Aleutian Islands Golden King Crab

2009 Crab SAFE Report Chapter

Douglas Pengilly, ADF&G, Kodiak, 30 April 2009

Executive Summary

Stock: Golden king crab/Aleutian Islands

Catches: The fishery has been prosecuted as a directed fishery since the 1981/82 season and has been open every season since then. Retained catch peaked during the 1985/86–1989/90 seasons (average annual retained catch = 11,875,811 pounds), but the retained catch dropped sharply from the 1989/90 to 1990/91 season and average annual retained catch for the period 1990/91–1995/96 was 6,930,627 pounds. Management towards a formally established guideline harvest level (GHL) was introduced for the first time in the 1996/97 season. A GHL of 5.9-million pounds was established for the 1996/97 season, which was subsequently reduced to 5.7-million pounds beginning with the 1998/99 season. The GHL (or, since the 2005/06 season, the total allowable catch, or TAC) has remained at 5.7 million pounds through the 2007/08 season, but was increased to 5.985-million pounds for 2008/09 season, which opened on 15 August 2008 and is currently ongoing. Average annual retained catch for the period 1996/97–2007/08 was 5,622,808 pounds. Retained catch in 2007/08, the most-recently completed season, was 5,508,100 pounds. Catch per pot lift of retained legal males decreased from the 1980s into the mid-1990's, but increased steadily since the 1996/97 season and increased markedly in 2005/06 with the advent of the Crab Rationalization program. Non-retained catch of sublegal and female golden king crabs during the fishery has decreased relative to the retained catch and in absolute numbers since the late-1990's. Estimated weight of discarded bycatch (sublegal and female golden king crabs) during the fishery decreased from 9,075,548 pounds in 1996/97 (representing 156% of the retained catch for that season) to 4,321,014 pounds in the 2004/05 season (representing 78% of the retained catch for that season). During the three seasons prosecuted as rationalized fisheries, estimated weight of discarded bycatch has ranged from 2,523,737 pounds for the 2005/06 season (representing 46% of the retained catch for that season) to 3,034,631 pounds for the 2007/08 season (representing 55% of the retained catch for that season). Estimates of the annual weight of bycatch mortality has correspondingly decreased since 1996/97, both in absolute value and relative to the retained catch weight.

Data and assessment: An assessment model has been developed for this stock (Siddeek 2008) and is under review for further development (minutes of the NPFMC SSC meeting, 29 September – 1 October 2008).

Available data for this assessment are from:

- fish tickets (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date) for the 1981/82–2007/08 seasons,
- size-frequency data from samples of retained crabs (presented for the 1997/98–2007/08 seasons in this assessment),
- data from pot lifts sampled by at-sea observers during crab fisheries (date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc; analysis of data from the 1996/97–2007/08 seasons are presented in this assessment); size frequency distribution of male and female golden king crabs captured by pot lifts randomly sampled during the 1997/98–2007/08 Aleutian Islands golden king crab fishery seasons are presented in this assessment,

- data on bycatch of golden king crabs obtained by at-sea observers during groundfish fisheries in reporting areas 541, 542, and 543 for calendar years 2000–2007 and preliminary data for 2008/09 (from 1 June 2008 through all available as of 8 April 2009)
- data from the 1997–2006 triennial pot surveys for golden king crabs in the Yunaska-Amukta Island area of the Aleutian Islands (approximately 171° W longitude), and
- data on growth and movement from commercial fishery recoveries of tagged crabs released during the triennial pot surveys.

Unresolved problems and major uncertainties: Most of the available data for this assessment are obtained from the fishery, which targets legal-size (≥6" carapace width) males, and trends in that data can be affected by changes in fishery practices as well as changes in the stock. Asynchronous aseasonal molting and the prolonged intermolt period (>1 year) of mature female and the larger male golden king crabs makes scoring shell conditions very difficult and especially difficult to relate to "time post-molt," posing problems for inclusion of shell condition data into assessment models. The triennial survey is too limited in geographic scope and too infrequent to provide an annual index of abundance for the entire Aleutian Islands Area.

Reference points: Due to the lack of stock biomass estimates available for this assessment, this stock is recommended for placement in Tier 5 for determination of OFL. For Tier 5 stocks, BMSY and MSST are not estimated and OFL is defined as "the average retained catch from a time period determined to be representative of the production potential of the stock" (NPFMC 2007b).

Stock biomass: Estimates of stock biomass are not available for this assessment.

Recruitment: Estimates of recruitment trends and current levels relative to virgin or historic levels are not available for this assessment. Fishery CPUE (catch number of legal retained males per pot lift) increased from 6 crabs per pot lift in the 1994/95 season to 23 crabs per pot lift in the 2007/08 season. However, the likely effects of changes in fishery practices on fishery CPUE make it difficult to view that strongly increasing trend in CPUE as a direct index of the trend in the abundance of legal males. Strong indices of recruitment to legal size that would be consistent with a strong increase in abundance of legal males in recent years have been lacking in the size distribution of crabs captured during recent commercial fishery seasons. However, the size distribution of crabs captured during recent commercial fishery seasons is likely also affected by changes in fishery practices.

Exploitation status: The fishery was managed with a GHL of 5.9-million pounds during 1996/97–1997/98 and with a fixed GHL/TAC of 5.7-million pounds during 1998/99–2007/08. Estimates of fishing mortality rate are not available for this assessment.

Management performance: Over the period 1996/97–2007/08 the total retained catch has been 2% below the total of the annual GHL/TACs. By season, retained catch has been as much as 13% below the GHL/TAC (the 1998/99 season) and as much as 6% above the GHL/TAC (the 2000/01 season). The retained catch for the most recently completed season (2007/08) was 3% below the 5.7-million pound TAC.

Forecasts: No forecasts of stock biomass are available for this assessment. By state regulation (**5 AAC 34.612**), the TAC for retained catch for the Aleutian Islands golden king crab fishery is set at 5.985-million pounds (apportioned as 3.15-million pounds for the area east of 174° W longitude and 2.835-million pounds for the area west of 174° W longitude) for the 2008/09 season and subsequent seasons until a stock assessment model is established by ADF&G for the stock.

Decision table: Not available for this assessment.

Recommendations: Approval and use of an assessment model that has been in development (Siddeek 2008) would allow for this stock to be moved to Tier 4 (NPFMC 2007b) and would provide focus for establishing research and data collection priorities.

Summary of Major Changes

Changes to this chapter since the September 2008 SAFE include:

- Updating with data from the fishery 2007/08 fishery season
- Inclusion of tables and graphs of the size frequency distributions of legal male, sublegal and legal male, and female golden king crabs captured in the last 11 completed Aleutian Islands golden king crab fisheries east and west of 174° W longitude
- Inclusion of graphs of the size frequency distributions of legal male, sublegal and legal male, and female golden king crabs captured in the last 11 completed Aleutian Islands golden king crab fisheries east and west of 174° W longitude
- Summarization of bycatch in the groundfish fisheries now includes summary by gear type, allowing for estimating bycatch mortality with assumptions on bycatch mortality rate by gear type.
- Inclusion of information on changes in fishery management practices that have occurred since September 2008 and information supplied by the industry on fishing practices supplied since September 2008.
- A table providing the species composition of randomly sampled pot lifts during recent Aleutian Islands golden king crab fisheries has been produced for the "Ecosystem Considerations" section.

Responses to Comments from the SSC

No recommendations pertaining to this report were made by the SSC at the September 2008 meeting. The following general recommendations to all assessment authors for future assessments that were not model-based assessments were made by the SSC at the May 2008 meeting:

1. *To the extent possible a consistent format should be used for the assessments; sections that are not relevant to a particular stock should be omitted.*

Response: Irrelevant sections have been omitted.

2. *Each assessment should provide a range of alternatives for the Plan Team and the SSC to consider when setting OFLs, for example,… alternative time periods used in Tier 4 and Tier 5 calculations.*

Response: Done.

3. [Pertains to model-based assessments]

4. *The rationale for selecting a specific time period … for establishing an OFL based on catch histories (Tier 5) should be clearly articulated. Unless compelling reasons exist to choose a different period, the default should be the full time series for which data are available. When alternative time periods are considered, the rationale and the resulting reference points should be presented for consideration by the Plan Team and SSC.*

Response: Done, I believe.

5. [Pertains to model-based assessments]

6. *To the extent possible, bycatch information should be provided for all stocks included in the SAFE in order to remove stocks from "retained catch OFL" to "total catch OFL".*

Response: Bycatch information is provided to the extent possible. However, bycatch data for this stock is not available for the full period of unconstrained catch; data on bycatch during groundfish fisheries is lacking for the period of unconstrained catch. Amendment 24 analysis defined OFL for Tier 5 stocks in terms of retained catch.

7. [Pertains to model-based assessments]

8. *The ecosystem considerations chapter could be expanded to include information on prey and predator consumption in a consistent format. A discussion of seabird predation on crab would be a useful addition. We note that seabirds feed on larval through juvenile crab, particularly in shallow waters or nearshore areas such as the Pribilof Islands. In addition, plankton-feeding birds eat larval crab throughout the year and juveniles consumed by seaducks and seabirds, particularly during winter months.*

Response: Suggested expansions remain lacking in this assessment. These could be difficult.

9. *Each assessment should include figures showing the available time series of catch and survey biomass, in addition to tables, to facilitate comparisons and selection of appropriate time periods.*

Response: Figures of available time series of catch biomass are provided. Survey biomass estimates are lacking for this assessment.

10. [Pertains to assessments for which time series of recruitment are available]

11. [Pertains to model-based assessments]

Introduction

Scientific name: *Lithodes aequispinus* J. E. Benedict, 1895

Description of general distribution
General distribution of golden king crabs is summarized by NMFS (2004):

> Golden king crab, also called brown king crab, range from Japan to British Columbia. In the BSAI, golden king crab are found at depths from 200 m to 1,000 m, generally in high-relief habitat such as inter-island passes.
>
> Golden, or brown king crab occur from the Japan Sea to the northern Bering Sea (ca. 61° N latitude), around the Aleutian Islands, on various sea mounts, and as far south as northern

British Columbia (Alice Arm) (Jewett et al. 1985). They are typically found on the continental slope at depths of 300-1,000 m on extremely rough bottom. They are frequently found on coral bottom.

In 2007/08, the most recently completed fishery season, commercial fishing for golden king crabs in the Aleutian Islands Area typically occurred at depths of 100–250 fathoms (183–457 m), with the pots sampled by at-sea observers fished at an average depth of 177 fathoms (324 m) in the area east of 174° W longitude and 181 fathoms (332 m) for the area east of 174° W longitude (Table 1). Those depths were similar to the average depths of pots fished in the Aleutian Islands Area during 2005/06 season (Barnard and Burt 2007) and the 2006/07 season (Barnard and Burt 2008).

Description of management unit(s) and spatial and seasonal management measures
From Bowers et al. (2008, page 6; see also Figure 1):

> The Aleutian Islands king crab Registration Area O has as its eastern boundary the longitude of Scotch Cap Light (164° 44' W long.), its northern boundary a line from Cape Sarichef (54° 36' N latitude) to 171° W long., north to 55° 30' N lat., and as its western boundary the Maritime Boundary Agreement Line as that line is described in the text of and depicted in the annex to the Maritime Boundary Agreement between the United States and the Union of Soviet Socialist Republics signed in Washington, June 1, 1990. Area O encompasses both the waters of the Territorial Sea (0–3 nautical miles) and waters of the Exclusive Economic Zone (3–200 nautical miles).

During the 1984/85–1995/96 seasons, the Aleutian Islands king crab populations had been managed using the Adak and Dutch Harbor Registration Areas, which were divided at 171° W longitude (Figure 2), but from the 1996/97 season to present the fishery has been managed using a division at 174° W longitude (Figure 1; Bowers et al. 2008). At its March 1996 meeting, the Alaska Board of Fisheries (BOF) replaced the Adak and Dutch Harbor areas with the newly created Aleutian Islands Registration Area O and directed ADF&G to manage the golden king crab fishery in the areas east and west of 174° W longitude as two distinct stocks. That re-designation of management areas was intended to more accurately reflect golden king crab stock distribution, as is shown by the longitudinal pattern in fishery production prior to the 1996/97 season (Figure 3). In this chapter we use "Aleutian Islands Area" to mean the area described by the current definition of Aleutian Islands king crab Registration Area O.

By State of Alaska regulation (**5 AAC 34.610 (b)**), the commercial fishing season for golden king crabs in the Aleutian Islands Area is August 15 through May 15.

Evidence of stock structure
Given the expansiveness of the Aleutian Islands Area and the existence of deep (>1,000 m) canyons between some islands, at least some weak structuring of the stock within the area would be expected. Data for making inferences on stock structure of golden king crabs within the Aleutian Islands is largely limited to the geographic location of commercial fishery catch and effort. Effort and catch by statistical area since 1982 and locations of over 70,000 fished pots that were sampled by observers since the 1996/97 season indicate that habitat for legal-sized males may be continuous throughout the waters adjacent to the Aleutian Islands. However, regions within the area in which available habitat is attenuated are suggested by regions of low fishery effort and catch (Figures 3 and 4); for example the southern side of islands between 174° W longitude and 177° W longitude (i.e., from Atka I. west to Adak I.) as compared to the area surrounding islands between 170°W longitude and 173° W longitude (i.e., between the Islands of the Four Mountains and Seguam Pass). Additionally, there is a gap of catch and effort in statistical areas between Petrel Bank/Petrel Spur and Bowers Bank, both of which areas have reported effort and catch. Recoveries during commercial fisheries of golden king crab tagged during ADF&G

surveys (Blau and Pengilly 1994, Blau et al. 1998, Watson and Gish 2002, Watson 2004, Watson 2007) have provided no evidence of substantial movements by crabs in the size classes that were tagged (males and females ≥90-mm CL). Maximum straight-line distance between release and recovery location of 90 golden king crabs released prior to the 1991/92 season and recovered through the 1992/93 season was 33.1 nm (61.2 km; Blau and Pengilly 1994). Of the 4,053 recoveries reported through 14 March 2008 of the golden king crabs tagged and released between 170.5° W longitude and 171.5° W longitude during the 1997, 2000, 2003, and 2006 triennial ADF&G Aleutian Island golden king pot surveys, none were recovered west of 174° W longitude and only four were recovered west of 172° W longitude (L. J. Watson, Fishery Biologist, ADF&G, Kodiak; personnel communication).

Description of life history characteristics relevant to stock assessments

The following review on molt timing and reproductive cycle is adapted with some additions from Watson et al. (2002):

> Unlike red king crabs, golden king crabs may have an asynchronous molting cycle (McBride et al. 1982, Otto and Cummiskey 1985, Sloan 1985, Blau and Pengilly 1994). In a sample of male golden king crabs 95–155-mm CL and female golden king crabs 104–157-mm CL collected from Prince William Sound and held in seawater tanks, Paul and Paul (2000) observed molting in every month of the year, although the highest frequency of molting occurred during May–October. Watson et al. (2002) estimated that only 50% of 139-mm CL male golden king crabs in the eastern Aleutian Islands molt annually and that the intermolt period for males ≥150-mm CL averages >1 year.
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> Female lithodids molt before copulation and egg extrusion (Nyblade 1987). From their observations on embryo development in golden king crabs, Otto and Cummiskey (1985) suggested that time between successive ovipositions was roughly twice that of embryo development and that spawning and molting of mature females occurs approximately every two years. Sloan (1985) also suggested a reproductive cycle >1 year with a protracted barren phase for female golden king crabs. Data from tagging studies on female golden king crabs in the Aleutian Islands are generally consistent with a molt period for mature females of ≤2 years and that females carry embryos for less than two years with a prolonged period in which they remain in barren condition (Watson et al 2002). From laboratory studies of golden king crabs collected from Prince William Sound, Paul and Paul (2001c) estimated a 20-month reproductive cycle with a 12-month clutch brooding period.
>
> Numerous observations on clutch and embryo condition of mature female golden king crabs captured during surveys have been consistent with asynchronous, aseasonal reproduction (Otto and Cummiskey 1985, Hiramoto 1985, Sloan 1985, Somerton and Otto 1986, Blau and Pengilly 1994, Blau et al. 1998, Watson et al. 2002). Based on data from Japan (Hiramoto and Sato 1970), McBride et al. (1982) suggested that spawning of golden king crab in the Bering Sea and Aleutian Islands occurs predominately during the summer and fall.

The success of asynchronous and aseasonal spawning of golden king crabs may be facilitated by fully lecithotrophic larval development (i.e., the larvae can develop successfully to juvenile crabs without eating; Shirley and Zhou 1997).

Note that asynchronous aseasonal molting and the prolonged intermolt period (>1 year) of mature female and the larger male golden king crabs likely makes scoring shell conditions very difficult and especially

difficult to relate to "time post-molt," posing problems for inclusion of shell condition data into assessment models.

Fishery

Description of the directed fishery

Only males of a minimum legal size may be retained by the commercial golden king crab fishery in the Aleutian Islands Area. By State of Alaska regulation (**5 AAC 34.620 (b)**), the minimum legal size limit is 6.0-inches (152 mm) carapace width (CW), including spines. A carapace length (CL) ≥135 mm is used to identify legal-size males when CW measurements are not available (Table 3-5 in NPFMC 2007b).

Prior to the 1996/97 season no formal preseason harvest target or limit was established for the fishery. The 1996/97–1997/98 seasons were managed under a 5,900,000-pound guideline harvest level (GHL), with 3,200,000 pounds apportioned to the area east of 174° W longitude and 2,700,000 pounds apportioned to the area west of 174° W longitude. The 1998/99–2004/05 seasons were managed under a 5,700,000-pound GHL, with 3,000,000 pounds apportioned to the area east of 174° W longitude and 2,700,000 pounds apportioned to the area west of 174° W longitude. For the 2005/06–2007/08 seasons the GHL was renamed a total allowable catch (TAC), with no change in the amount or area apportionment. By state regulation (**5 AAC 34.612**), the TAC for retained catch for the Aleutian Islands golden king crab fishery will be 5,985,000 pounds (apportioned as 3,150,000 pounds for the area east of 174° W longitude and 2,835,000 pounds for the area west of 174° W longitude) for the 2008/09 season and subsequent seasons until a stock assessment model is established by ADF&G for management of the stock.

Golden king crabs may be commercially fished only with king crab pots (as defined in 5 AAC 34.050). Pots used to fish for golden king crabs in the Aleutian Islands Area may be operated only from a shellfish longline and, since 1996, must have at least four escape rings of five and one-half inches minimum inside diameter installed on the vertical plane or at least one-third of one vertical surface of the pot composed of not less than nine-inch stretched mesh webbing to permit escapement of undersized golden king crabs (5 AAC 34.625 (b)). Prior to the regulation requiring an escape mechanism on pots, some participants in the Aleutian Islands golden king crab fishery voluntarily sewed escape rings (typically 139-mm or 5.5") into their gear or, more rarely, included panels with escape mesh (Beers 1992). With regard to the gear used by fishers since the establishment of **5 AAC 34.625 (b)** in 1996, Linda Kozak, a representative of the industry, reported in a 19 September 2008 email to the Crab Plan Team that,

> "… the golden king crab fleet has modified their gear to allow for small crab sorting. Lance Nylander, of Dungeness Gear Works in Seattle, has written a statement confirming that fact. Lance indicated to me on the phone that he believes he makes all the gear for the golden king crab harvesting fleet."

The referenced, undated letter to Whom It May Concern from Lance A. Nylander, President/Owner of Dungeness Gearworks Inc., Everett, WA (provided by L. Kozak via 19 September 2008 email to the Crab Plan Team) is excerpted here:

> After reviewing out records of gear building since 1999 for Golden King Crab, it was realized 9" escape web installed on the entire door, considerably reduced the sort time, compared to that of 4 – 5 ½" escape rings or 9" escape web place on 1/3 of a vertical surface.

> After that time, we saw a significant increase in Golden Crab gear door orders, to replace them with 9" escape web from smaller web.
> …
>
> Since 1999, DGW has installed 9" escape web on the door of over 95% of Golden Crab pot orders we manufactured.

The 2005/06 season was the first Aleutian Islands golden king crab fishery to be prosecuted under the Crab Rationalization Program. The following summary of changes to management of the fishery that resulted from the Crab Rationalization Program is from Bowers et al. (2008, page 16):

> Crab Rationalization introduced regulatory changes in the Aleutian Islands golden king crab fishery. The historic GHL has been changed to a Total Allowable Catch (TAC). Qualified participants are issued IFQ shares which they may harvest at any time while the season is open. Harvesters may now use gear cooperatively, transporting and fishing another vessel's gear if registered to do so. Additionally, observer coverage requirements have been decreased. Prior to rationalization, vessels harvesting golden king crab in the Aleutian Islands were required to carry an observer during 100% of their fishing activities. Current regulations stipulate that onboard observers are required during the harvest of 50% of the total golden king crab weight harvested by each catcher vessel and 100% of the fishing activity of each catcher-processor during each of the three trimesters as outlined in **5 AAC 39.645 (d)(4)(A)**.

Also accompanying the implementation of the Crab Rationalization program was implementation beginning in the 2005/06 season of a community development quota (CDQ) fishery for golden king crabs in the eastern Aleutians (i.e., east of 174° W longitude) and Adak Community Allocation (ACA) fishery for golden king crabs in the western Aleutians (i.e., west of 174° W longitude; Milani 2008). The CDQ fishery in the eastern Aleutians is allocated 10% of the golden king crab TAC for the area east of 174° W longitude and the ACA fishery in the western Aleutians is allocated 10% of the golden king crab TAC for the area west of 174° W longitude. Note that, because Adak is not a CDQ community, the ACA fishery in the western Aleutians is not a formal CDQ fishery. Both the CDQ fishery in the eastern Aleutians and the ACA fishery in the western Aleutians are prosecuted concurrently with the IFQ fishery and managed by ADF&G.

The following is historical review of the Aleutian Islands golden king crab fishery is from Bowers et al. (2008, pages 11–15):

> The golden king crab *Lithodes aequispinus* fishery in the Aleutian Islands has never failed to open due to low stock abundance, making it unique among Westward Region king crab fisheries. Golden king crabs inhabit depths greater than where most other commercially exploited king crabs are typically found. The depths and steep bottom topography of the inter-island passes inhabited by golden king crabs necessitate the use of longline rather than single-pot gear. No other major king crab fisheries in Alaska exist where longline pot gear is the only legal gear type.
>
> Historically, golden king crabs were taken as incidental harvest during red king crab fisheries in the Adak (Area R) and Dutch Harbor (Area O) Registration areas. One landing of golden king crabs was reported from the Adak Area during the 1975/76 season, but directed fishing for golden king crabs did not occur in either management area until the 1981/82 season. From the 1981/82 season through the 1995/96 season, the

golden king crab resource in the Aleutian Islands was harvested in separate directed fisheries occurring in the Adak and Dutch Harbor Registration areas.

During the 1981/82 season, 14 vessels landed 1.2 million pounds of golden king crabs in 76 deliveries from the Adak Area. By the following season, harvest had reached 8.0 million pounds with 99 vessels participating in the fishery. Between 1981 and 1995, an average of 50 vessels participated in the Adak golden king crab fishery, harvesting an average of 6.9 million pounds annually. Peak harvest in the Adak Area fishery occurred during the 1986/87 season when 12.9 million pounds of golden king crabs were harvested for an exvessel value of $37.6 million. Initially, the fishery was managed based on size, sex, and season restrictions as no stock assessment of the golden king crab population was performed in the Adak Area. Catches were monitored inseason and after the initial fishery, harvest levels were based on harvest expectations generated from the catch in prior seasons. The majority of golden king crabs harvested in the Adak Area were taken in the North Amlia and Petrel Bank Districts; however, significant harvest also occurred in the remainder of the Western Aleutian District.

From the 1981/82 season to the 1995/96 season, the average weight of golden king crabs harvested in the Adak Area fishery declined from 5.5 to 4.3 pounds and CPUE declined from nine to five legal crabs per pot lift. In July 1985, the BOF adopted a regulation reducing the minimum legal size for golden king crabs from 6.5 to 6.0 inches in carapace width (CW). Decreasing the legal size for golden king crabs in this area resulted in the expected decrease in average weight of legal crabs harvested after 1985/86 and an increased catch during the 1985/86 and 1986/87 seasons. This regulation change did not, however, reverse the trend of slowly declining catch rates in the area west of 171° W long.

Initial catches of golden king crabs in the Dutch Harbor Area were similar to those observed in the Adak Area fishery. Harvest was incidental to the red king crab fishery and effort in the fishery only increased as red king crab stocks decreased in abundance. Six vessels harvested approximately 116,000 pounds of golden king crabs during the 1981/82 Dutch Harbor red king crab season. The following season, 49 vessels participated in the directed golden king crab fishery, harvesting 1.2 million pounds. Between 1981 and 1995, an average of 18 vessels harvested approximately 1.5 million pounds of golden king crabs annually. Peak golden king crab harvest in the Dutch Harbor Area occurred during the 1995/96 season when 2.0 million pounds were harvested for an exvessel value of $5.2 million. The Dutch Harbor Area harvest was primarily from the Islands of Four Mountains and Yunaska Island area.

In general, the average weight of golden king crabs harvested in the Dutch Harbor Area declined during the period from 1981 to 1995, ranging from a high of 7.6 pounds during the 1983/84 season to 4.2 pounds during the 1992/93 season. In 1984, the BOF adopted an ADF&G proposal to lower the legal size for golden king crabs in the Dutch Harbor Area from 6.5 inches to 6.0 inches CW, which would affect average weight, and to establish the area as a permit fishery. CPUE has slowly declined throughout the history of this fishery, reaching a peak of 14 legal crabs per pot during the 1984/85 season and declining to 6 crabs during the 1994/95 season. The golden king crab stock in the Dutch Harbor Area was not surveyed for abundance prior to 1991 and the fishery was managed based on a historical average catch of 1.6 million pounds annually.

At its March 1996 meeting, the BOF chose to restructure management of king crabs in the Aleutian Islands. Formerly, the Aleutian Islands king crab populations had been managed using the Adak and Dutch Harbor Registration Areas that were established for

red king crab fisheries. However, during the 1970s and 1980s, red king crab fisheries declined in the Aleutian Islands while the golden king crab fishery gained increasing importance. Consequently, the BOF felt that king crab management areas in the Aleutian Islands should be re-designated to more accurately reflect current golden king crab stock distribution and patterns in fishing effort. The BOF, therefore, elected to replace the Adak and Dutch Harbor areas with the newly created Aleutian Islands Registration Area O and directed ADF&G to manage the golden king crab in the areas east and west of 174° W long. as two distinct stocks. It also stipulated that a conservative management plan be initiated and that all vessels registered for the fishery continue to carry an onboard observer for all of their fishing activities.

In 1996, when the initial golden king crab fishery in the new king crab Registration Area O occurred, GHLs were established at 3.2 million pounds for the area east of 174° W long., and 2.7 million pounds for the area west of 174° W long. Compared to the combined Adak and Dutch Harbor Area fisheries from prior years, there was reduced effort and harvest during the 1996/97 fishery. Eighteen vessels harvested 5.9 million pounds, down from 28 vessels taking 6.9 million pounds in 1995/96. This reduction in effort was likely due to the departure of vessels for the 1996 Bristol Bay red king crab season, which re-opened to commercial fishing for the first time since 1993. The eastern portion of Area O closed by emergency order on December 25, with a harvest of 3.3 million pounds, while the western portion was open for the entire registration year with a harvest of 2.5 million pounds.

During the 1996/97 fishery, the CPUE east of 174° W long. was six legal crabs per pot and the average weight was 4.5 pounds per crab. Most fishing effort was concentrated in the area around Yunaska Island and the Islands of Four Mountains with some effort in the Seguam and Amukta Pass areas. In the portion of Area O west of 174° W long., fishery performance was six legal crabs per pot lift with an average weight of 4.2 pounds per crab. Most harvest occurred between Amchitka Pass and Buldir Island. The 1996/97 golden king crab fishery in the Aleutian Islands had an estimated exvessel value of $12.5 million.

Since the 1996/97 season, effort and harvest in the Aleutian Islands east of 174° W long. have remained relatively stable. During the 1997/98 season, 15 vessels harvested 3.5 million pounds in an 84-day season. CPUE averaged seven legal crabs per pot lift and harvested crabs averaged 4.5 pounds each. The fishery west of 174° W long. has experienced greater variability in catch and effort. During the 1997/98 season, nine vessels participated in the fishery and harvested 2.4 million pounds. The GHL west of 174° W long. was not reached and the fishery was not closed. The fleet averaged six legal crabs per pot lift with landed crabs averaging 4.3 pounds. The 1997/98 Aleutian Islands golden king crab fishery had an exvessel value of $12.5 million.

