# Aleutian Islands Golden King Crab

# Crab SAFE Report Chapter

Douglas Pengilly, ADF&G, Kodiak

## 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 catch = 11,875,811 pounds), but average harvests dropped sharply from the 1989/90 to 1990/91 season and average harvests for the period 1990/91–1995/96 was 6,930,627 pounds. Management towards a formally established 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, and the GHL (or TAC, since the 2005/06 season) has remained at 5.7 million pounds through the ongoing 2007/08 season. Average retained catch for the period 1996/97–2006/07 was 5,633,236 pounds. Retained catch in the last completed season, 2006/07 was 5,262,342 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; CPUE increased markedly in the 2005/06 with the advent of the Crab Rationalization program. Non-retained catch of sublegal and female golden king crabs during the fishery as decreased relative to the retained catch and in absolute numbers since the mid-1990's.

Data and assessment: There is no assessment model in use for this stock. Available data are from fish tickets (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date), size-frequency data from samples of landed crabs, at-sea observer data from pot lifts sampled during the fishery (date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc), data from a triennial pot survey in the Yunaska-Amukta Island area of the Aleutian Islands (approximately 171° W longitude), and recovery data from tagged crabs released during the triennial pot surveys. These data are available through the 2006/07 season and the 2006 triennial pot survey.

Unresolved problems and major uncertainties: Most of the available data are obtained from the fishery which targets legal-size (≥6" carapace width) males and trends in the data can be affected by changes in fishery practices as well as changes in the stock. The triennial survey is too limited in geographic scope and too infrequent to provide a reliable index of abundance for the Aleutian Islands Area.

Reference points: This stock is recommended for Tier 5 stock due to the lack of biomass estimates. 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.

Recruitment: Estimates of recruitment trends and current levels relative to virgin or historic levels are not available. However, there is good evidence that the sharp increase in CPUE of retained legal males during recent fishery seasons was not due to a sharp increase in recruitment of legal-size males.

Exploitation status: Estimates of fishing mortality are not available.

Management performance: The fishery was managed with a GHL/TAC of 5.9-million pounds during 1996/97–1997/98 and 5.7-million pounds during 1998/99–2006/07. Over the period 1996/97–2005/06 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 (the 1998/99 season) and as much as 6% above the GHL/TAC (the 2000/01 season). Estimated weight of discarded bycatch (sublegal and female golden king crabs)

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). Estimated weight of discarded bycatch was reduced to 2,523,737 pounds in the 2005/06 and 2,573,040 pounds in 2006/07 season, representing <50% of the retained catch in each of those two seasons.

Forecasts: No forecasts of catch and biomass are available.

Decision table: Not available.

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

### *Summary of Major Changes*

Changes (if any) in the input data — N/A (= "not applicable" or "not available" or both)

Changes (if any) in the assessment methodology — N/A

Changes (if any) in the assessment results, including projected biomass, TAC, total catch (including discard mortality and retained catch), and FOFL (the full selection fishing mortality rate (F) that results in overfishing) — N/A

### *Responses to SSC Comments*

Responses to SSC comments specific to this assessment (for each comment that is addressed in the main text, list comment and give name of section where it is discussed; if the SSC did not make any comments specific to this assessment, say so) — N/A

Responses to SSC comments on assessments in general (for each comment that is addressed in the main text, list comment and give name of section where it is discussed; if the SSC did not make any comments on assessments in general, say so) — N/A

## 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 (page 3-34).
>
> 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 (page 3-43).

Commercial fishing for golden king crabs in the Aleutian Islands Area typically occurs at depths of 100–300 fathoms (183–549 m; Table 1); average depth of pots fished in the Aleutian Islands Area during the 2005/06 season was 183 fathoms (335 m) for the area east of 174° W longitude and 177 fathoms (324 m) for the area east of 174° W longitude (Barnard and Burt 2007).

Description of management unit(s) (be sure to include any spatial and/or seasonal management measures):

From Failor-Rounds (2008, page 4; 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 longitude), its northern boundary a line from Cape Sarichef (54° 36' N latitude) to 171° W longitude, north to 55° 30' N latitude, 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 (Figure 1). 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).

Formerly, the Aleutian Islands king crab populations had been managed using the Adak and Dutch Harbor Registration Areas, which had been divided at 171° W longitude since the 1984/85 season (Figure 2), but from the 1996/97 season to present the fishery has been managed using a division at 174° W longitude (Figure 1; Failor-Rounds 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 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, if any

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 1996 seasons 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 the 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 (e.g., special features of reproductive biology)

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.
>
> Female lithodids molt before copulation and egg extrusion (Nyblade 1987). From their observations on embryo development in golden king crabs, Otto and Cummiskey's (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).

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 my 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).

The following is historical review of the Aleutian Islands golden king crab fishery is from Failor-Rounds (2008, pages 9–13):

> The golden king crab 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 other commercially exploited king crabs are typically found (Blau et al. 1996). 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 (ADF&G 1984). From the 1981/82 season until the 1996/97 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 49 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. No stock assessment of the golden king crab population was performed in the Adak Area, and initially the fishery was managed based on size, sex, and season restrictions. Catches were monitored inseason (ADF&G 1999a) and after the initial fishery, harvest levels were set based on harvest expectations generated from catch in prior seasons (ADF&G 1983). 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 4.2 pounds and CPUE declined from 10 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 an expected decrease in average weight of legal crabs harvested after 1985/86 and 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 (ADF&G 1984). 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 4.1 pounds during the 1992/93 season. In 1984, the BOF adopted an ADF&G staff 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 have affected 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 1.5 million pounds annually (ADF&G 1999a).

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 2.6 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 pull 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, eight 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 seven legal crabs per pot lift with landed crabs averaging 4.3 pounds each. 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 (NPFMC 1998).

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 12 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 4.5-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 just under $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 an average of 11 to 12 crab 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 has averaged seven 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. 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. 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.

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 Failor-Rounds (2002, page 14):

> 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 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 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 summary of the 2006/07 Aleutian Islands golden fishery season is from Failor-Rounds (2008, pages 9–13):

The 2006/07 Aleutian Islands golden king crab fishery opened by regulation at 12:00 NOON August 15 with a TAC of 5.7 million pounds (5.13 million pounds IFQ, 0.57 million pounds CDQ); 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 second season under rationalization regulations, including the CDQ fishery for golden king crab, and the ACA fishery. Seven vessels participated in the IFQ fishery and landed 4.69 million pounds. The fleet averaged 23 legal crabs per pot lift, the same as the prior season, and landed crabs averaged 4.5 pounds each which is slightly higher than the 2005/06 season.

*East of 174° W long.*

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 six vessels participated in the Aleutian Islands golden king crab commercial fishery east of 174° W long. The fleet registered 8,150 pots, or 1,358 pots per vessel, only 92% of the overall pots registered during the 2005/06 fishery and on average 7% more pots registered per vessel as compared to the 2005/06 fishery. Weekly harvest peaked mid-September. 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 up to 36 legal crabs per pot lift, compared to 29 crabs per pot lift in this area the previous season. The average catch rate for the entire eastern portion was 24 crabs per pot lift, down slightly from 25 crabs per pot lift the previous season. The average weight of legal crabs was 4.6 pounds, the same as the 2005/06 season, with the largest crabs encountered around Seguam Island.

The IFQ fleet harvested 2.69 million pounds of golden king crabs during the season. Four shore-based processors in Dutch Harbor, one shore-based processor in Akutan, and one catcher-processor processed golden king crabs from the eastern Aleutian Islands. Exvessel price paid for live, whole crabs averaged $1.77 per pound, leading to a fishery value of $4.71 million, a decrease of $1.77 million from the 2005/06 fishery.

*West of 174° W long.*

A total of three vessels participated in the IFQ fishery west of 174° W long. The fleet registered 6,000 pots, an average of 2,000 pots per vessel, 25% more pots overall than were registered in the 2005/06 season, and 25% more pots per vessel than the 2005/06 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 ten to 54 crabs per pot lift and averaged 20, down from 21 crabs per pot lift the previous season. The average weight of legal crab was 4.3 pounds, an increase from the 2005/06 season average weight of 4.2 pounds.

The fleet harvested 2.00 million pounds of golden king crab. Golden king crabs were purchased and processed by one catcher-processor, one floating processor and by three shore-based processors, one in Adak and two in Dutch Harbor. Exvessel price averaged $1.33 per pound for live, whole crabs, yielding a total fishery value of $2.64 million, well below the previous 5-years' average fishery value of $8.03 million.

Although the TACs set for the Aleutian Islands golden king crab fishery for the areas east and west of 174° W longitude 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 fleet size has decreased, though average pots deployed per vessel has increased substantially. Only 8 vessels participated in the 2005/06 season and only 7 vessels participated in the 2006/07 season, whereas 15–22 vessels participated annually during the 1996/97–2004/05 seasons (Failor-Rounds 2008). In the eastern Aleutian Islands, the average number of pots deployed per vessel during rationalized golden king crab fisheries has nearly doubled compared to the number of pots utilized per vessel pre-rationalization (ADF&G 2008, Table 2). Average pot soak time for both the eastern Aleutian Islands and western Aleutian Islands golden king crab fisheries has increased considerably from the pre-rationalization level (through 2004/05) to the first rationalized 2005/06 fishery, and then lowered slightly during the second rationalized season in 2006/07 (ADF&G 2008, Table 3).

The 2007/08 Aleutian Islands golden king crab fishery opened on 15 August 2007 with a TAC of 3.0-million pounds for the area east of 174° W longitude (2.7-million pounds allocated to IFQ holders and 0.3-million pounds allocated to the CDQ fishery) and a TAC of 2.7-million pounds of the area west of 174° W longitude (2.43-million pounds allocated to IFQ holders and 0.27-million pounds allocated to the ACA fishery). As of April 8, 2008 (http://www.fakr.noaa.gov/ram/daily/cratland.pdf, Prepared: APR-08-08 06:46), 100% of the 2007/08 IFQ allocation for the area east of 174° W longitude has been harvested (2,690,377 pounds out of the 2,700,00 pounds allocated to IFQs) and 81% of the 2007/08 IFQ allocation for the area west of 174° W longitude has been harvested (1,974,167 pounds out of the 2,430,000 pounds allocated to IFQs).

In response to a proposal from Industry, the Alaska Board of Fisheries, during their March 2008 meeting, took action to set in regulation 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. The new regulations will not become effective until the 2008/09 season.

- 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, Coleman, and Salmon 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, all vessels 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.

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 (e.g., Barnard and Burt 2007). Estimates of the weight of bycatch (discarded non-retained) golden king crabs during the Aleutian Islands golden king crab fishery and other Aleutian Islands crab fisheries are reported under the section "DATA: Total catch, partitioned by strata used in the assessment model, if any," below.

- Summary of historical catch distributions

Table 4 provides the time series of GHLs/TACs, retained catch, estimated discard, and estimated total catch (estimated discard mortality and retained catch). 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, as handling 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 (NPFMC 2007b), we provide total catch estimates for assumptions of handling mortality rates of 10%, 20%, 30%, 40%, 50%, and 60%. Tables 5 and 6 provide the same time series separately for the areas east and west of 174° W longitude. Data sources for retained and non-retained (discard) catch are provided under the section "DATA."

### *Data (Items in this section should be presented in tabular form.)*

Data which should be presented as time series:

- Total catch, partitioned by strata used in the assessment model, if any

Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds of crabs landed, pot lifts, fishery catch per unit effort, and average weight of landed crabs) by fishery season from the 1981/82 season through the 2006/07 season is provided in Table 7; data are from fish ticket database summaries produced by ADF&G Dutch Harbor during March 2008. The size limit for golden king crabs has been 6" CW for the entire Aleutian Islands Area 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. Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds of crabs landed, 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 2006/07 season is provided in Table 8; data are from fish ticket database summaries produced by ADF&G Dutch Harbor during March 2008. Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds 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 2006/07 season is provided in Table 9; data are from fish ticket database summaries produced by ADF&G Dutch Harbor during March 2008. 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, we also provide the annual harvests during 1985/86–2006/07 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 10.

Observer data collected since the 1996/97 season on size distribution and estimated catch numbers of non-retained catch (provided by D. Barnard, ADF&G, 20 July 2007 and 7 April 2008) 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 2006/07 season according to the methods and parameters provided in Section 3.4 of NPFMC 2007b. Estimates of the weight of non-retained catch of golden king crabs by sex-size class for the total Aleutian Islands and for the areas east and west of 174° longitude, 1996/97–2006/07, are provided and compared with weight of retained catch in Tables 11–13. Although most of the non-retained catch of golden king crabs is attributable to the golden king crab fishery, some incidental catch of golden king crabs may occur in the 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* fisheries; the contribution of those fisheries to weight of non-retained golden king crabs is included in Table 11a. Estimates of the bycatch during groundfish fisheries, 2003–2007, is provided in Table 11b.

- Catch at age or catch at length, as appropriate

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 dockside by observers and ADF&G catch samplers by season, 1996/97–2006/07, are provided in Table 14. Tables 15 and 16 provide the data for the fisheries east and west of 174° W longitude separately.

- Survey biomass estimates and variances, and/or confidence intervals — N/A

- Survey numbers at age or numbers at length, as appropriate

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 17.

- Other time series data (e.g., predator abundance, fishing effort)

The time series of fishing effort (pot lifts) are provided in Tables 7–9.

- Sample sizes (e.g., numbers of age or length samples by year, gear, and area)

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 14–16.

Data which may be aggregated over time:

- 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 18–22).

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 5):

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

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 6):

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

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 intermit 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 23.

## Analytic Approach

### *Model Structure — N/A*

Description of overall modeling approach (e.g., age/size structured versus biomass dynamic, maximum likelihood versus Bayesian) — N/A

Reference for software used (e.g., Synthesis, AD Model Builder) — N/A

Description of, or reference for, population dynamic representations used in the model (e.g., Baranov catch equation, Brody length-at-age equation) — N/A

List and description of all likelihood components in the model — N/A

Discussion of changes in any of the above since the previous assessment — N/A

### *Parameters Estimated Independently*

List of parameters that are estimated independently of others (e.g., the natural mortality rate, parameters governing the maturity schedule)

- 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 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 $\beta_0$ and $\beta_1$) 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:
    - $_0$ = -15.558 (95% CI: -19.123 – -11.992)
    - $_1$ = 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:
    - $_0$ = -28.273 (95% CI: -30.181 – -26.308)
    - $_1$ = 0.264 (95% CI: 0.246 – 0.282)
  - SM50 = 107.0-mm CL (95% CI: 106.6 mm to 107.5 mm)

### *Parameters Estimated Conditionally — N/A*

List of parameters that are estimated conditionally on those described above (e.g., full-selection fishing mortality rates, parameters governing the survey and fishery selectivity schedules, recruitments) — N/A

Description of how these parameters are estimated (e.g., error structures assumed, list of likelihood components, constraints on parameters) — N/A

Critical assumptions and consequences of assumption failures — N/A

### Model Evaluation — N/A

Description of alternative models, if any (e.g., alternative M values or likelihood weights) — N/A

Evidence of search for balance between realistic (but possible over-parameterized) and simpler (but not realistic) models — N/A

Use hierarchical approach where possible (e.g. asymptotic vs domed selectivities, constant vs time varying selectivities) — N/A

Do parameter estimates make sense, are they credible? — N/A

Description of criteria used to evaluate the model or to choose between alternative models, including the role (if any) of uncertainty — N/A

Residual analysis (e.g. residual plots, time series plots of observed and predicted values or other approach) — N/A

Evaluation of the model, if only one model is presented; or evaluation of alternative models and selection of final model, if more than one model is presented — N/A

List of final parameter estimates, with confidence intervals or other statistical measures of uncertainty if possible (if the set of parameters includes quantities listed in the "Results" section below, the values of these quantities should be presented in the "Results" section rather than here) — N/A

Schedules, if any, defined by final parameter estimates — N/A

## TIER 5 OFL BACKGROUND ANALYSIS

An assessment model for Aleutian Islands golden king crab is in development (Siddeek et al. 2005). However, that model 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.

Time periods for averaging the retained catch. Two time periods have been previously suggested 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 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).]

Aside from those considerations the following changes in management measures by season are also important for considering the period to estimate the OFL from the average retained catch:

| Season | Change in management measure |
|---|---|
| 1984/85 | • Decrease in minimum size limit from 6.5" to 6.0" for the Dutch Harbor Area (i.e., the area east of 171° W longitude) |
| 1985/86 | • Decrease in minimum size limit from 6.5" to 6.0" 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 (Dutch Harbor and Adak Areas)<br>o 3.2-million pound GHL for the area east of 174° W longitude<br>o 2.7-million pound GHL for the area west of 174° W longitude |
| 1998ø99 | • GHL for area east of 174° W longitude reduced to 3.0-million pounds |
| 2005/06 | • First fishery under crab rationalization program |

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). Beginning with the 1996/97 season management was based on a GHL (or TAC) established for 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); 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 7–9, Figure 7). 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 7), which is, in turn, attributable to a reduction in the harvest reported from the area between 171° W longitude and 174° W longitude (Table 10; see also 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 attained the TAC in the 2005/06 and 2006/07 seasons, particularly during the 2006/07 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. Annual season average weights of landed crabs may give some idea of recruitment trends, although those average weights may also be influenced by changes in fishery practices (e.g., use of escape mechanisms and soak times; see "Description of the directed fishery"). We examine these data for three periods: 1985/86–1995/96, 1996/97–2004/05, and 2005/06–2006/07.

