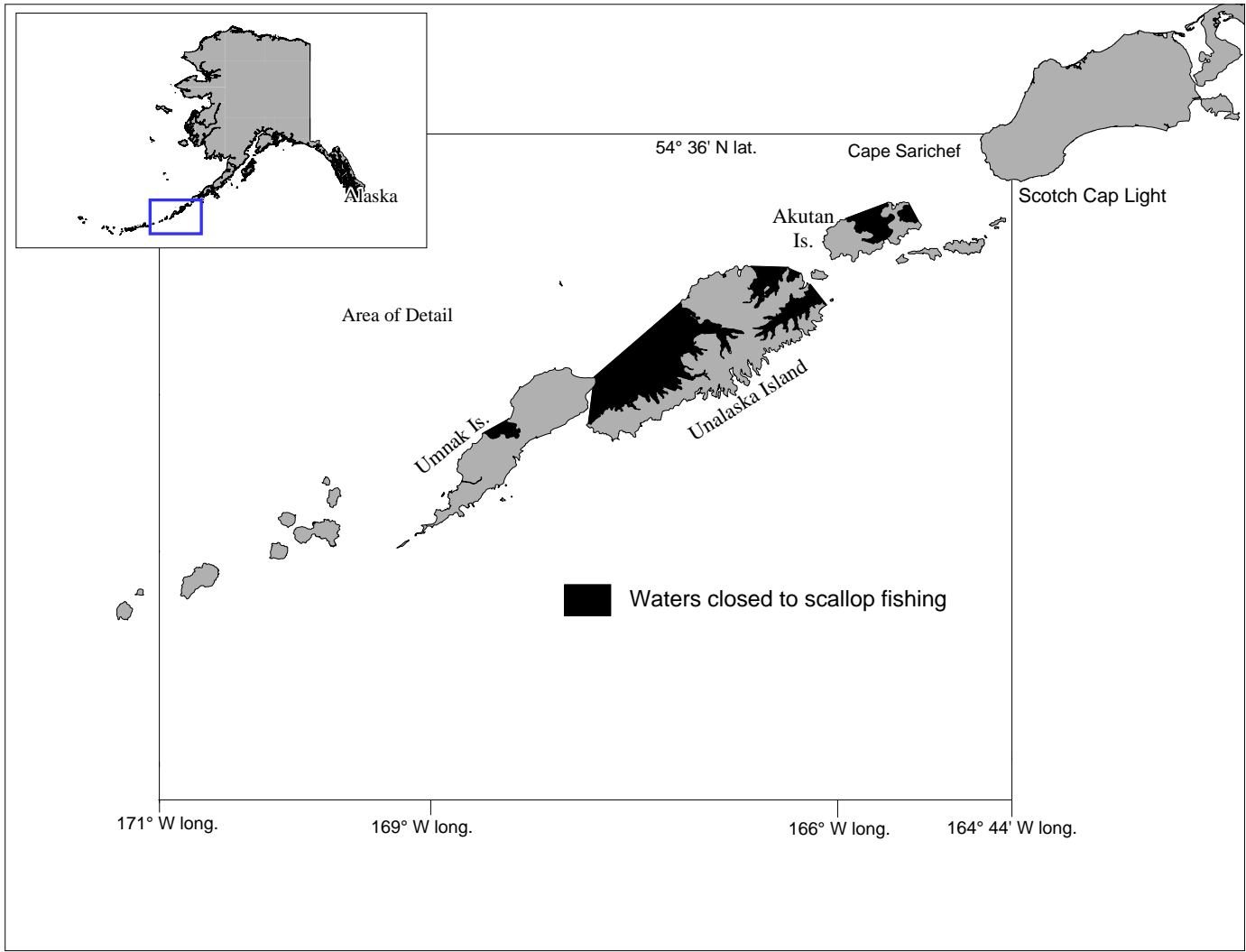
Figure 22.—Bering Sea weathervane scallop registration area and closed waters.



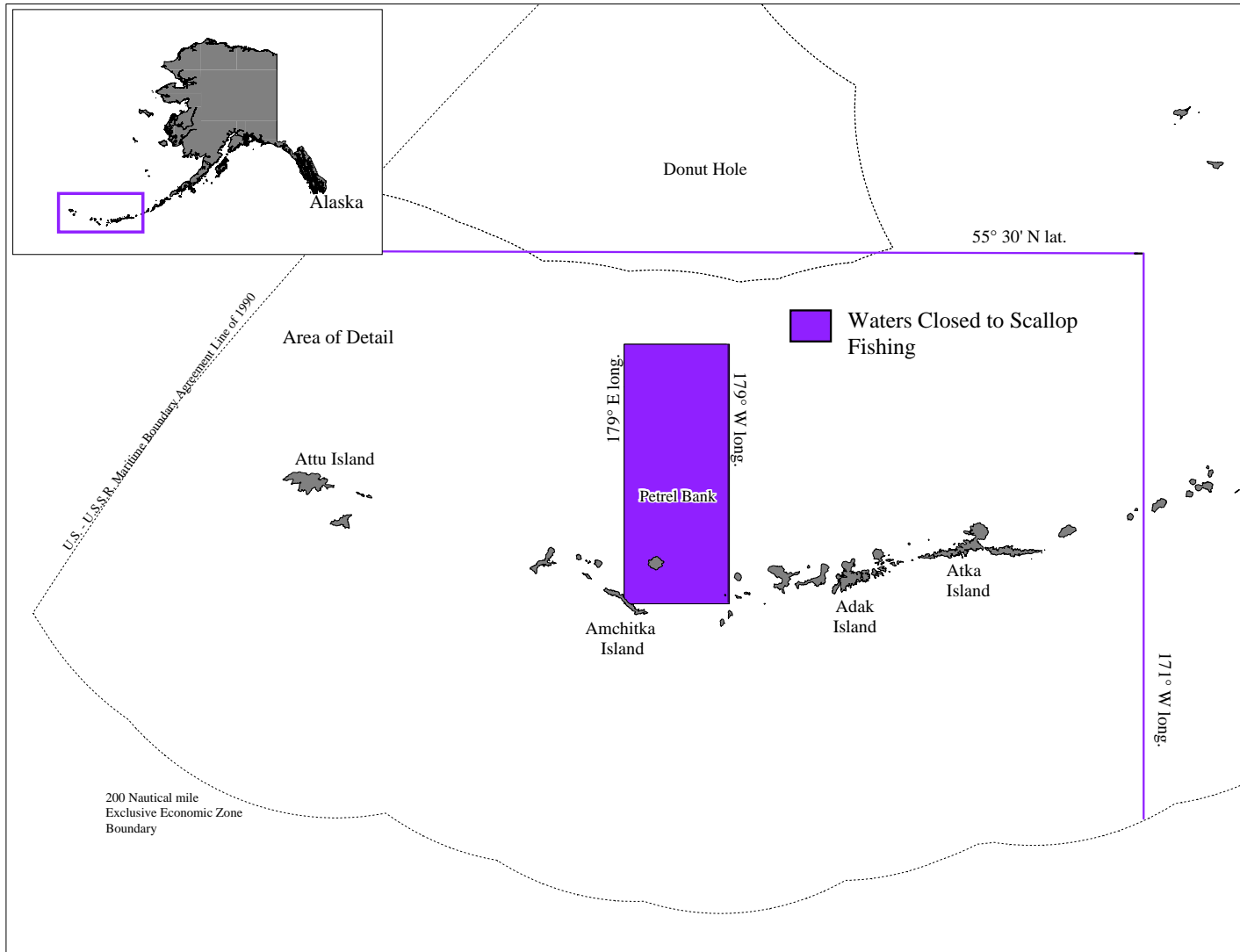
**Figure 23.**—Bering Sea Registration Area scallop shell heights from resampling observer data, 1998/99–2005/06.



