Stock Assessment and Fishery Evaluation Report
for the
KING AND TANNER CRAB FISHERIES
of the
Bering Sea and Aleutian Islands Regions

2004 Crab SAFE

Compiled by

The Plan Team for the King and Tanner Crab Fisheries
of the Bering Sea and Aleutian Islands

With Contributions by

F. Bowers, W. Donaldson, B. Failor-Rounds, A. Gilson,
K. Granath, J. Greenberg, G. Harrington, C. Lillo,
R. Otto, D. Pengilly, L. Rugolo, M.S.M. Siddeek,
J. Soong, B. Stevens, D. Stram, B. J. Turnock,
I. Vining, D. Witherell, and J. Zheng

September 2004

North Pacific Fishery Management Council
605 W. 4th Avenue, #306
Anchorage, AK 99501

Table of Contents

2004 Stock Assessment and Fishery Evaluation Report
King and Tanner Crab Fisheries in the
Bering Sea and Aleutian Islands

Executive Summary

The annual stock assessment and fishery evaluation (SAFE) report is a requirement of the North Pacific Fishery Management Council's *Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (FMP)*, and a federal requirement [50 CFR Section 602.12(e)]. The SAFE summarizes the current biological and economic status of fisheries, guideline harvest levels (GHL), and analytical information used for management decisions or changes in harvest strategies. The report is assembled by the Crab Plan Team with contributions from the State of Alaska, Department of Fish and Game (ADF&G) and the National Marine Fisheries Service (NMFS), and is available to the public and presented to the North Pacific Fishery Management Council (NPFMC) on an annual basis. Additional information on Bering Sea/Aleutian Islands (BSAI) king and Tanner crab is available on the NMFS web page at www.fakr.noaa.gov and the Alaska Department of Fish and Game (ADF&G) Westward Region web page at www.cf.adfg.state.ak.us/region4/rgn4home.htm.

Status of Annually Surveyed Crab Stocks

The FMP defines the minimum stock size threshold (MSST) and the maximum fishing mortality threshold (MFMT). These requirements are contained in the FMP and outlined in the following section, overfishing parameters. MSST is 50% of the mean total spawning biomass (SB = total biomass of mature males and females, also known as TMB = total mature biomass) for the period 1983-1997, upon which the maximum sustainable yield (MSY) was based. A stock is overfished if the SB is below MSST. MFMT is represented by the sustainable yield (SY) in a given year, which is the MSY rule applied to the current SB (the MSY control rule is $F = 0.2$ for king crabs, and $F = 0.3$ for Tanner and snow crabs). Overfishing occurs if the GHL exceeds the SY in one year. GHLs are developed from joint NMFS and ADF&G assessment of stock conditions based on harvest strategies developed by ADF&G. Figures 1-6 depict each crab stock's spawning biomass and catch history relative to overfishing.

Table 1. MSST, 2004 spawning biomass (SB), sustained yield (SY), and 2004/2005 guideline harvest levels (GHL) for BSAI king and Tanner crab stocks. Values are in millions of pounds.

Stock	MSST	2004 SB	2004 SY	2004/2005 GHL
Bristol Bay red king	44.8	176.4	35.3	15.4
Pribilof Islands red king	3.3	9.9	2.0	0.0
Pribilof Islands blue king	6.6	0.5	0.1	0.0
Saint Matthew blue king	11.0	7.3	1.5	0.0
EBS Tanner	94.8	86.8	26.0	0.0
EBS snow	460.8	343.7	103.1	20.9

In addition to the Federal requirements, survey results for five stocks (Pribilof District blue king crab, Saint Matthew Island Section blue king crab, Bristol Bay red king crab, eastern Bering Sea Tanner crab, and eastern Bering Sea snow crab) are compared to thresholds established in State of Alaska harvest strategies and regulations. ADF&G uses these thresholds to determine if a fishery should be opened and to calculate the GHL. Please refer to the attached report "Executive Summary: Status of King Crab Stocks in the Eastern Bering Sea in 2004" (Vining, et al 2004) for more detail on the population estimation methods for Bristol Bay red king crab, Pribilof District red and blue king crab, and Saint Matthew Island Section blue king crab.

Bering Sea Tanner crab (*Chionoecetes bairdi*):

The 2004 survey estimate of mature biomass decreased to 86.9 million pounds from the 2003 estimate of 100.8 million pounds. The 2002 estimate of 69.4 million pounds was essentially unchanged from the 2001 estimate of 67.7 million pounds. In 2003, this stock increased above the MSST (94.8 million pounds spawning biomass) for the first time in six years.

The fishery was closed in 1997 due to near-record low stock abundance in the 1997 NMFS survey and extremely poor performance in the 1996 fishery. The Council adopted a rebuilding plan for this stock in October 1999. NMFS approved the rebuilding plan in June 2000 (65 FR 38216). The fishery has been closed since 1999.

Based on the 2004 estimate of total mature biomass, the stock remains in "overfished" status for the seventh year since the 1998 overfished declaration. The total mature biomass estimate for 2004 is below MSST (86.8 million pounds) and down from the estimate for 2003 (100.8 million pounds), but it is the second highest estimate since 1997. Overall, estimates of total mature biomass have shown an increasing trend since the 1998 overfished declaration and the 2004 estimate is more than twice the estimate for 1998 (37.6 million pounds). However, the rate of increase in estimated total mature biomass since 1998 has been extremely slow relative to that seen when total mature biomass increased from 48.0 million pounds in 1985 to 249 million pounds in 1988. Given the 2004 survey data, this stock is not expected to be above the "rebuilt" level (MSY biomass, defined in the FMP as 189.6 million pounds of total mature biomass) in 2005.

The ADF&G estimate for Eastern Subdistrict mature female biomass declined from being just below the 21.0 million pound threshold in 2003 (20.8 million pounds) to 13.2 million pounds in 2004. Size frequency modes for females at 77.5 mm CW and 57.5 mm CW in 2003, which tracked well from 2001, disappeared or have greatly diminished in 2004. Abundance estimates of mature-sized females have shown only minor fluctuations in the Eastern Subdistrict since 1997 and remain depressed. The prolonged depressed level of mature-sized female abundance during the last eight years is in contrast with the rapid recovery from similarly depressed levels that was seen from the mid-1980s through the late-1980s. Abundance of juvenile-sized females (i.e., <80 mm CW) in 2004 was lower than the previous three surveys, except for in the <40 mm CW size class. There is no expectation for any appreciable increase in mature female EBS Tanner crab abundance or biomass in the next two years.

The area swept abundance estimates for mature-sized males in the Eastern Subdistrict have displayed a slight increasing trend from 1997 through 2004. The size frequency distribution for the Eastern Subdistrict in 2004 suggests the possibility for some increase in mature-sized male abundance next year. However, the estimated abundance of legal males has remained low since 1997, perhaps indicating that sublegal males are not molting into legal size. ADF&G estimated abundance of legal-sized males in Bristol Bay (Bering Sea waters east of 168° W longitude, south of 58° 39' N latitude and north of 54° 36' N latitude) in 2004 at 5.2 million crabs by the area swept method and at 3.2 million by the LBA method (the NMFS area swept estimate is 5.0 million crabs). Due to a preponderance of old-shell legal male crabs, ADF&G estimates the abundance of "exploitable legal males" (100% of new-shell legal males plus 32% of old-shell legal males) in Bristol Bay to be only 2.1 million crabs by the area-swept method and 1.7 million crabs by the LBA method. Both ADF&G and NMFS estimate the abundance of legal males in the Eastern Subdistrict west of 168° W longitude to be 0.3 million crabs.

Bering Sea snow crab (*Chionoecetes opilio*):

Snow crab spawning biomass in 2004 is estimated to be 343.7 million pounds using the area-swept method. This stock is below the MSST of 406.8 million pounds, with an estimated SB that is among the lowest on record. The SB estimated for 2004 increased 12% from the 2003 estimate of 306.2 million pounds. Estimated mature male biomass was 174.6 million pounds. Despite an increase in spawning biomass in 2004, this stock remains in a depressed condition and is unlikely to be above B_{MSY} in 2005; it is uncertain if thresholds will be met to allow a commercial fishery in 2006.

Size frequency distribution from the 2004 survey indicates a mode representing new-shell males centered at 40 mm CW indicating continued recruitment to this portion of the stock. However, similar signs of recruitment to the stock in the 2000 and 2001 proved ephemeral, disappearing in the 2002 survey. While this apparent recruitment is encouraging, modes of crabs in this size range have proven difficult to track through subsequent surveys. Although the area-swept estimate of total mature biomass in 2004 is higher than those for the mid-1980s, a size-based assessment model estimates the 2004 total mature biomass to be lower than in the mid-1980s and at the lowest level since 1978 (Turnock 2004; Appendix A, Table 2).

A size-based assessment model for EBS snow crab estimates that snow crab biomass was lower in the mid-1980s than is currently estimated, however the 2004 estimated biomass is near historic lows.

The estimated abundance of males greater than four inches in CW in 2004 (68 million crabs) has increased from the 2003 abundance level of 65 million crabs. The percentage of new-shell males greater than four inches in CW from the 2004 survey (approximately 67%) is comparable to the 2003 estimate of 70%.

The GHL of 20.9 million pounds for the 2005 season represents 6.1% of the estimated SB and 12.0% of the estimated mature male biomass in 2004. The 20.9 million pound harvest would corresponds to 23% of the estimated abundance of males greater than or equal to four inches CW, and 34% of the abundance of new-shell males greater than or equal to four inches CW. Under the state harvest strategy, the 2005 GHL was not constrained by the 58% cap on the harvest of exploitable legal males.

Bristol Bay red king crab (*Paralithodes camtschaticus*):

This stock was estimated to be above the stock threshold for a fishery opening. With ESB estimated as greater than 55.0 million pounds, a 15% exploitation rate on mature-sized males is used to determine the GHL. ADF&G estimated the average weight for legal crabs to be 6.44 pounds using the size distribution from this year's survey. That average weight was applied to 15% of the estimated abundance of mature-sized males (15.97 million; ADF&G LBA base model estimate) to compute the GHL. The 15% harvest rate on mature-sized males provides a harvest of 2.395 million legal males. A harvest of 2.395 million legal males would represent 23% of the estimated abundance of legal males (10.358 million animals; ADF&G LBA base model estimate).

Estimated total mature biomass in 2004 (176.4 million pounds) is essentially unchanged from the estimate from 2003 (178.1 million pounds); the 2004 estimate is nearly twice the MSY biomass currently defined in the FMP. The 2004 LBA base model estimates effective spawning biomass and legal male abundance to be at the highest since 1981 and abundance of mature-sized males and females to be at the highest since 1982. Mature-sized males and legal males in 2004 are estimated to be only slightly higher than the estimate for 2003, whereas abundance of mature-sized females is estimated to have increased to 35.35 million from 28.11 million in 2003.

Additional recruitment in 2005 to the mature-sized males can be expected from the size frequency distribution seen in the 2004 survey data. However, the mode that has contributed to recruitment to the mature-sized females in the 2003 and 2004 surveys appears close to fully recruited in 2004. Hence no significant increase in mature-sized females should be expected in 2005. The estimate for effective spawning biomass (ESB) in 2004 is only 12% above the threshold for applying the maximum 15% exploitation rate to mature-sized male abundance. So, it should be noted that only a slight decrease in estimated abundance and biomass of mature-sized females in 2005 could result in a reduction of the exploitation rate to 12.5% for computation of the 2005 GHL.

The male and female size-frequency distributions for 2004 show a mode of juvenile-sized crabs centered at approximately 67.5 mm CL. Size modes for crabs of that size do not always track into future surveys. However, if those juveniles do continue to track into future surveys, they would begin providing recruitment to the mature-sized females by 2006.

Pribilof District red king crab (*Paralithodes camtschaticus*):

No formal harvest strategy has been developed for this stock. The stock has been closed to fishing since 1999 due to imprecision of abundance estimates and concerns about bycatch of blue king crab. Concerns about possible effects to the Pribilof District blue king crab stock stem from the depressed condition of that stock; the Pribilof District blue king crab stock was declared overfished in 2002 and stock abundance estimates from this year's trawl survey data are the lowest on record. Past fishery and trawl survey data have indicated the potential for significant bycatch of blue king crab during a directed fishery on the Pribilof red king crab stock. Precision in the estimates for mature-sized and legal male red king crab males remains poor in 2004: plus-or-minus approximately 50% for the ADF&G CSA estimates and plus-or-minus 116% for the NMFS area-swept estimates. Results from a Pribilof red and blue king crab pot survey and a Pribilof red king crab test fishery conducted by ADF&G in September 2003 validate concerns about potential of bycatch on blue king crab and the poor precision of red king crab abundance estimates.

Although year-to-year comparisons are problematic due to poor precision of estimates, the time series of estimates indicates that the mature portion of this stock has been in decline since 2001. The 2004 survey provides no expectations for recruitment to the mature-sized or legal-sized males next year; hence mature abundance should be expected to decline through next year due to natural mortality. However, some males 40 mm to 75 mm CL were captured during the 2004 survey, providing an indicator of possible future recruitment.

Pribilof District blue king crab (*Paralithodes platypus*):

This stock is closed due to being below the threshold for a fishery opening. The stock remains in "overfished" condition for the third year in a row. Estimated total mature biomass decreased from 4.1 million pounds in 2003 to 0.5 million pounds in 2004 an abrupt drop to the lowest estimate on record. The 2004 total mature biomass estimate is 1/13th of MSST and 1/26th of the level that needs to be attained for two consecutive years for consideration of a fishery opening. Mature biomass has been in decline for the last 10 years and there is no evidence from this year's survey results that recruitment to the mature stock will occur in the near future.

In October 2004, the BOF adopted a new harvest strategy for blue king crabs in the Pribilof District. The harvest strategy requires that the spawning biomass estimate must exceed 13.2 million pounds for two consecutive years and that a minimum GHL threshold of 0.5 million pounds must be met prior to a fishery opening. The spawning biomass estimate for 2004 is 4.1 million pounds, thus the threshold was not met. The fishery has been closed since 1999 because the stock did not exceed the threshold level of abundance. Therefore, this population is declining in the absence of directed fishing pressure and in the absence of any bycatch during the Pribilof red king crab fishery; the Pribilof red king crab fishery has also remained closed since 1999. It is also worth noting that bycatch in trawl fisheries has not occurred due to the Pribilof trawl closure area. There is no evidence from this year's survey results that recruitment to the mature or legal male stock will occur in the near future.

<u>Saint Matthew Island Section blue king crab</u> (*Paralithodes platypus*):

The fishery has been closed since 1999 and will remain closed in 2004. This stock remains in "overfished" condition for the sixth year in a row since the "overfished declaration" of 1999. Estimated total mature biomass decreased from 12.8 million pounds in 2003 to 7.3 million pounds in 2004, but the reality of year-to-year fluctuations in estimated total mature biomass cannot be judged due to the low precision of the estimates. Total mature biomass would need to increase threefold to 22.0 million pounds from the 2004 estimate for the stock to be considered "rebuilt." Data from the 2004 survey do not provide any expectations for such an increase in the near-term future; the estimates from 1999 through 2004 indicate at best only a weakly increasing trend in total mature biomass. As in previous years, the stock is estimated to be above the threshold for a fishery opening, but with the GHL computed according to the fishery harvest strategy far below the minimum GHL of 2.5 million pounds.

<u>Crab Stocks With No Annual Survey</u>

Stock status for the following stocks are unknown due to a lack of survey data: Pribilof District golden king crab (*Lithodes aequispinus*); Saint Lawrence Island blue king crab; Northern District golden king crab; Aleutian Islands golden king crab; Western Aleutian Tanner crab (*C. bairdi*); Aleutian Islands (AI) scarlet king crab (*Lithodes couesi*); Bering Sea triangle Tanner crab (*Chionoecetes angulatus*); Eastern AI triangle Tanner crab; Eastern AI grooved Tanner crabs (*Chionoecetes tanneri*); Western AI grooved Tanner crabs and Bering Sea grooved Tanner crabs. The fisheries for the species identified in Table 3 occur under authority of an ADF&G commissioner's permit. Estimation of MSST for these stocks is not possible at this time because of insufficient data on the basic stock abundance.

Table 2. 2004/2005 Guideline harvest levels, fishery status, and MSY estimates for BSAI king and Tanner crab stocks that are surveyed on a limited basis.

Stock	GHL (millions of pounds)	Fishery/Season	MSY (millions of pounds)
WAI red king	Closed	10/25	1.5
EAI red king	Closed	Closed	NA
Norton Sound red king			0.5
Saint Lawrence blue king	None established	Permit	0.1
AI golden king	5.7	8/15	15.0
Pribilof golden king	0.15	Permit	0.3
Northern District golden king	0.01-0.02	Permit	0.3
AI scarlet king	Incidental harvest	Permit	NA
EBS scarlet king	Incidental harvest	Permit	NA
EAI Tanner	Stock status determ. pending	1/15	0.7
WAI Tanner	Closed	Closed	0.4
EAI triangle Tanner	Incidental harvest	Permit	1.0
EBS triangle Tanner	Incidental harvest	Permit	0.1
EAI grooved Tanner	0.05-0.2	Permit	1.8
EBS grooved Tanner	0.05-0.2	Permit	1.5
WAI grooved Tanner	Incidental harvest	Closed	0.2

NA: Indicates that insufficient data exists to generate an estimate.

Aleutian Islands red king crab: WAI (Adak or Petrel Bank) and EAI (Dutch Harbor). The GHL for the eastern portion is based on the results of surveys performed by ADF&G on a triennial basis; the most recent survey was performed in 2004. Few red king crabs have been caught in surveys of the eastern Aleutians since 1995. The eastern portion has been closed since 1983. Historically, the GHL for the western portion has been based on the most recent fishery performance. The western portion was closed for the 1996/97 and 1997/98 seasons due to poor performance and poor signs of recruitment during the 1995/96 season. The western portion was reopened for limited exploratory fishing in some areas in 1998/99. Based on the results of the 1998/99 season, the fishery in the western portion was closed in 1999/2000.

In 1999 the Crab Plan Team identified the need for standardized surveys in areas of historical production prior to reopening the fishery in the western portion; prior to that meeting, the western portion had not been surveyed since 1977. A cooperative ADF&G-Industry pot survey was performed in the Petrel Bank area under the provisions of a permit fishery in January-February and November of 2001. Results of those surveys showed high densities of legal crabs within limited portions of the surveyed area. Survey catches of females and prerecruit sized males were low. Based on results of the 2001 surveys and recommendations from ADF&G and the public, the Alaska Board of Fisheries adopted pot limits, and modified the season opening date.

A GHL of 0.5 million pounds was set for the 2002 season in the Petrel Bank area. Because only relative abundance information is available, ADF&G monitored the fishery utilizing inseason catch data. The management goal is to maintain a fishery CPUE of at least 10 legal crabs per pot lift. The 2002 fishery in the Petrel Bank area harvested 505,000 pounds. The fishery CPUE was 18 legal crabs per pot lift. Based on fishery performance, ADF&G announced a 0.5 million pound GHL for the 2003 fishery and the fleet harvested 479,000 pounds. The 2003 catch rate dropped to 10 legal crabs per pot lift. The 2004 Petrel Bank red king crab fishery will not open due to declining stock size. An additional pot survey is planned for 2006.

In order to assess red king crab in other portions of the western AI, during November 2002, a survey was conducted between 172° W longitude, and 179° W longitude (waters in the vicinity of Adak, Atka, and Amlia Islands). The survey of these waters yielded very few red king crabs and the area will remain closed until further notice.

Norton Sound red king crab: The Norton Sound red king crab legal male abundance is estimated from the triennial trawl survey and winter pot surveys. The 2004 estimated legal male biomass is 4.4 million pounds, an increase from the 2003 estimate of 3.1 million pounds of legal male crabs. This increase in abundance is the result of 16.9% increase in the abundance of recruit-sized crabs. The abundance of post-recruits remains low relative to historic levels. Recruitment is anticipated to remain strong in 2005, but may decrease in subsequent years. The Norton Sound crab fishery operates in the summer and in the winter. The legal male abundance remained in a range that allowed a harvest rate of 8% to be applied to the 2004 legal biomass estimate. The 2004 GHL was 353,000 pounds of which 26,500 pounds were allocated to the CDQ fishery.

Aleutian Islands golden king crab (Eastern Aleutian Islands and Western Aleutian Islands golden king crab stocks): A standardized triennial pot survey for golden king crab in a portion of the eastern Aleutian Islands (in the vicinity of Amukta, Chagulak, and Yunaska Islands) was initiated in 1997. Survey results and tag recovery data indicate that catch per unit effort (CPUE) of legal male crabs in the area surveyed has declined since 1997. Analysis of 1996-2003 golden king crab fishery performance and observer data from the entire area east of 174° W longitude indicate that the golden king crab stock has remained stable in that larger area, however ADF&G observer data indicates a continued decline since 2000, in the catch of sublegal male golden king crabs. The 2003-04 GHL for the Aleutian Islands has again been set at 5.7 million pounds, with 2.7 million pounds for the area west of 174° W longitude, and 3.0 million pounds for the area east of 174° W longitude.

Eastern Aleutian Islands Tanner crab: ADF&G surveys a portion of the eastern Aleutian Islands Tanner crab stock triennially. Improved trawl survey catches prompted ADF&G to conduct a pot survey of the Unalaska Bay, Makushin Bay, and Akutan Bay areas in 2003. Based on trawl survey data, ADF&G developed threshold levels of abundance to be met prior to a fishery opening and set 2004 GHLs of 47,219 pounds for Unalaska Bay and 87,891 pounds for Makushin Bay. ADF&G currently intends to survey the Unalaska Bay, Makushin Bay and Akutan Bay Tanner crab populations annually and a survey was conducted in August 2004, however a stock status determination has not yet been made for the 2005 fishery.

Overfishing Parameters

The FMP identifies the following overfishing definitions to provide objective and measurable criteria for identifying when the BSAI crab fisheries are overfished or overfishing is occurring, as required by the Magnuson-Stevens Fishery Conservation and Management Act. Table 3 provides the MSST, MSY, OY and maximum fishery mortality threshold (MFMT) control rule estimates for the BSAI king and Tanner crab stocks. The Crab Plan Team is currently studying revisions to the Overfishing Definitions.

Table 3. MSST, MSY, OY, and the MFMT values for BSAI king and Tanner crabs. Values in millions of pounds.

Stock	MSST	MSY	OY range	MFMT
WAI red king	NA	1.5	0-1.5	0.2
Bristol Bay red king	44.8	17.9	0-17.9	0.2
EAI red king	NA	NA	NA	0.2
Pribilof Islands red king	3.3	1.3	0-1.3	0.2
Norton Sound red king	NA	0.5	0-0.5	0.2
Pribilof Islands blue king	6.6	2.6	0-2.6	0.2
Saint Matthew blue king	11.0	4.4	0-4.4	0.2
Saint Lawrence blue king	NA	0.1	0-0.1	0.2
Aleutian Islands golden king	NA	15.0	0-15.0	0.2
Pribilof Islands golden king	NA	0.3	0-0.3	0.2
Northern District golden king	NA	0.3	0-0.3	0.2
Aleutian Islands scarlet king	NA	NA	NA	0.2
EBS scarlet king	NA	NA	NA	0.2
Total king crab		**43.9**	**0-43.9**	
Eastern Aleutian Tanner	NA	0.7	0-0.7	0.3
EBS Tanner	94.8	56.9	0-56.9	0.3
Western Aleutian Tanner	NA	0.4	0-0.4	0.3
Total Tanner		**58.0**	**0-58.0**	
EBS snow	460.8	276.5	0-276.5	0.3
Total snow		**276.5**	**0-276.5**	
Eastern Aleutian triangle Tanner	NA	1.0	0-1.0	0.3
EBS triangle Tanner	NA	0.3	0-0.3	0.3
Eastern Aleutian grooved Tanner	NA	1.8	0-1.8	0.3
EBS grooved Tanner	NA	1.5	0-1.5	0.3
Western Aleutian grooved Tanner	NA	0.2	0-0.2	0.3
Total other Tanner		**4.8**	**0-4.8**	

NA: Indicates that insufficient data exists to calculate value.

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY is estimated from the best information available. Proxy stocks are used for BSAI crab stocks where insufficient scientific data exists to estimate biological reference points and stock dynamics are inadequately understood. MSY for crab species is computed on the basis of the estimated biomass of the mature portion of the male and female population or total spawning biomass (SB) of a stock. A fraction of the *SB* is considered sustained yield (*SY*) for a given year and the average of the *SY*s over a suitable period of time is considered the MSY.

Overfishing and Overfished: The term "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. Overfishing is defined for king and Tanner crab stocks in the BSAI management area as any rate of fishing mortality in excess of the maximum fishing mortality threshold, F_{msy}, for a period of 1 year or more. Should the actual size of the stock in a given year fall below the minimum stock size threshold, the stock is considered overfished. If a stock or stock complex is considered overfished or if overfishing is occurring, the Secretary will notify the Council to take action to rebuild the stock or stock complex.

MSY control rule means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule for king and Tanner crabs is the mature biomass of a stock under prevailing environmental conditions, or proxy thereof, exploited at a fishing mortality rate equal to a conservative estimate of natural mortality. Sustainable yield (SY) in a given year is the MSY rule applied to the current spawning biomass. Overfishing occurs if the SY is exceeded for one year or more.

MSY stock size is the average size of the stock, measured in terms of mature biomass of a stock under prevailing environmental conditions, or a proxy thereof. It is the stock size that would be achieved under the MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required. For king and Tanner crab, the MSY stock size is the average mature biomass observed over the 15 year period from 1983 to 1997.

Maximum fishing mortality threshold (MFMT) is defined by the MSY control rule, and is expressed as the fishing mortality rate. The MSY fishing mortality rate $F_{msy} = M$, is a conservative natural mortality value set equal to 0.20 for all species of king crab, and 0.30 for all *Chionoecetes* species.

Minimum stock size threshold (MSST) is whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. The minimum stock size threshold is expressed in terms of mature biomass of a stock under prevailing environmental conditions, or a proxy thereof

Management Programs

Crab Rationalization Program

In January 2004, Congress amended section 313 of the Magnuson-Stevens Act through the Consolidated Appropriations Act of 2004 (Pub. L. No. 108-199, section 801), by adding paragraph (j). As amended, section 313(j)(1) requires the Secretary to approve by January 1, 2005, and implement thereafter, the Crab Rationalization Program as approved by the Council. The program is a limited access system that balances the interests of several groups with interests in these fisheries. The program addresses conservation and management issues associated with the current derby fishery and may reduce bycatch and associated discard mortality. The program also may increase the safety of crab fishermen by ending the race for fish. Share allocations to harvesters and processors, together with incentives to participate in fishery cooperatives, are designed to increase efficiencies, provide economic stability, and facilitate compensated reduction of excess capacities in the harvesting and processing sectors. The program was designed to protect community interests through Community Development Quota (CDQ) allocations and regional landing and processing requirements, as well as by several community protection measures.

NMFS is developing regulations to implement this program. Fishing under the program will begin August 2005.

Community Development Quota Crab Fisheries

The Magnuson-Stevens Act mandates that the Council and NMFS establish a Community Development Quota (CDQ) program under which a percentage of the total allowable catch for Bering Sea and Aleutian Island crab fisheries is allocated to the CDQ program (16 U.S.C. 1855 (i)(1)(A)). The Council and NMFS deferred management authority of the BSAI king and Tanner crab fisheries, including the CDQ fisheries, to the State, within the FMP framework. The FMP specifies three categories of management measures, which provide the framework for Federal/State management of the crab fisheries, including the determination of the GHLs and fishery seasons. Additionally, the FMP authorizes the State to allocate the crab CDQ reserve among CDQ groups and to manage crab harvesting activity of the BSAI CDQ groups (§8.1.4.2 of the FMP).

Sixty-five communities located along the Bering Sea are eligible for the CDQ program. These communities are aligned into six CDQ groups: Aleutian Pribilof Island Community Development Association (APICDA), Bristol Bay Economic Development Corporation (BBEDC), Central Bering Sea Fishermen's Association (CBSFA), Coastal Villages Regional Fund (CVRF), Norton Sound Economic Development Corporation (NSEDC), and Yukon Delta Fisheries Development Association (YDFDA). The CDQ reserve is 7.5% of the GHL for the following Bering Sea fisheries: Bristol Bay red king crab, Pribilof District red and blue king crab, Norton Sound red king crab, Saint Matthew Island Section blue king crab, Bering Sea snow crab, and Bering Sea Tanner crab. ADF&G divides the 7.5% reserve among the six CDQ groups.

Table 4. 2003-2005 CDQ percent allocation by group.

Fishery	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Bristol Bay red king	17	19	10	18	18	18
Pribilof Islands king	0	0	100	0	0	0
Saint Matthew blue king	50	12	0	12	14	12
Norton Sound red king	0	0	0	0	50	50
EBS Tanner	10	19	19	17	18	17
EBS snow	8	20	20	17	18	17

Table 5. 2004/2005 CDQ reserve by fishery.

Fishery	CDQ reserve
Bristol Bay red king	1.2 million pounds
Pribilof Islands king	Closed
Saint Matthew blue king	Closed
Norton Sound red king	0.026 million pounds
EBS Tanner	Closed
EBS snow	1.6 million pounds

License Limitation Program

Fishing under the crab license limitation program (LLP) began in January 2000. The goal of the LLP is to limit access to the crab fisheries to the historic participants or to persons who purchase licenses from historic participants. Owners of vessels must posses a valid LLP license in order to participate in the BSAI crab fisheries. NMFS issued licenses based on fishing history during a general qualifying period, with area/species endorsements based on additional qualifying periods for each species by area, and a recent qualifying period. Licenses also limit the size of the vessel deployed under the license. Interim licenses were also issued to any applicant that had a valid moratorium qualification for crab in 1999. Interim licenses are temporary and the total numbers of licenses will change as the interim licenses are either approved or denied. Interim licenses are issued if any part of a person's claim is contested. Also, the number of licenses may change as a result of a small number of new licenses issued from late-filed claims.

Table 6. BSAI crab License Limitation Program number of licenses issued as of May 2003.

Fishery	Licenses	Interim	Total
Bristol Bay red king	250	52	302
Saint Matthew blue king	165	34	199
Pribilof Islands king	110	26	136
Aleutian Islands golden king	27	11	38
Aleutian Islands red king	26	11	37
EBS Tanner	254	54	308
Norton Sound king	60	3	63

American Fisheries Act Crab Sideboards

In 1998, Congress passed the American Fisheries Act (AFA) to establish a new allocation program for the BSAI pollock fishery. The AFA placed harvest restrictions (commonly known as "sideboards") on the pollock fishers who received exclusive harvesting privileges under the AFA to protect the interests of fishers not directly benefited by the AFA.

Under regulations implementing the AFA, an AFA qualified vessel is ineligible to participate in any BSAI crab fishery unless that specific vessel participated in a specific crab fishery during certain qualifying years. AFA vessel permits may be endorsed for the Bristol Bay red king crab, EBS snow crab, EBS Tanner crab, Saint Matthew Island Section blue king crab, Pribilof District king crab, Aleutian Islands red king crab, and Aleutian Islands golden king crab fisheries. To participate in a BSAI crab fishery, the operator of an AFA vessel must posses a valid LLP endorsement for that crab fishery as well as an AFA vessel permit containing an endorsement for that crab fishery. The qualifying years and participation requirements for AFA vessels to participate in the crab fisheries are as follows:

Table 7. Participation requirements for AFA catcher vessels to determine eligibility to harvest crab species. An AFA vessel must have participated in the directed crab fishery during the participating years listed in order to be eligible to participate in that fishery in the future.

Fishery	Qualifying years
Bristol Bay red king	Made landings of BSAI king or Tanner crab species in 1996, 1997, or on or before February 7, 1998
Saint Matthew blue king	1995, 1996, or 1997
Pribilof Islands king	1995, 1996, or 1997
Aleutian Islands golden king	1997/1998 and 1998/1999
Aleutian Islands red king	1995/1996 and 1998/1999
EBS snow	Made a landing in each of four or more years from 1988 to 1997
EBS Tanner	1995 or 1996

In addition to the historic participation requirements, there is a cap on the amount of Bristol Bay red king crab and EBS Tanner crab that the AFA vessels may harvest. The Bristol Bay red king crab harvest cap is based on the aggregate five year (1991-1997, excluding 1994-1995) weighted average share. Under this cap, AFA vessels may harvest up to 10.96% of the general fishery GHL, which equals 1.564 million pounds for the 2004 fishery. The amount of the harvest cap may change if the number of AFA vessels with Bristol Bay red king crab endorsements changes. An aggregate harvest cap will be established for EBS Tanner crabs once the stock rebuilds. This harvest cap will be based on the aggregate historic catch of the endorsed EBS Tanner crab vessels for 1995-1996. Management and implementation of these crab harvest cap sideboards is deferred to the State of Alaska.

Table 8. Number of AFA qualified vessels eligible to harvest BSAI crabs and 2004 AFA harvest caps by fishery.

Fishery	Number of AFA qualified vessels	2004 Harvest cap
Bristol Bay red king	41	1.56 million pounds
Saint Matthew blue king	1	0.0 million pounds
Pribilof Islands king	2	0.0 million pounds
Aleutian Islands golden king	0	0.0 million pounds
Aleutian Islands red king	0	0.0 million pounds
EBS snow crab	6	0.0 million pounds
EBS Tanner crab	28	0.0 million pounds

Capacity Reduction Program

Pursuant to Section 144(d) of Public Law 106-554 (section 144), as amended by Public Law 107-20, NMFS is in the process of implementing a capacity reduction program for the BSAI crab fisheries, excluding Norton Sound. NMFS published the proposed rule on December 12, 2002 (67 FR 76329) and the final rule on December 12, 2003 (68 FR 69331). Section 144 mandates a specific capacity reduction program. The objective of the program is to permanently remove harvesting capacity from the BSAI crab fisheries by permanently reducing the number of crab LLP licenses issued vessel owners. The action is necessary because the BSAI crab fisheries are over capitalized. The program will: 1) prevent certain crab vessels from fishing again anywhere in the world; 2) revoke the crab LLP licenses based on the vessels' fishing history; 3) revoke any NMFS issued non-crab licenses that the vessels' owners hold; and, 4) revoke the vessels' fishing histories upon which NMFS based the licenses to be revoked.

Summary Tables of GHLs and Actual Harvests

Table 1. Combined general and CDQ fishery harvest and guideline harvest levels for major Bering Sea/Aleutian Islands king and Tanner crab fisheries during the 2003/2004 seasons.

Fishery	GHL[a]	Harvest[a]
Aleutian Islands red king crab (Petrel Bank, 2003)	0.5	0.48
Aleutian Islands golden king crab (2003/2004)	5.7	5.67
Bering Sea snow crab (2003)[b]	26.3	28.46
Bering Sea snow crab (2004)[c]	20.8	23.94
Bering Sea Tanner crab (2003)	Fishery Closed	0
Bristol Bay red king crab (2003)	15.7	15.70
Pribilof Islands red king crab (2003)	Fishery Closed	0
Pribilof Islands blue king crab (2003)	Fishery Closed	0
Saint Matthew Island blue king crab (2003)	Fishery Closed	0

[a] In millions of pounds.
[b] 2002/2003 season.
[c] 2003/2004 season.

Table 2. Western Aleutian Islands red king crab fishery harvest (thousands of pounds) relative to guideline harvest level (GHL; thousands of pounds), 1993/94 season to 2003/2004 season.

Season	GHL	Harvest
1993/94	None	698.1
1994/95	None	197.0
1995/96	None	38.9
1996/97	Fishery closed	
1997/98	Fishery closed	
1998/99	15.0	5.9
1999/00	Fishery closed	
2000/01	Fishery closed	
2001/02	Fishery closed	
2002/03	500.0[a]	505.6[a]
2003/04	500.0[a]	479.1[a]

[a] Petrel Bank only.

Table 3. Aleutian Islands golden king crab fishery harvest (millions of pounds) relative to guideline harvest level (GHL; millions of pounds), 1993/94 season to 2003/2004 season.

Season	GHL	Harvest
1993/94	None	5.55
1994/95	None	8.13
1995/96	None	6.89
1996/97	5.9	5.85
1997/98	5.9	5.95
1998/99	5.7	4.94
1999/00	5.7	5.84
2000/01	5.7	6.02
2001/02	5.7	5.89
2002/03	5.7	5.46
2003/04	5.7	5.67

Table 4. Eastern Bering Sea snow crab fishery harvest relative to harvest strategy target and guideline harvest level (GHL), 1994-2004.

Fishery Year	Harvest Strategy Target[a]	Actual[b]	Mature Male Biomass[c]	GHL[d]	Harvest[e]
1994	N/A[f]	36.3%	412.3	105.8	149.8
1995	N/A[f]	22.6%	332.9	55.7	75.3
1996	N/A[f]	13.9%	474.0	50.7	65.7
1997	N/A[f]	17.2%	694.4	117.0	119.5
1998	N/A[f]	34.6%	729.7	234.8	252.2
1999	N/A[f]	38.3%	502.6	195.9	192.3
2000	N/A[g]	16.9%	197.1	28.6	33.3
2001	14.7%	13.8%	182.8	27.3	25.3
2002	10.2%	10.6%	308.6	31.0	32.7
2003	11.5%	12.7%	224.9	25.8	28.5
2004	11.4%	13.1%	183.2	20.8	23.9

[a] Harvest strategy in effect since 2001 targets a percentage of the preseason survey estimate of mature male biomass.
[b] Actual harvest as a percentage of the preseason survey estimate of mature male biomass.
[c] Preseason estimate of mature male biomass provided by NMFS (millions of pounds).
[d] GHL established preseason (millions of pounds).
[e] Actual harvest (millions of pounds).
[f] GHL established as 58% percentage of males >101-mm carapace width.
[g] GHL established as 22% percentage of males >101-mm carapace width.

Table 5. Bristol Bay red king crab fishery harvest relative to harvest strategy target and guideline harvest level (GHL), 1993-2003.

Fishery Year	Harvest Strategy Target[a]	Actual[b]	Number of males >119 mm CL[c]	Number Harvested[d]	GHL[e]	Harvest[f]
1993	20%	23.0%	9.85	2.26	16.8	14.6
1994	Fishery Closed		8.49	0.00	0	0
1995	Fishery Closed		9.37	0.00	0	0
1996	10%	12.1%	10.34	1.25	5.0	8.4
1997	10%	11.2%	11.78	1.32	7.0	8.8
1998	15%	14.3%	15.00	2.14	16.3	14.8
1999	10%	11.5%	15.74	1.81	10.7	11.7
2000	10%	8.9%	13.13	1.17	8.4	8.2
2001	10%	9.8%	12.15	1.20	7.2	8.4
2002	10%	9.8%	14.11	1.38	9.3	9.6
2003	15%	14.3%	16.37	2.34	15.7	15.7

[a] Harvest strategy targets 20% of abundance of males >119-mm carapace length (CL) as estimated from preseason survey.

[b] Actual number of legal males harvested as percentage of preseason estimated abundance of males >119-mm carapace length (CL).

[c] Estimated abundance of males >119-mm carapace length (CL) from preseason survey (millions of animals). From Vining and Zheng (2004).

[d] Millions of animals.

[e] GHL established preseason (millions of pounds).

[f] Actual harvest (millions of pounds).

Table 6. Pribilof king crab fishery harvest relative to guideline harvest level (GHL), 1993-2003.

		Harvest[a]		
Fishery Year	GHL[a]	Red King	Blue King	Total
1993	3.4[b]	2.61	0.00	2.61
1994	2[b]	1.34	0.00	1.34
1995	2.5[c]	0.87	1.27	2.14
1996	1.8[c]	0.20	0.94	1.14
1997	1.5[c]	0.76	0.51	1.27
1998	1.25[c]	0.51	0.52	1.03
1999		Fishery closed		
2000		Fishery closed		
2001		Fishery closed		
2002		Fishery closed		
2003		Fishery closed		

[a] Millions of pounds.

[b] GHL established only for red king crab; closed to blue king crab.

[c] GHL estbalished for combined red and blue king crab.

Table 7. St. Matthew blue king crab fishery harvest relative to harvest strategy target and guideline harvest level (GHL), 1993-2003.

Fishery Year	Harvest Strategy Target[a]	Actual[b]	Number of males >104 mm CL[c]	Number Harvested[d]	GHL[e]	Harvest[f]
1993	20%	16%	3.98	0.63	4.4	3.00
1994	20%	20%	4.11	0.83	3.0	3.76
1995	20%	17%	3.99	0.67	2.4	3.17
1996	20%	15%	4.38	0.66	4.3	3.08
1997	20%	20%	4.70	0.94	5.0	4.65
1998	20%	15%	4.13	0.63	4.0	2.87
1999	Fishery closed		1.01	0	0	0
2000	Fishery closed		1.21	0	0	0
2001	Fishery closed		1.34	0	0	0
2002	Fishery closed		1.47	0	0	0
2003	Fishery closed		1.33	0	0	0

[a] Harvest strategy in effect for 1993-1998 seasons targeted 20% of abundance of males >104-mm carapace length (CL) as estimated from preseason survey.

[b] Actual number of legal males harvested as percentage of preseason estimated abundance of males >104-mm carapace length (CL).

[c] Estimated abundance of males >104-mm carapace length (CL) from preseason survey (millions of animals). From Vining and Zheng (2004).

[d] Millions of animals.

[e] GHL established preseason (millions of pounds).

[f] Actual harvest (millions of pounds).

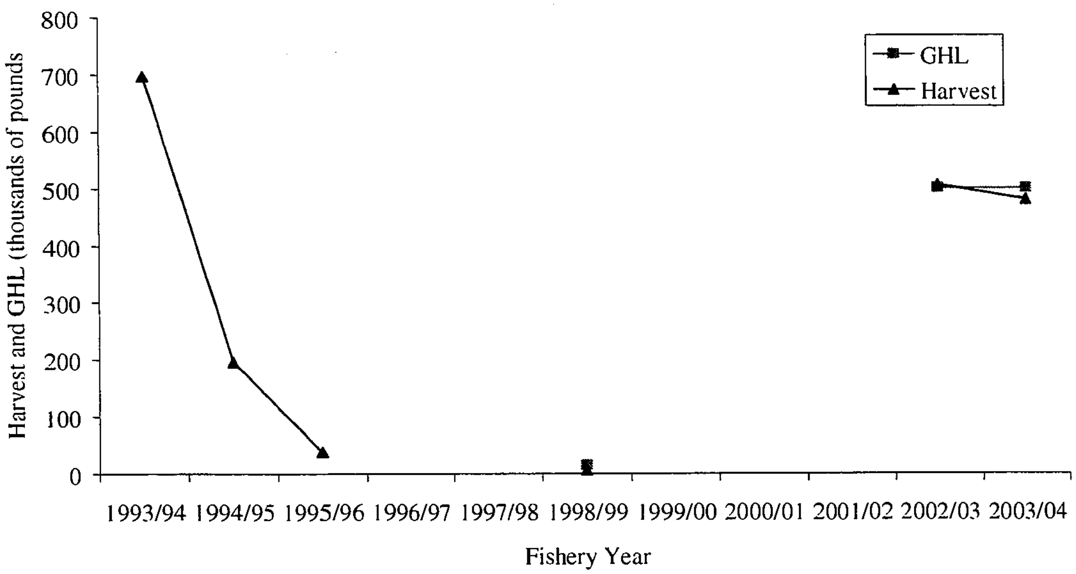


Figure 1. Western Aleutian Islands commercial red king crab fishery harvest and guideline harvest levels (GHLs), 1993/94-2003/04 (See Table 2).

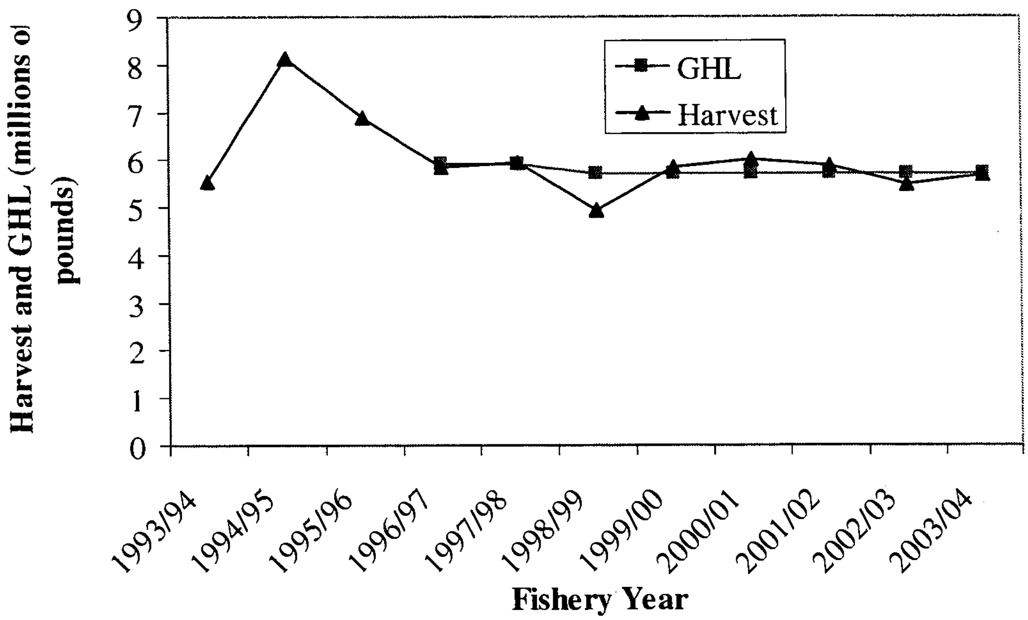


Figure 2. Aleutian Islands commercial golden king crab fishery harvest and guideline harvest levels (GHLs), 1993/94-2003/04 (see Table 3).

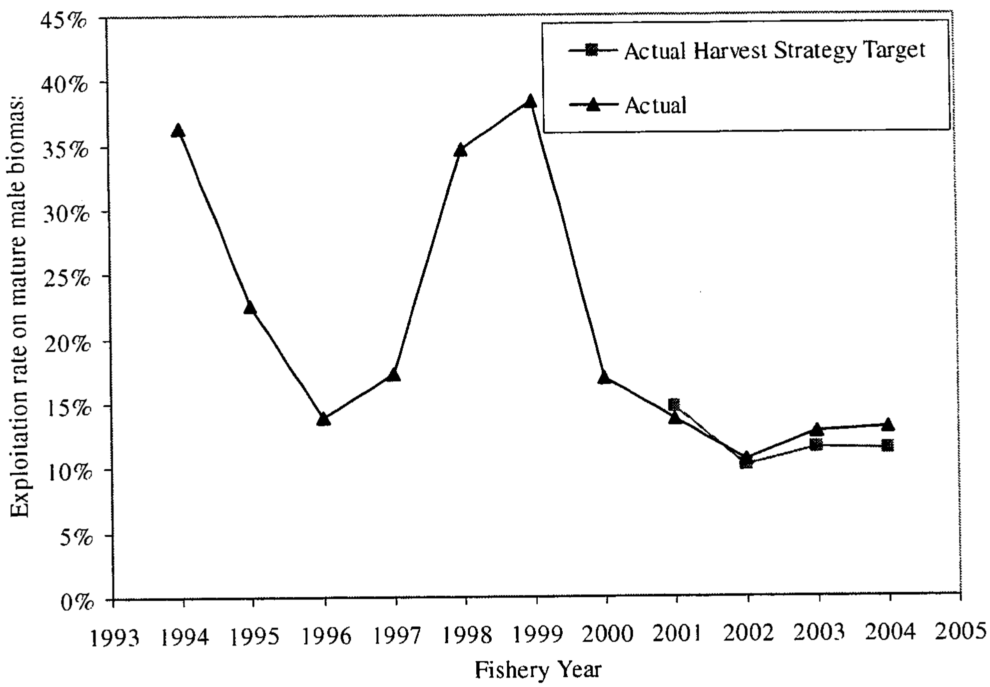


Figure 3. Comparison of harvest strategy specified and actual exploitation rates on mature male biomass in the Bering Sea commercial snow crab fishery, 1994-2004 (see Table 4).

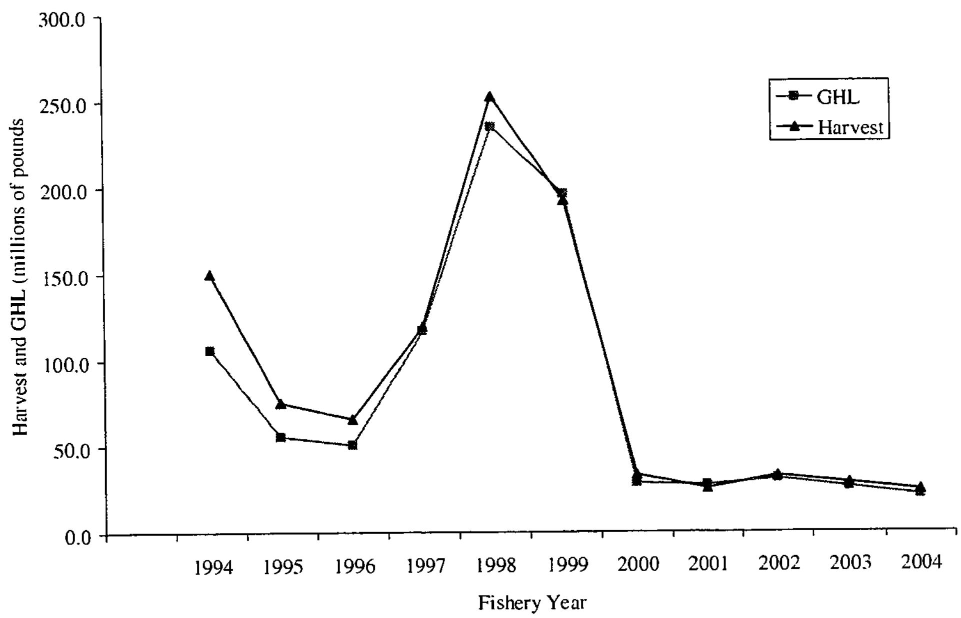


Figure 4. Bering Sea commercial snow crab general and CDQ fishery harvest and guideline harvest levels (GHLs), 1994-2004 (see Table 4).

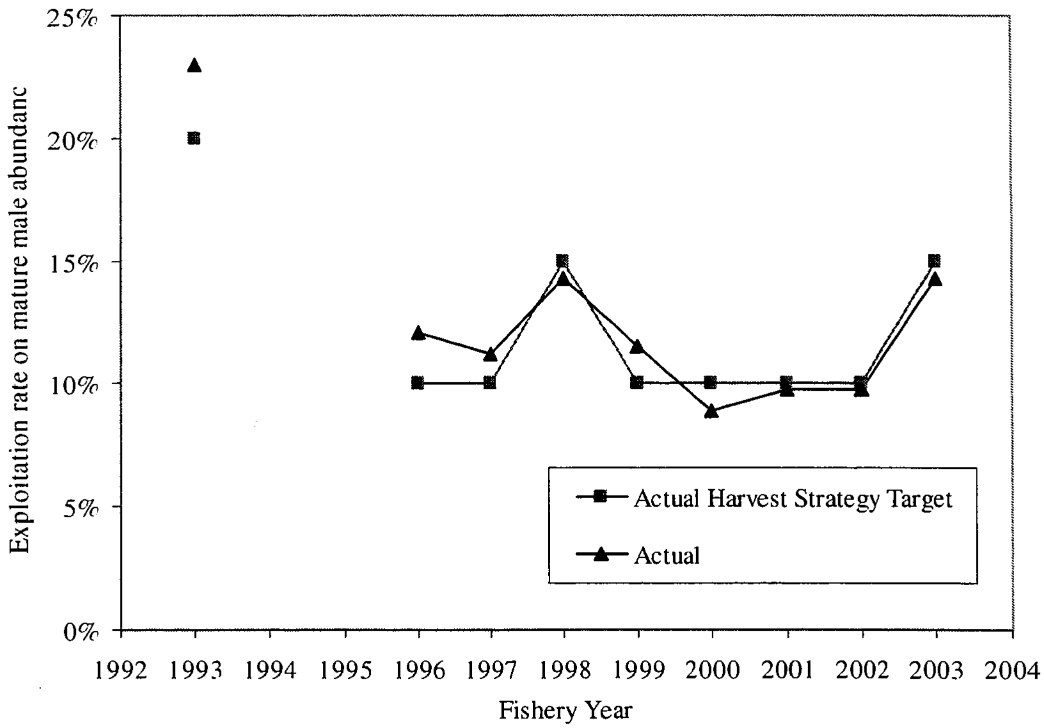


Figure 5. Comparison of harvest strategy specified and actual exploitation rates on males > 119-mm carapace length in the Bristol Bay red king crab commercial fishery, 1993-2003 (see Table 5).

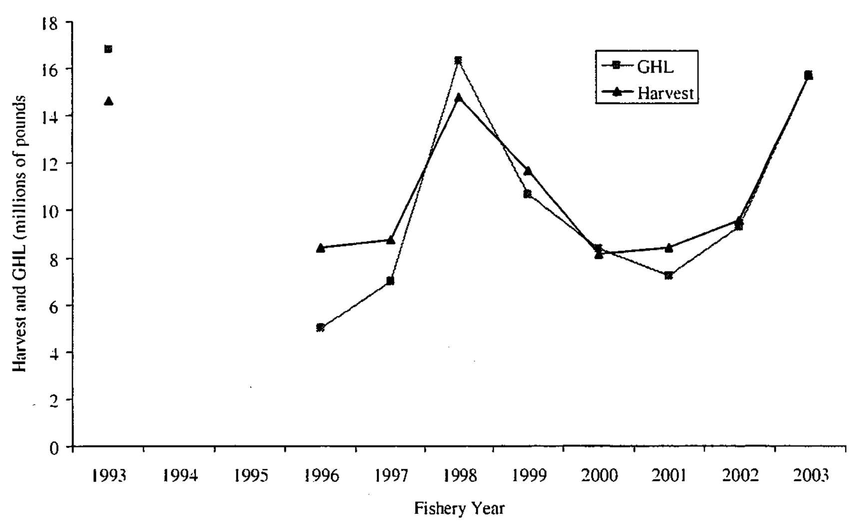


Figure 6. Bristol Bay commercial red king crab general and CDQ fishery harvest and guideline harvest levels, 1993-2003 (see Table 5).

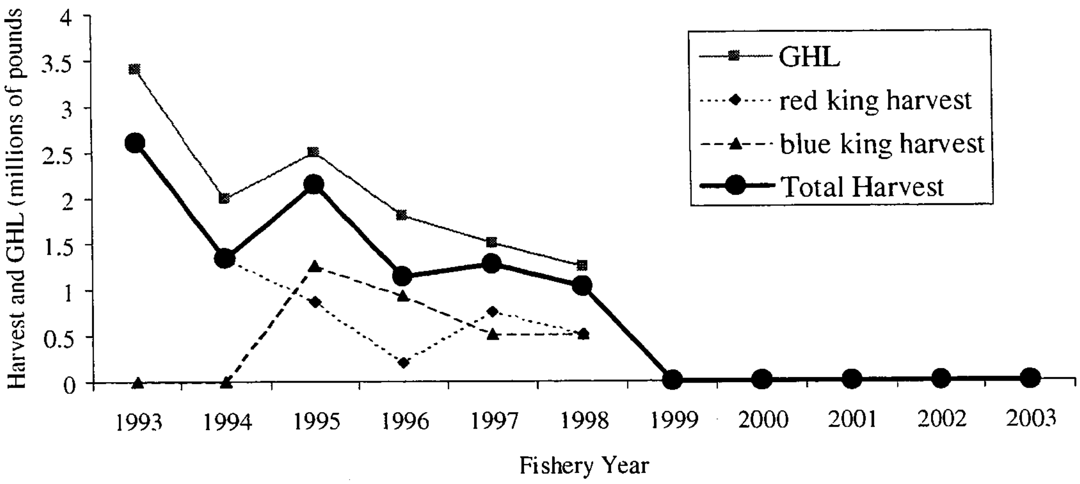


Figure 7. Pribilof District commercial red and blue king crab harvest and guideline harvest levels (GHLs), 1993-2003 (see Table 6).