<u>The pre-GHL/TAC period, 1985/86–1995/96</u>. Catch per pot lift (number of retained legal males; CPUE) in the entire Aleutian Islands Area showed a declining trend during 1985/86–1995/96 that accompanied the declining trend in harvest (Table 7, Figure 8). That trend is also shown within each of the areas east of 174° W longitude (Table 8, Figure 9) and west of 174° W longitude (Table 9, Figure 9). 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 7, Figure 10) and for each of the areas east and west of 174° W longitude (Tables 8–9, Figure 11).

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. Given that, as well as considering average retained catch over the period 1985/86–1995/96 as an estimate of OFL, the average retained catch over the period 1987/88–1995/96 should also be considered because it excludes the two years with the highest retained catch in the history of the fishery.

The GHL and pre-rationalization period, 1996/97–2004/05. Since the 1996/97 season, catches have stabilized with management of the fishery to a pre-season GHL/TAC and CPUE has 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 7–9, Figure 8, Figure 9). 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 would be consistent with 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, but then declined into the 2001/02–2004/05 seasons (Tables 7–9, Figure 10, Figure 11). The decline in average weights after the 1997/98 season could be indicative of increase in recruitment to legal size during the late 1990's and early 2000's that was responsible for the increase in CPUE over this period. Average weights continued to decline through the 2004/05 season in the area west of 174°W longitude, whereas average weights increased between the 2001/02 and 2004/05 seasons in the area east of 174°W longitude.

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 2006/07 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 1996/97–2006/07 is negatively correlated with the annual percent recruit-sized legal males among the legal males in pot lifts sampled by observers (r = -

0.76 for the area east of 174° W longitude and r = -0.83 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 12). 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.

Trends in the CPUE of incidentally captured sublegal males and females can also be assessed using the data from pot 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. 1997), 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 13). 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 13); 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 14). 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 14).

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 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), the CPUE 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 17). 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 number of crabs harvested in the 1997/98, 2000/2001, and 2003/04 seasons east of 174° W longitude in comparison to the relative changes in survey CPUE (the number harvest 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 8, Table 17). 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 increased over that period, consistent with the trend in fishery CPUE.

Weight of discarded bycatch golden king crabs has been estimated from size-sex frequency distribution in the non-retained catch in pot lifts sample by observers (Tables 4–6). 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). 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 has also be estimated using observer data and a range of assumed values for handling mortality (*hm*) of discarded bycatch (Tables 4–6). Although the effects of the total catch weight on the stock will depend on the true value of *hm*, it is notable that estimated total catch weight decreased during the period 1996/97–2004/05 under all scenarios for *hm*, both in absolute terms and relative to the retained catch (Figure 15, Figure 16).

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 west 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-size 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 total catch (retained catch plus handling mortality) weight during this period.

<u>The TAC and rationalized fishery period, 2005/06–2006/07</u>. Harvests in 2005/06–2006/07 decreased only slightly relative to the average for the period 1996/97–2004/05, whereas fishery CPUE increased markedly to values of 20 crabs per pot or more (Tables 7–9, Figure 8, Figure 9). The increase in CPUE was not accompanied by a decrease in average weight of landed crabs (Figure 10, Figure 11) or an increase in the percentage of legal males that were recruit-sized (Figure 12); in fact, average weight of landed crabs increased and the percent of legal males that were recruit-sized decreased. Hence the large increase in fishery CPUE that has accompanied rationalization cannot be explained by a large recruitment of legal males. The increase in CPUE is likely due largely to changes in fishery practices that have accompanied the rationalization of the fishery (see "Description of the directed fishery").

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 17). Nonetheless, survey CPUE of sublegal males and females remained low in 2006 relative to 1997 and 2000 (Table 17). 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 (2,523,737 pounds in 2005/06 and 2,573,040 in 2006/07; Tables 4–6). Due to that reduction in incidental catch of sublegal males and females relative to retained legal males (Figure 13, Figure 14), estimated total catch (retained plus handling mortality) weights in the 2005/06–2006/07 season are at the lowest value for the time series of estimates (Tables 4–6, Figure 15, Figure 16); even under the assumption *hm* = 60%, estimated total catch weight is only approximately 27–29% greater than the retained catch weight during 2005/06–2006/07. Again, however, it is uncertain how much that reduction can be attributed to changes in fishery practices as opposed to changes in the stock.

### Results

Definition of biomass measures used (e.g., biomass at length 50 and above):

- weight of retained catch during the commercial fishery for estimation of OFL

Definition of recruitment measures used (e.g., numbers at length 40-70) – N/A

Definition of fishing mortality measures used (e.g., full-recruitment F multiplied by selectivity for lengths 80 and above):

- weight of retained catch during the commercial fishery

Table of estimated abundance and biomass time series, including spawning biomass as one measure, with confidence bounds or other statistical measure of uncertainty if possible. Include estimates from previous SAFE for retrospective comparisons:

- Tables 4–6 and Tables 7–9 provide the annual weight of retained catch in a variety of formats and contexts.

Table of estimated recruitment time series, including average, with confidence bounds or other statistical measure of uncertainty if possible. Include estimates from previous SAFE for retrospective comparisons — N/A

Table of estimated catch/biomass time series, with confidence bounds or other statistical measure of uncertainty if possible:

- Tables 4–6 and Tables 7–9 provide the annual weight of retained catch in a variety of formats and contexts.

Graphs of fishery and survey selectivities, molting probabilities, and other schedules depending on parameter estimates

- See Figure 5 for graph of molting probability in 12–15 months at size for males
- Otherwise — N/A

Graph of estimated male, female, total and effective mature biomass time series, with confidence bounds if possible — N/A

Include a graph of the estimated fishing morality versus estimated spawning stock biomass, including applicable OFL and maximum $F_{target}$ definitions for the stock. The rationale is that graphs of this type are useful to evaluate management performance:

- 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 Figure 17 and Figure 18. Over the period 1996/97–2005/06 the average retained catch has been 2% below the average GHL/TAC. By season, retained catch has been as much as 13% the GHL/TAC (1998/99 season) and as much as 6% above the GHL/TAC.

Graph of estimated full selection F over time. — N/A

Graphs of model fits to survey numbers or proportions by age or length. — N/A

Graphs of model fits to catch numbers or proportions by age or length. — N/A

Uncertainty and sensitivity analyses. — N/A

1. The best approach for describing uncertainty and range of probable biomass estimates in stock assessments may depend on the situation. Approaches used previously are:
   a) Sensitivity analyses (tables or figures) that show ending biomass levels or likelihood component values obtained while systematically varying emphasis factors for each type of data in the model. — N/A
   b) Likelihood profiles for parameters or biomass levels may also be used. — N/A
   c) CVs for biomass estimated by bootstrap, implicit autodifferentiation, or the delta method; — N/A
   d) Subjective appraisal of magnitude and sources of uncertainty; — N/A
   e) Comparison of alternate models; — N/A
   f) Comparison of alternate assumptions about recent recruitment. — N/A

2. If a range of model runs (e.g.; based on CV's or alternate assumptions about model structure or recruitment) is used to depict uncertainty, then it is important that some qualitative or quantitative information about relative probability be included. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely. — N/A

3. if possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses. — N/A

4. retrospective analysis (retrospective bias in base model or models for each area). — N/A

5. historic analysis (plot of actual estimates from current and previous assessments for each area). — N/A

6. Simulation results (if available). — N/A

### 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:

- Estimated OFLs estimated as average retained catch (pounds) for seven different candidate time periods are provide in the table below.

| Time period | Number of seasons | OFL ( = average retained catch, pounds) |
|---|---|---|
| 1981/82–2006/07 | 26 | 7,261,516 |
| 1985/86–2006/07 | 22 | 7,405,837 |
| 1987/88–2006/07 | 20 | 6,772,773 |
| 1990/91–2006/07 | 17 | 6,091,139 |
| 1996/97–2006/07 | 11 | 5,633,236 |
| 1985/86-1999/00 | 15 | 8,233,663 |
| 1985/86–1995/96 | 11 | 9,178,438 |
| 1987/88–1995/96 | 9 | 8,165,540 |
| 1990/91–1995/96 | 6 | 6,930,627 |

- Original recommendation: average of 1985/86–2006/97 retained catch = 7,405,837 pounds.
- Final recommendation: average of 1990/91–1995/96 retained catch = 6,930,627 pounds.

List of standard harvest scenarios and description of projection methodology

- Standard harvest scenario is that retained catch will be ≤TAC under rationalized fishery

Table of 12-year projected catches corresponding to the alternative harvest scenarios, using stochastic methods if possible (mean values or other statistics may be shown in the case of stochastic recruitment scenarios) — N/A

Table of 12-year 5-year (or 10-year, if the stock is overfished) projected spawning biomass corresponding to the alternative harvest scenarios, using stochastic methods if possible (mean values or other statistics may be shown in the case of stochastic recruitment scenarios) — N/A

Table of 12-year projected fishing mortality rates corresponding to the alternative harvest scenarios, using stochastic methods if possible (mean values or other statistics may be shown in the case of stochastic recruitment scenarios) — N/A

Discussion of information, if any, that might warrant setting the GHL or total catch below the upper bound:

- ?

Recommendation of $F_{OFL}$ , OFL total catch, OFL retained catch for coming year: TBA

Include a subsection titled "Area Allocation of Harvests" and provide results and details of any apportionment schemes that are used. — N/A

### *Data gaps and research priorities*

The process of development and annual use of an assessment model to estimate spawning biomass will identify data gaps and research priorities.

### Summary

Table showing M, Tier (previous year or recommended), projected total biomass (give age or length range), female spawning biomass, male spawning biomass and total spawning biomass for current year and for next year. Male spawning biomass values at the time of mating for B0 and Bmsy and Fmsy (if available from stock-recruit relationship) or proxy values, FOFL , the maximum allowable value for Ftarget , the recommended value of OFL, the maximum allowable total catch.

| Parameter | Value |
|---|---|
| M | Default = 0.18 |
| Tier | 5 |
| Projected total biomass | N/A |
| Female spawning biomass, current year (2007/08) | N/A |
| Male spawning biomass, current year (2007/08) | N/A |
| Total spawning biomass, current year (2007/08) | N/A |
| Female spawning biomass, next year (2008/09) | N/A |
| Male spawning biomass, next year (2008/09) | N/A |
| Total spawning biomass, next year (2008/09) | N/A |
| Male spawning biomass values at the time of mating for B0 and Bmsy and Fmsy, or proxy values | N/A |
| Maximum allowable value for Ftarget | N/A |
| Recommended value of OFL | 6,930,627 pounds (retained catch) |
| Maximum allowable total catch | N/A |

## Literature Cited

Alaska Department of Fish and Game (ADF&G). 1983. Westward Region king crab survey results for 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1984. Westward Region Shellfish Report to the BOF. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1999. Annual management report for the shellfish fisheries of the Westward Region, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K99-49, Kodiak.

Alaska Department of Fish and Game (ADF&G). 2008. Staff comments on king and Tanner crab and supplemental issues proposals: Alaska Board of Fisheries Meeting, Anchorage, Alaska, March 3–9, 2008 . Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A08-01, Juneau.

Barnard, D. R. and R. Burt. 2007. Alaska Department of Fish and Game summary of the 2005/2006 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 07-02, Anchorage.

Beers, D. E. 1992. Annual biological summary of the Westward Region shellfish observer database, 1991. Alaska Department of Fish and game, Division of Commercial Fisheries, Regional Information Report 4K92-33, Kodiak.

Blau, S. F., and D. Pengilly. 1994. Findings from the 1991 Aleutian Islands golden king crab survey in the Dutch Harbor and Adak management areas including analysis of recovered tagged crabs. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K94-35, Kodiak.

Blau, S. F., D. Pengilly, and D. Tracy. 1996. Distribution of golden king crabs by sex, size, and depth zones in the eastern Aleutian Islands, Alaska. Pages 167–185 *in* High latitude crabs: Biology, management, and economics. Alaska Sea Grant College Program Report No. 96-02, University of Alaska Fairbanks.

Blau, S. F., L. J. Watson, and I. Vining. 1998. The 1997 Aleutian Islands golden king crab survey. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-30, Kodiak.

Failor-Rounds, B. 2008. Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, 2006/07. Pages 3–71 *in* Bowers, F. R., M. Schwenzfeier, S. Coleman, B. Failor-rounds, K. Milani, K. Herring, M. Salmon, and M. Albert. 2008. Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, Bering Sea and the Westward Region's Shellfish Observer Program, 2006/07.

Hiramoto, K. 1985. Overview of the golden king crab, *Lithodes aequispina*, fishery and its fishery biology in the Pacific waters of Central Japan. In: Proc. Intl. King Crab Symp., Univ. of Alaska Sea Grant Rpt. 85-12, Fairbanks, pp. 297-317.

Hiramoto, K., and S. Sato. 1970. Biological and fisheries survey on an anomuran crab, *Lithodes aequispina* Benedict, off Boso Peninsula and Sagami Bay, central Japan. Jpn. J. Ecol. 20:165-170. In Japanese with English summary.

Jewett, S. C., Sloan, N. A., and Somerton, D. A. (1985). "Size at sexual maturity and fecundity of the fjord-dwelling golden king crab *Lithodes aequispina* Benedict from northern British Columbia." *J. Crust. Biol.*, 5, pp. 377-385.

McBride, J., D. Fraser, and J. Reeves. 1982. Information on the distribution and biology of the golden (brown) king crab in the Bering Sea and Aleutian Islands area. NOAA, NWAFC Proc. Rpt. 92-02.

Milani, K. 2008. Annual management report for the Community Development Quota and Adak Community Allocation crab fisheries in the Bering Sea and Aleutian Islands, 2006/07. Pages 179–194 *in* Bowers, F. R., M. Schwenzfeier, S. Coleman, B. Failor-rounds, K. Milani, K. Herring, M. Salmon, and M. Albert. 2008. Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, Bering Sea and the Westward Region's Shellfish Observer Program, 2006/07.

Morrison, R., R. K. Gish, M. Ruccio. 1998. Annual management report for the shellfish fisheries of the Aleutian Islands. Pages 82–139 *in*: ADF&G. 1998. Annual management report for the shellfish fisheries of the Westward Region. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K98-39, Kodiak.

National Marine Fisheries Service (NMFS). 2004. Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. DOC, NOAA, National Marine Fisheries Service, AK Region, P.O. Box 21668, Juneau, AK 99802-1668, August 2004.

North Pacific Fishery Management Council (NPFMC). 2007a. Initial Review Draft: Environmental Assessment for proposed Amendment 24 to the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs to Revise Overfishing Definitions. 17 January 2007. North Pacific Fishery Management Council, Anchorage.

North Pacific Fishery Management Council (NPFMC). 2007b. Public Review Draft: Environmental Assessment for proposed Amendment 24 to the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs to Revise Overfishing Definitions. 14 November 2007. North Pacific Fishery Management Council, Anchorage.

Nyblade, C.F. 1987. Phylum or subphylum Crustacea, class Malacostraca, order Decopoda, Anomura. In: M.F. Strathman (ed), Reproduction and development of marine invertebrates on the northern Pacific Coast. Univ. Wash. Press, Seattle, pp.441-450.

Otto, R. S., and P. A. Cummiskey. 1985. Observations on the reproductive biology of golden king crab (*Lithodes aequispina*) in the Bering Sea and Aleutian Islands. Pages 123–136 *in* Proceedings of the International King Crab Symposium. University of Alaska Sea Grant Report No. 85-12, Fairbanks.

Paul, A. J., and J. M. Paul. 2000. Changes in chela heights and carapace lengths in male and female golden king crabs *Lithodes aequispinus* after molting in the laboratory. Alaska Fishery Research Bulletin 6(2): 70–77.

Paul, A. J., and J. M. Paul. 2001a. Growth of juvenile golden king crabs *Lithodes aequispinus* in the laboratory. Alaska Fishery Research Bulletin 8(2): 135–138.

Paul, A. J., and J. M. Paul. 2001b. Size of maturity in male golden king crab, *Lithodes aequispinus* (Anomura: Lithodidae). J. Crust. Biol. 21:384.

Paul, A. J., and J. M. Paul. 2001c. The reproductive cycle of golden king crab *Lithodes aequispinus* (Anomura: Lithodidae). J. Shellfish Res. 20:369–371.

Pengilly, D. 2005. ADF&G Bering Sea/Aleutian Islands crab regional research program support. Bering Sea Crab Research II, Project 2. Final Comprehensive Performance Report for NOAA Award NA16FN2621. October 2005. ADF&G, Juneau.