**Figure 24.**—Weathervane scallop harvest by round weight, meat weight, dredge hours, and CPUE, Bering Sea Registration Area, 1994/94–2005/06.



**Figure 25.**—Dutch Harbor weathervane scallop registration area and closed waters.



**Figure 26.**—Adak weathervane scallop registration area and closed waters.





## **APPENDIX A**

**Appendix A1.**—Commercial harvests of weathervane scallops from Prince William Sound, 1992–2005.

<b>Year</b>	<b>No. of Vessels</b>	<b>Harvest<sup>a</sup> (meat lb)</b>	<b>Harvest objective<sup>b</sup> (meat lb)</b>	<b>Season (hours)</b>	<b>Comments</b>
1992	4	208,836	64,000		
1993	7	63,068	50,000	67	
1994		Fishery rescheduled to 1995			Season start date changed.
1995	2	108,000	50,000	390	Additional 60,000 lb of illegal harvest.
1996	0		0		Closed due to illegal harvest.
1997	1	18,000	17,200	141	
1998	2	19,650 combined	6,000 East 14,000 West	78	
1999	2	20,410 combined	6,000 East 14,000 West	54 East 84 West	
2000	3	30,266 combined	9,000 East 21,000 West	744 East 783 West	
2001	1	30,090 combined	9,000 East 21,000 West	5,367 East 5,441 West	
2002	2	15,641 combined	6,000 East 14,000 West	5,544 East 5,517 West	
2003	1	19,980 combined	6,000 East 14,000 West	5,004 East 4,984 West	
2004	2	49,320 combined	26,000 East 24,000 West	2,748 East 5,367 West	
2005	3	49,205 combined	26,000 East 24,000 West	1,264 East 1,048 West	

<sup>a</sup> Harvest total for east and west areas combined are provided by provisions of confidentiality releases.

<sup>b</sup> Separate GHs were established for areas east and west of Kayak Island beginning in 1998.

## **Appendix B. Final report on Central Region Scallop Assessment Research Study (2005-2008)**

# NOAA Standardized Comprehensive Progress Report

## I. PROJECT IDENTIFIERS FMP EXTENDED JURISDICTION

### FINAL REPORT

**A. Project Title: Central Region Weathervane Scallop Assessment**

**B. Project Managers: Richard Gustafson and Dr. Kenneth J. Goldman**

**C. Period Covered by this Report: State Fiscal Years 2005 to 2008**

## II. PROJECT SUMMARY

Commercial fisheries for weathervane scallop, *Patinopecten caurinus*, in southcentral Alaska occur at Kamishak Bay in lower Cook Inlet and adjacent to Kayak Island near Prince William Sound. Fishery performance measurements have changed dramatically over time due to advances in fishing technology and changes in the composition and fishing patterns of the scallop fleet. This project fulfills the need for a fishery-independent assessment of the Kamishak Bay and Kayak Island weathervane scallop beds. Survey data are presented to stakeholders, the Alaska Board of Fisheries, and the North Pacific Fishery Management Council along with recommendations for management strategies to provide for long-term, sustained yield of the weathervane scallop resource.

### III. APPROACH

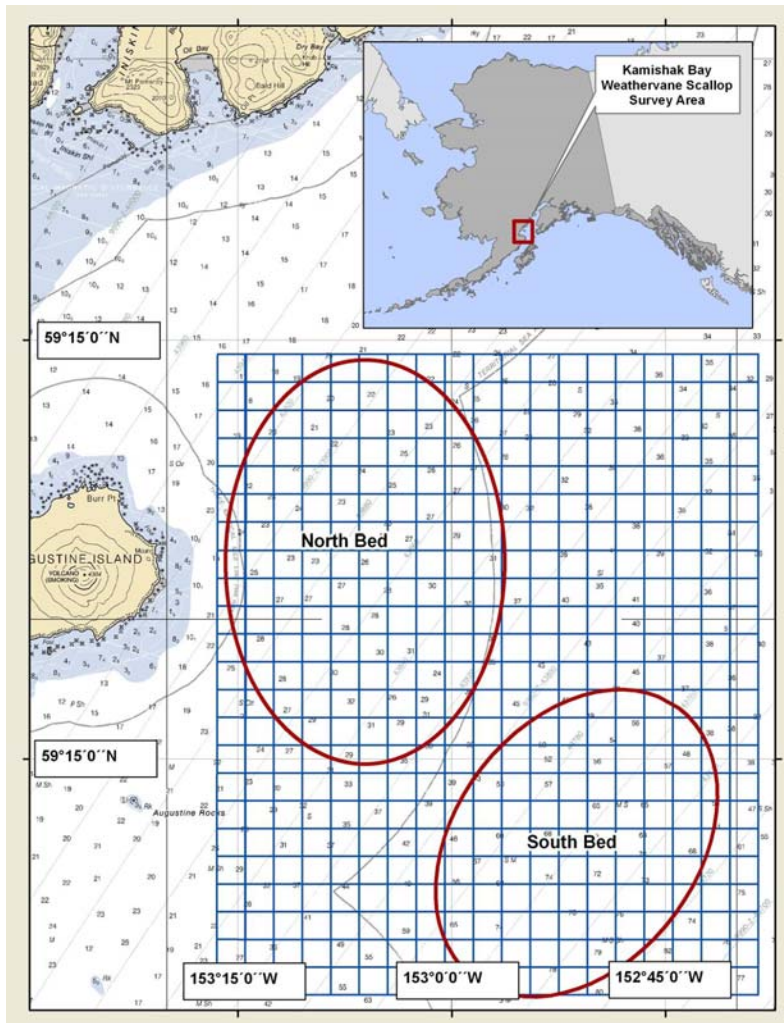
Commercial fisheries for weathervane scallop in southcentral Alaska occur in the Kamishak Bay area of lower Cook Inlet and adjacent to Kayak Island near Prince William Sound (Berceli et al 2003; Trowbridge and Bechtol 2003). These fisheries, dating to 1983 at Kamishak Bay and 1992 at Kayak Island, occur in federal waters but are managed by ADF&G under oversight of a federal fishery management plan (FMP; NPFMC 1995; NPFMC 2006). Management of these fisheries was historically based on in-season fishery performance (catch per unit effort; CPUE). Fishery-independent, area-swept, dredge surveys have been conducted by ADF&G Central Region biologists since 1995 in both areas and have substantially improved the ability to manage for sustained yield (Gunderson 1993). These surveys enabled ADF&G to: (1) delineate the primary scallop beds in the two areas; (2) better estimate scallop population abundance and biomass within these beds; (3) define stock composition through age and height-at-age data; (4) estimate bycatch rates of non-target species (particularly Tanner crab); and, (5) prepare to explore population productivity through age-structured models (Bechtol and Bue 1998; Bechtol 2000; Bechtol and Gustafson 2002; Bechtol 2003a, 2003b; Bechtol et al. 2003). In addition, preliminary efforts have been made using underwater video techniques to evaluate survey dredge catchability, thereby increasing accuracy of the survey estimates and resulting in more appropriate harvest limits by using a catchability coefficient less than one. 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.