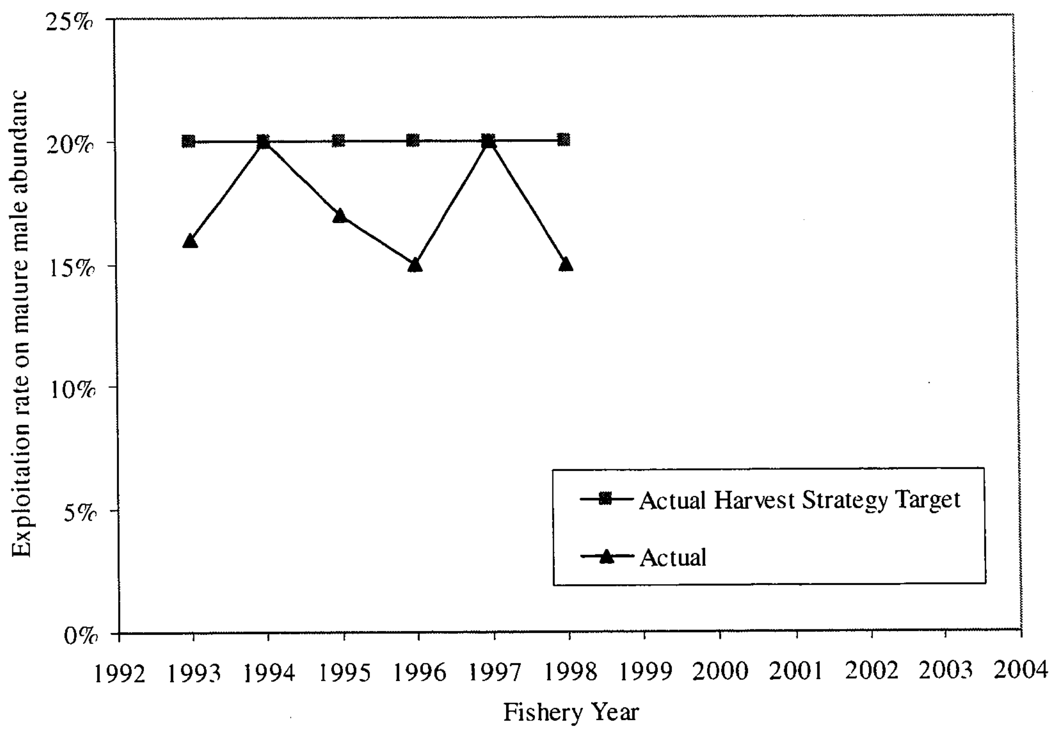


Figure 8. Comparison of harvest strategy specified and actual exploitation rates on mature-sized males (>104-mm carapace length) in the Saint Matthew Island Section commercial blue king crab fishery, 1993-2003 (see Table 7).

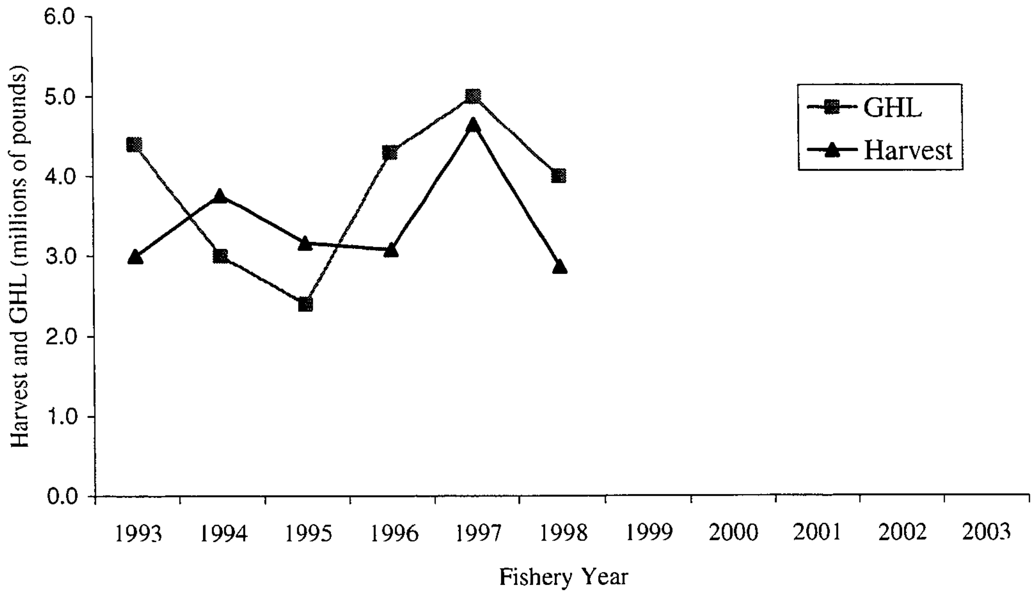


Figure 9. Saint Matthew Island Section commercial blue king crab harvest and guideline harvest levels (GHL), 1993-2003 (see Table 7).

RESULTS OF THE 2004 NMFS BERING SEA CRAB SURVEY
EXECUTIVE SUMMARY

This document summarizes data to be presented in the Report to Industry on the 2004 Eastern Bering Sea Trawl Survey. Numbers presented are trawl survey indices of population level and do not necessarily represent absolute abundance.

In 2004 we have had technical problems with the program that estimates distance fished and consequently area fished for the trawl. Estimates presented below are based on position data at the beginning and end of each tow (i.e., straight-line, point to point distance), although we would prefer to use an estimate of distance fished that is based on the path of the trawl over the bottom. From past years' data distances between the point to point and curved path estimates of distance fished are expected to be on the order of one percent. Estimates given below are the latest available and frequently are slightly lower (1-2%) than those used previously to set harvest levels. For this reason these estimates may not exactly match those given elsewhere in the SAFE report.

This year's survey was augmented by 75 tows that were funded by industry under a memorandum of understanding between the NMFS and the Bering Sea Fisheries Research Foundation. Data from these additional tows are still being analyzed and are not included in the estimates below. The estimates below are based on the same vessels and areas as were used in 2003. Data from the additional 75 tows will be presented in the final version of the Report to Industry.

For further information, contact Dr. Lou Rugolo, or Dr. Robert Otto, NMFS, P.O. Box 1638, Kodiak, AK 99615. Phone (907) 841-1700. GHLs (Guideline Harvest Levels) are for the combined open-access and CDQ fisheries. This draft reflects data analysis and management decision making through September 23, 2004

Red king crab (*Paralithodes camtschaticus*) Bristol Bay.

Legal males:	12.6 million crabs; 3% increase.
Pre-recruits:	10.1 million crabs; 11% increase.
Large females:	48.8 million crabs; 9% increase.
Synopsis:	Abundance legal males and pre-recruit males was stable. Abundance of mature females increased slightly but should be considered stable considering the usual imprecision of stock abundance estimates Almost all newshell females carried new eggs. Reproductive population estimates are well above the minimum stock size threshold (MSST), the stock is not considered to be in the overfished level of abundance although it remains far below the peak population levels of the 1970's
GHL:	15.4 million pounds (7,000 metric tons, t). Fishery opens October 15, 2004.

Red king crab (*Paralithodes camtschaticus*) Pribilof District.

Legal males: 0.9 million crabs; 62% decrease, low reliability.

Pre-recruits: 0.0 million crabs; 100% decrease, low reliability.

Large females: 0.6 million crabs; 54 % decrease, low reliability.

Outlook: Crabs are highly concentrated, and indices have very low precision. Reproductive population estimates are above the MSST, the stock is not considered to be in the overfished level of abundance. No future recruitment is apparent. Red king crabs in the Pribilof Islands have been historically harvested along with blue king crabs and are currently the dominant of the two species. There are concerns as to the low reliability of estimates and that unacceptable levels of blue king crab incidental catch could occur in a red king crab fishery.

GHL: Fishery will not open in 2004.

Pribilof Islands blue king crab (*P. platypus*) Pribilof District.

Legal males: <0.05 million crabs; 92 % decrease.

Pre-recruits: 0.1 million crabs; 77 % decrease

Large females: 0.1 million crabs; 92% decrease.

Outlook: Population is low and trends are not easily detectable. Little or no recruitment is apparent. Lowest total population estimates on record. Reproductive population estimate, which fell below the MSST in 2002 and 2003, remains so in 2004. The stock is considered to be in the overfished level of abundance.

GHL: Fishery will not open in 2004.

St. Matthew blue king crab (*P. platypus*) Northern District.

Legal males: 0.7 million crabs; 11% increase, no real change.

Pre-recruits: 0.2 million crabs; 33% decrease, no real change.

Large females: 0.2 million crabs; 71% decrease. Not well estimated.

Outlook: Indices are affected by the portion of the stock occupying untrawlable grounds. Population has declined steeply in 1999 and fell below the MSST. Reproductive population estimates continued to be below the MSST through 2002, but rose just above MSST in 2003 only to fall below again in 2004. The stock continues to be in the overfished level of abundance. The picture is clouded by large uncertainty in female abundance. The abundance of mature males was below the threshold for opening the fishery.

GHL: Fishery will not open in 2004.

Tanner crab (*Chionoecetes bairdi*) Eastern District.

Legal males: 5.3 million crabs; 28% decrease.

Pre-recruits: 30.8 million crabs; 25% increase.

Large females: 10.7 million crabs; 29% decrease.

Outlook: Some population indices increasing but estimates are uncertain. Reproductive population estimate was below the MSST from 1997-2002 and just barely above it in 2003, but again fell below MSST in 2004. The mature female biomass is well below the threshold value of 21 million pounds required to open a fishery.

GHL: Fishery will not open in 2004.

Snow crab (*C. opilio*) All districts combined.

Large males: 67.2 million crabs; 2% decrease.

Pre-recruits: 106.0 million crabs; 3.6% decrease.

Large females: 805.9 million crabs; 32% increase.

Outlook: Large males stable but pre-recruit males continue to decline. Large females increased and apparently there has been some recruitment at the lower end of the size range. Spawning biomass was approximately stable as declining male abundance was partially offset by the increased female abundance index. Lack of recruitment to female reproductive stock over several years is still evidenced by high frequencies of old shelled crab, especially at the largest sizes and despite the increase in overall abundance. There is some concern as to relatively high frequencies of females without eggs in the old shell group and that high harvest levels in small areas may be leading to lack of reproductive success in nearby concentrations of females. Reproductive population estimates that slightly exceeded MSST in 2001 were well below the MSST in 2002, 2003 and 2004. The stock is considered to be in the overfished level of abundance but is above 50% MSST. Under the current rebuilding plan and harvest strategy the fishery would be closed if the stock fell below 50% MSST.

GHL: 20.9 million pounds (9,500 t). Fishery is currently scheduled to open January 15, 2005.

History Relative to Overfishing for the surveyed stocks:

Eastern Bering Sea Tanner Crab

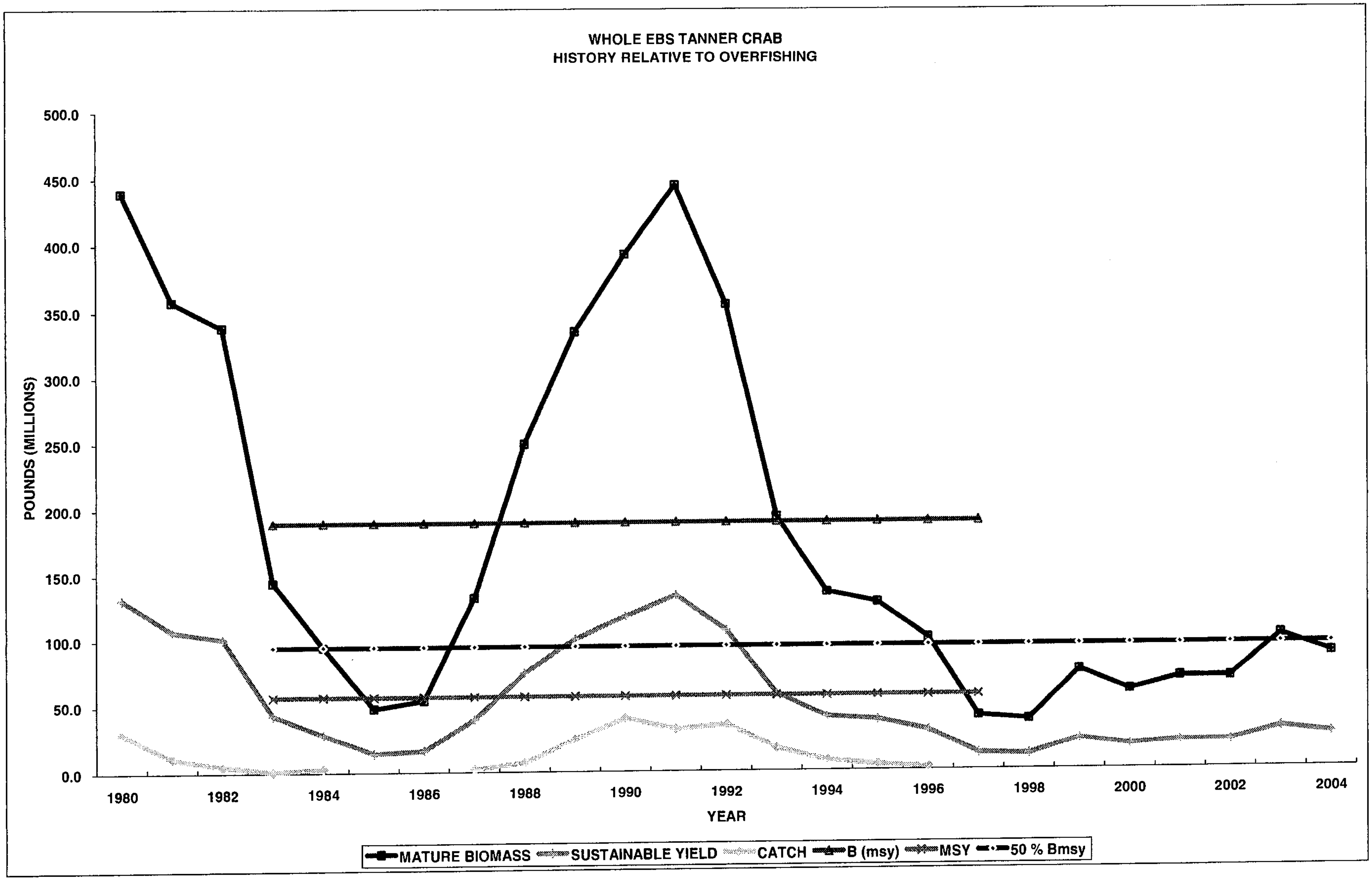
Eastern Bering Sea Snow Crab

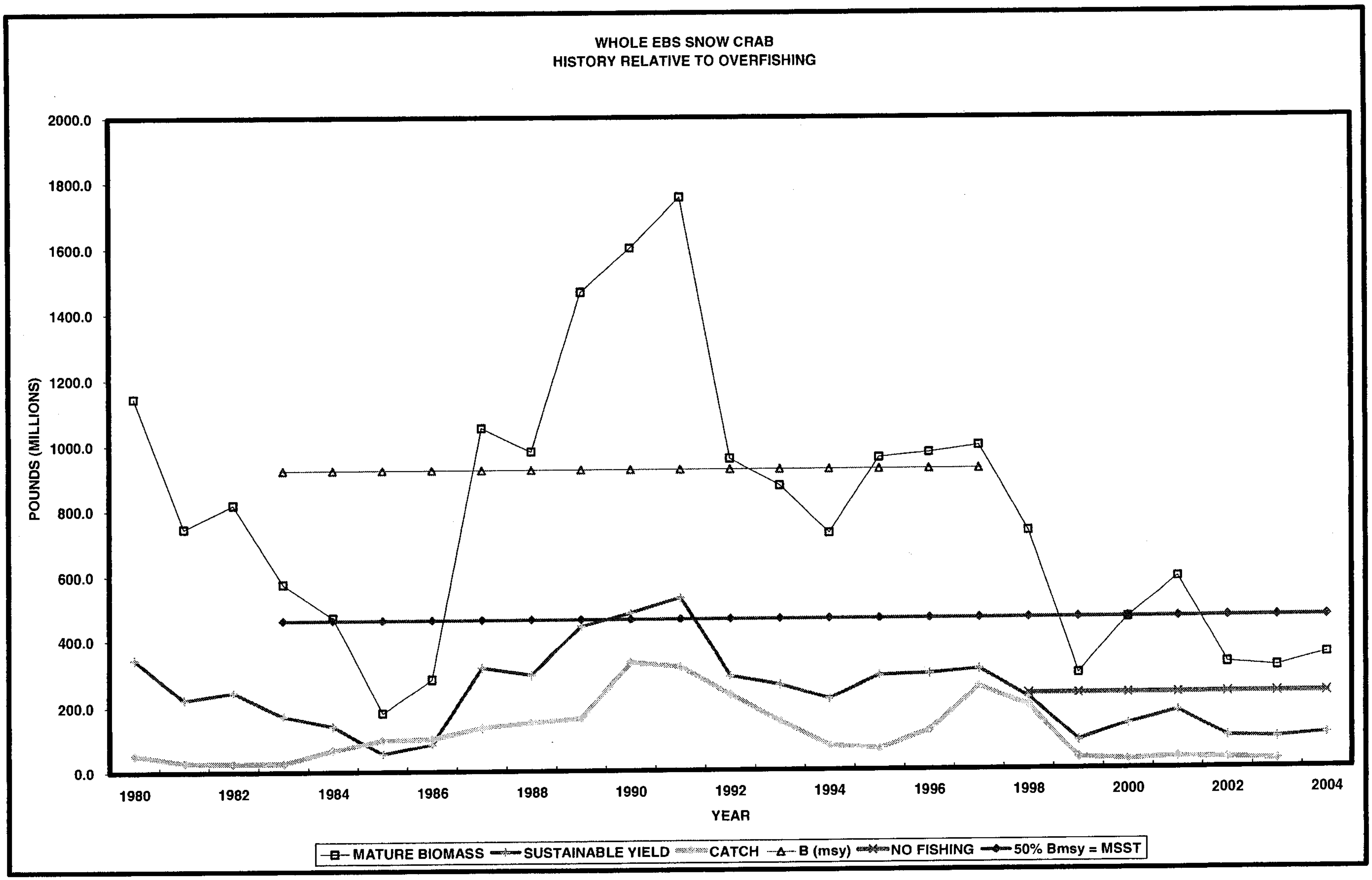
Bristol Bay Red King Crab

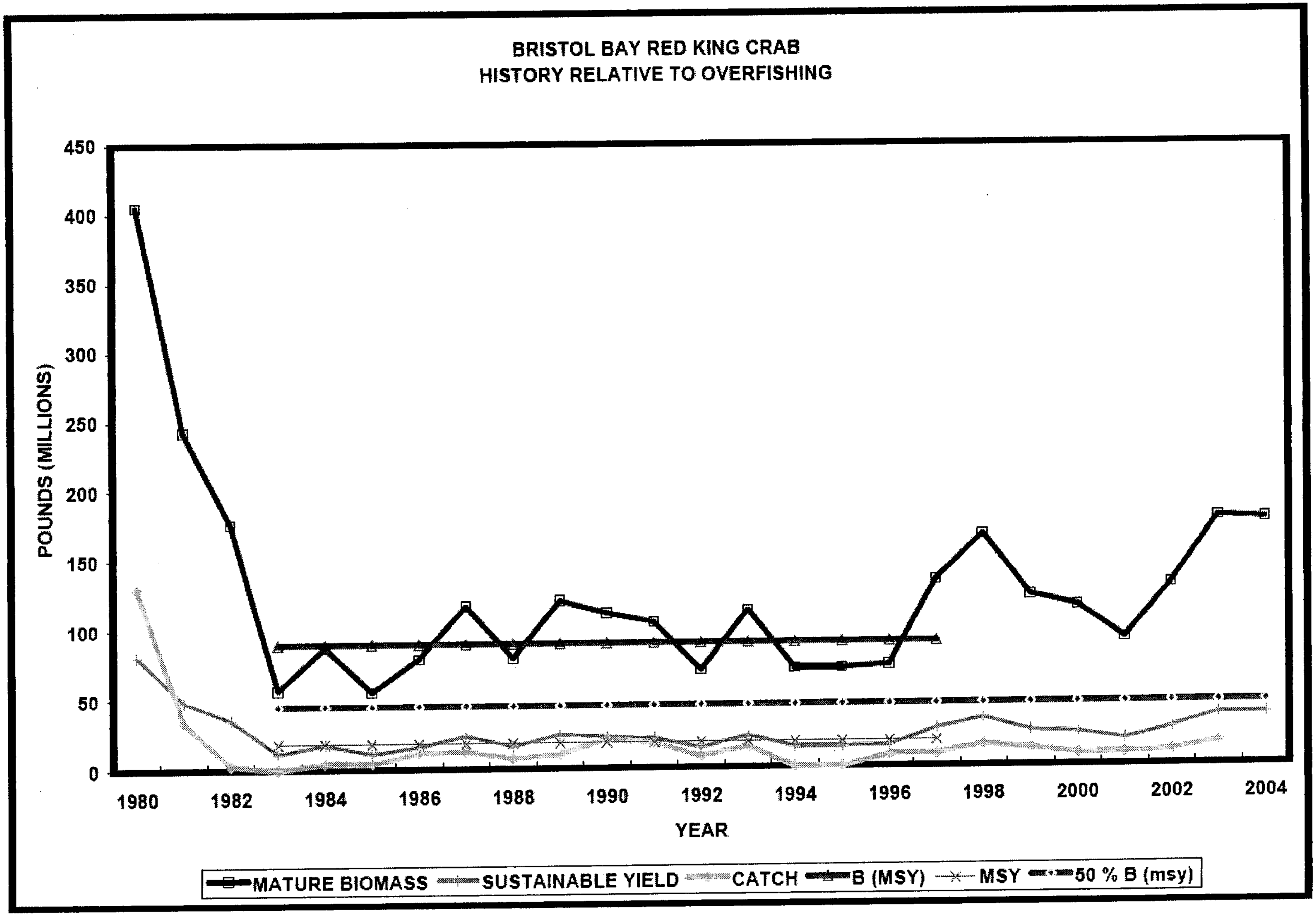
Pribilof Islands Red King Crab

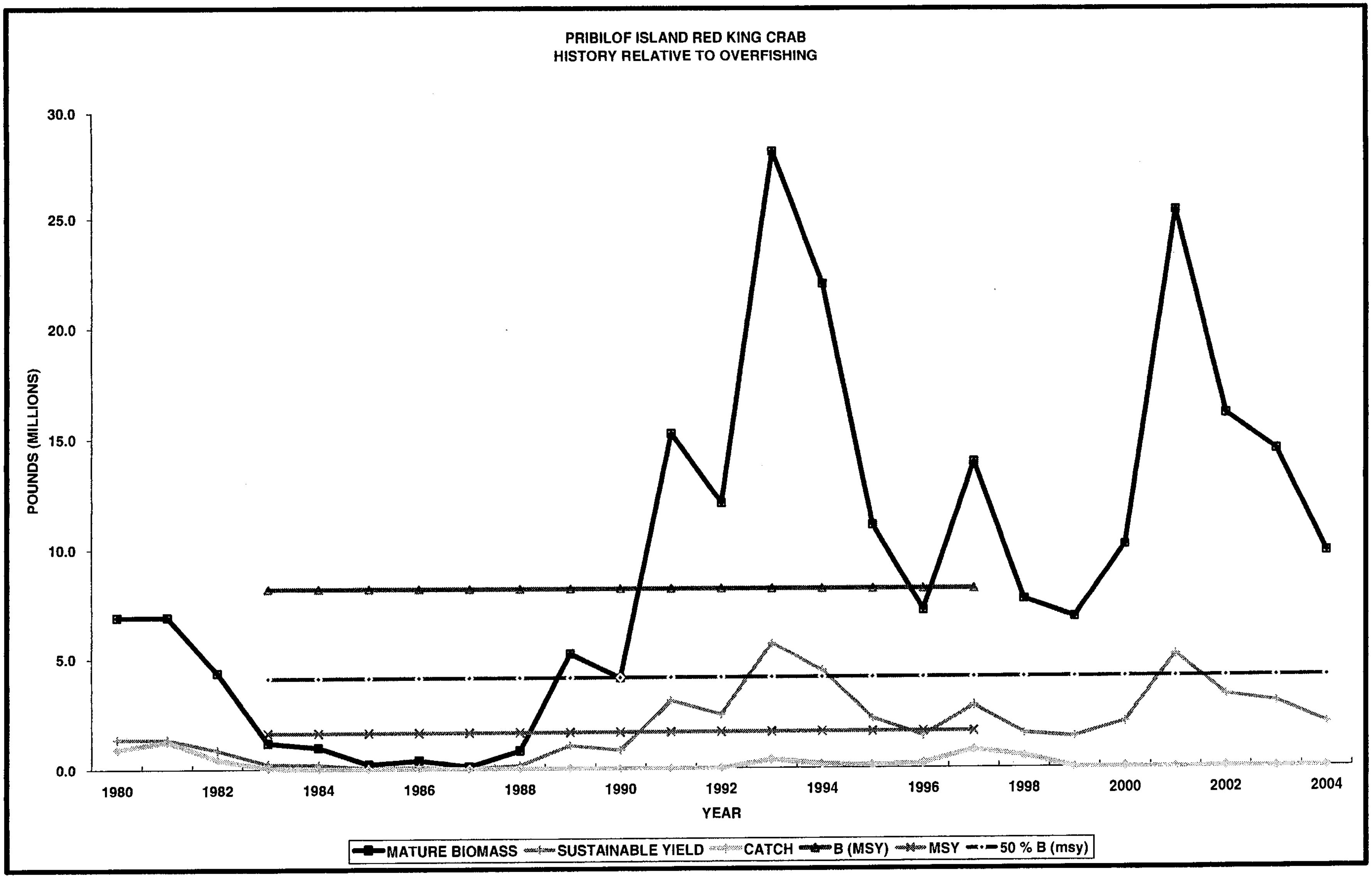
Pribilof Islands Blue King Crab

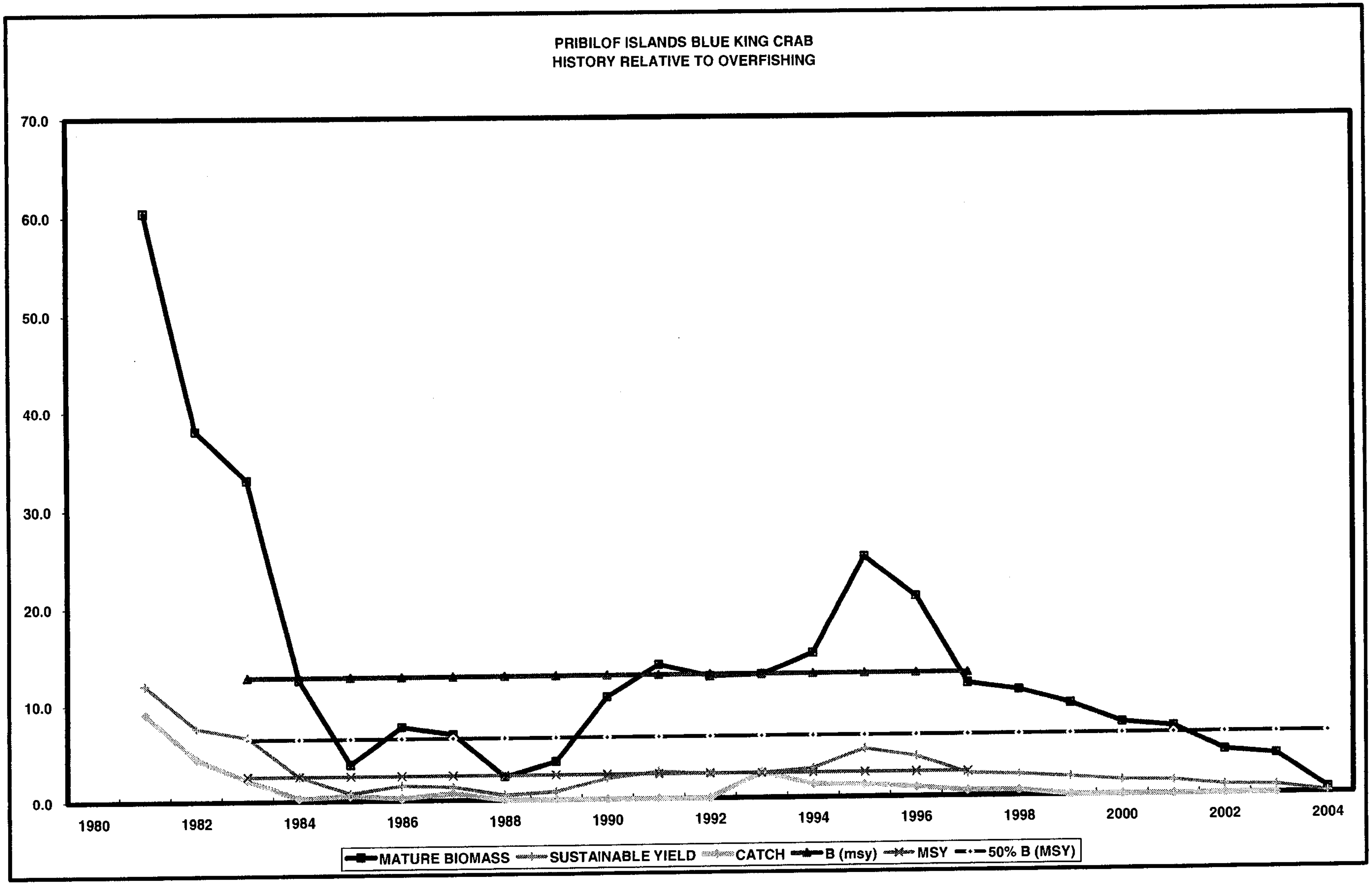
St. Matthew Blue King Crab


WHOLE EBS TANNER CRAB
HISTORY RELATIVE TO OVERFISHING
POUNDS (MILLIONS)
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
YEAR
MATURE BIOMASS
SUSTAINABLE YIELD
CATCH
B (msy)
MSY
50 % Bmsy


WHOLE EBS SNOW CRAB
HISTORY RELATIVE TO OVERFISHING
POUNDS (MILLIONS)
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
YEAR
MATURE BIOMASS
SUSTAINABLE YIELD
CATCH
B (msy)
NO FISHING
50% Bmsy = MSST


BRISTOL BAY RED KING CRAB
HISTORY RELATIVE TO OVERFISHING
POUNDS (MILLIONS)
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
YEAR
MATURE BIOMASS
SUSTAINABLE YIELD
CATCH
B (MSY)
MSY
50 % B (msy)


PRIBILOF ISLAND RED KING CRAB
HISTORY RELATIVE TO OVERFISHING
30.0
25.0
20.0
15.0
10.0
5.0
0.0
POUNDS (MILLIONS)
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
YEAR
MATURE BIOMASS
SUSTAINABLE YIELD
CATCH
B (MSY)
MSY
50 % B (msy)


PRIBILOF ISLANDS BLUE KING CRAB
HISTORY RELATIVE TO OVERFISHING
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
MATURE BIOMASS
SUSTAINABLE YIELD
CATCH
B (msy)
MSY
50% B (MSY)

EXECUTIVE SUMMARY:
STATUS OF KING CRAB STOCKS IN THE EASTERN BERING SEA IN 2004

By

Ivan Vining[1], Jie Zheng[2], and Douglas Pengilly[1]
[1] Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak
[2] Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau

The Alaska Department of Fish and Game (ADF&G) performs stock assessment analyses for the Bristol Bay red king crab *Paralithodes camtschaticus*, Pribilof red king crab, Pribilof blue king crab *P. platypus*, and St. Matthew Island blue king crab stocks using the data provided by the annual National Marine Fisheries Service (NMFS) eastern Bering Sea trawl survey (Rugolo et al. 2003), harvest data from the ADF&G fish ticket database, and ADF&G catch-sampling data. Two stock-assessment models developed by ADF&G are used: a length-based analysis (LBA) is used to estimate abundance of male and female Bristol Bay red king crabs and a catch-survey analysis (CSA) is used to estimate abundance of male Pribilof red king crabs, male and female Pribilof blue king crabs, and male St. Matthew Island blue king crabs. Both models differ from area-swept estimates of abundance in that they incorporate multiple years of trawl survey and fishery data to provide abundance estimates for the current survey year and previous survey years. The use of multiple years and sources of data in the LBA and CSA assessment methods results in abundance estimates that are generally more accurate than area-swept estimates based only on the current year's survey data. The LBA and CSA methods and their application to assessment of these stocks are reviewed in Zheng and Kruse (2000). Details on the LBA method applied to Bristol Bay red king crab in 2004 are provided in Appendix B to this SAFE.

Bristol Bay red king crab

The LBA estimation procedure provides estimates of abundance of males ≥ 95 mm carapace length (CL), abundance of females ≥ 90 mm CL, new recruitment of males and females to the modeled size classes, and effective spawning biomass (ESB). ESB is the biomass of mature females that the population of mature males can successfully mate in a given year. LBA estimates of small males (95-109 mm CL), prerecruit males (110-134 mm CL), mature males (≥120 mm CL) and legal males (≥135 mm CL), mature females (≥90 mm CL), and ESB for the years 1972-2004 are provided in Table 1. Trends in mature male and female abundance over 1972-2004 and a comparison of LBA and annual area-swept estimates are portrayed graphically in Figure 1. LBA estimates for mature-sized females increased to 35.345-million in 2004 from 28.111-million in 2003, continuing a trend in annually increasing abundance since 2000 (Table 1, Figure 1). Although the 2004 point estimates are only slightly higher than those for 2003, the 2004 LBA estimates for effective spawning biomass (61.868-million pounds) and legal male abundance (10.358-million) are the highest since 1981 and the 2004 LBA estimates for abundance of mature-sized males (15.967-million) and females are the highest since 1982.

Pribilof red king crab

The CSA estimation procedure for Pribilof red king crab provides estimates of the annual abundance during 1988-2004 for males in six size classes: Prerecruit 2 (105-119 mm CL), Prerecruit 1 (120-134 mm CL), Mature (≥120 mm CL), Recruit Legal (new-shells 135-149 mm CL), Postrecruit Legal (old-shells ≥135 mm CL and all ≥150 mm CL), and Legal (≥135 mm CL). Annual estimates of abundance for each size class for 1988-2004 are provided in Table 2; a graphical representation of the estimates of mature male abundance relative to area-swept estimates over 1988-2004 is provided in Figure 2. Estimated abundance of mature-sized and legal males for 2004 is 1.264-million and 1.244-million animals, respectively. Point estimates of abundance for mature-sized and legal males show a slight decreasing trend in recent years (Figure 2), but interpretation and reliability of such trends is difficult due to the very low precision of estimates (Table 2).

Pribilof blue king crab
The CSA estimation procedure for Pribilof blue king crab provides estimates of the annual abundance during 1975-2004 for males in six size classes and females in four size classes (Zheng and Pengilly 2003). The six male size classes for which abundance is estimated are Prerecruit II (105-119 mm CL), Prerecruit I (120-134 mm CL), Mature (≥120 mm CL), Recruit Legal (new-shells 135-148 mm CL), Postrecruit Legal (old-shells ≥135 mm CL and all ≥149 mm CL), and Legal (≥135 mm CL). The four female size classes for which abundance is estimated are Group 1 (100-109 mm CL), Group 2 (110-119 mm CL), Group 3 (120-129 mm CL), and Group 4 (≥130 mm CL). The total of the estimates for the four female size classes provides an estimate of mature-sized female abundance. Annual estimates of abundance for each size class for 1975-2004 are provided in Table 3 for males and Table 4 for females; a graphical representation of the estimates of mature-sized male and female abundance relative to area-swept estimates over 1975-2004 are provided in Figure 3. Estimated abundance of mature-sized and legal males for 2004 is 0.152-million and 0.145-million animals, respectively. Estimated abundance of mature-sized and legal males, as well as mature-sized females, have shown a declining trend since the mid-1990s. Estimated abundance of prerecruit males in 2004 is very low (0.024 million animals for combined Prerecruit I and Prerecruit II) and 0.137 million of the estimated 0.145 million legal males were accounted for by postrecruit legal males.

St. Matthew blue king crab
The CSA estimation procedure for St. Matthew blue king crab provides estimates of the annual abundance during 1978-2004 for males in six size classes: Prerecruit II (90-104 mm CL), Prerecruit I (105-119 mm CL), Mature (≥105 mm CL), Recruit Legal (new-shells 120-133 mm CL), Postrecruit Legal (old-shells ≥120 mm CL and all ≥134 mm CL), and Legal (≥120 mm CL). The CSA method for St. Matthew blue king crab assumes that natural mortality for the year between the 1998 and 1999 surveys was higher than that of other years to account for the drastic reduction in stock abundance observed between 1998 and 1999. Annual estimates of abundance for each size class for 1978-2004 are provided in Table 5; a graphical representation of the estimates of mature-sized male abundance relative to area-swept estimates over 1978-2004 is provided in Figure 4. Estimated abundance of mature-sized and legal males for 2004 is 1.291-million and 0.904-million animals, respectively. This stock is showing stability relative to the low stock size observed in 1999, but remains very low relative to the levels of 1991-1998.

Literature Cited

Rugolo, L.J., R.A. MacIntosh, C.E. Armistead, J.A. Haaga, and R.S. Otto. 2003. Report to industry on the 2003 eastern Bering Sea crab survey. National Marine Fisheries Service, Alaska Fisheries Science Center, Processed Report 2003-11, Kodiak.

Zheng, J. and G.H. Kruse. 2000. Status of king crab stocks in the eastern Bering Sea in 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J00-09, Juneau.

Zheng, J. and D. Pengilly. 2003. Evaluation of alternative rebuilding strategies for Pribilof Islands blue king crabs. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J03-10, Juneau.

Table 1. ADF&G estimates of annual abundance (millions of crabs), effective spawning biomass (ESB, millions of pounds), and 95% confidence intervals for 2004 for red king crabs in Bristol Bay estimated by length-based analysis from 1972-2004. Size measurements are mm CL.

	Males					Females		
Year mm→	Recruits (to model)	Small (95-109)	Prerec. (110-134)	Mature (>119)	Legal (>134)	Recruits (to model)	Mature (>89)	ESB (M lbs)
1972	NA	13.120	14.608	17.962	9.706	NA	59.465	53.833
1973	31.186	21.480	25.116	22.155	10.489	35.233	71.189	61.959
1974	23.006	16.309	33.797	33.826	14.968	28.883	71.981	93.023
1975	33.469	23.099	34.851	40.407	20.849	22.344	65.969	116.699
1976	45.692	31.582	44.437	48.454	25.234	34.160	74.172	128.012
1977	57.617	39.925	59.079	61.709	30.446	74.977	119.899	165.008
1978	25.185	18.526	59.814	76.460	40.132	49.568	122.040	203.999
1979	13.885	10.047	37.336	74.481	48.631	21.499	95.459	170.907
1980	25.140	17.257	25.851	59.805	44.502	36.208	94.185	167.942
1981	17.928	12.868	16.814	18.066	9.423	14.205	71.300	58.815
1982	22.069	15.427	15.017	9.691	2.911	18.166	30.342	22.963
1983	12.180	8.924	12.255	8.423	2.429	4.566	9.723	16.363
1984	18.272	12.687	11.573	7.363	2.271	7.928	9.583	14.387
1985	9.730	7.147	9.809	6.439	1.688	5.615	7.239	10.773
1986	7.096	5.134	11.887	11.216	4.290	4.038	9.036	14.338
1987	6.800	4.828	10.619	13.164	6.595	10.317	16.581	26.006
1988	7.072	4.995	9.855	13.933	8.029	6.279	17.749	29.561
1989	5.787	4.143	9.374	15.167	9.496	5.945	18.262	31.756
1990	1.620	1.304	7.145	14.960	10.123	0.938	13.616	26.238
1991	4.359	2.988	4.843	11.785	8.661	3.853	13.334	25.775
1992	5.993	4.176	5.955	9.906	6.761	3.356	12.616	24.651
1993	2.572	2.194	6.836	10.077	5.998	2.229	10.994	22.146
1994	1.187	1.042	5.311	8.586	4.893	0.404	8.047	17.552
1995	2.929	2.093	4.566	9.314	6.228	1.592	9.138	20.178
1996	3.191	2.400	5.113	10.222	7.088	4.375	12.931	26.710
1997	13.326	9.073	8.496	11.533	7.517	16.284	28.369	39.183
1998	3.283	3.332	13.109	15.306	7.817	1.774	28.210	51.427
1999	1.459	1.145	8.033	15.806	9.742	0.654	20.299	43.336
2000	3.767	2.654	5.733	12.872	8.859	4.719	18.860	39.589
2001	8.017	5.672	7.228	11.732	7.813	7.658	20.762	40.912
2002	2.368	2.294	9.289	13.552	7.943	2.632	22.027	45.900
2003	5.817	4.027	7.661	15.064	10.054	7.473	28.111	57.625
2004	15.132	10.381	11.339	15.967	10.358	9.052	35.345	61.868
			95% Confidence Limits in 2004					
Lower	10.842	NA	9.035	12.332	7.630	7.176	29.276	NA
Upper	24.103	NA	14.000	18.943	12.814	14.930	45.044	NA

Table 2. Annual abundance estimates (millions of crabs) and 95% confidence intervals for 2004 of Pribilof male red king crabs by 4-stage catch-survey analysis (CSA) from 1988-2004. Recruit legals are new-shelled males 135-149-mm CL. All other legal males are postrecruits. Size ranges are in mm CL.

Year	PreRec. II (105-119)	PreRec I (120-134)	Mature (≥120)	Recruit newshell (135-149)	Post Oldshell (≥135)	Legal (≥135)
1988	0.2891	0.0417	0.0625	0.0209	0.0000	0.0209
1989	0.2895	0.2158	0.2815	0.0457	0.0199	0.0657
1990	2.1309	0.2509	0.4631	0.1455	0.0667	0.2121
1991	0.3486	1.5540	2.0458	0.2982	0.1936	0.4918
1992	0.0655	0.6155	2.0087	0.8991	0.4941	1.3932
1993	0.6174	0.2037	1.7640	0.3415	1.2188	1.5603
1994	0.1267	0.4609	1.6226	0.1530	1.0087	1.1617
1995	0.1499	0.2010	1.3328	0.2647	0.8671	1.1318
1996	0.0310	0.1513	1.1533	0.1200	0.8819	1.0019
1997	0.7777	0.0581	0.9862	0.0871	0.8410	0.9281
1998	0.4014	0.5573	1.3624	0.0889	0.7163	0.8051
1999	0.3487	0.4036	1.4248	0.3648	0.6564	1.0212
2000	0.3647	0.3341	1.5015	0.2739	0.8934	1.1673
2001	0.3930	0.3339	1.5869	0.2378	1.0151	1.2529
2002	0.0437	0.3514	1.6834	0.2435	1.0886	1.3321
2003	0.0048	0.0883	1.4748	0.2293	1.1572	1.3865
2004	0.0006	0.0201	1.2641	0.0548	1.1893	1.2441
Lower 95%	NA	NA	0.5575	NA	NA	0.5434
Upper 95%	NA	NA	1.9708	NA	NA	1.9447

Table 3. Annual abundance estimates (millions of crabs) and 95% confidence intervals for 2004 of Pribilof blue king crab males by 4-stage catch-survey analysis (CSA) from 1975-2004. Recruit legals are new-shelled males 135-148-mm CL; all other legal males are postrecruits. Size ranges are in mm CL.

Year	PreRec. II (105-119)	PreRec I (120-134)	Mature (≥120)	Recruit newshell (135-148)	Post oldshell (≥135)	Legal (≥135)
1975	2.1538	3.8783	12.2488	3.8466	4.5238	8.3704
1976	1.1055	2.5245	10.5942	2.1236	5.9462	8.0698
1977	2.9061	1.4291	8.2844	1.5758	5.2795	6.8553
1978	2.4442	2.3282	7.8263	1.0967	4.4013	5.4981
1979	0.3412	2.2513	7.3545	1.6528	3.4503	5.1031
1980	0.5507	0.8391	5.4080	1.4258	3.1431	4.5689
1981	0.4623	0.5889	3.3165	0.5606	2.1670	2.7276
1982	0.4742	0.4625	1.9085	0.3912	1.0548	1.4460
1983	0.3573	0.4312	1.3465	0.3014	0.6139	0.9153
1984	0.0899	0.3491	1.0902	0.2740	0.4671	0.7411
1985	0.0283	0.1545	0.8968	0.2226	0.5197	0.7423
1986	0.0023	0.0536	0.6505	0.1120	0.4849	0.5969
1987	0.0022	0.0134	0.4571	0.0376	0.4061	0.4437
1988	0.0002	0.0027	0.2619	0.0121	0.2471	0.2592
1989	2.5449	0.0008	0.1907	0.0019	0.1880	0.1899
1990	0.6481	1.3812	1.6428	0.1239	0.1377	0.2616
1991	0.2008	0.8543	1.7431	0.6610	0.2278	0.8887
1992	0.8801	0.4314	1.5022	0.4027	0.6680	1.0708
1993	0.4389	0.6039	1.6386	0.2460	0.7887	1.0347
1994	0.5228	0.4483	1.5203	0.3047	0.7673	1.0720
1995	0.5369	0.4298	1.4540	0.2343	0.7899	1.0242
1996	0.3020	0.4215	1.2527	0.2106	0.6207	0.8312
1997	0.1054	0.3101	1.0149	0.1870	0.5178	0.7048
1998	0.1501	0.1824	0.7667	0.1190	0.4652	0.5843
1999	0.0759	0.1407	0.5812	0.0658	0.3747	0.4405
2000	0.0349	0.0954	0.4606	0.0434	0.3218	0.3652
2001	0.0165	0.0601	0.3541	0.0276	0.2664	0.2940
2002	0.0063	0.0336	0.2714	0.0233	0.2145	0.2378
2003	0.0020	0.0163	0.2052	0.0156	0.1733	0.1889
2004	0.0170	0.0073	0.1523	0.0076	0.1374	0.1450
Lower 95%	NA	NA	0.0789	NA	NA	0.0722
Upper 95%	NA	NA	0.2258	NA	NA	0.2178

Table 4. Annual abundance estimates (millions of crabs) and 95% confidence intervals for 2004 of Pribilof blue king crab females by 4-stage catch-survey analysis (CSA) from 1975-2004. Size ranges are in mm CL.

Year	Group 1 (100-109)	Group 2 (110-119)	Group 3 (120-129)	Group 4 (≥120)	Total Mature (≥100)
1975	1.6781	2.2892	1.5026	0.7802	6.2501
1976	3.6040	1.7893	1.5298	0.7679	7.6910
1977	2.7691	2.2936	1.4485	0.7860	7.2971
1978	1.9481	2.1145	1.5634	0.7936	6.4196
1979	0.9239	1.7163	1.5583	0.8059	5.0044
1980	1.9760	1.1583	1.4239	0.8030	5.3612
1981	0.9551	1.3179	1.1796	0.7717	4.2244
1982	0.5089	1.0242	1.0582	0.7090	3.3003
1983	0.5528	0.7191	0.9056	0.6435	2.8210
1984	0.2469	0.5870	0.7379	0.5776	2.1495
1985	0.1194	0.3960	0.6032	0.5126	1.6312
1986	0.0735	0.2420	0.4747	0.4537	1.2439
1987	0.0418	0.1439	0.3560	0.3987	0.9404
1988	0.0468	0.0837	0.2563	0.3439	0.7307
1989	0.6028	0.0593	0.1789	0.2897	1.1307
1990	0.8620	0.3088	0.1250	0.2393	1.5350
1991	0.9190	0.5459	0.1658	0.1948	1.8255
1992	1.4561	0.6754	0.2631	0.1681	2.5626
1993	0.9436	0.9798	0.3657	0.1635	2.4526
1994	1.8042	0.8545	0.5326	0.1778	3.3691
1995	1.1111	1.2039	0.5908	0.2147	3.1206
1996	0.6326	1.0321	0.7328	0.2493	2.6467
1997	0.3640	0.7537	0.7483	0.2899	2.1558
1998	0.2489	0.5135	0.6689	0.3178	1.7491
1999	0.4090	0.3516	0.5511	0.3266	1.6383
2000	0.2382	0.3493	0.4344	0.3195	1.3414
2001	0.1501	0.2631	0.3660	0.3011	1.0804
2002	0.0610	0.1781	0.3008	0.2815	0.8214
2003	0.0233	0.0978	0.2351	0.2593	0.6156
2004	0.0082	0.0500	0.1692	0.2306	0.4580
Lower 95%	NA	NA	NA	NA	0.3406
Upper 95%	NA	NA	NA	NA	0.5754

Table 5. Annual abundance estimates (millions of crabs) and 95% confidence intervals for 2004 of St. Matthew Island male blue king crabs by 4-stage catch-survey analysis (CSA) from 1978-2004. Natural mortality in year 1998/99 was estimated separately from other years ("2-*m* CSA model). Recruit legals are new-shelled males 120-133 mm CL. All other legal males are postrecruits. Size ranges are in mm CL.

Year	PreRec. II (90-104)	PreRec I (105-119)	Mature (≥105)	Recruit Newshell (120-133)	Post oldshell (≥120)	Legal (≥120)
1978	1.0269	1.4817	3.4180	1.2959	0.6404	1.9363
1979	2.3013	1.3592	3.5722	1.0643	1.1487	2.2130
1980	2.1005	2.5218	5.3061	1.1551	1.6293	2.7843
1981	0.8321	2.6579	6.6806	1.9090	2.1137	4.0227
1982	0.9484	1.4818	5.6681	1.9113	2.2751	4.1863
1983	0.4724	1.2803	4.0657	1.1137	1.6717	2.7854
1984	0.2821	0.8015	2.2907	0.8674	0.6218	1.4892
1985	0.5227	0.4934	1.4980	0.5188	0.4858	1.0046
1986	0.3884	0.6051	1.3458	0.3580	0.3827	0.7407
1987	0.7238	0.5301	1.3751	0.4456	0.3995	0.8450
1988	0.6523	0.8027	1.7250	0.4602	0.4621	0.9223
1989	1.6059	0.7819	1.9443	0.6790	0.4833	1.1624
1990	1.1591	1.6611	3.1323	0.7733	0.6979	1.4712
1991	1.1544	1.4491	3.6797	1.3715	0.8591	2.2307
1992	1.2022	1.4082	3.7400	1.1960	1.1357	2.3318
1993	1.2598	1.4567	3.9572	1.1511	1.3494	2.5005
1994	1.1677	1.5355	4.1106	1.1723	1.4028	2.5751
1995	1.4395	1.4777	3.9921	1.2056	1.3087	2.5143
1996	1.4332	1.6911	4.3104	1.2319	1.3873	2.6193
1997	0.9385	1.7303	4.6049	1.3950	1.4795	2.8745
1998	0.6027	1.3133	4.0807	1.3184	1.4490	2.7674
1999	0.3511	0.2855	1.0340	0.2900	0.4586	0.7486
2000	0.3087	0.4065	1.1907	0.2283	0.5559	0.7843
2001	0.3773	0.3972	1.2792	0.2949	0.5870	0.8819
2002	0.1514	0.4397	1.3619	0.2667	0.6555	0.9222
2003	0.3532	0.2706	1.2254	0.2685	0.6863	0.9548
2004	0.2813	0.3872	1.2914	0.2007	0.7035	0.9042
Lower 95%	NA	NA	0.7432	NA	NA	0.5096
Upper 95%	NA	NA	1.8395	NA	NA	1.2987

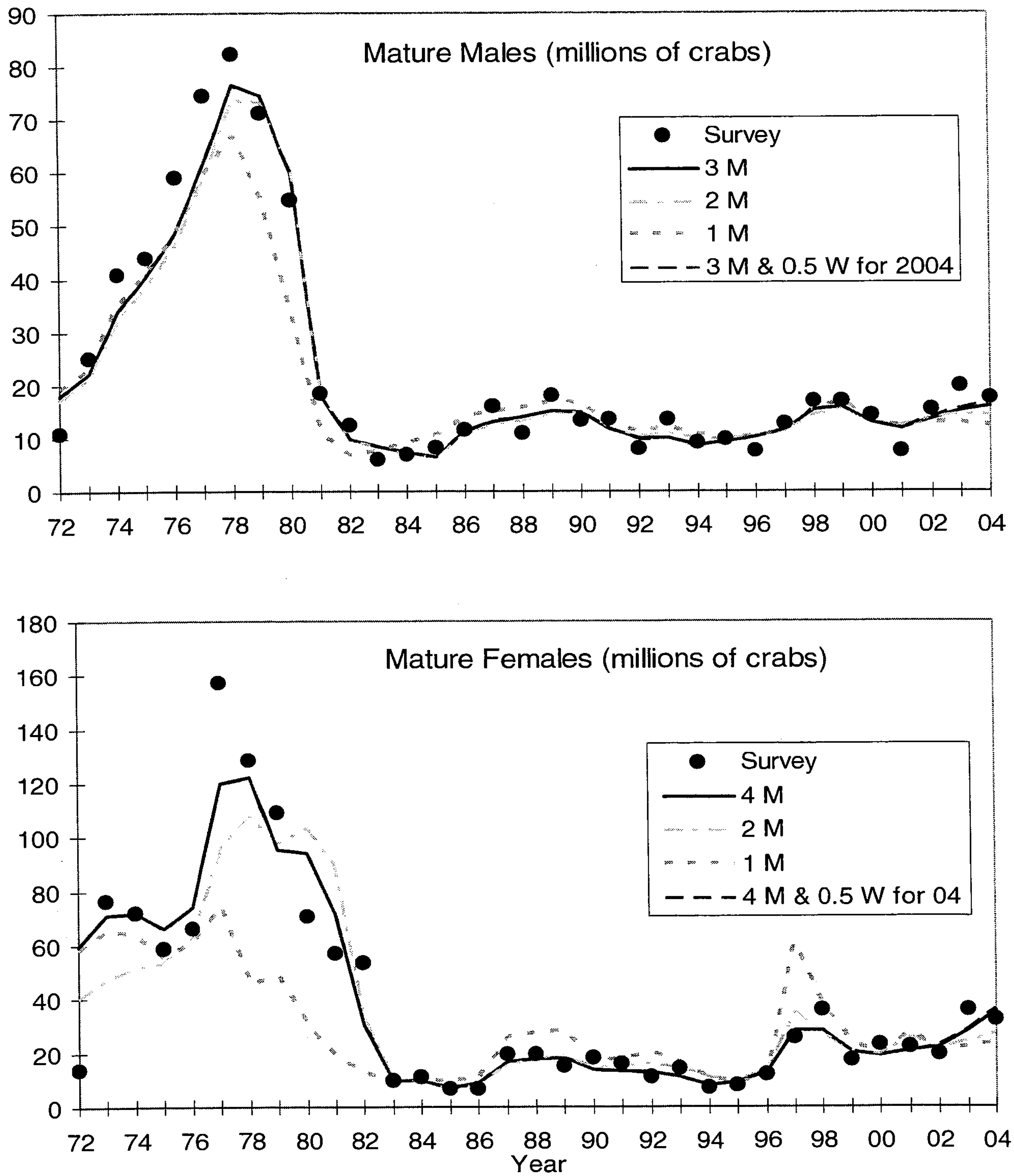


Figure 1. The LBA fit (line) to area-swept estimates (dots) of mature male (top panel) and mature female (bottom panel) Bristol Bay red king crab abundance (millions of crabs), 1972-2004 (ADF&G estimates). Four scenarios of LBA with different levels of natural mortality are compared; GHL calculations for 2004 use results from the male 3-*m* and female 4-*m* models are the models (see Appendix B).