Schwenzfeier, M., S. Coleman, and M. Salmon. 2008. Annual report of the onboard observer program for the Westward Region crab fisheries, 2006/07. Pages 195–230 *in* Bowers, F. R., M. Schwenzfeier, S. Coleman, B. Failor-rounds, K. Milani, K. Herring, M. Salmon, and M. Albert. 2008. Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, Bering Sea and the Westward Region's Shellfish Observer Program, 2006/07.

Siddeek, M. S. M., L. J. Watson, S. F. Blau, and H. Moore. 2002. Estimating natural mortality of king crabs from tag recapture data. Pages 51–80 *in* 2002. A. J. Paul, E. G. Elner, G. S. Jamieson, G. H. Kruse, R. S. Otto, B. Sainte-Marie, T. C. Shirley, and D. Woodby (eds). Crabs in coldwater regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks. 876 pp.

Siddeek, M.S.M., Barnard, D.R., Watson, L.J., and Gish, R.K. 2005. A Modified Catch-Length Analysis Model for Golden King Crab (*Lithodes aequispinus*) Stock Assessment in the Eastern Aleutian Islands. Fisheries Assessment and Management in Data-Limited Situations. Alaska Sea Grant College Program, AK-SG-05-02, 2005.

Sloan, N.A. 1985. Life history characteristics of fjord-dwelling golden king crabs *Lithodes aequispina*. Mar. Ecol. Prog. Ser. 22:219-228.

Somerton, D. A. 1980. A computer technique for estimating the size of sexual maturity in crabs. Can. J. Fish. Aquat. Sci. 37: 1488–1494.

Somerton, D.A., and R.S. Otto. 1986. Distribution and reproductive biology of the golden king crab, *Lithodes aequispina*, in the eastern Bering Sea. Fish. Bull. 84:571-584.

Watson, L. J. 2004. The 2003 triennial Aleutian Islands golden king crab survey and comparisons to the 1997 and 2000 surveys (revised October 17, 2005). Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K04-42, Kodiak. [Revised 10/17/2005].

Watson, L. J. 2007. The 2006 triennial Aleutian Islands golden king crab survey. Alaska Department of Fish and Game, Fishery Management Report No. 07-07, Anchorage.

Watson, L. J., and R. K. Gish. 2002. The 2000 Aleutian Islands golden king crab survey and recoveries of tagged crabs in the 1997 – 1999 and 2000 – 2002 fishing seasons. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K02-6, Kodiak.

Watson, L. J., D. Pengilly, and S. F. Blau. 2002. Growth and molting probability of golden king crabs (*Lithodes aequispinus*) in the eastern Aleutian Islands, Alaska. Pages 169–187 *in* 2002. A. J. Paul, E. G. Elner, G. S. Jamieson, G. H. Kruse, R. S. Otto, B. Sainte-Marie, T. C. Shirley, and D. Woodby (eds). Crabs in coldwater regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks. 876 pp.

**Perhaps in the future, dependent on the availability of time and information, a section on "ecosystem considerations" pertaining to Aleutian Islands golden king crabs will be included in this chapter. If and when that does happen, the section will follow an outline something like this:**

## Ecosystem Considerations

Discussion of any ecosystem considerations (e.g., relationships with species listed under the ESA, prohibited species concerns, bycatch issues, refuge areas, and gear considerations).

The following subsections should provide information on how various ecosystem factors might be influencing their stock or how the specific stock fishery might be affecting the ecosystem and what data gaps might exist that prevent assessing certain effects.

Stock assessment authors would be encouraged to rely on information in the Ecosystem Considerations chapter to assist them in developing stock-specific analysis and recommending new information to the Ecosystem Considerations chapter that might be required in future years to improve the analysis. Time-series that are in the Ecosystem Chapter would be referred to by the author and not duplicated in their chapter. In cases where the authors have time series or relationships that are specific to their stock, that information should be in their assessment chapter and not in the Ecosystem chapter.

### *Ecosystem Effects on Stock*

There are several factors that should be considered for each stock in this subsection. These include:

1) Prey availability/abundance trends (historically and in the present and foreseeable future). These prey trends could affect growth or survival of a target stock.

2) Predator population trends (historically and in the present and foreseeable future). These trends could affect stock mortality rates over time.

3) Changes in habitat quality (historically and in the present and foreseeable future). These would primarily be changes in the physical environment such as temperature, currents, or ice distribution that could affect stock migration and distribution patterns, recruitment success, or direct effects of temperature on growth.

### *Fishery Effects on the Ecosystem*

In this section the following factors should be considered:

1) Fishery-specific contribution to bycatch of prohibited species, forage (including herring and juvenile pollock), HAPC biota (in particular, species common to *YourFishery*), marine mammals and birds, and other sensitive non-target species (including top predators such as sharks, expressed as a percentage of the total bycatch of that category of bycatch.

2) Fishery-specific concentration of target catch in space and time relative to predator needs in space and time (if known) and relative to spawning components.

3) Fishery-specific effects on amount of large size target fish.

4) Fishery-specific contribution to discards and offal production.

5) Fishery-specific effects on age-at-maturity and fecundity of the target species.

6) Fishery-specific effects on EFH non-living substrate (using gear specific fishing effort as a proxy for amount of possible substrate disturbance).

Authors should consider summarizing the results of these analyses into a table as shown below (for example):

Analysis of ecosystem considerations for *YourStock* and the *YourFishery*. The observation column should summarize the past, present, and foreseeable future trends. The interpretation column should provide details on how the trend affects the stock (ecosystem effects on the stock) or how the fishery trend affects the ecosystem (fishery effects on the ecosystem). The evaluation column should indicate whether the trend is of: *no concern, probably no concern, possible concern, definite concern,* or*unknown.*

| **Ecosystem effects on Aleutian Islands golden king crab** | | | |
|---|---|---|---|
| Indicator | Observation | Interpretation | Evaluation |
| *Prey availability or abundance trends* | | | |
| Zooplankton | Stomach contents, ichthyoplankton surveys, changes mean wt-at-age | Stable, data limited | Unknown |
| *Predator population trends* | | | |
| Marine mammals | Fur seals declining, Steller sea lions increasing slightly | Possibly lower mortality on Pollock | No concern |
| Birds | Stable, some increasing some decreasing | Affects young-of-year mortality | Probably no concern |
| Fish (Pollock, Pacific cod, halibut) | Stable to increasing | Possible increases to pollock mortality | |
| *Changes in habitat quality* | | | |
| Temperature regime | Cold years pollock distribution towards NW on average | Likely to affect surveyed stock | No concern (dealt with in model) |
| Winter-spring environmental conditions | Affects pre-recruit survival | Probably a number of factors | Causes natural variability |
| Production | Fairly stable nutrient flow from upwelled BS Basin | Inter-annual variability low | No concern |
| **Aleutian Islands golden king crab fishery effects on ecosystem** | | | |
| Indicator | Observation | Interpretation | Evaluation |
| *Fishery contribution to bycatch* | | | |
| Prohibited species | Stable, heavily monitored | Minor contribution to mortality | No concern |
| Forage (including herring, Atka mackerel, cod, and pollock) | Stable, heavily monitored | Bycatch levels small relative to forage biomass | No concern |
| HAPC biota | Low bycatch levels of (spp) | Bycatch levels small relative to HAPC biota | No concern |
| Marine mammals and birds | Very minor direct-take | Safe | No concern |
| Sensitive non-target species | Likely minor impact | Data limited, likely to be safe | No concern |
| *Fishery concentration in space and time* | Generally more diffuse | Mixed potential impact (fur seals vs Steller sea lions) | Possible concern |
| *Fishery effects on amount of large size target fish* | Depends on highly variable year-class strength | Natural fluctuation | Probably no concern |
| *Fishery contribution to discards and offal production* | Decreasing | Improving, but data limited | Possible concern |
| *Fishery effects on age-at-maturity and fecundity* | New study initiated in 2002 | NA | Possible concern |

Table 1. Relative frequency distribution (percentage) of depths of pot lifts sampled during the 2005/06 Aleutian Islands golden king crab fishery east and west of 174 ° W longitude (from Barnard and Burt 2007).

| Depth (fm) | East of 174°W longitude (n=1,190) | East of 174°W longitude (n=1,370) |
|---|---|---|
| <76 | 0.1% | 0.1% |
| 76-100 | 6.5% | 1.6% |
| 101-125 | 16.0% | 6.9% |
| 126-150 | 15.7% | 20.9% |
| 151-175 | 15.6% | 26.2% |
| 176-200 | 8.4% | 16.9% |
| 201-225 | 8.8% | 13.7% |
| 226-250 | 8.2% | 9.2% |
| 251-275 | 11.8% | 2.9% |
| 276-300 | 6.9% | 0.9% |
| >300 | 2.1% | 0.6% |

**Table 2.** Average pots deployed per vessel in the eastern and western Aleutian Islands golden king crab fishery from the 2000/01 to the 2006/07 seasons (from ADF&G 2008).

| Fishery Season | Eastern Aleutian Islands Average Pots / Vessel | Western Aleutian Islands 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 |
| **Average** | **1,295** | **1,800** |

* Rationalized season

**Table 3.** Average soak times in hours and days in the eastern and western Aleutian Islands golden king crab fishery from the 2000/01 to the 2006/07 seasons (from ADF&G 2008).

| Fishery Season | Eastern Aleutian Islands | | Western Aleutian Islands | |
|---|---|---|---|---|
| | Soak Time (hours) | Soak Time (days) | Soak Time (hours) | Soak Time (days) |
| 2000/01 | 110.9 | 4.6 | 230.2 | 9.7 |
| 2001/02 | 105.6 | 4.4 | 294.9 | 12.3 |
| 2002/03 | 97.7 | 4.1 | 290.6 | 12.1 |
| 2003/04 | 97.0 | 4.0 | 321.6 | 13.4 |
| 2004/05 | 88.2 | 3.7 | 278.9 | 11.6 |
| **Average** | **99.9** | **4.2** | **283.2** | **11.8** |
| 2005/06* | 340.2 | 14.2 | 580.9 | 24.2 |
| 2006/07* | 277.8 | 11.6 | 456.3 | 19.0 |
| **Average** | **309.0** | **12.9** | **518.6** | **21.6** |

*Rationalized season

Table 4. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2006/07) for retained catch (pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) for the Aleutian Islands golden king crab fishery.

| | | | 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 | 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 | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |

Table 5. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2006/07) for retained catch (pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) for the Aleutian Islands golden king crab fishery in the area east of 174° W longitude.

| | | | 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 | 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 | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |

Table 6. Annual guideline harvest level (GHL, 1996/97–2004/05) or total allowable catch (TAC, 2005/06–2006/07) for retained catch (pounds), actual retained catch (pounds), estimated non-retained discards (pounds), and estimates of total catch (retained catch plus discard mortality; pounds) for the Aleutian Islands golden king crab fishery in the area west of 174° W longitude.

| Season | Retained GHL/TAC | Retained Catch | Non-retained Discards | Total Catch (retained plus discard mortality with assumed handling mortality rate (*hm*)) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *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 | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing | Ongoing |

Table 7. Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds of crabs landed, pot lifts, fishery catch per unit effort, and average weight of landed crabs) by fishery season from the 1981/82 season through the 2006/07 season.

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

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

Table 8. Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds of crabs landed, 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 2006/07 season.

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

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

Table 9. Harvest history for the Aleutian Islands golden king crab fishery (number of crabs and pounds 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 2006/07 season.

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

Table 10. Harvest history for the Aleutian Islands golden king crab fishery (pounds of crabs landed) 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 2006/07 season.

| 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 |
| Average: 1985/86–1995/96 | 1,604,255 | 3,240,917 | 4,333,266 |
| Average: 1996/97–2006/07 | 1,697,598 | 1,390,287 | 2,545,351 |
| Average: 1985/86–2006/07 | 1,650,926 | 2,315,602 | 3,439,308 |

Table 11a. Weight (in pounds) of retained legal males and estimated weight 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 1996/97–2006/07 seasons. All non-retained catch occurred during the commercial Aleutian Islands golden king crab fishery unless noted.

| | Retained | Non-retained | | | |
|---|---|---|---|---|---|
| Season | Legal Male | Legal male | Sublegal male | Female | Total |
| 1996/97 | 5,815,772 | 0 | 4,221,753[a] | 4,853,795[b] | 9,075,548[a,b] |
| 1997/98 | 5,945,683 | 0 | 4,198,607[d] | 4,494,061[e] | 8,692,668[d,e] |
| 1998/99 | 4,941,893 | 41,325 | 4,303,406 | 3,043,543 | 7,388,274 |
| 1999/00 | 5,838,788 | 63,877 | 3,930,277 | 3,557,417 | 7,551,570 |
| 2000/01 | 6,018,761 | 35,432 | 4,782,427 | 4,083,675 | 8,901,534 |
| 2001/02 | 5,918,706 | 26,541 | 3,787,239 | 3,074,681[f] | 6,888,462[f] |
| 2002/03 | 5,462,455 | 41,621 | 3,113,341 | 2,516,355[g] | 5,671,318[g] |
| 2003/04 | 5,665,828 | 38,870 | 2,663,899 | 2,270,716[h] | 4,973,484[h] |
| 2004/05 | 5,575,051 | 76,100 | 2,511,523 | 1,733,391 | 4,321,014 |
| 2005/06 | 5,520,318 | 140,493 | 1,478,601 | 904,642 | 2,523,737 |
| 2006/07 | 5,262,342 | 119,590 | 1,263,303 | 1,190,147 | 2,573,040 |

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 11b. Estimated annual weight (pounds) of discarded bycatch of Aleutian Islands golden king crabs (all sizes, males and females) during groundfish fisheries (all gear types and fisheries pooled) in reporting areas 541, 542, and 543 (Aleutian Islands west of 170° W longitude), 2003–2007 (summary of the data provided by J. Mondragon, NMFS-Alaska Region Office, 31 March 2008).

| Year | 541 | 542 | 543 | Total |
|---|---|---|---|---|
| 2003 | 82,695 | 10,153 | 1,315 | 94,163 |
| 2004 | 39,086 | 928 | 454 | 40,468 |
| 2005 | 5,728 | 2,461 | 5,677 | 13,865 |
| 2006 | 23,564 | 9,848 | 1,140 | 34,552 |
| 2007 | 212,515 | 5,472 | 3,217 | 221,203 |
| Average | 72,718 | 5,772 | 2,360 | 80,850 |

Table 12. Weight (in pounds) of retained legal males and estimated weight of non-retained legal male, non-retained sublegal male, and non-retained female golden king crabs during the commercial Aleutian Islands golden king crab fishery east of 174° longitude by season for the 1996/97–2006/07 seasons.

| | Retained | Non-retained | | | |
|---|---|---|---|---|---|
| Season | Legal male | Legal male | Sublegal male | Female | Total |
| 1996/97 | 3,290,862 | 0 | 2,099,555 | 1,931,988 | 4,031,543 |
| 1997/98 | 3,501,055 | 0 | 2,536,029 | 2,322,039 | 4,858,067 |
| 1998/99 | 3,247,863 | 34,358 | 2,976,521 | 1,765,592 | 4,776,471 |
| 1999/00 | 3,069,886 | 40,284 | 2,048,481 | 1,360,567 | 3,449,331 |
| 2000/01 | 3,134,079 | 17,720 | 2,501,540 | 1,555,971 | 4,075,231 |
| 2001/02 | 3,178,653 | 14,199 | 1,648,759 | 948,023 | 2,610,981 |
| 2002/03 | 2,821,851 | 25,535 | 1,315,071 | 959,113 | 2,299,720 |
| 2003/04 | 2,977,055 | 20,009 | 1,200,043 | 888,268 | 2,108,319 |
| 2004/05 | 2,886,817 | 19,555 | 919,950 | 544,263 | 1,483,769 |
| 2005/06 | 2,866,603 | 84,334 | 509,375 | 238,363 | 832,073 |
| 2006/07 | 2,992,010 | 92,819 | 567,443 | 472,872 | 1,133,134 |

Table 13. Weight (in pounds) of retained legal males and estimated weight retained legal males and weight of non-retained legal male, non-retained sublegal male, and non-retained female golden king crabs during the commercial Aleutian Islands golden king crab fishery west of 174° longitude by season for the 1996/97–2006/07 seasons.

| | Retained | Non-retained | | | |
|---|---|---|---|---|---|
| Season | Legal | Legal | Sublegal male | Female | Total |
| 1996/97 | 2,524,910 | 0 | 2,022,619 | 2,719,062 | 4,741,681 |
| 1997/98 | 2,444,628 | 0 | 1,592,503 | 2,105,650 | 3,698,153 |
| 1998/99 | 1,694,030 | 6,967 | 1,326,885 | 1,277,951 | 2,611,803 |
| 1999/00 | 2,768,902 | 23,592 | 1,881,796 | 2,196,850 | 4,102,238 |
| 2000/01 | 2,884,682 | 17,712 | 2,280,887 | 2,527,704 | 4,826,303 |
| 2001/02 | 2,740,054 | 12,343 | 2,138,480 | 2,126,575 | 4,277,398 |
| 2002/03 | 2,640,604 | 16,086 | 1,798,270 | 1,557,177 | 3,371,533 |
| 2003/04 | 2,688,773 | 18,861 | 1,463,856 | 1,380,145 | 2,862,862 |
| 2004/05 | 2,688,234 | 56,545 | 1,591,573 | 1,189,121 | 2,837,238 |
| 2005/06 | 2,653,715 | 56,159 | 969,226 | 666,279 | 1,691,664 |
| 2006/07 | 2,270,332 | 26,771 | 695,861 | 717,274 | 1,439,906 |