The primary goals of this project were the assessment of scallop beds in southcentral Alaska and the development of management criteria that will provide long-term, sustained yield for the commercial scallop fleet. The work encompassed four years of assessment work. Specific objectives for identified weathervane scallop beds in southcentral Alaska were to:

- 1) Determine population biomass and abundance through fishery independent surveys.
- 2) Determine height and age composition in fishery independent surveys.
- 3) Determine height and age composition in commercial fishery harvests.
- 4) Present harvest recommendations to the Alaska Board of Fisheries and the North Pacific Fisheries Management Council.
- 5) Document assessment efforts through fishery data reports.

#### Study Areas

Although weathervane scallops are found throughout the Kamishak Bay Management District, the fished component of the population is aggregated in two main areas, or scallop beds, located east and southeast of Augustine Island (Figure 1). The commercial scallop fishery has historically occurred in the bed located immediately east of Augustine Island (the north bed). Department trawl surveys also observed substantial aggregations in an area located southeast of the north bed (Bechtol 2001), and the first formal assessment of scallop abundance and biomass in this new scallop bed (the south bed) occurred in 2003 (Hammarstrom and Merritt 1985; Bechtol and Gustafson 2002; Bechtol et al. 2003). The scallop beds occur on relatively flat or gradually sloping bottom ranging from 30 to 90 m (~16.5 to 49 fathoms) in depth, on substrate composed of mud, sand, and pumice interspersed with shale outcroppings.

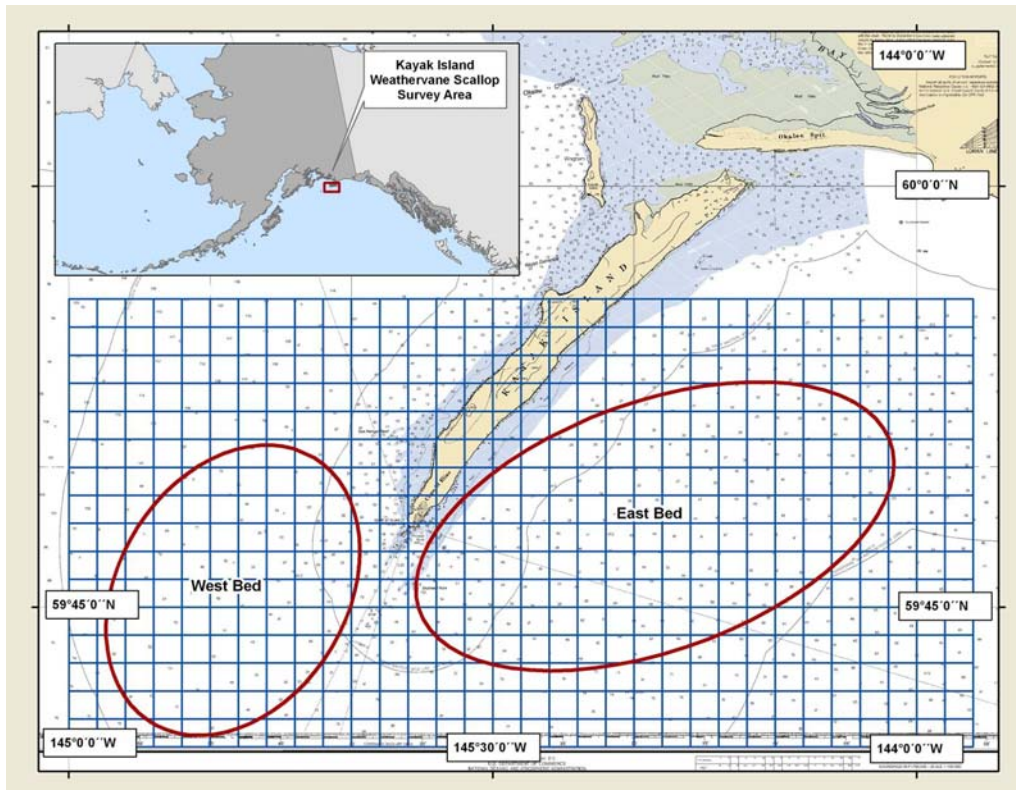


**Figure 1:** Location of main scallop beds in Kamishak Bay. Circled areas indicate the delineated edge of each scallop bed.

The Kayak Island study area is located approximately at Cape St. Elias (144°20' W. longitude, 59°47' N. latitude) on the southern end of Kayak Island in the Gulf of Alaska (Figure 2). Bottom substrate in the study area is primarily sand and pebbles with some rock and mud; rocky reefs are present near Cape St. Elias. Bottom depths in the scallop beds gradually slope from approximately 55 m (30 fathoms) in the northwest to over 110 m (60 fathoms) in the southeast.