Prior to the 1998/99 season, the Aleutian Islands golden king crab GHL east of 174° W long. was reduced from 3.2 million pounds to 3.0 million pounds. Fishery performance trends and data from tag recoveries indicated that the 200,000 pound GHL reduction for the area east of 174° W long. was necessary in order to comply with the overfishing definition specified in the Fishery Management Plan (FMP) for the king and Tanner crab fisheries of the Bering Sea and Aleutian Islands.

The 1998/99 fishery east of 174° W long. was similar to the prior two fisheries. Fourteen vessels registered and harvested 3.2 million pounds in a 68-day season. The catch rate was nine legal crabs per pot lift with landed crabs averaging 4.4 pounds each. West of

174° W long., effort declined significantly from the prior two seasons. A fleet of three vessels harvested 1.7 million pounds, or 63% of the GHL. The fleet averaged 11 legal crabs per pot lift with landed crabs averaging 4.1 pounds each. The 1998/99 fishery had an exvessel value of $9.3 million, the lowest in 14 years.

In July 1999, the BOF adopted a regulation to move the Registration Area O golden king crab fishery from September 1 to August 15 in order to accommodate fishers that participate in both the golden king and Bristol Bay red king crab (BBRKC) fisheries. The BBRKC fishery opening date had been moved from November 1 to October 15, which reduced the amount of fishing time available to the golden king crab fleet prior to the Bristol Bay opening. The change in opening date for Area O was designed to provide adequate fishing time for the golden king crab fleet to harvest the GHL east of 174° W long., prior to the opening of the BBRKC fishery.

In 2000/01, the fishery east of 174° W long. continued the stable trend seen in the previous four years. Fifteen vessels registered and harvested 3.1 million pounds. The CPUE was 10 legal crabs per pot, with a 4.4-pound average weight per crab. West of 174° W long., a fleet of 12 vessels harvested 2.9 million pounds. The CPUE was seven legal crabs per pot, while the average weight per crab was 4.1 pounds. With an exvessel value of $19.5 million, the 2000/01 season was the most valuable golden king crab fishery in six years.

These stable trends continued through the 2003/04 fishery. In the area east of 174° W long., since the 2001/02 season, 18 to 19 vessels participated and harvested an average of 2.99 million pounds per year. The CPUE and average weight have remained relatively stable with a CPUE ranging from 11 to 12 crabs per pot lift and legal males averaging 4.4 to 4.6 pounds. In the area west of 174° W long., six to nine vessels harvested an average of 2.69 million pounds per year. Legal males averaged 4.0 pounds and in 2001/02 and 2002/03 CPUE ranged from seven to eight crabs per pot lift. Catch rates rose during the 2003/04 fishery when average CPUE increased to 10 legal crabs per pot lift.

The number of vessels fishing and the average number of pots per vessel in the eastern portion of the Aleutian Islands golden king crab fishery remained fairly constant from the 1994/95 season to the 2004/05 season [Figure 5]. In the western portion of the Aleutian Islands golden king crab fishery, there has been a decrease in the number of vessels registered per season with a dramatic increase in the number of pots registered per vessel [Figure 6]. With the adoption of longline gear in 1986, vessels became more specialized in fishing for golden king crabs and were able to more efficiently operate gear. In recent years, with shorter Bristol Bay red king and Bering Sea snow crab *Chionoecetes opilio* fisheries, longline vessels that also fish in the Bering Sea have increased their effort in the Aleutian Islands. While the total number of vessels registered has remained relatively low since the early 1990s, the amount of time relative to other crab fisheries that these vessels spend fishing in the Aleutian Islands has increased, resulting in shorter golden king crab fisheries. The expansion of processing facilities in Adak has also contributed to the shorter seasons, especially in the western Aleutians. Vessels could deliver closer to the fishing grounds, saving approximately a week in transit time for each delivery. The implementation of Crab Rationalization in 2005 decreased participation further with the consolidation of quota onto fewer vessels. Under rationalization the season is open from August 15 to May 15 of the following year.

Effort in the rationalized golden king crab fishery has remained low relative to historic levels. In the 2006/07 fishery seven vessels participated in harvesting 4.69 million

pounds of the 5.13 million pound IFQ total allowable catch (TAC). Catch rates [in the IFQ fishery] were among the highest on record at 23 legal crabs per pot lift.

The following summary of the 2007/08 Aleutian Islands golden king crab IFQ fishery season is from Bowers et al. (2008, pages 15–16):

> The 2007/08 Aleutian Islands golden king crab fishery opened by regulation at noon on August 15 with a TAC of 5.7 million pounds (5.13 million pounds IFQ, 0.57 million pounds CDQ/ACA); 3.0 million pounds of which was apportioned to the area east of 174° W long. and further subdivided between the IFQ (2.7 million pounds) and CDQ (300,000 pounds) fisheries, and 2.7 million pounds apportioned to the area west of 174° W long. further subdivided into the IFQ (2.43 million pounds) and Adak Community Allocation (ACA) fishery (270,000 pounds). This was the third season under rationalization regulations, including the CDQ fishery for golden king crab, and the ACA fishery. Five vessels participated in the IFQ fishery and landed 4.94 million pounds. The fleet averaged 24 legal crabs per pot lift, a slight increase from the prior season, and landed crabs averaged 4.5 pounds each, the same as the 2006/07 season.
>
> *East of 174° W long.(IFQ)*
> With the implementation of Crab Rationalization, the golden king crab fleet has been reduced to less than half of the pre-rationalization fleet size. A total of four vessels participated in the Aleutian Islands golden king crab commercial fishery east of 174° W long. The fleet registered 4,200 pots, or 1,050 pots per vessel, a decrease from the more than 1,300 pots per vessel used during the 2006/07 season. Harvest peaked during the third week of September and was largely concluded by the end of November. Most fishing effort was concentrated around Yunaska Island, Islands of Four Mountains, and in Seguam and Amukta Passes. Catch rates tended to be highest in Amukta and Seguam Passes, with the most productive grounds yielding over 40 legal crabs per pot lift. The average catch rate for the entire eastern portion was 28 legal crabs per pot lift, a nearly 17% increase from the previous season. The average weight of legal crabs was 4.8 pounds, a 4.3% increase from the prior season, with the largest crabs encountered west of 172° W long.
>
> The IFQ fleet harvested 2.69 million pounds of golden king crabs during the season. Three shorebased processors in Dutch Harbor and one catcher-processor processed golden king crabs from the eastern Aleutian Islands. Exvessel price paid for live, whole crabs averaged $2.11 per pound, leading to a fishery value of $5.63 million, an increase of $0.92 million from the 2006/07 fishery.
>
> *West of 174° W long. (IFQ)*
> Three vessels participated in the IFQ fishery west of 174° W long. The fleet registered 4,800 pots, an average of 1,600 pots per vessel, 20% fewer pots than were registered in the 2006/07 season. Weekly harvest peaked in early November. Fishing effort was concentrated around the Delarof Islands, Amchitka Pass and the Petrel Bank. Weekly catch rates ranged from a low of 15 to a high of 34 legal crabs per pot lift and averaged 21, a 5% increase from the prior season. The average weight of legal crabs was 4.2 pounds, a slight decrease from 2006/07.
>
> The fleet harvested 2.25 million pounds of golden king crab. Golden king crabs were purchased and processed by one catcher-processor and by three shorebased processors, one in Adak and two in Dutch Harbor. Exvessel price averaged $1.63 per pound for live,

whole crabs, yielding a total fishery value of $3.63 million, well below the previous 5-years' average fishery value of $6.99 million.

The following summary of the 2007/08 Aleutian Islands golden king crab CDQ fishery season is from Milani (2008, pages 191–192):

> The 2007/08 Aleutian Islands (east of 174° W long.) CDQ golden king crab fishery allocation was based on 10% of the overall TAC. The TAC was divided between the six CDQ groups with a total allocation of 300,000 pounds. All CDQ groups were allocated a harvest, but only three fished. The remaining three groups transferred their quotas to other CDQ groups.
>
> The eastern Aleutian Islands CDQ golden king crab fishery opened concurrently with the Aleutian Islands golden king crab IFQ fishery on August 15. Permits were issued to each CDQ group before fishing began. The permit stated the group's allocation, which is determined by a percentage set forth for each CDQ group by the ADCCED [Alaska Department of Commerce, Community, and Economic Development]. The permit listed the vessel(s) requested by the group and authorized by ADF&G to participate in the fishery, and stated that those vessels must comply with requirements such as dates of operation, pot limits, buoy tags, and observer coverage. Vessel registration could begin as soon as the group permits were issued.
>
> Deliveries began September 27, and the final delivery was made October 25, although the season officially closed on May 15. Three vessels made six landings for an overall harvest of 300,000 pounds and a fishery value of approximately 650,000 dollars. No group went over their allocation.
>
> The average CPUE was 31, higher than the CPUE of 28 for the general [IFQ] fishery. Average weight of crabs in the CDQ fishery was 4.5 pounds, slightly less than the 4.8 pound average weight from the IFQ fishery. Each group used one vessel to harvest their allocation.
>
> Each vessel fishing for Aleutian Islands golden king crab was required to carry an observer for 50% of the harvest in each of three trimesters (August 15–November 15, November 16–February 15 and February 16–May 15) regardless if they were fishing CDQ or IFQ. Two of the CDQ vessels carried observers during all their CDQ fishing and observers covered 79% of the total harvest. During the fishery, observers collected biological data, provided inseason harvest rates to the department, and documented fishing practices of the fleet.

The following summary of the 2007/08 Aleutian Islands golden king crab ACA fishery season is from Milani (2008, page 192):

> The 2007/08 western Aleutian Islands ACA golden king crab fishery opened concurrently with the Aleutian Islands golden king crab IFQ fishery on August 15. ACDC [Adak Community Development Corporation, perhaps best known for the album, *Back in Black*] was issued 10% of the western portion (west of 174° W) of the Aleutian Islands golden king crab TAC for an allocation of 270,000 pounds. A permit was issued to ACDC before fishing began. The permit stated the group's allocation, the vessel(s) requested by the group and authorized by ADF&G to participate in the fishery, and stated that those vessels must comply with requirements such as dates of operation and observer coverage. Vessel registration could begin as soon as the group permit was issued.

One vessel registered to fish. All vessels fishing for Aleutian Islands golden king crab were required to carry an observer for 50% of the harvest in each of three trimesters (August 15–November 15, November 16–February 15 and February 16–May 15) regardless if they were fishing ACA or IFQ. All information regarding Aleutian Islands golden king crab for the 2007/08 fishery is confidential due to a limited number of participating processors and vessels.

The actual retained catch and GHL/TAC for the entire Aleutian Islands Area and for each of the areas east and west of 174° W longitude for the 1996/97–207/08 seasons are compared graphically in Figures 7 and 8. Over the period 1996/97–2007/08 the total retained catch has been 2% below the total of the annual GHL/TACs. By season, retained catch has been as much as 13% below the GHL/TAC (the 1998/99 season) and as much as 6% above the GHL/TAC (the 2000/01 season). The retained catch for the most recently completed season (2007/08) was 3% below the 5.7-million pound TAC.

Although the TACs set for the Aleutian Islands golden king crab fishery for the areas east and west of 174° W longitude through the 2007/08 season remained the same as for the pre-rationalized fishery since the 1998/99 season, there have been changes noted in fishery practices since the first rationalized fishery. With the implementation of crab rationalization in the 2005/06 season, fleet size has decreased, though average pots deployed per vessel has increased substantially. Only 8 vessels participated in the 2005/06 season, only 7 vessels participated in the 2006/07 season, and only 5 vessels participated in the 2007/08 season, whereas 15–22 vessels participated annually during the 1996/97–2004/05 seasons (Table 1-4 *in* Bowers et al. 2008). In the eastern Aleutian Islands, the average number of pots deployed per vessel during rationalized golden king crab fisheries has increased by over 500 pots per vessel compared to the number of pots utilized per vessel pre-rationalization (ADF&G 2008, Table 2). Since fishery rationalization, average pot soak time for both the eastern Aleutian Islands and western Aleutian Islands golden king crab fisheries has increased by approximately 10 days over that for the pre-rationalized fishery seasons (ADF&G 2008, Table 3).

In response to a proposal from Industry, the Alaska Board of Fisheries, during their March 2008 meeting, took action to set in regulation (**5 AAC 34.612**) TACs for the Aleutian Islands golden king crab fishery of 2.835-million pounds for the area west of 174° W longitude and of 3.15-million pounds for the area east of 174° W longitude. Those new regulations first became effective for the 2008/09 season.

The 2008/09 Aleutian Islands golden king crab fishery opened on 15 August 2008 with a TAC of 3.15-million pounds for the area east of 174° W longitude (2,835,000 pounds allocated to IFQ holders and 315,000 pounds allocated to the CDQ fishery) and a TAC of 2.835-million pounds for the area west of 174° W longitude (2,551,500 pounds allocated to IFQ holders and 283,500 pounds allocated to the ACA fishery). As of April 6, 2009 (http://www.fakr.noaa.gov/ram/daily/cratland.pdf, Prepared: APR-06-09 06:45), 2,823,773 pounds of the 2,835,000 pounds allocated to the IFQ fishery for the area east of 174° W longitude and 2,159,076 pounds of the 2,551,500 pounds allocated to the IFQ fishery for the area west of 174° W longitude has been harvested.

Information on bycatch and discards

Information on bycatch and discards during the Aleutian Islands golden king crab fishery is obtained by observers deployed on fishing vessels by the State of Alaska shellfish observer program (Schwenzfeier et al. 2008). During the 1988/89–1994/95 seasons observers were required only on vessels processing golden king crabs at sea, including catcher-processor vessels. During the 1995/96–2004/05 seasons, observers were required on all vessels fishing for king crabs in the Aleutian Islands Area at all times that a vessel was fishing. With the advent of the Crab Rationalization program in the 2005/06 season, all catcher-only vessels (C/Vs) fishing for golden king crabs in the Aleutian Islands Area are now required to

carry an observer for a period during which 50% of the vessel's harvest was obtained during each trimester of the fishery (August 15–November 15, November 16–February 15, and February 16–May 15). Observer coverage for catcher-processor vessels (C/Ps) and floater-processor vessels (F/Ps) is set at 100%.

Crab fishery observers conduct species composition sampling of retained catch and bycatch, and record data on catch, fishing effort, and location (Schwenzfeier et al. 2008). A summary of the information obtained by observers on bycatch and discards during the Aleutian Islands golden king crab fishery is provided in annual reports, the most recently available being produced for the 2006/07 season (Barnard and Burt 2008). General duties of crab fishery observers are summarized by Schwenzfeier et al. (2008, page 211):

> Observer duties specific to crab C/Vs include 1) interviewing the vessel operator daily for confidential catch and effort information, 2) during each fishing day collect biological data on the entire contents of a specified number of randomly selected pots for species composition, 3) during delivery, determine the average weight of retained crabs, 4) during delivery, conduct size frequency sampling of up to 100 randomly selected retained crabs for the purpose of determining carapace size and shell condition distributions, 5) during delivery, monitor size, sex, and species data for a legal tally of 600 retained crabs.
>
> Daily duties that are specific to crab C/P vessels require each observer to 1) interview the vessel operator for confidential catch and effort information, 2) collect biological data on the entire contents of a specified number of randomly selected pots for species composition sampling, 3) conduct size frequency sampling of 100 retained crabs for carapace size and shell condition distributions, 5) obtain size, sex, and species data for a legal tally of up to 600 retained crabs conducted throughout the day.
>
> Crab F/P observer sampling duties are conducted on each vessel delivering to the processor. Daily duties specific to floating processor (F/P) vessels require each observer to 1) interview the delivering vessel's captain for confidential catch and effort information, 2) determine average weight of retained crabs, 3) conduct size frequency sampling of 100 retained crabs for carapace size and shell condition distributions, 4) obtain size, sex, and species data for a legal tally of 600 retained crabs during the offload.

The following summary of the onboard observer program for the 2007/08 Aleutian Islands golden king crab fishery season is from Schwenzfeier et al. (2008, pages 212–213):

> The 2007/08 Aleutian Islands golden king crab season opened to fishing on August 15, 2007 with a Total Allowable Catch (TAC) of 5.7 million pounds. Five vessels participated in the fishery, including four C/Vs and one C/P.
>
> Observers placed on C/Vs fishing east of 174° W longitude were assigned a species composition sampling goal of four measurement and 10 count pots per fishing day. In the western management area, observers on C/Vs were assigned a species composition sampling goal of six measurement and four count pots per fishing day.
>
> Observers on the C/P were assigned a species composition sampling goal of four measurement and five count pots per fishing day in the eastern management area and five measurement pots per fishing day in the western management area.
>
> Observers in both management areas reported harvest information every Monday by e-mail, fax, phone, or radio. Observers deployed in the eastern management area reported

all tagged golden king crab recovered, and those participating in the western management area were required to measure and document red king crab bycatch from all pots lifted.

Catcher vessels delivered 4,262,005 pounds of golden king crab with 59 percent or 2,519,252 pounds of the weight was harvested while observers were onboard acting in the capacity of crab fisheries observers. The one C/P made 24 deliveries and harvest information for the vessel is confidential. The entire fleet lifted a total of 52,603 pots, 35,772 of which were lifted while an observer was onboard.

Observers sampled 2,088 pots in the eastern [east of 174° W longitude] and western [west of 174° W longitude] management areas for a 4.0% sample rate of all pots lifted. Observers on C/Vs sampled 1,662 of the pots lifted and completed 25 legal tallies and 25 size frequency samples. Observers on the C/P sampled 426 pots and completed 109 legal tallies and 109 size frequency samples.

A total of 2,343 pot lifts from 12 statistical areas had less than 50% observer coverage, and 147 pot lifts in seven of those statistical areas were not observed. In five statistical areas 2,196 pot lifts were between 30 and 47 percent observed. A total of 50,260 pots were lifted in the other 59 statistical areas where golden king crabs were harvested and they were between 50 and 100 percent observed.

Four out of 5 catcher vessels maintained a 50% or greater observer coverage level for each trimester. No fishing activities or harvest were observed during the first two weeks of the fishery from August 15 until the first week in September (statistical weeks 33 through 35), and likewise for the final weeks of the fishery from the first week of April through May 15 (statistical weeks 15 - 20).

Estimates of the weight of discarded bycatch by gear type of golden king crabs captured during federal groundfish fisheries in reporting areas 541, 452, and 543 during calendar years 2003–2007 were provided by J. Mondragon (NMFS-Alaska Region Office) for the 2008 SAFE. Preliminary data for the currently ongoing 2008/09 groundfish fishery year (July 2008 – June 2009) were provided by R. Foy (NMFS-AFSC, Kodiak). For reference: area 541 denotes the area within the US EEZ south of 55° 00' N latitude, west of 170° 00' W longitude, and east of 177° 00' W longitude; area 542 denotes the area within the US EEZ south of 55° 00' N latitude, west of 177° 00' W longitude, and east of 177° 00' E longitude; and area 543 denotes the area within the US EEZ south of 55° 00' N latitude and west of 177° 00' E longitude (Figure 9).

Summary of historical catch distributions

Statistics on annual harvest (retained catch), effort, CPUE, and average weight of retained crabs for the Aleutian Islands gold king crab fishery during the 1981/82–2007/08 seasons are provided in Table 4. Note that size limit for golden king crabs has been 6" CW for the entire Aleutian Islands Area only since the 1985/86 season and the areas east and west of 174° W longitude have been managed with separate GHLs or TACs since the 1996/97 season. Statistics on annual harvest (retained catch), effort, CPUE, and average weight of retained crabs for the Aleutian Islands golden king crab fishery in the area east of 174° W longitude by fishery season from the 1985/86 season through the 2007/08 season are provided in Table 5; those statistics for the area west of 174° W longitude by fishery season from the 1985/86 season through the 2007/08 are provided in Table 6. Because the Aleutian Islands golden king crab fishery was managed separately for the areas east and west of 171° W longitude during the 1985/86–1995/96 seasons, the annual retained catch (pounds) during 1985/86–2007/08 for the areas east of 171° W longitude, between 171° W longitude and 174° W longitude, and west of 174° W longitude are provided in Table 7. Notable changes in management measures for the Aleutian Islands golden king crab fishery through the 2007/08 season that have affected long-term trends in the fishery statistics are summarized in Table 8.

Crab fishery observer data collected during the 1996/97–2007/08 seasons on size distribution and estimated catch numbers of non-retained golden king crab catch (estimates for the 1996/97–2006/07 seasons provided by D. Barnard, ADF&G, 20 July 2007 and 7 April 2008; estimates for the 2007/08 season by D. Pengilly, ADF&G, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009) were used to estimate the weight of non-retained catch of legal male, sublegal male, and female golden king crabs during commercial fisheries by season through the 2007/08 season according to the methods and parameters provided in Section 3.4 of NPFMC 2007b. Estimates of the annual weight of bycatch (discarded) golden king crabs during the Aleutian Islands golden king crab fishery and other Aleutian Islands crab fisheries during 1996/97–2007/08 are in Table 9. Although most of the non-retained catch of golden king crabs is attributable to the directed golden king crab fishery, some incidental catch of golden king crabs has occurred in past fisheries directed on Aleutian Islands triangle Tanner crab *Chionoecetes angulatus*, eastern Aleutian Islands and Adak grooved Tanner crab *C. tanneri*, eastern Aleutian Islands Tanner crab *C. bairdi*, Adak red king crab *Paralithodes camtschaticus*, and eastern Aleutian Islands and Adak scarlet king crab *Lithodes couesi*; the contribution of those fisheries to weight of non-retained golden king crabs is included in Table 9. Estimates of the annual weight of bycatch (discarded) golden king crabs during only the directed Aleutian Islands golden king crab fishery in each of the areas east and west of 174° W longitude during 1996/97–2007/08 are in Tables 10 and 11.

Estimates of the annual weight of golden king crab bycatch during groundfish fisheries by gear type in federal catch reporting areas 541, 542, and 543 during calendar years 2003–2007 with preliminary estimates for fishing year 2008/09 are in Table 12.

Data

Total catch

Table 13 provides the 1996/97–2007/08 time series of GHLs/TACs, retained catch, estimated discard, and estimated total catch (estimated discard mortality and retained catch) for Aleutian Islands golden king crab during crab fisheries. No handling mortality rate for the Aleutian Islands golden king crab fishery was discussed by the Crab Plan Team during development of Amendment 24. However, pot fishing mortality rates of 10%, 20%, 30% were discussed for the Bristol Bay red king fishery and handling mortality rates of 25%, 40%, 50%, and 60% were discussed for the eastern Bering Sea snow crab fishery. This assessment provides total catch estimates for assumptions of bycatch/handling mortality rates of 10%, 20%, 30%, 40%, 50%, and 60% in crab fisheries (Table 13, Figure 10). Tables 14–15 and Figure 11 provide the 1996/97–2007/08 time series of total (retained catch plus discards) mortality estimates incurred only during the directed golden king crab fishery, separately for the areas east and west of 174° W longitude.

Estimates of bycatch of golden king crabs during groundfish fisheries are currently available only for calendar years 2003–2007; estimates of bycatch for fishery years are available only as preliminary estimates for the currently ongoing 2008/09 fishery year (Table 12). Hence the contribution of bycatch during groundfish fisheries cannot be incorporated with the estimates in Table 13 for a total catch estimate. However, some indication of the annual mortality due to bycatch mortality in the groundfish fisheries can be given by applying assumed handling mortality rates to the average bycatch during groundfish fisheries by gear type for the period calendar years 2003–2007 (Table 12). Assuming a low bycatch mortality rate of 10% during pot and hook-and-line groundfish fisheries and a bycatch mortality rate of 80% during trawl fisheries (NPFMC 2007b), average annual mortality for 2003–2007 is estimated at 12,547 pounds; assuming a high bycatch mortality rate of 60% during pot and hook-and-line groundfish fisheries and a bycatch mortality rate of 80% during trawl fisheries, average annual mortality for 2003–2007 is estimated at 49,786 pounds.

Catch at length

The size (carapace length, CL, mm) distribution of retained legal male golden king crabs from the Aleutian Islands golden king crab fishery sampled prior to processing at-sea and at dockside deliveries by observers and ADF&G catch samplers by season, 1997/98–2007/08, are provided in Table 16. Tables 17 and 18 provide the data on size distribution of retained legal male golden king crabs sampled from the fisheries east and west of 174° W longitude separately.

The size (CL, mm) distribution of male golden king crabs and that of female golden king crabs captured in pot lifts randomly sampled by observers during the 1997/98–2007/08 Aleutian Islands golden king crab fishery in the area east of 174° W longitude are provided in Tables 19 and 20, respectively.

The size (CL, mm) distribution of male golden king crabs and that of female golden king crabs captured in pot lifts randomly sampled by observers during the 1997/98–2007/08 Aleutian Islands golden king crab fishery in the area west of 174° W longitude are provided in Tables 21 and 22, respectively.

Survey numbers at length

Data on catch per unit effort of golden king crabs by sex-size class during triennial ADF&G pot surveys, 1997–2006 are provided in Table 23.

Fishing effort

The time series of fishing effort (pot lifts) are provided in Tables 4–6.

Sample sizes for length samples

Sample sizes for length samples from the fishery by season and area (entire Aleutian Islands Area and the areas east and west of 174° W longitude) are provided in Tables 16–22.

Independently-Estimated Life-History Parameters

Length at age

There is no length-at-age relationship established for golden king crab.

Growth per molt

Growth per molt and probability of molt was estimated for Aleutian Islands golden king crabs by Watson et al. (2002) based on information received from recoveries during the 1997/98 – 2000/01 commercial fisheries in the area east of 174° W longitude of male and female golden king crabs tagged and released during July–August 1997 in the area east of 174° W longitude (Tables 24–28).

Watson et al. (2002) used logistic regression to estimate the probability as a function of carapace length (CL, mm) at release that a male tagged and released in new-shell condition would molt within 12–15 months after release (Figure 12):

$$P(\text{molt}) = \exp(17.930 - 0.129*CL)/[1 + \exp(17.930 - 0.129*CL)].$$

Based on the above logistic regression Watson et al. (2002) estimated that the size at which 50% of new-shell males would be expected to molt within 12–15 months is 139-mm CL (S.E. = 0.81-mm CL).

Watson et al. (2002) used logistic regression to estimate the probability as a function of carapace length (CL, mm) at release that a male tagged and released as a sublegal ≥ 90-mm CL in new-shell condition would molt to legal size within 12–15 months after release (Figure 13):

$$P(\text{molt to legal size}) = 1 - \exp(15.541 - 0.127*CL)/[1 + \exp(15.541 - 0.127*CL)].$$

Based on the above logistic regression Watson et al. (2002) estimated that the size at which 50% of sublegal ≥90-mm CL, new-shell males would be expected to molt to legal size within 12–15 months is 123-mm CL (S.E. = 1.54-mm CL).

Growth per molt of juvenile golden king crabs, 2–35-mm CL, collected from Prince William Sound have been observed in a laboratory setting and equations describing the increase in CL and intermolt period were estimated from those observations (Paul and Paul 2001a); those results are not provided here.

Weight at length or weight at age

Parameters for estimating weight (g) from carapace length (CL, mm) of Aleutian Islands golden king crabs are provided in Table 29.

Natural mortality rate:

Estimates of natural mortality and some information pertaining to life span have been obtained using data from recoveries of golden king crabs tagged and released by ADF&G in the Aleutian Islands Area in 1991 (Blau and Pengilly 1994), 1997 (Blau, Watson, and Vining 1998), 2000 (Watson and Gish 2002), 2003 (Watson 2004), and 2006 (Watson 2007). Using data on tag recoveries during commercial fisheries through 2000 of males tagged in 1991 and 1997, Siddeek et al (2002) provide estimates of M = 0.375, M = 0.484, and M = 0.573. The longest period between tag release and tag recovery recorded to date for an Aleutian Island golden king crab is approximately 8 years (from 10 August 1997 to 10 October 2005); that animal was tagged and released as a 93-mm CL male. The longest period between tag release and tag recovery recorded to date for an Aleutian Island golden king crab tagged and released as a legal-size male is slightly more than 4 years (from 26 July 2003 to 3 September 2007; L. J. Watson, Fishery Biologist, ADF&G, Kodiak; personnel communication).

Parameters governing maturity schedule:

Males: Carapace length (CL) at maturity for male golden king crabs in three areas within the Aleutian Islands Area has been estimated by Otto and Cummiskey (1985) using Somerton's (1980) method of estimating the intersection point of lines estimated to fit two phases of growth in height of the right chela relative to CL:

- Eastern Bering Sea south of 54°14' N latitude: 130.0-mm CL (SD = 4.0 mm)
- Bowers Ridge: 108.6-mm CL (SD = 2.6 mm)
- Seguam Pass: 120.8-mm CL (SD = 2.9 mm).

Paul and Paul (2001b) studied mating success of male golden king crabs collected from Prince William Sound. The two smallest males studied (95-mm CL and 99-mm CL) could not induce females to ovulate. The smallest male examined that fertilized a female (a 101-mm CL male) fertilized a clutch in which only 71% of the eggs initiated division. In almost all of the clutches fertilized by hardshell males ≥107-mm CL, ≥90% of the eggs initiated division.