Table 14. Carapace length (CL, mm) frequency distribution from biological measurements of retained golden king crabs sampled by season during the 1996/97 through 2006/07 Aleutian Islands golden king crab fishery (data from ADF&G shellfish observer database, Dutch Harbor, 7 April 2008).

| CL (mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| <130 | 68 | 73 | 25 | 25 | 26 | 15 | 16 | 10 | 4 | 5 | 4 |
| 130 | 78 | 78 | 35 | 42 | 42 | 28 | 16 | 20 | 14 | 5 | 2 |
| 131 | 108 | 137 | 58 | 63 | 57 | 45 | 38 | 23 | 22 | 12 | 11 |
| 132 | 258 | 256 | 147 | 151 | 132 | 107 | 106 | 65 | 76 | 35 | 27 |
| 133 | 377 | 438 | 279 | 265 | 209 | 170 | 231 | 137 | 99 | 57 | 39 |
| 134 | 617 | 657 | 439 | 395 | 346 | 292 | 391 | 180 | 215 | 128 | 106 |
| 135 | 796 | 1,005 | 628 | 581 | 569 | 461 | 496 | 334 | 381 | 228 | 177 |
| 136 | 957 | 1,236 | 778 | 638 | 660 | 546 | 698 | 427 | 460 | 282 | 201 |
| 137 | 1,265 | 1,470 | 1,190 | 1,095 | 981 | 840 | 999 | 569 | 566 | 452 | 330 |
| 138 | 1,429 | 1,874 | 1,228 | 1,253 | 1,051 | 1,019 | 972 | 730 | 718 | 476 | 410 |
| 139 | 1,358 | 1,747 | 1,119 | 1,214 | 951 | 985 | 889 | 611 | 574 | 456 | 389 |
| 140 | 1,827 | 2,056 | 1,597 | 1,525 | 1,532 | 1,168 | 1,246 | 1,039 | 959 | 687 | 544 |
| 141 | 1,408 | 1,951 | 1,279 | 1,377 | 1,151 | 1,109 | 1,039 | 696 | 793 | 646 | 554 |
| 142 | 1,649 | 2,251 | 1,599 | 1,744 | 1,400 | 1,307 | 1,341 | 1,051 | 956 | 767 | 651 |
| 143 | 1,673 | 2,227 | 1,623 | 1,656 | 1,249 | 1,278 | 1,480 | 924 | 1,002 | 772 | 763 |
| 144 | 1,558 | 1,912 | 1,306 | 1,497 | 1,145 | 1,276 | 1,113 | 840 | 809 | 661 | 565 |
| 145 | 1,458 | 2,067 | 1,442 | 1,538 | 1,487 | 1,266 | 1,224 | 1,028 | 943 | 756 | 674 |
| 146 | 1,288 | 1,792 | 1,226 | 1,279 | 1,049 | 992 | 1,001 | 758 | 746 | 627 | 590 |
| 147 | 1,453 | 1,766 | 1,371 | 1,567 | 1,269 | 1,169 | 1,190 | 923 | 826 | 694 | 618 |
| 148 | 1,358 | 1,695 | 1,251 | 1,410 | 1,042 | 1,122 | 944 | 783 | 693 | 661 | 642 |
| 149 | 1,055 | 1,412 | 844 | 1,131 | 876 | 897 | 882 | 568 | 571 | 572 | 505 |
| 150 | 1,135 | 1,458 | 1,083 | 1,091 | 1,142 | 890 | 864 | 728 | 609 | 585 | 510 |
| 151 | 905 | 1,266 | 788 | 896 | 799 | 717 | 626 | 502 | 455 | 520 | 458 |
| 152 | 919 | 1,252 | 912 | 1,053 | 893 | 879 | 766 | 592 | 504 | 581 | 563 |
| 153 | 863 | 1,134 | 753 | 819 | 742 | 671 | 594 | 477 | 395 | 443 | 530 |
| 154 | 799 | 972 | 566 | 735 | 664 | 587 | 672 | 427 | 405 | 423 | 445 |
| 155 | 696 | 840 | 577 | 635 | 792 | 538 | 502 | 405 | 398 | 411 | 446 |
| 156 | 585 | 824 | 514 | 545 | 530 | 419 | 353 | 318 | 300 | 335 | 363 |
| 157 | 566 | 742 | 475 | 570 | 581 | 427 | 452 | 323 | 317 | 323 | 397 |
| 158 | 489 | 659 | 428 | 527 | 496 | 391 | 262 | 280 | 213 | 283 | 333 |
| 159 | 445 | 611 | 308 | 398 | 375 | 295 | 221 | 178 | 208 | 254 | 290 |

(continued)

Table 14. page 2 of 2.

| CL (mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 449 | 588 | 337 | 383 | 469 | 261 | 250 | 255 | 229 | 247 | 267 |
| 161 | 334 | 451 | 241 | 305 | 281 | 236 | 180 | 135 | 142 | 196 | 269 |
| 162 | 351 | 447 | 273 | 335 | 334 | 236 | 197 | 166 | 182 | 195 | 283 |
| 163 | 353 | 433 | 222 | 294 | 318 | 231 | 136 | 123 | 134 | 145 | 254 |
| 164 | 305 | 361 | 178 | 213 | 246 | 206 | 131 | 162 | 122 | 136 | 169 |
| 165 | 242 | 350 | 180 | 183 | 258 | 173 | 116 | 142 | 126 | 145 | 201 |
| 166 | 188 | 279 | 122 | 161 | 179 | 112 | 86 | 78 | 71 | 94 | 153 |
| 167 | 221 | 297 | 142 | 157 | 216 | 160 | 100 | 88 | 80 | 110 | 174 |
| 168 | 221 | 250 | 118 | 125 | 143 | 126 | 71 | 74 | 77 | 75 | 131 |
| 169 | 142 | 176 | 107 | 101 | 110 | 83 | 60 | 56 | 52 | 74 | 103 |
| 170 | 173 | 183 | 105 | 76 | 152 | 86 | 59 | 60 | 74 | 76 | 110 |
| 171 | 104 | 137 | 70 | 71 | 104 | 52 | 49 | 38 | 46 | 58 | 94 |
| 172 | 112 | 150 | 72 | 59 | 95 | 65 | 57 | 52 | 28 | 65 | 81 |
| 173 | 96 | 137 | 54 | 48 | 88 | 48 | 22 | 29 | 34 | 62 | 73 |
| 174 | 82 | 95 | 44 | 23 | 61 | 38 | 22 | 30 | 41 | 43 | 61 |
| 175 | 56 | 92 | 51 | 31 | 61 | 41 | 25 | 18 | 11 | 52 | 53 |
| 176 | 43 | 95 | 21 | 29 | 41 | 20 | 17 | 17 | 11 | 29 | 35 |
| 177 | 53 | 55 | 33 | 21 | 37 | 18 | 10 | 12 | 11 | 32 | 33 |
| 178 | 50 | 67 | 20 | 20 | 34 | 17 | 13 | 8 | 13 | 18 | 26 |
| 179 | 37 | 47 | 8 | 15 | 22 | 12 | 7 | 20 | 1 | 12 | 24 |
| 180 | 34 | 35 | 11 | 10 | 27 | 18 | 6 | 8 | 7 | 13 | 10 |
| >180 | 59 | 135 | 55 | 33 | 75 | 44 | 16 | 30 | 19 | 51 | 71 |
| Total | 33,145 | 42,718 | 28,332 | 30,408 | 27,589 | 24,189 | 23,254 | 17,547 | 16,742 | 15,065 | 14,812 |

Table 15. Carapace length (CL, mm) frequency distributions from biological measurements of retained golden king crabs sampled by season during the 1996/97 through 2006/07 Aleutian Islands golden king crab fishery east of 174° W longitude (data from ADF&G shellfish observer database, Dutch Harbor, 7 April 2008).

| CL(mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| <130 | 46 | 25 | 9 | 8 | 11 | 3 | 3 | 2 | 0 | 0 | 0 |
| 130 | 10 | 16 | 7 | 9 | 7 | 8 | 3 | 0 | 1 | 0 | 0 |
| 131 | 23 | 26 | 22 | 21 | 11 | 6 | 3 | 3 | 5 | 1 | 0 |
| 132 | 48 | 24 | 46 | 40 | 28 | 17 | 23 | 6 | 16 | 4 | 2 |
| 133 | 50 | 84 | 69 | 82 | 39 | 30 | 44 | 20 | 23 | 4 | 2 |
| 134 | 93 | 151 | 104 | 96 | 69 | 59 | 52 | 23 | 41 | 8 | 5 |
| 135 | 118 | 225 | 182 | 142 | 103 | 79 | 70 | 41 | 67 | 20 | 14 |
| 136 | 139 | 246 | 196 | 196 | 144 | 112 | 91 | 76 | 61 | 28 | 26 |
| 137 | 157 | 246 | 304 | 265 | 184 | 121 | 147 | 75 | 84 | 38 | 32 |
| 138 | 181 | 324 | 289 | 316 | 202 | 181 | 151 | 74 | 101 | 38 | 39 |
| 139 | 194 | 302 | 278 | 288 | 196 | 160 | 177 | 83 | 107 | 41 | 39 |
| 140 | 244 | 342 | 435 | 336 | 304 | 190 | 227 | 132 | 154 | 68 | 43 |
| 141 | 220 | 328 | 341 | 284 | 243 | 199 | 185 | 105 | 128 | 61 | 42 |
| 142 | 245 | 373 | 413 | 311 | 310 | 228 | 229 | 136 | 166 | 95 | 76 |
| 143 | 242 | 415 | 386 | 345 | 262 | 233 | 220 | 131 | 148 | 73 | 68 |
| 144 | 243 | 363 | 333 | 305 | 242 | 218 | 193 | 124 | 146 | 83 | 56 |
| 145 | 241 | 318 | 373 | 292 | 248 | 229 | 221 | 148 | 155 | 78 | 75 |
| 146 | 232 | 319 | 332 | 263 | 211 | 175 | 177 | 142 | 129 | 85 | 62 |
| 147 | 235 | 291 | 393 | 284 | 273 | 207 | 221 | 146 | 148 | 99 | 68 |
| 148 | 246 | 311 | 300 | 220 | 204 | 220 | 184 | 115 | 127 | 62 | 79 |
| 149 | 166 | 261 | 262 | 184 | 166 | 175 | 194 | 116 | 114 | 89 | 73 |
| 150 | 179 | 264 | 309 | 197 | 169 | 175 | 170 | 138 | 134 | 93 | 69 |
| 151 | 171 | 262 | 280 | 163 | 166 | 184 | 154 | 98 | 116 | 85 | 62 |
| 152 | 152 | 199 | 279 | 175 | 162 | 177 | 164 | 104 | 86 | 92 | 66 |
| 153 | 147 | 205 | 192 | 144 | 131 | 140 | 118 | 79 | 81 | 53 | 63 |
| 154 | 137 | 182 | 166 | 123 | 130 | 133 | 122 | 88 | 99 | 78 | 59 |
| 155 | 133 | 142 | 177 | 115 | 120 | 132 | 116 | 76 | 109 | 61 | 60 |
| 156 | 133 | 144 | 178 | 100 | 91 | 115 | 83 | 83 | 63 | 78 | 36 |
| 157 | 109 | 150 | 129 | 103 | 89 | 100 | 89 | 85 | 89 | 61 | 39 |
| 158 | 95 | 113 | 146 | 91 | 108 | 97 | 79 | 55 | 60 | 52 | 42 |
| 159 | 92 | 108 | 107 | 82 | 57 | 77 | 75 | 32 | 63 | 45 | 27 |

(continued)

Table 15. page 2 of 2.

| CL(mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 82 | 133 | 153 | 78 | 76 | 70 | 92 | 52 | 69 | 50 | 38 |
| 161 | 72 | 90 | 111 | 57 | 60 | 61 | 57 | 33 | 45 | 37 | 32 |
| 162 | 76 | 91 | 106 | 65 | 58 | 59 | 59 | 34 | 57 | 44 | 39 |
| 163 | 63 | 83 | 75 | 63 | 53 | 61 | 45 | 26 | 37 | 19 | 39 |
| 164 | 55 | 43 | 70 | 53 | 47 | 49 | 46 | 26 | 23 | 19 | 27 |
| 165 | 52 | 56 | 72 | 42 | 38 | 44 | 32 | 22 | 30 | 33 | 22 |
| 166 | 30 | 46 | 54 | 39 | 36 | 31 | 33 | 22 | 20 | 19 | 18 |
| 167 | 40 | 56 | 65 | 33 | 29 | 31 | 39 | 18 | 37 | 23 | 20 |
| 168 | 45 | 29 | 58 | 31 | 28 | 37 | 29 | 13 | 16 | 13 | 24 |
| 169 | 32 | 42 | 53 | 30 | 13 | 22 | 23 | 16 | 16 | 18 | 20 |
| 170 | 48 | 30 | 40 | 25 | 18 | 24 | 20 | 11 | 20 | 11 | 12 |
| 171 | 36 | 21 | 39 | 22 | 15 | 18 | 16 | 5 | 13 | 12 | 6 |
| 172 | 21 | 22 | 30 | 19 | 10 | 17 | 26 | 11 | 7 | 18 | 10 |
| 173 | 20 | 14 | 29 | 16 | 14 | 9 | 7 | 10 | 9 | 16 | 13 |
| 174 | 22 | 15 | 26 | 6 | 9 | 8 | 8 | 8 | 10 | 9 | 10 |
| 175 | 16 | 11 | 23 | 8 | 12 | 14 | 7 | 3 | 3 | 15 | 4 |
| 176 | 14 | 13 | 9 | 7 | 4 | 2 | 8 | 3 | 2 | 8 | 3 |
| 177 | 18 | 6 | 18 | 9 | 3 | 4 | 2 | 1 | 2 | 2 | 4 |
| 178 | 11 | 10 | 10 | 7 | 9 | 4 | 5 | 3 | 1 | 6 | 5 |
| 179 | 10 | 9 | 4 | 7 | 2 | 3 | 3 | 3 | 0 | 1 | 5 |
| 180 | 7 | 7 | 7 | 3 | 4 | 5 | 2 | 0 | 0 | 2 | 0 |
| >180 | 14 | 6 | 25 | 8 | 10 | 14 | 7 | 9 | 2 | 15 | 10 |
| Total | 5,505 | 7,592 | 8,114 | 6,208 | 5,228 | 4,767 | 4,551 | 2,865 | 3,240 | 2,063 | 1,685 |

Table 16. Carapace length (CL, mm) frequency distributions from biological measurements of retained golden king crabs sampled by season during the 1996/97 through 2006/07 Aleutian Islands golden king crab fishery west of 174° W longitude (data from ADF&G shellfish observer database, Dutch Harbor, 7 April 2008).