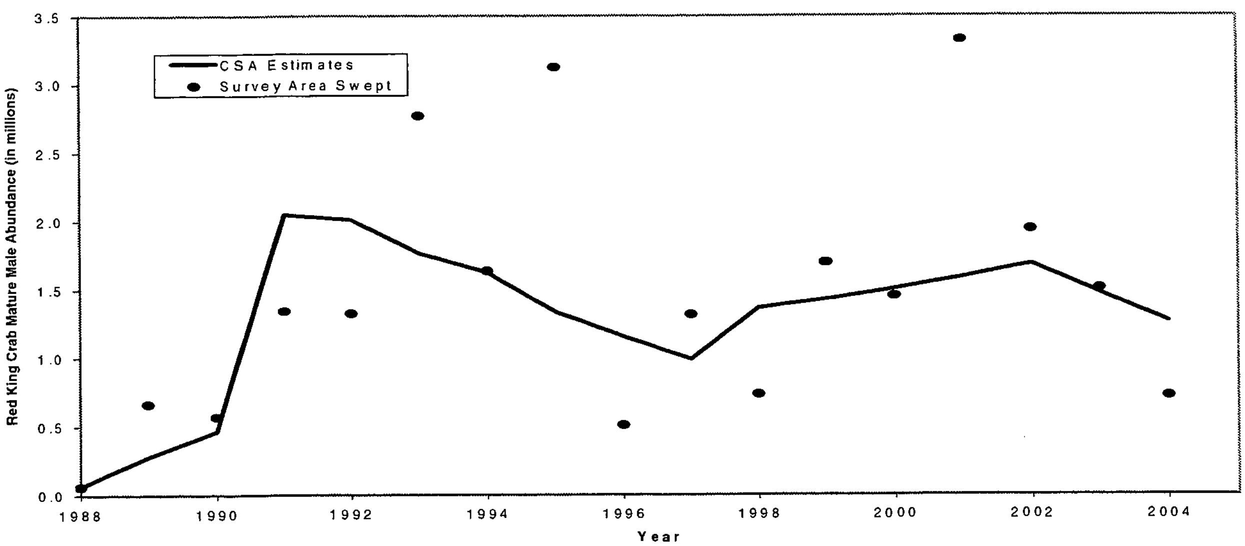
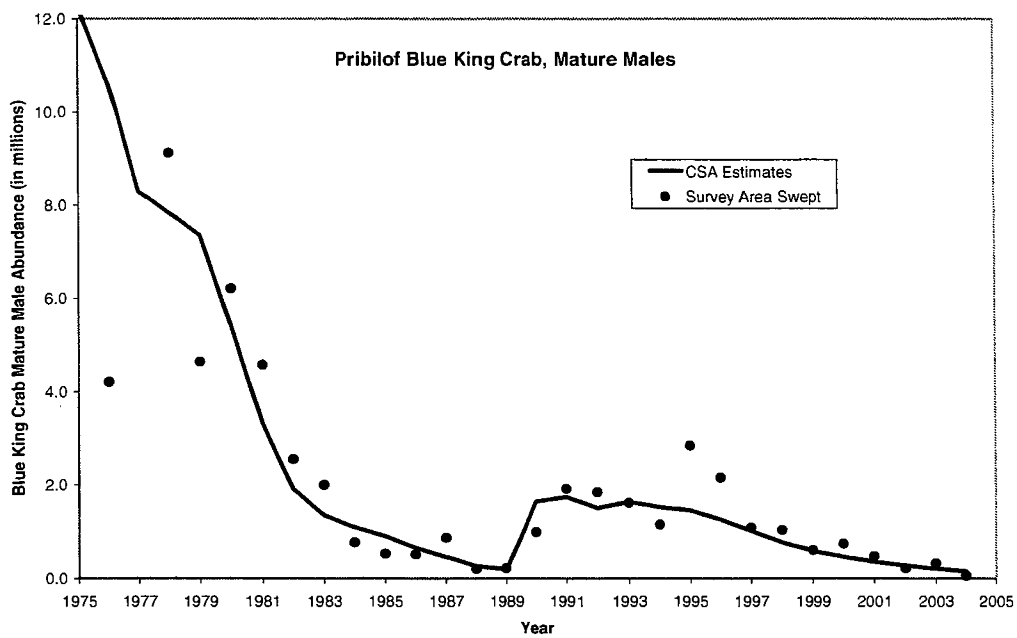


Figure 2. Annual estimates of abundance of mature male Pribilof red king crab. Solid line is the CSA estimate for 1988-2004. Dots are the area-swept estimates for 1978-2004.



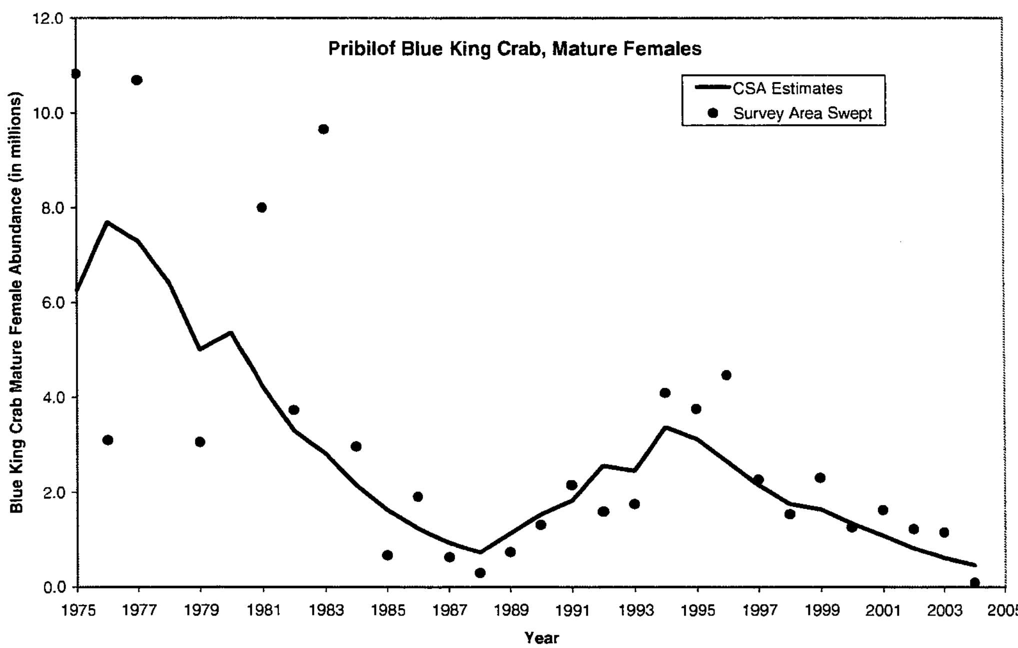


Figure 3. The CSA fit (line) to area-swept estimates (dots) of mature male (top panel) and mature female (bottom panel) Pribilof blue king crab abundance (millions of crabs), 1978-2004.

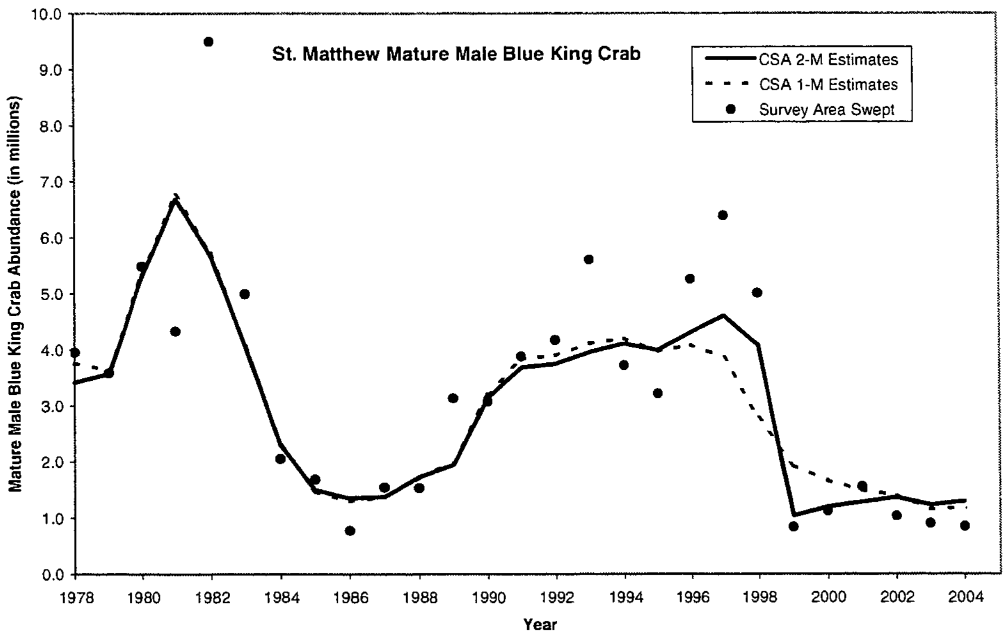


Figure 4. Annual estimates of abundance of mature male St. Matthew Island blue king crab for 1978-2004. Dashed line is the "2-*m*" catch-survey analysis (CSA) estimate that allows for increased natural mortality between 1998 and 1999. Solid line is the CSA estimate with constant natural mortality. Dots are the area-swept estimates. GHL computations for 2004 use the "2-*m*" CSA estimate.

BSAI Crab Bycatch

prepared by David Witherell and Diana Stram, NPFMC staff

What is bycatch?

Bycatch of crab occurs in the directed crab pot fisheries and other fisheries, including groundfish and scallop fisheries. In the crab fisheries, crab bycatch includes females of target species, sublegal males of target species, and non-target crab. In all other fisheries, crabs are a prohibited species, so every crab caught incidentally is considered bycatch.

How many crabs are taken as bycatch?

The following tables show the numbers of crab taken as bycatch in these fisheries.

Bycatch of *C. opilio* crabs (numbers of crab) in Bering Sea fisheries, 1994-2003.

Year	directed crab pot	groundfish trawl	groundfish fixed gear	scallop dredge	Total
1994	53,082,564	12,351,899	130,228	34,866	65,599,557
1995	48,734,000	5,165,555	230,233	0	54,129,788
1996	56,570,785	3,643,612	267,395	104,836	60,586,628
1997	75,005,446	5,276,208	554,103	195,345	81,031,102
1998	51,591,453	4,122,648	549,139	232,911	56,496,151
1999	47,093,200	1,544,747	269,778	150,421	49,058,146
2000	5,020,800	2,207,279	270,000	105,602	7,603,681
2001	6,123,100	1,293,143	215,000	68,458	7,699,701
2002	15,823,300	882,967	n/a	n/a	n/a
2003	22,140,336	615,012	n/a	n/a	n/a

Bycatch of St. Matthew blue king crabs (numbers of crab) in Bering Sea fisheries, 1994-2003.

Year	directed crab pot	groundfish trawl	groundfish fixed gear	scallop dredge	Total
1994	3,848,080	1,193	6	0	3,849,279
1995	confidential	2,725	47	0	n/a
1996	1,699,333	168	574	0	1,700,075
1997	confidential	8	187	0	n/a
1998	confidential	0	774	0	n/a
1999	n/a	0	4,983	0	n/a
2000	54,300	0	n/a	0	n/a
2001	1,300	0	n/a	0	n/a
2002	600	n/a	n/a	n/a	n/a
2003	0	n/a	n/a	n/a	n/a

Bycatch of Bristol Bay red king crabs (numbers of crab) in Bering Sea fisheries, 1994-2003.

Year	directed crab pot	groundfish trawl	groundfish fixed gear	scallop dredge	Total
1994	18,600	280,096	927	22	299,645
1995	0	44,934	3,257	0	48,191
1996	605,000	30,967	75,675	0	711,642
1997	985,000	50,711	25,579	0	1,061,290
1998	4,593,800	42,003	7,017	146	4,642,966
1999	957,800	84,709	8,968	1	1,026,178
2000	1,701,000	70,787	39,754	2	1,653,542
2001	2,419,100	58,552	19,000	0	2,496,652
2002	1,677,800	89,955	n/a	n/a	n/a
2003	5,808,200	91,937	n/a	n/a	n/a

Bycatch of *C. bairdi* crabs (numbers of crab) in Bering Sea fisheries, 1994-2003.

Year	directed crab pot	groundfish trawl	groundfish fixed gear	scallop dredge	Total
1994	19,003,200	2,496,761	48,221	245,000	21,793,182
1995	15,897,300	2,212,181	87,674	0	18,197,155
1996	4,588,000	1,836,031	279,560	17,000	6,930,591
1997	4,865,900	1,917,736	50,218	28,000	6,861,854
1998	4,293,800	1,477,816	46,552	36,000	5,854,168
1999	1,995,100	901,619	43,220	n/a	n/a
2000	491,000	1,002,074	140,453	53,614	1,539,141
2001	626,400	950,331	80,000	48,718	1,705,449
2002	1,282,600	1,086,286	n/a	n/a	n/a
2003	626,000	897,340	n/a	n/a	n/a

Do all these crabs die?

Crab Fisheries

Some crabs taken as bycatch die due to handling mortality. Several laboratory and field studies have been conducted to determine mortality caused by handling juvenile and female crab taken in crab fisheries. There are a variety of effects caused by handling, ranging from sublethal (reduced growth rates, molting probabilities, decreased visual acuity from bright lights, and vigor) to lethal effects. Studies have shown a range of mortality due to handling based on gear type, species, molting stage, number of times handled, temperature, and exposure time (Murphy and Kruse 1995). Handling mortality may have contributed to the high natural mortality levels observed for Bristol Bay red king crab in the early 1980's (65% for males and 82% for females), that along with high harvest rates, may have resulted in stock collapse (Zheng et al. 1995). However, another study concluded that handling mortality from deck impacts and temperature was not responsible for the decline on the red king crab fishery (Zhou and Shirley 1995, 1996).

Byersdorfer and Watson (1992, 1993) examined red king crab and Tanner crab taken as bycatch during the 1991 and 1992 red king crab test fisheries. Instantaneous handling mortality of red king crab was <1% in 1991, and 11.2% in 1992. Stevens and MacIntosh (1993) found average overall mortality of 5.2% for red king crabs and 11% for Tanner crabs on one commercial crab vessel. Authors recommend these results be viewed with caution, noting that experimental conditions were conservative; mortality in the fishery might be higher. Mortality for red king crab held 48 hours was 8% (Stevens and MacIntosh 1993, as cited in Queirolo et al. 1995). A laboratory study that examined the effects of multiple handling indicated that mortality of discarded red king crabs was negligible (2%), although body damage increased with handling (Zhou and Shirley 1995).

Delayed mortality due to handling does not appear to be influenced by method of release. In an experiment during a test fishery, red king crab thrown off the deck while the vessel was moving versus those gently placed back into the ocean had no differences in tag return rates (Watson and Pengilly 1994). Handling methods on mortality have been shown to be non-significant in laboratory experiments with red king crab (Zhou and Shirley 1995, 1996) and Tanner crab (MacIntosh et al. 1996). Although handling did not cause mortality, injury rates were directly related to the number of times handled.

Mortality of crabs is also related to time out of water and air temperature. A study of red king crabs and Tanner crabs found that crabs exposed to air exhibited reduced vigor and righting times, feeding rates (Tanner crabs), and growth (red king crabs) (Carls and O'Clair 1989). For surviving females, there was no impact on survival of eggs or larvae. Cold air resulted in leg loss or immediate mortality for Tanner crabs, whereas red king crabs exhibited delayed mortality that occurred during molting. A relationship was developed to predict mortality as the product of temperature and duration of exposure (measured as degree hours). Median lethal exposure was -8oC for red king crab and -4.3oC for Tanner crab. For example, if crabs were held on deck for

10 minutes and it was -23oC (10 degrees below zero Fahrenheit) outside, about 15% of the king crab and 50% of the Tanner crab would die of exposure. Because BSAI crab fisheries occur from November through March, cold exposure could cause significant handling mortality to crabs not immediately returned to the ocean. Zhou and Shirley (1995) observed that average time on deck was generally 2 to 3 minutes, and they concluded that handling mortality was not a significant source of mortality for red king crab.

Further research has indicated that windchill may be an important mortality factor. In 1997, a laboratory study examined the effects of cold windchill temperature on mortality, limb loss, and activity (righting response) for sublegal sized male Tanner crabs (Zhou and Kruse, 1998, Shirley 1998). The study found significant inverse relationships between windchill and crab mortality, limb loss, and activity. Crabs were exposed to combinations of temperatures and wind speeds for a duration of 5 minutes, then placed in seawater tanks and held for 7 days. Zhou and Kruse (1998) found that virtually all crabs died when exposed to windspeeds greater than 7.7 m/s (15 nautical miles per hour) and air temperatures less than -10.4°C (13.3oF). Stronger winds, even at warmer temperatures (but still below freezing), can have the same effect. Shirley (1998) reported that 50% of the crabs died in windchill temperatures of -11°C (this windchill temperature can result from air temperatures of 21°F and wind speeds of 30 nautical miles per hour). He concluded that "The effects of windchill on sublegal Tanner crabs is dramatic, and undoubtedly results in decreased recruitment to adult stocks".

On the other hand, there is evidence from the fishery itself that windchill during the snow crab fishery may not be as important a mortality factor as would be expected from the laboratory study on Tanner crabs (Shirley 1998) and prevailing weather conditions. The primary evidence in this regard is the low rate of deadloss that occurs during the snowcrab fishery. The snow crabs that are delivered to processors are generally subjected to the similar windchill exposures before being sorted on deck and deposited into the holding tank as are non-legal snow crabs and Tanner crabs before they are sorted and discarded. Data collected by onboard observers during the 1999 snow crab fishery indicate that bycatch crabs generally are not exposed to the air longer than the retained catch (D. Tracy, ADF&G, pers. comm). Laboratory experiments found that snow crabs were more sensitive than either Tanner crabs (Shirley 1998) or red king crabs (Shirley 1999) and experienced 100% to 40% mortality at windchill values from -16°C to -10°C. Snow crab males were exposed to wind speeds from 8 to 16 m/s and air temperatures from -2 to -10°C for 5 minutes (corresponding to 16 to 32 mph and 28 to 14°F, respectively). Reduced exposure time significantly reduced mortality. Limb loss was variable, but pronounced at windchill values below -10°C. Coordination of crabs (measured as an ability to right themselves) was impaired after all but the least severe treatment; concern for the crabs ability to avoid predation after exposure is warranted (Warrenchuk 2001; Warrenchuk and Shirley, 2002).

Because snow crabs are typically kept in holding tanks for one to three weeks prior to offloading at processors (R. Morrison, ADF&G, pers. comm.), high rates of deadloss would be expected in the deliveries if on-deck wind chill exposure resulted in mortality rates comparable to those experienced by Tanner crabs in the laboratory study. Commercial catch statistics from the 1990 through 1998 snow crab seasons, however, indicate that the annual deadloss averaged only 1.3% of the total delivered snow crabs and ranged from 0.7% to 2.0%. Such low rates of deadloss, despite the low temperatures and high winds that can occur in the Bering Sea during the snow crab fishery, may be reflective of features of fishing vessels and fishing practices that serve to protect captured and sorted crabs from windchill exposure. Shelter decks, storm walls, use of totes, and leeward alignment of vessels during gear retrieval, for example, would tend to protect crabs from windchill exposure during sorting. However, these low rates of deadloss are averages from throughoutt the season. Higher rates of deadloss may be found in crab deliveries made during periods following more severe weather conditions. Additionally, observer data collected during the 1998 and 1999 snow crab seasons indicate that sorted bycatch typically is returned to the sea in less time than the 5 minutes that crabs were exposed to windchill during the laboratory study (D. Tracy, ADF&G, pers. comm). Data on limb autotomies collected from bycatch Tanner crabs by onboard observers during the 1999 snow crab season also indicate that the effects of windchill in practice is less than that predicted from laboratory studies and prevailing weather.

Examination of 1,718 bycaught *bairdi* prior to discarding during the 1999 season indicates a limb autotomy rate of only 0.3% -- well below the limb autotomy rates observed in the laboratory study for windchills associated with high mortality rates. In summary, although it has been conclusively shown that windchill can effect high rates of mortality in Tanner crabs, there is also evidence that exposure of captured crabs to such windchill may not be common during actual fishing.

Retained crab mortality (evidenced by deadloss) is circumspect as a predictor of bycatch mortality. No relationship exists between windchill and reported deadloss. Since a relationship between windchill and mortality was clearly observed in the lab (Warrenchuk & Shirley,2002), retained crabs may not be subject to the same level of stress as bycatch crabs. Bycatch crabs are exposed longer than retained crabs as most crews prioritize sorting of retained crabs (Tracy and Byersdorfer 2000). Retained crabs are dropped only a short distance directly into the holding tanks, while non-retained crabs may be thrown over the side of the vessel or swept along the deck into scuppers, which results in rougher and more prolonged handling. Also, non-retained crabs are smaller and may lose heat quicker than retained crabs. Smaller crabs have a greater surface area to volume ratio and less thermal mass (Shirley 1999). Smaller juvenile Tanner crabs were more sensitive to cold aerial exposure than larger adults (Carls and O'Clair 1995) and adult Tanner crabs were more sensitive to exposure and windchill than larger red king crabs (Carls and O'Clair 1990; Shirley 1999). Mortality of non-retained snow crab during the 1998 fishery was estimated to be from 3.6% (windchill model) to 19.6% (temperature/windspeed model) (Warrenchuk and Shirley, accepted for publication).

Trawl Fisheries

The effect of crab bycatch on crab stocks is somewhat tempered by survival of discarded crabs. There have been numerous studies conducted on crab bycatch mortality, with each study having different objectives, methodology, and results. A summary of these studies is provided below, but many questions remain unanswered. Stevens (1990) found that 21% of the king crabs and 22% of the Tanner crabs captured incidentally in BSAI trawl fisheries survived at least 2 days following capture. Blackburn and Schmidt (1988) made observations on instantaneous mortality of crab taken by domestic trawl fisheries in the Kodiak area. They found acute mortality for softshell red king crab averaged 21%, hard shelled red king crab 1.2%, and 12.6% for Tanner crab. Another trawl study indicated that trawl induced mortalities aboard ship were 12% for Tanner crab and 19% for red king crab (Owen 1988). Fukuhara and Worlund (1973) observed an overall Tanner crab mortality of 60-70% in the foreign Bering Sea trawl fisheries. They also noted that mortality was higher in the summer (95%) than in the spring (50%). Hayes (1973) found that mortality of Tanner crab captured by trawl gear was due to time out of water, with 50% mortality after 12 hours. Natural Resource Consultants (1988) reported that overall survival of red king crab and Tanner crab bycaught and held in circulation tanks for 24-48 hours was <22%. In other analyses, the estimated mortality rate of trawl bycaught red king crab and Tanner crab was 80% (NPFMC 1993, 1995).

Other Groundfish Fisheries

Some crabs are caught incidentally by non-trawl gear in pursuit of groundfish, and a portion of these crabs die. No field or laboratory studies have been made to estimate mortality of crab discarded in these fisheries. However, based on condition factor information from the trawl survey, mortality of crab bycatch has been estimated and used in previous analyses (NPFMC 1993). Discard mortality rates for red king crab were estimated at 37% in longline fisheries and 37% in pot fisheries. Estimated bycatch mortality rates for Tanner crab were 45% in longline fisheries and 30% in pot fisheries. No observations had been made for snow crab, but mortality rates are likely similar to Tanner crab. In the analysis made for Amendment 37, a 37% mortality rate was assumed for red king crab taken in longline fisheries and an 8% rate for pot fisheries. Observer data on condition factors collected for crab during the 1991 domestic fisheries suggested lower mortality of red king crab taken in groundfish pot fisheries. Bycatch mortality rates used in the analysis of Amendment 37 (NPFMC 1996) for snow crabs were 45% in longline fisheries and 30% in pot fisheries.

Scallop Fishery

Observations from scallop fisheries across the state suggest that mortality of crab bycatch is low relative to trawl gear due to shorter tow times, shorter exposure times, and lower catch weight and volume. For crab taken as bycatch in the Gulf of Alaska weathervane scallop fishery, Hennick (1973) estimated that about 30% of Tanner crabs and 42% of the red king crabs bycaught in scallop dredges were killed or injured. Hammerstrom and Merrit (1985) estimated mortality of Tanner crab at 8% in Cook Inlet. Kaiser (1986) estimated mortality rates of 19% for Tanner crab and 48% for red king crab bycaught off Kodiak Island. Urban el al. (1994) reported that in 1992, 13-35% of the Tanner crab bycaught were dead or moribund before being discarded, with the highest mortality rate occurring on small (<40 mm cw) and large (>120 mm cw) crabs. Delayed mortality resulting from injury or stress was not estimated. Mortality in the Bering Sea appears to be lower than in the Gulf of Alaska, in part due to different sizes of crab taken. Observations from the 1993 Bering Sea scallop fishery indicated lower bycatch mortality of red king crab (10%), Tanner crab (11%) and snow crab (19%). As with observations from the Gulf of Alaska, mortality appeared to be related to size, with larger and smaller crabs having higher mortality rates on average than mid-sized crabs (D. Pengilly, ADF&G, unpublished data). Immediate mortality of Tanner crabs from the 1996 Bering Sea scallop fishery was 12.6% (Barnhart and Sagalkin 1998). Delayed mortality was not estimated. In the analysis made for Amendment 41, a 40% discard mortality rate (immediate and delayed mortality combined) was assumed for all crab species.

So what are the population impacts of bycatch?

By applying mortality rates estimated from scientific observations to the number of crabs taken as bycatch, it is possible to estimate the relative impacts of bycatch on crab populations. Discard mortality rates have been established in previous analysis (NPFMC 1999), and may be species or fishery specific. Bycatch mortality rates in trawl, dredge, and fixed gear fisheries for all crab species were set at 80% , 40%, and 20% respectively. For crab fisheries, mortality rates were averaged across different fisheries. Rates used were 24% for *C. opilio*, 20% for *C. bairdi*, and 8% for blue king crab and red king crab.The following tables show the resulting discard mortality estimates, the estimated population size based on the NMFS trawl survey, and the percentage of the population removed due to bycatch mortality.

Total bycatch (numbers) mortality of red king crab in all fisheries in the Bristol Bay area, 1994-2003, and current years survey abundance estimate.

Year	Bycatch mortality	Abundance (millions)	Bycatch as %
1994	225,759	33.9	0.67
1995	35,599	33.9	0.11
1996	88,309	53.3	0.17
1997	124,485	75.1	0.17
1998	402,568	75.6	0.52
1999	144,161	46.7	0.22
2000	200,661	50.0	0.40
2001	244,169	44.2	0.55
2002	206,188	78.3	0.26
2003	538,205	84.1	0.64

Total bycatch (numbers) mortality of blue king crab in all fisheries in the St. Matthew area, 1994-2003, and current years survey abundance estimate.

Year	Bycatch mortality	Abundance (millions)	Bycatch as %
1994	308,802	5.9	5.23
1995	conf	5.6	*
1996	136,196	10.0	1.36
1997	conf	10.0	*
1998	conf	8.4	*
1999	997	1.7	0.06
2000	n/a	1.7	*
2001	n/a	2.9	*
2002	48	1.2	0.001
2003	0	3.3	0

Total bycatch mortality (numbers) of *C. bairdi* crab in all fisheries in the Bering Sea, 1994-2003, and current years survey abundance estimate.

Year	Bycatch mortality	Abundance (millions)	Bycatch as %
1994	5,905,693	192.0	3.08
1995	4,966,740	189.9	2.62
1996	2,449,137	175.6	1.39
1999	2,528,612	159.0	1.59
1998	2,064,723	156.5	1.32
1999	n/a	349.5	*
2000	949,394	219.2	0.43
2001	921,032	600.1	0.15
2002	1,125,549	437.6	0.26
2003	843,072	448.1	0.19

Total bycatch mortality (numbers) of *C. opilio* in all fisheries in the Bering Sea, 1994-2003, and current years survey abundance estimate.

Year	Bycatch mortality	Abundance (millions)	Bycatch as %
1994	22,661,327	9,445.9	0.24
1995	15,874,651	8,655.3	0.18
1996	16,587,291	5,424.9	0.31
1997	22,411,232	4,107.5	0.55
1998	15,883,059	3,233.3	0.49
1999	11,349,869	1,401.0	0.81
2000	3,067,056	3,241.2	0.09
2001	2,589,299	3,861.3	0.07
2002	4,503,965	1,517.7	0.30
2003	5,805,709	2,630.8	0.22

What about unobserved mortality?

In addition to those crabs that are captured as bycatch, fishing activities can also cause crab mortality in ways that cannot be directly observed. A summary of these potential unobserved mortalities are discussed below.

Crab Fishery

Catching mortality is ascribed to those crabs that enter a pot and are eaten by other pot inhabitants before the pot is retrieved. Catching mortality likely occurs during the molting period, when crabs are more susceptible to cannibalism. Most crab fisheries are set to occur outside of the molting season, and catching mortality in these fisheries may be limited to octopus or large fish entering a pot. Because no evidence of crab is left in the pot, these mortalities remain unassessed.

Mortality is also caused by ghost fishing of lost crab pots and groundfish pots. Ghost fishing is the term used to describe continued fishing by lost or derelict gear. The impact of ghost fishing on crab stocks remains unknown. It has been estimated that 10% to 20% of crab pots are lost each year (Meyer 1971, Kruse and Kimker 1993). Based on skipper interviews, about 10,000 pots were estimated lost in the 1992 Bristol Bay red king, and Bering Sea Tanner and snow crab fisheries (Tracy 1994). Fewer pots are expected to be lost under pot limit regulations and shorter seasons. Bob Schofield, a major crab pot manufacturer, testified at the January 1996 Council meeting that he was making fewer pots since inception of the pot limit. He estimated that 6,461 pots were replaced in 1995. It is not known how long lost pots may persist and continue to fish, or just litter the bottom.

A sonar survey of inner Chiniak Bay (Kodiak, Alaska) found a high density of lost crab pots (190 pots) in an area of about 4.5 km2 (Vining et al. 1997). Underwater observations indicated that crabs and fish were common residents of crab pots, whether or not the pot mesh was intact. Intact pots recovered from the Chiniak Bay study area often contained crabs (primarily Tanner crabs) and octopus. High (1985) and High and Worlund (1979) observed that 20% of legal sized male red king crab and 8% of the sublegals captured by lost pots failed to escape.

Crabs captured in lost pots may die of starvation or by predation. Captured crab are subject to cannibalism (Paul et al. 1993), and predation by octopus, halibut and Pacific cod (High 1976). Crabs may have limited abilities to withstand starvation. In a simulated field study, 39% mortality of Tanner crabs was observed after

119 days of starvation (Kimker 1994). In a laboratory study, 10% of the Tanner crabs tested died of starvation in 90 days. Of the 90% that had survived 90 days, all later died even though they were freely fed (Paul et al. 1993). However, highest survival rates for juvenile king crabs fed a variety of diets were from those treatments recieving no food, even for extended period of 3 to 4 months (Shirley, unpublished data). To reduce starvation mortality in lost pots, crab pots have been required to be fitted with degradable escape mechanisms. Regulations required #120 cotton thread from 1977-1993. Beginning in 1993, regulations required #30 cotton thread or 30-day galvanic timed release mechanisms. A #30 cotton thread section is also required in groundfish pots. The average time for #30 cotton twine to degrade is 89 days, and the galvanic timed release about 30 days to degrade. Pots fitted with an escape mechanism of #72 cotton twine had a fishable life of 3-8 years and documented retention of up to 100 crabs per lost pot (Meyer 1971). High and Wolund (1979) estimated an effective fishing life of 15 years for king crab pots. Pots without escape mechanisms could continue to catch and kill crabs for many years, however testimony from crabbers and pot manufacturers indicate that all pots currently fished in Bering Sea crab fisheries contain escape mechanisms.

Mortality of crab caused by ghost fishing is difficult to estimate with precision given existing information. Mortality caused by continuous fishing of lost pots has not been estimated, but unbaited crab pots continue to catch crabs (Breen 1987, Meyer 1971), and pots are subject to rebaiting due to capture of Pacific cod, halibut, sablefish, and flatfish. In addition to mortality of trapped crab by ghost pots, and predation by octopus and fish, pot mesh itself can kill crabs. Lost pots retrieved by NMFS trawl surveys occasionally contain dead crabs trapped in loose webbing (Brad Stevens, NMFS, pers. comm). Pot limits and escape mechanisms may have greatly minimized ghost fishing due to pot loss in recent years.

Another very minor source of human induced crab mortality is direct gear impacts. Direct gear impacts result from a pot landing on the ocean floor when it is being set, presumably damaging any crab on which it lands. With reasonable assumptions, direct gear impacts are only a very minor source of mortality, however. An estimate of this impact can be derived by multiplying the number of pot lifts, the area they occupy, and relative crab density within areas fished in the Bering Sea. Assuming that pots land on different areas after each lift, and crab pots are set non-randomly over areas with relatively high density of crabs in directed fisheries, the total number of crab impacted can be roughly estimated. For 1993 the red king crab fishery, assuming a density of 5,000 red king crab of all sizes per square mile (density data from Stevens et al. 1998), a maximum of about two thousand red king crab were impacted (NPFMC 1996). Similarly, a maximum of 9,000 Tanner crabs (assuming 10,000 crab/mile2) and 110 thousand snow crabs (assuming 75,000 crab/mile2) were impacted by direct gear impacts in respective crab fisheries in 1993. It is not known what proportion of these crab die when a crab pot lands on them.

Trawl Gear

Not all crabs in the path of a trawl are captured. Some crab pass under the gear, or pass through the trawl meshes. Non-retained crabs may be subject to mortality from contact with trawl doors, bridles, footrope, or trawl mesh, as well as exposure to silt clouds produced by trawl and dredge gear. Only a few studies have been conducted to estimate catchability of crabs by trawl gear, and these studies are summarized below.

In one experiment to measure non-observable mortality, 169 red king crabs were tethered in the path of an Aleutian combination trawl (Donaldson 1990). The trawl was equipped with a footrope constructed of 14 inch bobbins spaced every 3 feet, separated by 6.5 inch discs. Thirty-six crabs (21.3%) were recovered onboard the vessel in the trawl. Divers recovered 46.2% of the crabs not captured by the trawl. Another 32.5% were not recovered but assumed to have interacted with the trawl. Of the 78 crabs not retained in the trawl, but captured by divers, only 2.6% were injured. If all injured crabs die, the non-observable mortality rate for trawl gear on red king crabs is estimated at 2.6% (Donaldson 1990). It should be noted that hard shelled crabs were used in this experiment; higher impacts would be expected if softshelled crabs were tested. Additionally, some areas have had higher intensity of bottom trawling than other areas, thus potentially exposing some crabs to multiple interactions with trawl gear.

In 1995, NMFS used underwater video cameras to observe the interaction of trawl gear with king and Tanner crabs (Craig Rose, NMFS, unpublished data). The experiment was conducted in Bristol Bay in an area with large red king crabs and Tanner crabs. Three types of trawl footropes were examined and they are as follows: a footrope with 3-4 foot lengths of 6" discs separated by 10" discs (called disc gear), a footrope with 24" rollers (tire gear), and an experimental float/chain footrope with the groundgear suspended about 8" off the seafloor. For disc gear, preliminary analysis indicated that all red king crab encountered entered the trawl and about 76% of the Tanner crabs were caught. Tire gear captured fewer king crabs (42%) and Tanner crabs (1%). The float/chain gear did not catch any of the crabs encountered. At the December 1995 Council meeting, excerpts of the NMFS video were shown to the Council and public. Trawl industry representatives testified that groundgear used to harvest finfish in this area depended on target species and bottom type, with tire gear type footropes used in hard bottom areas, and disc type gear used on smooth bottom areas. Testimony also indicated that variability existed in groundgear used among vessels, but that on average, most gear used in Bristol Bay trawl fisheries would be comprised of groundgear with discs or rollers larger than the disc gear tested and smaller than the tire gear tested.

The NMFS underwater video observations were further analyzed to determine the proportion of red king crab that were injured by passage under bottom trawl footropes (Rose 1999). Injury rates of 5% to 10% were estimated for crabs that encountered, but were not captured, in the center section of the trawl.

REFERENCES

Barnhart, J.P., and N. Sagalkin. 1998. Summary and analysis of onboard collected data from the 1996/97 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game Commercial Fisheries, Regional Information Report. Kodiak.

Blackburn, J. and D. Schmidt. 1988. Injury and apparent mortality rates from incidental trawl catches of halibut, king crab, and Tanner crab in the Kodiak area, 1977-81. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-21.

Breen, P.A. 1987. Mortality of Dinginess crabs caused by lost traps in the Fraser River estuary, British Columbia. North American Journal of fisheries Management 7:429-435.

Byersdorfer, S., and L.J. Watson. 1992. A summary of biological data collected during the 1991 Bristol Bay red king crab tagging study. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 92-14.

Byersdorfer, S., and L.J. Watson. 1993. A summary of biological data collected during the 1992 Bristol Bay red king crab test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 92-14.

Carls, M.G., and C.E. O'Clair. 1990. Influence of cold air exposures on ovigerous red king crabs (*Paralithodes camtschatica*) and Tanner crabs (*Chionoecetes bairdi*) and their offspring. Proceedings of the International Symposium on King and Tanner Crabs. Alaska Sea Grant College Program Report No. 90-04.

Carls, M.G. and C. E. O'Clair. 1995. Responses of Tanner crabs, Chionoecetes bairdi, exposed to cold air. Fish. Bull. 93: 44-56.

Donaldson, W.E. 1990. Determination of experimentally induced non-observable mortality on red king crab. Alaska Department of Fish and Game Regional Information Report 4K90-13.

Fukuhara, F.M., and D. Worlund. 1973. Incidence of halibut and Tanner crab in catches by the eastern Bering Sea mothership trawl fishery and independent trawlers. NOAA/NMFS/NAFC Report to the International North Pacific Fisheries Commission.

Hammerstrom, L.F., and M.F. Merritt. 1985. A survey of Pacific weathervane scallops (*Patinopecten caurinus*) in Kamishak Bay, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Information Leaflet 252.

Hayes, M.L. 1973. Survival of Tanner crab (*Chionoecetes bairdi*) after capture in trawls and subsequent handling and storage aboard fishing boats. NOAA/NMFS report to the International North Pacific Fisheries Commission.

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

High, W.L. 1976. Escape of Dunginess crabs from pots. Marine fisheries review 38(4):19-23.

High, W.L. 1985. Some consequences of lost fishing gear. Pages 430-437 in R.S. Shomura and H.O. Yoshida, editors. Proceedings of the workshop on the fate and impact of marine debris. NOAA/NMFS/SWFC Technical Memorandum 54.

High, W.L. , and D.D. Worlund. 1979. Escape of king crab (*Paralithodes camtschatica*) , from derelict pots. NOAA/NMFS/SSRS Technical Report 734.

Kimker, A. 1994. Tanner crab survival in closed pots. Alaska Fishery Research Bulletin 1(2):179-183.

Kruse, G.H., and A. Kimker. 1993. Degradable escape mechanisms for pot gear: a summary report to the Alaska Board of Fisheries. Alaska Department of Fish and Game Regional Information Report 5J93-01.

MacIntosh, R.A., B.G. Stevens, and J.A. Haaga. 1996. Effects of handling and discarding on mortality of Tanner crabs, *Chionoecetes bairdi*. Proceedings of the International Symposium on Biology, Management, and Economics of Crabs from High Latitude Habitats. Alaska Sea Grant College Program Report 96-05:577-590.

Meyer, R.M. 1971. A study concerning the problem of derelict pots in the king crab fishery. NOAA/NMFS unpublished manuscript.

Murphy, M.C. and G.H. Kruse. 1995. An annotated bibliography of capture and handling effects on crabs and lobsters. Alaska Fishery Research Bulletin 2(1):23-75.

NPFMC (North Pacific Fishery Management Council). 1993. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility Analysis alternatives to allocate the Pacific cod total allowable catch by gear and/or directly change the seasonality of the cod fisheries: Amendment 24 to the Fishery Management Plan for the groundfish fishery of the Bering Sea and Aleutian Islands area. October 1993.

NPFMC (North Pacific Fishery Management Council). 1994. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility analysis for Amendment 21a to the Fishery Management Plan for the Scallop Fishery of the Bering Sea and Aleutian Islands area.

NPFMC (North Pacific Fishery Management Council). 1995. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility analysis for red king crab bycatch in the Bering Sea trawl fisheries and alternatives for closure areas.

NPFMC (North Pacific Fishery Management Council). 1996. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility analysis for Amendment 37 to the Fishery Management Plan for Bering Sea and Aleutian Islands Groundfish.

NPFMC (North Pacific Fishery Management Council). 1999. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility analysis for Amendment 11 to the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs.

NRC (Natural Resources Consultants). 1988. Minimization of King and Tanner crab by-catch in trawl fisheries directed at demersal groundfish in the Bering Sea. February 1988.

Owen D. 1988. A bottom trawl survey on the west side of Kodiak Island: Viekoda Bay, Spiridon Bay, and Kupreanof Strait. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-28.

Paul, J.M., A.J. Paul, and A. Kimker. 1993. Starvation resistance in Alaska crabs: interim report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A93-03.

Queirolo, L.E., L.W. Frita, P.A. Livingston, M.R. Loefflad, D.A. Colpo, and Y.L. deReynier. 1995. Bycatch, Utilization, and Discards in the Commercial Groundfish Fisheries of the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. NOAA Technical Memorandum.

Rose, C. S. 1999. Injury rates of red king crab, *Paralithodes camtschatica*, passaging under bottom trawl footropes. Marine Fisheries Review 61(2):72-76.

Shirley, T.C. 1998. Appendix D: Crab handling mortality and bycatch reduction. In King and Tanner crab research in Alaska: Annual report for July 1, 1997 though June 30, 1998. Alaska Department of Fish and Game Regional Information Report No. 5J98-07.

Shirley, T. C. 1999. Appendix B: Effects of windchill on red king crabs. Ed. G. H. Kruse. King and Tanner Crab Research in Alaska. Annual Report for July 1, 1998 through June 30, 1999. Regional Information Report No. 5J99-10.

Somerton, D.A. and R.S. Otto. 1999. Net efficiency of a survey trawl for snow crab, *Chionoecets opilio*, and Tanner crab, C. bairid. Fish. Bull. 97:617-625.

Stevens, B.G. 1990. Survival of king and Tanner crabs captured by commercial sole trawls. Fishery Bulletin 88:731-744.

Stevens, B.G., and R.A. MacIntosh. 1993. Survival of crabs discarded from commercial pot fisheries. Cited in Queirolo et al. 1995. Bycatch, Utilization, and Discards in the Commercial Groundfish fisheries of the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. NOAA Technical Memorandum NMFS-AFSC-58.

Stevens, B.G., J.A. Haaga, and R.A. MacIntosh. 1998. Report to the industry on the 1998 Eastern Bering Sea crab survey. NOAA/NMFS-AFSC Processed Report 98-07.

Tracy, D.A. 1994. Biological summary of the 1992 mandatory shellfish observer program database. Alaska Department of Fish and Game. Regional Information Report 4K94-10.

Urban, D., D. Pengilly, and I. Vining. 1994. The scallop observer program and statewide data analysis summary to the Board of Fisheries. Alaska Department of Fish and Game Report 4K94-28.

Vining, I., S. Byersdorfer, W. Donaldson, B. Stevens, and G. Edwards. 1997. Lost crab and cod pot recovery and ghost fishing in Chiniak Bay and other areas in the waters around Kodiak Island, Alaska. Alaska Department of Fish and Game, Regional Information Report No. 4K97-42.

Vining, I., D. Witherell, and J. Heifetz. 1997. The effects of fishing gear on benthic communities. In: 1998 Ecosystem Chapter of SAFE Report.

Warrenchuk, J. J. 2001. The effects of windchill exposure on the snow crab, Chionoecetes opilio. M.S. Thesis, University of Alaska Fairbanks. 126 pp.

Warrenchuk, J. J. and T. C. Shirley. (accepted, 2001) Estimates of mortality of snow crab, Chionoecetes opilio, discarded during the Bering Sea fishery in 1998. Alaska Fisheries Research Bulletin.

Warrenchuk, J. J. and T. C. Shirley. 2002. The effects of windchill on the snow crab, Chionoecetes opilio. Crabs in cold water regions: biology, management, and economics. A.J. Paul, E.G. Dawe, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley, and D. Woodby (eds). University of Alaska Sea Grant, AK-SG-02-01, Fairbanks. 876 pp.

Watson, L.J., and D. Pengilly. 1994. Effects of release method on recovery rates of tagged red king crabs (*Paralithodes camtschaticus* in the 1993 Bristol Bay commercial fishery. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K94-40.

Zheng, J. M.C. Murphy, and G.H. Kruse. 1995. Overview of population estimation methods and robust long-term harvest strategy for red king crabs in Bristol Bay. Alaska Department of Fish and Game Regional Information Report No. 5J95-21.

Zhou, S. and T.C. Shirley. 1995. Effects of handling on feeding, activity, and survival of red king crabs, *Paralithodes camtschaticus* (Tilesius, 1815). Journal of Shellfish Research 14:173-177.

Zhou, S. and T.C. Shirley. 1996. Is handling responsible for the decline of the red king crab fishery? Proceedings of the International Symposium on Biology, Management, and Economics of Crabs from High Latitude Habitats. Alaska Sea Grant Program Report 96-02:591-611.

Zhou, S. and G.H. Kruse. 1998. Appendix C: Crab handling mortality and bycatch reduction. In King and Tanner Crab Research in Alaska: Annual Report for July 1, 1997 through June 30, 1998. Alaska Department of Fish and Game Regional Information Report No. 5J98-07.

ANNUAL MANAGEMENT REPORT FOR THE COMMERCIAL AND SUBSISTENCE SHELLFISH FISHERIES OF THE ALEUTIAN ISLANDS, BERING SEA AND THE WESTWARD REGION'S SHELLFISH OBSERVER PROGRAM, 2003

By

Westward Region Shellfish Staff

Regional Information Report[1] No. 4K04-43

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

September 2004

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

LIST OF TABLES (Cont.)

LIST OF FIGURES

LIST OF FIGURES (Cont.)

ABSTRACT

The Alaska Department of Fish and Game (ADF&G) is tasked with management of all commercial, subsistence and personal use shellfish fisheries occurring in the Territorial Sea and Exclusive Economic Zone (EEZ) of the Aleutian Islands west of Scotch Cap Light (164° 44' W long.) and all Bering Sea waters of the Territorial Sea and EEZ north of Cape Sarichef (58° 39' N lat.). King crab in the Bering Sea north of Cape Romanzof and Tanner crab in Norton Sound are managed by ADF&G's Arctic-Yukon-Kuskokwim Region.

In 2003, three species of king crabs, snow crabs, Tanner crabs, Dungeness crabs, and giant Pacific octopus were taken in the Bering Sea and Aleutian Islands (BSAI) commercial and subsistence fisheries.

This report presents details on the commercial and subsistence harvest, participation and value of shellfish fisheries in the BSAI area. Historical and current fishery management practices, a summary of the most recent commercial fishery and stock status information are presented for each fishery. The Bering Sea king and Tanner crab community development quota (CDQ) crab fisheries and American Fisheries Act (AFA) crab sideboards for Bristol Bay red king crab are summarized.

To enhance shellfish fishery management and collect data that would otherwise be unavailable, ADF&G has operated an observer program in the BSAI for crab since 1988 and for scallop since 1993. Varying levels of observer coverage are required for each crab fishery and observers are deployed on catcher vessels, catcher processors and floating processors. Observer costs are paid by either the vessel or ADF&G. Details of the crab and scallop observer program are presented as well as information on the BSAI pot limit program.

OVERVIEW

The ADF&G Westward Region includes all waters of the Territorial Sea and EEZ south of Cape Douglas (58° 51.1' N lat.) and west of 148° 50.25' W long. to the U.S.-Russia Maritime Boundary. ADF&G in Dutch Harbor is tasked with management of all commercial, subsistence and personal use shellfish fisheries occurring in the Territorial Sea and Exclusive Economic Zone (EEZ) of the Aleutian Islands west of Scotch Cap Light (164° 44' W long.) and all Bering Sea waters of the Territorial Sea and EEZ north of Cape Sarichef (58° 39' N lat.). King crab in the Bering Sea north of Cape Romanzof and Tanner crab in Norton Sound are managed by ADF&G's Arctic-Yukon-Kuskokwim Region. The waters of the BSAI support the largest and most valuable commercial crab fisheries in Alaska.

The BSAI are divided into registration areas for king crab management and include districts of Registration Area J for Tanner crab, Dungeness crab and miscellaneous shellfish management. BSAI king and Tanner crab fisheries are managed under a federal fisheries management plan (FMP) that establishes a cooperative management structure deferring king and Tanner crab management to the state of Alaska with federal oversight. The Bering Sea hair crab fishery is managed solely under state jurisdiction, as are other crab and miscellaneous shellfish fisheries.

Species commercially harvested during 2003 in waters of the Bering Sea and Aleutian Islands (BSAI) include red king crabs *Paralithodes camtschaticus*, golden king crabs *Lithodes aequispinus*, scarlet king crabs *Lithodes couesi,* snow crabs *Chionoecetes opilio*, Tanner crabs *Chionoecetes bairdi*, grooved Tanner crabs *Chionoecetes tanneri*, triangle Tanner crabs *Chionoecetes angulatus*, Dungeness crabs *Cancer magister*, and giant Pacific octopus *Octopus dolfeini*. Historically, waters of the BSAI have supported commercial harvests of blue king crabs *Paralithodes platypus*, green sea urchins *Strongylocentrotus droebachiensis*, pandalid shrimp, hair crab *Erimacrus isenbeckii, and* sea snails of several species, however these fisheries are currently either closed due to low abundance or are not being commercially pursued. In addition, a fishery for weathervane scallops *Patinopectin caurinus* occurs in the BSAI, however it is summarized in a separate report.

In 2003, 250 catcher vessels, eight catcher processors, six floating processors and 18 shorebased processors were involved in harvesting and processing non-scallop shellfish resources in the BSAI. BSAI shellfish landings totaled approximately 47.6 million pounds generating an approximate exvessel value of $147 million.

The Bering Sea snow crab fishery was the largest shellfish fishery in Alaska with a total harvest of 28.5 million pounds, followed by the Bristol Bay red king crab fishery with a total harvest of 15.7 million pounds and the Aleutian Islands golden king crab fishery with a total harvest of 5.7 million pounds.

In addition to the fisheries previously mentioned, there was a fishery for golden king crabs in the Pribilof District (0.15 million pounds), a fishery for red king crabs in the Petrel Bank portion of the Aleutian Islands (0.5 million pounds), and a fishery for grooved Tanner crab in the Bering Sea (0.2 million pounds). Scarlet king crabs were taken incidentally in the Aleutian Islands golden king crab fishery. Fisheries for red and blue king crabs in the Pribilof District, for blue king crabs in the Saint Matthew Island Section and for red king crabs in the eastern Aleutian Islands were closed due to low abundance. Both the Saint Matthew Island and Pribilof blue king crabs stocks are considered overfished.

While the Bering Sea snow crab fishery was open in 2003, the harvest was well below the long-term average and the stock is considered overfished. The Bering Sea Tanner crab fishery was closed due to low abundance, as were the Aleutian Islands Tanner crab fisheries. A commercial test fishery was conducted in the Eastern Aleutian Tanner crab District and 15,000 pounds of Tanner crab were harvested.

Dungeness crab harvests in the BSAI have historically been small. No boats registered to fish for Dungeness crab during the 2003 season in either the Aleutian Islands or North Peninsula Districts.

Relative to other portions of the Westward Region, the BSAI area has never supported large harvests of shrimp. In 2003, one vessel registered to fish for shrimp in the Aleutian Islands, thus all information is confidential.

2003 saw little participation in most BSAI fisheries for miscellaneous shellfish species. The Bering Sea hair crab fishery was closed due to low abundance and there was no effort targeting green sea urchins or sea cucumbers. Giant Pacific octopus were harvested incidentally in BSAI groundfish fisheries.

Both state and federal management agencies and the public have come to rely on shellfish observer data to provide information on the targeted and non-targeted portions of the catch. All vessels that process crabs at sea are required to be observed and catcher vessel observer coverage is either full or partial depending on the fishery. Vessels that process at sea pay for observer coverage themselves, while catcher vessels, depending on the fishery, either pay for coverage themselves or the department pays for the coverage with test fish funds.

Pot limits for BSAI crab fisheries were implemented in 1992. ADF&G currently issues buoy tags to enforce the various pot limits. This report summarizes the activities of the BSAI buoy tag program.

ANNUAL MANAGEMENT REPORT FOR THE COMMERCIAL AND SUBSISTENCE SHELLFISH FISHERIES OF THE ALEUTIAN ISLANDS, 2003/04

By

Karla Granath
and
Myke Bon

Dutch Harbor Area Office
P. O. Box 920587
Dutch Harbor, Alaska 99692

ALEUTIAN ISLANDS KING CRAB MANAGEMENT AREA

Description of Area

The Aleutian Islands king crab Registration Area O has as its eastern boundary the longitude of Scotch Cap Light (164° 44' W long.), its northern boundary a line from Cape Sarichef (54° 36' N lat.) to 171° W long., north to 55° 30' N lat., and as its western boundary the Maritime Boundary Agreement Line as that line is described in the text of and depicted in the annex to the Maritime Boundary Agreement between the United States and the Union of Soviet Socialist Republics signed in Washington, June 1, 1990 (Figure 1-1). 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).

ALEUTIAN ISLANDS RED KING CRAB

Historical Background

Historically, the red king crab *Paralithodes camtschaticus* resource in the Aleutian Islands was harvested in two registration areas. The Adak Registration Area consisted of those waters in the Aleutian Islands west of 171° W long., while the Dutch Harbor Registration Area encompassed waters east of 171° W long., (Figure 1-2). In addition, as the fleet moved westward, a third Registration Area (Area S) was established for the waters around Amchitka Island and the Petrel Bank. Area S was created in 1967 and was merged into Area R in 1978 (ADF&G 1991). In March of 1996, the Alaska Board of Fisheries (BOF) established the Aleutian Islands king crab Registration Area (Area O) by combining the existing Dutch Harbor and Adak Registration Areas. The BOF adopted this change to improve management of the increasingly important golden king crab *Lithodes aequispinus* resource in the Aleutian Islands. Combining the Adak and Dutch Harbor Areas was not expected to impact management of red king crabs in the Aleutian Islands (ADF&G 1999a).

Domestic fisheries for red king crabs in both the Adak and Dutch Harbor Registration Areas began in 1961, with effort and harvest increasing rapidly in both areas. The Adak Area reached a peak harvest of 21 million pounds in 1964/65, while maximum production of 33 million pounds in the Dutch Harbor Area was reached in 1966/67 (Table 1-1, Figure 1-3). Fluctuating harvest levels from one year to the next characterized the fisheries in the Dutch Harbor and Adak areas, and by the 1982/83 season the Dutch Harbor fishery had declined to a harvest of 430,000 pounds. Commercial fishing for red king crabs in the Dutch Harbor Area was closed on an annual basis after the 1982/83 season. The Adak fishery remained open through the 1995/96 season when only 39,000 pounds were harvested. After the 1995/96 season the fishery was closed for several years. Portions of the area were opened during the 1998/99, 2000/01, and 2001/02 seasons in order to assess the status of red king crab stocks. In 2002/03 the Petrel Bank portion of Area O was reopened to commercial fishing with a guideline harvest level (GHL) of

500,000 pounds. The Aleutian Islands red king crab fishery had a maximum fishery value of nearly $20 million in the 1980/81 season (Table 1-2).