Females: Otto and Cummiskey (1985) estimated CL at maturity for female golden king crabs in three areas within the Aleutian Islands Area as the estimated CL at which 50% of females are mature (SM50; as evidenced by presence of clutches of eggs or empty):

- Eastern Bering Sea south of 54°14' N latitude: 110.7-mm CL (SD = 0.8 mm)
- Bowers Ridge: 106.4-mm CL (SD = 0.5 mm)
- Seguam Pass: 113.2-mm CL (SD = 0.3 mm).

Blau and Pengilly (1994) estimated percent mature (as evidenced by presence of clutches of eggs or empty) as a function of CL for female golden king crabs in two areas within the Aleutian Islands Area

according to a logistic regression (with parameters β_0 and β_1) and estimated the CL at which 50% of females are mature (SM50):

- Aleutian Islands between 170° W longitude and 171° W longitude (near Yunaska I)
  - Logistic regression parameters:
    - β_0 = -15.558 (95% CI: -19.123 – -11.992)
    - β_1 = 0.142 (95% CI: 0.111 – 0.173)
  - SM50 = 109.6-mm CL (95% CI: 106.7 mm to 112.6 mm)
- Aleutian Islands between 171° W longitude and 172° W longitude (near Amukta I)
  - Logistic regression parameters:
    - β_0 = -28.273 (95% CI: -30.181 – -26.308)
    - β_1 = 0.264 (95% CI: 0.246 – 0.282)
  - SM50 = 107.0-mm CL (95% CI: 106.6 mm to 107.5 mm)

BACKGROUND FOR TIER 5 OFL ANALYSIS

An assessment model for Aleutian Islands golden king crab is in development (Siddeek 2008). However, that model is under review for further development (minutes of the NPFMC SSC meeting, 29 September – 1 October 2008) and has not yet been used for annual stock assessment and biomass estimation. Hence, as of this writing, this stock should remain in Tier 5. For Tier 5 stocks only an OFL is estimated, because it is not possible to estimate MSST without an estimate of biomass, and "the OFL represent the average retained catch from a time period determined to be representative of the production potential of the stock" (NPFMC 2007b). Additionally, NPFMC (2007b) states that for estimating the OFL of Tier 5 stocks, "The time period selected for computing the average catch, hence the OFL, [should] be based on the best scientific information available and provide the required risk aversion for stock conservation and utilization goals." This section provides background for considering the appropriate time period for estimating OFL.

Previously considered and recommended time periods for averaging the retained catch. Prior to 2008, two time periods were considered for computing the average retained catch for Aleutian Islands golden king crab: 1985–2005 (NPFMC 2007a) and 1985–1999 (NPFMC 2007b). NPFMC (2007b) suggested using the average retained catch over the years 1985 to 1999 as the estimated OFL for Aleutian Islands golden king crab. Years post-1984 were chosen based on an assumed 8-year lag between hatching during the 1976/77 "regime shift" and growth to legal size. With regard to excluding data from years after 1999, NPFMC (2007b) states, "Years from 2000 to 2005 were excluded for Aleutian Islands golden king crab when the TAC was set below the previous average catch." Note, however, that there was no TAC or GHL established for the entire Aleutian Islands Area prior to the 1996/97 season (see "Description of the directed fishery", above) and the GHL for the Aleutian Islands Area was reduced from 5.9-million pounds for the 1996/97 and 1997/98 seasons to 5.7-million pounds for the 1998/1999 season; the GHL or TAC has remained at 5.7-million pounds for all subsequent seasons to date (Table 4). Since 2008, Pengilly (2008) discussed nine periods, spanning periods as long as 26 seasons (1981/82–2006/07) to as short as 6 seasons (1990/91–1995/96), for computing average annual retained catch to estimate the OFL for the 2008/09 season. Of those, the Crab Plan Team at the May 2008 meeting recommended using the period 1990/91–1995/96 for computing the 2008/09 OFL (minutes of the NPFMC CPT meeting, 6–9 May 2008). Subsequent to that, the SSC recommended using the period 1985/86 – 1995/96 for computing the 2008/09 OFL (minutes of the NPFMC SSC meeting, 2–4 June 2008).

Considerations for recommending a time period for averaging the retained catch. The changes in size limit that occurred in 1984 and 1985 support using only data from after the 1984/85 season; the 1985/86 season was the first season that the entire Aleutian Islands Area was managed using the current 6.0" CW minimum size limit.

The change in management that occurred with the restructuring of management beginning with the 1996/97 season is also important for determining the period over which to average the retained catch. Prior to the 1996/97 season the former Adak Area (west of 171° W longitude) was managed essentially under a "size-sex-season" policy with no management towards a specified GHL, whereas the former Dutch Harbor area (east of 171° W longitude) was managed on the basis of fishery performance with the historic average landings providing an informal GHL (B. Failor-Rounds, ADF&G, July 17, 2007 memorandum). The 1996/97 season was the first managed towards formally established preseason GHLs for each of the areas east and west of 174° W longitude; 3.2-million pounds for the area east of 174° W longitude and 2.7-million pounds for the area west of 174° W longitude. The 3.2-million pound GHL for the area east of 174° W longitude was arrived at by doubling the 1.6-million pound average harvest of the previous five seasons (1991/92–1995/96) in the area east of 171° W longitude (more recent fish ticket runs show that the average harvest for the area east of 171° W longitude during 1991/92–1995/96 was actually 1.5-million pounds). The 2.7-million pound GHL for the area west of 174° W longitude was determined by the average harvest for the five seasons, 1990/91–1994/95 (data for the complete 1995/96 season for the area west of 174° W longitude was not available when the 1996/97 GHL was established). The reduction in the GHL for the area east of 174° W longitude from 3.2-million pounds to 3.0-million pounds beginning with the 1998/99 season will also have a slight influence on average harvests. The effect of those management measures instituted at the beginning of the 1996/97 season have resulted in a decrease in the annual harvests for the Aleutian Islands Area, relative to the entire period 1985/86–1995/96 and to the more recent 1990/91–1995/96 seasons (Tables 4–6, Figure 14). That reduction in harvest relative to the 1990/91–1995/96 seasons is attributable to a reduction in the harvest reported from the area east of 174° W longitude (Figure 14), which is, in turn, attributable to a reduction in the harvest reported from the area between 171° W longitude and 174° W longitude (Table 7; also, compare Figure 3 and Figure 4).

The change of management to a rationalized fishery beginning with the 2005/06 season has a small effect on the time series of harvests in that the TACs, unlike GHLs, cannot be exceeded; in fact, reportedly due to problems finding processors with available quota shares, the harvest did not attain the TAC in the 2005/06 and 2006/07 seasons, particularly during the 2006/07 season in the area west of 174° W longitude (Tables 4–6). The change to a rationalized fishery also resulted in changes in fishery practices (see "Description of the directed fishery" and Tables 2–3), which are a consideration when using fishery performance data or other fishery data to judge the condition of the stock.

Fishery performance data and available observer and pot survey data should be examined prior to determining the time period that is "representative of the production potential of the stock" and provides "the required risk aversion for stock conservation and utilization goals" for estimating OFL. Trends in annual retained catch and fishery CPUE may give some idea of the production potential of the stock and the effects of fishery removals, although those trends may also be affected by changes in fishery practices and management measures. Annual season average weights of landed crabs and size distribution of the catch may give some idea of recruitment trends, although those may also be influenced by changes in fishery practices (e.g., use of escape mechanisms and soak times; see "Description of the directed fishery"). These data are examined for three periods: 1985/86–1995/96, 1996/97–2004/05, and 2005/06–2007/08.

The pre-GHL/TAC period, 1985/86–1995/96. Catch (number of retained legal males) per pot lift (CPUE) in the entire Aleutian Islands Area showed a declining trend during 1985/86–1995/96 that accompanied the declining trend in harvest (Table 4, Figure 15). That trend is also shown within each of the areas east of 174° W longitude (Table 5, Figure 16) and west of 174° W longitude (Table 6, Figure 16). Average weights of landed crabs also showed a declining trend from 1985/86 into the mid-1990's, followed by a

sharp increase from the 1993/94 season through the 1995/96 season for the entire Aleutian Islands Area (Table 4, Figure 17) and for each of the areas east and west of 174° W longitude (Tables 5–6, Figure 18). Average retained catch for the period 1985/86–1989/90 was 11,875,811 pounds. Harvests dropped sharply from the 1989/90 to 1990/91 season (from 12,022,052 pounds to 6,590,362 pounds) and average retained catch for the period 1990/91–1995/96 was 6,930,627 pounds. By the 1993/94 season, the harvest in the Aleutian Islands golden king crab fishery was 44% of that for the 1985/86 season, the CPUE was 48% of that for the 1985/86 season, and the average weight of landed crabs was 89% of that for the 1985/86 season. The trends in declining catch, declining CPUE, and declining average weight of landed crabs from 1985/86 into the mid-1990's in a fishery that was, with the exception of the area east of 171° W longitude, managed on a "size-sex-season" may be evidence that the harvest during that period was not "representative of the production potential of the stock." Acknowledging the usual caveats in interpreting fishery data, the three declining trends together during this period could be interpreted as resulting from fishery that relied increasingly on annual recruitment to legal size as it fished on a declining stock of legal-size males.

The pre-rationalized GHL period, 1996/97–2004/05. Since the 1996/97 season, catches stabilized with management of the fishery to a pre-season GHL and CPUE increased steadily from the 1996/97 season through the 2004/05 season for the entire Aleutian Islands Area and within the areas east and west of 174° W longitude (Tables 4–6, Figures 15–16). The CPUE for the entire Aleutian Islands Area increased from 6.0 crabs per pot lift in 1996/97 to 14.2 in 2004/05; between 1996/97 and 2004/05, CPUE increased from 6.5 crabs per pot lift to 14.3 in the area east of 174° W longitude and from 6.1 crabs per pot lift to 12.1 in the area west of 174° W longitude. The trend in increasing CPUE over this period could be indicative of an increase in legal male abundance since the mid-1990's. For the entire Aleutian Islands Area and within the areas east and west of 174° W longitude, average weights of landed crabs during the 1996/97–1997/98 seasons were comparable to those of the 1985/86–1986/87 seasons (Tables 4–6, Figures 17–18). Post-1997/98 average weight of landed crabs for the entire Aleutian Islands Area declined and remained below the 1996/97–1997/98 average weight through the 2004/05 season (Table 4, Figure 17); in the area east of 174° W longitude, average weight of landed crabs returned to the that of the 1996/97–1997/98 seasons by the 2003/04 season, whereas in the area west of 174° W longitude the average weight of landed crabs continued to decline through the 2004/05 season (Tables 5–6, Figure 18). The decline in average weight of landed crabs after the 1997/98 season could be indicative of increase in recruitment to legal size during the late 1990's and early 2000's.

Observer data and, for the area east of 174° W longitude only, survey data from this period can also be used to give some assessment of the relative contribution of new recruits to legal-size crabs during this period. Classifying legal male golden king crabs as "recruits" is difficult due to the asynchronous, aseasonal molting of golden king crabs and the difficulties in consistently scoring shell condition of golden king crabs and relating those scores to time since the last molt (see "Description of life history characteristics relevant to stock assessments"). Instead we will only summarize data on the proportion of "recruit-sized" legal males among the legal males. Watson et al. (2002) estimated an average per molt increment of 15-mm CL from recoveries of eastern Aleutian Islands male golden king crabs tagged and released at sizes of 91–183-mm CL and Blau and Pengilly (1994) and Blau et al. (1998) estimated the CL at which 50% of male crabs are legal sized (6" CW) to be 135–137-mm CL. Hence we will use "legal-sized males ≤150-mm CL" as the definition of "recruit-sized legal males." The percentage of legal-size males that were recruit-sized was estimated from pot lifts sampled by observers during the 1996/97 seasons through the 2007/08 season for each of the areas east and west of 174° W longitude. Additionally the percentage of legal-size males that were recruit-sized was estimated for the area east of 174° W longitude using data from the ADF&G pot survey performed in the area between 170° 21' and 171° 33' W longitude during 1997, 2000, 2003, and 2006. Not surprisingly, within each area east and west of 174° W longitude the annual average weight of landed crabs over 1996/97–2007/08 is negatively correlated with the annual percent recruit-sized legal males among the legal males in pot lifts sampled by observers (r = -

0.85 for the area east of 174° W longitude and r = -0.80 for the area west of 174° W longitude) and trends in annual percent recruit-sized legal males are generally consistent with trends in average weights of landed crabs. For the area east of 174° W longitude the percent recruit-sized males in fishery pots sampled by observers increased slightly from 67% in the 1996/97 season to 69–71% in the 1997/98–2002/03 seasons and then declined steadily in subsequent seasons to 63% in the 2004/05 season; that percentage increased from 76% in the 1997 survey to 82% in the 2000 survey and declined to 72% in the 2003 survey (Figure 19). For the area west of 174° W longitude the percent recruit-sized males in fishery pots sampled by observers showed a general increasing trend from 73–74% in the 1996/97–1997/98 seasons to 77–81% in the 2002/03–2004/05 seasons (Figure 19).

Trends in the CPUE of incidentally captured sublegal males and females can also be assessed using the data from pots sampled by at-sea observers for the areas east and west of 174° W longitude. Among the sublegal males, males estimated to molt to legal size within the next year are referred to as "pre-recruit-1 males." Following Blau and Pengilly (1994) and Blau et al. (1996), we define pre-recruit-1 males as sublegal males ≥121-mm CL (see also Watson et al. 2002). Whereas CPUE of legal males increased during 1996/97–2004/05 in the area east of 174° W longitude, CPUE of sublegal males and females tended to decrease from the peak values of 19 sublegal males and 15 females per pot lift in the 1998/99 season to 11 sublegal males and 8 females per pot in 2004/05 (Figure 20). Although the estimated CPUE of sublegal males during the fishery east of 174° W longitude showed a declining trend since the late 1990s, the CPUE of pre-recruit-1 males remained stable over the years (Figure 20); the decrease in CPUE of sublegal males in the fishery east of 174° W longitude is due to decreases in the CPUE of sublegal males <121 mm CL. In the area west of 174° W longitude, CPUE of sublegal males was, with the exception of a peak value of 15 crabs per pot lift in the 1998/99 season, relatively stable, showing a weak increasing trend from the 1999/00 season (8 crabs per pot lift) through the 2004/05 season (11 crabs per pot lift; Figure 14). That variation in CPUE of sublegal males is largely attributable to pre-recruit-1 males (Figure 21). CPUE of females in the area west of 174° W longitude has also been relatively stable with the exception of the 1998/99 season (15 crabs per pot lift), showing only a weak decreasing trend from 1996/97 (12 crabs per pot lift) to 2004/05 (9 crabs per pot lift; Figure 21).

Data from triennial pot surveys (1997, 2000, 2003, 2006) in a limited area east of 174° W longitude (between 170° 21' and 171° 33' W longitude) is also available for inspecting trends in survey CPUE. The trend in CPUE of legal males during the triennial survey within the period 1996/97–2004/05 is not consistent with the trend in fishery CPUE for the area east of 174° W longitude. Although CPUE of legals males during the 1997, 2000, and 2003 surveys is somewhat stable in terms of absolute numbers (ranging only from 2.9 to 4.7 crabs per pot lift), it actually decreased from the 1997 through the 2003 surveys; the CPUE of legal males in the 2003 survey was 62% of that for the 1997 survey (Table 22). Additionally, survey CPUE of sublegal males declined from 49.7 crabs per pot lift in 1997 to 11.9 in the 2003 and survey CPUE of females declined from 58.6 crabs per pot lift in 1997 to 10.5 in 2003 (note, however, that the survey CPUE of sublegal males and females can be greatly affected by occasional large catches of small juvenile males and females).

Data on tag recovery rates of legal males tagged during the triennial survey are also available for inspection relative to stock trends in the area east of 174° W longitude. The annual number of crabs harvested during the 1997/98, 2000/2001, and 2003/04 seasons east of 174° W longitude is relatively stable in comparison to the decline in survey CPUE between the 1997 and 2003 surveys (the number harvested in the 2003/04 season was 83% of that harvested in the 1997/98 season, whereas the CPUE of legal males in the 2003 survey was 62% of that for the 1997 survey; Table 5, Table 22). However, recovery rates during commercial fisheries of legal males tagged during the surveys have not increased over this period, but have actually decreased: in the 1997/98 season, 20.4% of legal males tagged in 1997 were recovered; 20.0% of legal males tagged in 2000 were recovered during the 2000/01 season; and only 10.5% of the legal males tagged in 2003 were recovered during the 2003/04 season (Watson 2004).

Variation in the geographic distribution of tag releases among survey years and variation in the geographic distribution of fishery effort among seasons may account for the some of the variation in tag recovery rates by season. For example, tag recovery rates during the 2003/04 season varied among the release locations of legal males tagged during the 2003 survey, with generally higher recovery rates for those crabs tagged and released at locations east of 171° W longitude (Pengilly 2005). Legal males tagged and released in 2003 at locations east of 171° W longitude were recovered during the 2003/2004 fishery at a rate of 16.1% as compared to a rate of 3.4% for those tagged and release at locations west of 171° W longitude. Nonetheless, the decreasing trend in tag recovery rates suggests that legal male abundance did not decrease between 1997 and 2003 at the rate indicated by the decrease in survey CPUE and that abundance of legal males may have actually increased over that period, consistent with the trend in fishery CPUE.

Estimated weight of discarded bycatch decreased from 9,075,548 pounds in 1996/97 (representing 156% of the retained catch for that season) to 4,321,014 pounds in the 2004/05 season (representing 78% of the retained catch for that season; Table 19). Estimated total catch weight (retained catch weight plus by catch mortality weight) during this period for the entire Aleutian Islands Area and for each of the areas east and west of 174° W longitude decreased during the period 1996/97–2004/05 under all scenarios for *hm*, both in absolute terms and relative to the retained catch (Tables 13–15, Figures 10–11).

In summary, during the 9-season period 1996/97–2004/05 there was little variation in retained catch (ranging from 4.942-million pounds to 6.019-million pounds), making the Aleutian Islands fishery the most stable and consistently-producing fishery among the BSAI FMP crab fisheries. However, other information on the stock condition during this period is incomplete and often conflicting. Fishery CPUE of legal males has increased in both the areas east and west of 174° W longitude during this period whereas survey CPUE of legal males in the triennially surveyed portion of the area east of 174° has decreased. A declining trend in tag-recovery rates is consistent with an increasing trend in legal male abundance. Observer data on fishery CPUE of pre-recruit-1 sublegal males and data on the percentage of legal males that are recruit-sized provide no evidence for a large recruitment of legal males. Given all data sources together for the period 1996/97–2004/05, the abundance of legal males may have grown steadily from the late 1990s through the 2004/05 season with stable recruitment of legal males adding to surviving legal males. Although it unclear whether the decrease in bycatch of sublegal males and females relative to the catch of legal males during this period is due to changes in fishery practices or to population trends, that decrease has resulted in a decrease in the estimated total catch (retained catch plus handling mortality) weight during this period.

The rationalized TAC period, 2005/06–2007/08. Annual retained catch towards the 5.7-million pound TAC during 2005/06–2007/08 ranged from 5.26-million pounds to 5.52-million pounds, only a slight decrease relative to the average for the period 1996/97–2004/05 (5.69-million pounds). Fishery CPUE increased markedly to values of 22–23 crabs per pot lift or more during 2005/06–2007/08 (the previous high for fishery CPUE was 14 crabs per pot lift in the 2004/05 season; Tables 4, Figure 14). The increase in CPUE was not accompanied by a decrease in average weight of landed crabs (Tables 4–6, Figures 17–18) or an increase in the percentage of legal males that were recruit-sized (Figure 19). In fact, average weight of landed crabs increased and there was a clear decrease in the estimated percent of captured legal males that were recruit-sized.

In the 2006 pot survey within the area east of 174° W longitude, CPUE of legal males also increased from the 2003 value towards the value for the 1997 survey (Table 22). Nonetheless, survey CPUE of sublegal males and females remained low in 2006 relative to 1997 and 2000 (Table 22). Of the legal males tagged in 2006 7.4% were recovered during the 2006/07 season. Most of the tags recovered during the fishery are recovered by observers and after the 2004/05 season, observer coverage declined from 100% coverage to 66.5% coverage during the 2005/06 season (i.e., observers were not on vessels at times during which

33.5% of the retained catch was captured). That reduction in observer coverage influenced the tag recovery rate during the 2006/07 season relative to previous years when observer coverage was 100%. Adjusting for the reduction in observer coverage, the 7.4% recovery rate in the 2006/2007 season would be comparable to a recovery rate of 10–11% in a season with 100% coverage. The adjusted rate is comparable to the recovery rate during the 2003/04 season, but is half the rate for the 1997/98 and 2000/01 seasons. Given the number of crabs harvested in the 1997/98, 2000/01, 2003/04, and 2006/07 seasons east of 174° W longitude, the tag recovery rates suggest that abundance of legal males in 2006/07 was comparable to that in 2003/04 and higher than that in 1997/98 and 2000/01.

Estimated weight of non-retained bycatch in the 2005/06 season and 2006/07 season was markedly lower than in previous seasons (2.5-million to 3.0-million pounds; Tables 9–11). Due to the reduction in incidental catch of sublegal males and females relative to retained legal males (Figures 20–21), estimated total catch (retained plus handling mortality) weights in the 2005/06–2007/08 season are at the lowest value for the time series of estimates (Tables 13–15, Figures 10–11); even under the assumption hm = 60%, estimated total catch weight is only approximately 27–33% greater than the retained catch weight during 2005/06–2006/07.

Changes in fishery practices that accompanied the rationalization of the fishery (see "Description of the directed fishery," above) likely have had an affect on the fishery CPUE and the size distribution of the retained and non-retained catch during the 2005/06–2007/08 seasons. In particular, the cumulative relative size frequency distributions of the legal male (Figure 22), legal and sublegal male (Figure 23), and female (Figure 24) golden king crabs have shown a marked shift to the right in the rationalized seasons as compared to the pre-rationalized seasons; i.e., the contribution to the catch of smaller crabs has decreased and the contribution to the catch of larger crabs has increased. That change in size distribution of captured crabs, which results in a reduced contribution of recruit-sized legal males to the captured legal males (Figure 19) and an increase in average weights of retained legal males (Figures 17–18), may be due to the increased soak times used by fishers following rationalization (Table 3); being as the industry began the switch to gear with the modifications intended to reduce bycatch in 1999 (see "Description of the directed fishery," above), that change in size distribution is probably not due to a change in gear. That interpretation is consistent with the opinion of a gear manufacturer (undated letter from Lance A. Nylander, President/Owner of Dungeness Gearworks Inc., Everett, WA, to Whom It May Concern provided by L. Kozak via 19 September 2008 email to the Crab Plan Team): "Now that the fleet has been reduced and fisherman are allowed significantly longer soak times, they should see a significant reduction of by-catch, females and sub-legal males, by the usage of 9" escape web on one plane." The increased soak times employed following rationalization would also be expected to have a positive effect on fishery CPUE. Hence the likelihood that both fishery CPUE and the size distribution of captured crabs were affected by post-rationalization changes in fishery practices makes it difficult to interpret the trend in size distribution of the catch as due solely to a reduction in recruitment to the stock or to interpret the increase in fishery CPUE as solely due solely to an increase in the abundance of legal males.

Projections and Harvest Alternatives

List of parameter and stock size estimates (or best available proxies thereof) required by limit and target control rules specified in the fishery management plan:

- OFL = "The average retained catch from a time period determined to be representative of the production potential of the stock"

Specification of FOFL , OFL, the upper bound on Ftarget, and other applicable measures (if any) relevant to determining whether the stock is overfished or if overfishing is occurring:

- OFLs estimated as the average retained catch (pounds) during each of three different candidate time periods are provide in the table below. Periods that include seasons prior to the 1985/86

season are not included because of the change in size limits that occurred prior to the 1985/86 season. Periods that include seasons after the 1995/96 season are not included because the retained catch has been limited by either a GHL or TAC since the 1996/97 season.

Time period	Number of seasons	OFL (average retained catch, pounds)
1985/86–1995/96	11	9,178,438
1987/88–1995/96	9	8,165,540
1990/91–1995/96	6	6,930,627

- The period 1985/86–1995/96 is that recommended by the SSC for computing the OFL for the 2008/09 season. Although not explicitly stated in the SSC minutes the choice is apparently based on the desire for the longest possible period of unconstrained catch under the current size limit ("Earlier years were not recommended for inclusion because of a difference in the size limit regulations prior to 1985/86." Minutes of the NPFMC SSC meeting, 2–4 June 2008)**.**
- The period 1987/88–1995/96 is that originally recommended in May 2008 by the 2008 assessment author for computing the OFL for the 2008/09 season. The reasoning was based on the desire to have longest period of unconstrained catch under the current size limit, while excluding the two seasons with the highest retained catch in the history of the fishery (the 1985/86–1986/87 seasons). Trends of declining catch, declining CPUE, and declining average weight of landed crabs that occurred from 1985/86 into the mid-1990's could be interpreted as resulting from a fishery that relied increasingly on annual recruitment to legal size as it fished on a declining stock of legal-size males. Hence the catches during the full period of unconstrained catch under the current size limit, 1985/86–1995/96, could be viewed as unsustainable. Removal of the two highest-catch seasons, 1985/86–1986/87, at the beginning of that time period was offered as a compromise between the desire for the longest period possible for averaging catch and the desire for a period reflecting long-term production potential of the stock.
- The period 1990/91–1995/96 is that recommended by the Crab Plan Team at their May 2008 meeting for computing the OFL for the 2008/09 season. The Team felt that, given the decline in retained catch and CPUE that occurred from 1985/86 into the mid-1990's, the first five seasons of the full period of unconstrained catch under the current size limit should be removed from the period for computing OFL. The first five seasons had the highest catches of the period 1985/86–1995/96 (9.3-million pounds to 14.7-million pounds). During the next six seasons, 1990/95–1995/96, catches stabilized with low variability (5.6-million pounds to 8.1-million pounds) and without a discernable deceasing trend. Although fishery CPUE continued to decline through the 1995/96 season, fishery CPUE has increased and the fishery has been able to sustain annual retained catches of 4.9-million pounds to 6.0-million pounds in the 12 seasons completed since then.

- OFL for 2009/10 recommended to the Crab Plan Team by the assessment author: 6,930,627 pounds, the average of 1990/91–1995/96 retained catch. The arguments made the Crab Plan Team at the May 2008 meeting for using the 1990/91–1995/96 period to estimate OFL remain persuasive today.

List of standard harvest scenarios and description of projection methodology

- Standard harvest scenario is that retained catch will be ≤TAC under the rationalized fishery. The TAC for retained catch during the 2009/10 season will be 5,985,000 by state regulation (**5 AAC 34.612**).

- The actual retained catch and GHL/TAC for the entire Aleutian Islands Area and for each of the areas east and west of 174° W longitude (Tables 4–6) are compared graphically in Figures 7–8. Over the period 1996/97–2007/08 the average retained catch has been 2% below the average GHL/TAC. By season, retained catch has been as much as 13% below the GHL/TAC (1998/99 season) and as much as 6% above the GHL/TAC (2000/01 season).

Data gaps and research priorities

Currently, there are no biomass estimates for this stock. The process of development and annual use of an assessment model (e.g., Siddeek 2008) to estimate spawning biomass or a proxy will identify data gaps and research priorities.

Summary

Parameter	Value
M	Default = 0.18
Tier	5
Recommended value of OFL	6,930,627 pounds (retained catch)

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ECOSYSTEM CONSIDERATIONS

Fishery Effects on the ecosystem

Observer data on species composition of randomly sampled pots from the 2002/03–2007/08 seasons are presented here. Data are counts per taxon summed over all sampled pots in a season. The table presents those data expanded to an estimated total catch per season by dividing the total count for a taxon by the total number of pot lifts sampled during the season and multiplying by the number of pot lifts during the fishery season.