| CL (mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| <130 | 22 | 36 | 16 | 17 | 7 | 12 | 13 | 3 | 4 | 3 | 3 |
| 130 | 68 | 56 | 28 | 33 | 20 | 20 | 12 | 17 | 13 | 5 | 2 |
| 131 | 85 | 90 | 36 | 42 | 27 | 39 | 35 | 18 | 17 | 11 | 11 |
| 132 | 210 | 202 | 101 | 111 | 73 | 90 | 83 | 51 | 57 | 28 | 25 |
| 133 | 327 | 294 | 210 | 182 | 106 | 138 | 179 | 109 | 69 | 52 | 37 |
| 134 | 524 | 426 | 335 | 295 | 175 | 228 | 317 | 132 | 160 | 112 | 98 |
| 135 | 678 | 639 | 446 | 436 | 338 | 380 | 407 | 260 | 303 | 200 | 157 |
| 136 | 818 | 813 | 582 | 437 | 333 | 427 | 559 | 308 | 386 | 238 | 170 |
| 137 | 1,108 | 1,018 | 886 | 819 | 537 | 710 | 798 | 412 | 461 | 396 | 296 |
| 138 | 1,248 | 1,283 | 939 | 927 | 588 | 829 | 770 | 583 | 592 | 421 | 367 |
| 139 | 1,164 | 1,196 | 841 | 913 | 519 | 819 | 674 | 445 | 447 | 381 | 342 |
| 140 | 1,583 | 1,431 | 1,162 | 1,172 | 905 | 971 | 957 | 793 | 783 | 568 | 491 |
| 141 | 1,188 | 1,348 | 938 | 1,081 | 643 | 903 | 800 | 489 | 639 | 541 | 501 |
| 142 | 1,404 | 1,521 | 1,186 | 1,419 | 740 | 1,074 | 1,057 | 817 | 754 | 630 | 567 |
| 143 | 1,431 | 1,508 | 1,237 | 1,289 | 669 | 1,041 | 1,171 | 693 | 829 | 663 | 686 |
| 144 | 1,315 | 1,244 | 973 | 1,181 | 626 | 1,051 | 871 | 604 | 632 | 544 | 500 |
| 145 | 1,217 | 1,475 | 1,069 | 1,233 | 958 | 1,031 | 937 | 761 | 761 | 623 | 583 |
| 146 | 1,056 | 1,208 | 894 | 1,006 | 612 | 811 | 772 | 517 | 590 | 504 | 513 |
| 147 | 1,218 | 1,243 | 978 | 1,270 | 732 | 960 | 910 | 667 | 659 | 543 | 542 |
| 148 | 1,112 | 1,138 | 951 | 1,180 | 587 | 896 | 716 | 585 | 546 | 560 | 554 |
| 149 | 889 | 971 | 582 | 937 | 531 | 714 | 646 | 379 | 437 | 440 | 426 |
| 150 | 956 | 1,003 | 774 | 888 | 763 | 710 | 653 | 498 | 461 | 450 | 418 |
| 151 | 734 | 860 | 508 | 727 | 470 | 532 | 440 | 330 | 324 | 389 | 382 |
| 152 | 767 | 895 | 633 | 870 | 547 | 698 | 564 | 404 | 398 | 443 | 484 |
| 153 | 716 | 795 | 561 | 664 | 441 | 529 | 453 | 337 | 306 | 359 | 454 |
| 154 | 662 | 653 | 400 | 608 | 414 | 453 | 511 | 278 | 289 | 315 | 362 |
| 155 | 563 | 582 | 400 | 514 | 556 | 406 | 361 | 279 | 278 | 313 | 366 |
| 156 | 452 | 581 | 336 | 442 | 321 | 303 | 253 | 173 | 228 | 221 | 295 |
| 157 | 457 | 507 | 346 | 463 | 379 | 323 | 335 | 191 | 223 | 243 | 329 |
| 158 | 394 | 452 | 282 | 433 | 302 | 294 | 171 | 184 | 150 | 209 | 251 |
| 159 | 353 | 419 | 201 | 313 | 255 | 217 | 133 | 108 | 136 | 188 | 243 |

(continued)

Table 16. page 2 of 2.

| CL (mm) | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 367 | 394 | 184 | 300 | 316 | 191 | 144 | 160 | 155 | 169 | 208 |
| 161 | 262 | 303 | 130 | 247 | 168 | 175 | 114 | 76 | 89 | 141 | 224 |
| 162 | 275 | 304 | 167 | 265 | 204 | 177 | 125 | 98 | 118 | 139 | 229 |
| 163 | 290 | 296 | 147 | 227 | 200 | 168 | 84 | 69 | 91 | 119 | 201 |
| 164 | 250 | 279 | 108 | 154 | 145 | 157 | 77 | 104 | 90 | 98 | 128 |
| 165 | 190 | 260 | 108 | 141 | 179 | 129 | 79 | 91 | 92 | 103 | 168 |
| 166 | 158 | 194 | 68 | 118 | 114 | 81 | 50 | 31 | 45 | 57 | 129 |
| 167 | 181 | 218 | 77 | 120 | 150 | 128 | 54 | 53 | 43 | 81 | 145 |
| 168 | 176 | 192 | 60 | 91 | 82 | 88 | 41 | 50 | 60 | 57 | 100 |
| 169 | 110 | 120 | 54 | 68 | 73 | 59 | 31 | 30 | 33 | 49 | 79 |
| 170 | 125 | 135 | 65 | 51 | 117 | 62 | 39 | 38 | 51 | 62 | 93 |
| 171 | 68 | 100 | 31 | 47 | 64 | 34 | 26 | 13 | 27 | 42 | 82 |
| 172 | 91 | 108 | 42 | 40 | 65 | 47 | 28 | 28 | 18 | 44 | 66 |
| 173 | 76 | 93 | 25 | 30 | 60 | 39 | 14 | 11 | 23 | 44 | 54 |
| 174 | 60 | 75 | 18 | 17 | 39 | 30 | 13 | 8 | 24 | 33 | 50 |
| 175 | 40 | 70 | 28 | 23 | 34 | 27 | 15 | 9 | 8 | 35 | 47 |
| 176 | 29 | 76 | 12 | 19 | 26 | 18 | 8 | 4 | 6 | 20 | 29 |
| 177 | 35 | 42 | 15 | 9 | 22 | 14 | 5 | 5 | 8 | 29 | 28 |
| 178 | 39 | 53 | 10 | 13 | 21 | 13 | 6 | 3 | 10 | 12 | 21 |
| 179 | 27 | 31 | 4 | 6 | 19 | 9 | 2 | 8 | 1 | 11 | 17 |
| 180 | 27 | 28 | 4 | 4 | 17 | 13 | 4 | 6 | 7 | 11 | 9 |
| >180 | 45 | 120 | 30 | 19 | 50 | 29 | 8 | 10 | 17 | 33 | 56 |
| Total | 27,640 | 29,378 | 20,218 | 23,911 | 16,339 | 19,297 | 17,525 | 12,330 | 12,948 | 11,982 | 12,618 |

Table 17. 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 18. 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).

| | | Shell condition at release | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Months After Release | | New shell | | | Old shell | | | All shell conditions | | |
| | Statistic | Sublegal | Legal | All | Sublegal | Legal | All | Sublegal | Legal | 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 19. Mean and standard deviation (S.D.) of estimated growth in carapace length (mm) from two molts for male golden king crabstagged 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 | | Legal 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 20. 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 21. 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 22. 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).

| | | Released immature | | Released mature |
|---|---|---|---|---|
| Months After Release | Statistic | 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 23. 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 |

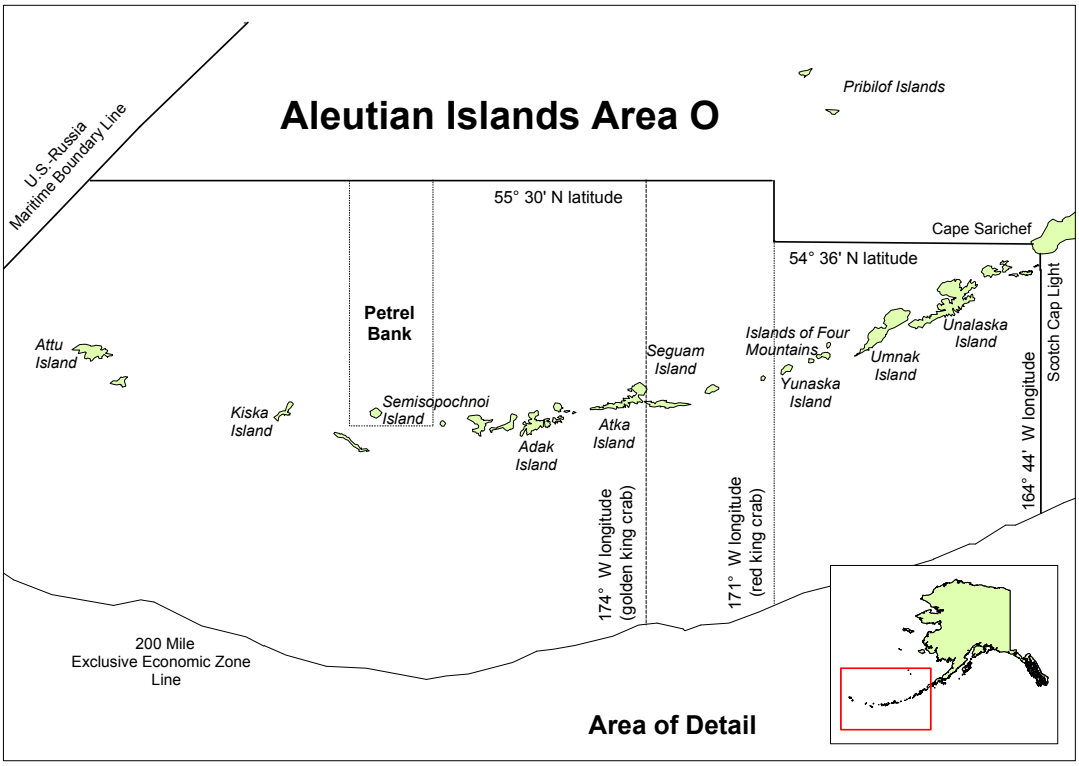



Figure 1. Aleutian Islands, Area O, red and golden king crab management area (from Failor-Rounds 2008).

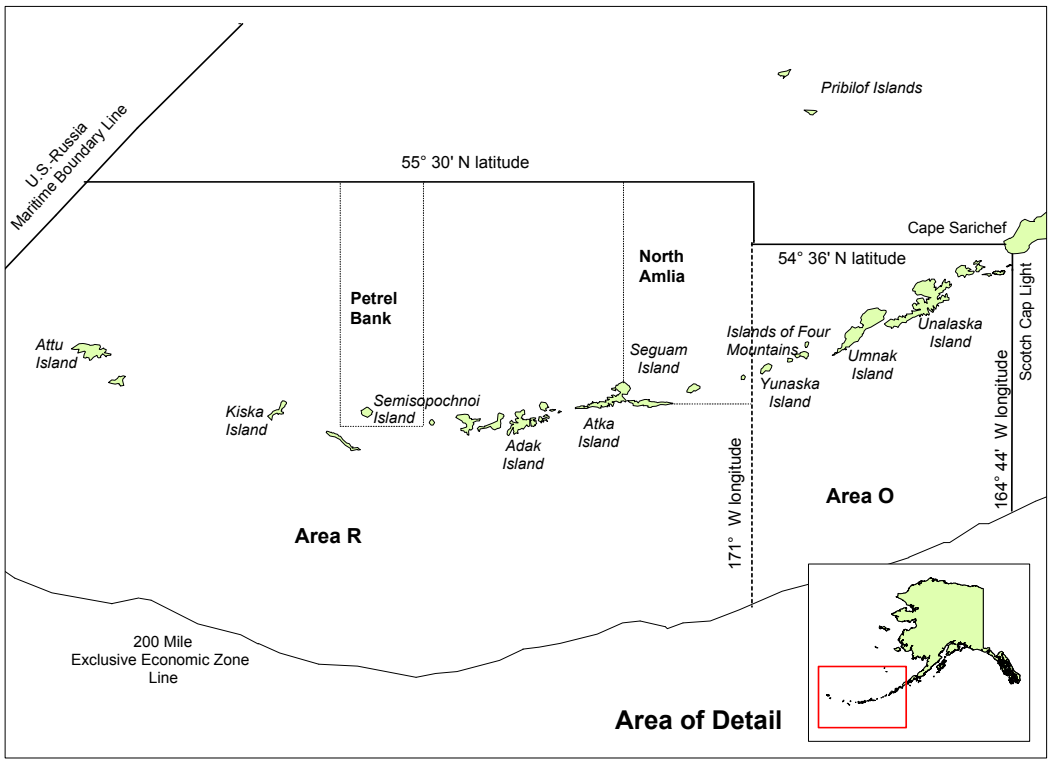



Figure 2. Adak (Area R) and Dutch Harbor (Area O) king crab Registration Areas and Districts, 1984/85 – 1995/96 seasons (from Failor-Rounds 2008).

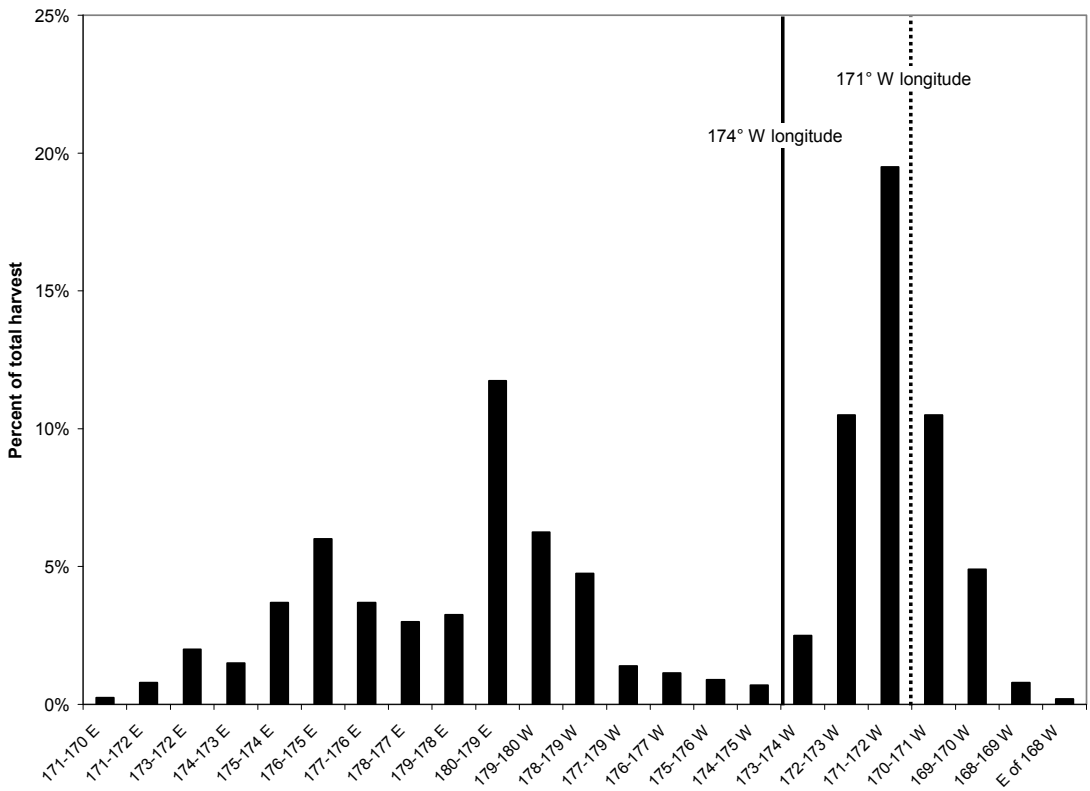



Figure 3. Percent of total 1982–1996 golden king crab harvest by one-degree longitude intervals in the Aleutian Islands, with dotted line denoting the border at 171° W longitude that was used until the end of the 1995/96 season to divide fishery management between the Dutch Harbor Area (east of 171° 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).

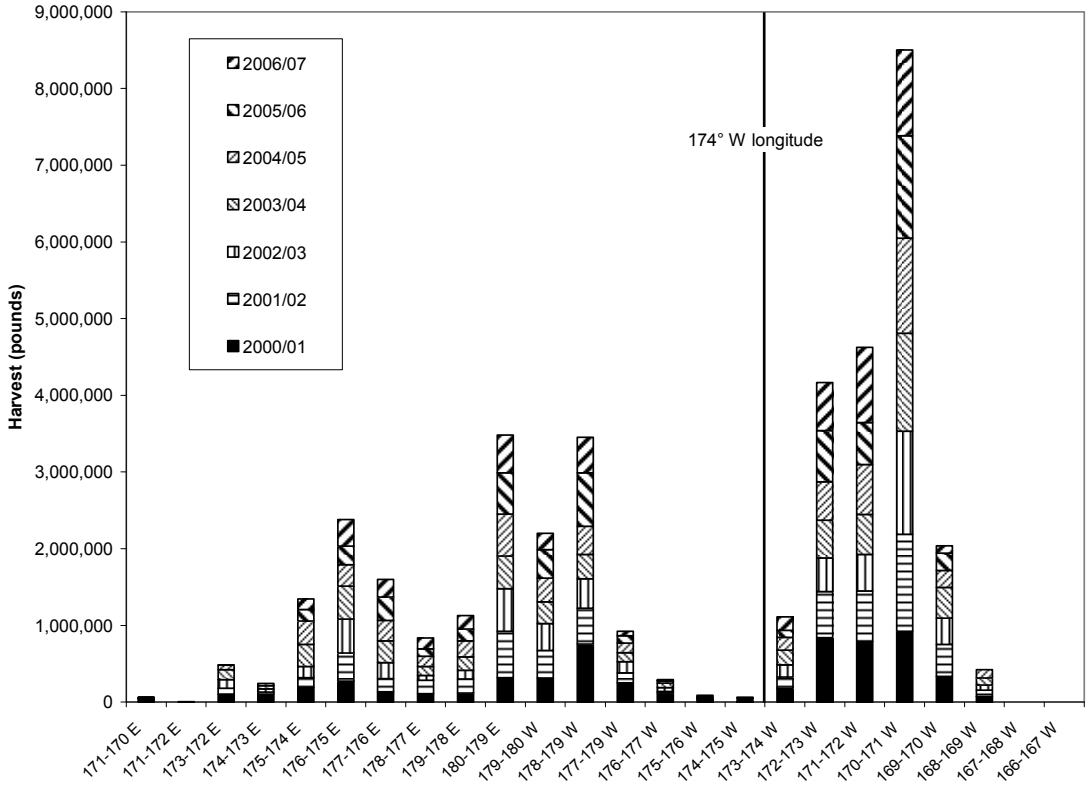



Figure 4. Harvest (pounds) of golden king crabs by one-degree longitude intervals in the Aleutian Islands during the 2000/01 through 2006/07 commercial fishery seasons, with solid line denoting the border at 174° W longitude that has been used since the 1996/97 season to manage Aleutian Island golden king crabs as separate stocks east and west of 174° W longitude (data from B. Failor-Rounds, Fishery Biologist, ADF&G, Dutch Harbor, 17 July 2007).