Observers have been required on all crab catcher-processor vessels since 1988 and on catcher vessels targeting red and golden king crabs in the Aleutian Islands since 1995. Observer coverage on golden king crab vessels provides red king crab bycatch data from that fishery, although red king crab bycatch in golden king crab gear is minimal due to the limited overlap in distribution of the two species. Observer coverage provides data on retained and non-retained crabs as well as information related to fishing patterns.

In 1996 and 1997, a catcher-processor vessel was permitted to target red king crabs on the Petrel Bank during directed golden king crab fishing. The goals of this project were to enumerate, tag, and collect biological data from all red king crabs captured and to recapture tagged individuals. During this two-year period, a total of 926 crabs were tagged along the north side of Amchitka Island and along the south side of Semisopochnoi Island. Of the tagged crabs, 440 were legal males and 160 were females; 89% of legal crabs were new shell. Recovery efforts yielded 15 tagged crabs, 6 of which were legal males. While the tagging was too limited to provide quantitative stock assessment data, it did provide some information related to migration, molting cycle, and seasonal distribution (Byersdorfer 1998).

In order to assess the status of red king crab stocks in portions of the Aleutian Islands where the department has gained little recent abundance information, a limited commercial fishery was opened on November 1, 1998 in two areas of the Aleutian Islands with the provision that crabs not harvested be tagged and released. In addition, vessel operators were required to document all red king crab fishing activities in a pilot house log book. East of 179° W long., a GHL of 5,000 pounds was established and west of 179° E long., a GHL of 10,000 pounds was set; these GHLs were set using historic catch information. Closed waters included the Petrel Bank, or the area between 179° E long. and 179° W long. The department did not open the Petrel Bank area in 1998/99 since prior efforts had provided some population data from that area (Byersdorfer 1998).

Three vessels registered to harvest red king crabs in the Aleutian Islands during the 1998/99 season, but only one recorded any landings. The GHL was not reached in either open area and the fishery was closed by emergency order on July 31, 1999. Observers were required on all vessels participating in the 1998/99 fishery.

In order to address concerns for red king crab abundance in the Petrel Bank area, two surveys were conducted in January/February and November, 2001. Due to budget constraints, the survey was designed so fishers could retain and sell all legal male red king crabs captured to cover survey expenses. The commissioner's permit specified stations to be fished, soak times and effort levels.

Capture of red king crabs from both of the 2001 surveys in the Petrel Bank area indicated healthy levels of legal males. CPUE (catch per unit of effort, defined as number of legal crabs per pot lift) for the combined surveys was 28. Survey CPUEs are not directly comparable to previous commercial fishery CPUEs because pot lifts in prior commercial fisheries were not conducted in a systematic manner and may have occurred in different fishing locations (Bowers et al. 2002). Sublegal male and female CPUE for the combined surveys was two and three, respectively.

Size frequency data from the 2001 surveys were comparable to the size composition that was found in catches prior to the 1995/96 fishery closure. The size frequency indicates that approximately 61% of the sampled legal-size crabs were post recruits. Of the crabs sampled 77% were new-shell. Similar to the surveys conducted in the mid 1990s, very few sublegal crabs were captured during the 2001 surveys.

The surveys conducted in 2001 indicate that legal male abundance has increased since the fishery was closed, however, red king crab female and sublegal abundance remains low. Given the legal male abundance, a limited commercial fishery on the Petrel Bank was re-opened during the 2002/03 season with a GHL of 500,000 pounds. With current effort levels, this is considered the minimum GHL that can be managed inseason. Because of the uncertainty in the status of sublegal and female red king crabs and to provide for overall stock protection, the department adopted a management strategy that would close the fishery prior to achieving the GHL if legal male CPUE drops below 10 crabs/pot. Establishing a low GHL with a moderate CPUE threshold level should help prevent the stock from declining to levels seen in the mid-90s. Trends in fishery performance will be used to evaluate future GHLs and having a defined threshold for closing the fishery will permit clearer understanding of the management strategy. Prior to opening a commercial fishery in other portions of the western Aleutians, the department will need to conduct surveys similar to those performed on the Petrel Bank.

In addition to commercial fisheries, long-standing subsistence and sport fisheries have targeted red king crabs in the vicinity of Unalaska Island. To gather subsistence harvest data, the department has periodically required fishers to obtain a harvest permit and log sheet. Historically, few of the permits were returned and the program was discontinued in 1994. On average, 15 permits were returned per year. The reported average annual harvest was 135 king crabs.

To address conservation concerns for the eastern Aleutian Islands red king crab stock, the BOF took action at the March 1999 meeting regarding the subsistence and sport king crab fisheries in that portion of the Aleutian Islands between 168° and 164° 44' W long. Regulations were adopted by BOF that closed the sport fishery and reduced the daily bag limit of subsistence king crabs from six to one per person per day. BOF also adopted regulations requiring that subsistence king and Tanner crab fishers operating in the Aleutian Islands between 168° and 164° 44' W long. obtain a subsistence permit before fishing.

In 2002, ADF&G issued 237 subsistence permits and harvest logsheets, of which 231, or 97.5%, were returned. The returned permits accounted for a harvest of 1,080 king crabs (Table 1-3). Estimates generated from the subsistence harvest logsheets indicate that approximately 1,108 king crabs were taken with harvest ranging from zero to 76 king crabs per permit. The majority of subsistence caught king crabs were taken from Captains Bay (48%) and adjacent to the Dutch Harbor spit (33%). There were 24 king crabs taken with dive gear (2%) and the remaining 1,056 crabs were taken with 1,902 pot lifts for an average CPUE of <1 legal crab per pot. Seventy-seven percent of the king crabs were harvested in June. These harvest figures are substantially less than estimates generated by a 1994 survey of 15.1% of households in Unalaska, where 6,892 king crabs were estimated to have been taken (ADF&G 1999b).

2003/04 Commercial Fishery

The Aleutian Islands king crab Registration Area O opened to commercial fishing for red king crabs by emergency order at NOON Alaska daylight time, October 25, 2003. The fishery occurred in the Petrel Bank area, which is defined as those waters of king crab Registration Area O west of 179° W long., east of 179° E long., and north of 51° 45' N lat. Based on historic catch information and results from the 2001 Petrel Bank pot surveys, the department established a GHL of 500,000 pounds.

Preseason registrations were received from 34 vessels and based on this number, pot limits were set at 34 pots for vessels less than or equal to 125 feet in overall length, and 43 pots for vessels greater than 125 feet in overall length. Thirty vessels participated in the Petrel Bank red king crab fishery. The fleet pulled 5,774 pots, an average of 192 pots per vessel.

Fishing effort was heavily concentrated on the west side of the Petrel Bank, north of Semisopochnoi Island. Catch rates tended to be higher during the day and dropped off slightly during the evening when the buoys were down as a result of strong currents. CPUE for the Petrel Bank was 10 legal crabs per pot lift and legal crabs averaged 8.0 pounds. The closure announcement was made at 8:00 PM on October 28, providing ten hours advance notice to the fleet.

Area O was closed to commercial fishing for red king crabs by emergency order at 6:00 AM Alaska standard time, October 29, 2003, 91 hours after it opened. Final harvest numbers indicate that 479,113 pounds of red king crabs were landed (Table 1-1). Five shore-based processors in Dutch Harbor, one in King Cove, one in Adak, and two catcher-processors purchased red king crabs. Exvessel price averaged $5.14 per pound and the 2003 Petrel Bank fishery had a total value of nearly $2.45 million (Table 1-2).

2003 Subsistence Fishery

In 2003, ADF&G in Dutch Harbor issued 231 subsistence permits and harvest logsheets, of which 105, or 45.5%, have been returned. The returned permits accounted for a harvest of 331 king crabs (Table 1-3). Estimates generated from the subsistence harvest logsheets indicate that approximately 728 king crabs were taken with harvest ranging from zero to 48 king crabs per permit. The majority of subsistence caught king crabs were taken in Captain's Bay (87%) and adjacent to the Dutch Harbor spit (8%). All of the red king crabs were taken with pot gear and the average CPUE was <1 legal crab per pot. Eighty-five percent of the red king crabs were harvested in June.

Fishery Management and Stock Status

A vessel may be registered to fish in the commercial red king crab and golden king crab fisheries concurrently; however, only single line pots may be operated in areas open to red king crab fishing and only longline pots may be operated in areas open to golden king crab fishing. Likewise, red king crab may only be retained from single line pots and golden king crab may only be retained from longline pots. Golden king crab fisheries in the Aleutian Islands are not restricted by pot limits. In the Petrel Bank red king crab fishery the fleet may operate no more than 1,250 total pots.

Western Aleutian Islands pot surveys conducted from 1975 to 1977 provided CPUE, fecundity, and relative abundance information of red king crabs (ADF&G 1978). Pot surveys were conducted on an annual basis in the Dutch Harbor Area until 1990 when trawl surveys were implemented to survey larger areas in a more timely fashion and to reduce gear selectivity inherent to pot fishing activities (Urban 1992). In the late 1970s, GHL ranges were established using a blend of pot survey results and fisheries data. Historic fishery GHLs set in the late 1970s ranged from 8.0 million to 26 million pounds for Dutch Harbor and from 0.5 million to 3.0 million pounds in Adak (ADF&G 1978). GHLs were often modified inseason based on fishery performance.

Most shellfish research in the Aleutian Islands has been directed at crab stocks inhabiting the eastern Aleutian Islands. Bottom trawl surveys of the waters around Unalaska Island were conducted in 1991, 1994, 1995, 1999, 2000, and 2003. Recent bottom trawl surveys have not captured many king crabs. In 1995, only two red king crabs were caught, thus no population estimate could be generated. During the 1999 survey, 72 red king crabs were caught, one of which was a legal male. All others were pre-recruit males and small females captured in a single tow made in Kalekta Bay (Worton 2000). This catch, while encouraging, does not appear to constitute a rebuilding event. The eastern Aleutian Islands were again surveyed by bottom trawl during the summer of 2000 and 2003. A single red king crab was captured during both years (Spalinger 2004 and Worton 2001), indicating that the red king crab population in the eastern Aleutian Islands remains severely depressed.

In November of 2002 the department conducted a survey similar in design to the Petrel Bank surveys of 2001 in the area between 172° W long. and 179° W long. The survey area was developed in consultation with Industry and focused on areas of historic red king crab abundance in the Adak, Atka, and Amlia Islands areas that have been closed to commercial red king crab fishing since the 1998/99 season and had not been previously surveyed. The survey had a total of 116 stations that were divided between state-waters (56 stations) and federal-waters (60 stations).

Ten vessels surveyed a total of 61 stations composed of 1,085 pot lifts. Survey catches were poor and only four legal males were captured during the entire survey. Due to poor survey catches and high operation costs, many vessels were unable to fulfill their survey commitment and only 34% of the survey was completed. The portion of the survey that was completed indicates that the red king crab stocks around Adak, Atka, and Amlia Islands continue to be severely depressed. Therefore, the department does not expect a commercial red king crab fishery to open in this area in the near future (Granath 2003).

Shell-age and size composition data from the 2001 and 2002 fisheries in the Petrel Bank area indicate that primarily older, post-recruit crabs support the fishery. Proportions of sublegal and female red king crabs did not change significantly from the 2001 surveys to the 2002 or 2003 commercial fisheries. Average weight and length of legal male red king crabs continues to increase. Average weight and length of legal male red king crabs increased from the surveys to 7.4 pounds and 162 mm in 2002 and up to 8.0 pounds and 168 mm in 2003.

Cumulative fishery CPUE did not drop below the benchmark of 10 during the 2003 fishery, although final numbers from fish ticket data indicate that the final fishery CPUE was 10 crabs per pot. Fishery CPUE climbed during the first 36 hours from 8.5 to 15.0 crabs per pot and steadily dropped for the remainder of the fishery with the exception of the morning of October 28, when most pots had soaked for an additional 12 hours. Compared to the combined survey CPUE of 28 and 2002 fishery CPUE of 18, performance during the 2003 fishery does not look promising and the stock appears to be in decline.

ALEUTIAN ISLANDS GOLDEN KING CRAB

Historic Background

The golden king crab *Lithodes aequispinus* fishery in the Aleutian Islands has never failed to open due to low stock abundance, making it unique among Westward Region king crab fisheries. Golden king crabs inhabit depths greater than where 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 two 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 (Table 1-4). 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 fishery occurred during the 1986/87 season when 12.8 million pounds of golden king crabs were harvested for an exvessel value of $37.6 million (Table 1-5). 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 1983a). 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 Western Aleutian District (Figure 1-2).

From the 1981/82 season to the 1995/96 season, 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 pull (Figure 1-4). In July 1985, 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 (Table 1-4). By the following season, 49 vessels were participating 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 (Figure 1-5). 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 (Table 1-5). The Dutch Harbor Area harvest was primarily from the Islands of Four Mountains and Yunaska Island area (Figure 1-1).

In general, 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 in the 1983/84 season to 4.1 pounds during the 1992/93 season (Figure 1-5). 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). In 1984, 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 and to establish the area as a permit fishery.

At its March 1996 meeting, 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, 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. 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, a GHL of 3.2 million pounds was established 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 harvest rate east of 174° W long., was six legal crabs per pot pull with an average weight of 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 (Figure 1-2). 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 (Table 1-4). 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 (Table 1-5).

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, 13 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 accrued at a rate of 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, 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 (Table 1-5).

These trends continued during the 2001/02 and 2002/03 fisheries. In the area east of 174° W long., 19 vessels participated both seasons and harvested 3.16 million pounds in 2001/02 and 2.77 million pounds in 2002/03. The CPUE and average weight remained the same for both years with an average of 12 crab per pot lift and legal males averaged 4.4 pounds each. In the area west of 174° W long, nine vessels harvested 2.73 million pounds in 2001/02 and six vessels harvested 2.64 million pounds in 2002/03 (Table 1-4). Again, the CPUE and average weight remained constant for both years with an average of seven crabs per pot lift and legal males averaged 4.0 pounds each. Exvessel values for the 2001/02 and 2002/03 seasons were $18.13 and $18.26 million pounds, respectively (Table 1-5).

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 has remained fairly constant during the past ten years (Figure 1-6). 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, especially in the past five years (Figure 1-7). 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 fisheries, those 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 can now deliver closer to the fishing grounds, which saves approximately a week in transit time for each delivery.

2003/2004 Fishery

The 2003/04 Aleutian Islands golden king crab fishery opened by regulation at 12:00 NOON August 15 with a GHL of 5.7 million pounds, 3.0 million pounds of which was apportioned to the area east of 174° W long., and 2.7 million pounds apportioned to the area west of 174° W long. Twenty-one vessels participated in the fishery and landed 5.67 million pounds. The fleet averaged 11 legal crabs per pot lift, up from nine the prior season, and landed crabs averaged 4.3 pounds each which is also higher than the 2002/03 season (Table 1-4).

East of 174° W long.

The commercial fishery for golden king crabs in the Aleutian Islands east of 174° W long. began with 18 vessels registered. The fleet registered 12,518 pots, or 699 pots per vessel, a five percent increase from the 2002/03 fishery when 11,834 pots, or 623 pots per vessel, were registered. Most fishing effort was concentrated around Yunaska Island, Islands of Four Mountains, and in Seguam and Amukta Passes. Catch rates tended to be highest around the Islands of Four Mountains, in Amukta Pass and north of Amlia Island, with the most productive grounds yielding up to 15 legal crabs per pot lift, compared to 16 crabs per pot lift in this area the pervious season (Table 1-6, Figure 1-8). The average catch rate for the entire eastern portion was 11 crabs per pot lift, down from 12 crabs per pot lift the previous season. The average weight of legal crabs was 4.6 pounds, an increase from 4.4 pounds during the 2002/03 season, with the largest crabs encountered east of the Islands of Four Mountains (170° W long.) (Table 1-6).

The fleet harvested 2.98 million pounds of golden king crabs in three and a half weeks of fishing. Landings averaged 869,000 pounds per week. Three shore-based processors in Dutch Harbor and one in Adak processed golden king crabs from the eastern Aleutian Islands. Exvessel price paid for live, whole crabs averaged $3.46 per pound, leading to a fishery value of $10.05 million, making it the third most valuable eastern Aleutian Islands golden king crab fishery on record (Table 1-5). A fishery closure announcement was issued to the fleet on September 3, providing the fleet with five days advance notice of the September 8 closure.

West of 174° W long.

A total of six vessels participated in the fishery west of 174° W long., three vessels began at the fishery opening on August 15, and an additional three joined the fishery after the closure in the east. The fleet registered 7,140 pots, an average of 1,190 pots per vessel, an increase from the previous season when 6,225 pots or an average of 1,038 pots per vessel were registered (Table 1-4). Fishing effort was concentrated around Kanaga Island, Tanaga Island, and the Delarof Islands. Weekly catch rates ranged from six to 14 crabs per pot lift and averaged ten which is up from seven crabs per pot lift the previous season. The average weight of legal crab was 4.0 pounds and has remained unchanged for the past three seasons. The largest crab were harvested from around Tanaga Island (Table 1-6).

The fleet harvested 2.69 million pounds of golden king crab in 25 weeks of fishing, four weeks faster than the previous season, and the shortest season west of 174° W long., on record. Landings averaged 113,000 pounds per week with a maximum weekly landing of 187,880 pounds. Golden king crabs were purchased/processed by one catcher-processor and by three shore-based processors, one in Adak and two in Dutch Harbor. Exvessel price was $3.83 per pound for live, whole crabs, yielding a total fishery value of $10.11 million, making it the most valuable western Aleutian Island golden king crab fishery since the 1994/95 season (Table 1-5).

A fishery closure announcement was issued to the fleet on January 30, providing one-week advance notice to the fleet of the February 6 closure.

Fishery Management and Stock Status

The Aleutian Islands golden king crab fishery is managed using two sources of inseason fishery data. Processors report landed catch to ADF&G weekly or more frequently as requested. These reports are the primary source of inseason harvest information. Observers stationed on each vessel participating in the fishery report average weight and catch rate information that is used in conjunction with landed catch to develop inseason projections of fishery length.

The department surveyed a small portion of the golden king crab habitat in the Aleutian Islands during the summer of 1997 (Blau et al. 1998). Prior to that, the department performed the only survey of this area in 1991 (Blau and Pengilly 1994). Only a small portion of the area in which golden king crabs are commercially important is currently surveyed. Mark-recapture data from the 1997 survey suggested that the commercial fishery was annually removing a minimum of 20% of the legal male crabs present in the area surveyed. The Fishery Management Plan (FMP) for king and Tanner crabs in the Bering Sea and Aleutian Islands specifies that the golden king crab stock in the Aleutian Islands is considered overfished when fishing mortality (F) exceeds 0.2 (NPFMC 1998). A fishing rate of F=0.2 corresponds to an annual mature male removal rate of approximately 18%. During the 1997/98 season, the GHL of 3.2 million pounds in the area east of 174° W long. was exceeded by approximately 300,000 pounds. Therefore, to maintain a long-term average harvest at 3.2 million pounds, the 1998/99 GHL in this area was reduced to 3.0 million pounds (D. Pengilly, ADF&G, Kodiak, personal communication).

The stations surveyed in 1997 were surveyed again in 2000 and 2003. Tag recovery rates changed only slightly even though approximately one-third fewer legal-sized male crabs were tagged in 2000 than in 1997. Harvest rates as indicated by tag returns in the 2000/2001 season were similar to those in 1997/98. Shell-age composition data indicated the stock is healthy, while size composition of the retained catch has changed very little (Watson and Gish 2002). Preliminary results from the 2003 survey indicate that overall approximately 22% fewer crab were tagged compared to the 2000 survey although numbers of tagged legal males were similar. Results from the 2003 survey and subsequent tag recoveries will be available in a report later this year.

Even though the harvest rates are at or near the allowable maximum in some areas, the Aleutian Islands golden king crab population is believed to be healthy. Portions of the stock occur at depths greater than those fished. Additionally, the area surveyed receives more fishing pressure than many other areas in the entire Aleutian Islands, so golden king crabs in other less heavily fished locales may have a lower harvest rate. In order to operate their gear more efficiently, fishers tend to utilize the shallowest waters in which crabs may be found in abundance. Distribution of legal males extends to depths greater than those fished, so the entire depth range distribution of legal males is not exploited. Recent fishery data also indicates that the stock is healthy. Average size of crabs harvested has remained nearly constant for the last six seasons. Average weight has been between 4.3 and 4.6 pounds per crab for the last ten years. Catch per unit of effort has also been stable and has been above the 10-year average during the last four seasons. All this information suggests that the 3.0 million-pound GHL has provided a stable fishery and protects against overfishing as defined in the FMP. Currently, the department intends to survey the area around Amukta and Yunaska Islands every three years, with the next survey scheduled for the summer of 2006.

In the Aleutian Islands west of 174° W long., no surveys are conducted. The 2.7 million-pound GHL has been in effect since the 1996/97 season and was determined on the basis of the preceding 5-year average harvest in the waters west of 174° W long. Fishery and observer data do not demonstrate a compelling reason to change the GHL from 2.7 million pounds as fishery statistics have not markedly changed since it was developed in 1996/97.

ALEUTIAN ISLANDS SCARLET KING CRAB

Historic Background

Scarlet king crabs *Lithodes couesi* are currently harvested under authority of a permit issued by the commissioner of ADF&G and authorized in 5 AAC 34.082. PERMITS FOR *LITHODES COUESI* KING CRAB. These permits are usually issued in conjunction with an Aleutian Islands golden king crab registration. Scarlet king crabs are typically found in waters deeper than 200 fathoms and have been taken as incidental harvest in the golden king crab and deepwater Tanner crab fisheries in the Aleutian Islands. Limited directed fishing has occurred; however, exploratory fishing does not indicate that a large biomass is present. Since 1992, annual harvest of scarlet king crabs in the Aleutian Islands has ranged from less than 5,000 pounds to a peak of nearly 63,000 pounds in 1995, when eight vessels made 21 landings. Exvessel value was at a maximum in 1995 when the fishery was worth approximately $110,000 (Table 1-7). Since 1996, effort and harvest in this fishery have been minimal and catch information has been confidential in all years except 1997 when 6,700 pounds were harvested. When BOF combined the Adak and Dutch Harbor king crab Registration Areas to create Area O, management of scarlet king crabs was not impacted (ADF&G 1999a).

2003 Fishery

In 2003, only two vessels registered to fish for scarlet king crabs in the Aleutian Islands, therefore all harvest information is confidential.

Fishery Management and Stock Status

No surveys are conducted, nor are any estimates of population abundance made for scarlet king crabs in the Aleutian Islands; consequently, stock status and distribution are not well known. Scarlet king crab males larger than or equal to five and one-half inches in CW may be taken as incidental harvest under the conditions of a commissioner's permit. No directed fishing for scarlet king crabs is anticipated prior to adoption of a plan for new and developing fisheries by the BOF. Future directed fisheries for scarlet king crabs would be conducted in accordance with the provisions of that plan. Observer coverage on each vessel registered for the king crab fisheries of the Aleutian Islands has provided biological information that will be used by the department to develop future management measures for scarlet king crab.

EASTERN ALEUTIAN TANNER CRAB DISTRICT

Description of Area

The Eastern Aleutian Tanner crab District encompasses all waters of Registration Area J between the longitude of Scotch Cap Light at 164° 44' W long., west to 172° W long., and south of the latitude of Cape Sarichef at 54°36' N lat. (Figure 1-9). Area J encompasses both waters of the Territorial Sea (0-3 nautical miles) and waters of the Exclusive Economic Zone (3-200 nautical miles).

TANNER CRAB

Historic Background

The Eastern Aleutian District has not supported harvests of Tanner crabs *Chionoecetes bairdi* as large as those recorded in other districts of Area J. Tanner crabs are found only in a few major bays and inlets of the eastern Aleutians and the directed fishery was relatively small in volume and geographically limited until the late 1970s. The fishery began in Akutan and Unalaska Bays and subsequently expanded to include all areas of known Tanner crab distribution in the Eastern Aleutian District. Harvest of Tanner crabs over the last 26 years has typically remained under one million pounds per year. Only in the three consecutive seasons from 1976/77 to 1978/79 did the harvest exceed one million pounds, reaching a peak of 2.5 million pounds in the 1977/78 season (Table 1-8). Vessel participation was low in 1973/74, with only six vessels registered and reached a high of 31 vessels in 1982 when the fishery was in decline. Vessel participation declined in 1991 to five vessels and consequently the harvest reached a low of 50,038 pounds. The Eastern Aleutian Islands Tanner crab fishery reached a maximum exvessel value of approximately $950,000 in 1977/78 (Table 1-9). Commercial fishing for Tanner crabs has not been permitted in the Eastern Aleutian District since 1994 due to low stock abundance.

Subsistence harvest limit reductions applied to the Eastern Aleutian Islands red king crab fishery in 1999 were not applied to Tanner crabs. However, the permit and reporting requirements for subsistence harvest were reinstated. Between 1988 and 1994, an average of 15 subsistence permits per year were returned and accounted for approximately 121 Tanner crabs annually. A survey of 15.1% of Unalaska households in 1994 generated an estimated total subsistence Tanner crab harvest of 10,957 crabs (ADF&G 1999b). ADF&G staff issued 179 subsistence permits in 1999, of which 80 were returned. Returned permits accounted for a Tanner crab harvest of 1,430 crabs and the estimated total harvest was 3,200 crabs (Table 1-3). The majority of Tanner crab harvest occurred in Illiuliuk and Captain's Bays. Tanner crab harvest peaked in early July and continued until the permits expired on January 31.

In 2001, out of the 201 subsistence permits and harvest logsheets issued, 200, or 99.5%, were returned. The returned permits accounted for a harvest of 1,701 Tanner crabs (Table 1-3). Estimates generated from the subsistence harvest logsheets indicate that approximately 1,710 Tanner crabs were taken and harvest ranged from zero to 568 Tanner crabs per permit. The majority of Tanner crabs were taken adjacent to the Dutch Harbor spit (45%) and adjacent to the landfill (24%). Tanner crabs were harvested throughout the year with peak catches occurring in June.

During 2002, ADF&G in Dutch Harbor issued 237 subsistence permits and harvest logsheets, of which 231, or 97.5% were returned. The returned permits accounted for a harvest of 2,451 Tanner crabs (Table 1-3). Estimates generated from the subsistence harvest logsheets indicate that approximately 2,515 Tanner crabs were taken and harvest ranged from zero to 363 Tanner crabs per permit. The majority of Tanner crabs were taken in Captains Bay (40%) and in Iliuliuk Bay adjacent to the landfill and spit (30%). The greatest number were harvested in May, although catch continued throughout the year.

2003 Commercial Fishery

The Tanner crab fishery in the Eastern Aleutian District was not opened during the 2003 season due to low stock abundance.

2003 Subsistence Fishery

In 2003, ADF&G issued 231 subsistence permits and harvest logsheets, of which 105, or 45.5%, have been returned. The returned permits accounted for a harvest of 3,953 Tanner crabs (Table 1-3). Estimates generated from the subsistence harvest logsheets indicate that approximately 8,697 Tanner crabs were taken and harvest ranged from zero to 915 Tanner crabs per permit. The majority of Tanner crabs were taken in Unalaska Bay (66%) and in Iliuliuk Bay adjacent to the landfill and spit (13%), with peak harvest in July although catch continued throughout the year.

Fishery Management and Stock Status

In 2002 the BOF adopted new management measures for the Eastern Aleutian Tanner crab District including pot limits, daily fishing periods and reporting requirements. A total of 300 pots are allowed in the fishery with no more than 50 pots per vessel. Pots may be operated to take Tanner crab only from 8:00 AM until 5:59 PM with a soak time of 14 hours from 6:00 PM until 7:59 AM. Fishers must report daily the number of pot lifts, number of crab retained and any other information considered necessary for the management and conservation of the fishery.

Prior to 1990, sporadic pot surveys were utilized to generate a Tanner crab abundance index in the eastern Aleutian Islands (Urban 1992). The pot surveys were not utilized to generate a GHL; instead they were used to monitor trends in abundance and recruitment. Pot surveys and fishery data were used to establish harvest levels of zero to 250,000 pounds (ADF&G 1983b). Since 1990, trawl surveys have been used to estimate abundance and are used in conjunction with fishery data for management purposes.

Trawl surveys in 1990 and 1991 indicated that a surplus of 100,000 pounds of Tanner crab were available for harvest. Commercial fisheries that opened in 1991 and 1992 based on those surveys resulted in legal male harvests of 50,038 and 98,703 pounds respectively (Table 1-9). A 1994 trawl survey of the same location revealed an 87% decrease in abundance of Tanner crabs since 1991. Results of the 1994 survey prompted the department to issue an emergency order closing the 1995 season (ADF&G 1999b). A trawl survey conducted by the department in 1995 indicated that the abundance of Tanner crabs had increased slightly over the 1994 level, but was still well below levels observed on the 1990 and 1991 surveys. The 1995 survey found an increase in juvenile male and immature female crabs. However, the abundance of legal male crabs was still very low (Urban 1996); thus, the fishery closure was extended.

A trawl survey conducted in 1999 indicated that the biomass of Tanner crabs in the eastern Aleutian Islands had increased. Abundance increases were recorded for all size classes, with females and large males showing the greatest change. Female abundance more than doubled from the 1995 survey estimate to 2.2 million crabs, and male crab abundance increased nearly four-fold to just over 4.0 million crabs of which approximately 0.4 million were legal size. The majority of the recruitment was observed in Akutan, Unalaska, and Makushin Bays (Worton 2000).

Because encouraging recruitment was noted during the 1999 trawl survey, the department surveyed the eastern Aleutian Islands again in 2000. Much of the recruitment observed in Akutan Bay in 1999 was not encountered in 2000; thus the Tanner crab abundance estimate declined (Worton 2001).

A commissioner's-permit survey using pot gear, similar in design to the pot surveys for red king crab in the western Aleutians, was conducted in the eastern Aleutian District during January/February of 2003. The survey focused on areas of historic Tanner crab abundance in Unalaska Bay, Beaver Inlet and Akutan Bay. The pot survey included areas that are inaccessible to the trawl survey. Results from the 2003 pot survey show an increase in the abundance of Tanner crabs in Unalaska Bay and Akutan Bay when compared to historic catch at the same survey locations (Bon 2004).

The 2003 trawl survey estimated total abundance at 6.4 million crabs, the third largest abundance estimate since 1990. Population estimates for legal males, post-recruit males, and adult females were the highest on record (Spalinger 2004). Based on trawl survey estimates, the Eastern Aleutian District Tanner crab stock appears capable of supporting a small harvest of legal males in 2004.

GROOVED TANNER CRAB

Historic Background

In a manner similar to other deep-water crab fisheries in the Aleutian Islands, the first harvest of grooved Tanner crabs *Chionoecetes tanneri* in the Eastern Aleutian District occurred in the early 1980s as incidental harvest in the Dutch Harbor golden king crab fishery. Directed fishing for this species did not begin until 1993, when one vessel participated in a fishery that lasted from July until December. The grooved Tanner crab fishery in the Eastern Aleutian District typically occurred between March and December. Peak harvest in the Eastern Aleutian District occurred in 1995 when seven vessels landed approximately 850,000 pounds (Table 1-10).

Limited data has been collected regarding the abundance, distribution, and stock status of deep-water crab species in the Bering Sea and Aleutian Islands. During the 1993 season, the department utilized data collected by onboard observers to restrict harvest to males of five inches or greater CW. In 1994, pursuant to permit provisions described in 5 AAC 35.511. PERMITS FOR TANNERI AND ANGULATUS TANNER CRAB IN REGISTRATION AREA J, the department required that vessels registered for this fishery carry an observer for all of their fishing activities. Data collected by observers has documented bycatch as well as fishing practices and has aided the department in developing further management measures.

In 1997, the department established GHLs for grooved Tanner crabs in the Eastern Aleutian, Bering Sea, and Alaska Peninsula Districts where most historical harvests had occurred. Harvest levels in this fishery were derived using catch information from previous seasons and data collected by onboard observers. A GHL of 200,000 pounds was established for each of the aforementioned areas, while smaller harvest levels of 100,000 pounds were established for the Kodiak and Western Aleutian Districts to allow for exploratory fishing. In addition, the department required that all pots be equipped with at least two escape rings of 4.5 inches minimum diameter (ADF&G 1999a).

2003 Fishery

No vessels registered to harvest grooved Tanner crabs in the Eastern Aleutian District during 2003.

Fishery Management and Stock Status

The grooved Tanner crab population in the Eastern Aleutian District is not surveyed; consequently, no estimates of population abundance are available for this stock. Fishery data from the mid 1990s is the primary source of information regarding abundance and stock status. Catch per unit of effort declined from 15 legal crabs per pot lift in 1993 to two in 1996 and catches decreased from over 850,000 pounds in 1995 to 106,000 pounds in 1996. In addition, fishing effort was concentrated in three statistical areas immediately to the south of Unalaska

Island. This information indicates that at least in the area historically fished, the population was heavily exploited.

Given poor fishery performance and declining harvests of the mid 1990s, the department re-evaluated deepwater Tanner crab harvest levels in 2000. A GHL range of 50,000 to 200,000 pounds was established for the Eastern Aleutian District. The GHL was set as a range to provide greater flexibility for inseason management and to better inform the public of the department's management goals for the fishery. The fishery will be managed so that the upper end of the GHL range is reached only when catch rates similar to, or greater than those documented prior to the harvest declines of the mid 1990s are observed. In addition to new GHL requirements, the department specified that four 4.5-inch escape rings be placed on the lower third of each pot and required that pots be fished over multiple depth strata. Observers required on all vessels registered for the fishery will collect biological and fishery data.

TRIANGLE TANNER CRAB

Historic Background

In the Eastern Aleutian District triangle Tanner crab *Chionoecetes angulatus* is harvested under a permit authorized in 5 AAC 35.511. PERMITS FOR TANNERI AND ANGULATUS TANNER CRAB IN REGISTRATION AREA J. Triangle Tanner crabs were incidentally harvested in the eastern Aleutian grooved Tanner crab fishery, where the species has occurred in small numbers. Prior to 1995 and the beginning of the directed fishery, no harvest of triangle Tanner crabs was reported on fish tickets; however, shellfish observers stationed on board vessels participating in the grooved Tanner crab fishery observed small numbers of triangle crabs harvested in 1994 (ADF&G 1999a). Two vessels targeted triangle Tanner crabs in the Eastern Aleutian District during the 1995 and 1996 seasons, thus harvest information from those fisheries is confidential (Table 1-11). From 1997 to 2000, no vessels registered to harvest triangle Tanner crabs in the Eastern Aleutian District.

2003 Fishery

No vessels registered to harvest triangle Tanner crabs in the Eastern Aleutian District during 2003.

Fishery Management and Stock Status

Surveys of population abundance are not conducted for triangle Tanner crabs; thus the status of this stock is unknown. Because of the paucity of population level data for this species and the history of the fishery, additional fishing for triangle Tanner crabs in the Eastern Aleutian District will be limited to incidental harvest during the grooved Tanner crab fishery. Vessels registered to fish for grooved Tanner crabs will be permitted to harvest triangle Tanner crabs at up to 50% of the weight of the target species. This harvest level is consistent with the historic development of the fishery and allows retention of a deepwater species that is believed to have a high mortality rate when taken incidentally in pot gear.

WESTERN ALEUTIAN TANNER CRAB DISTRICT

Description of Area

The Western Aleutian District of Registration Area J includes all waters west of 172° W long., east of the United States-Russia Maritime Boundary Line of 1991, and south of 54° 36' N lat. (Figure 1-9). Area J encompasses both waters of the Territorial Sea (0-3 nautical miles) and waters of the Exclusive Economic Zone (3-200 nautical miles).

TANNER CRAB

Historic Background

Harvest of Tanner crabs *Chionoecetes bairdi* from the Western Aleutian District has, in general, been incidental to the directed red king crab fishery in that area. Commercial harvest has ranged from a high of over 800,000 pounds during the 1981/82 season to less than 8,000 pounds in 1991/92 (Table 1-12). No commercial harvest of Tanner crabs has occurred in the Western Aleutian District since 1995/96. The Western Aleutian District Tanner crab fishery reached a maximum value of just over $1 million in the 1981/82 season (Table 1-13). Tanner crab abundance in the Western Aleutian District is probably limited by available habitat. Most of the historical harvest occurred within a few bays in the vicinity of Adak and Atka Islands.

2003/04 Fishery

The Western Aleutian District Tanner crab fishery has a regulatory opening date of November 1, however, the fishery was not opened during the 2003/04 season. The fishery was not opened because there is no BOF approved management plan in place, nor has sufficient population data been collected to develop a GHL.

Fishery Management and Stock Status

No stock assessment surveys are conducted for Tanner crabs in the Western Aleutian District; thus no population estimates are available. Stock status is currently unknown. Historic fisheries were managed using GHLs set from commercial catch data (ADF&G 1985).

GROOVED TANNER CRAB

Historic Background

In the Western Aleutian District, harvest of grooved Tanner crab first occurred in conjunction with the developing golden king crab fishery in the Adak king crab management area during the late 1970s. Effort in this fishery has been minimal with two or fewer vessels participating during most years. Only in 1995 did significant fishing effort occur, when six vessels harvested approximately 146,000 pounds of grooved Tanner crabs (Table 1-14).

To prevent overharvest of this population where little abundance information is available, the ADF&G restricted harvest to males of five inches or greater CW in 1993. In addition, beginning in 1994, and according to provisions provided in 5 AAC 35.511 PERMITS FOR TANNERI AND ANGULATUS TANNER CRAB IN REGISTRATION AREA J, all vessels registered for the fishery were required to carry an onboard observer for all of their fishing activities. Using information collected by onboard observers and historic catch information, the department established GHLs for grooved Tanner crabs in the Western Aleutian District in 1997. The GHL was set at 100,000 pounds; this level was believed to be adequate to allow for exploratory fishing and incidental harvest (ADF&G 1999a). Since 1997, the department has reevaluated harvest levels for deepwater Tanner crabs. Because commercial fishing for grooved Tanner crabs in the Western Aleutian District has only occurred during four seasons and no survey data is available, confidence was not as high in the GHL for this district as in other districts where grooved Tanner crab harvest has occurred. In order to prevent overharvest of this stock, no GHL was set in 2000 when new deepwater Tanner crab GHLs were announced and the fishery will remain closed until further notice.

In addition to harvests of *C. bairdi* and grooved Tanner crab, fishers have anecdotally reported incidental triangle Tanner crab catch in the grooved Tanner crab and golden king crab fisheries in the Western Aleutian District. There have not been any landings of triangle Tanner crab from this area and there is currently no fishery.

2003 Fishery

The Western Aleutian District was not open to commercial fishing for grooved Tanner crabs in 2003.

Fishery Management and Stock Status

No stock assessment surveys have been conducted for grooved Tanner crabs in the Western Aleutian District; therefore, no estimates of population abundance are available. Fishery data from the mid 1990s indicates that the western Aleutian Islands may not support grooved Tanner crab populations as large as the eastern Aleutian Islands and the Bering Sea. Commercial fishery data from the mid 1990s indicates that neither catch nor CPUE were large when compared to those observed in other districts.

ALEUTIAN DISTRICT DUNGENESS CRAB

Description of Area

The Aleutian District for Dungeness crab *Cancer magister* management includes all waters of Registration Area J west of the longitude of Scotch Cap Light (164° 44' W long.), south of the latitude of Cape Sarichef (54° 36' N lat.), and east of the United States-Russia Maritime Boundary Line of 1991 (Figure 1-10). Area J encompasses both waters of the Territorial Sea (0-3 nautical miles) and waters of the Exclusive Economic Zone (3-200 nautical miles).

Historic Background

Islands in the Aleutian Chain are separated by deep passes with swift currents and are closely bordered on the north by the Aleutian Basin and to the south by the Aleutian Trench. Dungeness crabs inhabit bays, estuaries, and other shallow water habitats, areas that are sparse and widely dispersed in the Aleutian Islands. Therefore, populations of Dungeness crabs are small and fishing effort has been low within the district.

The Aleutian District Dungeness crab fishery has occurred primarily as a small-vessel, summer fishery in the vicinity of Unalaska Island. Some larger-vessel effort has occurred in other locales within the district, but fishing in these areas has been sporadic throughout the history of the fishery. Interest and activity in this fishery has been erratic from year to year, with the first reliable reports of harvest made in 1970. Since 1974, harvests have ranged from no landings, to a peak of over 91,000 pounds in 1984/85 (Table 1-15). Four vessels operated that year, with over 80% of their catch coming from Unalaska and Makushin Bays. In addition to commercial harvest, Dungeness crabs have also been taken in subsistence and sport fisheries occurring in the vicinity of Unalaska Island. Subsistence harvest reports returned to ADF&G between 1988 and 1994 indicate that Dungeness harvests were larger than those documented for both red king *Paralithodes camtschaticus* and Tanner crabs *C. bairdi* crabs. On average, 15 harvest reports were returned per year and Dungeness harvest averaged 686 crabs per year with a range of five to 1,906 crabs per year (ADF&G 1999b). No estimate of current Dungeness harvest by sport or subsistence users is available, but it is believed to be small.

2003/04 Fishery

No vessels registered to harvest Dungeness crabs during the 2003/04 season.

Fishery Management and Stock Status

The Aleutian Islands Dungeness crab fishery is managed using size, sex, and season restrictions. Only male Dungeness crabs six and one-half inches (165 mm) or greater in carapace width may be retained in the Aleutian District from 12:00 NOON May 1 to 12:00 NOON January 1. No stock assessment work has been performed and limited biological and fishery data have been collected through dockside sampling. The status of this species in the Aleutian Islands is unknown, but the resource is believed to be limited due to the lack of suitable habitat.

ALEUTIAN DISTRICT SHRIMP

Description of Area

The Aleutian District of Registration Area J, as described for shrimp, includes all Bering Sea and Pacific Ocean waters west of the longitude of Cape Sarichef at 164° 55' W long. and east of the United States-Russia Maritime Boundary Line of 1991 (Figure 1-11). Area J encompasses both waters of the Territorial Sea (0-3 nautical miles) and waters of the Exclusive Economic Zone (3-200 nautical miles). The Aleutian District includes four sections: Unalaska Bay, Makushin Bay, Usof Bay, and Beaver Inlet.

Historic Background

Commercial fishing for shrimp in the Aleutian District began in the 1960s with Russian and Japanese participation. Most harvests occurred northwest of the Pribilof Islands, with some harvests as large as 30,000 metric tons per year. In 1972 a domestic trawl fishery began targeting northern pink shrimp *Pandalus borealis* in the vicinity of Unalaska Island. Catch and effort increased and harvest peaked in 1977/78 at 6.8 million pounds (Table 1-16). Sharp declines in catches after 1978 led to a reduction in season length. Between 1983 and 1991 no fishing occurred; however, in 1992 four catcher-processors targeted shrimp northwest of the Pribilof Islands. Low concentrations of shrimp were located and all four vessels departed the fishery after making a total of six landings for 72,133 pounds. Since 1992, interest in fishing for shrimp in the Aleutian District has remained at a very low level, several vessels registered to fish, but made no landings. In 1999, the first commercial harvest of shrimp in the Aleutian District occurred since 1992. Only two vessels registered for the fishery; therefore, catch information is confidential. Initial catches were composed primarily of northern pink shrimp. As the fishery progressed, sidestriped shrimp *Pandalopsis dispar* became the dominant species in the catch. The fishery was closed on July 9, 1999, because ADF&G did not possess adequate information regarding the abundance and distribution of these species and it was not possible to prosecute the trawl fishery in accordance with 5 AAC 39.210. MANAGEMENT PLAN FOR HIGH IMPACT EMERGING FISHERIES.

2003 Fishery

The 2003 trawl fishery did not open because there was insufficient information on shrimp stock abundance and distribution. There is no closed season for shrimp fishing with pots in the Aleutian Islands. One vessel registered to fish with pots in 2003, thus all catch information is confidential.

Fishery Management and Stock Status

ADF&G has obtained limited population information for the shrimp stocks of the Aleutian Islands. The last extensive commercial activity occurred in the 1970s and trawl surveys conducted by ADF&G and NMFS do not target shrimp. Consequently, ADF&G does not possess information to develop a management plan or conduct a commercial trawl fishery. Fishers have expressed interest in collaborating with ADF&G on a stock assessment survey, but funding constraints have limited such endeavors. Once BOF has adopted a plan for new and developing fisheries, a collaborative survey may be one step in the creation of a sustainable, well-managed fishery. In 2000, NMFS performed a pilot deep-sea trawl survey of the continental slope. Sidestriped shrimp was the most abundant shrimp species, found primarily on the continental slope of the Bering Sea east of Zhemchug Canyon at an average depth of 214 fathoms. NMFS conducted an eastern Bering Sea continental slope survey again in 2002. Sidestriped and northern pink shrimp were the most abundance species encountered although extensive data was not collected (Hoff and Britt 2003). Shrimp are also encountered during the NMFS summer Bering Sea trawl survey. The most abundant species caught on the survey are northern pink shrimp which are found along the outer shelf between the 100 and 200 meter depth contours and humpy shrimp, *P. goniurus*, which are usually found in water shallower than 100 meters.

ALEUTIAN DISTRICT MISCELLANEOUS SHELLFISH SPECIES

Description of Area

The Aleutian Islands portion of miscellaneous shellfish Registration Area J, includes all waters south of the latitude of Cape Sarichef (54° 36' N lat.), west of the longitude of Scotch Cap Light (164° 44' W long.), and east of the United States-Russia Maritime Boundary Line of 1991 (Figure 1-12). Area J encompasses both waters of the Territorial Sea (0-3 nautical miles) and waters of the Exclusive Economic Zone (3-200 nautical miles). Area J is not divided into districts.

Introduction

Shellfish species included in this section are those which have been harvested in relatively small amounts compared to the commercial king and Tanner crab fisheries which occur in the Aleutian Islands. Miscellaneous shellfish species include hair crabs, sea urchins, sea cucumbers, snails, *Paralomis multispina* (cherry) crab, and octopi. Prior to 1999, it was ADF&Gs policy to register vessels for exploratory fishing in these new and emerging fisheries under authority of a commissioner's permit described in 5 AAC 38.062. PERMITS FOR OCTOPI, SQUID, KOREAN HAIR CRAB, SEA URCHINS, SEA CUCUMBERS, SEA SNAILS, CORAL, AND OTHER MARINE INVERTEBRATES. Typically, permit conditions were general and not fully developed on an individual species basis. Fisheries for these species were conducted without prior knowledge of stock abundance or distribution and no harvest limits were established. To allow for the orderly development and regulation of expanding fisheries, BOF adopted 5 AAC 39.210. MANAGEMENT PLAN FOR HIGH IMPACT EMERGING FISHERIES, which delineated criteria that must be met in order for a high impact emerging fishery to occur. In addition, BOF will be considering a plan for the development of new fisheries that will provide a framework to be employed by resource harvesters in the development of new fisheries.

2003 Fisheries

Octopus

In 2003, there was no directed fishing for octopi, although it is permitted in the Aleutian Islands under the authority of a commissioner's permit. Incidental harvest may be retained on a commercial entry fisheries commission (CFEC) card at up to 20% of the weight of the target species. In 2003, out of the 113 vessels registered for incidental harvest, 70 made 313 landings of octopi totaling 242,946 pounds from the Aleutian Islands (Table 1-17). At-sea discards totaled 26,248 pounds. The majority of retained octopi were sold to processors (66%), while the rest was either retained for bait (21%), discarded (12%) or sold for use as fishmeal (1%). Octopus landings were made by vessels targeting Pacific cod or other groundfish species using pot gear (98%), longline gear (1%) and trawl gear (1%).

Sea Cucumber and Sea Urchin

In September, ADF&G issued a news release announcing the GHL for sea cucumbers and sea urchins in the Westward Region. The 2003 season opened under a commissioner's permit with a GHL of 5,000 pounds each of eviscerated product for sea cucumbers and whole animal weight for sea urchins in the Aleutian Islands. The small GHLs were established to permit conservative commercial exploration of areas that lacked historic harvest data and to allow ADF&G to collect critical information for future management purposes. However, no vessels or divers registered or fished for either of these fisheries in the Aleutian Islands in 2003.

Other Miscellaneous Shellfish Species

No vessels were registered for any other miscellaneous shellfish species in the Aleutian Islands in 2003.

Fishery Management and Stock Status

No surveys of abundance for octopi have been performed in the Aleutian Islands; thus, no population data is available. ADF&G has not developed a management plan for this species. In addition to incidental harvest which is limited to 20% of the weight of the target species, directed fishing may also occur under the authority of a commissioner's permit. A fishing logbook is required for the directed fishery and only pots or dive gear may be used. Stock assessment work has not been performed for other miscellaneous shellfish species in the Aleutian Islands and until such work has been performed and a BOF approved management plan has been adopted, only limited fisheries for these species will be allowed.

LITERATURE CITED

Alaska Department of Fish and Game (ADF&G). 1978. Westward region shellfish report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries. Kodiak.

Alaska Department of Fish and Game (ADF&G). 1983a. 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). 1983b. 1983 Westward Region Tanner Crab population surveys. Alaska Department of Fish and Game, Westward Region. 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). 1985. Westward region Tanner crab survey results for 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1991. Westward region shellfish report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K91-4, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1999a. 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). 1999b. Customary and traditional use worksheet for marine invertebrates, including king and Tanner crab; Alaska Peninsula-Aleutian Islands Area *in* Westward region report to the Alaska Board of Fisheries 1999, Kodiak.

Blau, S. F. and D. Pengilly. 1994. Findings from the 1991 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.T. 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.

Bon, M. 2004. Analysis of the 2003 Eastern Aleutian District Tanner crab commissioner's-permit pot survey. Regional Information Report *in review*, Kodiak.

Bowers, F.R., W. Donaldson, and D. Pengilly. 2002. Analysis of the January-February and November 2001 Petrel Bank red king crab commissioner's-permit surveys. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K02-11, Kodiak.

Byersdorfer, S. 1998. A summary of tagging data collected by observers on board the F/V Patricia Lee during the Aleutians brown king crab fishery from November 1996 to February 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K98-22, Kodiak.

Granath, K. 2003. Analysis of the November 2002 Adak, Atka, and Amlia Islands red king crab commissioner's permit survey. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-33, Kodiak.

Hoff, G.R. and L.L. Britt. 2003. The 2002 eastern Bering Sea upper continental slope survey of groundfish and invertebrate resources. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-141, 261p.

NPFMC. 1998. Fisheries Management Plan for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands.

Spalinger, K. 2004. Bottom trawl survey of crab and groundfish: Kodiak, Chignik, South Peninsula, and Eastern Aleutian areas, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report *in review*, Kodiak.

Urban, D. 1992. A bottom trawl survey of crab and groundfish in the Kodiak Island, Alaska Peninsula, and Dutch Harbor areas, June to September, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 92-10, Kodiak.

Urban, D. 1996. Bottom trawl survey of crab and groundfish: Kodiak Island Chignik, and Eastern Aleutian areas, 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Informational Report 4K96-39, Kodiak.

Worton, C. 2000. Bottom trawl survey of crab and groundfish: Kodiak Island, Chignik, South Alaska Peninsula, and Eastern Aleutian areas, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K00-58, Kodiak.

Worton, C. 2001. Bottom trawl survey of crab and groundfish: Kodiak Island, Chignik, South Alaska Peninsula, and Eastern Aleutian areas, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K01-58, Kodiak.

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 4K02-06, Kodiak.

Table 1-1. Aleutian Islands, Area O, red king crab commercial fishery data, 1960/61 - 2003/04.