### Vessel and Gear

The state research vessel *Pandalus* will be used for these surveys. The R/V *Pandalus* has an overall length of 20 m (66 ft), a displacement of 100 mt, and is powered by a 365 hp diesel engine. Survey staff typically includes three to four biologists and a two or three person vessel crew. The survey is conducted with a 2.4-m (8-ft) dredge having a ring bag consisting of 10.2-cm (4.0-inch) inside diameter rings. To facilitate retention of small scallops, the ring bag is fitted with a 3.8-cm (1.5-inch) mesh liner. Dredge weight is approximately 816 kg (1,800 lb).



**Figure 2:** Location of main scallop beds adjacent to Kayak Island. Circled areas indicate the delineated edge of each scallop bed.

### Sample Design

Central Region conducts fishery-independent, area-swept, dredge surveys with a systematic sampling design. Sampling stations were defined by overlaying a checker-board grid of 1,855-m (1.0-nmi) 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 catch exceeded a threshold level of 9.1kb (20 lb). The edge of a scallop bed was considered delineated when catch in a given station was below the threshold amount. For animal populations with individuals that are randomly distributed, a single systematic sample provides good variance estimates. Because weathervane scallops have a patchy distribution and are not uniformly clustered within beds, a systematic sample tends to overestimate the population variance (Thompson 1992). However, similar to previous surveys (Bechtol and Bue 1998; Bechtol 2003a, 2003b), equally distributing sampling effort across the survey area and achieving a delineation of weathervane scallop bed boundaries took precedence over precision about the variance estimate.

The 2007 Kamishak Bay and 2008 Kayak Island surveys were set to standardized areas for the first time (see Figures 1 and 2). 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 a polygon was drawn around all stations where the catch exceeded the threshold of 9.1 kg/nm (20 lbs). Central Region groundfish/shellfish 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 Greg Rosencranz (statewide scallop biometrician 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 ADF&G 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 ADF&G 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.

### **Data Collection**

The vessel skipper recorded the following information for each tow:

- |  |                               |
|--|-------------------------------|
| 1. sequential tow number                     | 7. tow start and stop times   |
| 2. alphanumeric station code                 | 8. distance towed             |
| 3. date                                      | 9. maximum and minimum depths |
| 4. start and stop locations (lat. and long.) | 10. sea conditions            |
| 5. tow compass heading                       | 11. scope used                |
| 6. average vessel speed                      | 12. gear performance          |

Upon completion of each tow, the catch was washed clean of mud and separated into weathervane scallops, weathervane scallop shells, fish, Tanner crab, and other bycatch, including debris. Tanner crab were weighed in aggregate then sampled to determine carapace width, shell condition, and sex. Fish were weighed in aggregate then enumerated by major species group. Debris, assorted invertebrates, and any remaining bycatch were weighed and their relative contribution visually estimated (e.g., 60% sea stars and 40% rocks).

### **Weathervane Scallop Sampling**

Total live weight and abundance of weathervane scallops, including broken shells with attached viscera, were recorded. Weathervane scallop shells and shell fragments without attached viscera were weighed and discarded. Empty weathervane scallop shells with both valves connected by an intact hinge ligament (referred to as "cluckers" or "clappers"), were retained, cleaned, measured for shell height, aged, labeled, and bagged for archival purposes.

Twenty weathervane scallops were randomly selected, weighed, and shucked aboard the vessel. Their meats (i.e. the large adductor muscle, referred to as the "quick" by the fishing industry) were placed into a container, and their dorsal shells were cleaned, labeled, measured, aged, and placed in storage for a second age determination in the lab. Several non-random samples of immature weathervane scallops from each tow were also shucked, cleaned, measured, aged, and stored for representative height-at-age data. Shell heights of all weathervane scallops remaining from a tow were captured with an electronic measuring board to construct height frequency distributions. For some tows, a large scallop catch necessitated that only a subsample of the

scallops be measured for heights with the remaining scallops discarded after collecting weight and abundance data.

Fresh weathervane scallop meat recovery was estimated each day from whole weight of the twenty scallops sampled from each tow and the weight of their shucked meats. Mean fresh meat recovery was estimated as pooled meat weight divided by pooled whole scallop weight.

Age determination of Central Region scallops has been based on visual identification of annuli, confirmed by tracking of strong cohorts among survey and fishery years. Weathervane scallop shells are collected for age assessment from Central Region research dredge surveys and from the Alaska Scallop Fishery Observer Program. Central Region dredge surveys collect scallop shells from Kamishak Bay and the Kayak Island area; a first age reading is conducted on board the research vessel during the survey, with second age readings occurring in the lab. The Alaska Scallop Fishery Observer Program collects scallop shells from all commercially fished areas of the state, except Kamishak Bay – Central Region often provides an observer to collect data and/or shells from the Kamishak Bay commercial scallop fishery. Central Region staff, along with ADF&G staff in Kodiak, is currently developing a scallop ageing protocol in order to standardize the ageing of scallops statewide. This will allow ADF&G staff to estimate vital rates (e.g. population growth and natural mortality rates) and produce age structured population models for all scallop beds in Alaska. Additionally, we hope to validate the temporal deposition of annuli on scallop shells (i.e. of scallop age classes) via isotope and/or laser ablation techniques, or verify deposition timing via indirect techniques such as marginal increment analyses.

### Surveys

Four weathervane scallop surveys were completed under this grant funded project (two at Kamishak Bay and two at Kayak Island). The Kamishak Bay surveys occurred from May 11-20, 2005 and from June 24-29, 2007. The Kayak Island surveys occurred from June 2-12, 2006 and from June 3-10, 2008.

### Data Analysis

The weathervane scallop population estimate derived from the surveys was based on area-swept calculations (Gunderson 1993), similar to estimates for previous weathervane scallop surveys in southcentral Alaska (Hammarstrom and Merritt 1985; Bechtol and Bue 1998; Bechtol and Gustafson 2002). Mean catch per nautical mile ( $\bar{c}$ ), variance ( $s^2$ ), and 95% confidence interval (c.i.) within a bed were calculated by

$$\bar{c} = \frac{\sum_{i=1}^n \frac{c_i}{l_i}}{n}, \quad (1)$$

and

$$s^2 = \frac{1}{n-1} \sum_{i=1}^n \left( \frac{c_i}{l_i} - \bar{c} \right)^2, \quad (2)$$

$$c.i. = \pm t_{95\%, n-1d.f.} \frac{s}{\sqrt{n}}, \quad (4)$$

where

$c_i$  is the catch of a species, either as abundance or weight, in sample tow  $i$ ,  
 $l_i$  is the distance towed in nautical miles for sample tow  $i$ , and  
 $n$  is the number of stations sampled.