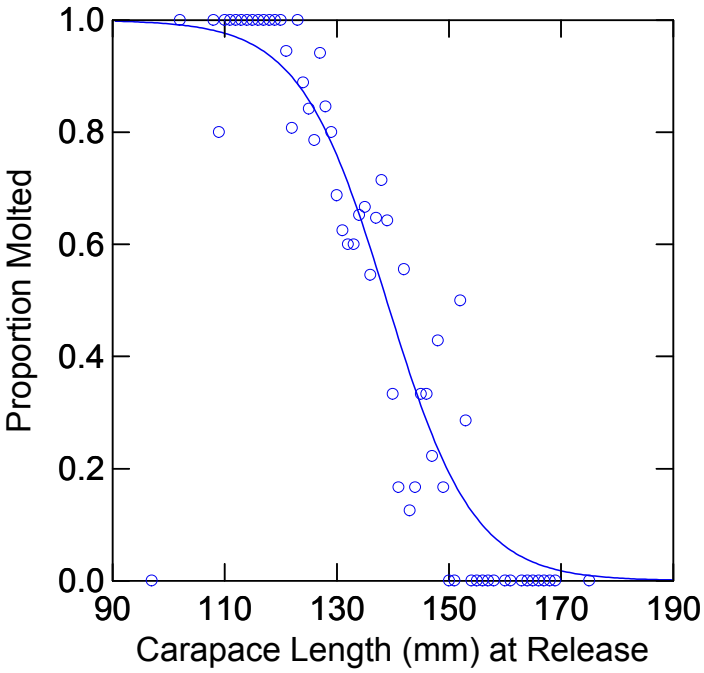



Figure 5. Proportion molting prior to recovery as related to carapace length at release of 487 new-shell male golden king crab tagged and released in the Yunaska Island area of the Aleutian Islands, Alaska, July-August 1997 and recovered 12-15 months later during the 1998/99 commercial golden king crab fishery, with curve showing a logistic regression fit to the data (from Watson et al. 2002).

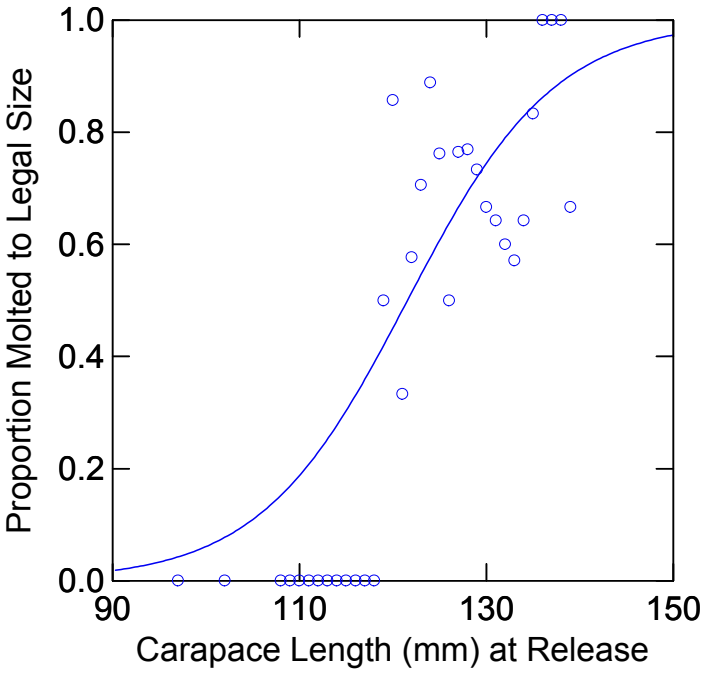



Figure 6. Proportion by carapace length at release of 281 male golden king crabs tagged and released as sublegal new-shell males in Yunaska Island area of Aleutian Islands, Alaska, July-August 1997, that molted to legal size prior to their recovery 12-15 months later during the commercial golden king crab fishery, with curve showing a logistic regression fit to the data (from Watson et al. 2002).

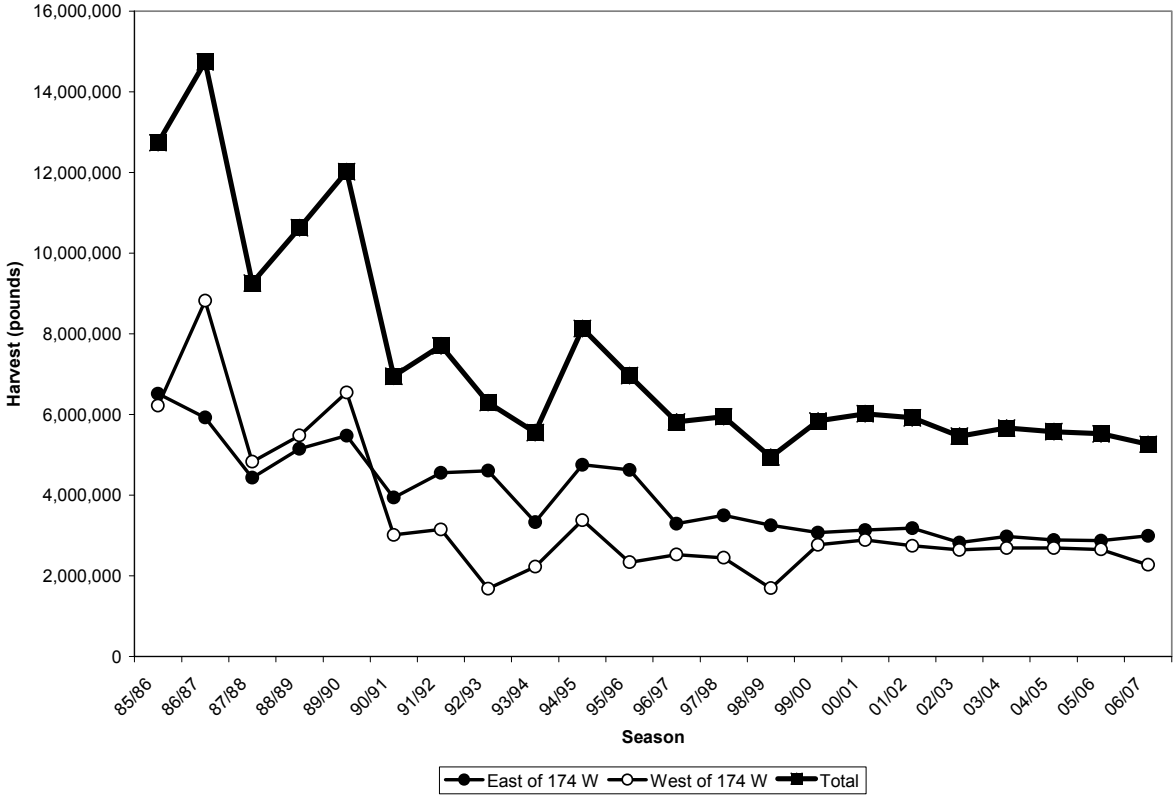



Figure 7. Retained catch (harvest in pounds) in the Aleutian Islands golden king crab fishery, 1985/86–2006/07 seasons for the entire Aleutian Islands Area and for each of the areas east and west of 174° W longitude.

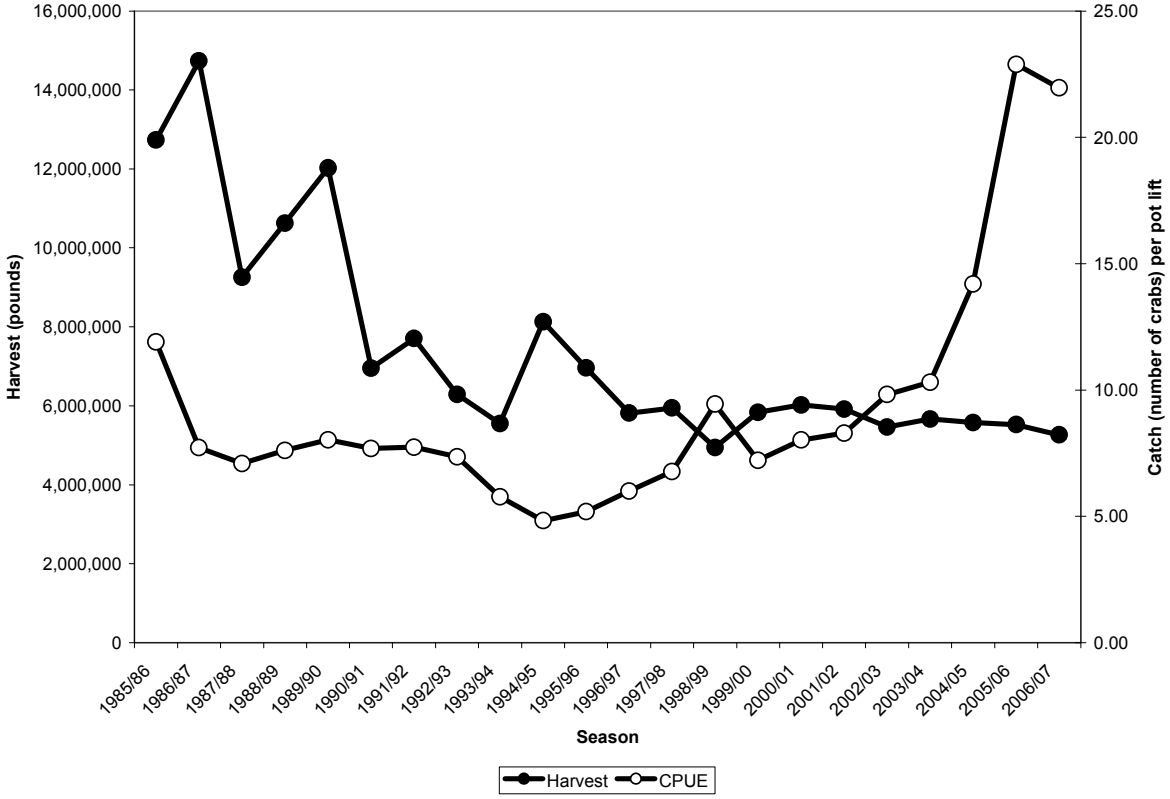



Figure 8. Retained catch (harvest in pounds) and catch (number of retained legal crabs) per pot lift (CPUE) in the Aleutian Islands golden king crab fishery, 1985/86–2006/07 seasons.

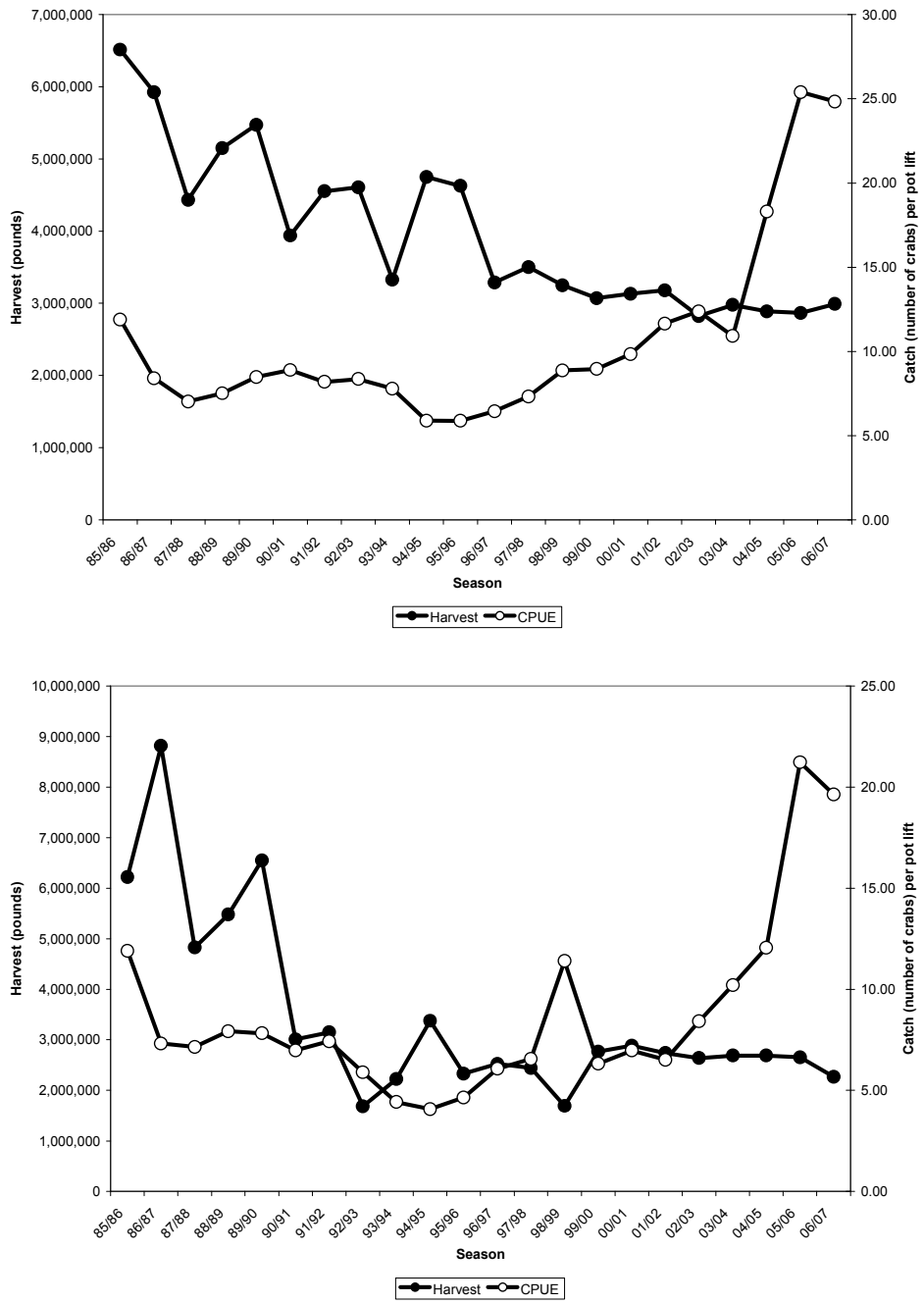



Figure 9. Retained catch (harvest in pounds) and catch (number of retained legal crabs) per pot lift (CPUE) in the Aleutian Islands golden king crab fishery, 1985/86–2006/07 seasons, for the area east of 174° W longitude (top panel) and the area west of 174° W longitude (bottom panel).

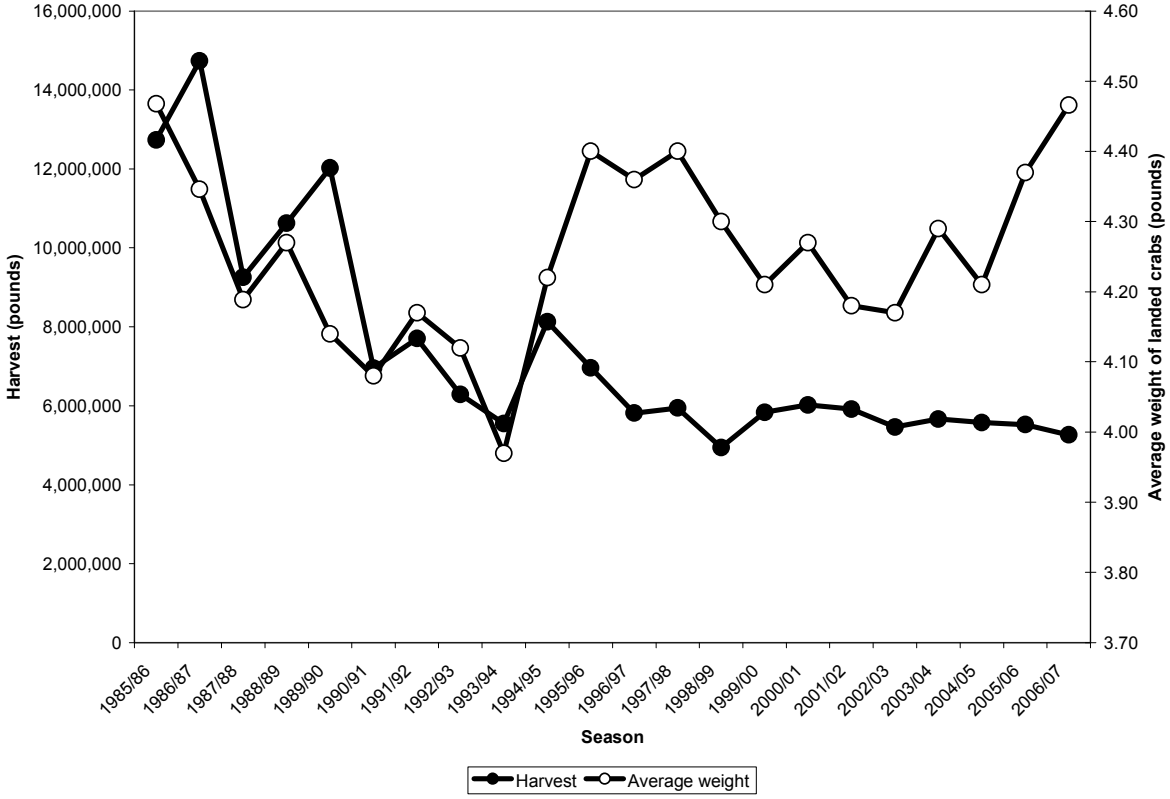



Figure 10. Retained catch (harvest in pounds) and average weight (pounds) of landed crabs in the Aleutian Islands golden king crab fishery, 1985/86–2006/07 seasons.