Taxa	2002/03[a]	2003/04[b]	2004/05[c]	2005/06[d]	2006/07[e]	2007/08[f]
Anthomastus sp.	524	703	874	491	1,137	428
Anthoptilum sp.	0	17	0	0	0	0
arrowtooth flounder	666	1,218	513	235	162	202
Arthrogorgia sp.	0	1,012	1,615	853	929	403
articulated bamboo coral	40	0	0	0	0	0
Atka mackerel	121	206	266	43	162	25
Balanophyllia sp.	1,109	0	0	0	0	0
bamboo coral	0	17	0	0	0	0
barnacle unident.	383	172	19	0	232	0
basket star	15,412	20,567	13,113	14,039	12,767	12,270
bigmouth sculpin	20	51	57	0	23	0
bivalve unident.	0	51	19	0	23	0
Black coral unident.	20	137	0	0	0	0
brittle star unident.	7,787	8,199	107,391	27,161	7,985	6,501
bryozoan unident.	343	2,985	304	7,510	1,137	76
Buccinum snail unident.	0	0	0	0	348	0
Calcigorgia sp.	323	292	1,045	384	627	454
Caryophyllia sp.	101	429	19	0	70	0
chiton unident.	0	0	38	21	23	0
circumboreal toad crab	0	0	19	0	0	0
Cladopathes sp.	0	0	19	0	0	0
Clavularia sp.	182	926	152	427	348	252
Coral unident.	1,473	257	1,159	21	116	101
Crangon sp.	0	0	1,900	0	0	0
Crypthelia sp.	867	532	475	533	604	504
Cup coral unident.	222	841	133	43	93	202
Cyclohelia sp.	1,271	1,853	1,197	1,088	1,323	554
Distichopora sp.	968	1,064	912	1,515	1,346	1,361
Dover sole	20	17	0	0	0	0
dusky rockfish	20	17	0	0	0	0
Errinopora sp.	383	669	209	85	255	76
Fanellia sp.	2,300	1,938	1,843	2,688	1,509	1,260
flatfish unident.	141	206	76	0	0	151
flathead sole	20	0	0	0	0	0
Fungiacyathus sp.	0	34	0	0	0	0
giant octopus	767	823	893	448	162	176
golden king crab	3,990,805	3,376,806	3,122,138	2,272,617	2,193,098	2,393,407

(continued)

Taxa	2002/03[a]	2003/04[b]	2004/05[c]	2005/06[d]	2006/07[e]	2007/08[f]
graceful decorator crab	0	17	0	21	23	0
great sculpin	20	0	0	21	46	0
Greenland halibut (or Greenland turbot)	565	137	209	64	0	76
grenadier (rattail) unident.	222	189	152	85	46	126
grooved Tanner crab	625	189	665	21	0	0
hair crab	0	137	38	0	46	25
hairy triton (or Oregon triton)	2,542	978	912	299	743	479
hermit crab unident.	20	51	38	0	23	50
hydrocoral unident.	1,069	2,264	76	85	70	126
hydroid unident.	1,392	806	35,841	112,208	7,219	9,096
Ideogorgia sp.	0	51	0	21	0	0
invertebrate unident.	888	1,801	437	491	93	0
Javania sp.	40	69	0	43	23	0
jellyfish unident.	20	1,115	114	171	116	0
Kamchatka coral (or bubblegum coral)	1,755	1,287	1,235	448	627	680
lampshell unident.	0	69	0	0	0	0
leech unident.	61	103	95	0	0	0
Lepidisis sp.	0	172	0	0	0	0
Lillipathes spp.	0	0	19	21	46	0
mussel unident.	20	34	76	0	0	0
Neptune snail unident.	0	120	19	0	23	0
nudibranch unident.	0	17	0	0	0	0
octopus unident.	0	0	0	21	0	0
Pacific cod	1,896	3,019	608	491	696	252
Pacific halibut	5,709	6,124	1,501	683	302	479
Pacific lyre crab	222	86	247	149	46	25
Pacific ocean perch	484	154	57	21	46	0
Pacific oyster	0	17	0	0	0	0
Paralomis multispina	0	0	152	21	0	25
Paralomis sp.	20	0	0	0	0	0
Plexauridae unident.	2,078	686	437	597	789	1,083
Pribilof neptune (or Pribilof whelk)	686	137	0	0	0	0
prickleback unident.	0	0	0	0	23	0
Primnoidae Group I	5,527	5,386	6,461	6,486	3,436	3,452
Primnoidae unident.	0	789	437	43	882	1,008
prowfish	0	17	0	0	0	0
Ptilosarcus sp.	0	0	0	21	0	0
red king crab	2,784	4,854	361	64	1,254	277

(continued)

Taxa	2002/03[a]	2003/04[b]	2004/05[c]	2005/06[d]	2006/07[e]	2007/08[f]
redbanded rockfish	0	34	0	0	46	0
red-tree coral	161	446	703	235	464	151
rock sole unident.	61	17	0	0	0	25
rockfish unident.	262	1,064	494	469	232	731
rougheye rockfish	61	154	1,007	405	0	0
sablefish (or black cod)	424	532	76	64	186	25
sand dollar unident.	0	34	0	0	0	0
scale worm unident.	61	154	209	21	162	0
scaled crab	20	69	19	0	0	0
scallop unident.	101	69	228	0	70	0
scarlet king crab	3,530	1,098	1,178	256	743	1,083
sculpin unident.	323	497	266	363	441	227
sea anemone unident.	141	240	38	85	255	101
sea cucumber unident.	262	154	171	43	70	0
sea lily (or feather star) unident.	343	0	342	171	325	227
sea pen or sea whip unident.	81	0	19	0	0	0
sea pen unident.	0	189	0	0	139	25
sea raspberry	40	0	38	0	23	0
sea spider unident.	121	103	133	171	162	151
sea urchin unident.	6,314	3,963	2,680	3,798	3,784	4,334
sea whip unident.	0	17	0	0	0	0
shortspine thornyhead	222	172	133	21	23	0
shrimp unident.	40	137	0	0	46	0
skate unident.	1,614	1,201	779	917	1,880	554
slender seawhips	0	0	38	0	0	0
snail unident.	4,620	4,288	4,941	2,816	1,787	2,293
snailfish unident.	282	137	19	43	23	378
soft coral unident.	1,775	2,556	247	64	46	76
sponge unident.	17,651	23,655	16,609	23,811	16,017	12,598
starfish unident.	8,472	7,599	3,972	1,963	4,805	3,301
stony coral unident.	2,723	0	133	0	0	0
Stylantheca sp.	61	69	0	0	0	0
Stylaster sp.	6,859	11,304	7,735	6,081	7,776	4,737
triangle Tanner crab	0	0	57	21	0	25
tube worm unident.	101	772	209	0	0	25
tunicate unident.	1,816	926	190	43	627	227
unknown/not recorded	0	17	0	0	0	0
walleye pollock	161	0	57	0	0	0
worm unident.	40	1,407	380	0	46	0
yellow Irish lord	605	172	76	0	23	0

a. Based on 6,495 randomly sampled pot lifts out of 131,021 total pot lifts for the 2002/03 season.
b. Based on 7,294 randomly sampled pot lifts out of 125,119 total pot lifts for the 2003/04 season.
c. Based on 4,825 randomly sampled pot lifts out of 91,694 total pot lifts for the 2004/05 season.
d. Based on 2,563 randomly sampled pot lifts out of 54,685 total pot lifts for the 2005/06 season.
e. Based on 2,286 randomly sampled pot lifts out of 53,065 total pot lifts for the 2006/07 season.
f. Based on 2,088 randomly sampled pot lifts out of 52,609 total pot lifts for the 2007/08 season.

Table 1. Relative frequency distribution (percentage) of depths and average depth of pot lifts sampled by at-sea observers during the 2007/08 Aleutian Islands golden king crab fishery east of 174° W longitude, west of 174° W longitude, and for the total Aleutian Islands area (data from ADF&G Crab Observer Database, 23 March 2009).

Depth (fm)	East of 174°W longitude (n=996)	West of 174°W longitude (n=1,082)	Total Aleutian Islands (n=2,088)[a]
<76	0.0%	0.0%	0.0%
76-100	5.3%	1.9%	3.5%
101-125	20.8%	5.2%	12.6%
126-150	18.8%	16.5%	17.6%
151-175	11.4%	21.0%	16.4%
176-200	9.5%	26.2%	18.2%
201-225	9.5%	15.8%	12.8%
226-250	8.7%	7.9%	8.4%
251-275	5.8%	4.2%	5.0%
276-300	6.2%	0.7%	3.4%
>300	3.8%	0.6%	2.2%
Average (fm)	176.9	181.4	179.2

a. Includes 10 pots without location recorded.

Table 2. Average pots deployed per vessel in the Aleutian Islands golden king crab fishery, east and west of 174° W longitude, for the 2000/01 through 2007/08 seasons (from ADF&G 2008, Bowers, et al., 2008).

Fishery Season	East of 174°W longitude Average Pots / Vessel	West of 174°W longitude Average Pots / Vessel
2000/01	707	743
2001/02	680	943
2002/03	623	1,038
2003/04	695	1,190
2004/05	693	1,230
Average	**680**	**1,029**
2005/06*	1,232	1,600
2006/07*	1,358	2,000
2007/08*	1,050	1,600
Average*	**1,246**	**1,733**

* Rationalized season

Table 3. Average soak times in hours and days in the Aleutian Islands golden king crab fishery, east and west of 174° W longitude, for the 2000/01 through 2007/08 seasons (from ADF&G 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

Fishery Season	East of 174°W longitude		West of 174°W longitude	
	Soak Time (hours)	Soak Time (days)	Soak Time (hours)	Soak Time (days)
2000/01	111	4.6	230	9.7
2001/02	106	4.4	295	12.3
2002/03	98	4.1	291	12.1
2003/04	97	4.0	322	13.4
2004/05	88	3.7	279	11.6
Average	**100**	**4.2**	**283**	**11.8**
2005/06*	340	14.2	581	24.2
2006/07*	278	11.6	456	19.0
2007/08*	413	17.2	534	22.3
Average*	**344**	**14.3**	**524**	**21.8**

***Rationalized season

Table 4. Harvest history for the Aleutian Islands golden king crab fishery (GHL/TAC, pounds and number of retained crabs, pot lifts, fishery catch per unit effort, and average weight of landed crabs) by fishery season from the 1981/82 season through the 2007/08 season (includes the Community Development and Adak Community Allocation fisheries for the 2005/06–2007/08 seasons; from Pengilly 2008, updated with 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

Season	GHL/TAC Millions of Pounds	Harvest Pounds[a]	Harvest Number[a]	Pot lifts	CPUE[b]	Average Weight[c]
1981/82	-	1,319,666	242,407	28,263	8.4	5.4[d]
1982/83	-	9,236,942	1,746,206	179,888	9.4	5.3[d]
1983/84	-	10,495,045	1,964,772	267,519	7.2	5.3[d]
1984/85	-	4,819,347	995,453	90,066	10.7	4.8[e]
1985/86	-	12,734,212	2,811,195	236,281	11.9	4.5[f]
1986/87	-	14,738,744	3,340,627	433,020	7.7	4.4[f]
1987/88	-	9,257,005	2,174,576	306,730	7.1	4.2[f]
1988/89	-	10,627,042	2,488,433	321,927	7.6	4.3[f]
1989/90	-	12,022,052	2,902,913	357,803	8.0	4.1[f]
1990/91	-	6,950,362	1,703,251	214,814	7.7	4.1[f]
1991/92	-	7,702,141	1,847,398	234,857	7.7	4.2[f]
1992/93	-	6,291,197	1,528,328	203,221	7.4	4.1[f]
1993/94	-	5,551,143	1,397,530	234,654	5.8	4.0[f]
1994/95	-	8,128,511	1,924,271	386,593	4.8	4.2[f]
1995/96	-	6,960,406	1,582,333	293,021	5.2	4.4[f]
1996/97	5.9	5,815,772	1,334,877	212,727	6.0	4.4[f]
1997/98	5.9	5,945,683	1,350,160	193,214	6.8	4.4[f]
1998/99	5.7	4,941,893	1,150,029	119,353	9.4	4.3[f]
1999/00	5.7	5,838,788	1,385,890	186,169	7.2	4.2[f]
2000/01	5.7	6,018,761	1,410,315	172,790	8.0	4.3[f]
2001/02	5.7	5,918,706	1,416,768	168,151	8.3	4.2[f]
2002/03	5.7	5,462,455	1,308,709	131,021	9.8	4.2[f]
2003/04	5.7	5,665,828	1,319,707	125,119	10.3	4.3[f]
2004/05	5.7	5,575,051	1,323,001	91,694	14.2	4.2[f]
2005/06	5.7	5,520,318	1,263,339	54,685	22.9	4.4[f]
2006/07	5.7	5,262,342	1,178,321	53,065	22.0	4.5[f]
2007/08	5.7	5,508,100	1,233,848	52,609	23.5	4.5[f]

a. Includes deadloss.
b. Catch (number of crabs) per pot lift.
c. Average weight (pounds) of landed crabs, including deadloss.
d. Managed with 6.5" CW minimum size limit.
e. Managed with 6.5" CW minimum size limit west of 171° W longitude and 6.0" minimum size limit east of 171° W longitude.
f. Managed with 6.0" minimum size limit.

Table 5. Harvest history for the Aleutian Islands golden king crab fishery (GHL/TAC, pounds and number of retained crabs, pot lifts, fishery catch per unit effort, and average weight of landed crabs) for the area east of 174° W longitude by fishery season from the 1985/86 season through the 2007/08 season (includes the Community Development Quota fishery for the 2005/06–2007/08 seasons; from Pengilly 2008, updated with 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

Season	GHL/TAC Millions of Pounds	Harvest Pounds[a]	Harvest Number[a]	Pot lifts	CPUE[b]	Average Weight[c]
1985/86	-	6,514,777	1,400,484	117,718	11.9	4.7
1986/87	-	5,922,425	1,307,032	155,240	8.4	4.5
1987/88	-	4,431,745	1,029,424	146,501	7.0	4.3
1988/89	-	5,148,776	1,169,427	155,518	7.5	4.4
1989/90	-	5,473,218	1,317,833	155,262	8.5	4.2
1990/91	-	3,938,756	945,641	106,281	8.9	4.2
1991/92	-	4,553,550	1,093,983	133,428	8.2	4.2
1992/93	-	4,606,054	1,118,955	133,778	8.4	4.1
1993/94	-	3,328,604	832,194	106,890	7.8	4.0
1994/95	-	4,751,501	1,128,013	191,455	5.9	4.2
1995/96	-	4,627,487	1,046,780	177,773	5.9	4.4
1996/97	3.2	3,290,862	731,909	113,460	6.5	4.5
1997/98	3.2	3,501,055	780,610	106,403	7.3	4.5
1998/99	3.0	3,247,863	740,011	83,378	8.9	4.4
1999/00	3.0	3,069,886	709,332	79,129	9.0	4.3
2000/01	3.0	3,134,079	704,702	71,551	9.9	4.5
2001/02	3.0	3,178,653	730,030	62,639	11.7	4.4
2002/03	3.0	2,821,851	643,886	52,042	12.4	4.4
2003/04	3.0	2,977,055	643,074	58,883	10.9	4.6
2004/05	3.0	2,886,817	637,536	34,848	18.3	4.5
2005/06	3.0	2,866,603	623,971	24,569	25.4	4.6
2006/07	3.0	2,992,010	650,587	26,195	24.8	4.6
2007/08	3.0	2,989,997	633,253	22,653	28.0	4.7

a. Includes deadloss.
b. Catch (number of crabs) per pot lift.
c. Average weight (pounds) of landed crabs, including deadloss.

Table 6. Harvest history for the Aleutian Islands golden king crab fishery (GHL/TAC, pounds and number of crabs landed, pot lifts, fishery catch per unit effort, and average weight of landed crabs) for the area west of 174° W longitude by fishery season from the 1985/86 season through the 2007/08 season (includes the Adak Community Allocation fishery for the 2005/06–2007/08 seasons; from Pengilly 2008, updated with 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

Season	GHL/TAC Millions of Pounds	Harvest Pounds[a]	Harvest Number[a]	Pot lifts	CPUE[b]	Average Weight[c]
1985/86	-	6,219,435	1,410,711	118,563	11.9	4.4
1986/87	-	8,816,319	2,033,595	277,780	7.3	4.3
1987/88	-	4,825,260	1,145,152	160,229	7.2	4.2
1988/89	-	5,478,266	1,319,006	166,409	7.9	4.2
1989/90	-	6,548,834	1,585,080	202,541	7.8	4.1
1990/91	-	3,011,606	757,610	108,533	7.0	4.0
1991/92	-	3,148,591	753,415	101,429	7.4	4.2
1992/93	-	1,685,143	409,373	69,443	5.9	4.1
1993/94	-	2,222,539	565,336	127,764	4.4	3.9
1994/95	-	3,377,010	796,258	195,138	4.1	4.2
1995/96	-	2,332,919	535,553	115,248	4.7	4.4
1996/97	2.7	2,524,910	602,968	99,267	6.1	4.2
1997/98	2.7	2,444,628	569,550	86,811	6.6	4.3
1998/99	2.7	1,694,030	410,018	35,975	11.4	4.1
1999/00	2.7	2,768,902	676,558	107,040	6.3	4.1
2000/01	2.7	2,884,682	705,613	101,239	7.0	4.1
2001/02	2.7	2,740,054	686,738	105,512	6.5	4.0
2002/03	2.7	2,640,604	664,823	78,979	8.4	4.0
2003/04	2.7	2,688,773	676,633	66,236	10.2	4.0
2004/05	2.7	2,688,234	685,465	56,846	12.1	3.9
2005/06	2.7	2,653,715	639,368	30,116	21.2	4.2
2006/07	2.7	2,270,332	527,734	26,870	19.6	4.3
2007/08	2.7	2,518,103	600,595	29,956	20.0	4.2

a. Includes deadloss.
b. Catch (number of crabs) per pot lift.
c. Average weight (pounds) of landed crabs, including deadloss.

Table 7. Harvest history for the Aleutian Islands golden king crab fishery (pounds of retained crabs) for the areas east of 171° W longitude, between 171° W longitude and 174° W longitude, and west of 174° W longitude by fishery season from the 1985/86 season through the 2007/08 season (includes the Community Development and Adak Community Allocation fisheries for the 2005/06–2007/08 seasons; from Pengilly 2008, updated with 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

Season	East of 171° W long.	171° W long to 174° W long.	West of 174° W long.
1985/86	1,709,453	4,805,324	6,219,435
1986/87	1,869,180	4,053,245	8,816,319
1987/88	1,388,983	3,042,762	4,825,260
1988/89	1,546,113	3,602,663	5,478,266
1989/90	1,852,249	3,620,969	6,548,834
1990/91	1,699,675	2,239,081	3,011,606
1991/92	1,516,779	3,036,771	3,148,591
1992/93	1,404,452	3,201,602	1,685,143
1993/94	915,460	2,413,144	2,222,539
1994/95	1,750,481	3,001,020	3,377,010
1995/96	1,993,980	2,633,507	2,332,919
1996/97	2,617,750	673,112	2,524,910
1997/98	1,748,178	1,752,877	2,444,628
1998/99	1,562,267	1,685,596	1,694,030
1999/00	1,785,602	1,284,284	2,768,902
2000/01	1,324,687	1,809,392	2,884,682
2001/02	1,770,138	1,408,515	2,740,054
2002/03	1,751,219	1,070,632	2,640,604
2003/04	1,772,776	1,204,279	2,688,773
2004/05	1,567,849	1,318,968	2,688,234
2005/06	1,556,720	1,309,883	2,653,715
2006/07	1,216,389	1,775,621	2,270,332
2007/08	1,137,476	1,852,521	2,518,103
Average: 1985/86–1995/96	1,604,255	3,240,917	4,333,266
Average: 1996/97–2007/08	1,650,921	1,428,807	2,543,081
Average: 1985/86–2007/08	1,628,602	2,295,468	3,399,256

Table 8. Notable changes in management measures for the Aleutian Islands golden king crab fishery through the 2007/08 season.

Season	Change in management measure
1984/85	• Decrease in minimum size limit from 6.5" CW to 6.0" CW for the Dutch Harbor Area (i.e., the area east of 171° W longitude)
1985/86	• Decrease in minimum size limit from 6.5" CW to 6.0" CW for the Adak Area (i.e., the area west of 171° W longitude)
1996/97	• Aleutian Islands golden king crab management restructured to manage the area east of 174° W longitude separate from the area west of 174° W longitude; previously divided at 171° W longitude into the Dutch Harbor and Adak Areas • Preseason GHLs formally established: o 3.2-million pound GHL for the area east of 174° W longitude o 2.7-million pound GHL for the area west of 174° W longitude
1998/99	• GHL for area east of 174° W longitude reduced to 3.0-million pounds
2005/06	• First fishery under crab rationalization program

Table 9. Estimated weight (pounds) of non-retained legal male, non-retained sublegal male, and non-retained female Aleutian Islands golden king crabs during commercial crab fisheries by season for the 1996/97–2007/08 seasons (from Pengilly 2008, updated with 2007/08 retained catch data from F. Bowers, ADF&G, 24 March 2009, and 2007/08 bycatch estimates from D. Pengilly, ADF&G, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009). All non-retained catch occurred during the commercial Aleutian Islands golden king crab fishery unless noted.

Season	Legal male	Sublegal male	Female	Total
1996/97	0	4,221,753[a]	4,853,795[b]	9,075,548[a,b]
1997/98	0	4,198,607[c]	4,494,061[d]	8,692,668[c,d]
1998/99	41,325	4,303,406	3,043,543	7,388,274
1999/00	63,877	3,930,277	3,557,417	7,551,570
2000/01	35,432	4,782,427	4,083,675	8,901,534
2001/02	26,541	3,787,239	3,074,681[e]	6,888,462[e]
2002/03	41,621	3,113,341	2,516,355[f]	5,671,318[f]
2003/04	38,870	2,663,899	2,270,716[g]	4,973,484[g]
2004/05	76,100	2,511,523	1,733,391[h]	4,321,014[h]
2005/06	140,493	1,478,601	904,642	2,523,737
2006/07	119,590	1,263,303	1,190,147	2,573,040
2007/08	127,560	1,504,738	1,402,333	3,034,632

a. Includes 99,579 pounds from crab fishing not directed on golden king crabs.
b. Includes 202,745 pounds from crab fishing not directed on golden king crabs.
c. Includes 70,075 pounds from crab fishing not directed on golden king crabs.
d. Includes 66,373 pounds from crab fishing not directed on golden king crabs.
e. Includes 83 pounds from crab fishing not directed on golden king crabs.
f. Includes 65 pounds from crab fishing not directed on golden king crabs.
g. Includes 2,303 pounds from crab fishing not directed on golden king crabs.
h. Includes 7 pounds from crab fishing not directed on golden king crabs.

Table 10. Estimated annual weight (pounds) of non-retained legal male, non-retained sublegal male, and non-retained female golden king crabs captured and discarded during the commercial Aleutian Islands golden king crab fishery east of 174° longitude by season for the 1996/97–2007/08 seasons (from Pengilly 2008, updated with 2007/08 bycatch estimates from D. Pengilly, ADF&G, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009).

Season	Legal male	Sublegal male	Female	Total
1996/97	0	2,099,555	1,931,988	4,031,543
1997/98	0	2,536,029	2,322,039	4,858,067
1998/99	34,358	2,976,521	1,765,592	4,776,471
1999/00	40,284	2,048,481	1,360,567	3,449,331
2000/01	17,720	2,501,540	1,555,971	4,075,231
2001/02	14,199	1,648,759	948,023	2,610,981
2002/03	25,535	1,315,071	959,113	2,299,720
2003/04	20,009	1,200,043	888,268	2,108,319
2004/05	19,555	919,950	544,263	1,483,769
2005/06	84,334	509,375	238,363	832,073
2006/07	92,819	567,443	472,872	1,133,134
2007/08	105,155	573,115	341,780	1,020,050

Table 11. Estimated annual weight (pounds) of non-retained legal male, non-retained sublegal male, and non-retained female golden king crabs captured and discarded during the commercial Aleutian Islands golden king crab fishery west of 174° longitude by season for the 1996/97–2007/08 seasons (from Pengilly 2008, updated with 2007/08 bycatch estimates from D. Pengilly, ADF&G, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009).

Season	Legal	Sublegal male	Female	Total
1996/97	0	2,022,619	2,719,062	4,741,681
1997/98	0	1,592,503	2,105,650	3,698,153
1998/99	6,967	1,326,885	1,277,951	2,611,803
1999/00	23,592	1,881,796	2,196,850	4,102,238
2000/01	17,712	2,280,887	2,527,704	4,826,303
2001/02	12,343	2,138,480	2,126,575	4,277,398
2002/03	16,086	1,798,270	1,557,177	3,371,533
2003/04	18,861	1,463,856	1,380,145	2,862,862
2004/05	56,545	1,591,573	1,189,121	2,837,238
2005/06	56,159	969,226	666,279	1,691,664
2006/07	26,771	695,861	717,274	1,439,906
2007/08	22,405	931,623	1,060,553	2,014,581

Table 12. Estimated annual weight (pounds) of discarded bycatch of Aleutian Islands golden king crabs (all sizes, males and females) during groundfish fisheries by year, gear type, and reporting area in federal reporting areas 541, 542, and 543 (Aleutian Islands west of 170° W longitude; see Figure 9) for calendar years 2003–2007 (summary of the data provided by J. Mondragon, NMFS-Alaska Region Office, 31 March 2008) and fishery year 2008/09 (summary of preliminary data provided by R. Foy, NMFS-AFSC, Kodiak, 8 April 2009).

		Reporting Area			
Year[a]	Gear	541	542	543	Total
2003	Hook and line	352	380	86	819
2003	Non-pelagic trawl	501	585	1,228	2,315
2003	Pot	81,842	9,188	0	91,030
2003	All gear types	82,695	10,153	1,315	94,163
2004	Hook and line	111	231	6	348
2004	Non-pelagic trawl	515	697	449	1,660
2004	Pot	38,461	0	0	38,461
2004	All gear types	39,086	928	454	40,469
2005	Hook and line	384	222	392	998
2005	Non-pelagic trawl	3,533	1,689	5,284	10,506
2005	Pot	1,811	550	0	2,361
2005	All gear types	5,728	2,461	5,677	13,865
2006	Hook and line	165	1,394	7	1,566
2006	Non-pelagic trawl	1,938	8,391	1,133	11,462
2006	Pot	21,461	63	0	21,525
2006	All gear types	23,564	9,848	1,140	34,552
2007	Hook and line	152	3,603	186	3,942
2007	Non-pelagic trawl	1,033	1,867	3,030	5,930
2007	Pot	211,332	1	0	211,332
2007	All gear types	212,515	5,472	3,217	221,203
2008/09[b]	Hook and line	17	81	121	218
2008/09[b]	Non-pelagic trawl	798	10,150	3,250	14,198
2008/09[b]	Pot	11,983	0	0	11,983
2008/09[b]	All gear types	12,799	10,230	3,371	26,400
Average[c]	Hook and line	233	1,166	135	1,535
Average[c]	Non-pelagic trawl	1,504	2,646	2,225	6,375
Average[c]	Pot	70,981	1,960	0	72,942
Average[c]	All gear types	72,718	5,772	2,361	80,850

a. Calendar year except when noted as otherwise.
b. Preliminary data received 8 April 2009 for groundfish fishery year 2008/09, July 2008 – June 2009.
c. Average for calendar years 2003–2007 only.

Table 13. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2008/09) for retained catch (i.e., not including discards; in pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) of Aleutian Islands golden king crabs during crab fisheries (see Tables 4 and 9).

			Non-	Total Catch					
	Retained	Retained	Retained	(retained plus discard mortality with assumed handling mortality rate, *hm*)					
Season	GHL/TAC	Catch	Discards	*hm*=10%	*hm*=20%	*hm*=30%	*hm*=40%	*hm*=50%	*hm*=60%
1996/97	5,900,000	5,815,772	9,075,548	6,723,327	7,630,882	8,538,437	9,445,991	10,353,546	11,261,101
1997/98	5,900,000	5,945,683	8,692,668	6,814,950	7,684,217	8,553,483	9,422,750	10,292,017	11,161,284
1998/99	5,700,000	4,941,893	7,388,274	5,680,720	6,419,548	7,158,375	7,897,203	8,636,030	9,374,858
1999/00	5,700,000	5,838,788	7,551,570	6,593,945	7,349,102	8,104,259	8,859,416	9,614,573	10,369,730
2000/01	5,700,000	6,018,761	8,901,534	6,908,914	7,799,068	8,689,221	9,579,374	10,469,528	11,359,681
2001/02	5,700,000	5,918,706	6,888,462	6,607,552	7,296,398	7,985,244	8,674,091	9,362,937	10,051,783
2002/03	5,700,000	5,462,455	5,671,318	6,029,587	6,596,719	7,163,850	7,730,982	8,298,114	8,865,246
2003/04	5,700,000	5,665,828	4,973,484	6,163,176	6,660,525	7,157,873	7,655,222	8,152,570	8,649,919
2004/05	5,700,000	5,575,051	4,321,014	6,007,152	6,439,254	6,871,355	7,303,457	7,735,558	8,167,660
2005/06	5,700,000	5,520,318	2,523,737	5,772,692	6,025,065	6,277,439	6,529,813	6,782,186	7,034,560
2006/07	5,700,000	5,262,342	2,573,040	5,519,646	5,776,950	6,034,254	6,291,558	6,548,862	6,806,166
2007/08	5,700,000	5,508,100	3,034,632	5,811,563	6,115,026	6,418,489	6,721,952	7,025,416	7,328,879
2008/09	5,985,000	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

Table 14. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2008/09) for retained catch (i.e., not including discards; in pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) of golden king crabs during the Aleutian Islands golden king crab fishery in the area east of 174° W longitude (see Tables 5 and 10).