An estimate of the population ( $P$ ) was calculated by expanding  $\bar{c}$  over the surveyed area as

$$P = \left( \frac{6,076}{8} \right) N \bar{c}, \quad (5)$$

where

6,076 is the length in feet of a nautical mile,  
 8 is the width of the dredge in feet, and  
 $N$  is the number of survey squares within a defined bed.

Variance of the surveyed population was estimated by

$$Var(\bar{C}) = \left( 1 - \frac{8}{6,076} \right) \frac{s^2}{n}, \quad (6)$$

$$Var(P) = \left( N \frac{6,076}{8} \right)^2 Var(\bar{C}). \quad (7)$$

GHLs were calculated independently as shucked scallop meats for individual scallop beds. This calculation relied on the estimated scallop population biomass, estimated meat recovery, and the target harvest rate.

All retained scallop shells were re-aged in the laboratory by a second age reader. Discrepancies in ages were resolved through re-aging and agreement by multiple age readers. Based on height-at-age data pooled between the beds (east and west at Kayak Island; north and south at Kamishak Bay) for aged scallop shells, ages were assigned to all un-aged shell heights proportional to the aged shells in either 5 or 10-mm height classes, depending upon sample size in the height classes. Age composition within a bed was then determined by summing both the observed and assigned scallop ages. Prior to summarizing within a particular bed, scallop height and age data were standardized to counts per nautical mile and adjusted for scallops that were counted but not aged or measured.

#### **List of Personnel Involved in Project:**

Dr. Kenneth J. Goldman: Fishery Biologist III, Project leader

Richard Gustafson: Fishery Biologist I, Field and lab data collection and entry, scallop ageing, gear preparation and maintenance, and reporting.

Margaret Spahn: Fisheries Biologist I, GIS mapping, survey design, data collection and analysis.  
Carla Armstrong: FWT III aged the scallop shells.  
Other ADF&G staff: Charles Trowbridge, Mike Byerly, Bob Berceci and Robert Fusco participated in biological catch sampling.

#### **IV. RESULTS. EVALUATION AND CONCLUSIONS**

##### *A. Describe the project results and findings.*

The Cook Inlet and Prince William Sound registration areas (which contain the Kamishak Bay and Kayak Island scallop beds, respectively) are currently the only two management areas in Alaska where scallop stock status is assessed by fishery independent research surveys, and where the scallop fishery is managed based on survey results. Survey results were used to develop annual commercial fishery guideline harvest levels (GHL's) for Central Region scallop beds. Specific criteria used to develop GHL's included scallop biomass, abundance, age composition, and changes in these measures since the previous survey. Following discussions of recommendations between ADF&G research and management staff, GHL's (and Tanner crab bycatch limits) were finalized and announced through ADF&G news releases issued prior to the season opening for each respective harvest area.

As stated earlier in this document, the Kamishak Bay and Kayak Island surveys are now set to standardized sampling areas and all data for each of the scallop beds from all survey years have been standardized to those areas (see Figures 1 and 2) for presentation in this report. The standardized areas for Kamishak Bay scallop beds are 90.2 nm<sup>2</sup> for the north bed and 68.0 nm<sup>2</sup> for the south bed. The standardized areas for the Kayak Island scallop beds are 78.9 nm<sup>2</sup> for the east bed and 48.6 nm<sup>2</sup> for the west bed.

#### **Kamishak Bay Scallop Survey Results**

##### **2005**

A total of 68 successful 1nm dredge tows were conducted during the 2005 Kamishak Bay weathervane scallop survey (38 in the north bed and 30 in the south bed). Catch in the north bed was 1,959 weathervane scallops weighing 861 kg (1,896lb). Catch abundance ranged from 0 to 185 resulting in a mean among all stations of 51.6 scallops/nm. Standardized catches by weight ranged from 0 to 75.2kg/nm (165.9lb/nm) with a mean catch among all stations fished of and 22.6kg/nm (49.9lb/nm). Catch in the south bed was 2,209 weathervane scallops weighing 471 kg (1039 lb). Catch abundance ranged from 0 to 293 scallops/nm resulting in a mean among all stations of 73.6 scallops/nm. Standardized catches by weight ranged from 0 to 72.0 kg/nm (158.7lb/nm) with a mean catch among all stations fished of 15.8kg/nm (34.6lb/nm). Abundance and biomass estimates from these data are given in Table 1.

##### **2007**

A total of 74 successful 1nm dredge tows were conducted during the 2007 Kamishak Bay weathervane scallop survey (43 in the north bed and 31 in the south bed). Catch in the north bed was 3,175 weathervane scallops weighing 1,122 kg (2,474 lb). Catch abundance ranged from 0 to 305 scallops/nm resulting in a mean among all stations of 73.8 scallops/nm. Standardized catches by weight ranged from 0 to 84.8 kg/nm (187.1lb/nm) with a mean catch among all stations fished of 26.1 kg/nm (57.5lb/nm). Catch in the south bed was 3,580 weathervane scallops weighing 728 kg (1,606 lb). Catch abundance ranged from 0 to 453 scallops/nm

resulting in a mean among all stations of 115.5 scallops/nm. Standardized catches by weight ranged from 0 to 108.0 kg/nm (238.1 lb/nm) with a mean catch among all stations fished of 23.5 kg/nm (51.8 lb/nm). Abundance and biomass estimates from these data are given in Table 1.

**Table 1:** Date summary and estimates for weathervane scallops in Kamishak Bay, 1996-2008.

Year	Number stations sampled	Mean catch (kg/nm)	Median catch (kg/nm)	Biomass estimate (kg)	Confidence interval (95%)	CV	Abundance estimate	Confidence interval (95%)	CV	Estimated biomass (kg meat)
<b>North Bed</b>										
1996	26	62.9	51.3	4,310,269	+ 1,507,881	17.0%	16,298,521	+ 6,190,250	18.4%	367,980
1998 <sup>a</sup>	-	-	-	-	-	-	-	-	-	-
1999	41	68.7	44.5	4,708,518	+ 1,567,318	17.0%	12,382,976	+ 4,200,007	17.3%	308,168
2001	37	63.1	29.4	4,322,133	± 1,498,643	17.7%	9,999,335	± 3,446,756	17.6%	275,120
2003	31	26.2	25.4	1,792,480	+ 556,217	15.8%	4,117,007	+ 1,129,507	14.0%	121,603
2005	38	22.6	15.0	1,551,675	+ 493,564	16.2%	3,555,537	+ 1,089,195	14.8%	107,057
2007	43	26.1	22.8	1,787,798	± 491,063	14.0%	5,059,604	± 1,394,499	13.3%	142,144
<b>South Bed</b>										
2003	31	74.4	47.2	3,845,330	± 959,077	12.7%	8,269,024	± 3,078,303	17.9%	260,870
2005	29	16.2	8.8	839,513	+ 408,048	23.7%	3,935,269	+ 1,518,843	17.7%	57,922
2007	31	23.5	16.0	1,214,096	+ 485,278	20.4%	5,966,159	+ 2,428,242	18.7%	97,958