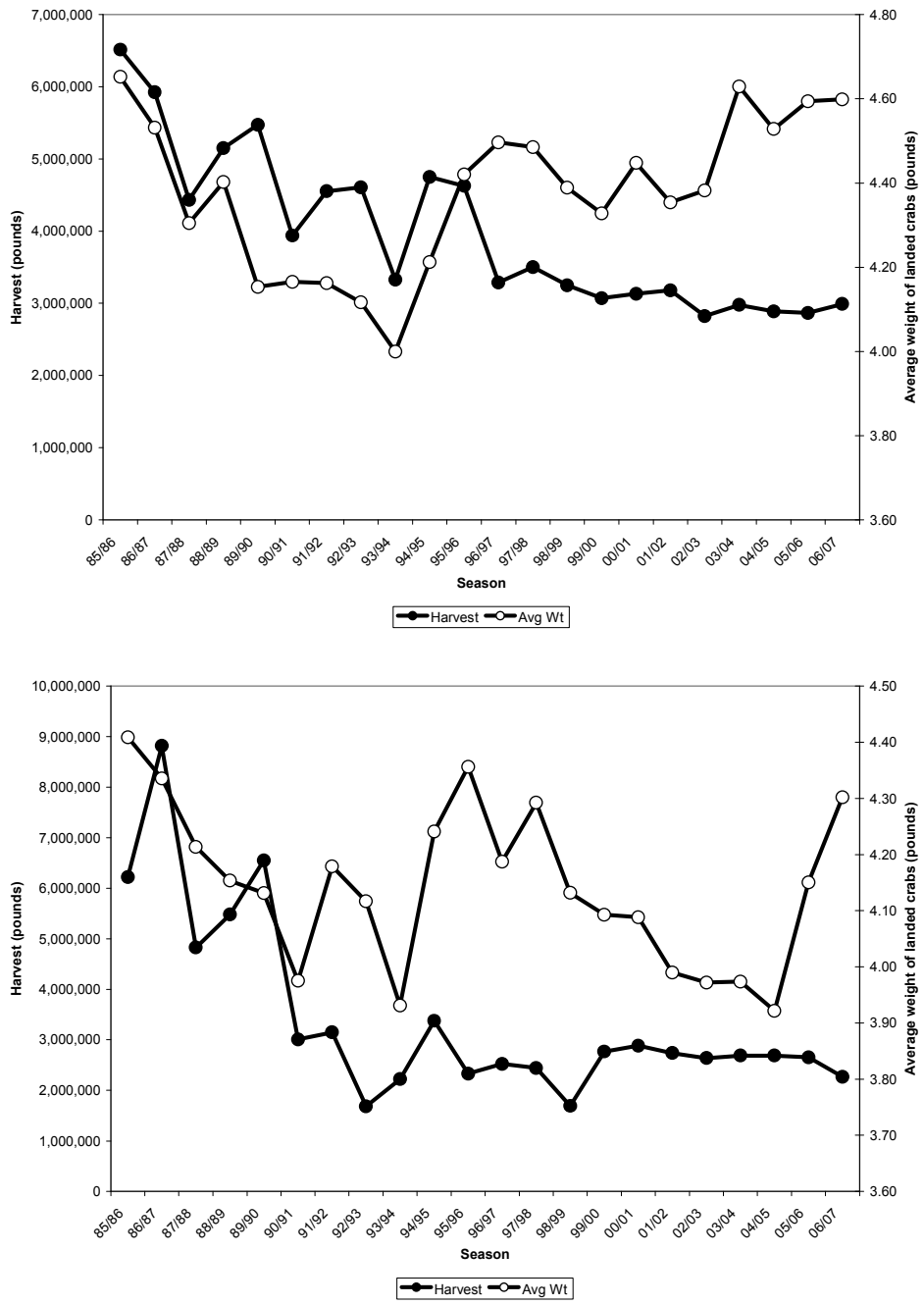
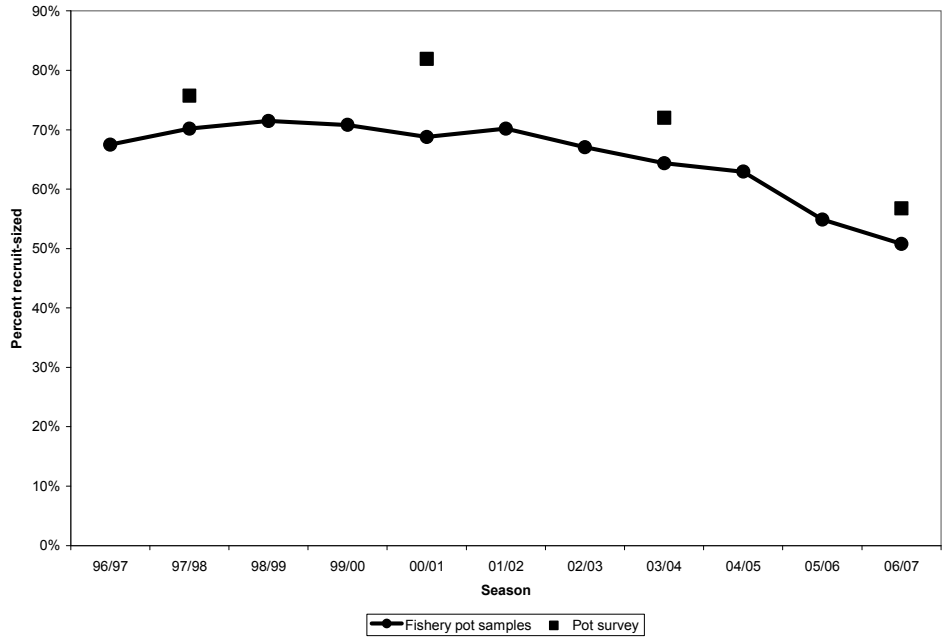



Figure 11. Retained catch (harvest in pounds) and average weight (pounds) of landed crabs in the Aleutian Islands golden king crab fishery, 1985/86–2006/07 seasons, for the area east of 174° W longitude (top panel) and the area west of 174° W longitude (bottom panel).



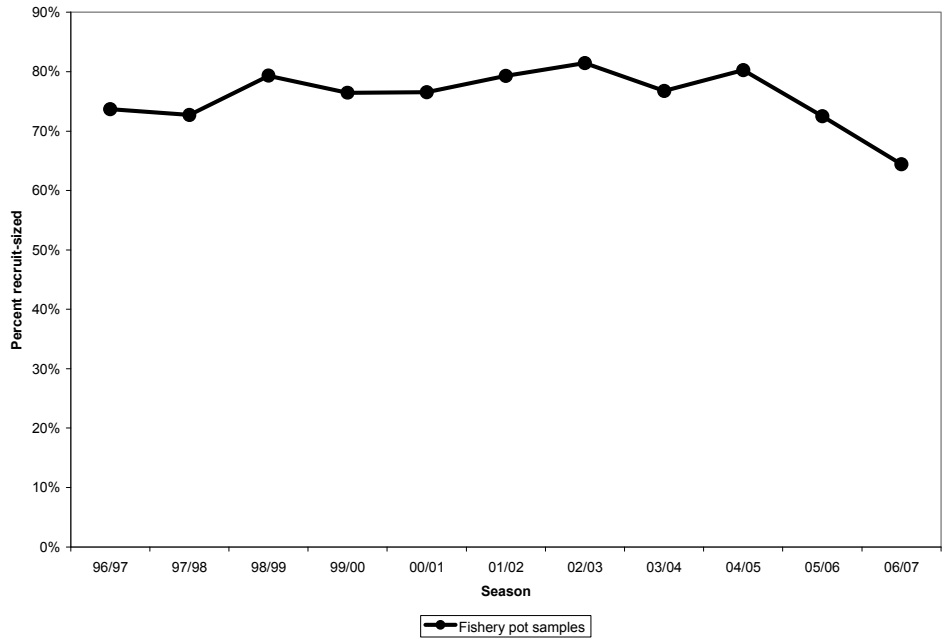
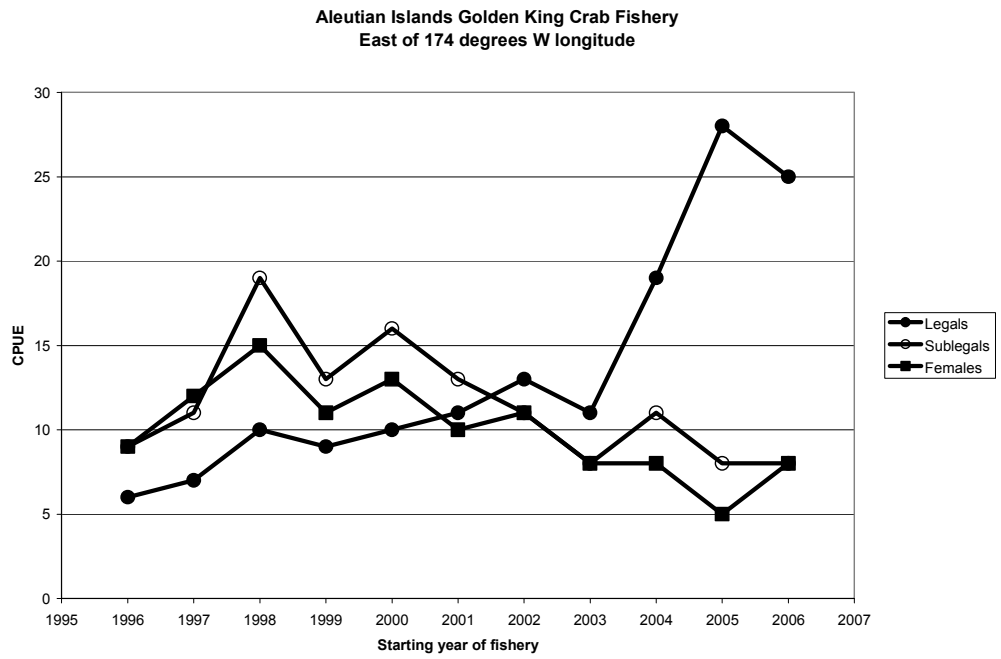




Figure 12. Percent of legal males that were recruit-sized (<151 mm CL) in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery east of 174º W longitude, 1996/97–2006/07, and in pots fished during the triennial ADF&G Aleutian Islands golden king crab pot survey, 1997–2006 (top panel) and in pots randomly sampled by observers during the Aleutian Islands golden king crab fishery west of 174º W longitude, 1996/97–2006/07 (bottom panel).



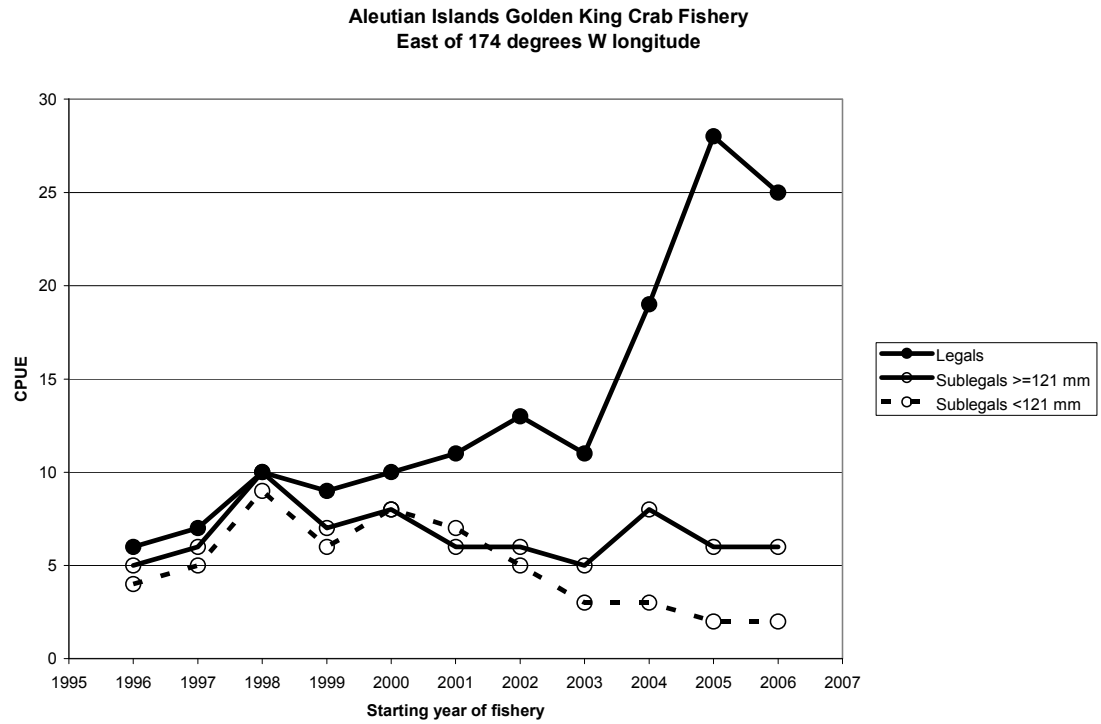
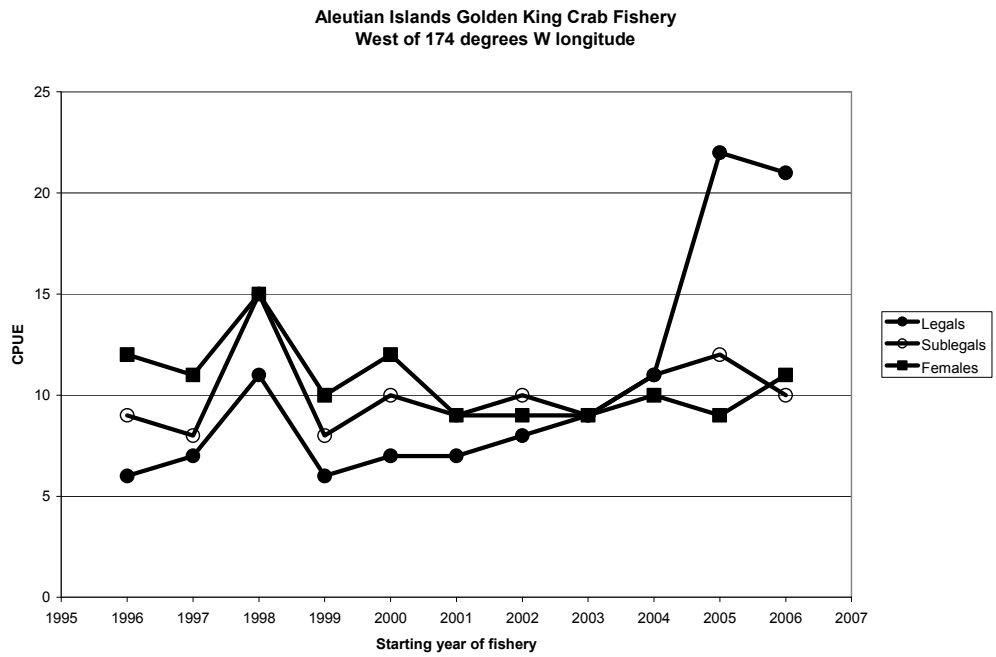




Figure 13. Catch per unit effort of legal males, sublegal males, and females (top panel) and of legal males, sublegal males ≥121 mm CL, and sublegal males <121 mm CL (bottom panel) in the Aleutian Islands golden king crab fishery east of 174º W longitude, 1996/97–2006/07 seasons, as estimated from contents of pots randomly sampled by observers.