			Non-	Total Catch (retained plus discard mortality with assumed handling mortality rate, *hm*)					
	Retained	Retained	retained						
Season	GHL/TAC	Catch	Discards	*Hm*=10%	*hm*=20%	*hm*=30%	*hm*=40%	*hm*=50%	*hm*=60%
1996/97	3,200,000	3,290,862	4,031,543	3,694,016	4,097,171	4,500,325	4,903,479	5,306,633	5,709,788
1997/98	3,200,000	3,501,055	4,858,067	3,986,862	4,472,668	4,958,475	5,444,282	5,930,089	6,415,895
1998/99	3,000,000	3,247,863	4,776,471	3,725,510	4,203,157	4,680,804	5,158,452	5,636,099	6,113,746
1999/00	3,000,000	3,069,886	3,449,331	3,414,819	3,759,752	4,104,685	4,449,619	4,794,552	5,139,485
2000/01	3,000,000	3,134,079	4,075,231	3,541,602	3,949,125	4,356,648	4,764,171	5,171,694	5,579,218
2001/02	3,000,000	3,178,653	2,610,981	3,439,751	3,700,849	3,961,947	4,223,045	4,484,143	4,745,241
2002/03	3,000,000	2,821,851	2,299,720	3,051,823	3,281,795	3,511,767	3,741,739	3,971,711	4,201,683
2003/04	3,000,000	2,977,055	2,108,319	3,187,887	3,398,719	3,609,551	3,820,383	4,031,215	4,242,047
2004/05	3,000,000	2,886,817	1,483,769	3,035,194	3,183,571	3,331,948	3,480,325	3,628,701	3,777,078
2005/06	3,000,000	2,866,603	832,073	2,949,810	3,033,018	3,116,225	3,199,432	3,282,639	3,365,847
2006/07	3,000,000	2,992,010	1,133,134	3,105,323	3,218,637	3,331,950	3,445,264	3,558,577	3,671,891
2007/08	3,000,000	2,989,997	1,020,050	3,092,002	3,194,007	3,296,012	3,398,017	3,500,022	3,602,027
2008/09	3,150,000	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

Table 15. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2008/09) for retained catch (pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) of golden king crabs during the Aleutian Islands golden king crab fishery in the area west of 174° W longitude (see Tables 6 and 11).

			Non-	Total Catch (retained plus discard mortality with assumed handling mortality rate, *hm*)					
Season	Retained GHL/TAC	Retained Catch	retained Discards	*Hm*=10%	*hm*=20%	*hm*=30%	*hm*=40%	*hm*=50%	*hm*=60%
1996/97	2,700,000	2,524,910	4,741,681	2,999,078	3,473,246	3,947,414	4,421,583	4,895,751	5,369,919
1997/98	2,700,000	2,444,628	3,698,153	2,814,443	3,184,259	3,554,074	3,923,889	4,293,704	4,663,520
1998/99	2,700,000	1,694,030	2,611,803	1,955,210	2,216,391	2,477,571	2,738,751	2,999,931	3,261,112
1999/00	2,700,000	2,768,902	4,102,238	3,179,126	3,589,350	3,999,573	4,409,797	4,820,021	5,230,245
2000/01	2,700,000	2,884,682	4,826,303	3,367,312	3,849,943	4,332,573	4,815,203	5,297,833	5,780,464
2001/02	2,700,000	2,740,054	4,277,398	3,167,794	3,595,534	4,023,273	4,451,013	4,878,753	5,306,493
2002/03	2,700,000	2,640,604	3,371,533	2,977,757	3,314,911	3,652,064	3,989,217	4,326,371	4,663,524
2003/04	2,700,000	2,688,773	2,862,862	2,975,059	3,261,345	3,547,632	3,833,918	4,120,204	4,406,490
2004/05	2,700,000	2,688,234	2,837,238	2,971,958	3,255,682	3,539,406	3,823,129	4,106,853	4,390,577
2005/06	2,700,000	2,653,715	1,691,664	2,822,881	2,992,048	3,161,214	3,330,381	3,499,547	3,668,713
2006/07	2,700,000	2,270,332	1,439,906	2,414,323	2,558,313	2,702,304	2,846,294	2,990,285	3,134,276
2007/08	2,700,000	2,518,103	2,014,581	2,719,561	2,921,019	3,122,477	3,323,935	3,525,394	3,726,852
2008/09	2,835,000	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

Table 16. Carapace length (CL, mm) frequency distribution from biological measurements of retained golden king crabs sampled by season during the 1997/98 through 2007/08 Aleutian Islands golden king crab fishery (from Pengilly 2008; 2007/08 data from the ADF&G Crab Observer Database, 1 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<130	73	25	25	26	15	16	10	4	5	4	3
130	78	35	42	42	28	16	20	14	5	2	4
131	137	58	63	57	45	38	23	22	12	11	13
132	256	147	151	132	107	106	65	76	35	27	35
133	438	279	265	209	170	231	137	99	57	39	40
134	657	439	395	346	292	391	180	215	128	106	82
135	1,005	628	581	569	461	496	334	381	228	177	125
136	1,236	778	638	660	546	698	427	460	282	201	166
137	1,470	1,190	1,095	981	840	999	569	566	452	330	237
138	1,874	1,228	1,253	1,051	1,019	972	730	718	476	410	327
139	1,747	1,119	1,214	951	985	889	611	574	456	389	374
140	2,056	1,597	1,525	1,532	1,168	1,246	1,039	959	687	544	409
141	1,951	1,279	1,377	1,151	1,109	1,039	696	793	646	554	434
142	2,251	1,599	1,744	1,400	1,307	1,341	1,051	956	767	651	571
143	2,227	1,623	1,656	1,249	1,278	1,480	924	1,002	772	763	525
144	1,912	1,306	1,497	1,145	1,276	1,113	840	809	661	565	458
145	2,067	1,442	1,538	1,487	1,266	1,224	1,028	943	756	674	535
146	1,792	1,226	1,279	1,049	992	1,001	758	746	627	590	461
147	1,766	1,371	1,567	1,269	1,169	1,190	923	826	694	618	498
148	1,695	1,251	1,410	1,042	1,122	944	783	693	661	642	535
149	1,412	844	1,131	876	897	882	568	571	572	505	486
150	1,458	1,083	1,091	1,142	890	864	728	609	585	510	422
151	1,266	788	896	799	717	626	502	455	520	458	406
152	1,252	912	1,053	893	879	766	592	504	581	563	451
153	1,134	753	819	742	671	594	477	395	443	530	392
154	972	566	735	664	587	672	427	405	423	445	377
155	840	577	635	792	538	502	405	398	411	446	386
156	824	514	545	530	419	353	318	300	335	363	341
157	742	475	570	581	427	452	323	317	323	397	352
158	659	428	527	496	391	262	280	213	283	333	273
159	611	308	398	375	295	221	178	208	254	290	303

(continued)

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CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
160	588	337	383	469	261	250	255	229	247	267	289
161	451	241	305	281	236	180	135	142	196	269	257
162	447	273	335	334	236	197	166	182	195	283	272
163	433	222	294	318	231	136	123	134	145	254	210
164	361	178	213	246	206	131	162	122	136	169	220
165	350	180	183	258	173	116	142	126	145	201	215
166	279	122	161	179	112	86	78	71	94	153	173
167	297	142	157	216	160	100	88	80	110	174	183
168	250	118	125	143	126	71	74	77	75	131	165
169	176	107	101	110	83	60	56	52	74	103	126
170	183	105	76	152	86	59	60	74	76	110	134
171	137	70	71	104	52	49	38	46	58	94	111
172	150	72	59	95	65	57	52	28	65	81	83
173	137	54	48	88	48	22	29	34	62	73	77
174	95	44	23	61	38	22	30	41	43	61	69
175	92	51	31	61	41	25	18	11	52	53	55
176	95	21	29	41	20	17	17	11	29	35	44
177	55	33	21	37	18	10	12	11	32	33	50
178	67	20	20	34	17	13	8	13	18	26	33
179	47	8	15	22	12	7	20	1	12	24	31
180	35	11	10	27	18	6	8	7	13	10	21
>180	135	55	33	75	44	16	30	19	51	71	85
Total	42,718	28,332	30,408	27,589	24,189	23,254	17,547	16,742	15,065	14,812	12,924

Table 17. Carapace length (CL, mm) frequency distributions from biological measurements of retained golden king crabs sampled by season during the 1997/98 through 2007/08 Aleutian Islands golden king crab fishery east of 174° W longitude (from Pengilly 2008; 2007/08 data from the ADF&G Crab Observer Database, 1 April 2009).

CL(mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<130	25	9	8	11	3	3	2	0	0	0	2
130	16	7	9	7	8	3	0	1	0	0	0
131	26	22	21	11	6	3	3	5	1	0	5
132	24	46	40	28	17	23	6	16	4	2	9
133	84	69	82	39	30	44	20	23	4	2	8
134	151	104	96	69	59	52	23	41	8	5	20
135	225	182	142	103	79	70	41	67	20	14	26
136	246	196	196	144	112	91	76	61	28	26	32
137	246	304	265	184	121	147	75	84	38	32	42
138	324	289	316	202	181	151	74	101	38	39	70
139	302	278	288	196	160	177	83	107	41	39	82
140	342	435	336	304	190	227	132	154	68	43	95
141	328	341	284	243	199	185	105	128	61	42	89
142	373	413	311	310	228	229	136	166	95	76	108
143	415	386	345	262	233	220	131	148	73	68	124
144	363	333	305	242	218	193	124	146	83	56	101
145	318	373	292	248	229	221	148	155	78	75	109
146	319	332	263	211	175	177	142	129	85	62	107
147	291	393	284	273	207	221	146	148	99	68	103
148	311	300	220	204	220	184	115	127	62	79	109
149	261	262	184	166	175	194	116	114	89	73	105
150	264	309	197	169	175	170	138	134	93	69	105
151	262	280	163	166	184	154	98	116	85	62	114
152	199	279	175	162	177	164	104	86	92	66	88
153	205	192	144	131	140	118	79	81	53	63	106
154	182	166	123	130	133	122	88	99	78	59	108
155	142	177	115	120	132	116	76	109	61	60	96
156	144	178	100	91	115	83	83	63	78	36	67
157	150	129	103	89	100	89	85	89	61	39	94
158	113	146	91	108	97	79	55	60	52	42	84
159	108	107	82	57	77	75	32	63	45	27	65

(continued)

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CL(mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
160	133	153	78	76	70	92	52	69	50	38	64
161	90	111	57	60	61	57	33	45	37	32	70
162	91	106	65	58	59	59	34	57	44	39	63
163	83	75	63	53	61	45	26	37	19	39	43
164	43	70	53	47	49	46	26	23	19	27	55
165	56	72	42	38	44	32	22	30	33	22	41
166	46	54	39	36	31	33	22	20	19	18	32
167	56	65	33	29	31	39	18	37	23	20	41
168	29	58	31	28	37	29	13	16	13	24	41
169	42	53	30	13	22	23	16	16	18	20	25
170	30	40	25	18	24	20	11	20	11	12	44
171	21	39	22	15	18	16	5	13	12	6	24
172	22	30	19	10	17	26	11	7	18	10	17
173	14	29	16	14	9	7	10	9	16	13	21
174	15	26	6	9	8	8	8	10	9	10	15
175	11	23	8	12	14	7	3	3	15	4	11
176	13	9	7	4	2	8	3	2	8	3	11
177	6	18	9	3	4	2	1	2	2	4	12
178	10	10	7	9	4	5	3	1	6	5	8
179	9	4	7	2	3	3	3	0	1	5	7
180	7	7	3	4	5	2	0	0	2	0	7
>180	6	25	8	10	14	7	9	2	15	10	25
Total	7,592	8,114	6,208	5,228	4,767	4,551	2,865	3,240	2,063	1,685	2,950

Table 18. Carapace length (CL, mm) frequency distributions from biological measurements of retained golden king crabs sampled by season during the 1997/98 through 2007/08 Aleutian Islands golden king crab fishery west of 174° W longitude (from Pengilly 2008; 2007/08 data from the ADF&G Crab Observer Database, 1 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<130	36	16	17	7	12	13	3	4	3	3	1
130	56	28	33	20	20	12	17	13	5	2	4
131	90	36	42	27	39	35	18	17	11	11	8
132	202	101	111	73	90	83	51	57	28	25	26
133	294	210	182	106	138	179	109	69	52	37	31
134	426	335	295	175	228	317	132	160	112	98	59
135	639	446	436	338	380	407	260	303	200	157	98
136	813	582	437	333	427	559	308	386	238	170	131
137	1,018	886	819	537	710	798	412	461	396	296	188
138	1,283	939	927	588	829	770	583	592	421	367	253
139	1,196	841	913	519	819	674	445	447	381	342	286
140	1,431	1,162	1,172	905	971	957	793	783	568	491	302
141	1,348	938	1,081	643	903	800	489	639	541	501	337
142	1,521	1,186	1,419	740	1,074	1,057	817	754	630	567	448
143	1,508	1,237	1,289	669	1,041	1,171	693	829	663	686	381
144	1,244	973	1,181	626	1,051	871	604	632	544	500	350
145	1,475	1,069	1,233	958	1,031	937	761	761	623	583	419
146	1,208	894	1,006	612	811	772	517	590	504	513	343
147	1,243	978	1,270	732	960	910	667	659	543	542	385
148	1,138	951	1,180	587	896	716	585	546	560	554	413
149	971	582	937	531	714	646	379	437	440	426	368
150	1,003	774	888	763	710	653	498	461	450	418	304
151	860	508	727	470	532	440	330	324	389	382	284
152	895	633	870	547	698	564	404	398	443	484	352
153	795	561	664	441	529	453	337	306	359	454	279
154	653	400	608	414	453	511	278	289	315	362	260
155	582	400	514	556	406	361	279	278	313	366	285
156	581	336	442	321	303	253	173	228	221	295	262
157	507	346	463	379	323	335	191	223	243	329	252
158	452	282	433	302	294	171	184	150	209	251	182
159	419	201	313	255	217	133	108	136	188	243	233

(continued)

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CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
160	394	184	300	316	191	144	160	155	169	208	218
161	303	130	247	168	175	114	76	89	141	224	181
162	304	167	265	204	177	125	98	118	139	229	201
163	296	147	227	200	168	84	69	91	119	201	161
164	279	108	154	145	157	77	104	90	98	128	156
165	260	108	141	179	129	79	91	92	103	168	174
166	194	68	118	114	81	50	31	45	57	129	135
167	218	77	120	150	128	54	53	43	81	145	137
168	192	60	91	82	88	41	50	60	57	100	120
169	120	54	68	73	59	31	30	33	49	79	93
170	135	65	51	117	62	39	38	51	62	93	88
171	100	31	47	64	34	26	13	27	42	82	83
172	108	42	40	65	47	28	28	18	44	66	62
173	93	25	30	60	39	14	11	23	44	54	54
174	75	18	17	39	30	13	8	24	33	50	50
175	70	28	23	34	27	15	9	8	35	47	43
176	76	12	19	26	18	8	4	6	20	29	32
177	42	15	9	22	14	5	5	8	29	28	37
178	53	10	13	21	13	6	3	10	12	21	23
179	31	4	6	19	9	2	8	1	11	17	23
180	28	4	4	17	13	4	6	7	11	9	14
>180	120	30	19	50	29	8	10	17	33	56	60
Total	29,378	20,218	23,911	16,339	19,297	17,525	12,330	12,948	11,982	12,618	9,669

Table 19. Carapace length (CL, mm) distribution of male golden king crabs captured in pot lifts randomly sampled by at-sea observers during the 1997/98–2007/08 (97/98–07/08) Aleutian Islands golden king crab fishery in the area east of 174° W longitude (data from the ADF&G Crab Observer Database, 8 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<51	8	12	22	4	8	1	1	0	0	0	0
51-55	17	35	28	5	7	3	0	0	0	0	0
56-60	29	79	35	7	11	2	0	0	0	0	0
61-65	84	152	80	25	38	8	4	1	0	2	0
66-70	191	249	140	51	53	28	11	6	1	0	0
71-75	350	471	239	141	123	46	36	21	3	2	1
76-80	593	680	403	230	207	74	40	45	10	22	2
81-85	966	1,038	707	315	289	142	76	73	38	41	7
86-90	1,221	1,273	911	430	360	189	128	106	48	43	11
91-95	1,547	1,701	1,251	523	477	303	202	118	46	49	6
96-100	1,953	2,073	1,533	631	641	412	238	142	77	43	18
101-105	2,610	2,927	2,084	760	785	465	324	231	77	48	35
106-110	3,476	3,846	2,510	1,054	1,035	613	526	338	105	84	46
111-115	4,599	5,295	3,075	1,410	1,327	769	611	476	123	105	66
116-120	5,899	7,025	4,511	1,864	1,734	944	891	707	189	134	99
121-125	7,432	8,863	6,289	2,252	2,246	1,326	1,283	1,147	364	248	220
126-130	9,165	10,415	8,422	3,176	3,206	2,119	1,939	1,571	511	376	424
131-135	9,992	10,994	10,261	3,810	4,802	2,849	2,516	2,040	973	815	887
136-140	9,358	9,985	10,152	4,021	5,345	3,646	3,149	2,673	1,662	1,090	1,533
141-145	8,010	8,145	8,827	3,360	5,098	3,561	3,203	2,879	1,923	1,481	1,865
146-150	6,065	6,085	6,691	2,400	3,899	3,068	2,931	2,626	1,968	1,456	1,897
151-155	3,832	3,747	4,270	1,638	2,526	2,109	2,085	1,905	1,668	1,249	1,768
156-160	2,487	2,451	2,519	1,052	1,485	1,245	1,333	1,268	1,118	952	1,246
161-165	1,551	1,524	1,623	607	887	798	780	852	854	681	1,008
166-170	916	783	903	354	470	363	416	402	450	397	641
171-175	482	398	441	171	220	183	226	166	220	188	361
176-180	187	138	182	62	107	61	94	86	92	87	199
181-185	86	48	43	15	34	19	37	14	31	38	79
186-190	21	14	20	9	8	7	12	5	13	17	23
>190	5	2	5	3	3	0	1	1	1	2	12
Total	83,132	90,448	78,177	30,380	37,431	25,353	23,093	19,899	12,565	9,650	12,454

Table 20. Carapace length (CL, mm) distribution of female golden king crabs captured in pot lifts randomly sampled by at-sea observers during the 1997/98–2007/08 (97/98–07/08) Aleutian Islands golden king crab fishery in the area east of 174° W longitude (data from the ADF&G Crab Observer Database, 8 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<51	8	11	21	3	9	0	0	0	1	0	0
51-55	11	30	24	8	2	0	2	0	0	0	0
56-60	18	70	41	8	15	5	0	0	0	1	0
61-65	73	127	58	21	23	10	5	1	0	0	0
66-70	156	225	114	61	57	21	15	12	1	2	0
71-75	415	466	225	140	122	50	38	46	4	9	0
76-80	760	781	430	265	242	118	54	85	16	12	1
81-85	1,218	1,290	807	417	422	211	98	82	38	31	3
86-90	1,630	1,528	1,056	477	536	268	185	125	65	43	6
91-95	1,867	1,996	1,362	624	733	438	301	162	51	45	12
96-100	2,452	2,382	1,704	730	869	612	366	206	62	44	12
101-105	3,522	3,339	2,582	980	1,030	718	484	308	81	61	26
106-110	4,662	4,496	3,520	1,447	1,182	957	592	423	128	71	31
111-115	5,582	5,553	4,200	1,866	1,201	1,091	694	569	121	95	33
116-120	6,055	5,628	4,851	1,961	1,172	1,162	904	637	138	158	59
121-125	6,167	4,764	4,628	1,630	1,033	1,085	1,032	755	161	230	113
126-130	5,747	3,734	3,675	1,158	880	967	1,024	733	154	290	178
131-135	5,169	3,060	2,839	790	729	806	843	624	153	384	258
136-140	3,815	1,985	1,787	433	458	480	540	391	158	399	311
141-145	2,153	1,045	941	249	199	205	297	182	80	272	201
146-150	868	390	397	95	69	68	78	66	38	95	118
151-155	301	128	105	39	32	15	30	14	16	23	23
156-160	88	38	33	7	10	6	6	2	2	11	5
161-165	16	11	8	6	3	4	0	0	2	2	1
166-170	7	4	3	6	0	1	1	0	2	1	0
171-175	3	1	0	0	1	0	0	0	1	0	0
176-180	2	1	0	1	0	0	1	0	0	0	0
181-185	1	0	0	0	0	0	0	0	0	0	0
186-190	0	0	0	0	0	0	0	0	0	0	0
>190	0	0	1	0	0	0	1	0	0	0	0
Total	52,766	43,083	35,412	13,422	11,029	9,298	7,591	5,423	1,473	2,279	1,391

Table 21. Carapace length (CL, mm) distribution of male golden king crabs captured in pot lifts randomly sampled by at-sea observers during the 1997/98–2007/08 (97/98–07/08) Aleutian Islands golden king crab fishery in the area west of 174° W longitude (data from the ADF&G Crab Observer Database, 8 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<51	9	10	13	5	8	4	3	0	0	1	3
51-55	2	2	18	13	6	2	0	1	0	0	0
56-60	2	4	24	21	5	5	5	1	0	0	0
61-65	11	15	67	25	9	10	16	6	0	0	0
66-70	26	48	112	47	16	21	22	6	0	0	1
71-75	77	96	143	96	24	27	26	37	1	1	2
76-80	162	128	218	139	74	54	26	61	2	0	5
81-85	327	211	354	309	168	95	39	80	3	6	10
86-90	469	318	552	513	290	177	60	127	9	11	20
91-95	711	466	856	835	485	318	101	138	25	17	45
96-100	1,025	676	1,173	1,437	858	497	190	246	48	50	67
101-105	1,590	1,011	1,788	2,255	1,439	904	318	424	97	108	168
106-110	2,194	1,410	2,518	3,188	2,077	1,407	545	710	180	196	300
111-115	2,957	1,841	3,219	4,246	3,080	1,876	987	1,102	321	354	466
116-120	3,674	2,465	4,274	5,416	4,063	2,703	1,601	1,772	566	533	765
121-125	4,706	3,165	5,625	6,853	5,748	3,650	2,631	2,638	931	888	1,162
126-130	5,904	4,032	7,116	8,378	7,475	4,880	4,215	4,135	1,684	1,622	1,894
131-135	7,430	5,316	9,013	10,713	10,224	6,797	6,366	5,802	3,285	3,047	3,329
136-140	7,424	5,421	8,860	10,197	10,225	7,179	7,193	6,070	4,587	4,447	4,430
141-145	6,332	4,257	7,831	8,160	8,242	5,484	6,006	5,207	4,512	4,828	4,233
146-150	4,689	3,058	5,510	5,454	5,377	3,567	4,119	3,409	3,540	3,994	3,548
151-155	2,873	1,598	3,423	3,311	3,022	1,928	2,559	1,860	2,222	2,853	2,452
156-160	1,745	833	1,714	1,890	1,488	950	1,229	891	1,137	1,841	1,698
161-165	1,088	453	999	1,070	860	477	710	520	660	1,193	1,114
166-170	701	196	412	565	423	223	344	226	242	636	633
171-175	394	86	206	307	225	96	137	103	165	282	312
176-180	198	22	72	113	74	28	46	37	62	125	125
181-185	94	8	35	49	25	10	10	12	22	34	39
186-190	35	5	10	13	4	2	6	0	7	19	9
>190	28	1	3	7	3	4	2	0	0	3	5
Total	56,877	37,152	66,158	75,625	66,017	43,375	39,512	35,621	24,308	27,089	26,835

Table 22. Carapace length (CL, mm) distribution of female golden king crabs captured in pot lifts randomly sampled by at-sea observers during the 1997/98–2007/08 (97/98–07/08) Aleutian Islands golden king crab fishery in the area west of 174° W longitude (data from the ADF&G Crab Observer Database, 8 April 2009).

CL (mm)	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
<51	0	2	14	6	2	3	3	0	0	0	0
51-55	2	0	4	13	4	4	1	1	0	0	0
56-60	0	5	22	30	7	1	5	1	0	0	0
61-65	6	22	58	28	10	15	11	5	0	0	0
66-70	32	41	84	47	13	12	19	9	0	0	0
71-75	76	98	139	96	30	43	34	28	0	1	0
76-80	152	148	227	145	69	63	27	62	2	0	2
81-85	295	214	420	317	168	109	42	82	2	4	2
86-90	568	268	565	548	279	210	71	116	6	23	20
91-95	830	483	952	946	582	287	122	149	22	38	32
96-100	1,112	753	1,293	1,699	1,005	594	197	266	55	47	74
101-105	1,742	1,162	2,052	2,779	1,569	1,090	389	438	148	124	217
106-110	2,530	1,651	2,958	4,147	2,392	1,722	751	777	240	199	334
111-115	3,321	2,345	4,262	5,369	3,443	2,155	1,270	1,148	430	329	511
116-120	3,851	2,750	4,976	5,936	4,169	2,794	1,615	1,575	530	423	726
121-125	4,084	2,858	5,564	6,628	4,865	2,822	1,863	1,858	611	603	905
126-130	4,291	2,646	5,588	6,697	5,329	2,956	2,138	2,022	678	838	1,298
131-135	4,431	2,308	5,637	6,602	5,598	2,655	2,366	1,789	910	1,245	1,744
136-140	4,612	2,018	4,952	5,245	4,515	2,357	2,108	1,392	993	1,441	1,645
141-145	3,780	1,608	3,466	3,354	3,130	1,560	1,482	761	710	1,091	1,021
146-150	2,537	1,144	2,110	1,855	1,573	823	777	331	331	557	512
151-155	1,422	684	961	899	857	418	355	134	102	175	189
156-160	666	279	393	381	291	139	145	46	32	49	60
161-165	249	72	120	128	120	51	50	8	8	17	17
166-170	68	10	33	35	30	19	10	3	2	0	4
171-175	12	2	2	9	9	6	0	0	0	0	1
176-180	4	0	1	0	1	3	0	0	0	0	0
181-185	1	0	0	0	1	0	0	0	0	0	0
186-190	0	0	0	0	0	1	0	0	0	0	0
>190	3	0	1	0	0	0	1	0	0	0	0
Total	40,677	23,571	46,854	53,939	40,061	22,912	15,852	13,001	5,812	7,204	9,314

Table 23. Catch per unit effort (CPUE; number of crabs per pot lift) of legal males, sublegal males, and females in the 1997–2006 ADF&G Aleutian Islands golden king crab triennial pot survey for 61 stations fished in common over all four surveys (data from Watson 2007; 62 stations were fished in common over all four surveys, but data from one of those stations – station 12 – was not included due to excessive soak time and inability to sample entire catch in 2006 survey).

Survey Year	Legal Males	Sublegal Males	Females
1997	4.7	49.7	58.6
2000	3.1	30.7	32.7
2003	2.9	11.9	10.5
2006	4.3	11.9	17.2

Table 24. Mean and standard deviation (S.D.) of estimated growth in carapace length (mm) from a single molt by shell condition and legal status at release for male golden king crabs tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered during subsequent commercial fishery seasons 0–4, 12–15, 24–27, 36-38 and 12–38 months after release (from Watson et al. 2002).

Months After Release	Statistic	Shell condition at release: New shell Sublegal	New shell Legal	New shell All	Old shell Sublegal	Old shell Legal	Old shell All	All shell conditions Sublegal	All shell conditions Legal	All shell conditions All
0–4	N	3	8	11	0	1	1	3	9	12
	Mean	19.7	10.0	12.6	-	11	11	19.7	10.1	12.5
	S.D.	3.51	3.63	5.66	-	-	-	3.51	3.41	5.42
12–15	N	232	62	294	4	5	9	236	67	303
	Mean	14.6	13.9	14.5	12.5	13.2	12.9	14.6	13.9	14.4
	S.D.	2.71	3.43	2.88	2.38	2.39	2.26	2.71	3.35	2.87
24–27	N	148	42	190	0	2	2	148	44	192
	Mean	14.2	14.9	14.4	-	13.0	13.0	14.2	14.8	14.3
	S.D.	3.29	2.03	3.06	-	4.24	4.24	3.29	2.13	3.07
36–38	N	25	8	33	0	0	0	25	8	33
	Mean	15.4	15.8	15.5	-	-	-	15.4	15.8	15.5
	S.D.	3.13	1.98	2.87	-	-	-	3.13	1.98	2.87
12–38	N	405	112	517	4	7	11	409	119	528
	Mean	14.5	14.4	14.5	12.5	13.1	12.9	14.5	14.4	14.5
	S.D.	2.96	2.93	2.95	2.38	2.61	2.43	2.96	2.92	2.95

Table 25. Mean and standard deviation (S.D.) of estimated growth in carapace length (mm) from two molts for male golden king crabs tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered during the commercial fishery 12–15, 24–27, 36–38, and 12–38 months after release (from Watson et al. 2002).