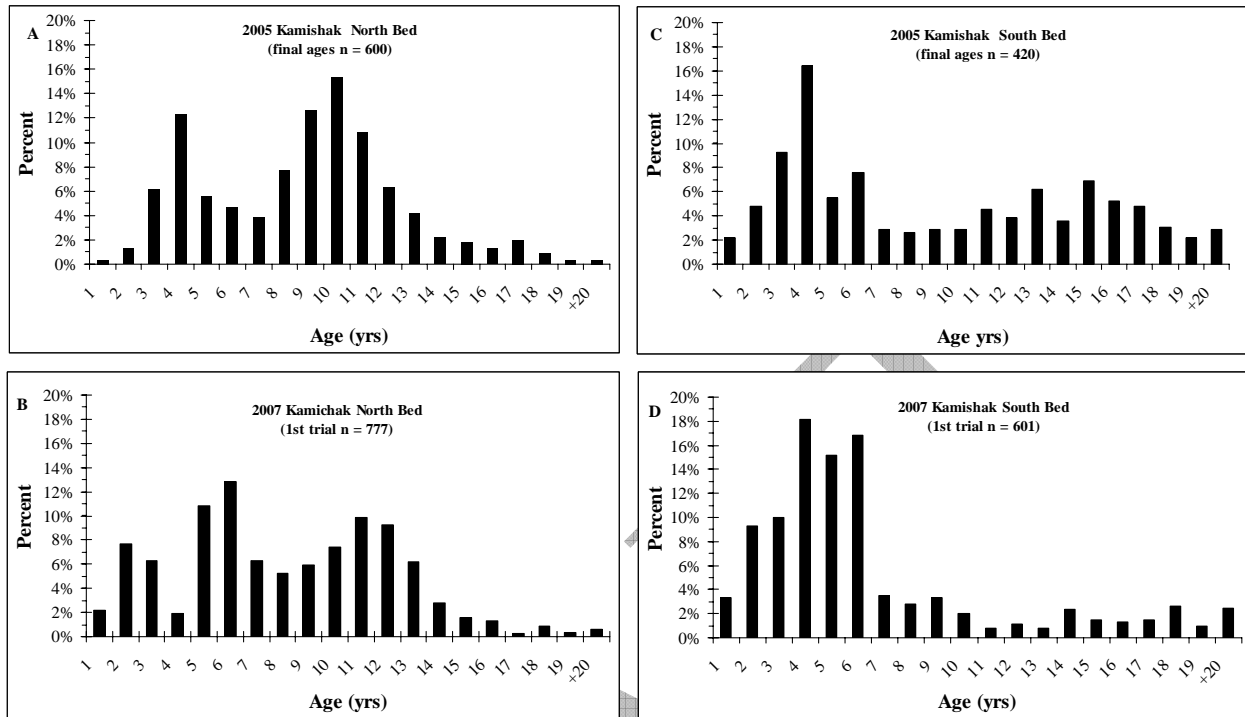
a = dredge lost - survey not adequately completed

### Survey Age and Height Composition

The current focus on scallops in Central Region is to develop an age structured model. Prior to the development of that model, a statewide scallop ageing protocol is being developed by Central Region staff with assistance from ADF&G staff in Kodiak. Upon completion of the ageing protocol, age and growth models will be developed from scallop ages from Central Region beds and an age structured model will be built. Ageing of scallops will also be done for all scallop beds across the state, however, shells in all beds outside Central Region are only obtained from the fishery, hence a fishery independent sample will likely be required to obtain age and height from smaller scallops that are not retained in commercial fishing gear.

Survey age composition in Kamishak Bay ranged from young-of-the-year (age zero) to age 24 (Figure 3). The progression of strong cohorts can be seen growing across some calendar years, and young age classes tend to be the most abundant age classes in the survey. In 56% of the surveys, weighted age composition data indicated that over ½ of the surveyed population were between ages zero and seven; however the catch of older scallops is still quite good. Such diversity in the age composition of the survey catch as well as in the fishery indicates relatively strong resilience to population disturbances. This is likely due to the fact that: (1) the population is supported by a wide range of age classes; and (2) the fishery is not strictly dependent upon recruitment pulses.

Thousands of scallops have been measure during Central Region surveys. Scallop heights in Kamishak Bay range from approximately 25 mm to 195 mm. Once the scallop ageing protocol is complete, all heights will be related to ages (or small groups of age classes), however, the focus of our program in the development of age structured population models.



**Figure 3:** Age composition of weathervane scallops from the Kamishak Bay survey for 2005 and 2007.

### Fishery Age and Height Composition

Harvest data collected from the Kamishak Bay District weathervane scallop fishery, in addition to the weight of harvested meats, included shell height. Shell samples from shucked scallops have been collected annually by both Department observers and commercial fishing crews. Fishermen were instructed to randomly select 100 shells over the duration of a trip or for each 5-day period within a trip. For the north bed, early fishery samples indicated a fishery supported by a relatively broad range of shell heights from approximately 110 mm to 190 mm. Following the 1987 closure due to low abundance caused by suspected illegal harvest, the fishery appears to have become supported by a narrow height range of scallops through 1995. Over subsequent years, data indicate recruitment to the population, and the fishery was again supported by a broader height range of scallops. The die-off observed in the 2002 fishery was accompanied by a decline in the range of heights supporting the fishery, which continued to be observed through 2005. The range was quite narrow and appeared truncated at the upper end. There has been no participation in the in the Kamishak Bay commercial fishery over the past two years. Although there are only three years of harvest data, the south bed fishery appears to be supported by a broad range of heights. However, the 2004 data indicate a slight truncation at the upper end of the height range and a decrease in the middle of the range. Scallop age classes from the fishery will be examined upon completion of the statewide ageing protocol.

## Kayak Island Scallop Survey Results

### 2006

A total of 56 successful 1nm dredge tows were conducted during the 2006 Kayak Island weathervane scallop survey (34 in the east bed and 22 in the west bed). Catch in the east bed was 5,238 weathervane scallops weighing 1445.9 kg (3,187.5 lb). Catch abundance ranged from 5 to 1,332 scallops/nm resulting in a mean among all stations of 154.1 scallops/nm.