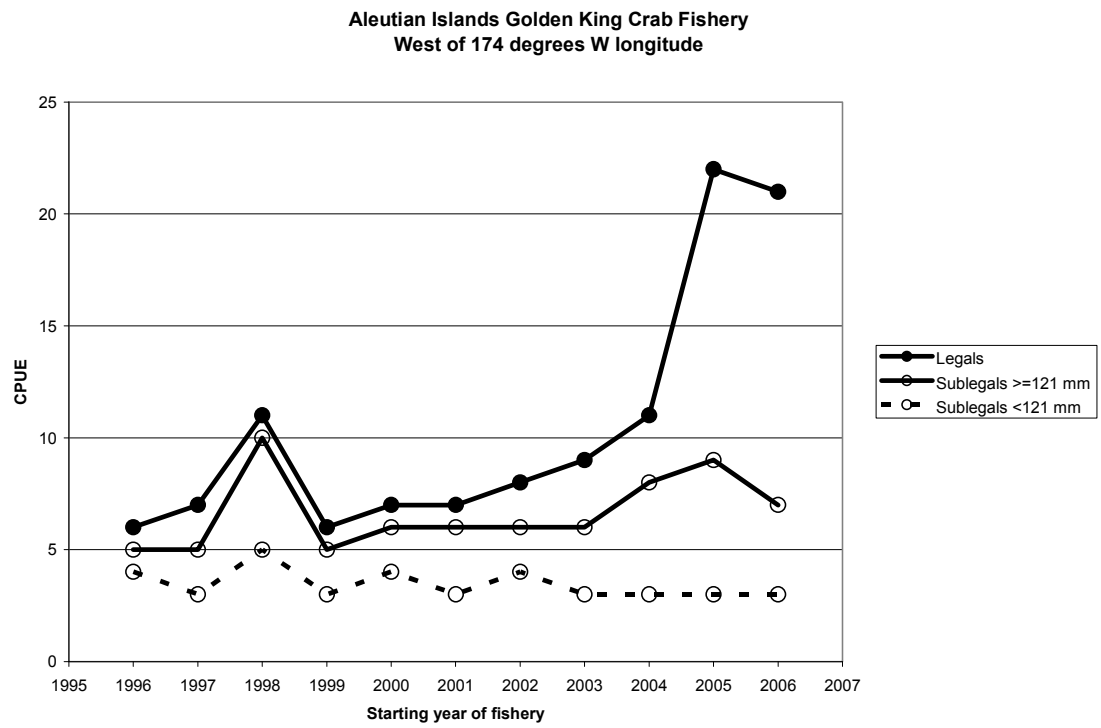




Figure 14. Catch per unit effort of legal males, sublegal males and females (top panel) and of legal males, sublegal males ≥121 mm CL, and sublegal males <121 mm CL (bottom panel) in the Aleutian Islands golden king crab fishery west of 174º W longitude, 1996/97–2006/07 seasons, as estimated from contents of pots randomly sampled by observers.

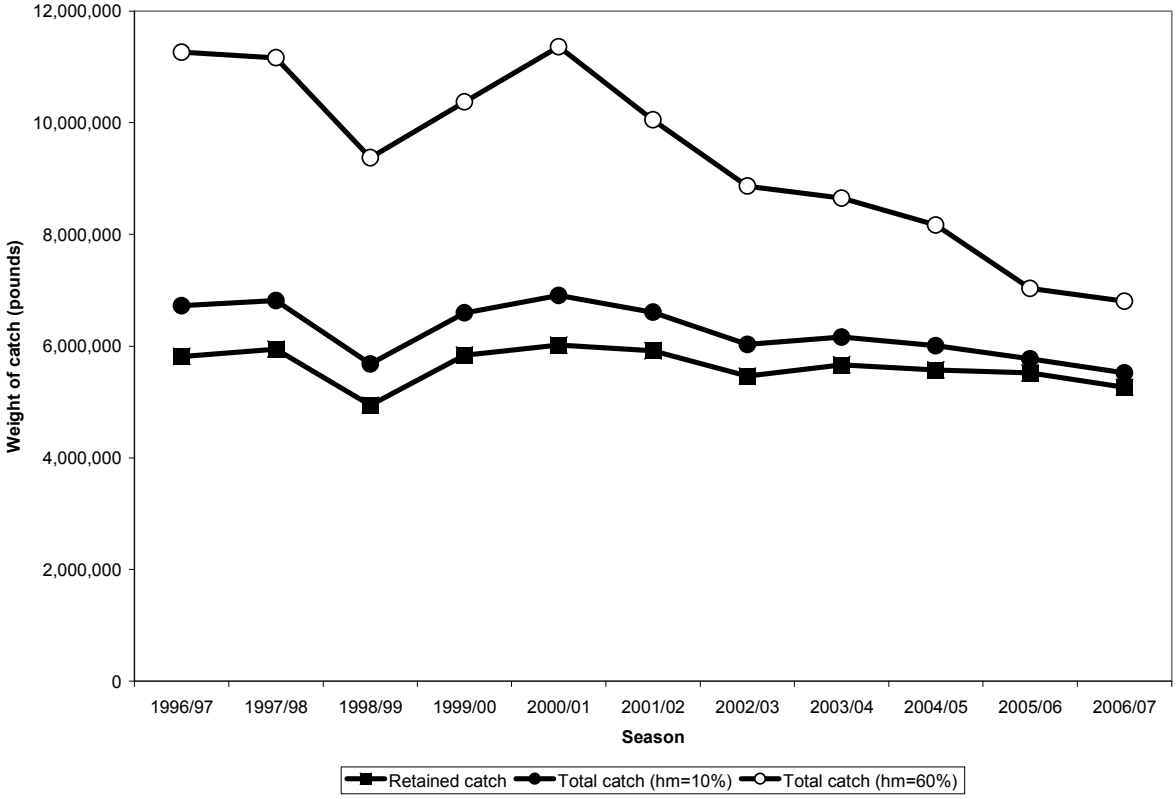
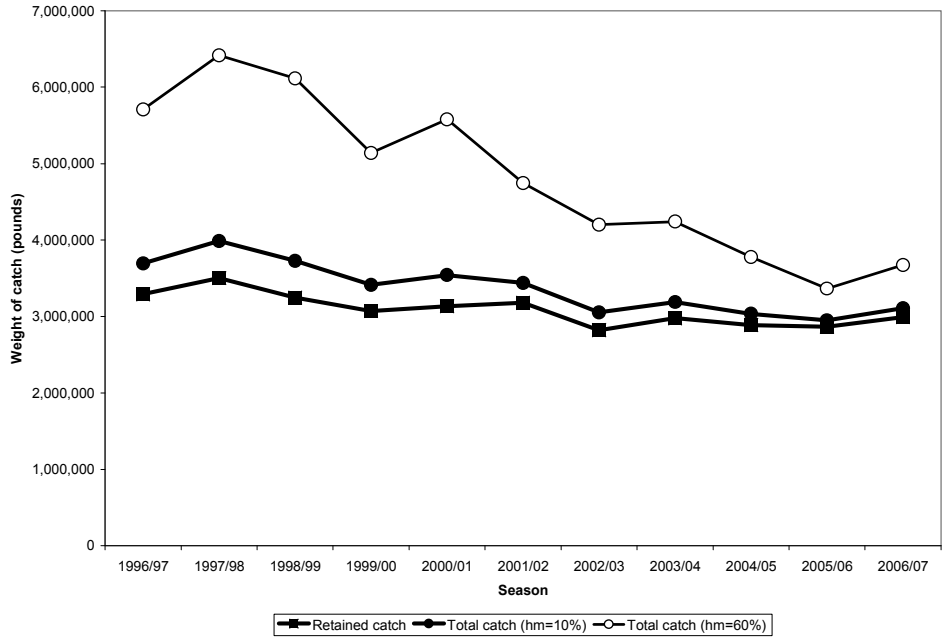



Figure 15. Annual retained catch (pounds) for the 1996/97–2006/07 Aleutian Islands golden king crab fishery compared to total catch (retained catch plus handling mortality of discarded bycatch, pounds) estimated by assuming handling mortality (*hm*) rates of *hm*=10% and *hm*=60%.



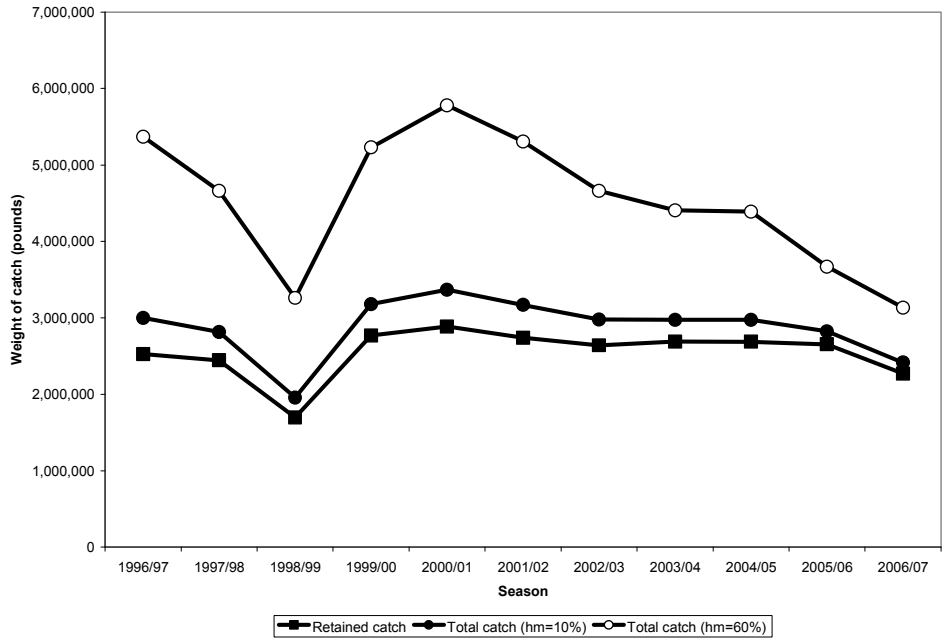




Figure 16. Annual retained catch (pounds) for the 1996/97–2006/07 Aleutian Islands golden king crab fishery in the area east of 174° W longitude (top panel) and in the area west of 174° W longitude (bottom panel) compared to total catch (retained catch plus handling mortality of discarded bycatch, pounds) estimated by assuming handling mortality (*hm*) rates of *hm*=10% and *hm*=60%.

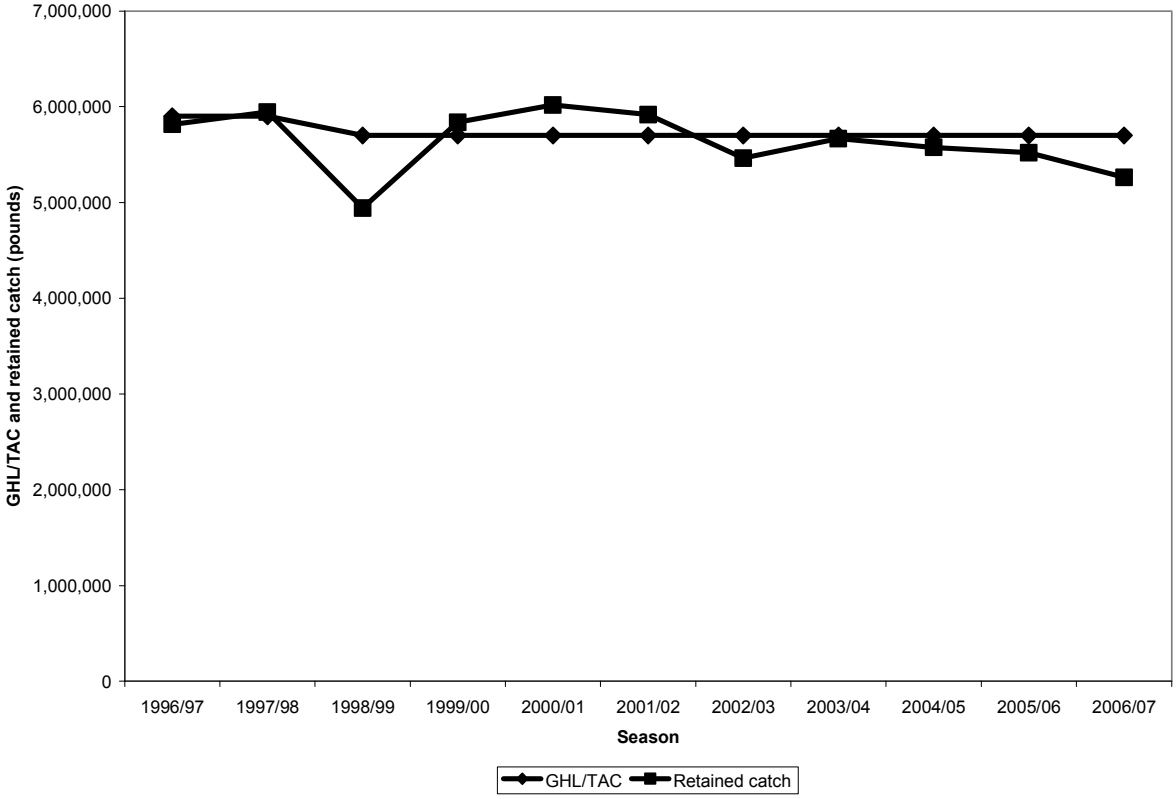
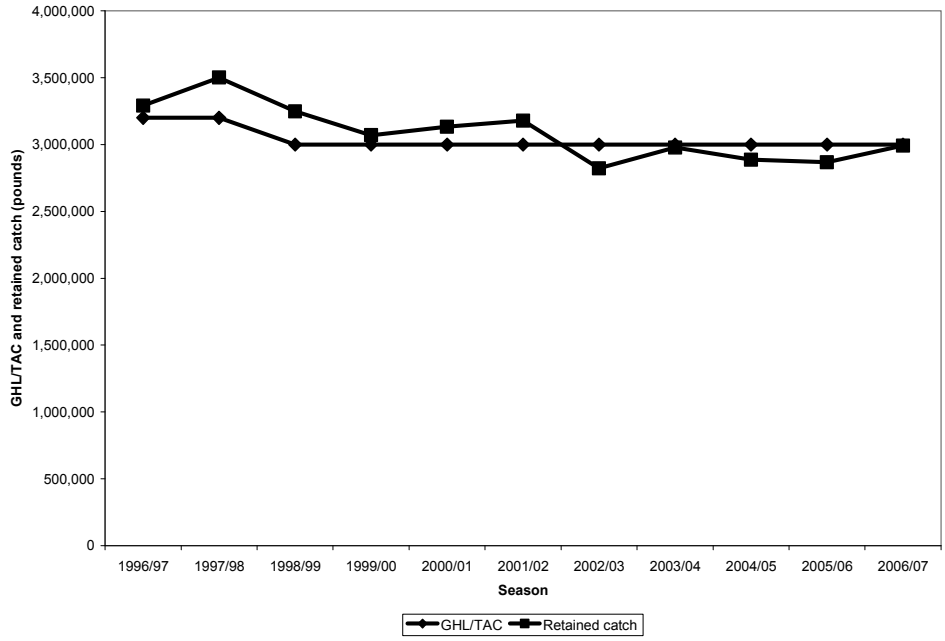



Figure 17. Pre-season GHL (in pounds for the 1996/97–2004/05 seasons) and TAC (in pounds for the 2005/06–2006/07 seasons) compared to the retained catch (pounds) during the 1996/97–2006/07 Aleutian Islands golden king crab fishery.



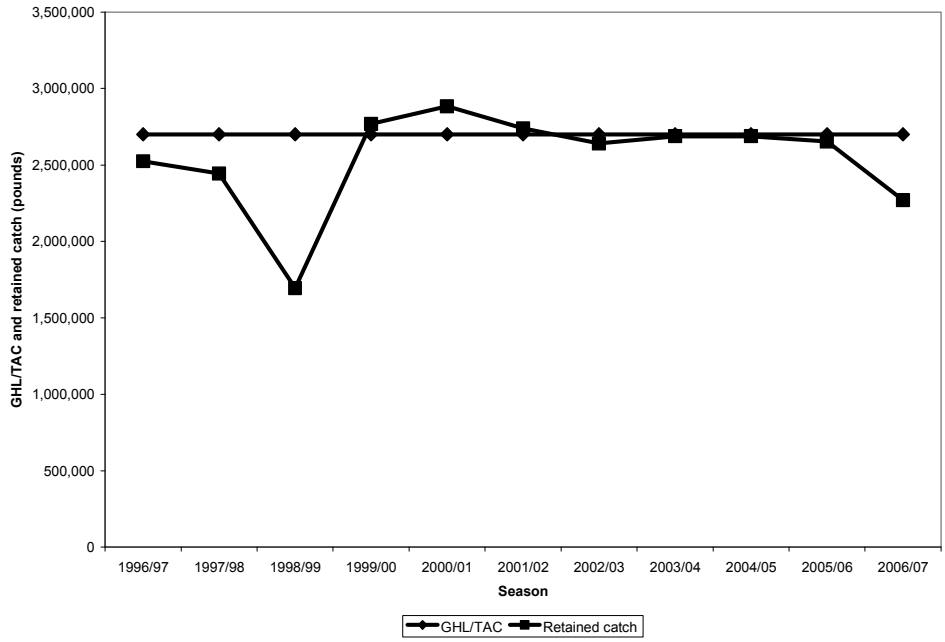




Figure 18. Pre-season GHL (in pounds for the 1996/97–2004/05 seasons) and TAC (in pounds for the 2005/06–2006/07 seasons) compared to the retained catch (pounds) during the 1996/97–2006/07 Aleutian Islands golden king crab fishery in the area east of 174° W longitude (top panel) and in the area west of 174° W longitude (bottom panel).