Months after release		Status at Release		
		Sublegal	Legal	All
12–15	N	2	0	2
	Mean	25.0	-	25.0
	S.D.	1.41	-	1.41
24–27	N	34	0	34
	Mean	30.1	-	30.1
	S.D.	2.73	-	2.73
36–38	N	48	1	49
	Mean	31.3	36	31.4
	S.D.	3.39	-	3.42
12–38	N	84	1	85
	Mean	30.6	36	30.7
	S.D.	3.26	-	3.29

Table 26. Percent by shell condition and legal status at release of male golden king crabs tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered during the commercial fishery 0–4, 12–15, 24–27, and 36–38 months after release that were estimated to have not molted (% Not), to have molted once (% One), or to have molted twice (% Two) prior to recovery (from Watson et al. 2002).

		Shell condition at release								
Months After		New shell			Old shell			All shell conditions		
Release	Statistic	Sublegal	Legal	All	Sublegal	Legal	All	Sublegal	Legal	All
0–4	N	221	520	741	3	34	37	224	554	778
	% Not	98.6	98.5	98.5	100.0	97.1	97.3	98.7	98.4	98.5
	% One	1.4	1.5	1.5	0.0	2.9	2.7	1.3	1.6	1.5
	% Two	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12–15	N	283	184	467	4	6	10	287	190	477
	% Not	17.3	66.3	36.5	0.0	16.7	10.0	17.0	64.7	36.0
	% One	82.0	33.7	63.0	100.0	83.3	90.0	82.3	35.3	63.6
	% Two	0.7	0.0	0.4	0.0	0.0	0.0	0.7	0.0	0.4
24–27	N	187	49	236	0	2	2	187	51	238
	% Not	2.7	14.3	5.1	-	0.0	0.0	2.7	13.7	5.0
	% One	79.1	85.7	80.5	-	100.0	100.0	79.1	86.3	80.7
	% Two	18.2	0.0	14.4	-	0.0	0.0	18.2	0.0	14.3
36–38	N	74	9	83	0	0	0	74	9	83
	% Not	1.3	0.0	1.2	-	-	-	1.3	0.0	1.2
	% One	33.8	88.9	39.8	-	-	-	33.8	88.9	39.8
	% Two	64.9	11.1	59.0	-	-	-	64.9	11.1	59.0

Table 27. Percent by maturity at release of female golden king crabs tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered during the commercial golden king crab fishery 0–4, 12–15, 24–27, and 36–38 months after release that were estimated to have not molted or to have molted at least once prior to recovery (from Watson et al. 2002).

		Maturity Status at Release		
Months After release	Statistic	Immature	Mature	All
0–4	N	13	22	35
	% Not Molted	92.3	100.0	2.9
	% Molted	7.7	0.0	97.1
12–15	N	5	10	15
	% Not Molted	40.0	70.0	60.0
	% Molted	60.0	30.0	40.0
24–27	N	2	9	11
	% Not Molted	0.0	0.0	0.0
	% Molted	100.0	100.0	100.0
36–38	N	0	7	7
	% Not Molted	-	0.0	0.0
	% Molted	-	100.0	100.0

Table 28. Range, mean, and standard deviation (S.D.) of estimated growth in carapace length (mm) for female golden king crabs tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered during the commercial fishery 0–4, 12–15, 24–27, and 36–38 months after release, by maturity status at release and by maturity status at recovery (compiled from pages 178–182 *in* Watson et al. 2002).

Months After Release	Statistic	Released immature		Released mature
		Recovered immature	Recovered mature	Recovered mature
0–4	N	0	1	0
	Range	-	10	-
	Mean	-	10	-
	S.D.	-	-	-
12–15	N	2	1	4
	Range	8–9	11	2–10
	Mean	8.5	11	6.5
	S.D.	0.71	-	3.4
24–27	N	0	2	9
	Range	-	6–8	4–11
	Mean	-	7.0	5.8
	S.D.	-	1.4	2.2
36–38	N	0	0	7
	Range	-	-	3–15
	Mean	-	-	10.1
	S.D.	-	-	3.9

Table 29. Estimated parameters (A and B) for estimating weight (g) from carapace length (CL, mm) of male and ovigerous female Aleutian Islands golden king crabs according to the equation, Weight = $A*CL^B$ (from Table 3-5, NPFMC 2007b).

Parameter	Males	Ovigerous females
A	0.0002988	0.001424
B	3.135	2.781

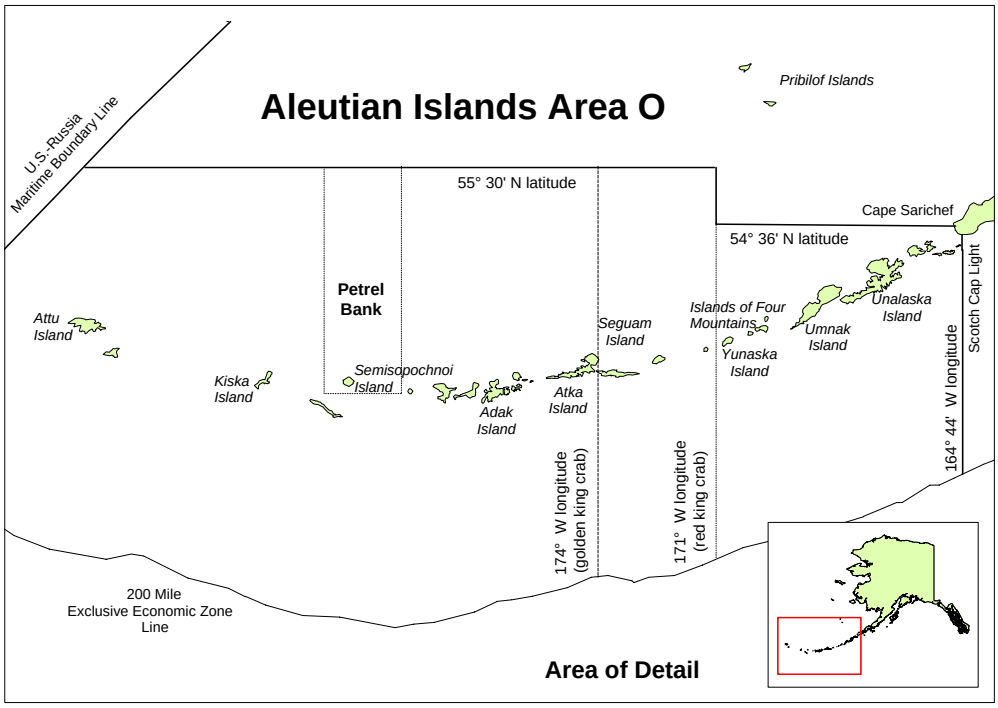


Figure 1. Aleutian Islands, Area O, red and golden king crab management area (from Bowers et al. 2008).

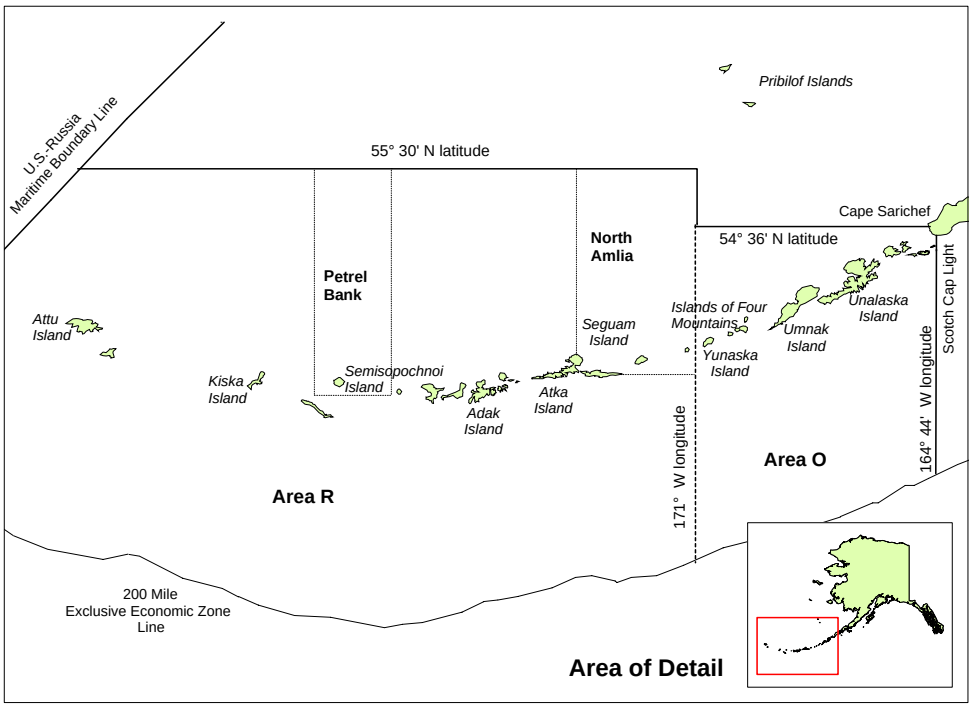


Figure 2. Adak (Area R) and Dutch Harbor (Area O) king crab Registration Areas and Districts, 1984/85 – 1995/96 seasons (Bowers et al. 2008).

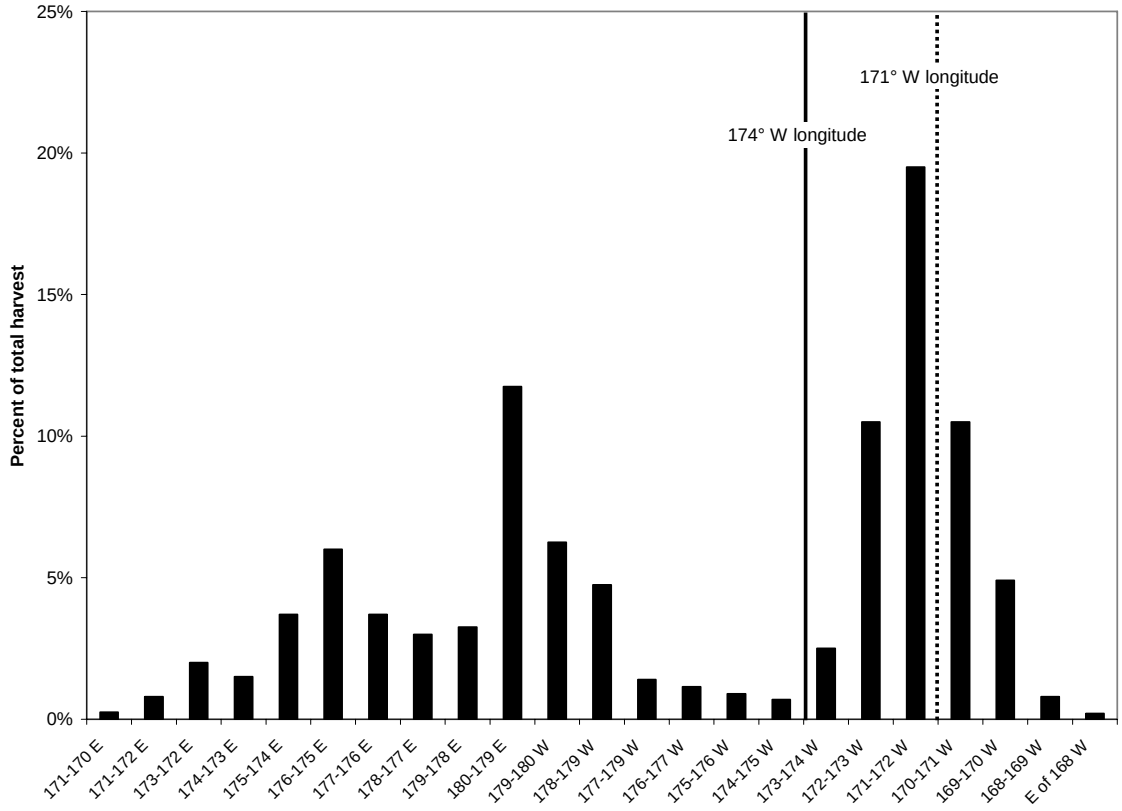


Figure 3. Percent of total 1982–1996 golden king crab harvest by one-degree longitude intervals in the Aleutian Islands, with dotted line denoting the border at 171° W longitude that was used until the end of the 1995/96 season to divide fishery management between the Dutch Harbor Area (east of 171° W longitude) and the Adak Area (west of 171° W longitude) and solid line denoting the border at 174° W longitude that has been used since the 1996/97 to manage Aleutian Island golden king crabs as separate stocks east and west of 174° W longitude (from Figure 4-2 *in* Morrison et al. 1998).

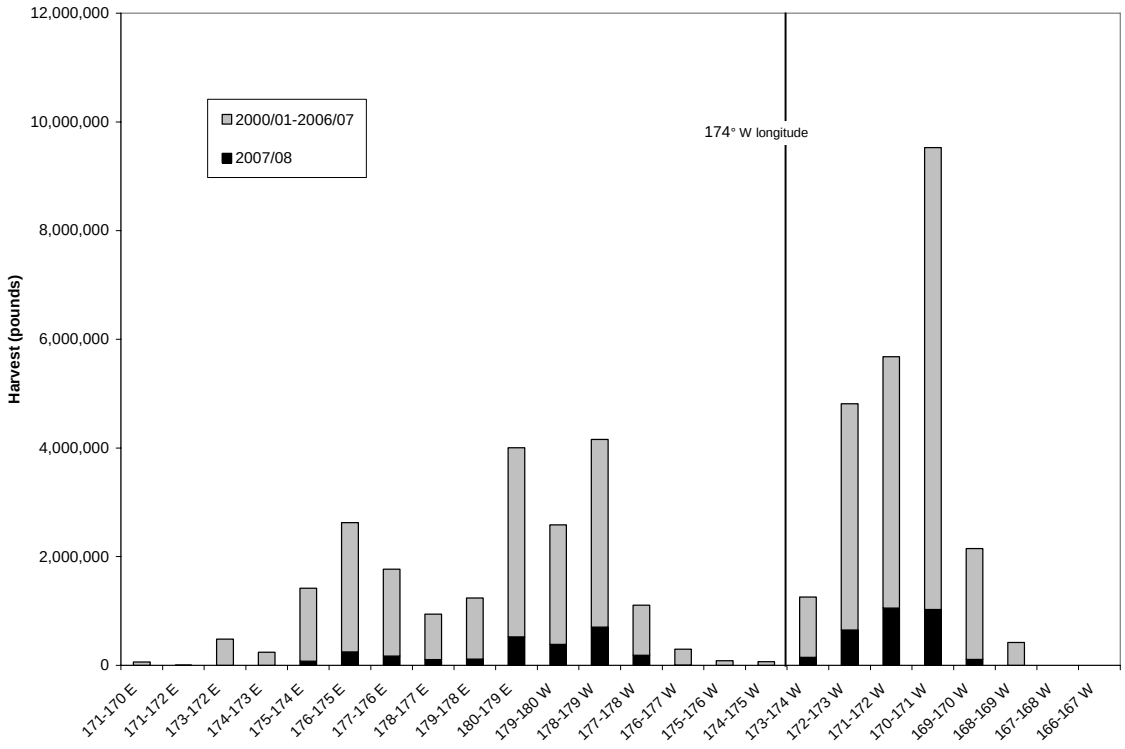


Figure 4. Harvest (pounds) of golden king crabs by one-degree longitude intervals in the Aleutian Islands during the 2000/01 through 2007/08 commercial fishery seasons, with the harvest for the 2007/08 season distinguished from the total harvest for the 2000/01–2006/07 seasons; solid line denotes the border at 174° W longitude that has been used since the 1996/97 season to manage Aleutian Island golden king crabs as separate stocks east and west of 174° W longitude (2000/01–2006/07 data from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

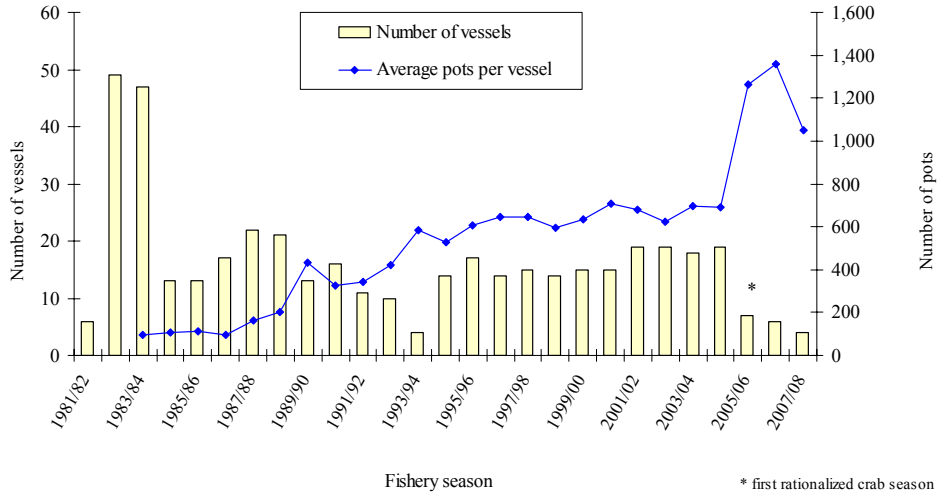


Figure 5. Aleutian Islands golden king crab fishery vessel registrations and average number of pots per vessel for the area east of 174° W longitude for the 1996/97–2007/08 seasons, east of 171° W longitude for the 1984/85–1995/96 seasons, and east of 172° W longitude for the 1981/82–193/84 seasons (includes the Community Development Quota fishery for the 2005/06–2007/08 seasons; from Figure 1-6 *in* Bowers et al. 2008).

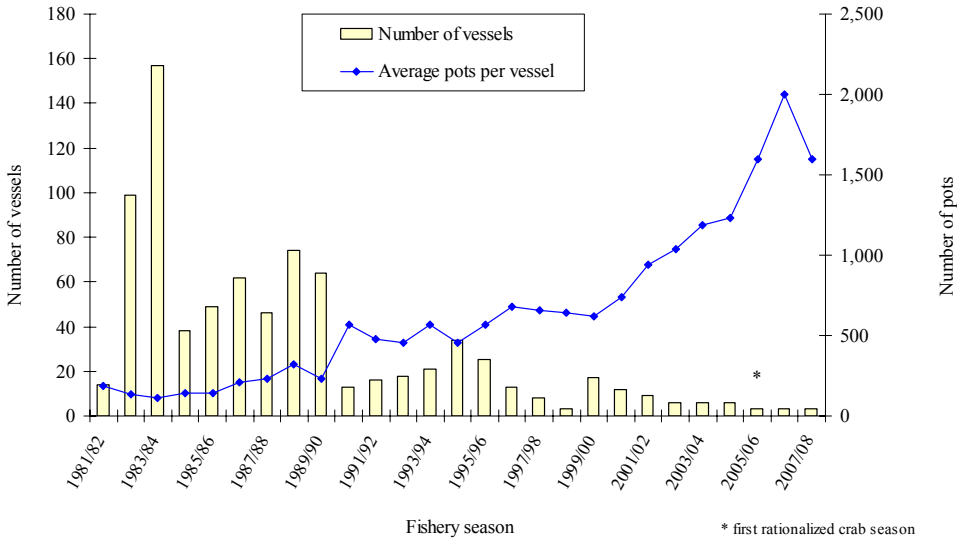


Figure 6. Aleutian Islands golden king crab fishery vessel registrations and average number of pots per vessel for the area west of 174° W longitude for the 1996/97–2007/08 seasons, west of 171° W longitude for the 1984/85–1995/96 seasons, and west of 172° W longitude for the 1981/82–193/84 seasons (includes the Adak Community Allocation fishery for the 2005/06–2007/08 seasons; from Figure 1-7 *in* Bowers et al. 2008).

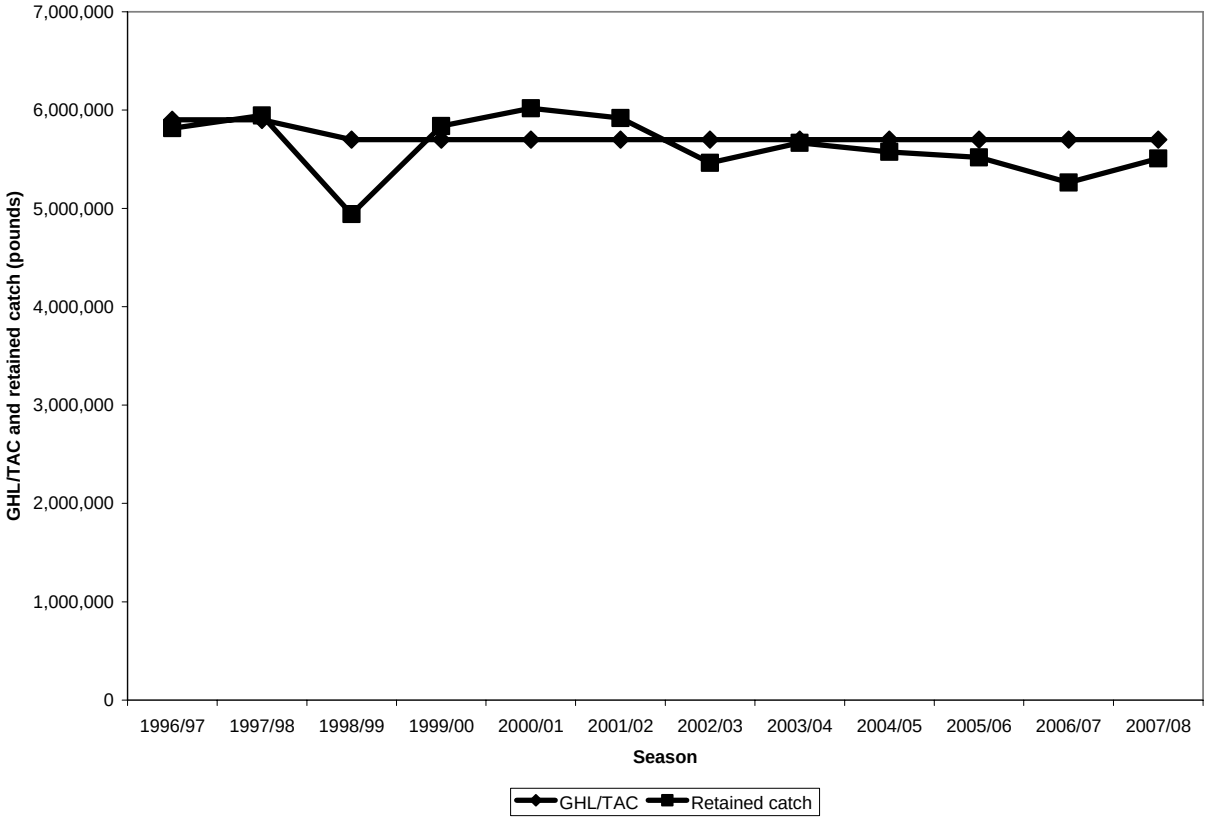
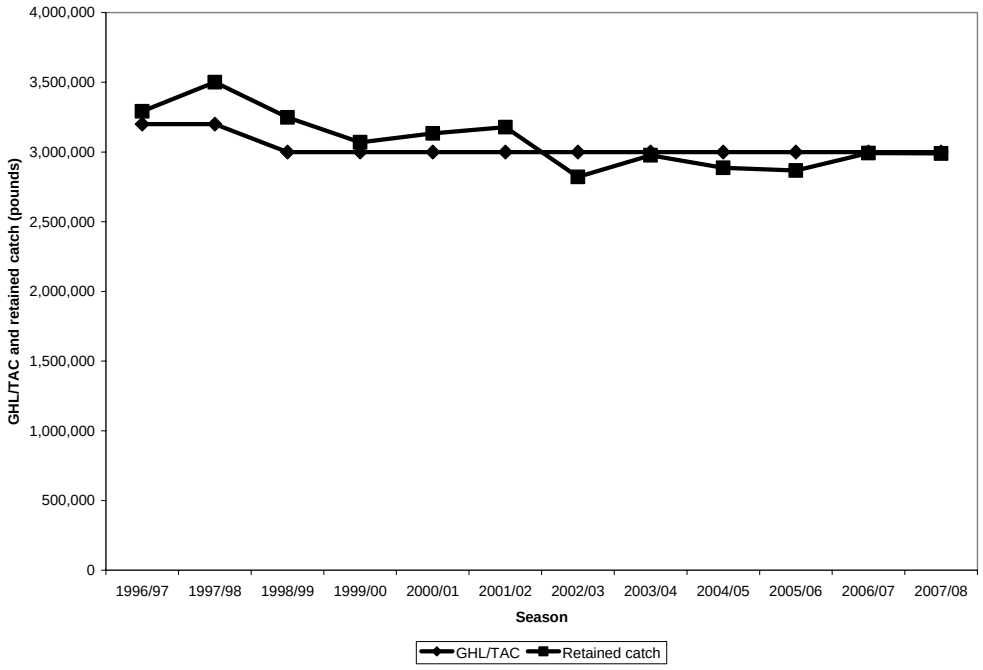
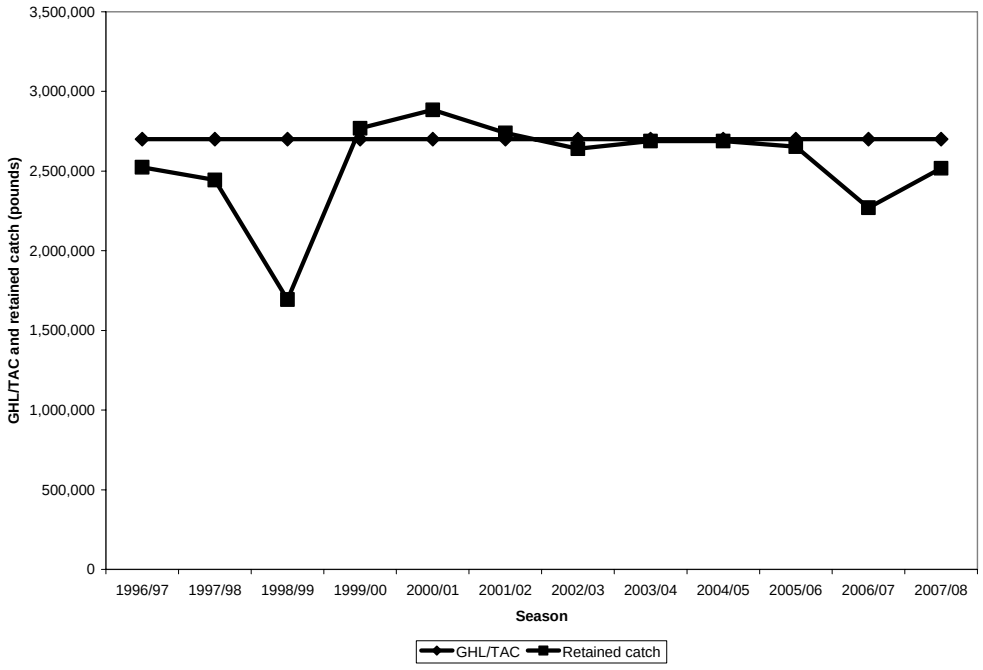


Figure 7. Pre-season GHL (in pounds for the 1996/97–2004/05 seasons) and TAC (in pounds for the 2005/06–2007/08 seasons) compared to the retained catch (pounds) during the 1996/97–2007/08 Aleutian Islands golden king crab fishery (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).