		Number of				Pots		Average		
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Lifted	CPUE[d]	Weight[c]	Length[e]	Deadloss[c]
1960/61	East of 172°	NA	NA	NA	NA	NA	NA	NA	NA	NA
	West of 172°	4	41	NA	2,074,000	NA	NA	NA	NA	NA
	TOTAL									
1961/62	East of 172°	4	69	NA	533,000	NA	NA	NA	NA	NA
	West of 172°	8	218	NA	6,114,000	NA	NA	NA	NA	NA
	TOTAL		**287**		**6,647,000**					
1962/63	East of 172°	6	102	NA	1,536,000	NA	NA	NA	NA	NA
	West of 172°	9	248	NA	8,006,000	NA	NA	NA	NA	NA
	TOTAL		**350**		**9,542,000**					
1963/64	East of 172°	4	242	NA	3,893,000	NA	NA	NA	NA	NA
	West of 172°	11	527	NA	17,904,000	NA	NA	NA	NA	NA
	TOTAL		**769**		**21,797,000**					
1964/65	East of 172°	12	336	NA	13,761,000	NA	NA	NA	NA	NA
	West of 172°	18	442	NA	21,193,000	NA	NA	NA	NA	NA
	TOTAL		**778**		**34,954,000**					
1965/66	East of 172°	21	555	NA	19,196,000	NA	NA	NA	NA	NA
	West of 172°	10	431	NA	12,915,000	NA	NA	NA	NA	NA
	TOTAL		**986**		**32,111,000**					
1966/67	East of 172°	27	893	NA	32,852,000	NA	NA	NA	NA	NA
	West of 172°	10	90	NA	5,883,000	NA	NA	NA	NA	NA
	TOTAL		**983**		**38,735,000**					

-Continued-

Table 1-1. (Page 2 of 6)

Season	Locale	Number of Vessels[a]	Number of Landings	Number of Crabs[b]	Harvest[b,c]	Pots Lifted	CPUE[d]	Average Weight[c]	Average Length[e]	Deadloss[c]
1967/68	East of 172°	34	747	NA	22,709,000	NA	NA	NA	NA	NA
	West of 172°	22	505	NA	14,131,000	NA	NA	NA	NA	NA
	TOTAL		**1,252**		**36,840,000**					
1968/69	East of 172°	NA	NA	NA	11,300,000	NA	NA	NA	NA	NA
	West of 172°	30	NA	NA	16,100,000	NA	NA	NA	NA	NA
	TOTAL				**27,400,000**					
1969/70	East of 172°	41	375	NA	8,950,000	72,683	NA	NA	NA	NA
	West of 172°	33	435	NA	18,016,000	115,929	NA	6.5	NA	NA
	TOTAL		**810**		**26,966,000**	**188,612**				
1970/71	East of 172°	32	268	NA	9,652,000	56,198	NA	NA	NA	NA
	West of 172°	35	378	NA	16,057,000	124,235	NA	NA	NA	NA
	TOTAL		**646**		**25,709,000**	**180,433**				
1971/72	East of 172°	32	210	1,447,692	9,391,615	31,531	46	7	NA	NA
	West of 172°	40	166	NA	15,475,940	46,011	NA	NA	NA	NA
	TOTAL		**376**		**24,867,555**	**77,542**				
1972/73	East of 172°	51	291	1,500,904	10,450,380	34,037	44	7		
	West of 172°	43	313	3,461,025	18,724,140	81,133	43	5.4	NA	NA
	TOTAL		**604**	**4,961,929**	**29,174,520**	**115,170**	**43**	**5.9**		
1973/74	East of 172°	56	290	1,780,673	12,722,660	41,840	43	7.1	NA	NA
	West of 172°	41	239	1,844,974	9,741,464	70,059	26	5.3	148.6	NA
	TOTAL		**529**	**3,625,647**	**22,464,124**	**111,899**	**32**	**6.2**		

-Continued-

Table 1-1. (Page 3 of 6)

Season	Locale	Number of Vessels[a]	Number of Landings	Number of Crabs[b]	Harvest[b,c]	Pots Lifted	CPUE[d]	Average Weight[c]	Average Length[e]	Deadloss[c]
1974/75	East of 172°	87	372	1,812,647	13,991,190	71,821	25	7.7		
	West of 172°	36	97	532,298	2,774,963	32,620	16	5.2	148.6	NA
	TOTAL		**469**	**2,344,945**	**16,766,153**	**104,441**	**22**	**7.1**		
1975/76	East of 172°	79	369	2,147,350	15,906,660	86,874	25	7.4		
	West of 172°	20	25	79,977	411,583	8,331	10	5.2	147.2	NA
	TOTAL		**394**	**2,227,327**	**16,318,243**	**95,205**	**23**	**7.3**		
1976/77	East of 172°	72	226	1,273,298	9367965[f]	65,796	19	7.4		
	East of 172°	38	61	86,619	830458[g]	17,298	5	9.6	NA	NA
	West of 172°				FISHERY	CLOSED				
	TOTAL		**287**	**1,359,917**	**10,198,423**	**83,094**	**16**	**7.5**		
1977/78	East of 172°	33	227	539,656	3658860[f]	46,617	12	6.8		
	East of 172°	6	7	3,096	25557[h]	812	4	8.3	NA	NA
	West of 172°	12	18	160,343	905,527	7,269	22	5.7	152.2	NA
	TOTAL		**252**	**703,095**	**4,589,944**	**54,698**	**13**	**6.5**		
1978/79	East of 172°	60	300	1,233,758	6,824,793	51,783	24	5.5	NA	NA
	West of 172°	13	27	149,491	807,195	13,948	11	5.4	NA	1,170
	TOTAL		**327**	**1,383,249**	**7,631,988**	**65,731**	**21**	**5.5**		
1979/80	East of 172°	104	542	2,551,116	15,010,840	120,554	21	5.9	NA	NA
	West of 172°	18	23	82,250	467,229	9,757	8	5.7	152	24,850
	TOTAL		**565**	**2,633,366**	**15,478,069**	**130,311**	**20**	**5.9**		
1980/81	East of 172°	114	830	2,772,287	17,660,620[f]	231,607	12	6.4	NA	NA
	East of 172°	54	120	182,349	1,392,923[h]	30,000	6	7.6		
	West of 172°	17	52	254,390	1,419,513	20,914	12	5.6	149	54,360
	TOTAL		**1,002**	**3,209,026**	**20,473,056**	**282,521**	**11**	**6.4**		

-Continued-

Table 1-1. (Page 4 of 6)

Season	Locale	Number of Vessels[a]	Number of Landings	Number of Crabs[b]	Harvest[b,c]	Pots Lifted	CPUE[d]	Average Weight[c]	Average Length[e]	Deadloss[c]
1981/82	East of 172°	92	683	741,966	5,155,345	220,087	3	6.9	NA	NA
	West of 172°	46	106	291,311	1,648,926	40,697	7	5.7	148.3	8,759
	TOTAL		**789**	**1,033,277**	**6,804,271**	**260,784**	**4**	**6.6**		
1982/83	East of 172°	81	278	64,380	431,179	72,924	1	6.7		
	West of 172°	72	191	284,787	1,701,818	66,893	4	6.0	150.8	7,855
	TOTAL		**469**	**349,167**	**2,132,997**	**139,817**	**3**	**6.1**		
1983/84	East of 172°				FISHERY	CLOSED				
	West of 172°	106	248	298,948	1,981,579	60,840	5	6.6	157.3	3,833
	TOTAL	**106**	**248**	**298,948**	**1,981,579**	**60,840**	**5**	**6.6**	**157.3**	**3,833**
1984/85	East of 171°				FISHERY	CLOSED				
	West of 171°	64	113	206,751	1,367,672	50,685	4	6.6	155.1	0
	TOTAL	**64**	**113**	**206,751**	**1,367,672**	**50,685**	**4**	**6.6**	**155.1**	**0**
1985/86	East of 171°				FISHERY	CLOSED				
	West of 171°	35	89	162,271	906,293	32,478	5	5.6	152.2	6,120
	TOTAL	**35**	**89**	**162,271**	**906,293**	**32,478**	**5**	**5.6**	**152.2**	**6,120**
1986/87	East of 171°				FISHERY	CLOSED				
	West of 171°	33	69	126,146	712,243	29,189	4	5.6	NA	500
	TOTAL	**33**	**69**	**126,146**	**712,243**	**29,189**	**4**	**5.6**	**NA**	**501**
1987/88	East of 171°				FISHERY	CLOSED				
	West of 171°	71	109	211,712	1,213,933	43,433	5	5.7	148.5	6,900
	TOTAL	**71**	**109**	**211,712**	**1,213,933**	**43,433**	**5**	**5.7**	**148.5**	**6,900**
1988/89	East of 171°				FISHERY	CLOSED				
	West of 171°	73	156	266,053	1,567,314	64,374	4	5.9	153.1	557
	TOTAL	**73**	**156**	**266,053**	**1,567,314**	**64,374**	**4**	**5.9**	**153.1**	**557**

-Continued-

Table 1-1. (Page 5 of 6)

		Number of				Pots		Average		
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Lifted	CPUE[d]	Weight[c]	Length[e]	Deadloss[c]
1989/90	East of 171°				FISHERY CLOSED					
	West of 171°	56	123	196,070	1,118,566	54,513	4	5.7	151.5	759
	TOTAL	**56**	**123**	**196,070**	**1,118,566**	**54,513**	**4**	**5.7**	**151.5**	**759**
1990/91	East of 171°				FISHERY CLOSED					
	West of 171°	7	34	146,903	828,105	10,674	14	5.6	148.1	0
	TOTAL	**7**	**34**	**146,903**	**828,105**	**10,674**	**14**	**5.6**	**148.1**	**0**
1991/92	East of 171°				FISHERY CLOSED					
	West of 171°	10	35	165,356	951,278	16,636	10	5.7	149.8	0
	TOTAL	**10**	**35**	**165,356**	**951,278**	**16,636**	**10**	**5.7**	**149.8**	**0**
1992/93	East of 171°				FISHERY CLOSED					
	West of 171°	12	30	218,049	1,286,424	16,129	13	6.0	151.5	5,000
	TOTAL	**12**	**30**	**218,049**	**1,286,424**	**16,129**	**13**	**6.0**	**151.5**	**5,000**
1993/94	East of 171°				FISHERY CLOSED					
	West of 171°	12	21	119,330	698,077	13,575	9	5.8	154.6	7,402
	TOTAL	**12**	**21**	**119,330**	**698,077**	**13,575**	**9**	**5.8**	**154.6**	**7,402**
1994/95	East of 171°				FISHERY CLOSED					
	West of 171°	20	31	30,337	196,967	18,146	2	6.5	157.5	1,430
	TOTAL	**20**	**31**	**30,337**	**196,967**	**18,146**	**2**	**6.5**	**157.5**	**1,430**
1995/96	East of 171°				FISHERY CLOSED					
	West of 171°	4	12	6,880	38,941	2,205	3	5.7	153.6	235
	TOTAL	**4**	**12**	**6,880**	**38,941**	**2,205**	**3**	**5.7**	**153.6**	**235**
1996/97					FISHERY CLOSED					
1997/98					FISHERY CLOSED					

-Continued-

Table 1-1. (Page 6 of 6)

		Number of				Pots		Average		
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Lifted	CPUE[d]	Weight[c]	Length[e]	Deadloss[c]
1998/99	West of 174°	3	6	749	5,900	102	7	7.9	NA	0
1999/2000					FISHERY CLOSED					
2000/01[i]	Petrel Bank[j]	1	3	11,257	76,792	498	23	6.8	161.0	0
2001/02[k]	Petrel Bank[j]	4	5	22,080	153,961	700	32	7.0	159.5	82
2002/03	Petrel Bank[j]	33	35	68,300	505,642	3,782	18	7.4	162.4	1,311
2003/04	Petrel Bank[j]	30	31	59,828	479,113	5,774	10	8.0	167.9	2,617

a Many vessels fished both east and west of 171° W long., thus total number of vessels reflects registrations for entire Aleutian Islands.
b Deadloss included.
c In pounds.
d Number of legal crabs per pot lift.
e In millimeters.
f Split season based on 6.5 inch minimum legal size.
g Split season based on 8 inch minimum legal size.
h Split season based on 7.5 inch minimum legal size.
I January/February Petrel Bank survey (fish ticket harvest code 15).
j Those waters of king crab Registration Area O between 179° E long., 179° W long., and north of 51° 45' N lat.
k November Petrel Bank survey (fish ticket harvest code 15).

Table 1-2. Aleutian Islands, Area O, red king crab fishery economic performance data, 1973/74 - 2003/04. No economic data available prior to 1973.

Year		Value		Season Length	
		Exvessel[a]	Total[b]	Days	Dates
1973/74	East of 172°	$0.65	$8,269,729	24	11/01 - 11/24
	West of 172°	NA	NA	NA	NA
1974/75	East of 172°	$0.37	$5,176,740	75	11/01 - 01/14
	West of 172°	$0.35	$971,237	NA	NA
1975/76	East of 172°	$0.42	$6,680,797	71	11/01 - 01/10
	West of 172°	$0.38	$156,402	NA	NA
1976/77	East of 172°[c]	$0.64	$5,995,497	37	11/01 - 12/07
	East of 172°[d]	$0.79	$656,061	31	12/13 - 01/13
	West of 172°		FISHERY CLOSED		
1977/78	East of 172°[c]	$0.99	$3,622,271	84	09/15 - 12/08
	East of 172°[e]	$1.35	$34,502	28	12/08 - 01/05
	West of 172°	$1.36	$1,231,517	NA	NA
1978/79	East of 172°	$1.35	$9,213,471	71	09/10 - 11/20
	West of 172°	$1.23	$992,850	NA	NA
1979/80	East of 172°	$0.90	$13,509,756	122	09/10 - 01/10
	West of 172°	$0.68	$317,716	NA	NA
1980/81	East of 172°[c]	$1.02	$18,013,832	73	11/01 - 01/12
	East of 172°[e]	$1.03	$1,434,711	31	01/15 - 02/15
	West of 172°	$0.92	$1,305,952	72	01/15 - 03/28
1981/82	East of 172°	$2.30	$11,617,293	107	11/01 - 02/15
	West of 172°	$2.01	$3,314,341	107	11/01 - 02/15
1982/83	East of 172°	$3.43	$1,478,944	66	11/01 - 01/05
	West of 172°	$3.44	$5,854,254	76	11/01 - 01/15
1983/84	East of 172°		FISHERY CLOSED		
	West of 172°	$3.43	$6,796,816	340	01/01 - 12/16
1984/85	East of 172°		FISHERY CLOSED		
	West of 172°	$2.10	$2,872,111	97	11/10 - 02/15
1985/86	East of 172°		FISHERY CLOSED		
	West of 172°	$2.15	$1,948,530	107	11/01 - 02/15

-Continued-

Table 1-2. (page 2 of 2)

Year		Value		Season Length	
		Exvessel[a]	Total[b]	Days	Dates
1986/87	East of 172°		FISHERY CLOSED		
	West of 172°	$3.87	$2,756,380	107	11/01 - 02/15
1987/88	East of 172°		FISHERY CLOSED		
	West of 172°	$4.00	$4,855,732	107	11/01 - 02/15
1988/89	East of 172°		FISHERY CLOSED		
	West of 172°	$5.00	$7,836,570	34	11/01 - 12/04
1989/90	East of 172°		FISHERY CLOSED		
	West of 172°	$4.20	$4,697,977	107	11/01 - 02/15
1990/91	East of 172°		FISHERY CLOSED		
	West of 172°	$4.00	$3,312,420	107	11/01 - 02/15
1991/92	East of 172°		FISHERY CLOSED		
	West of 172°	$3.00	$2,853,834	107	11/01 - 02/15
1992/93	East of 172°		FISHERY CLOSED		
	West of 172°	$5.05	$6,496,441	76	11/01 - 01/15
1993/94	East of 172°		FISHERY CLOSED		
	West of 172°	$3.87	$2,701,558	107	11/01 - 02/15
1994/95	East of 172°		FISHERY CLOSED		
	West of 172°	$5.50	$1,083,319	27	11/01 - 11/28
1995/96	East of 172°		FISHERY CLOSED		
	West of 172°	$2.81	$109,424	107	11/01 - 02/15
1996/97 - 1997/98			FISHERY CLOSED		
1998/99	West of 174°		CONFIDENTIAL		
1999/2000 - 2001/02			FISHERY CLOSED		
2002/03	Petrel Bank[f]	$6.51	$3,291,729	2	10/25 - 10/27
2003/04	Petrel Bank[f]	$5.14	$2,449,189	4	10/25 - 10/29

[a] Average price per pound.
[b] In millions of dollars.
[c] Split season based on 6.5 inch minimum legal size.
[d] Split season based on 8.0 inch minimum legal size.
[e] Split season based on 7.5 inch minimum legal size.
[f] Those waters of king crab Registration Area O between 179° E long., 179° W long., and north of 51° 45' N lat.

Table 1-3. Eastern Aleutian Islands, west of Scotch Cap Light and east of 168° W long., subsistence king and Tanner crab harvest, 1999-2003.

Year	Number of Permits Issued	Number of Permits Returned	Percentage Returned	Harvest[a]			
				King crab reported	King crab estimated	Tanner crab reported	Tanner crab estimated
1999	180	80	44.4	788	1,773	1,430	3,218
2000	194	143	73.7	511	693	905	1,228
2001	201	200	99.5	1,128	1,134	1,701	1,710
2002	237	231	97.5	1,080	1,108	2,451	2,515
2003[b]	231	105	45.5	331	728	3,953	8,697

[a] Harvest estimate from Unalaska Island (no reported harvest on permits from any other area).
[b] Data incomplete, permits are returned throughout the year.

Table 1-4. Aleutian Islands golden king crab commercial fishery data, 1981/82-2003/04 seasons.

		Number of				Number of Pots			Average		
										Carapace	
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Registered	Lifted	CPUE[d]	Weight[c]	Length[e]	Deadloss[c]
1981/82	East of 172° W.	6	16	22,666	115,715	0	2,906	8	5.1	158	8,752
	West of 172° W.	14	76	217,700	1,194,046	2,647	24,627	9	5.5	160	22,064
	TOTAL		**92**	**240,458**	**1,319,761**	**2,647**	**27,533**	**9**	**5.4**		**30,816**
1982/83	East of 172° W.	49	136	227,471	1,184,971	NA	29,369	8	5.2	158	47,479
	West of 172° W.	99	501	1,509,001	8,006,274	13,111	150,103	10	5.3	158	220,743
	TOTAL		**637**	**1,737,109**	**9,191,245**	**13,111**	**179,472**	**10**	**5.3**		**268,222**
1983/84	East of 172° W.	47	132	238,353	1,810,973	4,514	29,595	8	7.6	NA	45,268
	West of 172° W.	157	1,002	1,534,909	8,128,029	17,406	226,798	7	5.3	NA	171,021
	TOTAL		**1,134**	**1,773,262**	**9,939,002**	**21,920**	**256,393**	**7**	**5.6**		**186,289**
1984/85	East of 171° W.	13	67	327,440	1,521,142	1,394	24,044	14	4.6	161	70,362
	West of 171° W.	38	85	643,597	3,180,095	5,270	64,777	10	4.9	157	125,073
	TOTAL		**152**	**971,274**	**4,701,237**	**6,664**	**88,821**	**11**	**4.8**		**195,435**
1985/86	East of 171° W.	13	67	410,977	1,968,213	1,479	34,287	12	4.7	156	38,663
	West of 171° W.	49	386	2,052,048	11,124,759	7,057	202,401	10	5.4	151	5,304
	TOTAL		**453**	**2,463,025**	**13,092,972**	**8,536**	**236,688**	**10**	**5.3**		**43,967**
1986/87	East of 171° W.	17	71	400,389	1,869,180	1,575	37,585	11	4.7	NA	9,510
	West of 171° W.	62	525	2,923,947	12,798,004	12,958	392,185	7	4.4	150	276,736
	TOTAL		**596**	**3,324,336**	**14,667,184**	**14,533**	**429,770**	**8**	**4.4**		**286,246**
1987/88	East of 171° W.	22	77	299,734	1,383,198	3,591	43,017	7	4.6	150	24,210
	West of 171° W.	46	386	1,908,989	8,001,177	10,687	267,705	7	4.2	147	165,415
	TOTAL		**463**	**2,208,723**	**9,324,375**	**14,278**	**310,722**	**7**	**4.2**		**189,625**
1988/89	East of 171° W.	21	57	323,695	1,545,113	4,215	40,869	8	4.8	154	22,960
	West of 171° W.	74	455	2,165,508	9,080,196	23,627	280,732	8	4.2	149	122,251
	TOTAL		**512**	**2,489,203**	**10,625,309**	**27,842**	**321,604**	**8**	**4.3**		**145,211**

-Continued-

Table 1-4. (Page 2 of 3)

		Number of				Number of Pots			Average		
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Registered	Lifted	CPUE[d]	Weight[c]	Carapace length[e]	Deadloss[c]
1989/90	East of 171° W.	13	70	424,067	1,852,249	5,635	43,345	10	4.4	151	17,421
	West of 171° W.	64	505	2,520,786	10,162,400	14,724	324,153	8	4.0	149	100,724
	TOTAL		**575**	**2,944,853**	**12,014,649**	**20,359**	**367,498**	**8**	**4.1**		**118,145**
1990/91	East of 171° W.	16	58	384,885	1,718,848	5,225	54,618	7	4.3	148	42,800
	West of 171° W.	13	167	1,312,116	5,250,687	7,380	160,960	8	4.0	145	176,583
	TOTAL	**24**	**235**	**1,697,001**	**6,969,535**	**12,605**	**214,578**	**8**	**4.1**		**219,383**
1991/92	East of 171° W.	11	50	335,647	1,447,732	3,760	40,604	8	4.3	148	45,100
	West of 171° W.	16	206	1,511,751	6,254,409	7,635	192,949	8	4.1	145	96,848
	TOTAL	**20**	**256**	**1,847,398**	**7,702,141**	**11,395**	**233,553**	**8**	**4.2**		**141,948**
1992/93	East of 171° W.	10	44	330,159	1,375,048	4,222	37,718	9	4.1	148	37,200
	West of 171° W.	18	130	1,198,169	4,916,149	8,236	165,503	7	4.1	147	104,215
	TOTAL	**22**	**174**	**1,528,328**	**6,291,197**	**12,458**	**203,221**	**8**	**4.1**		**141,415**
1993/94	East of 171° W.	4	14	217,788	915,460	2,334	22,490	10	4.2	149	7,324
	West of 171° W.	21	147	1,102,541	4,635,683	11,970	212,164	5	4.2	148	165,358
	TOTAL	**21**	**161**	**1,320,329**	**5,551,143**	**14,304**	**234,654**	**6**	**4.2**		**172,682**
1994/95	East of 171° W.	14	45	384,353	1,750,267	7,378	67,537	6	4.6	148	29,908
	West of 171° W.	34	247	1,539,866	6,378,030	15,604	319,006	5	4.1	150	242,065
	TOTAL	**35**	**292**	**1,924,219**	**8,128,297**	**22,982**	**386,543**	**5**	**4.2**		**271,973**
1995/96	East of 171° W.	17	42	431,867	1,993,980	10,325	65,030	7	4.6	150	14,676
	West of 171° W.	25	139	1,134,274	4,896,926	14,213	226,463	5	4.2	147	338,223
	TOTAL	**28**	**181**	**1,566,141**	**6,890,906**	**24,538**	**291,493**	**5**	**4.4**		**352,899**
1996/97	East of 174° W.	14	70	725,452	3,262,516	9,040	113,460	6	4.5		156,857
	West of 174° W.	13	100	618,498	2,591,720	8,805	100,340	6	4.2		78,973
	TOTAL	**18**	**170**	**1,343,950**	**5,854,236**	**17,845**	**213,800**	**6**	**4.4**	**147**	**235,830**

-Continued-

Table 1-4. (Page 3 of 3)

		Number of				Number of Pots			Average		
										Carapace	
Season	Locale	Vessels[a]	Landings	Crabs[b]	Harvest[b,c]	Registered	Lifted	CPUE[d]	Weight[c]	length[e]	Deadloss[c]
1997/98	East of 174° W.	15	74	780,609	3,501,054	9,720	106,403	7	4.5	147	131,480
	West of 174° W.	8	160	569,550	2,444,628	5,240	86,811	7	4.3	148	79,525
	TOTAL	**15**	**234**	**1,350,159**	**5,945,682**	**14,960**	**193,214**	**7**	**4.4**	**147**	**211,005**
1998/99	East of 174° W.	14	55	740,011	3,247,863	8,295	83,378	9	4.4	148	82,113
	West of 174° W.	3	44	409,531	1,691,385	1,930	35,920	12	4.1	146	21,218
	TOTAL	**16**	**99**	**1,149,542**	**4,939,248**	**10,225**	**119,298**	**10**	**4.3**	**147**	**103,331**
1999/00	East of 174° W.	15	60	709,332	3,069,886	9,514	79,129	9	4.3	147	67,574
	West of 174° W.	17	113	676,558	2,768,902	10,564	101,040	7	4.1	147	104,675
	TOTAL	**17**	**173**	**1,385,890**	**5,838,788**	**20,078**	**180,169**	**8**	**4.2**	**147**	**172,249**
2000/01	East of 174° W.	15	50	704,702	3,134,079	10,598	71,551	10	4.5	147	55,999
	West of 174° W.	12	100	705,613	2,884,682	8,910	101,239	7	4.1	145	53,158
	TOTAL	**17**	**150**	**1,410,315**	**6,018,761**	**19,508**	**172,790**	**8**	**4.3**	**146**	**109,157**
2001/02	East of 174° W.	19	45	725,297	3,158,179	12,927	62,325	12	4.4	147	49,523
	West of 174° W.	9	90	684,631	2,730,249	8,491	105,219	7	4.0	145	43,505
	TOTAL	**21**	**134**	**1,409,928**	**5,888,428**	**21,418**	**167,544**	**8**	**4.2**	**146**	**93,028**
2002/03	East of 174° W.	19	43	644,236	2,821,851	11,834	52,037	12	4.4	148	55,425
	West of 174° W.	6	72	664,915	2,640,951	6,225	95,581	7	4.0	146	32,467
	TOTAL	**22**	**115**	**1,309,151**	**5,462,802**	**18,059**	**147,618**	**9**	**4.2**	**147**	**87,892**
2003/04	East of 174° W.	18	37	643,074	2,977,055	12,518	58,973	11	4.6	149	76,006
	West of 174° W.	6	60	676,633	2,690,207	7,140	66,255	10	4.0	146	49,321
	TOTAL	**21**	**96**	**1,319,707**	**5,667,262**	**19,658**	**125,228**	**11**	**4.3**	**147**	**125,327**

[a] Many vessels fished both east and west of 174° W, thus total number of vessels reflects registrations for entire Aleutian Islands.
[b] Deadloss included.
[c] In pounds.
[d] Number of legal crabs per pot lift.
[e] In millimeters, from observer bycatch database.

Table 1-5. Aleutian Islands golden king crab fishery economic performance data, 1981/82 - 2003/04 seasons.

Year		Value		Season Length	
		Exvessel[a]	Total[b]	Days	Dates
1981/82	East of 172° W.	$2.05	$0.22	75	11/01-01/15
	West of 172° W.	$2.06	$2.41	227	11/01-06/15
	Total	**$2.06**	**$2.63**		
1982/83	East of 172° W.	$3.00	$3.41	105	11/01-02/15
	West of 172° W.	$3.01	$23.43	166	11/01-04/15
	Total	**$3.01**	**$26.85**		
1983/84	East of 172° W.	$3.05	$5.38	105	11/01-02/15
	West of 172° W.	$2.92	$23.23	157	11/10-04/15
	Total	**$2.94**	**$28.62**		
1984/85	East of 171° W.	$1.35	$1.96	229	07/01-02/15
	West of 171° W.	$2.00	$6.11	240	11/10-07/08
	Total	**$1.79**	**$8.07**		
1985/86	East of 171° W.	$2.00	$3.86	121	07/01-10/31
	West of 171° W.	$2.50	$27.80	288	11/01-08/15
	Total	**$2.43**	**$31.66**		
1986/87	East of 171° W.	$2.85	$5.30	182	07/01-12/31
	West of 171° W.	$3.00	$37.56	288	11/01-08/15
	Total	**$2.98**	**$42.86**		
1987/88	East of 171° W.	$2.85	$3.87	62	07/01-09/02
	West of 171° W.	$3.00	$23.51	289	11/01-08/15
	Total	**$2.98**	**$27.38**		
1988/89	East of 171° W.	$3.00	$4.57	93	09/01-12/04
	West of 171° W.	$3.20	$28.66	288	11/01-08/15
	Total	**$3.17**	**$33.23**		
1989/90	East of 171° W.	$3.50	$6.42	104	09/01-12/15
	West of 171° W.	$3.00	$30.18	288	11/01-08/15
	Total	**$3.08**	**$36.61**		
1990/91	East of 171° W.	$3.00	$5.03	68	09/01-11/09
	West of 171° W.	$3.00	$15.22	288	11/01-08/15
	Total	**$3.00**	**$20.25**		
1991/92	East of 171° W.	$2.00	$2.81	74	09/01-11/15
	West of 171° W.	$2.50	$15.39	289	11/01-08/15
	Total	**$2.41**	**$18.20**		
1992/93	East of 171° W.	$2.50	$3.30	76	09/01-11/17
	West of 171° W.	$2.05	$9.86	288	11/01-08/15
	Total	**$2.15**	**$13.16**		

-Continued-

Table 1-5. (Page 2 of 2)

Year		Value		Season Length	
		Exvessel[a]	Total[b]	Days	Dates
1993/94	East of 171° W.	$2.15	$1.95	212	09/01-03/31
	West of 171° W.	$2.50	$11.18	288	11/01-08/15
	Total	**$2.44**	**$13.13**		
1994/95	East of 171° W.	$4.00	$6.88	57	09/01-10/28
	West of 171° W.	$3.33	$20.43	288	11/01-08/15
	Total	**$3.48**	**$27.31**		
1995/96	East of 171° W.	$2.60	$5.15	38	09/01-10/09
	West of 171° W.	$2.10	$9.57	289	11/01-08/15
	Total	**$2.25**	**$14.72**		
1996/97	East of 174° W.	$2.23	$6.93	115	09/01-12/25
	West of 174° W.	$2.23	$5.60	365	09/01-08/31
	Total	**$2.23**	**$12.53**		
1997/98	East of 174° W.	$2.25	$7.58	84	09/01-11/24
	West of 174° W.	$2.10	$4.96	365	09/01-08/31
	Total	**$2.19**	**$12.54**		
1998/99	East of 174° W.	$1.87	$5.92	68	09/01-11/07
	West of 174° W.	$2.04	$3.41	365	09/01-08/31
	Total	**$1.92**	**$9.33**		
1999/00	East of 174° W.	$3.26	$9.78	55	09/01-10/25
	West of 174° W.	$3.09	$8.23	348	09/01-8/14
	Total	**$3.15**	**$18.01**		
2000/01	East of 174° W.	$3.50	$10.77	40	08/15-09/24
	West of 174° W.	$3.09	$8.75	286	08/15-05/28
	Total	**$3.33**	**$19.52**		
2001/02	East of 174° W.	$3.30	$10.26	26	08/15-09/10
	West of 174° W.	$2.93	$7.87	227	08/15-03/30
	Total	**$3.16**	**$18.13**		
2002/03	East of 174° W.	$3.30	$9.13	23	08/15-09/07
	West of 174° W.	$3.50	$9.13	205	08/15-03/08
	Total	**$3.38**	**$18.26**		
2003/04	East of 174° W.	$3.46	$10.05	24	08/15-09/08
	West of 174° W.	$3.83	$10.11	175	08/15-02/06
	Total	**$3.61**	**$20.16**		

[a] Average price per pound.
[b] In millions of dollars.

Table 1-6. Aleutian Islands golden king crab catch by statistical area, 2003/04 season.

Locale	Statistical Area	Number of Landings	Number of Crab[a]	Harvest[a,b]	Pots lifted	CPUE[c]	Ave. Weight[b]	Deadloss[b]
Islands of Four Mts.	695239	4	1,678	7,878	275	6.10	4.69	481
	695301	4	38,741	199,951	3,001	12.91	5.16	3,613
	695302	4	5,548	28,585	454	12.22	5.15	513
Yunaska Island	705200	12	81,527	353,475	8,093	10.07	4.34	11,201
	705232	16	149,072	689,391	12,984	11.48	4.62	13,357
	705300	5	49,602	226,185	3,416	14.52	4.56	5,032
Amukta Pass	715202	7	46,324	218,954	3,555	13.03	4.73	7,829
	715231	9	46,341	204,969	4,676	9.91	4.42	5,057
Seguam Pass	725201	12	75,764	350,637	7,903	9.59	4.63	8,147
Adak Island	765144	13	7,152	28,469	786	9.10	3.98	648
Kanaga/Tanaga Islands	775131	17	16,200	63,285	2,030	7.98	3.91	1,594
	775133	10	6,667	26,275	708	9.42	3.94	388
	775134	6	3,328	14,699	746	4.46	4.42	258
Delarof Islands	785102	19	19,665	76,545	2,642	7.44	3.89	2,089
	785131	20	50,203	170,172	4,105	12.23	3.39	6,677
	785134	10	2,539	10,040	443	5.73	3.95	114
	795131	12	13,104	51,296	1,191	11.00	3.91	2,390
Amchitka Pass	795102	10	5,777	22,399	578	9.99	3.88	580
	795132	16	16,303	62,804	1,204	13.54	3.85	3,961
Other[d]		476	684,172	2,861,253	66,438	10.30	4.18	51,398

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot lift.
[d] Combination of statistical areas in which landings were made by fewer than three vessels.

Table 1-7. Aleutian Islands scarlet king crab fishery data, 1992-2003.

		Number of					Value		Average		
Year	Area	Vessels	Landings	Crabs[a]	Harvest[a,b]	Pots lifted	Exvessel[c]	Total[d]	Weight[b]	CPUE[e]	Deadloss[b]
1992	Dutch Harbor	NO LANDINGS									
	Adak	CONFIDENTIAL									
1993	Dutch Harbor	NO LANDINGS									
	Adak	NO LANDINGS									
1994	Dutch Harbor	CONFIDENTIAL									
	Adak	6	10	6,624	21,308	7,520	$1.76	$37.5	3.2	<1	10,829
	Total	7	10	6,624	21,308	7,520	$1.88	$37.5	3.1	<1	10,829
1995	Dutch Harbor	3	3	6,270	13,871	5,706	$2.18	$30.2	2.2	1	1,755
	Adak	6	18	19,544	49,126	15,046	$1.82	$89.4	2.5	1	2,066
	Total	8	21	25,814	62,997	20,752	$1.89	$119.1	2.4	1	3,821
1996	Dutch Harbor	3	10	10,190	20,924	10,247	$1.78	$37.2	2.0	1	3,990
	Adak	4	13	10,133	24,076	19,170	$1.80	$43.3	2.4	<1	1,861
	Total	7	23	20,323	45,000	29,417	$1.79	$80.6	2.2	<1	5,851
1997	Aleutian Islands	3	12	2,698	6,720	21,217	$1.40	$9.4	2.5	<1	408
1998	Aleutian Islands	7	CONFIDENTIAL								
1999	Aleutian Islands	2	CONFIDENTIAL								
2000	Aleutian Islands	2	CONFIDENTIAL								
2001	Aleutian Islands	2	CONFIDENTIAL								
2002	Aleutian Islands	2	CONFIDENTIAL								
2003	Aleutian Islands	2	CONFIDENTIAL								

[a] Deadloss included.
[b] In pounds.
[c] Price per pound.
[d] Thousands of dollars.
[e] Number of legal crabs per pot lift.

Table 1-8. Eastern Aleutian District Tanner crab fishery data, 1973/74 - 2003.

Season	Number of Vessels	Number of Landings	Crabs	Harvest[a,b]	Pots lifted	Average Weight[b]	Average CPUE[c]	Deadloss[b]
1973/74	6	14	210,539	498,836	NA	2.4	60	0
1974/75					CONFIDENTIAL			
1975/76	8	13	219,166	534,295	4,646	2.4	47	0
1976/77	12	35	544,755	1,239,569	9,640	2.3	57	0
1977/78	15	198	1,104,631	2,494,631	29,855	2.3	37	0
1978/79	20	174	542,081	1,280,115	18,618	2.4	29	0
1979/80	18	107	352,819	886,487	18,040	2.5	20	NA
1981	29	119	264,238	654,514	21,771	2.5	12	NA
1982	31	138	332,260	739,694	30,109	2.2	11	NA
1983	23	107	250,774	547,830	22,168	2.2	11	NA
1984	16	91	104,761	239,585	11,069	2.3	9	NA
1985	7	56	78,930	181,407	6,295	2.3	13	60
1986	8	37	73,187	167,339	10,244	2.3	7	400
1987	8	65	72,098	162,097	5,915	2.2	12	115
1988	20	130	129,478	309,918	11,011	2.4	12	2,000
1989	12	108	144,593	326,196	14,615	2.3	10	2,300
1990	10	75	68,859	155,648	6,858	2.3	10	0
1991	5	27	21,511	50,038	1,849	2.3	12	0
1992	4	29	42,096	98,703	2,963	2.3	14	0
1993	7	34	51,441	118,609	3,530	2.3	15	0
1994	8	119	71,760	166,080	6,303	2.3	11	40
1995-2002					FISHERY CLOSED			
2003[d]	3	10	6,695	15,138	191	2.3	35	9

[a] Deadloss included beginning 1980.
[b] In pounds.
[c] Number of legal crabs per pot lift.
[d] January/February survey (fish ticket harvest code 15).

Table 1-9. Eastern Aleutian District Tanner crab fishery economic performance data, 1973/74 - 2003.

Season	Date		Value	
	Opened	Closed	Exvessel[a]	Total[b]
1973/74	1-Oct	31-Jul	NA	
1974/75	18-Jan	15-Oct	NA	
1975/76	20-Jan	15-Oct	$0.20	$0.11
1976/77	7-Nov	15-Jun	$0.30	$0.38
1977/78	1-Nov	15-Jun	$0.38	$0.95
1978/79	1-Nov	15-Jun	$0.52	$0.67
1979/80	1-Nov	15-Jun	$0.52	$0.46
1981	15-Jan	15-Jun	$0.58	$0.38
1982	15-Feb	15-Jun	$1.25	$0.92
1983	15-Feb	15-Jun	$1.20	$0.66
1984	15-Feb	15-Jun	$0.98	$0.23
1985	15-Jan	15-Jun	$0.96	$0.17
1986	15-Jan	15-Jun	$1.66	$0.28
1987	15-Jan	15-Jun	$2.03	$0.33
1988	15-Jan	10-Apr	$2.18	$0.67
1989	15-Jan	7-May	$2.72	$0.88
1990	15-Jan	9-Apr	$1.97	$0.31
1991	15-Jan	31-Mar	$1.25	$0.06
1992	15-Jan	31-Mar	$2.07	$0.20
1993	15-Jan	31-Mar	$1.70	$0.20
1994	15-Jan	31-Mar	$2.11	$0.35
1995-2003		FISHERY CLOSED		

[a] Price per pound.
[b] Millions of dollars.

Table 1-10. Eastern Aleutian District grooved Tanner crab fishery data, 1993 - 2003.

	Number of					Average			Value	
Year	Vessels	Landings	Crabs[a]	Harvest[a,b]	Pots lifted	Weight[b]	CPUE[c]	Deadloss[b]	Exvessel[d]	Total[e]
1993					CONFIDENTIAL					
1994	3	27	426,230	759,239	38,106	1.8	11	19,474	$1.73	$1.3
1995	7	51	494,522	850,427	75,259	1.7	6	28,338	$1.57	$1.3
1996	3	24	55,593	106,071	24,199	1.9	2	7,659	$1.00	$0.1
1997-2000					NO LANDINGS					
2001					CONFIDENTIAL					
2002					NO LANDINGS					
2003					NO LANDINGS					

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot lift.
[d] Price per pound.
[e] Millions of dollars.

Table 1-11. Eastern Aleutian District triangle Tanner crab fishery data, 1993 - 2003.

Year	Number of			Harvest[a,b]	Pots lifted	Average		Deadloss[b]	Value	
	Vessels	Landings	Crabs[a]			Weight[b]	CPUE[c]		Exvessel[d]	Total[e]
1993						NO LANDINGS				
1994						NO LANDINGS				
1995	2					CONFIDENTIAL				
1996	2					CONFIDENTIAL				
1997-2000						NO LANDINGS				
2001	1					CONFIDENTIAL				
2002						NO LANDINGS				
2003						NO LANDINGS				

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot lift.
[d] Price per pound.
[e] Millions of dollars.

Table 1-12. Western Aleutian District Tanner crab fishery data, 1973/74 - 2003/04.

Year	Number of Vessels	Number of Landings	Crabs[a]	Harvest[a,b]	Pots lifted	Average Weight[b]	Average CPUE[c]	Deadloss[b]
1973/74	7	12	31,079	71,887	2,390	2.3	13	NA
1974/75					CONFIDENTIAL			
1975/76					CONFIDENTIAL			
1976/77					NO LANDINGS			
1977/78	6	7	103,190	237,512	2,700	2.3	38	NA
1978/79	6	9	84,129	197,244	4,730	2.3	18	0
1979/80	10	12	147,843	337,297	5,952	2.3	25	NA
1980/81	9	23	95,102	220,716	7,327	2.3	13	0
1981/82	17	43	364,164	838,697	21,910	2.3	17	6,470
1982/83	61	125	225,491	488,399	40,450	2.2	6	7,662
1983/84	31	86	171,576	384,146	20,739	2.2	8	200
1984/85	31	41	75,009	163,460	13,416	2.2	6	1,000
1985/86	15	30	98,089	206,814	7,999	2.1	12	0
1986/87	8	24	19,874	42,761	10,878	2.1	2	200
1987/88	15	37	63,545	141,390	7,453	2.2	9	200
1988/89	36	77	69,280	148,997	18,906	2.1	4	233
1989/90	12	30	22,937	48,746	6,204	2.1	4	3,810
1990/91	5	21	6,901	14,779	1,309	2.1	5	125
1991/92	8	8	3,483	7,825	986	2.2	4	NA
1992/93					CONFIDENTIAL			
1993/94					NO LANDINGS			
1994/95					NO LANDINGS			
1995/96					CONFIDENTIAL			
1996/97 - 2003/04					FISHERY CLOSED			

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot pull.

Table 1-13. Western Aleutian District commercial Tanner crab fishery economic data 1973/74 - 2003/04.

Year	Value	
	Exvessel[a]	Total
1973/74	NOT AVAILABLE	
1974/75	CONFIDENTIAL	
1975/76	CONFIDENTIAL	
1976/77	NO LANDINGS	
1977/78	$ 0.38	$90,255
1978/79	$ 0.53	$104,539
1979/80	$ 0.52	$175,394
1980/81	$ 0.54	$119,187
1981/82	$ 1.30	$1,081,895
1982/83	$ 1.27	$610,536
1983/84	$ 0.95	$364,749
1984/85	$ 1.30	$211,198
1985/86	$ 1.40	$289,540
1986/87	$ 1.50	$63,842
1987/88	$ 2.10	$296,499
1988/89	$ 1.00	$148,764
1989/90	$ 1.00	$44,936
1990/91	$ 1.25	$18,318
1991/92	$ 1.00	$7,825
1992/93	CONFIDENTIAL	
1993/94	NO LANDINGS	
1994/95	NO LANDINGS	
1995/96	CONFIDENTIAL	
1996/97 - 2003/04	FISHERY CLOSED	

[a] Price per pound.

Table 1-14. Western Aleutian District grooved Tanner crab fishery data, 1992 - 2003.

				Value		Average		
Year	Harvest[a,b]	Vessels	Pots lifted	Exvessel[c]	Total[d]	Weight[b]	CPUE[e]	Deadloss[b]
1992				CONFIDENTIAL				
1993				NO LANDINGS				
1994				CONFIDENTIAL				
1995	145,795	6	17,749	$1.52	$0.195	1.9	4	17,190
1996				CONFIDENTIAL				
1997-1998				NO LANDINGS				
1999-2003				FISHERY CLOSED				

[a] Deadloss included.
[b] In pounds.
[c] Price per pound.
[d] Millions of dollars.
[e] Number of legal crabs per pot lift.

Table 1-15. Aleutian District Dungeness crab fishery data, 1974 - 2003.

Year	Season Dates	Number of Vessels	Number of Landings	Number of Crabs[a]	Harvest[a,b]	Pots Lifted	Average Weight[b]	Average CPUE[c]	Price per Pound
1974	01/01-12/31	3	13	24,459	60,517	3,399	2.4	8	NA
1975	01/01-12/31				CONFIDENTIAL				
1976/77	05/01-01/01				NO LANDINGS				
1977/78	05/01-01/01				NO LANDINGS				
1978/79	05/01-01/01				CONFIDENTIAL				
1979/80	05/01-01/01				CONFIDENTIAL				
1980/81	05/01-01/01				NO LANDINGS				
1981/82	05/01-01/01				NO LANDINGS				
1982/83	05/01-01/01				CONFIDENTIAL				
1983/84	05/01-01/01				CONFIDENTIAL				
1984/85	05/01-01/01	4	50	40,128	91,739	13,555	2.3	3	$1.35
1985/86	05/01-01/01	4	19	8,590	17,830	1,706	2.1	5	NA
1986/87	05/01-01/01				CONFIDENTIAL				
1987/88	05/01-01/01	5	43	13,247	26,627	2,987	2.0	4	$0.95
1988/89	05/01-01/01	6	45	10,814	22,634	2,581	2.1	4	$0.90
1989/90	05/01-01/01	4	31	5,165	11,124	2,078	2.1	2	$0.90
1990/91	05/01-01/01	3	11	8,379	17,365	1,345	2.1	6	$0.90
1991/92	05/01-01/01	4	14	3,654	7,412	732	2.0	5	$1.25
1992/93	05/01-01/01	4	13	2,854	5,649	555	2.0	5	$0.83
1993/4	05/01-01/01	5	12	3,448	7,531	797	2.2	4	$0.78
1994/95-2000/01	05/01-01/01				NO LANDINGS				
2001/02	05/01-01/01				CONFIDENTIAL				
2002/03	05/01-01/01				CONFIDENTIAL				
2003/04	05/01-01/01				NO LANDINGS				

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot lift.

Table 1-16. Aleutian Islands District trawl shrimp fishery data, 1972 - 2003.

	Date		Number of				Value	
Season	Opened	Closed	Vessels	Landings	Tows	Harvest[a]	Exvessel[b]	Fishery[c]
1972	1/1	12/1				CONFIDENTIAL		
1973	1/1	12/1				CONFIDENTIAL		
1974	1/1	12/1	7	88	721	5,749,407	NA	NA
1975	1/1	12/1	4	14	54	467,196	NA	NA
1976	1/1	12/1	8	66	689	3,670,609	$0.07	$0.26
1977/78	2/1	3/1	7	93	1,372	6,800,393	$0.12	$0.82
1978/79	4/1	3/1	7	74	1,007	4,946,350	$0.15	$0.74
1979/80	4/1	2/1	7	68	799	3,292,049	$0.20	$0.66
1980	3/1	12/1	4	60	711	2,454,829	$0.23	$0.56
1981	3/1	12/1	6	45	551	2,185,326	$0.22	$0.48
1982	5/1	6/1				CONFIDENTIAL		
1983-1991						NO LANDINGS		
1992	1/1	12/1	4	6	94	72,133	NA	NA
1993-1998						NO LANDINGS		
1999	1/1	7/9	2			CONFIDENTIAL		
2000-2003						FISHERY CLOSED		

[a] In pounds.
[b] Price per pound.
[c] In millions of dollars.

Table 1-17. Aleutian Islands miscellaneous shellfish fishery data 1996 - 2003.

Year	Fishery	Number of Vessels	Number of Landings	Number of Pots Pulled	Harvest[a]
1996	Octopus	35	119	17,800	62,214
	Sea Urchins	6	15[b]		3,701
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		
1997	Octopus[c]	38	107		73,472
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina				
1998	Octopus		CONFIDENTIAL		
	Octopus[c]	24	75		29,360
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		
1999	Octopus[c]	34	95		115,322
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		
2000	Octopus[c]	31	91		21,265
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		
2001	Octopus[c]	25	51		13,097
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		

-Continued-

Table 1-17. (Page 2 of 2)

Year	Fishery	Number of Vessels	Number of Landings	Number of Pots Pulled	Harvest[a]
2002	Octopus[c]	56	186		96,585
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		
2003	Octopus[c]	70	313		242,946
	Sea Urchins		NO LANDINGS		
	Sea Cucumbers		NO LANDINGS		
	Hair Crab		NO LANDINGS		
	Snails		NO LANDINGS		
	Paralomis multispina		NO LANDINGS		

[a] In pounds. Deadloss included.
[b] Dives.
[c] Octopus bycatch.

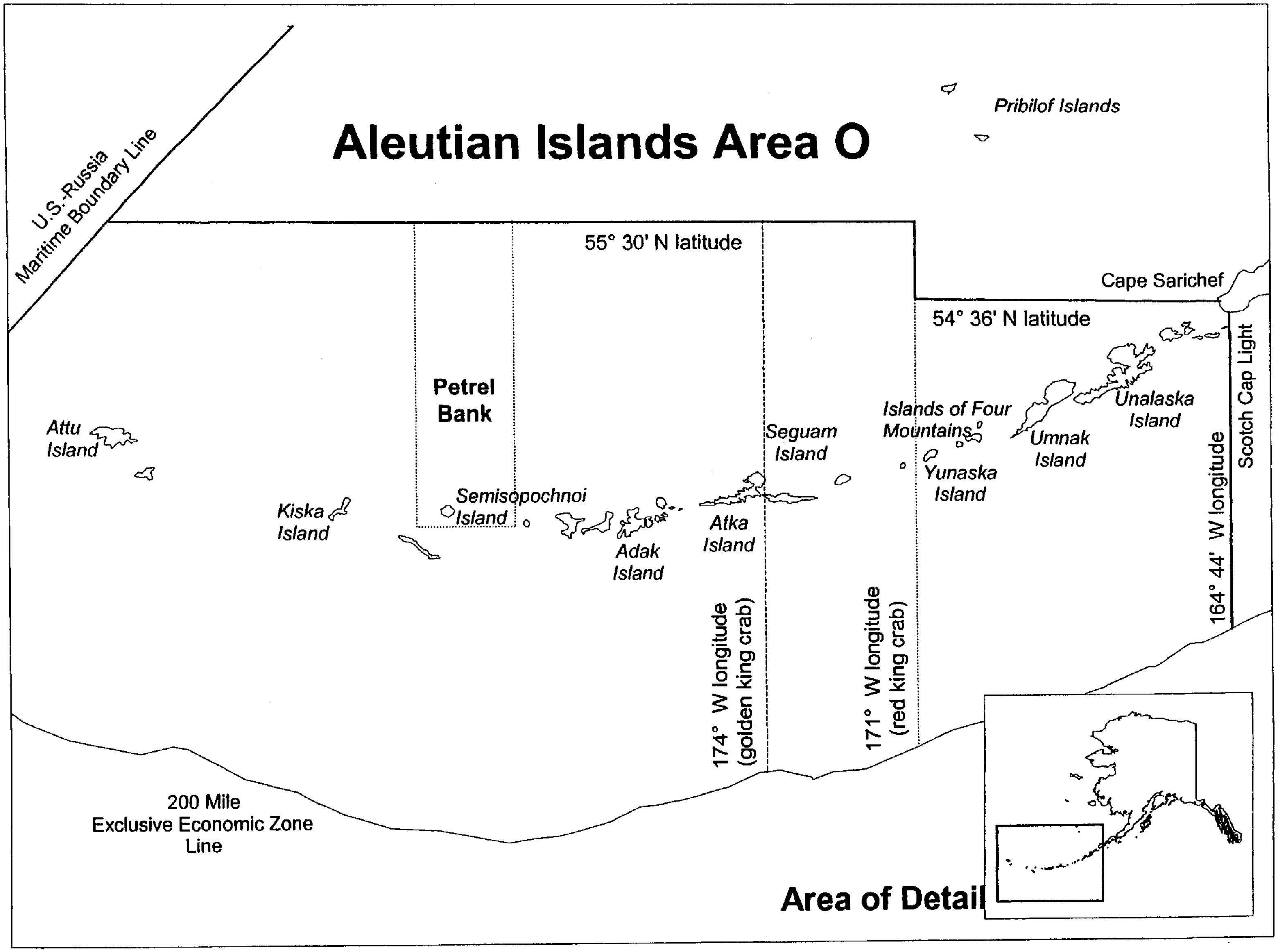


Figure 1-1. Aleutian Islands, Area O, king crab management area.

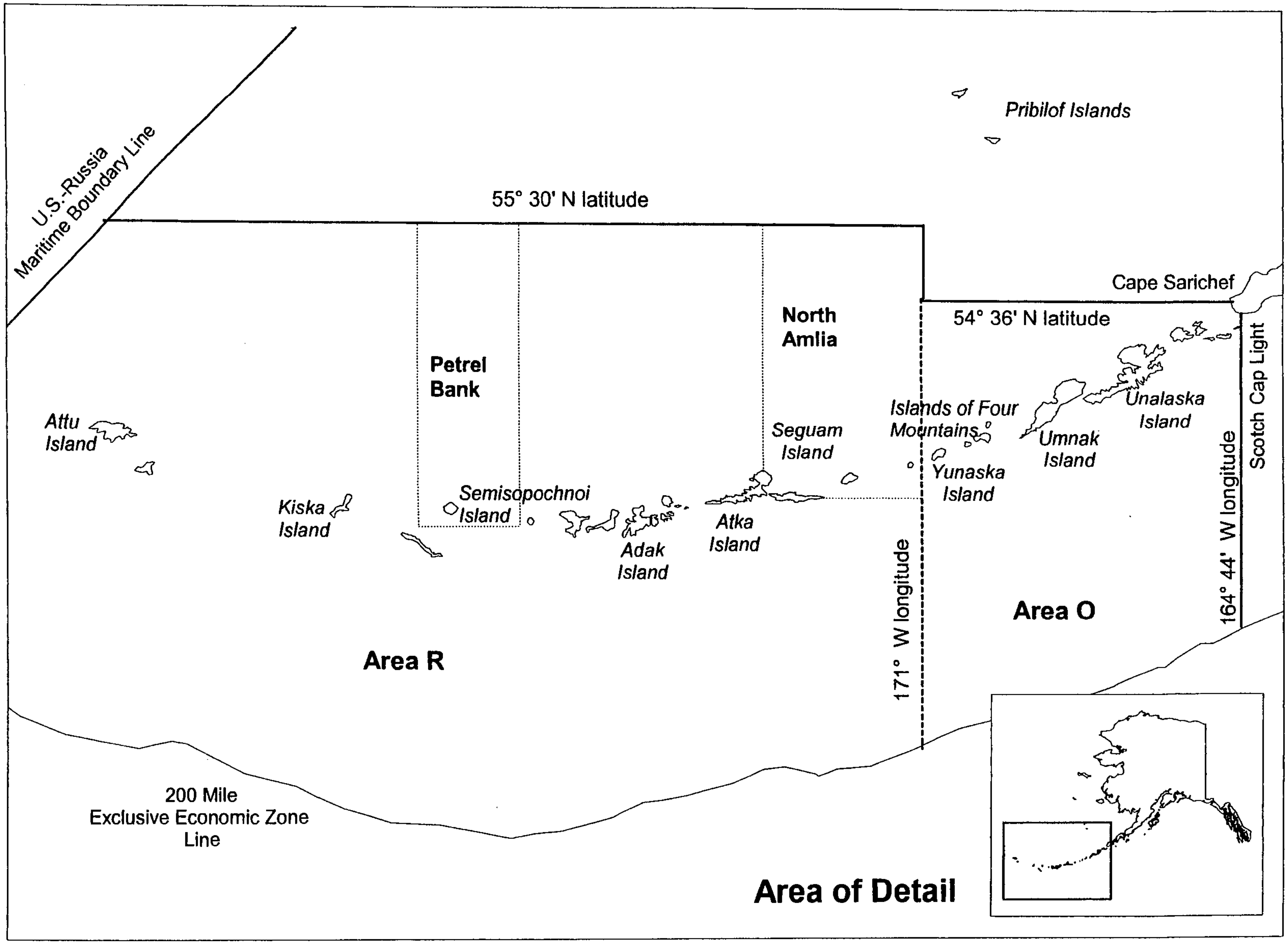


Figure 1-2. Adak (Area R) and Dutch Harbor (Area O) king crab Registration Areas and Districts 1981/82 – 1996/97.

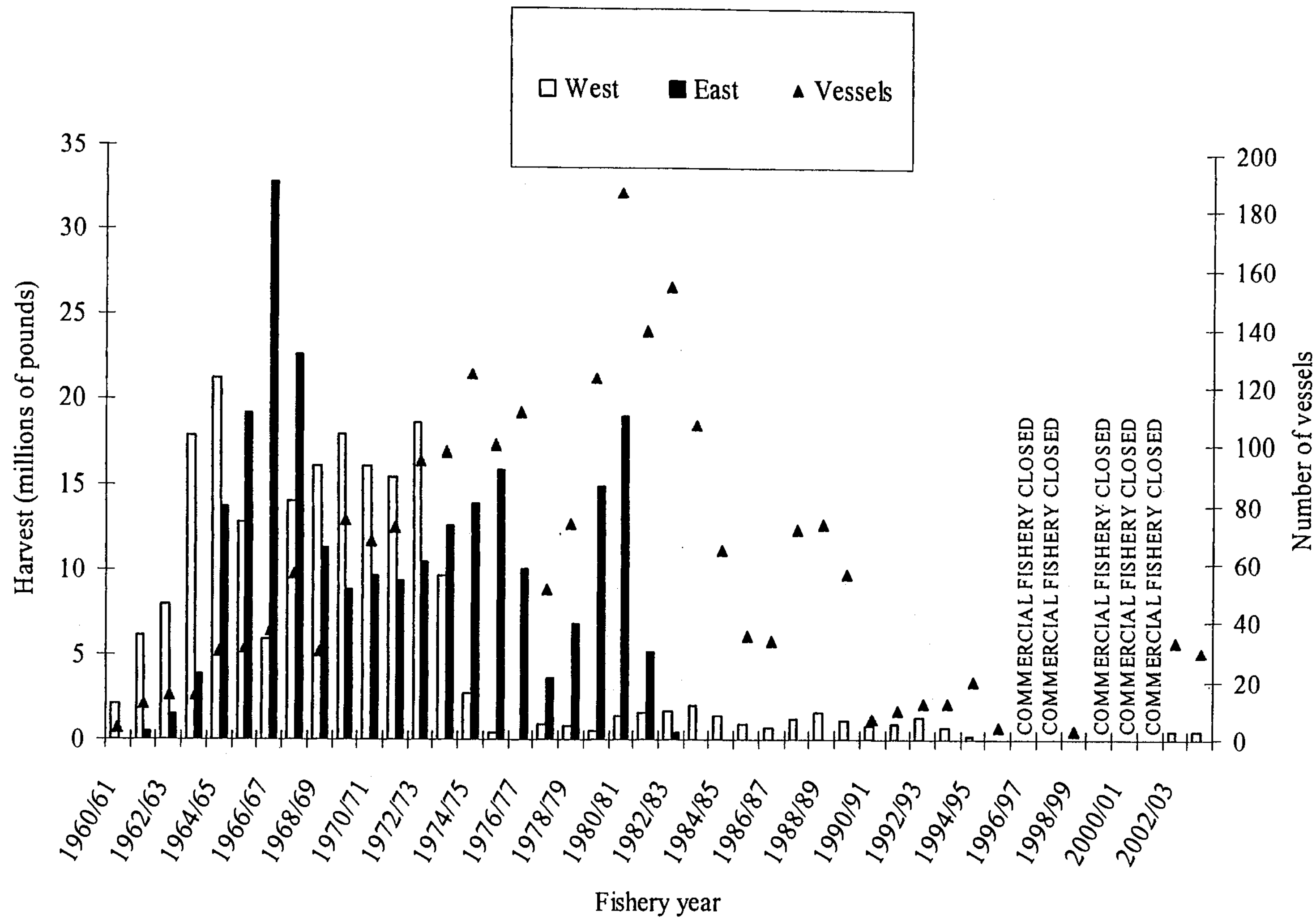


Figure 1-3. Aleutian Islands red king crab fishery harvest and vessel effort, 1960/61 - 2003/04.