Standardized catches by weight ranged from 0.7 kg/nm (1.5 lb/nm) to 397.7 kg/nm (877 lb/nm) with a mean catch among all stations fished of 42.5 kg/nm (93.8 lb/nm). Catch in the west bed was 5,483 weathervane scallops weighing 1,232 kg (2717 lb). Catch abundance ranged from 1 to 1,332 scallops/nm resulting in a mean among all stations of 249.2 scallops/nm. Standardized catches by weight ranged from 0.3 kg/nm (0.6 lb/nm) to 287.9 kg/nm (635 lb/nm) with a mean catch among all stations fished of 56.0 kg/nm (123.5 lb/nm). Abundance and biomass estimates from these data are given in Table 2.

### 2008

A total of 47 successful 1nm dredge tows were made during the 2008 Kayak Island survey (37 in the east bed and 10 in the west bed). The slightly fewer number of tows in this year was due to inclement weather conditions. Catch in the east bed was 4,356 weathervane scallops weighing 1,340 kg (2,954 lb). Catch abundance ranged from 0 to 654 scallops/nm resulting in a mean among all stations of 117.7 scallops/nm. Standardized catches by weight ranged from 0 to 199.7 kg/nm (440.3 lb/nm) with a mean catch among all stations fished of 36.2 kg/nm (79.8 lb/nm). Catch in the west bed was 1,058 weathervane scallops weighing 196 kg (432 lb). Catch abundance ranged from 3 to 374 scallops/nm resulting in a mean among all stations of 105.8 scallops/nm. Standardized catches by weight ranged from 0.01kg (0.02 lb/nm) to 71.5 kg/nm (157.6 lb/nm) with a mean catch among all stations fished of 19.6 kg/nm (43.2 lb/nm). Abundance and biomass estimates from these data are given in Table 2.

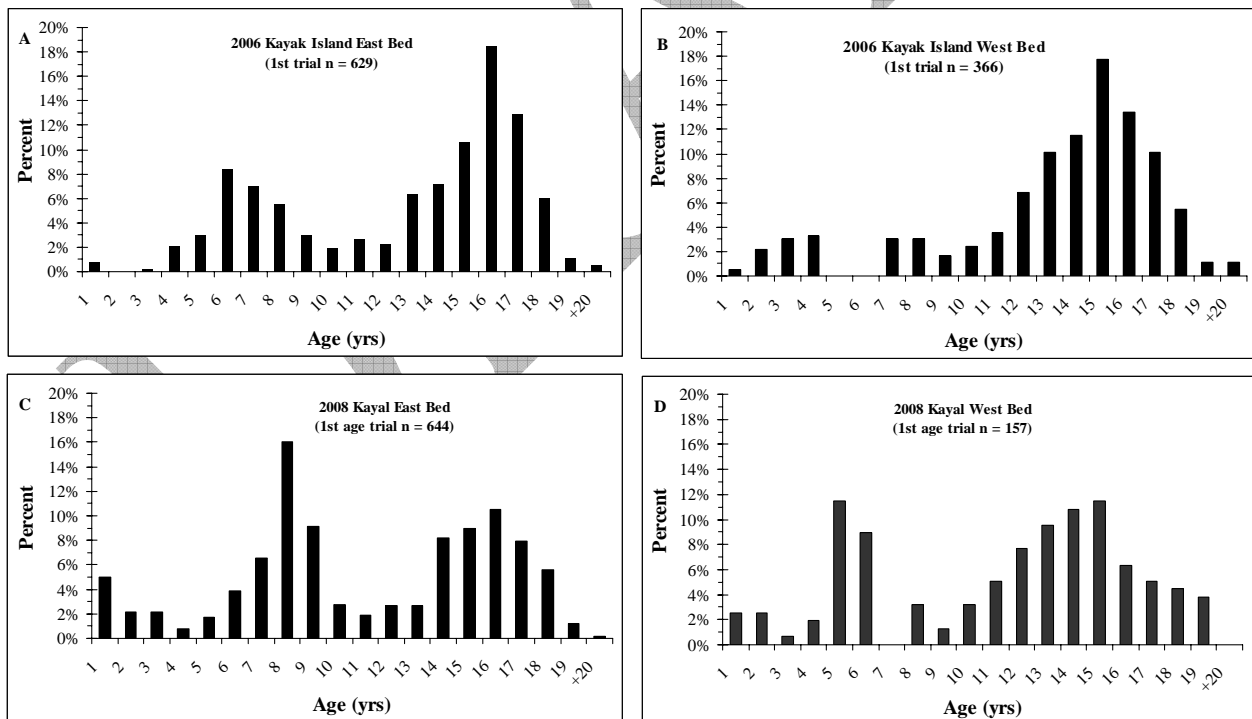
**Table 2:** Date summary and estimates for weathervane scallops at Kayak Island, 1996-2008.

Year	Number stations sampled	Mean catch (kg/nm)	Median catch (kg/nm)	Biomass estimate (kg)	Confidence interval (95%)	CV	Abundance estimate	Confidence interval (95%)	CV	Estimated biomass (kg meat)
<b>East Bed</b>										
1996	38	29.3	14.1	1,757,822 ±	1,055,363	30.6%	7,665,330 ±	5,055,277	33.6%	139,401
1998	28	21.1	15.4	1,264,488 ±	435,385	16.8%	5,496,099 ±	1,807,737	16.0%	96,411
2000	33	37.6	41.1	2,255,855 ±	620,392	14.0%	9,513,606 ±	2,435,296	13.1%	165,743
2002	20	10.5	9.4	632,222 ±	286,199	21.6%	2,579,532 ±	1,163,924	21.6%	45,304
2004	31	77.3	32.7	4,639,592 ±	3,157,355	34.7%	17,905,822 ±	11,691,177	33.3%	304,720
2006	32	58.0	22.6	2,701,657 ±	1,576,540	29.8%	9,771,298 ±	5,395,445	28.2%	194,880
2008	37	36.2	21.5	2,172,708 ±	888,923	20.9%	7,063,665 ±	2,860,387	20.7%	132,311
<b>West Bed</b>										
1998	21	34.2	20.9	1,264,389 ±	761,806	28.9%	5,156,119 ±	2,309,193	21.5%	96,403
2000	20	94.0	26.6	3,474,949 ±	2,174,617	29.9%	17,777,746 ±	10,269,460	27.6%	255,312
2002	17	39.3	18.9	1,453,192 ±	782,516	25.4%	6,027,791 ±	3,104,626	24.3%	104,133
2004	25	84.9	23.6	3,135,745 ±	1,758,535	27.2%	14,278,296 ±	7,276,183	24.7%	205,950
2006	20	61.4	19.1	2,270,835 ±	1,379,643	29.0%	10,106,636 ±	6,068,318	28.7%	163,803
2008	10	19.6	12.8	723,702 ±	601,572	36.7%	3,910,300 ±	3,129,662	35.4%	44,071