East of 174° W



West of 174° W

Figure 8. Pre-season GHL (in pounds for the 1996/97–2004/05 seasons) and TAC (in pounds for the 2005/06–2007/08 seasons) compared to the retained catch (pounds) during the 1996/97–2007/08 Aleutian Islands golden king crab fishery in the area east of 174° W longitude (top panel) and in the area west of 174° W longitude (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

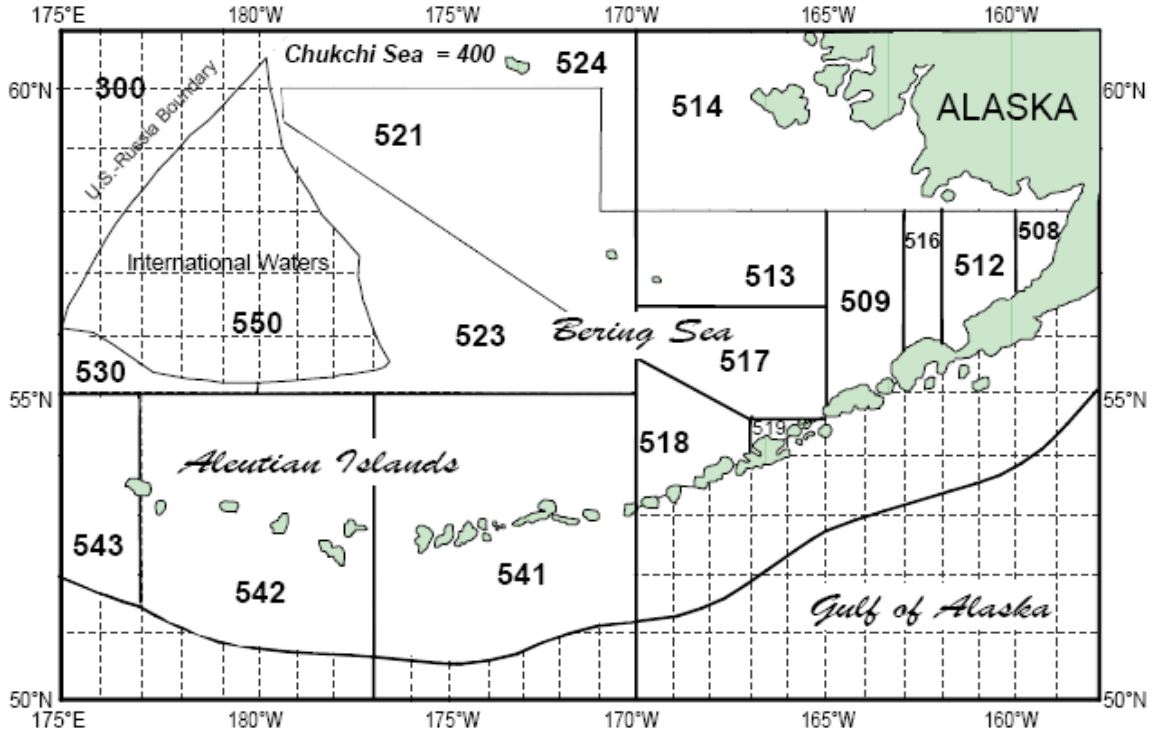


Figure 9. Map of federal groundfish fishery reporting areas for the Bering Sea and Aleutian Islands showing reporting areas 541, 542, and 543 that are used to obtain data on bycatch of Aleutian Islands golden king crabs during groundfish fisheries (from http://www.fakr.noaa.gov/rr/figures/fig1.pdf).

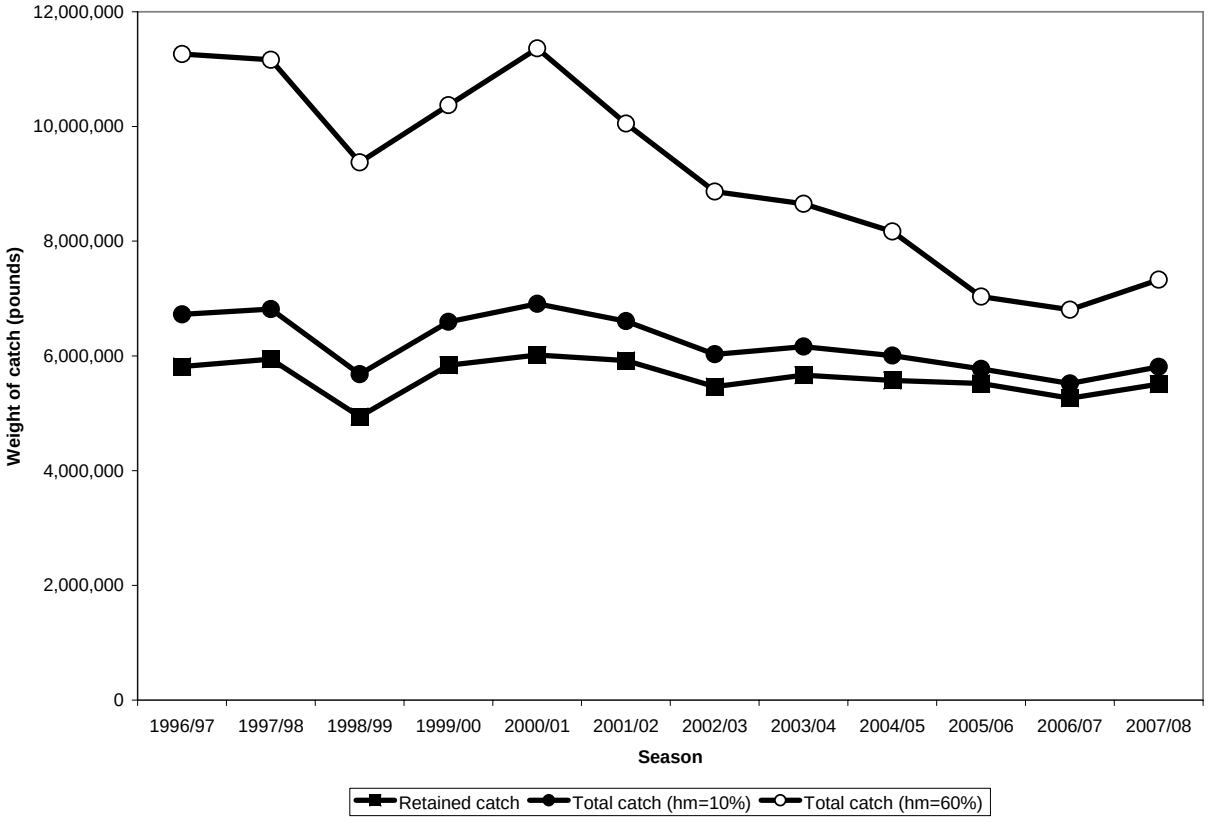


Figure 10. Annual retained catch (pounds) for the 1996/97–2007/08 Aleutian Islands golden king crab fishery compared to total catch (retained catch plus handling mortality of discarded bycatch, pounds) of Aleutian Islands golden king crabs during crab fisheries estimated by assuming handling mortality (*hm*) rates of *hm*=10% and *hm*=60% (from Pengilly 2008; estimates for 2007/08 by D. Pengilly, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009; see Table 4).

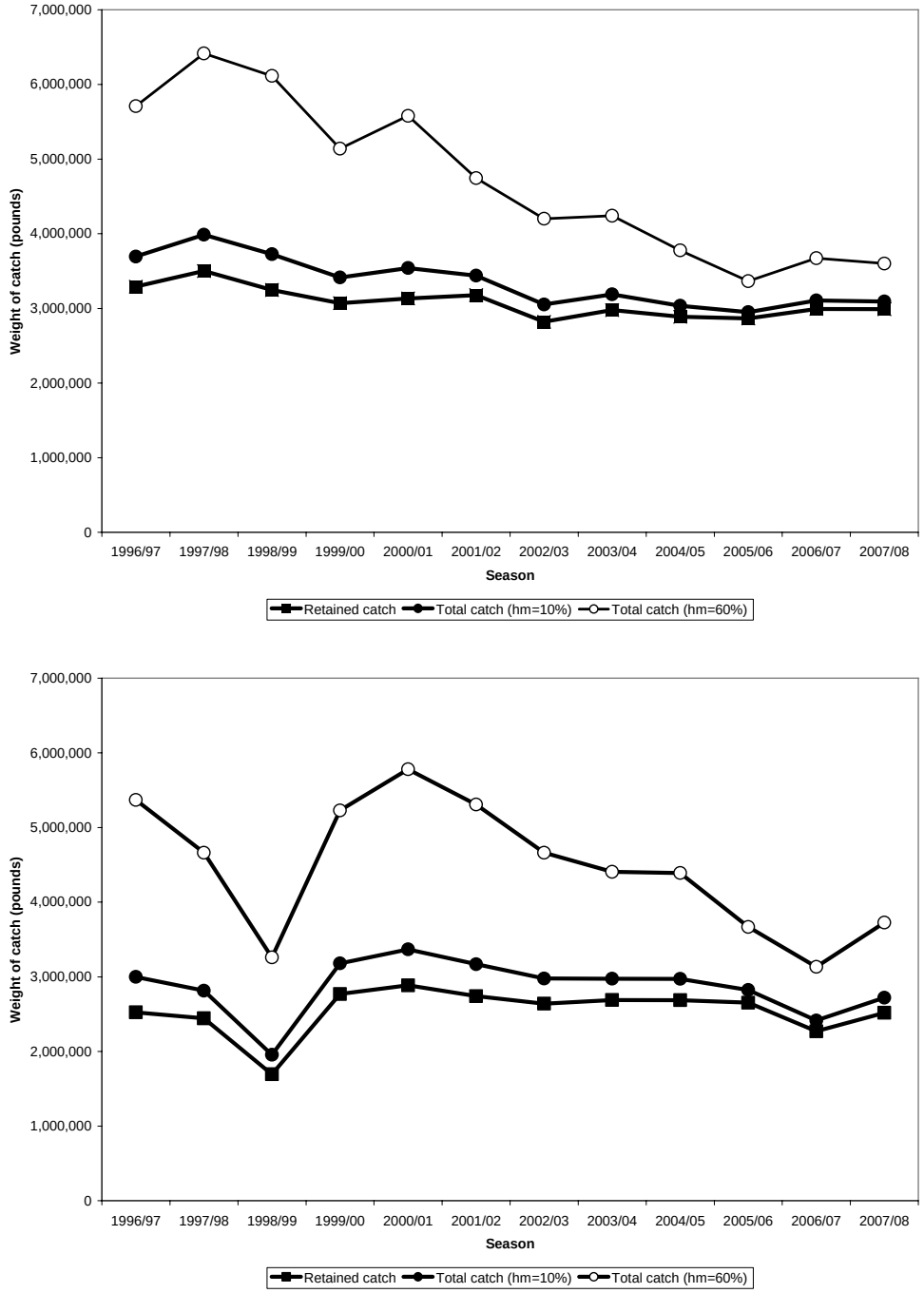


Figure 11. Annual retained catch (pounds) for the 1996/97–2007/08 Aleutian Islands golden king crab fishery in the area east of 174° W longitude (top panel) and in the area west of 174° W longitude (bottom panel) compared to total catch (retained catch plus handling mortality of discarded bycatch, pounds) during the golden king crab fishery estimated by assuming handling mortality (*hm*) rates of *hm*=10% and *hm*=60% (from Pengilly 2008; estimates for 2007/08 by D. Pengilly, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009; see Tables 5 and 6).

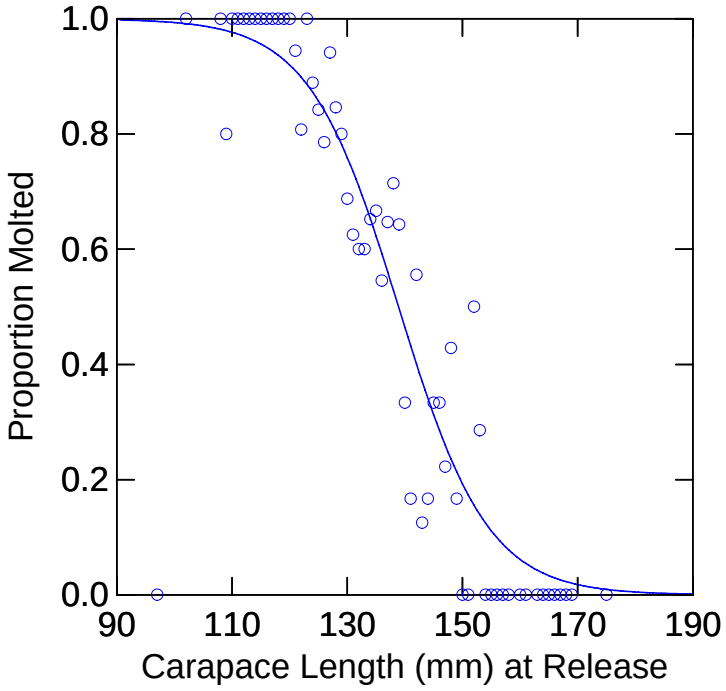


Figure 12. Proportion molting prior to recovery as related to carapace length at release of 487 new-shell male golden king crab tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered 12-15 months later during the 1998/99 commercial golden king crab fishery, with curve showing a logistic regression fit to the data (from Watson et al. 2002).

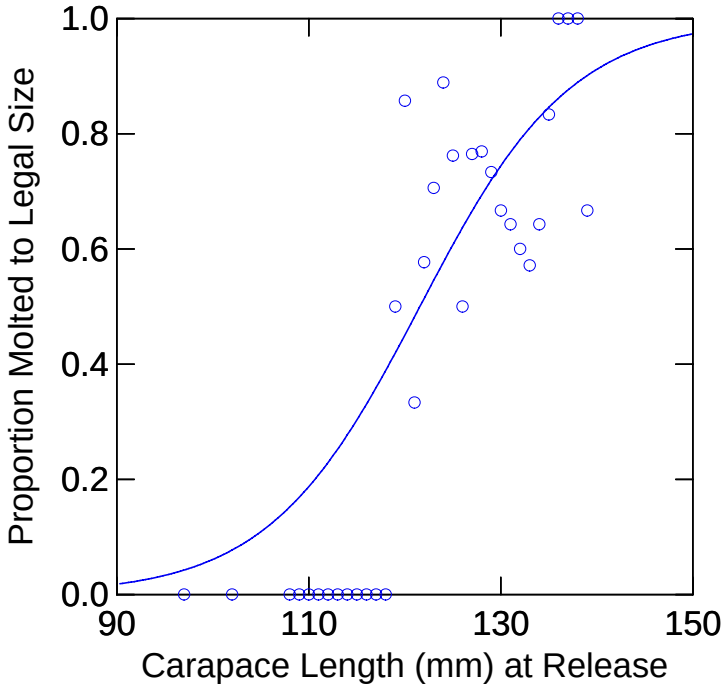


Figure 13. Proportion by carapace length at release of 281 male golden king crabs tagged and released as sublegal new-shell males in Yunaska Island area of Aleutian Islands, Alaska, July-August 1997, that molted to legal size prior to their recovery 12-15 months later during the commercial golden king crab fishery, with curve showing a logistic regression fit to the data (from Watson et al. 2002).

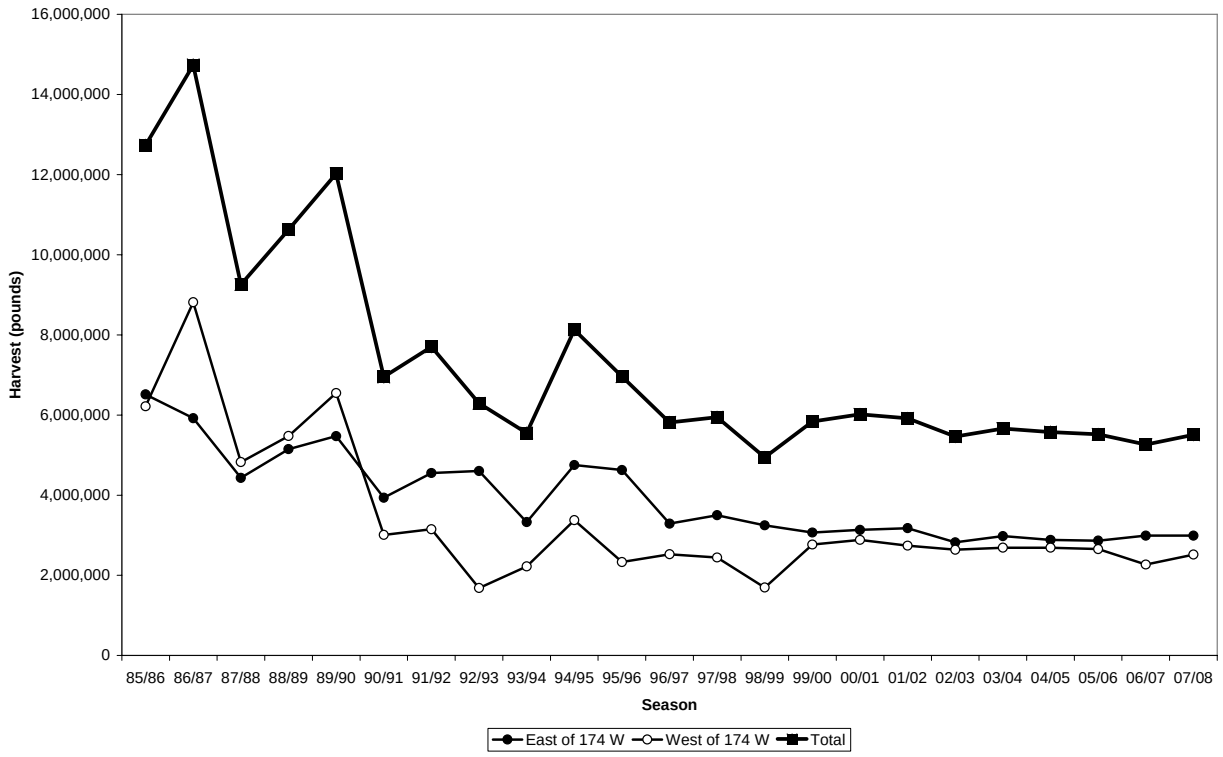


Figure 14. Retained catch (harvest in pounds) in the Aleutian Islands golden king crab fishery, 1985/86–2007/08 seasons for the entire Aleutian Islands Area and for each of the areas east and west of 174° W longitude (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

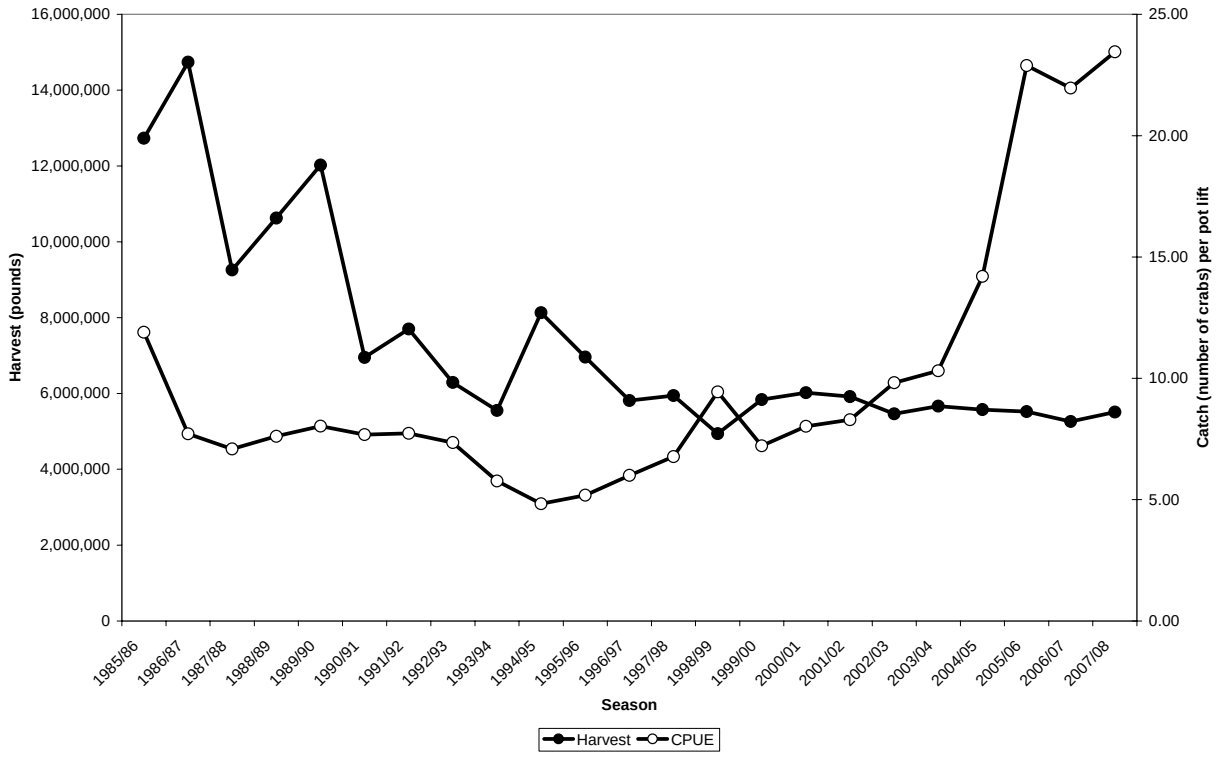


Figure 15. Retained catch (harvest in pounds) and catch (number of retained legal crabs) per pot lift (CPUE) in the Aleutian Islands golden king crab fishery, 1985/86–2007/08 seasons (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

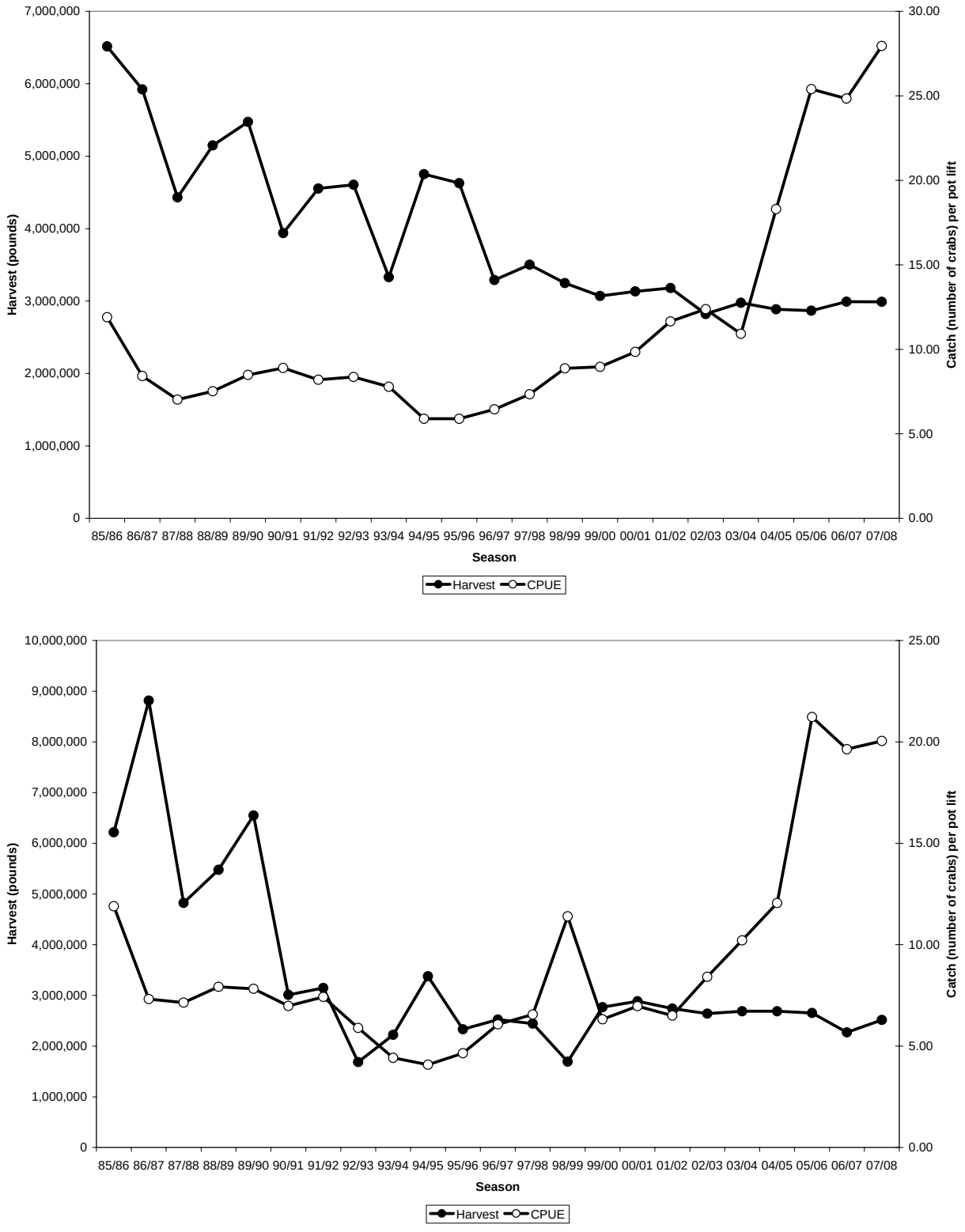


Figure 16. Retained catch (harvest in pounds) and catch (number of retained legal crabs) per pot lift (CPUE) in the Aleutian Islands golden king crab fishery, 1985/86–2007/08 seasons, for the area east of 174° W longitude (top panel) and the area west of 174° W longitude (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

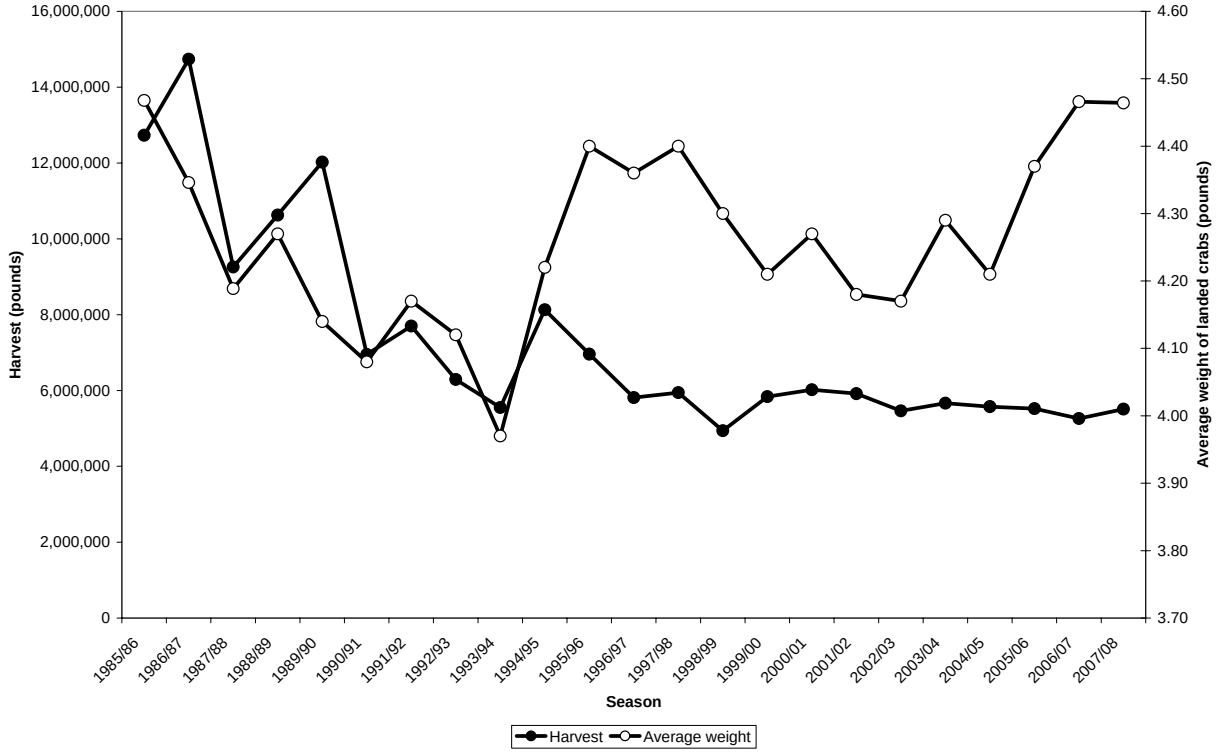


Figure 17. Retained catch (harvest in pounds) and average weight (pounds) of landed crabs in the Aleutian Islands golden king crab fishery, 1985/86–2007/08 seasons (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

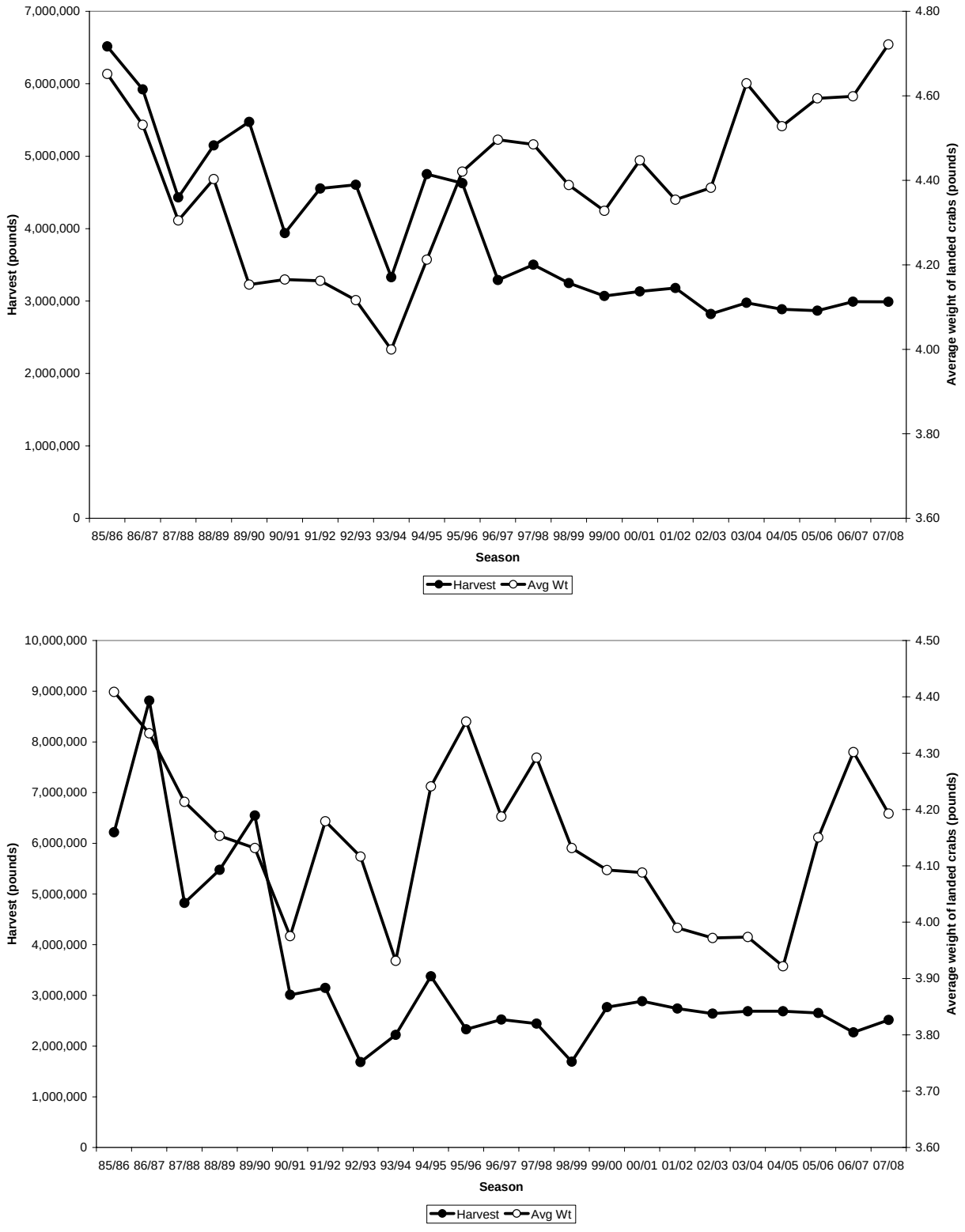


Figure 18. Retained catch (harvest in pounds) and average weight (pounds) of landed crabs in the Aleutian Islands golden king crab fishery, 1985/86–2007/8 seasons, for the area east of 174° W longitude (top panel) and the area west of 174° W longitude (from Pengilly 2008; 2007/08 data from F. Bowers, ADF&G, 24 March 2009).