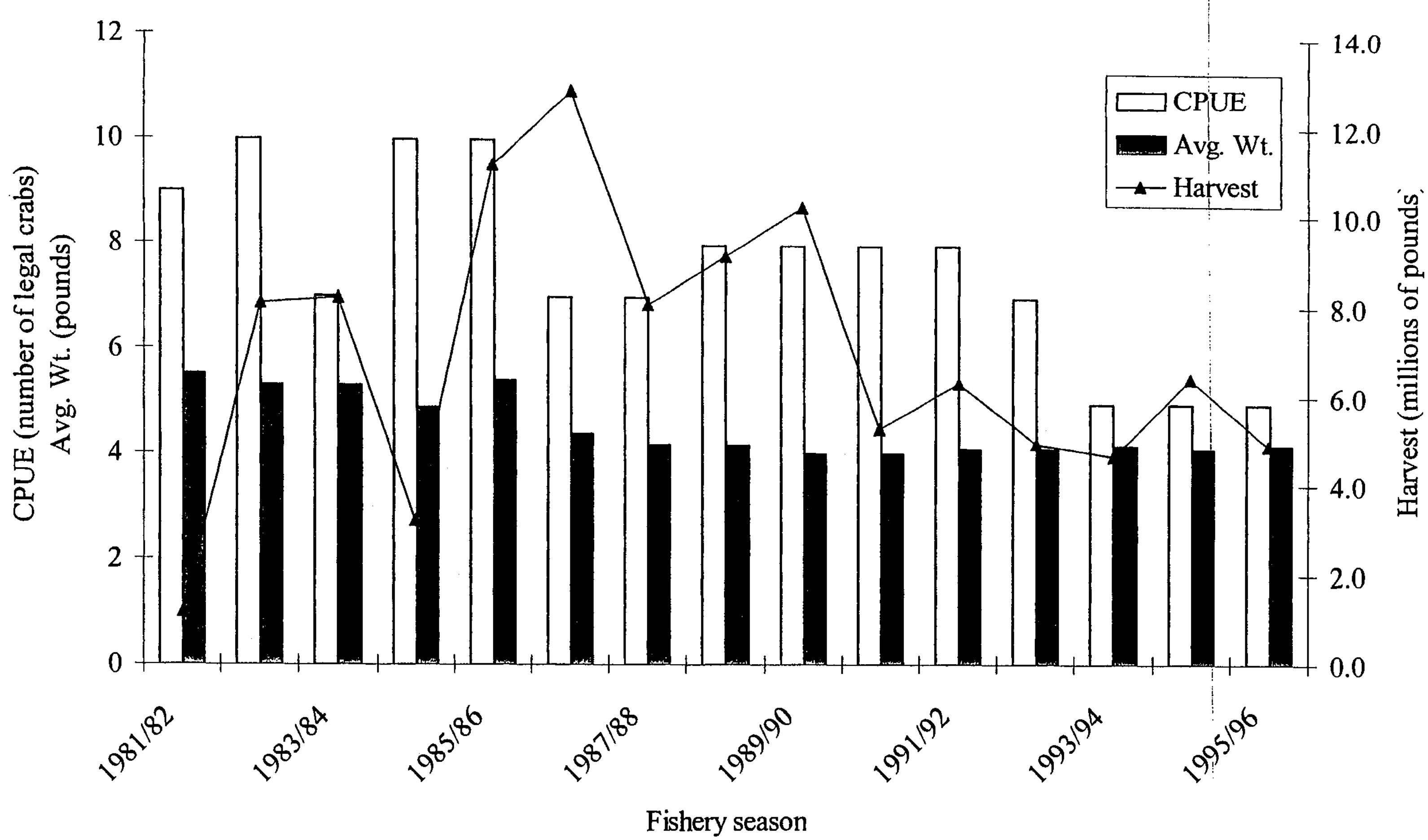


Figure 1-4. Adak Area golden king crab fishery harvest, fishery performance and average weight data, 1981/82 - 1995/96 seasons.

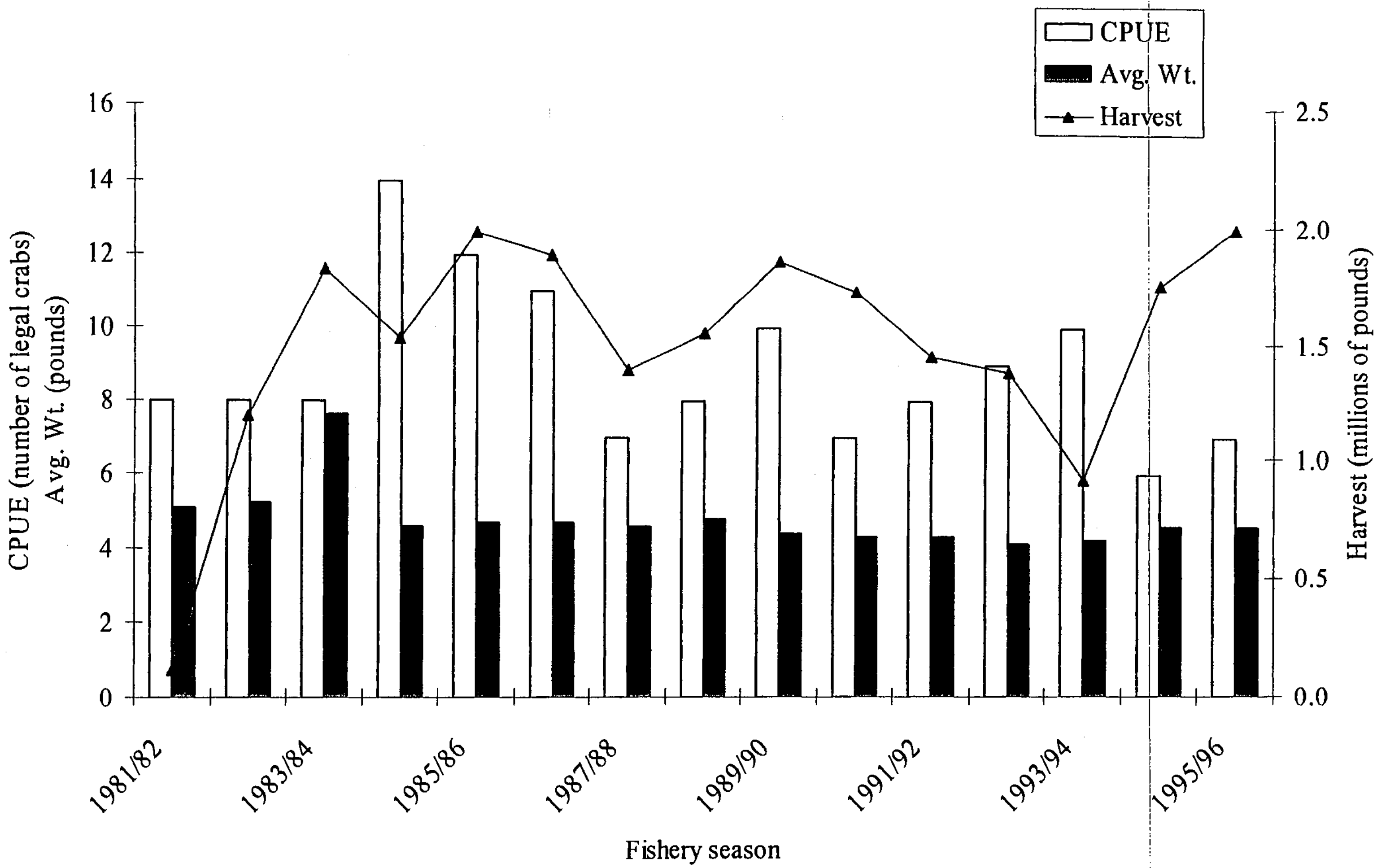


Figure 1-5. Dutch Harbor Area golden king crab fishery harvest, fishery performance and average weight data, 1981/82 - 1995/96 seasons.

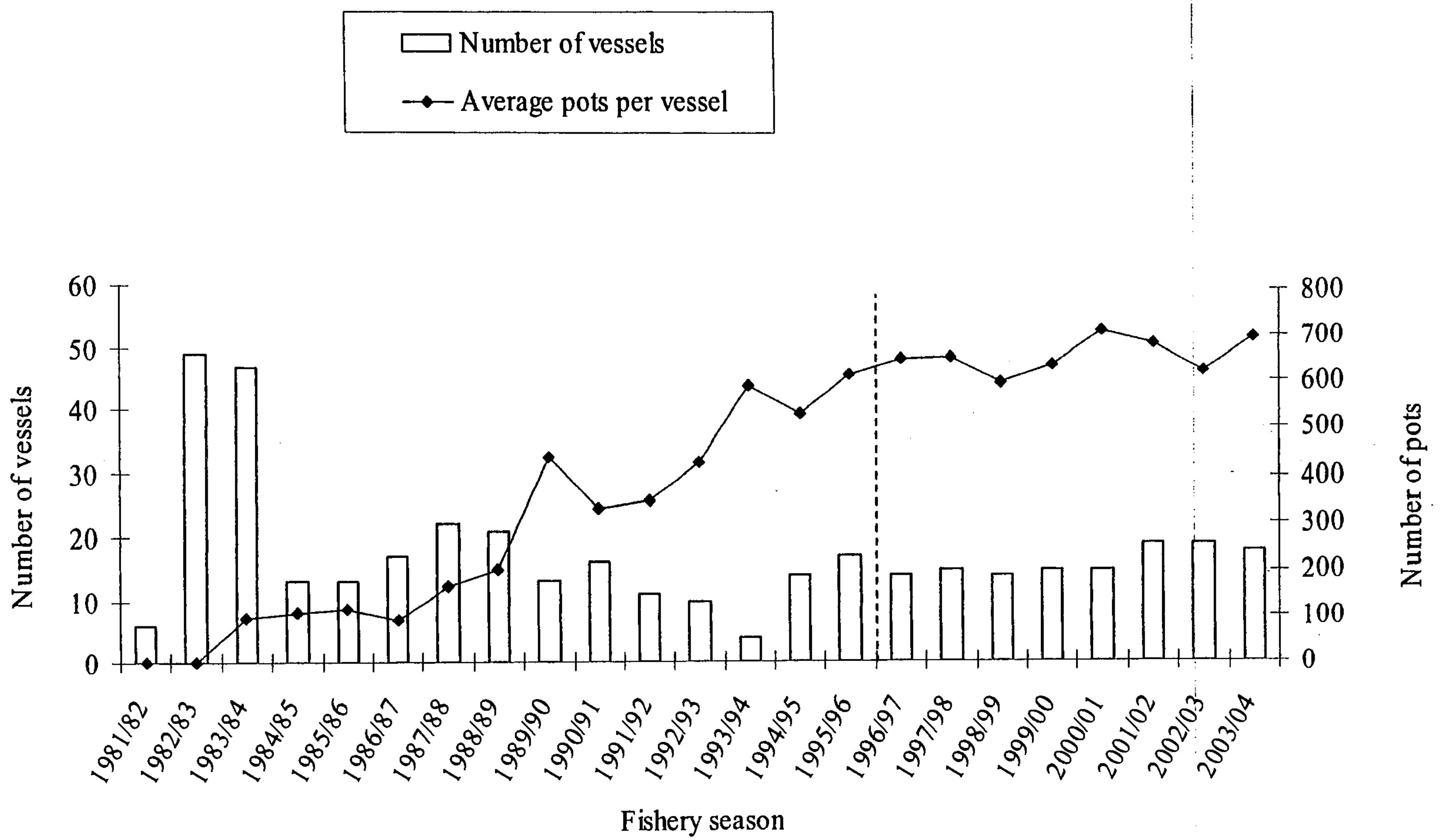


Figure 1-6. Eastern Aleutian Island golden king crab fishery vessel registrations and average number of pots per vessel 1981/82 - 2003/04.

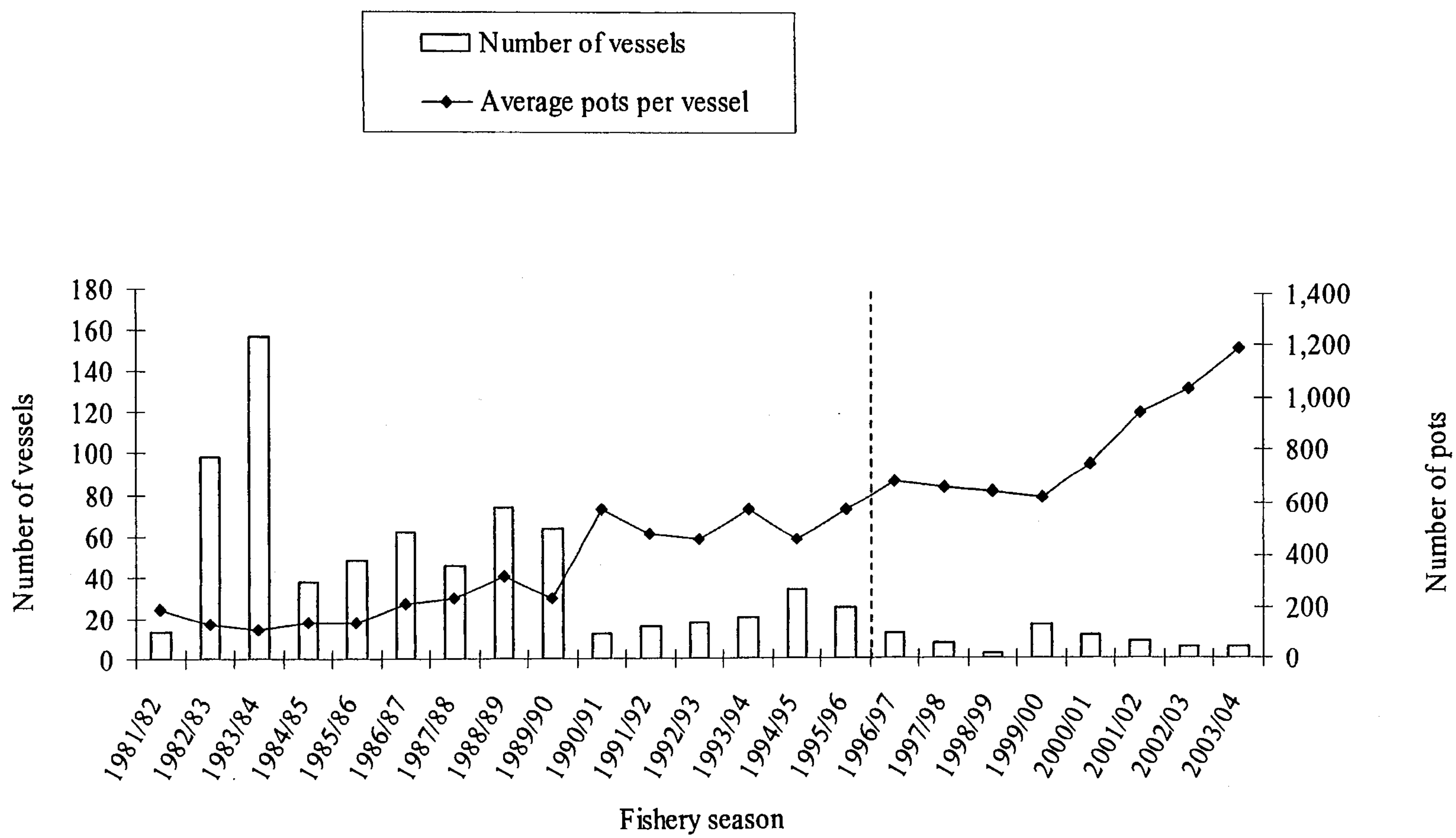


Figure 1-7. Western Aleutian Island golden king crab fishery vessel registrations and average number of pots per vessel 1981/82 - 2003/04.

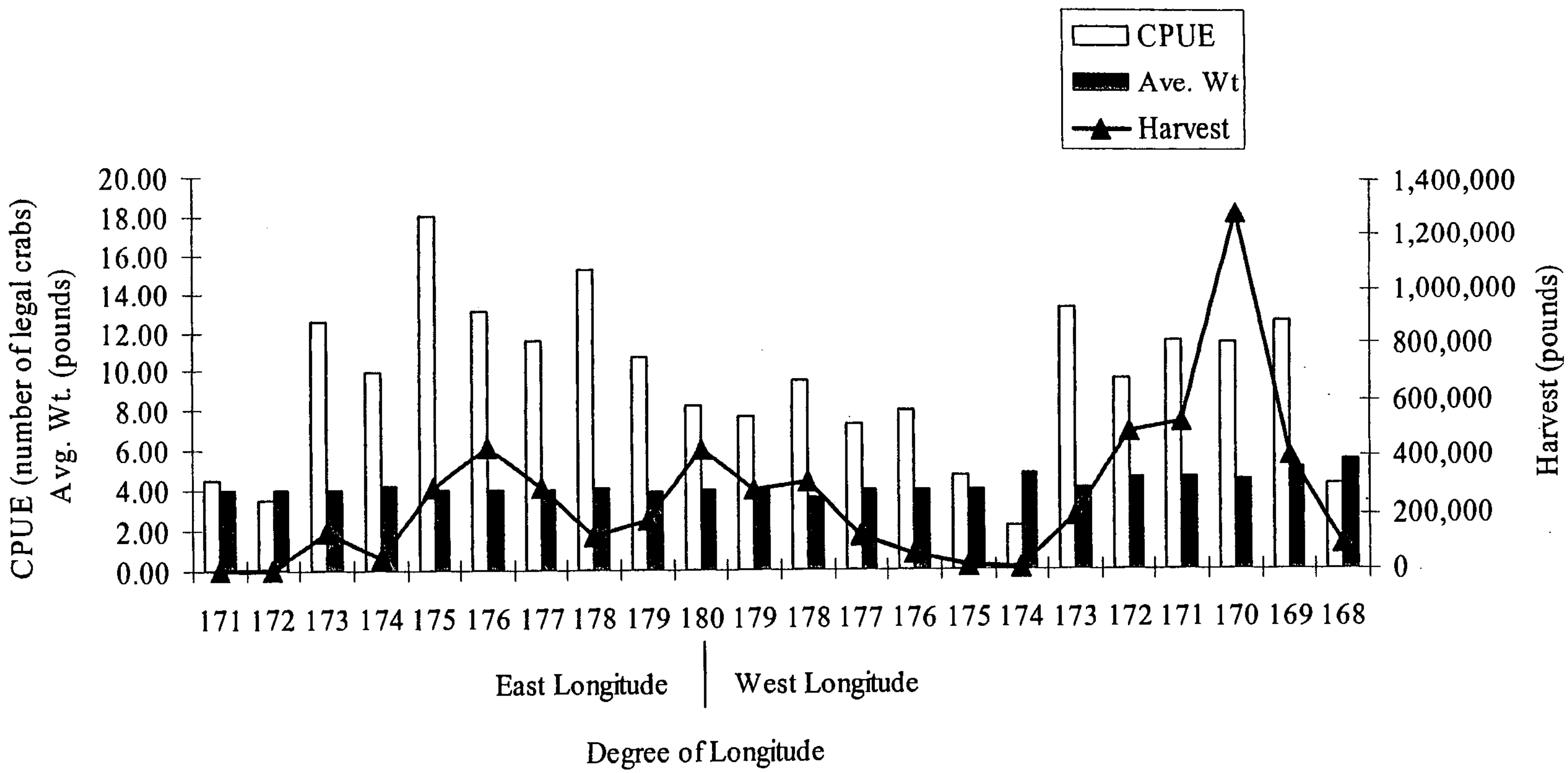


Figure 1-8. Aleutian Islands golden king crab fishery harvest, catch per unit of effort and average weight data by degree of longitude, 2003/2004.

ANNUAL MANAGEMENT REPORT FOR THE COMMERCIAL SHELLFISH FISHERIES OF THE BERING SEA, 2003

by

Forrest R. Bowers
Barbi Failor-Rounds
and
Amy E. Gilson

Dutch Harbor Area Office
P. O. Box 920587
Dutch Harbor, Alaska 99692

KING CRAB REGISTRATION AREA T
BRISTOL BAY

Description of Area

King crab Registration Area T (Bristol Bay) includes all waters of the Territorial Sea (0-3 nautical miles from shore) and all waters of the Exclusive Economic Zone (3-200 nautical miles from shore) north of the latitude of Cape Sarichef (54° 36' N lat.), east of 168° W long., and south of the latitude of Cape Newenham (58° 39' N lat.) (Figure 2-1).

Historic Background

Commercial fishing for red king crabs *Paralithodes camtschaticus* in the Bering Sea began with Japanese harvests in 1930. The Japanese fishery ended in 1940 and resumed again from 1953 until 1974. The Russian king crab fleet operated in the eastern Bering Sea from 1959 through 1971. U.S. fishers entered the eastern Bering Sea fishery with trawl gear in 1947. Effort and catches declined in the 1950s, with no catch reported in 1959. A period of low catches followed through 1966 before the domestic fishery expanded to full-scale in the late 1970s.

The red king crab fishery in the eastern Bering Sea traditionally harvested crabs from waters north of Unimak Island and the Alaska Peninsula from Cape Sarichef to Port Heiden. With the decline of king crab stocks in other areas of the state, U.S. effort in the eastern Bering Sea increased beginning in 1966 with a peak harvest of 129.9 million pounds in 1980 (Table 2-1, Figure 2-2). Since 1980, king crab stocks throughout Alaska, including Bristol Bay, declined sharply and have not recovered to pre-1980 levels, leading to closures of the Bristol Bay red king crab (BBRKC) fishery in 1983, 1994, and 1995. From 1980 to 2001, economic value of the BBRKC fishery ranged from $8.9 million in 1982 to a high of $115.3 million in 1980 (Table 2-2, Figure 2-3). Exvessel price ranged from $0.90 per pound in 1980 to a high of $6.26 per pound in 1999.

In 1980, the Alaska Board of Fisheries (BOF) defined that portion of the Bering Sea south of Cape Newenham and east of 168° W. long. as the Bristol Bay King Crab Registration Area T, and the area was designated an exclusive registration area. During any king crab registration year (June 28 through June 27), vessels registering for and fishing in this area are prohibited from fishing in any other exclusive or super-exclusive king crab registration area. Only non-exclusive areas may be fished once a vessel is registered in Area T.

The National Marine Fisheries Service (NMFS) has conducted annual trawl abundance index surveys of the eastern Bering Sea since 1968. This multi-species (crab and groundfish) survey is conducted during the summer months and the resulting area-swept estimates of abundance are published annually. In 1983, the NMFS trawl survey of the Bering Sea indicated a record low number of legal male crabs and the lowest total king crab population ever recorded. Small female crabs carrying fewer eggs and high predator abundance were also noted. Consequently, the fishery was closed for the 1983 season. The fishery reopened in 1984 and catches slowly increased to over 20.3 million pounds in 1990. Due to the large number of catcher-processors and floating-processors in the fishery and the inability of the Alaska Department of Fish and Game (ADF&G) to monitor these catches, an onboard observer program was initiated in 1988. Fishing effort increased dramatically from 89 vessels in 1984 to over 300 vessels in 1991 (Table 2-1, Figure 2-3). The number of pots used by the fleet also increased, with almost 90,000 pots registered for the 1991 fishery compared to just under 22,000 pots registered in 1984.

Due to the increased number of pots, the BOF established a 250-pot limit enforced through a buoy sticker program, which was implemented for the 1992 BBRKC fishery. This measure was intended to improve manageability of the fishery by extending the length of the season as well as reducing the potential for pot loss and gear conflict.

Immediately following the 1992 BBRKC fishery, the 250-pot limit was repealed by NMFS. This action was taken because of inconsistencies between the state regulations and provisions of the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (FMP), mandating application of pot limits in a nondiscriminatory manner (NPFMC 1998). In the spring of 1993, the BOF adopted new regulations, setting pot limits based on overall vessel length. For the BBRKC fishery, vessels in excess of 125 feet in overall length were limited to 250 pots and vessels 125 feet and under in overall length were allowed a maximum of 200 pots. These pot limits were administered through a buoy tag program from the Dutch Harbor and Kodiak ADF&G offices.

Voluntary daily vessel reports received via single side band (SSB) radio and marine telex have been used to manage the BBRKC fishery since 1993. The 1993 season ran for nine days and the total harvest was 14.6 million pounds, approximately 2.2 million pounds less than the 16.8 million pounds harvest guideline.

Results of the NMFS 1994 summer trawl survey of the Eastern Bering Sea indicated declines in all size-classes of both male and female red king crabs in the Bristol Bay area. Compared to observations made during the 1993 survey, the abundance index of large male crabs decreased 25%. Based on the 1994 survey results, large female abundance was estimated at 7.5 million crabs, which was below the minimum threshold of 8.4 million crabs necessary to allow a fishery. Consequently, the BBRKC fishery was not open for the 1994 season.

To address potential measurement errors in the area-swept trawl abundance estimates, ADF&G developed a length-based analysis (LBA) model for estimating population abundance. This method, used for the first time prior to the 1995 season, incorporates a variety of data sources including dockside sampling and observer collected data, as well as data collected on the annual NMFS survey. The LBA is less susceptible to year-to-year variations in factors unrelated to population abundance (i.e. oceanographic conditions, changes in species distribution, and subsequent availability to the survey gear) and is therefore more likely to produce an accurate estimate of abundance. Analysis of the 1995 NMFS survey using the LBA model indicated no significant difference in the abundance of mature male and female red king crabs from estimates made from the 1994 survey (Zheng et al. 1995). Based on these combined results, the BBRKC fishery remained closed for the 1995 season.

Due to the depressed status of the BBRKC population, the BOF, at their March 1996 meeting adopted a revised harvest strategy to promote stock rebuilding. One of the most significant changes to the harvest strategy was a reduction in the exploitation rate of mature male crabs from 20% to 10% at levels below where the stock is considered rebuilt (55 million pounds of effective spawning biomass (ESB)), or 15% when the stock is considered rebuilt.

Results from the LBA incorporating the 1996 NMFS survey data indicated increased abundance in all size classes of males and females compared to the 1995 estimate (Zheng et al. 1996). Of major importance was an increase in the number of large females in 1996 to 10.2 million crabs, which was well above the threshold of 8.4 million large female crabs necessary to allow a fishery. This was a significant increase relative to the prior two years where fishery closures occurred due to insufficient numbers of large female crabs. Based on a 10% mature male exploitation rate, the 1996 guideline harvest level (GHL) was set at 5.0 million pounds. The 1996 fishery lasted four days and a total of 8.4 million pounds were harvested, exceeding the GHL by 68%.

To address the difficulty in managing this fishery at low GHLs, the BOF held a special meeting in August of 1997 implementing new pot limits and vessel preseason registration requirements. Also adopted were regulations that extended the tank inspection window for the BBRKC fishery from 24 to 30 hours and allowed fishers to leave baited pots on the fishing grounds when a fishery closure announcement is made with less than 24 hours of advance notice. New pot limits were based on vessel overall length, the preseason GHL, and the number of vessels preseason registered for the fishery. These new pot limit regulations were adopted with a sunset provision of December 31, 1998, to provide for reevaluation at the 1999 BOF meeting.

The LBA, using the 1997 NMFS survey data, indicated that all components of the BBRKC crab stock increased from levels observed in 1996 (Zheng et al. 1997), ESB was below the 55 million pound threshold necessary to allow a 15% harvest rate. Therefore, a 10% mature male exploitation rate was used, generating a general fishery GHL of 7.0 million pounds for the 1997 season. Based on the GHL and number of vessels that filed a preseason registration, pot limits were set at 100 and 125 pots for small and for large vessels, respectively. The 1997 fishery lasted four days and a total of 8.8 million pounds were harvested. The 1997 harvest exceeded the GHL by 26%, largely due to extremely high catch rates in the final hours of the fishery.

Analysis of the 1998 NMFS survey data indicated the abundance of pre-recruit male red king crabs increased by 85%, resulting in an increase in the fishable stock of mature male crabs for the 1998 season. The abundance of large females (>89 mm carapace length) increased by 42% (Stevens et al. 1998a). Effective spawning biomass was estimated to be over 55 million pounds, resulting in a 15% harvest rate on mature male crabs. The GHL for the 1998 general fishery (non Community Development Quota) was 15.8 million pounds. Because the GHL was in excess of 12 million pounds, the preseason registration requirement was waived and pot limits were set at 200 for vessels less than or equal to 125 feet in length and 250 for vessels greater than 125 feet in length. Total harvest in the 1998 fishery, which lasted five days, was 14.2 million pounds.

At the March 1999 meeting, the BOF made permanent the interim management measures that were adopted in the fall of 1997. The BOF also passed anti-prospecting regulations that were amended in 2000. The regulations prohibit vessels from participating in the Bristol Bay king crab fishery if they have operated pot, longline, or trawl gear in that portion of Registration Area T north of 55° 30' N lat. and east of 164° W long. during the 30 days immediately prior to the opening of the king crab season. However, an exception was made for vessels participating in a directed pollock fishery with trawl gear in Area T north of 55° 30' N lat. and east of 164° W long. during the 14 days prior to the red king crab season. These vessels may participate in the BBRKC fishery if they delivered to an offshore processor or had 100 percent federal groundfish onboard observer coverage for the entire 14 days prior to the opening. The BOF also adopted a regulation that moved the opening date of the commercial red king crab fishery in Bristol Bay from November 1 to October 15. The change to an earlier opening was intended to improve fleet and industry efficiency by reducing the hiatus between the BBRKC fishery and the Bering Sea king crab fisheries, opening on September 15.

The LBA, including the 1999 NMFS survey data, indicated that while the abundance of legal and mature male red king crabs in Bristol Bay increased, all other classes decreased from the 1998 level: small males by 57%, pre-recruit males by 27%, and large females by 7% (Zheng and Kruse 1999). The LBA estimates resulted in an ESB of 47.0 million pounds. By applying an exploitation rate of 10% to the mature male population, a general fishery GHL of 10.1 million pounds was set. The 1999 season lasted five days, with a total harvest of 11.1 million pounds.

The LBA, including the 2000 NMFS survey data, indicated that the abundance of almost all size-classes of the Bristol Bay red king crab stock decreased from levels observed in 1999. Small males increased by 192%, but all others decreased: pre-recruit males by 23%, mature males by 14%, and legal males by 3%. Large females also decreased by 10% (Zheng and Kruse 2000). The 2000 ESB was estimated to be 39.9 million pounds, a decrease of 11% compared to 1999. At 39.9 million pounds, ESB was above the threshold for a fishery opening with a 10% exploitation rate on mature males. The 10% exploitation rate on mature males resulted in a general fishery GHL of 7.7 million pounds. The 2000 fishery opened at 4:00 PM on October 16 after a 24-hour delay to allow strong winds in the Bristol Bay area to diminish. A total of 239 catcher-only vessels and seven catcher-processors participated. However, only 244 vessels made landings. A total of 7.6 million pounds of red king crabs was harvested in the 4.2-day fishery, which was closed by emergency order at 9:00 PM on October 20.

Results of the NMFS stock assessment survey and LBA in 2001 gave an estimated ESB of 40.6 million pounds and a mature male abundance estimate of nearly 11 million crabs. When the harvest strategy was applied to these estimates, a general fishery GHL of 7.2 million pounds was the result of using a 10% exploitation rate applied to the mature male abundance estimate. The 2001 fishery opened at 4:00 PM on October 15 with 232 vessels registered (two registered vessels did not make landings). The fishery closed at 11:59 PM on October 18 after approximately 7.8 million pounds were harvested.

In 2002, survey results provided an estimated ESB of 37.7 million pounds and a mature male abundance estimate of 14.3 million crabs. A 10% exploitation rate was applied to the mature male abundance resulting in a general fishery GHL of 8.56 million pounds. The 2002 fishery opened at 4:00 PM on October 15 with 242 vessels registered. The fishery closed at NOON on October 18 after approximately 8.9 million pounds were harvested.

In 2003, the BOF modified the BBRKC harvest strategy. The BOF maintained the existing 10% and 15% harvest rates on mature males and implemented a 12.5% harvest rate on mature males when the ESB is greater than or equal to 34.75 million pounds but less than 55 million pounds.

American Fisheries Act

The American Fisheries Act (AFA), passed in 1998 by Congress, gave pollock fishers exclusive fishing privileges in the Bering Sea/Aleutian Islands (BSAI) pollock fishery. To protect the interests of fishers not directly benefited by the AFA, sideboards were established for AFA fishers qualified to participate in BSAI crab fisheries. To implement the sideboards, the BOF developed a management plan requiring ADF&G to manage AFA vessels with a harvest cap equally apportioned between all AFA qualified vessels or through a cooperative fishery when 100% of AFA qualified participants agree to the cooperative. The harvest cap specified by the AFA was implemented for the first time in the 2000 BBRKC fishery.

Of the 239 catcher-only vessels that participated in the 2000 BBRKC fishery, 25 participated under AFA sideboards. The AFA vessels fished in a cooperative manner with a fixed harvest cap of 10.96% of the general fishery GHL, or 0.9 million pounds. Post-season production reports show that AFA vessels harvested approximately 0.7 million pounds or 84.7% of their cap.

During the 2001 BBRKC fishery, 31 vessels participated under the AFA sideboards and fished in a cooperative manner. The fleet harvested 0.70 million pounds of a 0.72 million pound cap. Most of the vessels fishing under the AFA sideboards in 2001 were not constrained by the cap.

In 2002, 31 vessels participated under the AFA sideboards and fished in a cooperative manner. Twenty seven of the AFA vessels were constrained by the cap and stopped fishing prior to the closure. Several of the participating vessels exceeded the individual limits, however the AFA fleet remained under the cap and harvested 917,676 pounds, or 97.6% of the 939,842 pound cap.

2003 Fishery

NMFS survey and LBA results for 2003 indicated that the stock was above the fishery threshold with an estimated abundance of 29.7 million mature females and an estimated ESB of 60.7 million pounds. Both of these estimates represented substantial increases from those generated in 2002. Since ESB was estimated to be greater than 55.0 million pounds, the harvest strategy specifies an exploitation rate of 15% on mature males. Given an estimated mature male abundance of 16.4 million crabs and an average weight of 6.4 pounds per legal crab, the 2003 GHL was set at 15.7 million pounds, 1.2 million pounds of which were allocated to the Community Development Quota fishery.

Preseason vessel registration was required prior to 5:00 PM, September 24, 2003. Based on the 254 preseason vessel registrations received prior to that deadline and the 14.5 million pound general fishery GHL, pot limits were set at 200 pots for vessels less than or equal to 125 feet in overall length and 250 pots for vessels greater than 125 feet in overall length. In addition, preseason vessel registrations were used to select catcher vessels to carry onboard observers during the fishery; 24 catcher vessels were selected and 23 observers were deployed. Eight catcher processors and one floating processor registered for the fishery. Based on preseason effort levels and catch rate data from recent BBRKC fisheries, the department chose to manage the 2003 fishery through inseason catch reports from fishers rather than with a closure announced prior to the opening. As part of the inseason management process, the department advised the fleet that catch updates would be made daily at noon and 9:00 PM and that the department would attempt to provide the fleet with 24-hours advance notice of the fishery closure, but given the pace of recent BBRKC fisheries, less than 24-hours advance notice was possible.

During the week preceding vessel registration, department staff consulted with United States Coast Guard (USCG) search and rescue personnel and National Weather Service (NWS) forecasters regarding a potential weather-related delay in the season opening. NWS staff did not forecast storm force winds in the operational area of vessels that would be travelling to the Bristol Bay red king crab fishing grounds from Dutch Harbor, Akutan, King Cove, or False Pass, nor were storm force winds forecast for the time period October 15-18. USCG personnel did not foresee that current or forecast weather conditions would hamper a search and rescue mission immediately before or during the first 18 hours of the fishery, thus the season was not delayed.

Vessel hold and gear inspections as part of the "quick registration" process began October 7 in Dutch Harbor and Akutan, October 8 in King Cove, and October 10 in False Pass. Vessel registration began at 10:00 AM, October 14. A total of 252 vessels registered for the fishery, which began at 4:00 PM, October 15. Intent to participate in the volunteer catch reporting program was received from 139 vessel operators. Observers on 32 additional vessels contributed daily catch reports as well. Catch reports were first received at 6:00 PM October 15, however these reports represented only the first two hours of the season and no catch was reported.

By 6:00 PM October 17, the catch rate was approximately 19 legal crabs per pot lift, the fleet pulled approximately 12,000 pots in the preceding twelve hours, and the cumulative harvest had reached 3.4 million pounds (Table 2-3). By 6:00 AM October 19, catch rates had increased to 23 legal crabs per pot lift and the fleet pulled approximately 13,000 pots in the previous 12 hours. The cumulative catch at 6:00 AM October 19 was 8.5 million pounds and the fleet was harvesting approximately 1.7 million pounds every 12 hours. Based on catch reports received through 6:00 AM October 19 and the most recent 12-hour harvest, the department issued a news release at NOON on October 19 stating that the GHL would be met and that the fishery would close at 6:00 PM October 20. One hundred and seventeen vessel operators participated in the inseason management process by providing at least one catch report during the fishery.

Catch reports received from the fleet on October 20 indicated that catch per unit of effort decreased after the closure announcement was made, while the number of pot lifts per 12 hour period increased. The fleet pulled nearly 43,000 pots in the final 24 hours of the fishery. The general fleet harvest projection including the AFA fleet portion based on inseason reports received after the closure announcement was approximately 16.6 million pounds. Actual harvest was 14,530,248 pounds, or 99.9% of the GHL.

The fleet was provided with more than 24 hours of advance notice of the fishery closure, thus all gear was required to be unbaited and stored with the doors open, or removed from the water by the time of the closure. The majority of the fleet was able to comply with this requirement, however 13 vessels experienced mechanical problems or delays that caused them to have gear stored illegally.

Fishers restricted under the AFA cap in the general fishery made a substantial change to their fishing practices in 2003. All but two of the participating vessels chose to be assigned a preseason trip limit rather than fish competitively until 80% of the cap was reached before receiving a limit. The AFA fleet made the change in an attempt to address perceived inequities in the prior management approach. Catch rates of the 32 vessels participating under the AFA cap in the general fishery were lower than those recorded by the non-capped portion of the fleet. As a fleet, the AFA vessels rarely exceeded a catch rate of 20 legal crabs per pot lift (Table 2-4). Vessels operating under the AFA cap had an average catch per unit of effort (CPUE) of 15 legal crabs per pot lift compared to an overall fleet average CPUE of 18 legal crabs per pot lift. Ten of the AFA vessels reached their trip limit and stopped fishing prior to the closure. Both vessels participating in the competitive fishery reached 80% of their portion of the cap. The AFA fleet remained well under the cap and harvested 1,189,013 pounds or 75% of the cap.

The 2003 Bristol Bay red king crab fishery was 122 hours long, a substantial increase from the 2002 season length of 68 hours. The 2003 legal male CPUE was 18, a slight decrease from the 2002 catch rate of 20 legal crabs per pot lift. Catch rates were highest between 56° and 57° N lat. and between 163° and 164 ° W long. High catch rates were also reported as far west as 165° W long. In general, the highest catch rates during the 2003 fishery occurred to the west of the most productive areas in the 2002 fishery, which were west of 163° W long. Nearly 85% of the 2003 harvest occurred in four adjacent ADF&G statistical areas (Table 2-5).

The fleet pulled approximately 129,000 pots to harvest 14,530,248 pounds (Table 2-1). Landed king crabs averaged 6.2 pounds per crab, representing a decrease of nearly 0.2 pounds per crab from the 2002 fishery average weight (Table 2-6) and the average weight used for GHL setting process. The decrease in average weight is consistent with survey results indicating improved recruitment to the legal size class.

Fishers were paid an average price of $5.08 per pound by shore plants in Dutch Harbor, Akutan, Saint Paul, King Cove, Sand Point, and Kodiak. In addition, one floating processor and two catcher processors purchased crabs after the season. The 2003 Bristol Bay red king crab fishery had an exvessel value of $72.7 million, a substantial increase from the 2002 exvessel value of $54.2 million (Table 2-2, Figure 2-3).

Weather conditions during the 2003 Bristol Bay red king crab fishery were generally poor and fishers reported that operations were slowed due to weather. No vessels were lost, however one fatality occurred. A single vessel reported mechanical problems before the season opened and was not able to participate in the fishery.

ADF&G personnel or observers contacted approximately 76% of Bristol Bay red king crab vessel operators for postseason interviews. Biological data were collected from the majority of these deliveries. The Alaska Bureau of Wildlife Enforcement (ABWE) stationed personnel in all ports where Bristol Bay red king crabs were landed and cited four vessel operators for possession of undersized crab. ABWE seized 14,955 pounds of illegal king crab valued at approximately $75,000.

Size data indicated that the majority (72%) of the harvest was composed of recruit sized crabs. An increase from 61% recruits in 2002. Landed red king crabs averaged 149 mm in carapace length (CL), a slight decrease from the 2000, 2001, and 2002 average CL of 151 mm (Table 2-6).

Prior to the 2003 general red king crab fishery in Bristol Bay, ADF&G conducted cost-recovery fishing using a chartered vessel. The department intended to conduct all 2003 cost-recovery activities in the Pribilof District, but low catches of legal males in the Pribilof District forced the department to divert the chartered vessel to Bristol Bay. The cost-recovery project harvested and sold approximately 32,000 pounds of Bristol Bay red king crabs (Table 2-7), worth approximately $180,000 (Table 2-8). The 2003 cost-recovery fishery is part of an ongoing program used to collect funds to conduct research on Bering Sea shellfish and to fund pre-season practical examinations for new observers. No additional cost-recovery fishing occurred post season.

Stock Status

The status of the Bristol Bay red king crab stock and fishery are evaluated through the use of abundance based thresholds. When the total mature biomass (TMB) of red king crabs in Bristol Bay falls below the 44.8 million pound minimum stock size threshold (MSST), the stock is considered overfished. In 2003, the TMB of red king crabs in Bristol Bay was estimated to be 178.1 million pounds, which is well above the maximum sustained yield (MSY) value of 89.6 million pounds TMB and is the highest TMB estimate since 1981.

The state harvest strategy for Bristol Bay red king crabs establishes three thresholds that must be met prior to a fishery opening. The first is a threshold abundance level of 8.4 million mature females, the second is an ESB threshold of 14.5 million pounds of ESB, and the third is a minimum GHL threshold of 4.0 million pounds. LBA estimates for 2003 show the stock to be above both the mature female abundance threshold at 29.7 million females and the ESB threshold at 60.7 million pounds of ESB. Mature female abundance and ESB increased substantially from the 2002 levels.

Legal male abundance increased substantially over the 2002 level. At 12.3 million crabs, the legal male abundance estimate in 2003 is the largest in the last 20 years. (Rugolo et al. 2003). Strong recruitment experienced in 2003 resulted in a slightly lower average weight and average crab size during the 2003 fishery. Given recent survey trends, there should be a modest increase in mature female crab abundance, ESB, and legal male crab abundance in 2004 and it is likely that fishery thresholds will be met and the stock will be above MSST.

KING CRAB REGISTRATION AREA Q
BERING SEA

Description of Area

The Bering Sea king crab Registration Area Q has as its southern boundary a line from 54° 36' N lat., 168° W long., to 54° 36' N lat., 171° W long., to 55° 30' N lat., 171° W. long., to 55° 30' N lat., 173° 30' E long., as its northern boundary the latitude of Point Hope (68° 21' N lat.), as its eastern boundary a line from 54° 36' N lat., 168° W long., to 58° 39' N lat., 168° W long., to Cape Newenham (58° 39' N lat.), and as its western boundary the United States-Russia Maritime Boundary Line of 1991 (Figure 2-4). Area Q is divided into the Pribilof District, which includes waters south of Cape Newenham, and the Northern District, which incorporates all waters north of Cape Newenham. The Northern District is subdivided into three sections: the Saint Matthew Island Section, which includes waters north of Cape Newenham and south of Cape Romanzof; the Norton Sound Section, which includes all waters north of Cape Romanzof, south of Cape Prince of Wales, and east of 168° W long; and the Saint Lawrence Island Section, which encompasses all remaining waters of the district. Registration Area Q includes waters of both the Territorial Sea (0-3 nautical miles from shore) and the Exclusive Economic Zone (3-200 miles from shore).

PRIBILOF DISTRICT RED AND BLUE KING CRAB

Historic Background

The king crab fishery in the Pribilof District began in 1973, when vessels targeted blue king crabs *Paralithodes platypus* in the vicinity of Saint George and Saint Paul Islands. The first reported catch in this area was 1.3 million pounds taken by eight vessels between July 1973 and October 1974. The average weight of crabs harvested was 7.3 pounds and CPUE was 26 legal crabs per pot lift. By the 1980/1981 season, fishing effort had increased to 110 vessels, that harvested 11.0 million pounds, the highest catch on record. However, by that time the fishery CPUE had dropped to nine legal crabs per pot lift and continued declining to a low of two crabs per pot by the end of the 1986/1987 season. Consequently, the harvest dropped to 260,000 pounds, taken by 16 vessels (Table 2-9). Due to this six-year decline in harvest and concurrently low annual population estimates, the blue king crab fishery was closed beginning with the 1988/1989 season and remained closed until 1995 (Figure 2-5).

In 1993, the BOF adopted regulations that set pot limits based on overall vessel length for all king crab fisheries in the Bering Sea. In the Pribilof District, pot limits were established at 50 for vessels over 125 feet overall length and at 40 for vessels 125 feet overall length or less.

The 1993 NMFS summer trawl survey of the Bering Sea indicated a marked increase in the abundance of red king crabs around the Pribilof Islands. Although no threshold abundance level for opening the fishery was established for Pribilof District red king crabs, survey results indicated a harvestable surplus of legal-sized male crabs. Consequently, a red king crab fishery in the Pribilof

District opened for the first time in September 1993. A harvest of 2.6 million pounds was taken from a GHL of 3.4 million pounds. In 1994, the Pribilof District was again opened to the commercial harvest of red king crabs, and 104 vessels harvested 1.3 million pounds.

In 1995, an increase in blue king crab abundance and a continued harvestable surplus of red king crabs resulted in a combined red and blue king crab GHL of 2.5 million pounds. Subsequent declines in red and blue king crab abundance over the next three years resulted in a combined GHL for 1998 of 1.3 million pounds (Table 2-10). Poor fishery performance during those seasons resulted in annual harvests below the fishery GHL. From 1999 to 2002, blue king crab abundance continued to decline and the Pribilof fishery was not opened.

Since 1993, fishery openings have ranged from six to 14 days (Table 2-10). This compares to the eight-year period from 1980-1988 when fishery openings ranged from 10 to 86 days. Due to shorter seasons, the Pribilof District fishery has been managed in season using voluntary catch reports from fishing vessels. Reports are received up to twice per day and are used to calculate CPUE, effort, and daily harvest. Inseason management of the fishery allows the department to base management decisions on real-time fishery performance and to respond to changes in catch rates caused by weather, crab abundance, and effort.

The economic value of the Pribilof District red king crab fishery peaked at $13.0 million in 1993 with an exvessel price of $4.98 per pound, the second highest on record. The value of the Pribilof District blue king crab fishery peaked at $13.6 million in 1981/1982, with an exvessel price of $1.50 per pound. Since 1995, the exvessel price of red or blue king crabs has not exceeded $3.37 per pound. Total value of the fishery declined from $6.8 million in 1995 to $2.4 million in 1998 (Table 2-10, Figure 2-6).

2003 Fishery

The blue king crab fishery in the Pribilof District was not opened in 2003 due to the continued decline in blue king crab abundance. The stock remains below the threshold level of abundance required for a fishery opening. Due to significant uncertainty surrounding estimated red king crab abundance and concerns for blue king crab bycatch in a directed red king crab fishery, the red king crab fishery also remained closed for the 2003 season.

Stock Status

The population of blue king crabs in the Pribilof District remains at its lowest level since 1985. Legal (≥ 135 mm CL) male abundance was estimated to be 0.2 million crabs in 2003, the same estimate generated in 2002. The pre-recruit (110-134 mm CL) male abundance estimate remained at less than 0.1 million crabs and large (≥ 90 mm CL) female abundance decreased from 1.2 to 1.1 million crabs (Rugolo et al. 2003). Overall, the population abundance remains low and there appears to be little or no recruitment.

The abundance index for large female red king crabs in the Pribilof District increased from 0.4 to 1.1 million crabs. This apparent increase should be viewed with caution since female red king crab abundance in the Pribilof District is difficult to accurately estimate with confidence. The abundance of pre-recruit males increased slightly from 0.02 million in 2002 to 0.1 million crabs in 2003. Legal male red king crab abundance decreased from 1.8 million crabs in 2002 to 1.3 million crabs in 2003. In general, estimates of red king crab abundance in the Pribilof District are considered inaccurate. The inaccuracy of red king crab abundance estimates in the Pribilof District coupled with the potential for blue king crab bycatch in a red king crab fishery, the lack of a formal harvest strategy for red king crabs and poor performance of prior fisheries has contributed to the continued closure of the fishery despite a modest increase in legal male abundance (NPFMC 2003).

The Pribilof blue king crab stock was declared overfished in September of 2002 and the department developed a rebuilding harvest strategy as part of a comprehensive rebuilding plan for the blue king crab stock (Zheng and Pengilly 2003). The BOF selected a harvest strategy that includes a 10% harvest rate on mature males and a 500,000 pound minimum GHL.

In addition to the annual NMFS eastern Bering Sea crab survey, ADF&G conducted a pot survey targeting red and blue king crab in the Pribilof District in 2003. The objectives of the survey were to determine the distribution and relative abundance of red and blue king crab in the District and to conduct cost-recovery fishing to cover the costs of the survey and related expenses. A total of 696 pots were pulled during the survey with an overall legal male red and blue king crab CPUE of less than one crab per pot lift. An additional 202 pots were pulled as part of the cost-recovery effort. Only 146 legal male red king crab were caught and sold for cost-recovery from the Pribilof District, thus the chartered vessel was directed to Registration Area T for the remainder of the cost-recovery efforts.

SAINT MATTHEW ISLAND SECTION BLUE KING CRAB

Historic Background

The commercial blue king crab fishery in the Saint Matthew Island Section of the Northern District was first prosecuted in 1977, resulting in a commercial harvest of 1.2 million pounds. In 1978, the catch increased to almost 2.0 million pounds (Table 2-11). Catches decreased in 1979 and 1980 due to lack of effort. In 1981, several vessels returned to the Saint Matthew Island Section during the Norton Sound Section fishery. Catches were strong, and after the Norton Sound Section closed, additional vessels moved into the Saint Matthew Section, taking 4.6 million pounds of blue king crabs. Catch and effort increased to a peak harvest of 9.5 million pounds in 1983 when 164 vessels participated. In subsequent seasons, catches remained at or below 4.7 million pounds (Figure 2-7).

NMFS trawl surveys from 1983 to 1998 in the Saint Matthew Island indicated a harvestable surplus of blue king crabs ranging from 1.7 to 8.0 million pounds. In 1998, the legal male abundance decreased by 21%, resulting in a GHL of 4.0 million pounds. The 1998 season closed before the GHL was attained due to poor fishery performance and observer information indicating a relatively high incidental capture rate of sublegal males and female crabs. The 1998 CPUE was seven crabs per pot lift, the second lowest CPUE on record. The 1998 season, which was managed based on inseason catch reports, lasted 11 days, the longest since a 17-day opening that occurred in 1983, when 9.5 million pounds were harvested (Table 2-12). The actual harvest of 2.9 million pounds equaled the harvest projected from inseason catch reports (Table 2-13). From 1999 to 2002, abundance estimates for the Saint Matthew blue king crab stock were low and the fishery remained closed because harvest strategy abundance thresholds were not met.

In 1993, BOF adopted regulation changes and moved the opening date of the Saint Matthew king crab fishery from September 1 to September 15 (Table 2-14), concurrent with the king crab fishery in the Pribilof District. This action was taken to improve effort distribution between the Pribilof and Saint Matthew areas, thereby reducing the number of vessels participating in each fishery. Differential pot limits, established in 1993 for the Saint Matthew Island Section, limited vessels over 125 in feet overall length to 75 pots and vessels 125 feet in overall length or less to a maximum of 60 pots.

The exvessel price for Saint Matthew blue king crab during the last open season, 1998, averaged \$1.87 per pound, the lowest on record since 1984 and 1985, when fishers received \$1.75 and \$1.60 per pound, respectively. Total value for this fishery peaked in 1983 at \$25.8 million, and since 1994, has not been higher than \$15.0 million (Table 2-12). In contrast, the number of vessels participating has generally increased, from 87 in 1994 to 131 in 1998 (Figure 2-8). Average weight per crab has ranged from 4.0 to 5.0 pounds, depending on the percentage of new recruits entering the fishery each year. The average weight per crab during the last fishery (1998), was 4.7 pounds (Table 2-11).

2003 Fishery

The 2003 Saint Matthew Island Section blue king crab fishery remained closed because the GHL calculated from the harvest strategy was below the minimum GHL threshold specified in regulation.

Stock Status

Based on the 2003 NMFS survey, the abundance index for legal male blue king crabs decreased from 0.7 million crabs in 2002 to 0.6 million in 2003. Abundance of pre-recruit male blue king crabs increased from 0.2 million crabs in 2002 to 0.3 million in 2003. Large female blue king crab abundance increased from 0.1 million crabs in 2002 to 0.8 million in 2003 (Rugolo et al. 2003). Total mature biomass for the Saint Matthew Island blue king crab stock increased significantly over the 2002 level from 4.7 million pounds to 12.8 million pounds. The 2003 TMB estimate is above the MSST value of 11.0 million pounds established for this stock. The stock is above MSST for the first time in the last five years. The apparent increase in TMB should be viewed with caution because the estimates are based on low numbers of blue king crabs caught. Female blue king crab can be particularly difficult to catch during the trawl survey resulting in highly variable estimates from one year to the next.

A rebuilding plan was adopted for this stock in 2000 (NPFMC 2000). Stocks listed as overfished are not deemed rebuilt until TMB increases to or above the maximum sustainable yield biomass, which is twice the MSST, or 22.0 million-pounds TMB for the Saint Matthew Island blue king crab stock. Based on the 2003 survey results, the TMB would have to nearly double for the stock to be considered rebuilt. Survey data indicates that the stock may slowly be recovering (NPFMC 2003).

PRIBILOF DISTRICT GOLDEN KING CRAB

Historic Background

Golden king crabs *Lithodes aequispina* are found in commercial concentrations in only a few deep canyons in the Bering Sea District and have never sustained large harvests when compared to other Bering Sea king crab fisheries. As with many other crab fisheries in the Bering Sea, the fishery for golden king crabs was pioneered by foreign fishing fleets. A domestic fishery developed during the 1982/83 season after BOF directed ADF&G to regulate fishing for golden king crabs in the Pribilof District by emergency order (ADF&G 1984). By the 1984 season, BOF directed ADF&G to manage the Area Q golden king crab fishery under authority of a commissioner's permit that allowed the fishery to develop and expand into new areas (ADF&G 1985).