## Survey Age and Height Composition

The current focus on scallops in Central Region is to develop an age structured model. Prior to the development of that model, a statewide scallop ageing protocol is being developed by Central Region staff with assistance from ADF&G staff in Kodiak. Upon completion of the ageing protocol, age and growth models will be developed from scallop ages from Central Region beds and an age structured model will be built. Ageing of scallops will also be done for all scallop beds across the state, however, shells in all beds outside Central Region are only obtained from the fishery, hence a fishery independent sample will likely be required to obtain age and height from smaller scallops that are not retained in commercial fishing gear.

Survey age composition has ranged from young-of-the-year age zero to age 22 (Figure 4). The progression of strong cohorts is somewhat difficult to see in the data. The dominant age classes in most years are between seven and 12 years old, but the full range of age and height classes are observed in the survey data. In 67% of the surveys, weighted age composition data indicated that well over  $\frac{1}{2}$  of the surveyed population was between ages seven and 12; however the catch of younger and older scallops is still good. Such diversity in the age composition of the survey catch as well as in the fishery indicates relatively strong resilience to population disturbances. An age-structured model will be developed for this area over the next several years for presentation to the Alaska Board of Fisheries and the North Pacific Fisheries Management Council.



**Figure 4:** Age composition of weathervane scallops from the Kayak Island survey in 2006 and 2008.

Thousands of scallops have been measure during Central Region surveys. Scallop heights at



Kayak Island range from approximately 13 mm to 175 mm. Once the scallop ageing protocol is complete, all heights will be related to ages (or small groups of age classes), however, the focus of our program in the development of age structured population models.

### **Fishery Age and Height Composition**

Harvest data collected from the Kayak Island weathervane scallop fishery, in addition to the weight of harvested meats, included shell height composition. Shell samples from shucked scallops have been collected annually by both Department observers and commercial fishing crews. Data indicate a fairly narrow range of scallop heights supported the fishery with scallop shell heights between 125 and 140 mm, which comprised approximately 77% of the catch sample. However, recruitment to the scallop population with shell heights less than 120 mm is better represented by a broader range of heights than in other years. Overall heights of scallops commercially fished at Kayak Island ranges from approximately 105 mm to 187 mm. Scallop age classes from the fishery will be examined upon completion of the statewide ageing protocol.

*B. Specifically detail which objectives were achieved, not achieved, or partially met. For each objective not achieved, describe why. Were the goals and objectives in the original proposal realistic? Has the project led to unexpected benefits? Is there general satisfaction with the results of the project? If not, why not?*

### **Project objectives:**

**1. Determine population biomass and abundance through fishery independent surveys.**

This objective was completely achieved.

**2. Determine height and age composition in fishery independent surveys.**

This objective was completely achieved, however, once the scallop ageing protocol is complete, all heights will be related to ages (or small groups of age classes).

**3. Determine height and age composition in commercial fishery harvests.**

This objective was completely achieved, however once the scallop ageing protocol is complete, all heights will be related to ages (or small groups of age classes).

**4. Present harvest recommendations to the Alaska Board of Fisheries and the North Pacific Fisheries Management Council.**

This objective was achieved, but is ongoing. We continue to supply information from our survey data to the North Pacific Fishery Management Council and the Alaska Board of Fisheries as needed for management and for proposals to alter the fishery when the come before the Board.

**5. Document assessment efforts through fishery data reports.**

This objective has not been fully achieved. We did complete all necessary semi-annual and annual reports required by the NOAA extended jurisdiction program that funded this project. We are in the process of catching up on Department reports. The 2002 Kayak and 2003

Kamishak survey reports are in the final editing stages after coming back from Department review.

*C. Describe significant modifications made to the original goals/objectives and why the changes were necessary.*

No significant changes or modifications occurred during the course of this project, however due to this project scallop research in Central Region has been able to make significant strides in standardizing our survey design. Additionally, during the course of this project, Central Region research biologists are leading the way in developing a statewide ageing protocol in collaboration with ADF&G staff in Kodiak. Additionally, Central Region groundfish/shellfish 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 ADF&G 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 ADF&G 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 ADF&G 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.

*D. If applicable, describe any additional or future work to accomplish the stated project goals.*

We expect to complete the statewide aging protocol in January 2009 and begin to move toward developing age structured models for scallop beds statewide. We will also continue to do comparisons between the video assessment survey technique and the dredge survey.

*E. Summarize the project and provide a conclusion.*

The Cook Inlet and Prince William Sound registration areas (which contain the Kamishak Bay and Kayak Island scallop beds, respectively) are currently the only two management areas in Alaska where scallop stock status is assessed by fishery independent research surveys, and where the scallop fishery is managed based on survey results. Survey results were used to develop annual commercial fishery guideline harvest levels (GHL's) for Central Region scallop beds. Specific criteria used to develop GHL's included scallop biomass, abundance, age composition, and changes in these measures since the previous survey. Following discussions of recommendations between ADF&G research and management staff, GHL's (and Tanner crab bycatch limits) were finalized and announced through ADF&G news releases issued prior to the season opening for each respective harvest area.

This project has been enormously successful and has accomplished the vast majority of proposed goals in the original proposal. It has also provided the ability work on aspects of scallop biology and engage in potential new methods from which to achieve abundance estimates, which are beyond the scope of the proposed research four years ago. If ADF&G 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.

## V. PRODUCTS

All necessary semi-annual and annual reports required by the NOAA extended jurisdiction program that funded this project were completed. The 2002 Kayak and 2003 Kamishak survey reports underwent Departmental review and the redrafts should be completed in the spring 2009.

Survey data are used for setting guideline harvest for the scallop fisheries and used in news releases for the fisheries. Data will also be presented in report and visual presentation form to the North Pacific Fishery Management Council and the Alaska Board of Fisheries as required.

Oral presentations on Central Region scallops have been presented to the Scientific and Statistical Committee of the North Pacific Fishery Management Council and in several ADF&G departmental meetings.

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## **VII. KEY WORDS**

Weathervane scallop, scallop, assessment, dredge, age, distribution, biomass, abundance.

DRAFT