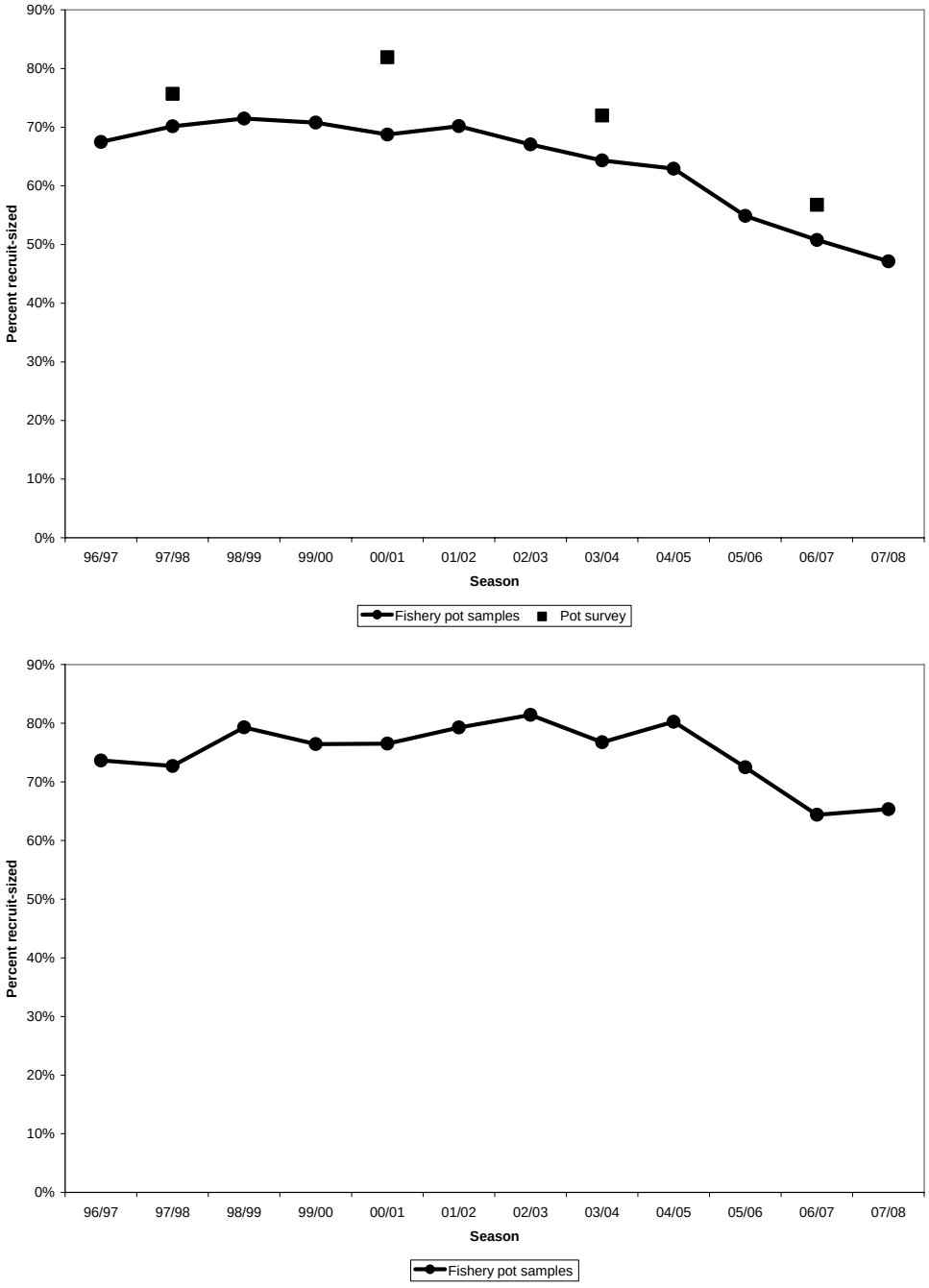
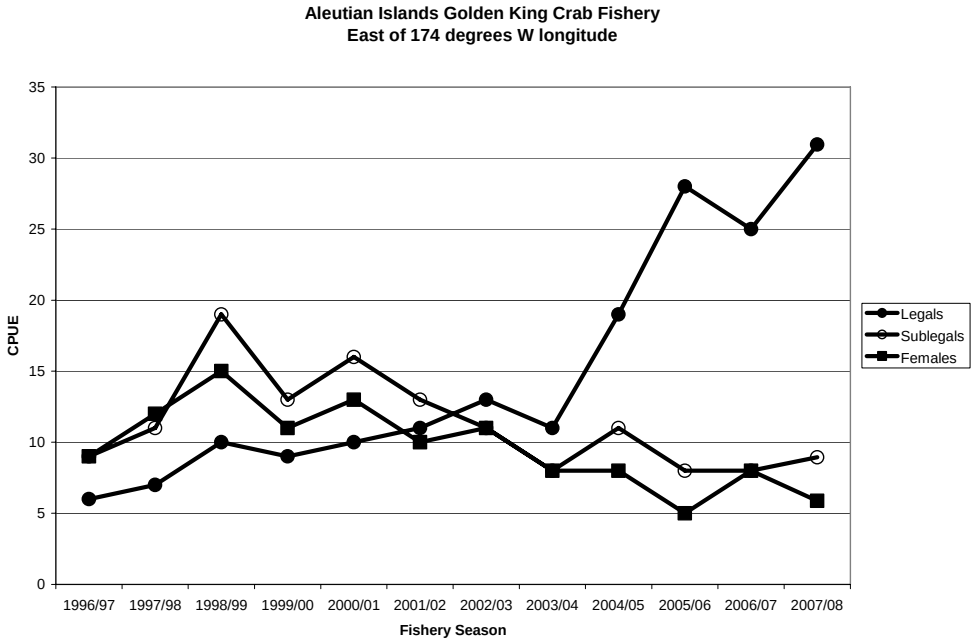


Figure 19. Percent of legal males that were recruit-sized (<151 mm CL) in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery east of 174º W longitude, 1996/97–2007/08, and in pots fished during the triennial ADF&G Aleutian Islands golden king crab pot survey, 1997–2006 (top panel) and in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery west of 174º W longitude, 1996/97–2007/08 (bottom panel; from Pengilly 2008; 2007/08 data from the ADF&G Crab Observer Database, 23 March 2009).



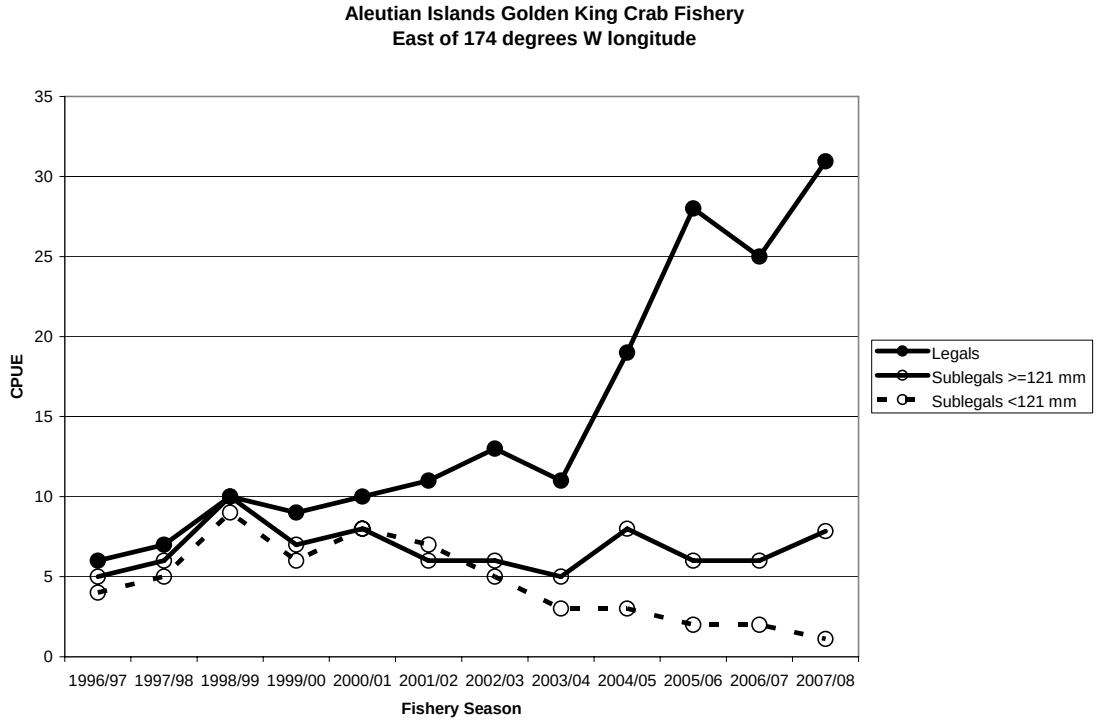
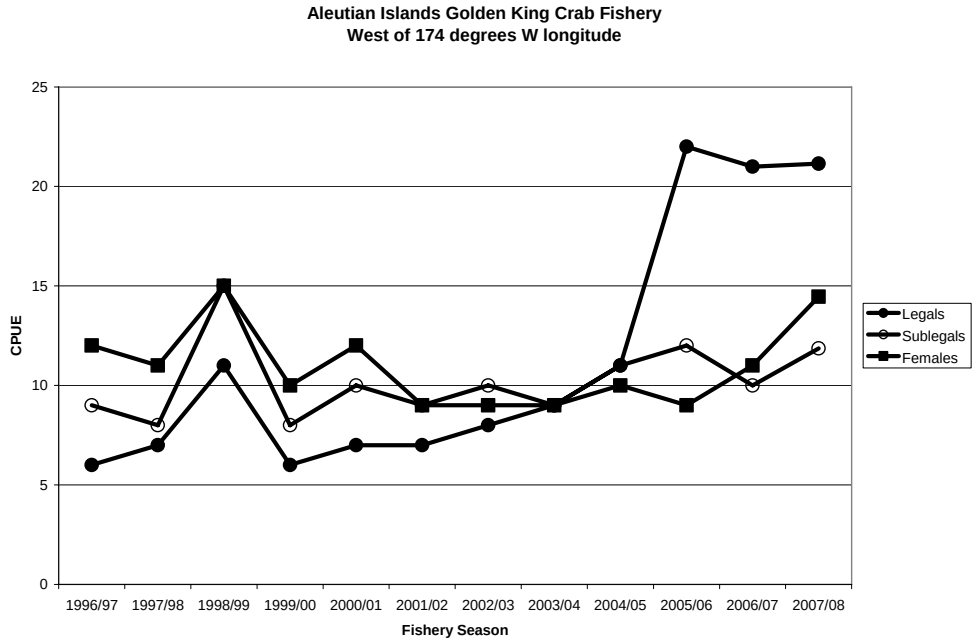


Figure 20. Catch per unit effort of legal males, sublegal males, and females (top panel) and of legal males, sublegal males ≥121 mm CL, and sublegal males <121 mm CL (bottom panel) in the Aleutian Islands golden king crab fishery east of 174º W longitude, 1996/97–2007/08 seasons, as estimated from contents of pots randomly sampled by observers (from Pengilly 2008; estimates for 2007/08 by D. Pengilly, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009).



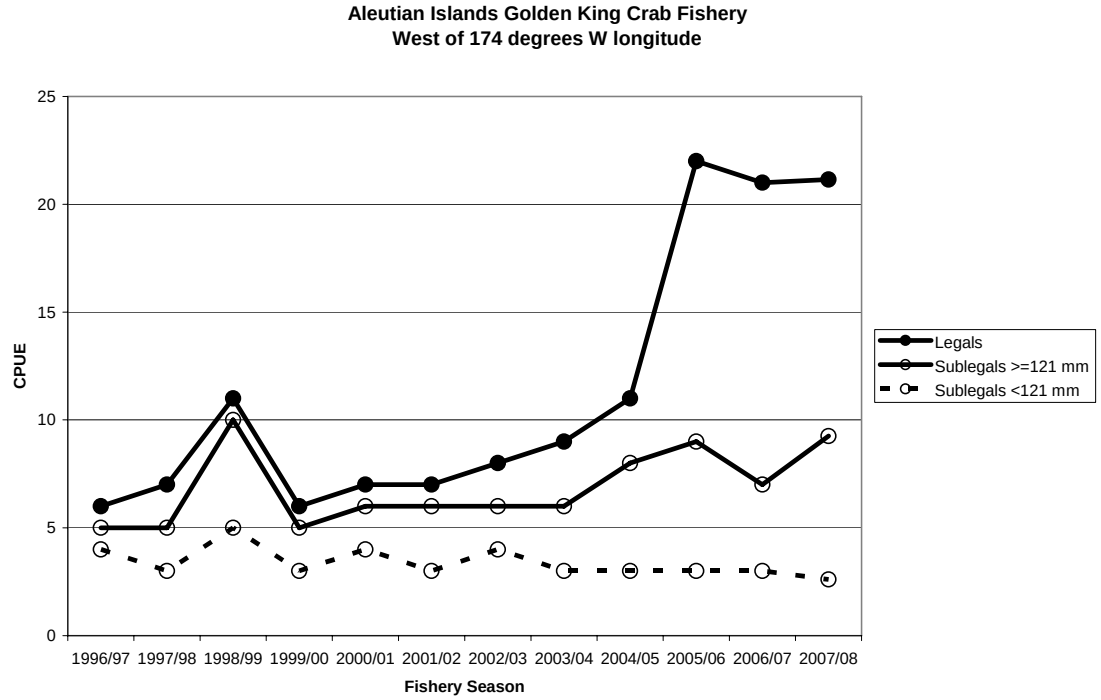


Figure 21. Catch per unit effort of legal males, sublegal males and females (top panel) and of legal males, sublegal males ≥121 mm CL, and sublegal males <121 mm CL (bottom panel) in the Aleutian Islands golden king crab fishery west of 174º W longitude, 1996/97–2007/08 seasons, as estimated from contents of pots randomly sampled by observers (from Pengilly 2008; estimates for 2007/08 by D. Pengilly, using data from the ADF&G Crab Observer Database, 23 March and 1 April 2009).

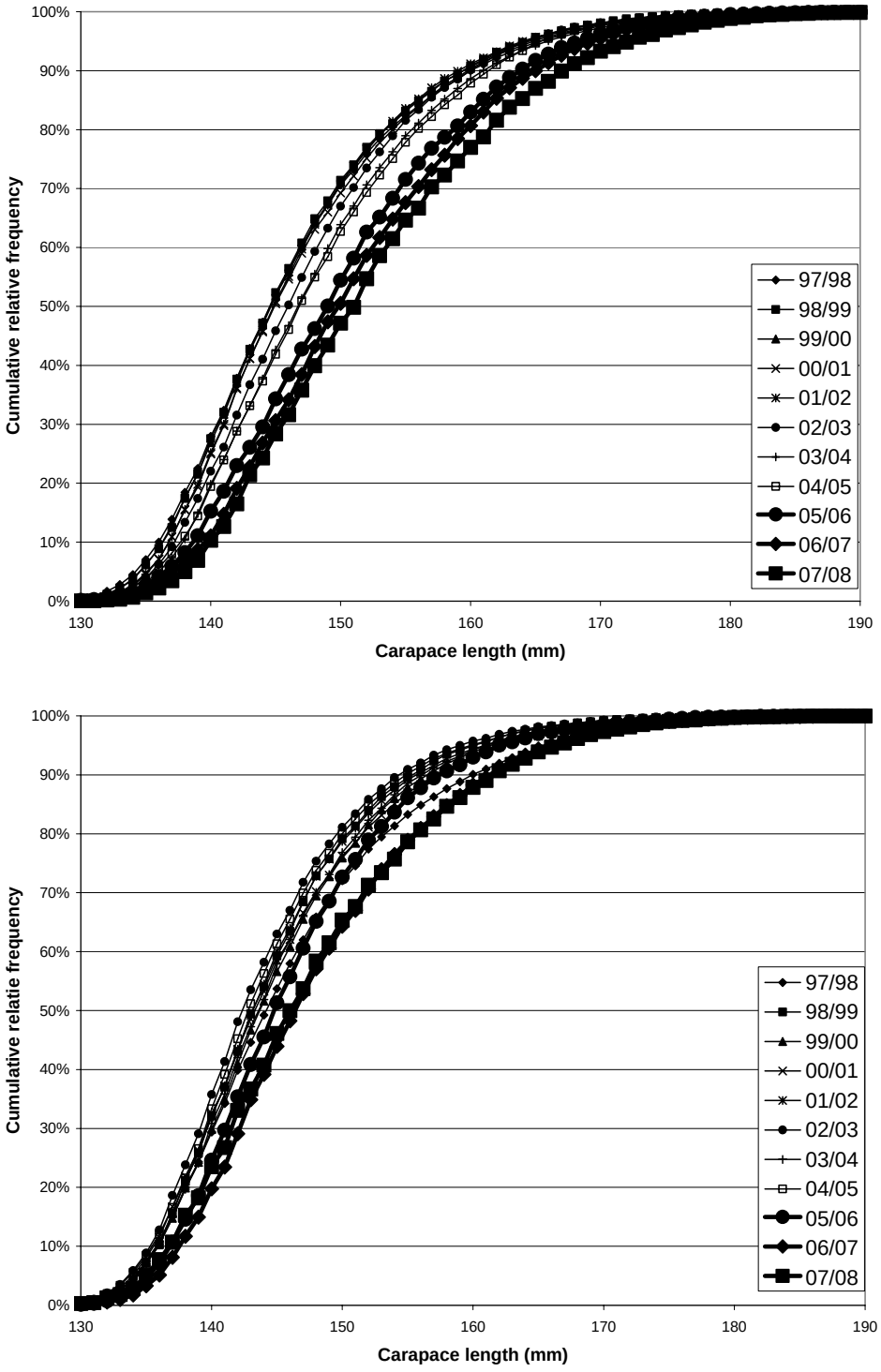


Figure 22. Cumulative relative size frequency distribution of legal male golden king crabs in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery east of 174º W longitude, 1997/98–2007/08 (top panel) and in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery west of 174º W longitude, 1997/98–2007/08 (data from the ADF&G Crab Observer Database, 23 March 2009).

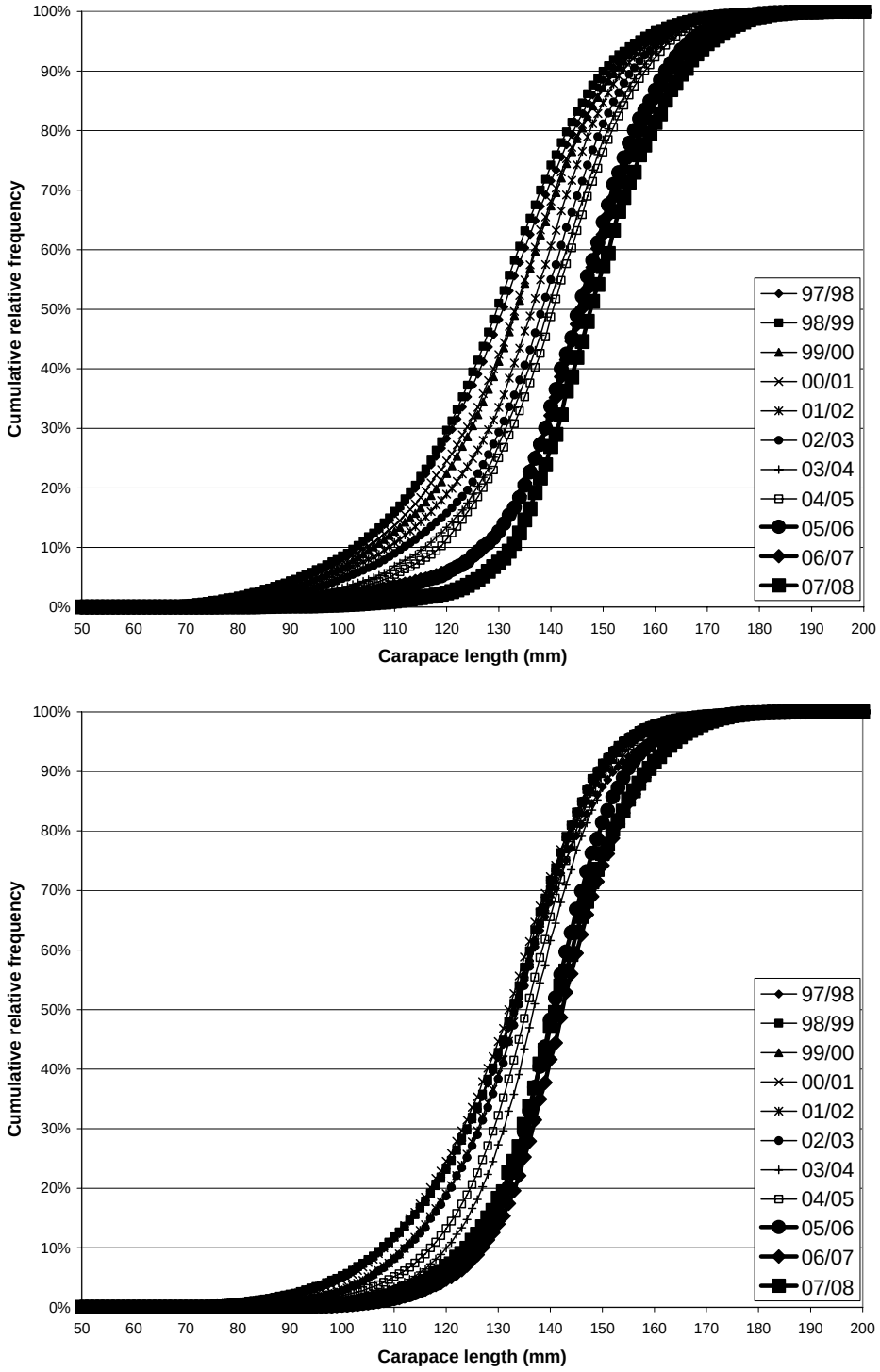


Figure 23. Cumulative relative size frequency distribution of male golden king crabs in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery east of 174º W longitude, 1997/98–2007/08 (top panel) and in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery west of 174º W longitude, 1997/98–2007/08 (data from the ADF&G Crab Observer Database, 23 March 2009).

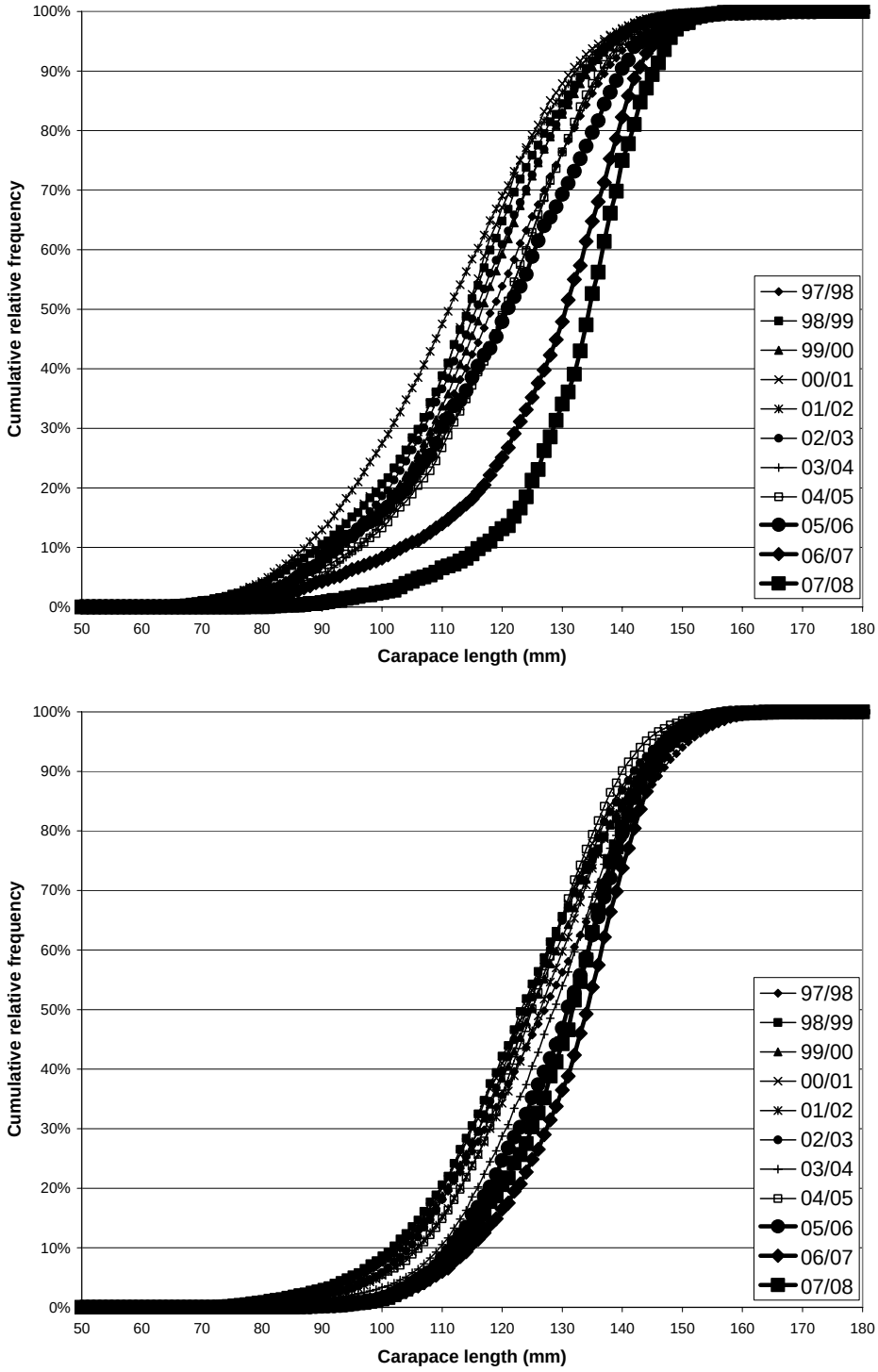


Figure 24. Cumulative relative size frequency distribution of female golden king crabs in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery east of 174º W longitude, 1997/98–2007/08 (top panel) and in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery west of 174º W longitude, 1997/98–2007/08 (data from the ADF&G Crab Observer Database, 23 March 2009).