The first domestic harvest of golden king crabs in the Bering Sea occurred in June of 1982 when two vessels fished in the Pribilof District. Effort increased to 10 vessels during the following season with a harvest of nearly 70,000 pounds. The size limit for golden king crabs in the Pribilof District was reduced from six and one-half inches to five and one-half inches in 1983. Subsequently, effort in the Pribilof District peaked during the 1983/84 season when 50 vessels harvested 860,000 pounds of golden king crabs. From 1984 to 1992, no more than two vessels participated each year in the fishery. Since the 1983/84 season, harvest has not exceeded 350,000 pounds annually (Table 2-15). The Pribilof District golden king crab fishery reached a maximum exvessel value of just over $1 million in 1995, and the highest price fishers received per pound was $3.81 in 1994 (Table 2-16). During the last nine years in the Pribilof District fishery an average of five vessels have annually harvested an average of 166,000 pounds. CPUE has averaged seven legal crabs per pot lift with an average weight of 4.0 pounds. Most harvest in the Pribilof District has occurred in the area immediately to the south of the Pribilof Islands.

At its March 1993 meeting, BOF developed pot limits for all king crab fisheries in the Bering Sea. Current pot limits in the Pribilof District are set at 40 pots for vessels 125 feet or less in length and 50 pots for vessels greater than 125 feet in length.

In 2000, the Pribilof district golden king crab fishery opened with a GHL of 150,000 pounds, which was 50,000 pounds less than the 1999 harvest level. This adjustment better complies with guidelines outlined in the FMP for the king and Tanner crab fisheries of the Bering Sea and Aleutian Islands and is based on the average harvest from 1983 to 1997. Seven vessels harvested 127,000 pounds in 2000. The GHL was not reached; thus the fishery remained open until the end of the year. In 2001, six vessels harvested 146,000 pounds and the fishery was closed by emergency order (Table 2-16).

The golden king crab fishery in the Bering Sea is managed using inseason catch reports provided by processors and observers. Fishing is restricted to depths of 100 fathoms or greater. Starting in 2001, 100% observer coverage was required for each vessel registered for the fishery to provide fishery and biological data that has not previously been available. In addition, vessel logbooks issued with the commissioner's permit provide location of fishing operations, effort, and estimates of bycatch. Primary bycatch species include non-retained golden king crabs, Pacific halibut *Hippoglossus stenolepis*, Pacific cod *Gadus macrocephalus* and, snow crabs *Chionoecetes opilio*.

The 2002 fishery opened January 1 with a GHL of 150,000 pounds, and closed by emergency order on May 14. The total harvest was 150,434 pounds. CPUE averaged six legal crabs per pot lift, a decrease from the CPUE of eight legal crabs per pot during the 2001 fishery. Landed crabs averaged 4.3 pounds per crab, the same as the 2001 season. The 2002 Pribilof District golden king crab fishery had a total fishery value of $438,000, which was just $9,000 more than the 2001 fishery value.

2003 Fishery

The 2003 Pribilof District golden king crab fishery opened on January 1 with a GHL of 150,000 pounds. Three vessels registered for the fishery and began fishing in late March. A fourth vessel registered in April but did not fish. Because only two processors participated in the fishery, most harvest information is confidential. The majority of the harvest in 2004 again occurred south of Saint George Island (Table 2-17).

Stock Status

The golden king crab population in the Pribilof District is not surveyed and no estimate of abundance has been made. There are no plans to survey this population, nor has a formal harvest strategy been developed. Population size is believed to be limited by the amount of available habitat in the Pribilof District. The fishery is currently managed using a GHL set from the long-term average harvest. Data collected by onboard observers in conjunction with data from the landed catch are used to annually evaluate the status of the stock.

NORTHERN DISTRICT GOLDEN KING CRAB

Historic Background

A domestic fishery for golden king crabs in the Saint Matthew Island Section of the Northern District also began in the 1982/83 season. Effort and harvest in the Northern District has been sporadic. Since the initial fishery, harvest has only been documented during ten seasons. Harvest peaked during the 1987 season when 11 vessels harvested over 424,000 pounds. Since 1988, no more than four vessels have participated during any season (Table 2-18). The majority of the golden king crab harvest in the Northern District has occurred west of Saint Matthew Island. There has been no documented harvest of golden king crabs from either the Saint Lawrence Island or Norton Sound Sections.

At its March 1993 meeting, BOF developed pot limits for all king crab fisheries in the Bering Sea. Current pot limits in the Northern District are set at 60 pots for vessels 125 feet or less in length and 75 pots for vessels greater than 125 feet in length. These pot limits are significantly lower than the average number of pots fished per vessel in the Aleutian Islands golden king crab fishery, which has no pot limits in place. The Northern District fishery has never been closed by emergency order (Table 2-19).

The golden king crab fishery in the Bering Sea is managed using inseason catch reports provided by processors and observers. Starting in 2001, 100% observer coverage was required for each vessel registered for the fishery in order to provide fishery and biological data that has not previously been available. In addition, vessel logbooks issued with the commissioner's permit provide location of fishing operations, effort, and estimates of bycatch. Primary bycatch species include non-retained golden king crabs, Pacific halibut, Pacific cod, and snow crabs. Fishing is also restricted to depths of 100 fathoms or greater.

2003 Fishery

The fishery opened January 1 with a GHL of 10,000 to 20,000 pounds and closed December 31, 2003. A single vessel registered to fish for golden king crabs in the Northern District of Area Q in 2003, thus harvest information is confidential.

Stock Status

The golden king crab population in the Northern District is not surveyed and no estimate of abundance has been made. There are no plans to survey this population, nor has a formal harvest strategy been developed. Population size is believed to be limited by the amount of available habitat in the Northern District. The current GHL of 10,000 to 20,000 pounds is designed to allow for some exploratory fishing and data gathering.

BERING SEA SCARLET KING CRAB

Historic Background

Scarlet king crabs *Lithodes couesi* are harvested under authority of a permit issued by the commissioner of ADF&G authorized in 5 AAC 34.082 PERMITS FOR *LITHODES COUESI* KING CRAB. Harvest of scarlet king crabs in the Bering Sea has primarily occurred as incidental harvest in the grooved Tanner crab *Chionoecetes tanneri* and golden king crab fisheries. Although vessels first registered to fish for Bering Sea scarlet king crabs in 1992, no commercial landings occurred prior to 1995. In 1995, four vessels harvested 26,684 pounds (Table 2-20) and were paid an exvessel price of $2.12 per pound. Only two vessels participated in 1996, consequently all catch information is confidential. No vessels registered to fish for scarlet king crabs from 1997 to 1999. A single vessel was permitted to retain scarlet king crabs as incidental harvest during the grooved Tanner crab fishery in 2000 and 2001. Since less than three vessels participated, the harvest information is confidential. Scarlet king crab incidental harvest was permitted at a rate of 50% of the weight of the target species. No vessels registered to retain incidental catch of scarlet king crab in 2002.

2003 Fishery

Three vessels registered to retain scarlet king crabs as incidental harvest during the 2003 Bering Sea golden king and deep-water Tanner crab fisheries. Due to the limited amount of participation in the fishery all harvest information is confidential.

Fishery Management and Stock Status

No annual abundance estimates are available for scarlet king crab stocks, nor have any stock assessment surveys been conducted. Onboard observers have been required on most vessels targeting deepwater crab species since 1994 and have collected information detailing the size and sex composition of the retained and non-retained scarlet king crab and bycatch species. This information will be used to help develop management measures for these deepwater crab stocks in the future. Currently, ADF&G does not intend to register any vessels to fish directly for scarlet king crabs in the Bering Sea pending BOF adoption of a plan for the development of new fisheries. Any additional directed fishing for scarlet king crabs will be conducted in accordance with that plan. Retention of scarlet king crabs captured in other deepwater crab fisheries will be permitted at low levels.

BERING SEA TANNER CRAB MANAGEMENT DISTRICT

Description of Area

The Bering Sea District of Tanner crab Registration Area J includes all waters of the Bering Sea north of Cape Sarichef at 54° 36' N lat. and east of the U.S.-Russia Maritime Boundary Line of 1991. This district is divided into the Eastern and Western Subdistricts at 173° W long. The Eastern Subdistrict is further divided at the latitude of Cape Romanzof and 168° W long. into the Norton Sound Section to the east and the General Section to the south and west (Figure 2-9).

BERING SEA TANNER CRAB

Historic Background

The first reported U.S. harvest of Tanner crabs *Chionoecetes bairdi* occurred in 1968, incidental to the harvest of red king crabs in Bristol Bay. In 1974, a directed Tanner crab fishery began. Harvest peaked at 66.6 million pounds during the 1977/78 season (Table 2-21). In the fall of 1978, NMFS predicted sharp declines in Tanner crab abundance beginning with the 1978/79 fishing season. As anticipated, Tanner crab stocks declined, and by 1984 the commercial harvest fell to 1.2 million pounds (Figure 2-10). Further stock declines led to a fishery closure during the 1986 and 1987 seasons.

In 1992, in an effort to slow the harvest rate in order to provide sufficient time for inseason management of the Tanner crab fishery, the BOF adopted regulations which restricted all participating vessels to fishing a maximum of 250 pots. In 1993, in order to comply with federal law regarding application of pot limits in a nondiscriminatory manner, differential pot limits based on vessel length were implemented. Vessels 125 feet or under in overall length were limited to a maximum of 200 pots, while vessels longer than 125 feet in overall length were limited to a maximum of 250 pots.

Also in 1993, BOF adopted regulations that opened and closed that portion of the Eastern Subdistrict east of 168° W long., to Tanner crab fishing concurrent with the regulatory opening and emergency order closure of the Bristol Bay red king crab fishery. If sufficient GHL remained to be taken, the BOF mandated a reopening of the Eastern Subdistrict between 163° and 173° W long. for the directed Tanner crab fishery 10 days after the closure of the Bristol Bay red king crab fishery. In the event the Bristol Bay red king crab fishery failed to open, the portion of the Eastern Subdistrict west of 163° W long. would open to a directed Tanner crab fishery on November 1. These BOF actions were based on observer bycatch data and historic harvest patterns indicating that the majority of female king crab bycatch in the Bristol Bay red king crab and Bering Sea Tanner crab fisheries came from waters east of 163° W long.

During the 1994 and 1995 seasons, the Bristol Bay red king crab fishery did not open due to low stock abundance. As a result, the Tanner crab fishery opened on November 1 in the Eastern Subdistrict west of 163° W long. The commercial Tanner crab harvest in 1994 was 7.8 million pounds; in 1995 the harvest declined to 4.2 million pounds (Table 2-22).

The GHL for the 1996 Tanner crab fishery was 8.4 million pounds (Table 2-23). Due to poor fishery performance, the fishery was closed before the GHL was reached; a total of 1.8 million pounds was harvested. The average size of crabs harvested in 1996 was 152 mm carapace width (CW). This compares to an average of 149 mm CW observed in 1995. The percentage of new-shell crabs harvested in 1996 decreased to 47% from 59% observed in the 1995 harvest (Table 2-24).

Based on poor fishery performance in 1996 and results from the 1997 NMFS survey indicating significant declines in most segments of the Tanner crab population (Stevens et al. 1998a), the

Bering Sea Tanner crab fishery remained closed for the 1997 season. The 1998 NMFS survey indicated further declines in Tanner crab abundance and the fishery did not open in 1998. Abundance of large male and female Tanner crabs continued to decline to the lowest level in the history of the survey (Stevens et al. 1998b). Because the stock fell below the MSST established in the FMP for this fishery, the stock was declared overfished by NMFS in 1998, necessitating the establishment of a rebuilding plan.

At the March 1999 BOF meeting, a revised harvest strategy was adopted as part of a comprehensive Bering Sea Tanner crab rebuilding plan. The harvest strategy for the Eastern Subdistrict specifies a threshold of 21.0 million pounds of mature female biomass that, for management purposes, are females ≥ 80 mm CW. No directed crab fishery is prosecuted when female biomass is below that threshold. When the mature female biomass is between 21.0 million and 45.0 million pounds, a maximum harvest rate of 10% is applied to "molting mature males", or those mature male crabs likely to continue to grow, defined as 100% of new-shell and 15% of old-shell males greater than 112 mm CW. When the mature female biomass is above 45.0 million pounds the harvest rate is set at a maximum of 20% of molting mature males.

When establishing a GHL, no more than 50% of the exploitable legal-size male abundance may be harvested. Exploitable legal-size male abundance is 100% of new shell and 32% of old-shell male crabs greater than 140 mm CW. Separate GHLs are calculated for the areas east and west of 168° W long. The minimum fishery threshold is 4.0 million pounds. If the fishery is not opened because it did not meet threshold requirements, the fishery may reopen the following season if a GHL of at least 8.0 million pounds is calculated through the harvest strategy, but only half of the GHL may be taken that year. If the fishery remains closed because the GHL is calculated to be greater than 4.0 million pounds, but less than 8.0 million pounds, the fishery may reopen the following year if the calculated GHL is at least 4.0 million pounds. This safeguard was established to protect against survey bias in the year following a closure due to low stock abundance.

Pre-recruit crab abundance began increasing in 1998 and 1999, but this trend reversed in 2000 and 2001. In addition, the stock remained below fishery threshold level established in the harvest strategy and the fishery was closed from 1999 to 2002.

2003 Fishery

Harvest strategy thresholds were not met in 2003. Consequently, the Bering Sea Tanner crab fishery remained closed for the 2003 season.

Stock Status

The abundance of Tanner crabs in the Bering Sea District remains below levels to allow for a fishery, but the stock demonstrates increasing male and female abundance trends. The estimated abundance of molting mature males increased 71% over the 2002 level to 10.3 million crabs. The 2003 estimate for mature female abundance was 52% greater than in 2002. The 2003 legal male abundance estimate was 3.1 million crabs, only a slight increase from the 2002 level. The 2003

Bering Sea Tanner crab mature female biomass was 20.8 million pounds and the fishery was not opened because the harvest strategy threshold of 21 million pounds of mature female biomass was not met.

The 2003 estimate of spawning biomass increased from 69.4 million pounds to 100.8 million pounds. In 2003, the stock increased above MSST (94.8 million pounds of spawning biomass) for the first time in six years. Despite increases in abundance observed in 2003, the stock remains well below the rebuilt level of 189.6 million pounds of spawning biomass and is not likely to reach that level in 2004 (NPFMC 2003).

BERING SEA SNOW CRAB

Historic Background

The first commercial landings of snow crabs *Chionoecetes opilio* from the Bering Sea were recorded in 1977, incidental to the harvest of Tanner crabs. In 1981, a reduction in the Tanner crab harvest resulted in increased snow crab harvest. The harvest of snow crabs fell from 52.8 million pounds in 1981 to 26.1 million by 1983 (Table 2-25, Figure 2-11). In 1984, harvest increased slightly, and in 1985, 66 million pounds were landed. In 1986, the harvest increased to 98.0 million pounds. The commercial catch continued to increase annually to a high of 328.6 million pounds in 1991. Although stocks began to decline, the harvest of snow crabs remained over 100 million pounds through the 1994 season. In 1996, the harvest declined to 65.7 million pounds, the lowest in the preceding eleven seasons. The GHL more than doubled in 1997 to 117.0 million pounds and the fleet harvested 119.5 million pounds. In the 1998 general fishery, 229 vessels harvested 243.3 million pounds.

The NMFS stock assessment survey in 1998 indicated that the estimate of large male snow crabs declined by 17% from the prior year's survey, resulting in a general fishery GHL of 186.2 million pounds. Two hundred and forty one vessels landed 184.5 million pounds during the 1999 general fishery, ending on March 22.

In 1999, the surveyed stock was 60% of the minimum stock size threshold, defined as half the long term average mature biomass established in the FMP for Bering Sea and Aleutian Islands king and Tanner Crab (NPFMC 1998). In response to significant stock declines, ADF&G initially reduced the 58% exploitation rate on 102 mm CW and larger male snow crabs by 50%. The revised 29% exploitation rate would still have resulted in a removal rate from the estimated mature biomass close to the long-term average. Thus, in accordance with NMFS guidelines for stock rebuilding, the harvest rate was reduced by an additional 25% to 22%, which also took into consideration handling mortality during the fishery and high natural mortality during the six month hiatus between the survey and the fishery opening. This reduction in exploitation rate resulted in a GHL of 28.5 million pounds for the 2000 season.

The 2000 snow crab fishery was scheduled to open by regulation at noon on January 15. However, by early January, a significant portion of the fishing grounds were ice covered. The ADF&G and industry had concerns about potential gear conflicts and gear loss due to sea ice and vessel interactions because of the limited fishing area. ADF&G was also concerned with the handling effects and the potential for increased handling mortality and limb loss of captured crabs in a derby-style fishery under extreme weather conditions. ADF&G received input from representatives of the crab industry and the majority indicated a desire to delay the season. The USCG was also in favor of delaying the season due to vessel safety concerns during severe vessel icing conditions. On January 7, ADF&G announced by news release that the fishery would be delayed and would not open prior to April 1, and that two weeks advance notice would be provided to industry prior to an opening. On March 7, ADF&G issued a news release defining criteria that would be used to open the fishery. These criteria, developed with input from industry, specified that at least 50% of the fishing grounds had to be ice free at the time of the opening, and that the ice edge at 167° W long. could be no further south than 58° N lat. On March 15, ADF&G issued a news release indicating opening criteria had been met and that the fishery would open at noon on April 1.

The 2000 general fishery opened at noon on April 1 and closed at noon on April 8 (Table 2-26). A total of 229 vessels, including nine catcher-processors, registered and received tank inspections in Akutan, Dutch Harbor, King Cove, and Saint Paul Island. In addition, five floating processors registered to purchase and process crabs on the grounds during the fishery. In 1999, 241 vessels, including 10 catcher-processors, participated along with 11 floating processors.

Due to the relatively small GHL, management of the 2000 fishery was based on daily inseason reports from fishers. A total of 75 vessel operators or 33% of the fleet reported numbers of pots fished and number of crabs retained daily. Reports were received via marine telex and over single side band radio every 24 hours and were used to generate inseason estimates of harvest.

Catch projections indicated that the daily harvest ranged from less than 0.2 million pounds on the first day of the fishery to over 8.0 million pounds on the final day of the season. The projected harvest based on inseason reports, was estimated to be 31.3 million pounds. The actual harvest of 30.8 million pounds exceeded the 26.4 million pound general fishery GHL by 17%.

Daily CPUE ranged from 31 retained crabs per pot lift on the first reporting day to 149 retained crabs on the day prior to the closure. Projected CPUE based on inseason reports was 129. The actual CPUE for the 2000 fishery, based on postseason fish ticket data, was 137. Overall fishery CPUE for the 1999 fishery was 158 retained crabs per pot.

Based on inseason reports, fishers made a total of 170,064 pot pulls throughout the course of the seven-day 2000 fishery. The average number of pot pulls per day was 24,700 and ranged from 2,241 on the first day of the fishery to 43,905 on the day of the closure. In comparison, the 1999 fishery lasted 66 days and the average number of pots pulled per day was 13,621.

Harvest from the Eastern Subdistrict was 20.9 million pounds from 217 landings, or 68% of the total harvest. In recent years the majority of the harvest had occurred in the Eastern Subdistrict. Total harvest from the Western Subdistrict was 9.8 million pounds from 91 landings. The majority of the Eastern Subdistrict harvest came from six statistical areas surrounding the Pribilof Islands. The majority of the harvest in the Western Subdistrict came from four statistical areas along the 100 fathom depth contour, between 173° and 174° W long. In both subdistricts the majority of the harvest came from areas which have, in recent years, contributed the majority of the harvest.

Analysis of observer and dockside sampling data indicated an average weight of 1.3 pounds for crabs landed during the 2000 fishery. New-shell crabs made up 95.2% of the harvest. In 1999, new-shell crabs made up 97.7% of the harvest and the overall average weight was 1.3 pounds. Crabs less than 102 mm CW made up 8.3 percent of the 2000 harvest. This compares to 23.3, 21.1, 9.7, and 13.7% of crabs less than 102 mm CW harvested during the 1996, 1997, 1998, and 1999 seasons, respectively.

The exvessel price for snow crabs harvested in the 2000 fishery was two-tiered due to concerns for higher than normal old-shell crabs expected in the catch. Fishers were offered $1.85 per pound for new-shell crabs and $1.00 per pound for old-shell crabs. Fishers reported encountering high percentages of old-shell crabs in the first two days of the fishery, but thereafter located areas, which contained predominantly new-shell animals. As a result, less than 10% of crabs landed were old-shell animals. Based on an average exvessel price of $1.81 per pound, the 2000 snow crab fishery was worth $55.1 million. This compares to an exvessel price of $0.88 per pound and an overall fishery value in excess of $161 million in 1999.

Analysis of the 2000 National Marine Fisheries Service summer trawl survey of the Eastern Bering Sea indicated a 19% decrease in the abundance of large (≥ 102 mm CW) male crabs from the 1999 survey. However, small (< 102 mm CW) male and large (≥ 50 mm CW) female abundance increased 100% and 212%, respectively. Due to the large increase in both small male and large female abundance, the spawning biomass, estimated at 472.7 million pounds, was slightly above the minimum stock size threshold of 460.8 million pounds.

In the spring of 2000, the BOF adopted a harvest strategy specifying a stepped harvest rate on mature male crabs that is dependant on estimated spawning biomass and that would rebuild the stock. The rebuilding plan specifies an exploitation rate of 16.875% of the mature male biomass when the spawning biomass is between 460.8 and 921.6 million pounds, resulting in a GHL for the 2001 season of 27.3 million pounds with 25.3 available to the general fishery and 2.0 million pounds allocated to the CDQ fishery.

The 2001 Bering Sea snow crab general fishery opened by regulation at noon on January 15 and closed by emergency order at 11:59 PM on February 14. The fleet harvested 23,382,046 pounds, or 92% of the GHL. A total of 207 vessels, including 7 catcher-processors participated in the 2001 fishery. Because of lengthy price negotiations, most catcher vessels did not begin fishing until 4:00 PM on February 3. As a result, harvest for the first 18 days of the season, 2.2 million pounds, was taken almost entirely by catcher-processor vessels. Catch projections based on inseason reports indicate that daily harvest ranged from less than 60,000 pounds reported on January 17 to over 2.7 million pounds reported on February 12 and February 14. The closure announcement, made over single side band radio and distributed by email and fax, was released to the public at 6:30 PM on February 12, providing the fleet with 54 hours advance notice of the closure. Based on the inseason reports through February 12, it appeared that the 25.3 million pound GHL would be reached by the closure, however, fleet efficiency was reduced by poor weather that developed after the closure announcement was made. Catch projections based on reports received after the fishery closure indicated that the total harvest would fall short of the GHL at approximately 23.0 million pounds.

The average exvessel price per pound in 2001 was $1.53, resulting in a total fishery value of $32.1 million, a significant decrease from the 2000 fishery value of $55.1 million.

Weather conditions in the Bering Sea throughout the 2001 fishery were very unfavorable. Several storms, some generating hurricane force winds, combined with large tides to produce extremely dangerous sea conditions. Several vessels lost wheelhouse windows and experienced other structural damaged caused by large waves. No vessels or lives were lost during the 2001 fishery. Sea ice was not a major concern in 2001, and the main ice pack remained north of Saint Matthew Island throughout the fishery.

The 2001 NMFS trawl survey of the Eastern Bering Sea indicated a 2% increase in the abundance of large male crabs when compared to the 2000 survey. Pre-recruit male and large female abundance increased 114% and 3%, respectively. The total mature biomass of snow crab in the Bering Sea was estimated to be 571.0 million pounds which is above the minimum stock size threshold of 460.8 million pounds.

Given the estimated total mature biomass of 571.0 million pounds and current harvest strategy requirements, the GHL was set using a 16.875% exploitation rate. The calculated GHL of 51.0 million pounds constituted a harvest greater than 50% of the estimated exploitable legal male abundance and thus, according to harvest strategy requirements was adjusted down to not exceed 50% of the exploitable legal male abundance. The resultant 2002 Bering Sea snow crab GHL was 30.8 million pounds with 28.5 million pounds available to the general fishery. The remaining 2.31 million pounds were allocated to the CDQ fishery. Approximately 61% of the four inch and greater carapace width males encountered during the 2001 survey had old shells.

The 2002 Bering Sea snow crab general fishery opened by regulation at NOON on January 15 and closed by emergency order at NOON on February 8. Total harvest was 30,252,501 pounds, exceeding the general fishery GHL of 28.5 million pounds by 1.8 million pounds (6.4%).

A total of 191 vessels, including eight catcher-processors, participated in the 2002 fishery. Three floating processors also registered and purchased crabs on the grounds during and after the fishery. A total of five shore-based processors in Dutch Harbor, two in Saint Paul, one in King Cove and two in Kodiak also purchased and processed snow crabs. In addition, two catcher-processor vessels purchased snow crabs from catcher vessels after the fishery. The fleet registered 33,028 pots for the 2002 fishery and purchased 37,807 buoy tags.

The fleet spent January 15 and 16 deploying gear and less than 1.0 million pounds total were taken on those days. By January 18, the fleet had harvested 2.1 million pounds and was pulling approximately 15,000 pots per day for a CPUE of 71 crabs per pot lift and a daily harvest rate of 1.3 million pounds. Daily harvest and CPUE peaked on January 19 when the fleet harvested 2.0 million pounds with a CPUE of 101 crabs per pot lift. CPUE and harvest declined steadily for the remainder of the fishery. By early February fleet size had diminished to less than 180 vessels and less than 30,000 pots were being fished. Vessels left the snow crab fishery prior to the closure to participate in other fisheries. Reports received through 6:00 AM February 7 indicated that in the prior 24 hours, the fleet harvested 1.1 million pounds and pulled approximately 15,600 pots for a CPUE of 57 crabs per pot lift and a cumulative harvest of nearly 26.0 million pounds. Given this catch rate, the department issued a news release at noon on February 6 announcing that the 2002 Bering Sea snow crab fishery would close at noon on February 8. Based on inseason catch reports received from approximately 34% of the fleet, the total harvest for the 2002 snow crab fishery was 28.1 million pounds and the fleet pulled approximately 320,000 pots for a CPUE of 68 crabs per pot lift. Actual CPUE for the 2002 fishery based on fish ticket data was 76 crabs per pot lift.

Unlike the 2001 fishery, in 2002 the Bering Sea snow crab fleet voted to accept a price offer prior to the beginning of vessel registration on January 13. The fleet voted to accept $1.40 per pound for new-shell crabs that were four inch and greater carapace width. As the fishery progressed, some fishers experienced difficulty in finding grounds containing a high percentage of new-shell crabs. Approximately 31% of landed crabs had old shells. As a result, processors offered a second price of $0.90 to $1.00 per pound for old-shell crabs that were four inch and greater carapace width. Given this price structure, the 2002 Bering Sea snow crab fishery had an estimated exvessel value of $44 million.

In addition to old-shell crabs that were delivered, onboard observers and fishers reported that up to 30% of legal crabs caught were being discarded at sea due to shell condition. During the 2001 fishery, approximately 20% of the legal snow crabs that were caught were not retained and 4.8% of snow crabs landed had old shells.

Due to the protracted length of the 2002 fishery, most vessels made one or two landings prior to the closure of the fishery. By the fishery closure, approximately 66% of the harvest had already been processed, thus post season processing delays experienced in 2001 were reduced. Processing was completed by February 17. Two processors operating under sideboards of the AFA were constrained by their processing caps; none were constrained in 2001.

Weather conditions in the Bering Sea during the 2002 fishery did not significantly hamper the fleet, however heavy freezing spray slowed production in late January and early February. Like the 2001 fishery, no vessels or lives were lost in 2002. Unlike the 2001 fishery, sea ice was a significant factor throughout the season. Sea ice forced most of the fleet to remain below 59° N lat. and thus a significant portion of the stock could not be fished. In addition, sea ice forced fishers to move gear more frequently. Post season, sea ice covered some gear stored north of 56° 30' N lat.

2003 Fishery

The 2003 Bering Sea snow crab general fishery opened by regulation at noon on January 15 and closed by emergency order at 6:00 AM on January 25. Fish ticket data indicate a harvest of 26.34 million pounds, exceeding the general fishery GHL of 23.69 million pounds by 2.65 million pounds (11.2%).

Analysis of the 2002 NMFS trawl survey data indicated a 2% decrease in the abundance of male crabs when compared to the 2001 survey. Small male and large female abundance decreased 12% and 67%, respectively. The total mature biomass of snow crab in the Bering Sea is estimated to be 313.0 million pounds which is below the minimum stock size threshold of 460.8 million pounds and is a decrease from the 2001 TMB estimate of 571.0 million pounds.

Given the estimated total mature biomass of 313.0 million pounds and the recently adapted harvest strategy requirements, the GHL was set using an 11.5% exploitation rate. The resultant 2003 Bering Sea snow crab GHL was 25.6 million pounds with 23.7 million pounds available to the general fishery. The remaining 1.9 million pounds were allocated to the CDQ fishery. Approximately 35% of males 102 mm and greater CW encountered during the 2002 survey had old or very old shells.

Preseason vessel registration was required by 5:00 PM on December 24, 2002. A total of 193 vessels filed preseason registrations. Four additional vessels filed for late registration and were permitted to enter the fishery, however only two of the four late registrants actually participated. Observer coverage was assigned based on the number of catcher vessels that filed preseason registrations. Eighteen catcher vessels carried observers during the 2003 Bering Sea snow crab fishery.

Based on the snow crab GHL, pot limits were set at 100 pots for vessels less than or equal to 125 feet in overall length and 120 pots for vessels greater than 125 feet in overall length. A total of 20,452 buoy tags were purchased by 192 vessel operators for the 2003 Bering Sea snow crab fishery. The fleet purchased 37,807 buoy tags for the 2002 fishery. The 2003 snow crab fishery is the first in which pot limits were lower than 200 pots for vessels less than or equal to 125 feet in overall length and 250 pots for vessels greater than 125 feet in overall length.

The quick registration process began January 9 with preseason tank inspections in Dutch Harbor, Akutan, King Cove, and False Pass. Preseason tank inspections are not provided in Saint Paul, however, tank inspections are conducted in Saint Paul 24 hours prior to the fishery opening. In the four other tank inspection locations, the fleet was registered on January 13. The tank inspection process was also used to enlist vessel operators in the inseason catch reporting program. Over 50% of the fleet volunteered to report effort and catch data daily during the fishery.

During the week preceding vessel registration, department staff consulted with USCG search and rescue personnel and NWS forecasters regarding a potential weather-related delay in season opening. NWS staff did not forecast storm force winds in the operational area of vessels that would be travelling to the snow crab fishing grounds from Dutch Harbor, Akutan, King Cove, Saint Paul or False Pass, nor were storm force winds forecast for the time period January 15-17. USCG personnel did not foresee that current or forecast weather conditions would hamper a search and rescue mission immediately before or during the first 48 hours of the fishery, thus the season was not delayed.

A total of 192 vessels, including five catcher-processors participated in the 2003 fishery. Three floating processors also registered and purchased crabs on the grounds during and after the fishery. A total of six shore-based processors in Dutch Harbor, two in Saint Paul, one in King Cove, and one in Kodiak also purchased and processed snow crabs. In addition, two catcher processor vessels purchased snow crabs from catcher vessels after the fishery.

The fleet spent January 15 and the early portion of the 16th deploying gear and less than 0.2 million pounds total were taken on those days. By 6:00 AM January 17, the fleet had harvested 2.3 million pounds and was pulling approximately 15,000 pots per day for a CPUE of 114 crabs per pot lift and a daily harvest rate of 2.1 million pounds. Daily harvest peaked on January 23 when the fleet harvested 3.1 million pounds with a CPUE of 153 crabs per pot lift. CPUE peaked on January 20 at 158 crabs per pot (Table 2-27).

Reports received through 6:00 AM January 23 indicated that in the prior 24 hours, the fleet harvested 2.8 million pounds and pulled approximately 15,100 pots for a CPUE of 151 crabs per pot lift and a cumulative harvest of nearly 18.8 million pounds. Given this catch rate, the department issued a news release at 2:00 PM on January 23 announcing that the 2003 Bering Sea snow crab fishery would close at 6:00 AM January 25. Based on inseason catch reports received from approximately 40% of the fleet, the estimated total harvest for the 2003 snow crab fishery was 24.9 million pounds with an estimated effort of 143,718 pot lifts for a CPUE of 142 crabs per pot lift. In 2002, the fleet harvested 30.3 million pounds and pulled approximately 308,000 pots for a CPUE of 76 crabs per pot lift. Actual CPUE for the 2003 fishery based on fish ticket data is 155 crabs per pot lift from a total of 139,903 pot lifts.

Higher than expected CPUE and on the grounds reports of increased recruitment to the snow crab stock prompted the Pacific Northwest Crab Industry Advisory Committee (PNCIAC) to file a formal request for an inseason adjustment to the GHL. Such inseason adjustments are permitted if FMP criteria are met. Since GHLs are set using the regulatory harvest strategy and annual biomass estimates, an increase in GHL would have required a revision to one or both. The Bering Sea snow crab stock was declared overfished in 1999 and is currently being managed under a rebuilding plan. ADF&G determined that the PNCIAC request for a GHL increase would not be consistent with the goal of rebuilding the stock and the request was denied.

Weather conditions in the Bering Sea during the 2003 fishery did not significantly hamper the fleet and sea ice location allowed the fleet to operate farther north and west of areas that have been recently fished. Like the prior two snow crab fisheries, no vessels or lives were lost in 2003. Despite the lack of sea ice on the grounds, the 2003 Bering Sea snow crab harvest did not occur over a broad geographic area. Nearly one half of the 2003 harvest occurred in four ADF&G statistical areas, three of which are contiguous (Table 2-28).

The preliminary estimated average weight of crabs landed during the 2003 fishery was 1.2 pounds, a slight decrease from the 2002 average weight of 1.3 pounds. Preliminary data does not indicate a significant difference in average weight between crabs harvested in the Eastern and Western Subdistricts (Table 2-29). In 2003, relatively little of the snow crab harvest occurred in the Eastern Subdistrict, a sharp contrast to the fisheries of the 1990s when the majority of the harvest occurred east of 173° W long. During 2003, approximately 4.0 million pounds (15%) of snow crabs were harvested east of 173° W long.

As in 2002, representatives of the snow crab fleet voted to accept a price offer from processors prior to the start of tank inspections. The fleet voted to accept $1.85 per pound for new-shell crabs that were four inch and greater CW, a substantial increase from the 2002 price of $1.40 per pound. In contrast to 2002, the fleet did not encounter large numbers of old or very old shell crabs on the grounds (Table 2-30) resulting in an average exvessel price of $1.83 per pound and a total exvessel value of nearly $47 million, an increase from the 2002 exvessel value of $44 million (Table 2-31).

ADF&G personnel or observers contacted approximately 85% of snow crab vessel operators for data collection interviews. Biological data were collected from the majority of these deliveries. The ABWE stationed personnel in all ports where snow crabs were landed. Neither ABWE nor ADF&G personnel encountered any illegally harvested Tanner crabs in the snow crab catch. The fishery was not free from enforcement activities, however. The USCG located six vessels that had crossed the US-Russia Maritime Boundary into Russian waters and were ordered to port. NMFS agents seized 181,457 pounds of snow crab from five vessels that were fishing in Russian waters. The sixth vessel that was ordered to port did not have any illegally taken crab onboard.

Stock Status

The Bering Sea snow crab stock fell below the minimum stock size threshold and was declared overfished in 1999. Since 1999, snow crab abundance in the Bering Sea has fluctuated. Both the 2000 and 2001 NMFS surveys estimated the total snow crab population to be in excess of 3.0 billion crabs. The 2002 estimate was substantially lower at approximately 1.5 billion crabs. The 2003 total crab abundance increased from the 2002 level to 2.6 billion crabs. In 2003, large male snow crab abundance was estimated to be 65.2 million crabs, a 16% decrease from the 2002 level. In addition, prerecruit males decreased 34% in abundance to 166.5 million crabs, however large female abundance increased 20% to 614.0 million crabs (Rugolo et al. 2003).

Approximately 46% of the large male abundance was found in the Eastern Subdistrict compared to 60% in 2002, 46% in 2000 and 2001, and 70% in 1999. Thirty percent of large males were classified as having old shells, compared to 35% in 2002 and 63% in 2001.

Small male and female abundance increased significantly from the 2002 level and large female abundance increased by 20%. While the presence of these 40-50 mm CW crabs is encouraging, similar signs of recruitment to the stock in 2000 and 2001 disappeared from the survey before reaching maturity.

Federal FMP and state harvest strategy requirements use the total mature snow crab biomass (TMB) to evaluate the stock. TMB is defined as the biomass of all the mature male and female snow crabs. In 2001, the TMB of snow crabs in the Bering Sea was estimated to be 571 million pounds, a 21% increase over the 2000 level of 473 million pounds, but well below the Federal FMP defined rebuilt level of 921.6 million pounds. In 2003, TMB decreased to 306.2 million pounds compared to 313 million pounds in 2002. TMB must remain above 230.4 million pounds in order for a fishery to occur.

Relative to FMP criteria, the Bering Sea snow crab stock remains below the rebuilt level. The recruitment observed in 2000 and 2001 does not appear to have contributed significantly to stock rebuilding, however it helped sustain small commercial harvests that otherwise may not have been possible. It is difficult to predict if TMB will be adequate to meet the harvest strategy threshold for opening the 2005 fishery, or if the minimum GHL threshold will be met.

BERING SEA GROOVED TANNER CRAB

Historic Background

In 1988, BOF established a special permit season for deepwater Tanner crabs. However, no commercial harvest of grooved Tanner crabs from the Bering Sea occurred until 1992. In 1993, ADF&G restricted the harvest to male crabs with a CW of 127 mm (5 inches) or greater. Six vessels harvested just less than 660,000 pounds. The following year, differential pot limits, based on vessel size, were applied to vessels fishing for deepwater Tanner crabs in the Bering Sea. Effort and landings consequently decreased as four vessels harvested slightly over 300,000 pounds (Table 2-32).

At the March 1995 meeting, BOF determined that pot limits should not apply to the deepwater permit fisheries of the Westward Region. Effort increased significantly that year when eight vessels harvested over one million pounds with a fishery value exceeding $1.3 million. Since 1995, the number of vessels registered for Bering Sea District grooved Tanner crabs has not exceeded three vessels for any year. Catch per unit effort was highest in 1994 at 11 legal crabs per pot lift and declined to three in 1996. Harvests decreased from over 1,000,000 pounds in 1995 to 107,000 pounds in 1996. No vessels registered to fish grooved Tanner crabs in the Bering Sea District from 1997 to 1999, while only one vessel registered each year in 2000 and 2001. Historically, fishing effort has been concentrated in a few statistical areas immediately south of Saint George Island.

In 1997, ADF&G set GHLs for grooved Tanner crabs that were based on prior harvest information. In the past, the Bering Sea, Alaska Peninsula, and Eastern Aleutian Districts supported the largest catches of grooved Tanner crabs. A GHL of 200,000 pounds was established for each of these districts. A GHL of 100,000 pounds was established in the Kodiak and Western Aleutian Districts to allow for exploratory fishing. Additionally, due to concerns about handling mortality on undersized and female deepwater crabs caught and released, ADF&G began to require a minimum of two escape rings per pot with a minimum inside ring diameter of 4.5 inches.

Given fishery performance and declining harvests of the mid-1990s, the department reevaluated deepwater Tanner crab harvest levels in 1999. A GHL range of 50,000 to 200,000 pounds was established for the Bering Sea District. The GHL was set as a range to provide greater flexibility for inseason management and to better inform the public of the department's management goals for the fishery. The fishery is managed so that the upper end of the GHL range is reached only when catch rates similar to or greater than those documented prior to the harvest declines of the mid 1990s are observed. In addition to new GHL requirements, the department specified that four 4.5" escape rings be placed on the lower third of each pot and required that pots be fished over multiple depth strata. Since 1994, observers have been required on each vessel registered for the fishery and will collect biological and fishery data.

2003 Fishery

A single vessel registered for the directed Bering Sea grooved Tanner crab fishery in 2003. Two additional vessels registered to retain grooved Tanner crab incidentally taken during the Pribilof District golden king crab fishery, but did not harvest any grooved Tanner crab. A fourth vessel illegally retained a small amount of grooved Tanner crab taken incidentally in the Pribilof District golden king crab fishery. The Bering Sea District grooved Tanner crab harvest in 2003 was confidential due to limited participation.

Stock Status

The grooved Tanner crab population in the Bering Sea District is not surveyed; subsequently, no estimates of population abundance are available for this stock. Fishery data is the primary source of information regarding abundance and stock status. Based on this information, the population appears to have been heavily exploited, at least in the area historically fished.

BERING SEA TRIANGLE TANNER CRAB

Historic Background

Historically, triangle Tanner crabs *Chionoecetes angulatus* were taken as incidental harvest in the grooved Tanner crab fishery. Vessel operators have verbally reported retention of triangle Tanner crabs before 1994. To obtain biological information on grooved Tanner crabs, ADF&G implemented 100% onboard observer coverage in 1994. That year, onboard observers documented a single incidence of triangle Tanner crab bycatch, but prior to 1995, this species had not been commercially harvested. In 1995, four vessels registered to retain triangle Tanner crabs, and harvested over 49,000 pounds for a total fishery value of $50,000. In 1996, 2000, and 2001, only one vessel delivered triangle Tanner crabs as incidental harvest each year. No vessels registered to fish triangle Tanner crabs in the Bering Sea District in 1997, 1998, 1999, or 2002 (Table 2-33).

Due to the lack of stock abundance data for this species additional fishing for triangle Tanner crabs in the Bering Sea District will be limited to incidental harvest during the grooved Tanner crab fishery. Vessels registered to fish for grooved Tanner crabs will be permitted to harvest triangle Tanner crabs at up to 50% of the weight of the target species as incidental harvest. This harvest level is consistent with the historic catches and allows for limited retention of this deepwater species that is believed to experience significant handling mortality when caught and released.

2003 Fishery

There was no directed fishing for triangle Tanner crabs in the Bering Sea District in 2003 and incidental harvest during the Bering Sea District grooved Tanner crab fishery is confidential.

Stock Status

Surveys of population abundance are not conducted for triangle Tanner crabs in the Bering Sea; thus the status of this stock is unknown. There are currently no plans to survey this population.

MISCELLANEOUS SHELLFISH SPECIES BERING SEA

Description of Area

The Bering Sea portion of Registration Area J, as described herein for miscellaneous shellfish, includes all Bering Sea waters of both the Territorial Sea (0-3 nautical miles from shore) and the Exclusive Economic Zone (3-200 miles from shore) north of the latitude of Cape Sarichef at 54° 36' N lat. and east of the United States-Russia Maritime Boundary Line of 1991 (Figure 2-12).

Introduction

Miscellaneous shellfish species include hair crabs *Erimacrus isenbeckii*, green sea urchins *Strongylocentrotus droebachiensis*, red sea cucumbers *Parastichopus californicus*, snails *Neptunea* and *Buccinum*, octopus *Octopus dofleini*, and cherry crabs *Paralomis multispina*, a deepwater crab closely related to king crabs. These species have been harvested in relatively small amounts when compared to the commercial king and Tanner crab fisheries in the Bering Sea. Prior to 1999, it was ADF&G policy to allow commercial fishing for miscellaneous shellfish species under authority of a commissioner's permit described in 5 AAC 38.062. PERMITS FOR OCTOPI, SQUID, HAIR CRAB, SEA URCHINS, SEA CUCUMBERS, SEA SNAILS, CORAL, AND OTHER MARINE INVERTEBRATES. Typically, permit conditions were general and not fully developed on an individual species basis. Fisheries for miscellaneous shellfish species occurred without prior knowledge of stock abundance or distribution and no harvest limits were established. To better regulate these types of fisheries, ADF&G and BOF have developed a draft policy on the implementation of new and developing fisheries. Prior to the formal adoption of this policy, ADF&G will only register vessels for those fisheries with an established GHL, or when sufficient data is available to develop a conservative GHL.

Those species of current or historic interest in the Bering Sea include cherry, hair and Dungeness crabs *Cancer magister*, octopus, and snails. North Peninsula District shrimp do not fall under the miscellaneous species category, but are included in this report due to low or infrequent annual harvests. The fishery for shrimp in the Bering Sea District is described in the Aleutian Islands section of this report.

Bering Sea Hair Crabs

Description of Area

The Bering Sea hair crab fishery is prosecuted in an area that includes all waters north of 54° 36' N lat., south of 60° N lat., east of the United States-Russia Maritime Boundary Line of 1991, and west of 168° W long. (Figure 2-13). There is no formal hair crab registration area established in regulation; rather, the fishing area is set using the terms of a commissioner's permit.

Historic Background

The fishery for hair crabs in the Bering Sea was pioneered by the Japanese fleet during the 1960s and first commercially exploited by the U. S. fleet in 1979. In its early years, the domestic hair crab season was opened by emergency order concurrent with the Bering Sea Tanner crab fishery. In 1980, the BOF established a yearlong season within a three-mile area of the Pribilof Islands. In 1984, under conditions of a commissioner's permit issued by ADF&G, the year-round hair crab fishery was expanded in the Bering Sea District. Between 1979 and 1992, however, the majority of hair crabs landed was reported as incidental catch in the Bering Sea Tanner crab fisheries.

Beginning in the fall of 1993, under the terms of the Commissioner's Permit, all vessels fishing for hair crabs were required to carry an observer during all fishing activities (ADF&G 1996). In 1994, hair crab pots were defined by BOF as pots with a rigid tunnel opening in the top of the pot, with a tunnel perimeter not to exceed 26 inches and a base that does not exceed 48 inches in any one direction. Legal retention of hair crabs is permitted only from hair crab pots.

In 1996, due to a steady increase in the number of vessels participating in this fishery, the Alaska Legislature authorized the Commercial Fisheries Entry Commission (CFEC) to regulate vessel licenses in the Bering Sea hair crab fishery. Vessel qualification was based on participation in at least one of the qualifying years from 1992 to 1995. Licenses were issued to 23 vessels for those waters beyond five nautical miles of Saint George and Saint Paul Islands. Also included in this legislation were provisions which allow any vessel 58 feet and under to fish within five nautical miles of Saint George and Saint Paul Islands. In addition, it was the intent of the Legislature, expressed in the moratorium, that BOF maintain 100% observer coverage on all vessels participating in the Bering Sea hair crab fishery. However, ADF&G exempted vessels under 44 feet in length from mandatory observer coverage because of observer safety considerations (ADF&G 1998).

Observers provide catch and effort reports that are expanded into harvest estimates. Their data, along with information collected from vessel operators and processors, allow ADF&G to manage the Bering Sea hair crab fishery in season. Catch reports from processors are used to verify estimates generated from observer data. Reports from fishers provide information regarding distribution of crabs, gear conflicts, weather, and other fishing conditions.

Participation and harvest in the Bering Sea hair crab fishery has varied greatly over the history of the U. S. fishery. Effort and harvest reached a peak of 67 vessels and 2.4 million pounds in 1980 when the fishery was prosecuted as an incidental harvest fishery during the Tanner crab season (Table 2-34 and Figure 2-14). Between 1985 and 1990, effort was minimal due to low stock abundance. Since the 1996 moratorium, effort has remained at 19 or fewer vessels and in 2000 only three vessels made landings. In the 1990s, harvest reached a peak of 2.3 million pounds in the 1993/94 season. Total fishery value peaked in 1995 at $5.7 million (Table 2-35). Since 1995, both effort and GHL have been declining. During the 2000 season, only 1,500 pounds of hair crabs were harvested, for a total fishery value of $5,000.

Since the establishment of the year-round permit fishery in the Bering Sea in 1984, average weight and CPUE have also fluctuated significantly. The highest CPUE of 10 crabs per pot was recorded in 1991, while CPUE dropped to less than one crab per pot during the spring 1993 and 2000 seasons. Average weight of retained hair crabs was highest during the early years of the U.S. fishery at 2.1 pounds, but decreased to 0.9 pound in 1991. In the late 1990s, the average weight of retained hair crabs has remained around 1.6 pounds (Table 2-34).

Beginning in 1993, the hair crab fishing season opening date was set at November 1, which conflicted with the Bristol Bay red king crab fishery. In 1998, ADF&G solicited comments from industry regarding a new opening date. A consensus was reached that the fishery would open 10 days after the closure of the Pribilof District or Saint Matthew Island Section king crab fisheries, whichever closed later. The fishery opened on October 8 in 1998. In 1999, BOF changed the Bristol Bay red king crab season opening to October 15; thus the hair crab fishery was again in conflict. Consensus was reached with industry to conduct the fishery 10 days after the closure of the Bristol Bay red king crab fishery. Subsequently, in 1999 and 2000, the hair crab season opened on October 30.

The GHL for Bering Sea hair crabs is established using results of the NMFS Bering Sea trawl survey. Since there are no registration areas, districts, or sections established in regulation for hair crabs, survey results are described in terms of Bering Sea king crab registration areas, districts and sections (Figure 2-4). Because confidence in the results of this survey is relatively low, a 20% fishery exploitation rate has been used to determine the GHL. Male hair crabs ≥ 83 mm in CW are defined as legal crabs in the commissioner's permit for this fishery.

Typically, the majority of legal-sized male hair crabs encountered during the trawl survey have been found in the vicinity of the Pribilof Islands and the fishery harvest has occurred primarily in the area east of Saint Paul Island. During the 1999 survey, however, 65% of the large male hair crab population in the Bering Sea was found in the Northern District instead of the traditional Pribilof District. Subsequently, in 2000, the Pribilof District was closed to commercial hair crab fishing due to low stock abundance, and for the first time, a directed hair crab fishery was opened in the Northern District of king crab Registration Area Q. Given the experimental nature of the fishery, the low abundance of small male crabs found during the 2000 survey, the relative size of the stock, and lack of fishery data from the Northern District, the harvest rate was set conservatively at 10% of the estimated large male hair crab abundance. As a result of low stock abundance, the Bering Sea was closed to hair crab fishing in 2001 and 2002.

In 2003, CFEC instituted a vessel-based limited entry program for the Bering Sea hair crab fishery and issued hair crab permits to qualified vessel owners. Impact of the limited entry program on fishery management is currently unknown, but the program should lead to a more easily managed fishery if stock conditions allow a reopening. It is estimated that approximately 20 permanent licenses will be issued for the fishery.

2003 Fishery

The 2003 Bering Sea hair crab fishery was closed in both the Northern and Pribilof Districts due to low stock abundance.

Stock Status

The abundance index for large male hair crabs declined from 1981 to 1992, increased from 1992 to 1995, and decreased again from 1995 to 1999. The 2003 NMFS trawl survey of the eastern Bering Sea indicated that the abundance of large male hair crabs decreased 52% from the 2002 level to 1.0 million crabs and that the abundance estimate for large females decreased 65% from the 2002 level to 0.2 million crabs (Rugolo et al. 2003). Population trends observed during the last seven years and weak performance of recent commercial fisheries indicate that the Bering Sea hair crab population is severely depressed. Precise estimates of total female and small male hair crab abundance have never been available from current trawl survey data. In general, the biology and habitat usage of hair crabs makes them difficult to survey with trawl gear. Large male abundance is thought to be better estimated because recruitment trends can be followed in the survey results and fishery harvests.

Bering Sea Octopus

The last directed fishery for octopus in the Bering Sea occurred in 1995, with areas fished covering both Aleutian Islands and Bering Sea waters. Less than three vessels made landings; therefore, the harvest information is confidential. Since 1995, all reported harvests in the Bering Sea have been incidental to other fisheries. Any vessel registered for groundfish in the Westward Region using a miscellaneous finfish permit may retain incidentally caught octopus at up to 20% of the weight of the target species.

In 2003, 112 vessels registered for octopus incidental harvest in the Bering Sea/Aleutian Islands area. Seventy eight of these vessels made 237 landings with 94,642 pounds of octopus landed. Another 27,961 pounds were discarded at sea (Table 2-36). The majority of the octopi caught in the Bering Sea are retained for use as bait in other fisheries. In 2003, 93% of the octopus harvest was taken with pot gear, 5% with non-pelagic trawl gear, and the remainder with longline gear and mid-water trawl gear.

The incidental harvest of octopi in Bering Sea groundfish fisheries more than doubled from 2002 to 2003. Verbal reports from fishers and processors indicate that market interest in octopuses has increased and that some fishers are operating to increase their incidental harvest of octopuses while remaining below the maximum retainable amount. The department intends to closely monitor effort in the octopus fishery as well as the spatial and temporal distribution of the incidental harvest.

Cherry Crabs

Fishing for cherry crabs is managed under the terms of a commissioner's permit. Although one vessel was registered to fish for cherry crabs in 1995, no commercial harvest was reported. One vessel, for which landings are confidential, participated in the 1996 fishery. No vessels requested commissioner's permits to fish for cherry crabs in the Bering Sea District from 1997 through 2003. Given the lack of available data on this stock, the department will not issue permits allowing harvest of cherry crabs.

Sea Cucumbers and Sea Urchins

ADF&G annually issues a news release announcing the GHL for red sea cucumbers and green sea urchins in the Westward Region. The season in the Bering Sea Area opens October 1 under terms of a commissioner's permit with a GHL of 5,000 pounds of eviscerated red sea cucumbers and 5,000 pounds round weight for green sea urchins. The small GHLs were established to permit conservative commercial exploration of areas that lacked historic harvest data and to allow ADF&G to collect critical information for future management purposes (Ruccio and Jackson 2000). No commercial harvest of either species occurred in the Bering Sea District in 2001. In 2002, a separate guideline harvest range of 30,000 to 60,000 pounds was established for the waters around Saint George Island. This harvest level was based on abundance estimates obtained from dive survey data and marketing factors. One diver harvested green sea urchins in the Saint George Island area in 2002, therefore all harvest information is confidential.

In 2003, the GHL for the Bering Sea Area (excluding Saint George Island) was again set at 5,000 pounds each, for red sea cucumbers and green sea urchins. No divers registered to harvest green sea urchins or red sea cucumbers in 2003.

Snails

Historic Background

Commercial fishing for snails in the Bering Sea was initiated by the Japanese fleet in 1971 and continued until 1987, however little information is available from this early fishery. The Fishery Conservation and Management Act of 1976 required that foreign nations provide the United States with records concerning fisheries occurring inside the U.S. Exclusive Economic Zone (EEZ) and the Japanese began to provide fishing records following the passage of the act (MacIntosh 1979). NMFS recorded 14 vessels participating in 1971, five vessels in 1972, no vessels in 1973, and six vessels in 1974. No fishing occurred in 1975 and 1976. In 1977, records indicate that participation in the fishery increased to three vessels (MacIntosh 1980). In the 1980s all fishing was conducted by catcher-processor vessels. The majority of the retained catch during this early fishery was composed of the Pribilof Neptune *Neptunea pribiloffensis*. Smaller components of the retained catch were composed of *Buccinum angulossum* and *B. scalariforme* (MacIntosh 1980). Exvessel value was $242 thousand in 1977, increasing to $1.3 million by 1979. Russian vessels began fishing for snails in the same area in 1989.

The Foreign Fisheries Observer Program assigned observers to Japanese catcher-processors in the years 1984-1987 and later to Russian vessels in 1989. The Russian venture only lasted one year with minimal return. Converted Tanner crab pots were used in the early foreign fishery. Pots were long-lined in depths from 100 to 150 fathoms. Data from the Foreign Fisheries Observer Program showed the Japanese vessels pulled an average of 2,779 pots per day with an average soak time of 50 hours while the Russian vessels averaged just 1,219 pot lifts per day with an average soak time of 80 hours.

The U.S. fishery began in 1992 when two vessels registered to fish for snails. One vessel harvested snails as incidental harvest in the Tanner crab fishery and the second participated in a directed fishery for snails after the June closure of the hair crab fishery. Fishing for snails was limited to waters of the Bering Sea District west of 168° W long. from 1994 to 1996. In 1997, snail fishing was limited to waters west of 164° W long.

Observer coverage was required as a condition of the commissioner's permit issued in 1993 under 5 AAC 39.210 (h) MANAGEMENT PLAN FOR HIGH IMPACT EMERGING FISHERIES. Minimal crab bycatch was observed in the area west of 168° W long. Bycatch of legal sized king crabs was less than one animal per pot. Female snow crabs had the highest incidence of bycatch at one animal per pot (Tracy 1995).

Observer coverage was not required again until 1997 when two vessel operators expressed interest in fishing east of 168° W longitude. Vessels were restricted to grounds west of 164° W long. and north of 54° 36' N latitude. These restrictions were conditions of the permit issued under 5 AAC 38.062 PERMITS FOR OCTOPI, SQUID, HAIR CRAB, SEA URCHINS, SEA CUCUMBERS, SEA SNAILS, CORAL, AND OTHER MARINE INVERTEBRATES. There was no bycatch of red or blue king crabs; however, bycatch of Tanner crabs was observed. An estimated 17,300 female and 2,100 sublegal male Tanner crabs, in addition to 57,600 sublegal snow crabs, were captured in the 192,000 pots pulled.

In the 1997 fishery, average CPUE was 16 snails per pot, equal to the CPUE from vessels fishing northwest of the Pribilof Islands in the 1996 fishery. The majority of the catch for the 1997 season was composed of the genera *Neptunea* and *Buccinum*. Catches increased from 313,000 pounds in 1993 to 3,570,000 pounds in 1996 and then declined to 932,000 pounds in 1997 (Table 2-37 and Figure 2-15). The value of the fishery increased from $125 thousand in 1993 to over $1.05 million in 1996 and then dropped to $308 thousand in 1997 (Table 2-38). From 1998 to 2002, no snails were harvested from the Bering Sea.

2003 Fishery

No vessels registered to harvest snails from the Bering Sea in 2003.

Stock Status

The NMFS eastern Bering Sea trawl survey provides distribution and relative abundance information on Bering Sea snail populations. However, differential catchability of various species of snails makes accurate population estimates difficult.

NORTH PENINSULA DISTRICT

Description of Area

The North Peninsula District for shrimp management includes all Bering Sea waters of both the Territorial Sea (0-3 nautical miles from shore) and the Exclusive Economic Zone (3-200 miles from shore) east of the longitude of Cape Sarichef at 164° 55'30" W long. (Figure 2-16). The North Peninsula District for management of Dungeness crabs includes all waters of both the Territorial Sea (0-3 nautical miles from shore) and the Exclusive Economic Zone (3-200 miles from shore) north of the latitude of Cape Sarichef at 54° 36' N lat. (Figure 2-17).

Shrimp

No vessels have registered for the North Peninsula District pot or trawl shrimp fishery since 1994. Currently, shrimp fishing is not permitted in this district due to a lack of data concerning the shrimp stocks.

Dungeness Crabs

Fishing effort for the North Peninsula Dungeness crab fishery has been sporadic, with few vessels participating. Typically the fishery has occurred north of Unimak Island. In 1995, six vessels made 19 deliveries for a harvest of 134,407 pounds. Catch information from 1996 to 1998 is confidential, as less than three vessels participated in each of those years. The average annual harvest in the three-year period from 1996-1998 was approximately 48,000 pounds. No vessels registered to fish for Dungeness crabs in the North Peninsula District in 1999. One vessel, for which landings are confidential, participated in the 2000 fishery. No vessels registered to fish for Dungeness crabs in 2001. In 2002, three vessels registered to fish for Dungeness crabs and harvested less than 22,000 pounds (Table 2-39). No vessels registered to fish for Dungeness crabs in the North Peninsula District in 2003.

Stock Status

There is no population data available to determine the status of the North Peninsula Dungeness crab stock. This fishery is managed using size, sex, and season restrictions. Currently in this District only male Dungeness crabs with a shoulder width of 165 mm or larger may be taken between 12:00 noon May 1 through 12:00 noon October 18.

BERING SEA/ALEUTIAN ISLANDS COMMUNITY DEVELOPMENT QUOTA CRAB FISHERIES

Description of Area

The Bering Sea, for Community Development Quota (CDQ) fisheries, encompasses all waters of the Territorial Sea (0-3 nautical miles) and Exclusive Economic Zone (3-200 nautical miles from shore) north of Cape Sarichef (54° 36' N lat.), south of Cape Prince of Wales (65° 49' N lat.), and east of the U.S.-Russia Maritime Boundary Line, including the waters of Bristol Bay. For those CDQ fisheries managed by the ADF&G Westward Region, Cape Romanzof (61° 49' N lat.) is the northern boundary (Figure 2-18).

CDQ Program Background

The North Pacific Fishery Management Council (NPFMC) established the CDQ Program in 1992 for walleye pollock and was later expanded to sablefish and Pacific halibut. In 1995 the NPFMC included certain Bering Sea king and Tanner crab stocks in the CDQ Program. The BOF adopted regulations for the Bering Sea/Aleutian Islands king and Tanner crab CDQ fisheries in 1997, and fisheries started in 1998. The State of Alaska manages the CDQ Program and ADF&G manages the crab CDQ fisheries.

Sixty-five coastal Bering Sea communities are eligible for the CDQ Program. These communities are aligned into six CDQ organizations and are collectively referred to as CDQ groups. The groups are Aleutian Pribilof Island Community Development Association (APICDA), Bristol Bay Economic Development Corporation (BBEDC), Central Bering Sea Fishermen's Association (CBSFA), Coastal Villages Regional Fund (CVRF), Norton Sound Economic Development Corporation (NSEDC), and Yukon Delta Fisheries Development Association (YDFDA).

The CDQ groups are non-profit entities, which may have for-profit subsidiaries. Each group submits comprehensive plans on the intended use of the CDQ funds, which vary widely between groups. Most include fishing-related investments, scholarships, training, employment services, and other projects which are intended to benefit the communities and regions the CDQ groups represent. Some groups are buying equity in fishing vessels which will harvest crab in both CDQ and general fisheries.

The CDQ groups receive allocations for the following Bering Sea crab fisheries: Norton Sound red king crab *Paralithodes camtschaticus*, Bristol Bay red king crab, Pribilof red and blue king crab *Paralithodes platypus*, St. Matthew blue king crab, Bering Sea snow crab *Chionoecetes opilio*, and Bering Sea Tanner crab *Chionoecetes bairdi*. To be eligible as a CDQ crab fishery, the crab stock must have an established guideline harvest level (GHL), be managed under the Fishery Management Plan (FMP) for Bering Sea/Aleutian Islands king and Tanner crabs and have a reliable survey to estimate abundance. The CDQ allocation percentage is based on the total actual harvest each year. The annual CDQ allocations for crab were phased in over a three-year period (3.5% of the total allowable fishery harvest for 1998, 5.0% for 1999, and reaching a maximum of 7.5% for 2000 and subsequent years). The individual CDQ group allocation varies in each fishery (Table 2-40). The value of the crab fisheries to the CDQ groups is estimated to be 20-30% of the exvessel fishery value. This report addresses all CDQ crab fisheries except the Norton Sound CDQ red king crab fishery.

Fishery History

The CDQ groups are required to submit fishery plans to the department prior to each CDQ crab fishery. Plans include names of participating vessels and operators, vessel information regarding safety and communications, intended processor and location, method of attaining but not exceeding the allocation, and if a cooperative effort, the method for apportioning the allocation.

All CDQ crab fishing seasons have been subsequent to the general fisheries season, and all CDQ vessels have also participated in the prior general fishery. Before vessels are allowed to register for the CDQ fishery, ADF&G must generate an accurate estimate of the general fishery harvest. Fishers are required to obtain buoy tags for all gear fished, and if required, an onboard observer. At the time of registration all gear on board the vessel must be tagged with CDQ buoy tags and all gear in the water must be tagged before being deployed in the fishery. Additionally, all gear must be in compliance with the closure requirements of the general fishery.

The allocation for 1998 was 3.5% of the total harvest of red king crab, blue king crab and snow crab. This was increased in 1999 to 5.0% of the total harvest, and again in 2000 to 7.5% of the total harvest of king and Tanner crab.

All six CDQ groups participated in the CDQ fisheries; however, not all groups participated in each fishery. All CDQ groups have participated in the snow crab fishery yearly. Five groups participated in the St. Matthew Island Section CDQ blue king crab fishery in 1998 and one group participated in the Pribilof red and blue king crab CDQ fishery, the only year a commercial fishery has occurred since the inception of the CDQ program for crab. Five groups participated in the Bristol Bay red king crab CDQ fishery from 1998 to 2000, and all six groups have participated since. No Tanner crab fishery has occurred due to low stock abundance.

Regulations pertaining to the CDQ fisheries authorize a harvest prior to the general fishery; however, the department did not allow a CDQ harvest before the general fishery during the first year. A full understanding of the impact of these new fisheries and adequate staff to handle the increased management burden was needed before allowing CDQ fisheries to occur prior to the general fisheries. The department's intent was to allow CDQ groups to harvest part of their allocation before the general fishery during the second and subsequent years of the program. This would have allowed CDQ groups to harvest part of their 1999 allocation of snow crab in the fall of 1998. The National Marine Fisheries Service (NMFS) determined that the CDQ regulatory language did not allow for a harvest of the allocation outside of the calendar year to which it was assigned. The intent of NMFS was not to impede ADF&G management of the CDQ crab fisheries. The federal CDQ regulations were revised, but not in time for any harvest of the 1999 allocation of snow crab to occur in the fall of 1998. The Alaska Board of Fisheries (BOF) agreed to address an agenda change request at the March 1999 meeting to consider a proposal to prohibit any CDQ harvest prior to the general fishery. Representatives of processors and non-CDQ fishers contended that CDQ crabs on the market prior to the general fishery would be detrimental to the value of the general fishery. The BOF directed the CDQ, non-CDQ and processor representatives to reach a compromise, and adopted the compromise into regulation. The new regulations allow a CDQ king or Tanner crab fishery prior to the general fishery only when the GHL is 50 million pounds or more, and a maximum of 30% of the CDQ allocation may be harvested preseason.

In 1999, the department changed permitting procedures after the allocation was exceeded in the snow crab fishery for two consecutive years. Permits for CDQ fisheries were previously issued only to vessels fishing for the groups. These permits were issued before the actual allocation was established, and therefore did not reference the CDQ group's harvest allocation. Permits were henceforth to be issued to each CDQ group, initially stating the group allocation percentage and followed by an addendum with the actual allocation in pounds. The vessels were to be issued a permit that referred to the group permit and the associated allocation.

Observer coverage requirements have fluctuated over the history of the CDQ crab fisheries. During the first year of CDQ crab fishing operations, onboard observers were required during all fishing operations. In 1999, observer coverage was reduced in the CDQ snow crab fishery from one observer per vessel to one per CDQ group while during the Bristol Bay CDQ red king crab fishery, coverage remained at one observer per vessel. Observer coverage in the 2000 CDQ snow crab fishery was increased from one observer per group to two per group. During the 2001 CDQ Bristol Bay red king crab fishery, only one observer was required per group. In previous years, all CDQ vessels for this fishery were required to carry on board observers. Observers collect biological data and document the fishing practices of the CDQ fleet.

2003 CDQ Fisheries

Bering Sea CDQ Snow Crab Fishery

The 2003 Bering Sea CDQ snow crab fishery occurred subsequent to the general snow crab fishery. The 2003 CDQ allocation was 7.5 percent of the total snow crab commercial harvest. Based on inseason processor reports and hailed weights for the general fishery, the CDQ allocation was 2,120,637 pounds. All six CDQ groups participated in the fishery. The percent allocated to each group ranged from 8-20%. Percentages allocated to each group are determined by a percentage set forth for these CDQ groups by the Alaska Department of Community and Economic Development (ADCED).

Ten vessels participated in the fishery. Data from fish tickets show that those vessels made 29 deliveries for a harvest of 2,119,027 pounds including deadloss, approximately 99.9% of the allocation (Table 2-41). None of the CDQ groups exceeded their allocation.

Permits were issued to each CDQ group prior to the closure of the general fishery on January 25. The permit stated the group's allocation, listed the vessel(s) requested by the group and authorized by ADF&G to participate in the fishery, and stated that those vessels must comply with requirements such as dates of operation, pot limits, buoy tags, and observer coverage. Vessel registration could begin noon January 29, ninety-six hours after the closure of the general fishery. Typically vessel registration for the CDQ fishery begins 72 hours after the closure of the general fishery, but was delayed 24 hours in 2003 to obtain a more accurate estimate of the general fishery harvest. CDQ groups were notified of their preliminary allocation January 29. Final allocations were announced February 10 after processing of all general fishery harvest was completed. During the fishery, two of the groups received amended allocations resulting from poundage transfers. One group transferred poundage to another after completing fishing and finding their final landing was less than expected. Transfers were approved through the ADCED and ADF&G.

The first vessel began fishing on January 30 and fishing operations concluded on March 24. The first delivery of CDQ snow crab occurred on February 7 with the final delivery March 26. Average exvessel price per pound in the 2003 CDQ snow crab fishery was $1.80 (Table 2-42), slightly less than the general fishery where the average price per pound was $1.83. The fishery value to the fleet was approximately $3.78 million, and the estimated value to the CDQ groups was 20-30% of the CDQ fleet fishery value.

The average number of legal male crab per pot pull (catch per unit effort or CPUE) was 120 retained crabs per pot, a substantial increase from the 2002 CDQ CPUE of 99 retained crabs per pot, but less than the general fishery CPUE of 155 retained crabs per pot. Average weight of crabs in the CDQ fishery was 1.2 pounds, the same as the general fishery. Catches were landed at three shorebased processors, located in Dutch Harbor, and St. Paul. No floater-processors operated during the CDQ fishery. In 2003, for the first time a catcher processor vessel participated in the CDQ fishery.

Observer coverage in the 2003 fishery was two for each group, the same coverage employed since 2000. Since each group except one utilized two or fewer vessels, all but one vessel in the fleet fished with an onboard observer for the entire season. Observers collected biological data, provided inseason harvest rates to the department, and documented fishing practices of the CDQ fleet.

Saint Matthew Island Section CDQ Blue King Crab Fishery

No CDQ harvest of Saint Matthew Island Section blue king crab occurred in 2003 due to closure of the commercial fishery.

Pribilof District CDQ Red and Blue King Crab Fishery

No CDQ harvest of Pribilof District red or blue king crab occurred in 2003 due to closure of the commercial fishery.

Bristol Bay CDQ Red King Crab Fishery

The 2003 Bristol Bay CDQ red king crab fishery allocation based on inseason processor reports and hailed weights from the general fishery, was 1,167,040 pounds. All six CDQ groups participated in this fishery.

Permits were issued to each CDQ group prior to the closure of the general fishery on October 21. The permit stated the group's preliminary allocation, which is determined by a percentage set forth for each CDQ group by the ADCED. The permit listed the vessel(s) requested by the group and authorized by ADF&G to participate in the fishery, and stated that those vessels must comply with requirements such as dates of operation, pot limits, buoy tags, and observer coverage. Vessel registration could begin at 8:00 am October 24, 72 hours after closure of the general fishery. Eight vessels registered on October 24, three of which were registered in St. Paul; one registered October 26, two registered October 27, one registered October 29, and the last vessel registered November 5. The final fishery allocations were announced October 27. Deliveries began October 29, and the final delivery was made November 16. Thirteen vessels made 20 landings for an overall harvest of 1,166,662 pounds and a fishery value of approximately 5.4 million dollars. One CDQ group exceeded its allocation, however all other CDQ groups were under their allocation.

The average CPUE was 30, higher than the CPUE of 18 for the general fishery, but the same as the 2002 CDQ fishery. The average soak time during the CDQ fishery was 45 hours compared to a soak time of 31 hours during the general fishery. Average weight of crabs in the CDQ fishery was 6.7 pounds, compared to an average weight of 6.2 for the general fishery. Two of the groups used three vessels to harvest their allocation, one group used one vessel, and the remaining three groups used two vessels each.

Prior to 2001, all CDQ vessels for this fishery were required to carry onboard observers. During the 2001 to 2003 seasons, only one observer was required per CDQ group. Based on this coverage, six vessels were without observer coverage. During the fishery observers collected biological data, provided inseason harvest rates to the department, and documented fishing practices of the CDQ fleet.

Bering Sea CDQ Tanner Crab Fishery

No CDQ harvest of Tanner crab occurred during 2003 due to closure of the commercial fishery.

BERING SEA KING AND TANNER CRAB BUOY IDENTIFICATION PROGRAM

Introduction and Background

Early 1990s BSAI crab fisheries were characterized by increased fishing effort, decreased GHLs, and shorter fishing seasons than prior years. In response to these changes, the BSAI crab industry submitted a petition regarding pot limits to the BOF. The petition was supported by ADF&G data indicating that management was more difficult and conservation concerns were increased during low GHL fisheries due in part to the amount of gear on the fishing grounds. On March 20, 1991 the BOF proposed an agenda change request regarding this issue and subsequently adopted BSAI pot limit regulations. Effective August 1, 1992 these regulations limited the number of pots a vessel may operate while harvesting BSAI king and Tanner crabs. The buoy identification program was created to help implement these regulations, and as per Alaska State statute, designed to be completely self-supportive by generating funds.

Buoy identification stickers were first implemented during 1992 Bristol Bay red king crab season, but were temporarily suspended due to product failure. Pot limit requirements for Bering Sea Tanner crab fisheries remained in effect until repealed by National Marine Fisheries Services on November 30, 1992. According to the Fishery Management Plan for Bering Sea /Aleutian Island King and Tanner Crab, pot limit regulation is a category II measure (NPFMC 1998). Category II measures may be adopted at the state level but are subject to the federal appeal process and must adhere to national standards requiring regulation application to be nondiscriminatory. Consequently, in February 1993, BOF passed differential pot limit regulations. Each fishery has specific pot limits based on vessel overall length (OL) (Table 2-43). Vessels in excess of 125 feet OL are entitled to operate the maximum number of pots allowed for a fishery, and vessels 125 feet or less in OL may fish 80% of the maximum pot limit. Further differential pot limit regulations for the Bristol Bay red king crab fishery were adopted on an interim basis August 27, 1997. The regulations created an 11-tier pot limit system dependent on fishery GHL and anticipated fleet size. The tiered system was made permanent March 1999.

Implementation

Beginning with 1992-1993 Bristol Bay king and Bering Sea Tanner crab seasons, ADF&G leased additional office space and employed a Fish and Wildlife Technician III to administer the buoy identification program. Regulations providing implementation of the buoy identification program are stated in Alaska Statute 16.05.050. POWERS AND DUTIES OF THE COMMISSIONER and Alaska Statute 16.05.632. IDENTIFICATION OF SHELLFISH POTS OR BUOYS, OR BOTH, USED IN THE TAKING OF KING CRAB AND REQUIREMENTS FOR BUOYS.

By May 1993 heavy-duty, self-locking, nylon tags had taken the place of buoy stickers. After use in several fisheries, numerous quality control problems and industry complaints prompted ADF&G to initiate trial tests of other manufactured tags. Eventually, a new style buoy tag was procured which required an independent means of attachment. The Alaska Department of Fish and Game initially supplied zip ties for tag attachment at no additional charge, but dispersal was discontinued due to high failure rates. Consequently, industry is now responsible for tag attachment. The new style tags were first issued in September 1998 and continue to be used.

Replacement Tags

Buoy tag replacement issues were resolved during the initial BOF meeting regarding pot limits. Regulations were written based on concerns from the Division of Fish and Wildlife Protection regarding prosecution of cases involving replacement tags. Specifics regarding replacement tag sales are included in 5 AAC 34.826. (b) KING CRAB POT MARKING REQUIREMENTS FOR REGISTRATION AREA T, 5 AAC 34.926. (b) KING CRAB POT MARKING REQUIREMENTS FOR REGISTRATION AREA Q, and 5 AAC 35.526. (b) TANNER CRAB POT MARKING REQUIREMENTS FOR REGISTRATION AREA J.

Between the 1994 Bristol Bay red king crab and Bering Sea Tanner crab fisheries, and prior to 1995 snow crab season, the Dutch Harbor ADF&G office received input from fishers concerned with tag replacement regulations. At the time, vessels delivering to remote areas such as King Cove or Saint Paul were unable to obtain replacement tags without travelling to Dutch Harbor. Some vessel operators felt the cost of travelling to Dutch Harbor with three crewmembers was prohibitive to obtaining replacement tags and would promote illegal fishing.

During 1998-1999 seasons, stakeholders reiterated buoy tag replacement issues. In response to these concerns ADF&G began allowing permit holders to file an official affidavit in Saint Paul or King Cove, however ADF&G personnel must be available for verification. This change was implemented prior to 2000 Bering Sea snow crab fishery.

Buoy Identification Tag Refunds

Since the inception of the tag program, refunds for buoy tags have not been offered because the $2.00 fee per tag covers administrative and program implementation costs. However, during the 2001 Bering Sea snow crab fishery, two buoy tag refunds were issued as per 15 AAC 116.120. REFUND OF LICENSE FEES.

Requests for buoy identification tag refunds may be procured only through ADF&G Headquarters in Juneau. To request a refund, the following information must be sent by the tag administrator to administrative staff in Kodiak: name, address, social security number of the permit holder, vessel name and ADF&G number, a copy of the check used for original payment, number of tags purchased/returned, the imprinted sequential tag numbers, return date of unused, complete set of tags and person who received the tags, budget code for refunding, and a statement from the permit holder explaining the refund request. All refund requests are out of the tag program administrator's jurisdiction and will be evaluated by ADF&G Headquarters in Juneau.

Vessel Length Verification

The tiered pot limit regulations are based in part on vessel OL. These measurements are outlined in 5 AAC 34.825 (j) LAWFUL GEAR FOR REGISTRATION AREA T and 5 AAC 35.525 (f) LAWFUL GEAR FOR REGISTRATION AREA J. In order to obtain the maximum number of buoy tags allotted per fishery all vessels with OL in excess of 125 feet must present valid, original or notarized, U.S. Coast Guard or certified marine surveyor documentation, showing the vessel's OL. The permit holder is required to show OL documentation the first time buoy tags are purchased, and when any change in vessel OL occurs. The ADF&G office in Dutch Harbor has an established list of 98 vessels with documented OL in excess of 125 feet.

Administration of the Buoy Identification Program

Bering Sea buoy tags are issued from the ADF&G offices in Kodiak and Dutch Harbor for an administrative fee of $2.00 per tag. Tags are issued to the holder of a valid, fishery specific, Commercial Fisheries Entry Commission interim use permit card. An authorized agent may be issued tags if an affidavit is signed by the permit holder and filed with ADF&G in Dutch Harbor. Also upon request, ADF&G Dutch Harbor office will send buoy tags through the U.S. Mail, via priority mail with insurance and return receipt. Due to potential weather delayed mail service, the deadline for mail request is generally two to three weeks prior to the opening of each fishery. The deadline is announced in fishery specific news releases regarding pot limits.

2003 Buoy Tag Sales

Several of the Bering Sea crab fisheries were not open to commercial harvest because stocks did not meet minimum threshold levels. The Pribilof Island red king and blue king crab, Saint Matthew Island blue king crab, and Bering Sea Tanner crab fisheries were closed in 2003. Tags for these fisheries are stored in Dutch Harbor ready for issue when needed (Table 2-44).

No tags were procured for the 2003 Bering Sea snow crab fishery, rather tags for this fishery were issued from partial sets in storage. Tag sales for this fishery are as follows: from Dutch Harbor 146 vessels purchased 15,825 tags (26 were mail requests) and in Kodiak 46 vessels purchased 4,752 tags. One hundred ninety two vessels purchased 20,452 tags and 5 replacement tags were issued for 20,457 total tags. Ten vessels purchased 1,868 tags for the 2003 Bering Sea snow crab CDQ fishery. No replacement tags were issued.

Four vessels purchased tags for 2003 Pribilof District golden king crab fishery, 160 tags were sold and 6 replacements issued, a total of 166 tags. One vessel purchased 60 tags for the 2003 Northern District, Saint Matthew Island Section golden king crab fishery. No replacement tags were issued. There was no fishing effort in 2003 for South Peninsula grooved Tanner crab.

There were 65,000 tags procured for the 2003 Bristol Bay red king crab fishery. Tag sales for this fishery are as follows: from Dutch Harbor 207 vessels purchased 41,966 tags (32 were mail requests), in Kodiak 46 vessels purchased 7,732 tags. Two hundred fifty two vessels purchased 49,198 tags and no replacement tags were issued. Thirteen vessels purchased 2,470 tags for the 2003 Bristol Bay red king crab CDQ fishery. No replacement tags were issued. The Petrel Bank red king crab fishery had 33 vessels purchase 1,221 tags and no replacement tag was issued. One set of 34 tags was purchased from Kodiak, the other 32 vessels purchased tags in Dutch Harbor.

LITERATURE CITED

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

Alaska Department of Fish and Game (ADF&G). 1985. Westward Region Shellfish Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1996. Annual management report for the shellfish fisheries of the Westward Region, 1994. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Informational Report 4K96-37, Kodiak.

Alaska Department of Fish and Game (ADF&G). 1998. Annual management report for the shellfish fisheries of the Westward Region, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Informational Report 4K98-39, Kodiak.

MacIntosh, R. 1979. Alaska's snail resource. Alaska Seas and Coasts Vol. 6. No. 5.

MacIntosh, R. 1980. The snail resource of the eastern Bering Sea and its fishery. Marine Fisheries Review 42:15-20.

North Pacific Fishery Management Council (NPFMC). 1998. Fisheries Management Plan for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands. North Pacific Fishery Management Council. Anchorage.

North Pacific Fishery Management Council (NPFMC). 2000. A Rebuilding Plan for the Saint Matthew Blue King Crab Stock. North Pacific Fishery Management Council, Anchorage.

North Pacific Fishery Management Council (NPFMC). 2003. Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. Anchorage.

Ruccio, M., and Jackson, D. 2000. Management plan for the Red Sea Cucumber and Green Sea Urchin Commercial Fisheries for the Westward Region, 2000-01. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 4K00-59, Kodiak.

Rugolo, L. J., R. A. MacIntosh, C. E. Armistead, J. A. Haaga, and R. S. Otto. 2003. Report to the Industry on the 2003 Eastern Bering Sea Crab Survey. AFSC Processed Report 2003-11.

Stevens, B. G., J. A. Haaga, and R. A. MacIntosh. 1998a. Report to Industry on the 1998 Eastern Bering Sea Crab Survey. AFSC Processed Report 98-07.

Stevens, B. G., R. S. Otto, J. A. Haaga, and R. A. MacIntosh. 1998b. Report to Industry on the 1997 Eastern Bering Sea Crab Survey. Alaska Fisheries Science Center (AFSC) Processed Report 98-02.

Tracy, D. 1995. Alaska Department of Fish and Game biological summary of the 1993 mandatory shellfish observer program database. Alaska Department of Fish and Game, Commercial Fisheries Management and Development, Regional Information Report No. 4K95-14, Kodiak.

Zheng, J., M. C. Murphy, and G. H. Kruse. 1995. Overview of population estimation methods and robust long-term harvest strategy for red king crabs in Bristol Bay. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 5J95-21, Juneau.

Zheng, J., G. H. Kruse, and M. C. Murphy. 1996. Stock status of Bristol Bay red king crabs in 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 5J96-12, Juneau.

Zheng, J., G. H. Kruse, and M. C. Murphy. 1997. Status of king crab stocks in the eastern Bering Sea in 1997. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 5J97-13, Juneau.

Zheng, J., and G. H. Kruse. 1999. Status of king crab stocks in the Eastern Bering Sea in 1999. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 5J99-09, Juneau.

Zheng, J., and G. H. Kruse. 2000. Status of king crab stocks in the Eastern Bering Sea in 2000. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 5J00-09, Juneau.

Zheng, J., and D. Pengilly. 2003. Evaluation of alternative rebuilding strategies for Pribilof Islands blue king crabs. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 5J03-10, Juneau.

Table 2-1. Bristol Bay commercial red king crab fishery harvest data, 1966-2003.

	Number of				Number of Pots			
Year	Vessels	Landings	Crabs[a]	Harvest[a,b]	Registered	Pulled	CPUE[c]	Deadloss[b]
1966	9	15	140,554	997,321	NA	2,720	52	NA
1967	20	61	397,307	3,102,443	NA	10,621	37	NA
1968	59	261	1,278,592	8,686,546	NA	47,496	27	NA
1969	65	377	1,749,022	10,403,283	NA	98,426	18	NA
1970	51	309	1,682,591	8,559,178	NA	96,658	17	NA
1971	52	394	2,404,681	12,955,776	NA	118,522	20	NA
1972	64	611	3,994,356	21,744,924	NA	205,045	19	NA
1973	67	441	4,825,963	26,913,636	NA	194,095	25	NA
1974	104	605	7,710,317	42,266,274	NA	212,915	36	NA
1975	102	592	8,745,294	51,326,259	NA	205,096	43	1,639,483
1976	141	984	10,603,367	63,919,728	NA	321,010	33	875,327
1977	130	1,020	11,733,101	69,967,868	NA	451,273	26	730,279
1978	162	926	14,745,709	87,618,320	NA	406,165	36	1,273,037
1979	236	889	16,808,605	107,828,057	NA	315,226	53	3,555,891
1980	236	1,251	20,845,350	129,948,463	78,352	567,292	37	1,858,668
1981	177	1,026	5,307,947	33,591,368	75,756	542,250	10	711,289
1982	90	255	541,006	3,001,210	36,166	141,656	4	95,834
1983				FISHERY CLOSED				
1984	89	137	794,040	4,182,406	21,762	112,556	7	35,601
1985	128	130	796,181	4,174,953	30,117	85,003	9	6,436
1986	159	230	2,099,576	11,393,934	32,468	178,370	12	284,127
1987	236	311	2,122,402	12,289,067	63,000	220,871	10	120,388
1988	200	201	1,236,131	7,387,795	50,099	153,004	8	23,537
1989	211	287	1,684,706	10,264,791	55,000	208,684	8	81,334

-Continued-

Table 2-1. (Page 2 of 2)

Year	Number of Vessels	Number of Landings	Number of Crab[a]	Harvest[a,b]	Number of Pots Registered	Number of Pots Pulled	CPUE[c]	Deadloss[b]
1990	240	331	3,120,326	20,362,342	69,906	262,131	12	116,527
1991	302	324	2,630,446	17,177,894	89,068	227,555	12	119,670
1992	281	289	1,196,958	8,043,018	68,189	205,940	6	9,000
1993	292	361	2,261,287	14,628,639	58,881	253,794	9	133,442
1994				FISHERY CLOSED				
1995				FISHERY CLOSED				
1996	196	198	1,249,005	8,405,614	39,461	76,433	16	24,166
1997	256	265	1,315,969	8,756,490	27,499	90,510	15	13,771
1998	274	284	2,140,607	14,233,063	56,420	141,707	15	53,716
1999	257	268	1,812,403	11,090,930	42,403	146,997	12	44,132
2000	246	256	1,166,796	7,546,145	26,352	98,694	12	76,283
2001	230	238	1,196,040	7,786,420	24,571	63,242	19	57,294
2002	242	254	1,377,922	8,856,828	25,833	68,328	20	32,177
2003	252	275	2,335,614	14,530,248	46,964	129,019	18	228,272

[a] General fishery only. Deadloss included.
[b] In pounds.
[c] Number of legal crab retained per pot pull.
NA: Not available.

Table 2-2. Bristol Bay commercial red king crab fishery economic data, 1980-2003.

Year	GHL[a]	Value		Season Length	
		Exvessel	Total[b]	Days	Dates
1980	70-120	$0.90	$115.3	40	09/10-10/20
1981	70-100	$1.50	$49.3	91	09/10-12/15
1982	10-20[d]	$3.05	$8.9	30	09/10-10/10
1983		FISHERY CLOSED			
1984	2.5- 6.0	$2.60	$10.8	15	10/01-10/16
1985	3.0-5.0	$2.90	$12.1	8	09/25-10/02
1986	6.0-13.0	$4.05	$45.0	13	09/25-10/07
1987	8.5-17.7	$4.00	$48.7	12	09/25-10/06
1988	7.5	$5.10	$37.6	8	09/25-10/02
1989	16.5	$5.00	$50.9	12	09/25-10/06
1990	17.1	$5.00	$101.2	12	11/01-11/13
1991	18.0	$3.00	$51.2	7	11/01-11-08
1992	10.3	$5.00	$40.2	7	11/01-11/08
1993	16.8	$3.80	$55.1	9	11/01-11/10
1994		FISHERY CLOSED			
1995		FISHERY CLOSED			
1996	5.0	$4.01	$33.6	4	11/01-11/05
1997	7.0	$3.26	$28.5	4	11/01-11/05
1998	15.8	$2.64	$37.4	5	11/01-11/06
1999	10.1	$6.26	$69.1	5	10/15-10/20
2000	7.7	$4.81	$36.0	4	10/16-10/20[c]
2001	6.6	$4.81	$37.5	3.3	10/15-10/18
2002	8.6	$6.14	$54.2	2.8	10/15-10/18
2003	14.5	$5.08	$72.7	5.1	10/15-10/20

[a] General fishery only. In millions of pounds.
[b] Millions of dollars.
[c] Delayed start due to weather.
[d] Inseason revision to 4.7 million pounds.

Table 2-3. 2003 Bristol Bay commercial red king crab fishery inseason catch and effort projections for the non-AFA fleet based on 12-hour reports to ADF&G.

October Date	Report Hour	Potlifts	Catch[a, b]	Cummulative Catch[a, b]	Number of Crabs	CPUE[c]	Number of Vessels Reporting
16	12	875	18,385	18,385	2,965	3	62
16	24	7,538	634,241	652,626	105,262	13	72
17	36	13,326	1,291,590	1,944,216	313,583	16	72
17	48	11,919	1,428,993	3,373,209	544,066	19	70
18	60	11,987	1,410,507	4,783,716	771,567	19	70
18	72	14,228	1,983,196	6,766,912	1,091,437	23	67
19	84	13,245	1,733,606	8,500,518	1,371,051	21	67
19	96	13,757	2,114,717	10,615,235	1,712,135	24	31
20	108	20,158	2,507,157	13,122,392	2,116,515	21	30
20	120	23,129	2,799,791	15,922,183	2,568,094	19	17
Total		130,162	15,922,183	15,922,183	2,568,094	20	

[a] In pounds.
[b] Based on 6.4 pound average weight.
[c] Number of legal crab retained per pot pull.

Table 2-4. 2003 Bristol Bay commercial red king crab fishery catch and effort projections for the AFA fleet, based on inseason vessel reports to the AFA fleet manager.

October Date	Report Hour	Potlifts	Catch[a, b]	Cummulative Catch[a, b]	Number of Crabs	CPUE[c]	Percentage of Cap Harvested
16	12	30	4,007	4,007	636	21	0
16	24	978	62,515	66,522	9,923	10	4
17	36	1,285	98,601	165,123	15,651	12	10
17	48	1,626	180,508	345,631	28,652	18	22
18	60	1,025	125,402	471,032	19,905	19	30
18	72	1,763	222,699	693,731	35,349	20	44
19	84	1,214	96,674	790,404	15,345	13	50
19	96	1,635	158,855	949,259	25,215	15	60
20	108	1,950	141,643	1,090,902	22,483	12	68
20	120	1,507	108,776	1,199,678	17,266	11	75
Total		13,013	1,199,678	1,199,678	190,425	15	75

[a] In pounds.
[b] Based on 6.3 pound average weight.
[c] Number of legal crab retained per pot pull.

Table 2-5. Bristol Bay commercial red king crab fishery catch by statistical area, 2003.

Statistical	Number of			Pots	Average		
Area	Landings	Crab[a]	Harvest[a,b]	Lifted	CPUE[c]	Weight[b]	Deadloss[b]
615601	9	27,147	169,988	2,220	12	6.3	5,793
615630	30	86,673	543,395	7,939	11	6.3	12,024
615700	4	365	2,361	125	3	6.5	5
625531	4	1,695	12,433	244	7	7.3	113
625600	85	356,899	2,224,697	22,749	16	6.2	43,366
625630	98	324,285	1,999,160	24,403	13	6.2	30,285
625700	7	6,401	37,423	576	11	5.8	457
625800	4	17,036	106,999	1,115	15	6.3	2,183
635530	8	49,464	314,360	2,501	20	6.4	976
635600	125	722,345	4,567,930	31,765	23	6.3	73,242
635630	102	575,591	3,604,332	27,857	21	6.3	44,861
635700	8	36,745	209,728	1,781	21	5.7	2,890
635800	5	26,672	171,239	1,963	14	6.4	2,847
645600	11	73,133	362,997	2,016	36	5.0	7,532
645630	12	23,778	157,897	1,139	21	6.6	1,566
Other[d]	3	7,385	45,309	626	12	6.1	132
Total	515	2,335,614	14,530,248	129,019	18	6.2	228,272

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crab retained per pot pull.
[d] Combination of three statistical areas from which less than three vessels made landings.

Table 2-6. Bristol Bay commercial red king crab fishery harvest composition by fishing season, 1973-2003.

Season	Percent		Size	Average		% Old
	Recruit	Postrecruit[a]	Limit[b]	Weight (pounds)	Length (mm)	Shell
1973	63	37	6¼	5.6	NA	NA
1974	60	40	6¼	5.5	NA	NA
1975	21	79	6¼[c]	5.7	NA	NA
1976	56	44	6½	6.0	148	27.4
1977	67	33	6½	5.9	148	13.0
1978	75	25	6½	5.9	147	6.9
1979	47	53	6½	6.4	152	10.4
1980	44	56	6½	6.2	151	11.0
1981	14	86	6½[d]	6.3	151	47.4
1982	68	32	6½	5.5	145	24.6
1983			FISHERY CLOSED			
1984	59	41	6½	5.2	142	26.5
1985	66	34	6½	5.2	142	25.8
1986	65	35	6½	5.4	142	25.5
1987	77	23	6½	5.8	145	19.0
1988	59	41	6½	6.0	147	15.1
1989	58	42	6½	6.1	148	17.7
1990	49	51	6½	6.5	152	14.7
1991	44	56	6½	6.5	152	12.1
1992	33	67	6½	6.7	153	22.3
1993	33	67	6½	6.5	152	15.2
1994			FISHERY CLOSED			
1995			FISHERY CLOSED			
1996	31	69	6½	6.7	153	24.3
1997	28	72	6½	6.7	152	11.0
1998	40	60	6½	6.7	152	19.1
1999	72	28	6½	6.1	148	6.3
2000	65	35	6½	6.5	151	16.3
2001	54	46	6½	6.5	151	22.3
2002	61	39	6½	6.4	151	22.2
2003	72	28	6½	6.2	149	21.9

[a] Legal sized old and new shell greater than 153mm carapace length defined as postrecruits.
[b] Minimum carapace width in inches.
[c] 6½ inches after 11/01.
[d] 7 inches after 10/20

NA: Not Available.

Table 2-7. Bristol Bay red king crab cost-recovery harvest data, 1990-2003.

	Number of			Number of	Average		
Year[a]	Landings	Crabs[b]	Harvest[b,c]	Pots Pulled	CPUE[d]	Weight[c]	Deadloss[c]
1990	3	9,567	80,701	870	16	5.9	24,540
1991	2	30,351	205,851	518	62	6.4	12,817
1992	1	11,213	74,089	670	17	6.3	3,000
1993	1	8,384	53,200	464	18	6.3	800
1994	1	14,806	93,336	732	21	6.0	4,500
1995	2	14,123	80,158	564	26	5.5	2,339
1996	3	15,390	107,955	355	44	6.9	1,918
1997	4	21,698	154,739	658	37	6.3	18,040
1998	2	22,230	188,176	738	36	7.0	32,564
1999	2	12,438	79,765	698	18	6.4	165
1999[e]	2	16,930	106,179	541	31	6.3	245
2000[f]	2	14,196	86,218	702	20	6.1	347
2001[e]	3	17,605	120,435	597	29	6.8	138
2002[e]	2	14,528	96,221	277	52	6.6	181
2003[f,g]	1	5,327	33,817	584	9	6.4	143

[a] All cost recovery from 1990-1998 was conducted to fund the Bering Sea and Aleutian Islands shellfish research program.
[b] Deadloss included.
[c] In pounds.
[d] Number of legal crab retained per pot pull.
[e] Bering Sea and Aleutian Islands shellfish research and observer program cost recovery.
[f] Bering Sea and Aleutian Islands shellfish research program cost recovery.
[g] Includes 1,222 pounds harvested in the Pribilof District.

Table 2-8. Bristol Bay red king crab cost-recovery economic performance data, 1990-2003.

Year[a]	Harvest[b]	Value		Charter dates	Charter length[c]
		Exvessel	Total		
1990	56,161	$5.10	286.4	8/7-9/7	30
1991	193,034	$3.75	723.9	9/2-10/7	35
1992	71,089	$5.24	372.5	10/8-10/23	15
1993	52,400	$6.57	344.3	8/20-9/20	31
1994	88,836	$5.21	462.8	9/25-10/25	30
1995	77,819	$6.65	517.5	8/1-8/31	31
1996	106,037	$4.53	480.4	8/1-8/31	31
1997	136,699	$3.55	485.2	7/25-8/21	28
1998	155,612	$3.25	505.7	8/1-8/28	28
1999	79,600	$6.02	478.8	9/25-10/11	17
1999[d]	105,934	$6.32	669.5	9/25-10/11,10/25-11/10	34
2000[e]	85,871	$5.82	499.8	9/20-10/04	15
2001[d]	120,297	$5.18	623.1	9/22-10/10, 10/23-11/8	36
2002[d]	96,087	$6.45	619.6	9/23-10/9, 10/17-10/27	27
2003[e,f]	33,674	$5.56	187.2	9/1-10/4	34

[a] All cost recovery from 1990-1998 was conducted to fund the Bering Sea and Aleutian Islands shellfish research program.
[b] Deadloss not included. In pounds.
[c] In days.
[d] Bering Sea and Aleutian Islands shellfish research and observer program cost recovery.
[e] Bering Sea and Aleutian Islands shellfish research program cost recovery.
[f] Includes 1,204 pounds harvested in the Pribilof District.

Table 2-9. Pribilof District commercial red and blue king crab fishery data, 1973/74-2003.

	Number of			Harvest[b]	Number of Pots		CPUE[c]	Average		
Year[a]	Vessels	Landings	Crabs[b]	(pounds)	Registered	Pulled		Weight (pounds)	Length[d] (mm)	Deadloss (pounds)
1973/74	8	13	174,420	1,276,533	NA	6,814	26	7.3	NA	NA
1974/75	70	101	908,072	7,107,294	NA	45,518	20	7.8	157.8	NA
1975/76	20	54	314,931	2,433,714	NA	16,297	19	7.7	159.1	NA
1976/77	47	113	855,505	6,611,084	NA	71,738	12	7.7	158.1	NA
1977/78	34	104	807,092	6,456,738	NA	106,983	8	7.9	158.9	159,269
1978/79	58	154	797,364	6,395,512	NA	101,117	8	8.1	159.3	63,140
1979/80	46	115	815,557	5,995,231	NA	83,527	10	7.7	155.9	284,555
1980/81	110	258	1,497,101	10,970,346	31,636	167,684	9	7.3	155.7	287,285
1981/82	99	312	1,202,499	9,080,729	25,408	176,168	7	7.6	158.2	250,699
1982/83	122	281	587,908	4,405,353	34,429	127,728	5	7.5	159.8	51,703
1983/84	126	221	276,364	2,193,395	36,439	86,428	3	7.9	159.9	4,562
1984/85	16	25	40,427	306,699	3,122	15,147	3	7.6	155.5	NA
1985/86	26	49	77,607	532,735	6,038	23,483	3	6.9	146.5	7,500
1986/87	16	25	36,988	258,939	4,376	15,800	2	7.0	NA	5,450
1987/88	38	68	95,131	701,337	9,594	40,507	2	7.4	152.7	9,910
1988/89-92/93				FISHERY CLOSED						
1993[e]	112	135	380,217	2,607,634	4,860	35,942	11	6.9	154.4	NA
1994[e]	104	121	167,520	1,338,953	4,675	28,976	6	8.0	162.1	2,929
1995[e]	117	151	107,521	871,173		33,531	3	8.1	162.5	15,316
1995[f]	119	152	172,987	1,267,454		34,721	5	7.3	N/A	46,263
1995[g]	127	162	280,508	2,138,627	5,400	37,643	8	NA		61,579
1996[e]	66	90	25,383	200,304		29,425	<1	7.9	161.0	319
1996[f]	66	92	127,676	937,032		30,607	4	7.3	153.1	14,997
1996[g]	66	92	153,059	1,137,336	2,730	30,607	3	7.4		15,316

-Continued-

Table 2-9. (Page 2 of 2)

Year[a]	Number of Vessels	Number of Landings	Number of Crabs[b]	Harvest[b] (pounds)	Number of Pots Registered	Number of Pots Pulled	CPUE[c]	Average Weight (pounds)	Average Length[d] (mm)	Deadloss (pounds)
1997[e]	53	110	90,641	756,818		28,458	3	8.4	164.3	18,807
1997[f]	51	105	68,603	512,374		27,652	3	7.5	163.6	16,747
1997[g]	53	110	159,244	1,269,192	2,230	30,400	5	8.0		35,554
1998[e]	57	84	68,129	510,365		23,381	3	7.5	158.8	8,703
1998[f]	57	83	68,513	516,996		22,965	3	7.5	156.1	22,289
1998[g]	57	84	136,642	1,027,361	2,398	23,381	3	7.5		30,992
1999-2003					FISHERY	CLOSED				

[a] Blue king crab, 1973 - 1988.
[b] Deadloss included.
[c] Number of legal crabs retained per pot pull.
[d] Carapace length.
[e] Red king crab.
[f] Blue king crab.
[g] Blue and red king crab fisheries combined.
NA: Not Available.

Table 2-10. Guideline harvest level (GHL), economic performance and season length summary for the Pribilof District commercial red and blue king crab fishery, 1980/81-2003.

		Value		Season Length	
Year[a]	GHL[b]	Exvessel	Total[c]	Days	Dates
1980/81	5.0-8.0	$0.90	$9.6	60	09/15-11/15
1981/82	5.0-8.0	$1.50	$13.6	47	09/10-10/28
1982/83	5.0-8.0	$3.05	$13.4	15	09/10-09/25
1983/84	4.0[d]	$3.00	$6.6	10	09/01-09/11
1984/85	0.5-1.0	$2.50	$0.1	15	09/01-09/16
1985/86	0.3-0.8	$2.90	$1.4	26	09/25-10/21
1986/87	0.3-0.8	$4.05	$1.2	55	09/25-11/20
1987/88	0.3-1.7	$4.00	$2.8	86	09/25-12/20
1988/89-92/93		FISHERY CLOSED			
1993[e]	3.4	$4.98	$13.0	6	09/15-09/21
1994[e]	2.0[d]	$6.45	$8.6	6	09/15-09/21
1995[e]	2.5[g]	$3.37	$2.9	7	09/15-09/22
1995[f]	2.5[g]	$2.92	$3.9	7	09/15-09/22
1996[e]	1.8[g]	$2.76	$0.6	11	09/15-09/26
1996[f]	1.8[g]	$2.65	$2.4	11	09/15-09/26
1997[e]	1.5[g]	$3.09	$2.3	14	09/15-09/29
1997[f]	1.5[g]	$2.82	$1.4	14	09/15-09/29
1998[e]	1.25[g,h]	$2.39	$1.2	13	09/15-09/28
1998[f]	1.25[g,h]	$2.34	$1.2	13	09/15-09/28
1999-2003		FISHERY CLOSED			

[a] Blue king crab, 1980-1988.
[b] Guideline harvest level, millions of pounds.
[c] Millions of dollars.
[d] Set not to exceed.
[e] Red king crab.
[f] Blue king crab.
[g] Combined red and blue king crab.
[h] General fishery only.

Table 2-11. Saint Matthew Island Section commercial blue king crab fishery data, 1977-2003.

	Number of			Harvest[a]	Number of Pots		CPUE[b]	Percent	Average		Deadloss
Year	Vessels	Landings	Crabs[a]	(pounds)	Registered	Pulled		Recruits	Weight (pounds)	Length[c] (mm)	(pounds)
1977	10	24	281,665	1,202,066		17,370	16	7	4.3	130.4	129,148
1978	22	70	436,126	1,984,251		43,754	10	NA	4.5	132.2	116,037
1979	18	25	52,966	210,819		9,877	5	81	4.0	128.8	128.8
1980					CONFIDENTIAL						
1981	31	119	1,045,619	4,627,761		58,550	18	NA	4.4	NA	53,355
1982	96	269	1,935,886	8,844,789		165,618	12	20	4.6	135.1	142,973
1983	164	235	1,931,990	9,454,323	38,000	133,944	14	27	4.8	137.2	828,994
1984	90	169	841,017	3,764,592	14,800	73,320	11	34	4.5	135.5	31,983
1985	79	103	484,836	2,427,110	13,000	51,606	9	9	5.0	139	2,613
1986	38	43	219,548	1,003,162	5,600	22,093	10	10	4.6	134.3	32,560
1987	61	62	234,521	1,075,179	9,370	28,440	8	5	4.6	134.1	400
1988	46	46	302,053	1,325,185	7,780	10,160	30	65	4.4	133.3	22,358
1989	69	69	247,641	1,166,258	11,983	30,853	8	9	4.7	134.6	3,754
1990	31	38	391,405	1,725,349	6,000	26,264	15	4	4.4	134.3	17,416
1991	68	69	726,519	3,372,066	13,100	37,104	20	12	4.6	134.1	216,459
1992	174	179	544,956	2,474,080	17,400	56,630	10	9	4.6	134.1	0
1993	92	136	629,874	2,999,921	5,895	58,647	11	6	4.8	135.4	0
1994	87	133	827,015	3,764,262	5,685	60,860	14	60	4.6	133.3	46,699
1995	90	111	666,905	3,166,093	5,970	48,560	14	45	4.8	135	90,191
1996	122	189	661,115	3,080,916	8,010	91,205	7	47	4.7	134.6	36,892
1997	117	166	939,822	4,649,660	7,650	81,117	12	31	4.9	139.5	209,490
1998	131	255	612,346	2,868,965	8,561	89,500	7	46	4.7	135.8	14,417
1999-2003					FISHERY CLOSED						

[a]Deadloss included.
[b]Number of legal crabs retained per pot pull.
[c]Carapace length.
NA: Not Available.

Table 2-12. Guideline harvest level (GHL), economic performance and season length summary for the Saint Matthew Island Section commercial blue king crab fishery, 1983-2003.

		Value		Season Length	
Year	GHL[a]	Exvessel	Total[b]	Days	Dates
1983	8	$3.00	$25.80	17	08/20-09/06
1984	2.0-4.0	$1.75	$6.50	7	09/01-09/08
1985	0.9-1.9	$1.60	$3.80	5	09/01-09/06
1986	0.2-0.5	$3.20	$3.20	5	09/01-09/06
1987	0.6-1.3	$2.85	$3.10	4	09/01-09/05
1988	0.7-1.5	$3.10	$4.00	4	09/01-09/05
1989	1.7	$2.90	$3.50	3[c]	09/01-09/04
1990	1.9	$3.35	$5.70	6	09/01-09/07
1991	3.2	$2.80	$9.00	4	09/16-09/20
1992	3.1	$3.00	$7.40	3[c]	09/04-09/07
1993	4.4	$3.23	$9.70	6	09/15-09/21
1994	3.0	$4.00	$15.00	7	09/15-09/22
1995	2.4	$2.32	$7.10	5	09/15-09/20
1996	4.3	$2.20	$6.70	8	09/15-09/23
1997	5.0	$2.21	$9.80	7	09/15-09/22
1998	4.0[d]	$1.87	$5.34	11	09/15-09/26
1999-2003			FISHERY CLOSED		

[a] Guideline harvest level, millions of pounds.
[b] Millions of dollars.
[c] Actual length - 60 hours.
[d] General fishery GHL.

Table 2-13. Guideline harvest level (GHL), inseason harvest projections and actual commercial harvests for the St. Matthew Island Section blue king crab fishery, 1983-2003.

Year	Guideline Harvest Levels[a]	Projected Harvest[a,b]	Actual Harvest[a,c]
1983	8.0	8.0	9.5
1984	2.0 - 4.0	4.0	3.8
1985	0.9 - 1.9	2.0	2.4
1986	0.2 - 0.5	1.0	1.0
1987	0.6 - 1.3	1.3	1.1
1988	0.7 - 1.5	1.5	1.3
1989	1.7	1.7	1.2
1990	1.9	1.9	1.7
1991	3.2	3.2	3.4
1992	3.1	3.1	2.5
1993	4.4	4.4	3.0
1994	3.0	3.0	3.8
1995	2.4	2.4	3.2
1996	4.3	4.3	3.1
1997	5.0	5.0	4.6
1998	4.0[d]	2.9	2.9
1999-2003		FISHERY CLOSED	

[a] Millions of pounds.
[b] Based on inseason catch reports.
[c] Deadloss included.
[d] General fishery only.

Table 2-14. Commercial harvest of blue king crabs by season for the St. Matthew Island Section, 1977-2003.

Season	Date Opened	Date Closed	Harvest[a]	Minimum Size[b]	Price per Pound
1977	Jun-07	Aug. 16	1,202,066	5 1/2	$1.00
1978	Jul-15	Sept. 3	1,984,251	5 1/2	$0.95
1979	Jul-15	Aug. 24	210,819	5 1/2	$0.70
1980	Jul-15	Sept. 3	CONFIDENTIAL	5 1/2	CONFIDENTIAL
1981	Jul-15	Aug. 21	4,627,761	5 1/2	$0.90
1982	Aug-01	Aug. 16	8,844,789	5 1/2	$2.00
1983[c,d]	Aug-20	Sept. 6[c]	9,506,880[d]	5 1/2	$3.00
1984	Aug-01	Sept. 8	3,764,592	5 1/2	$1.75
1985	Sep-01	Sept. 6	2,427,110	5 1/2	$1.60
1986	Sep-01	Sept. 6	1,003,162	5 1/2	$3.20
1987	Sep-01	Sep-05	1,075,179	5 1/2	$2.85
1988	Sep-01	Sep-05	1,325,185	5 1/2	$3.10
1989	Jan-01	Sep-04	1,166,258	5 1/2	$2.90
1990	Sep-01	Sep-07	1,725,349	5 1/2	$3.35
1991	Sep-16	Sep-20	3,372,066	5 1/2	$2.80
1992	Sep-04	Sep-07	2,474,080	5 1/2	$3.00
1993	Sep-15	Sep-21	2,999,921	5 1/2	$3.23
1994	Sep-15	Sep-22	3,764,262	5 1/2	$4.00
1995	Sep-15	Sep-22	3,166,093	5 1/2	$2.32
1996	Sep-15	Sep-16	3,080,916	5 1/2	$2.20
1997	Sep-15	Sep-22	4,649,660	5 1/2	$2.21
1998	Sep-15	Sep-26	2,868,965	5 1/2	$1.87
1999-2003		FISHERY CLOSED			

[a] In pounds, deadloss included.
[b] Carapace width in inches.
[c] Part of Northern District open until September 20.
[d] St. Lawrence Island harvest of 52,557 lbs. included.

Table 2-15. Pribilof District golden king crab fishery harvest data, 1981/82-2003 seasons.

Season	Number of Vessels	Number of Landings	Number of Crabs[a]	Harvest[a,b]	Pots lifted	CPUE[c]	Average Weight[b]	Average Length[d]	Deadloss[b]
1981/82	2				CONFIDENTIAL				
1982/83	10	19	15,330	69,970	5,252	3	4.6	151	570
1983/84	50	115	253,162	856,475	26,035	10	3.4	127	20,041
1984					NO LANDINGS				
1985	1				CONFIDENTIAL				
1986	1				CONFIDENTIAL				
1987	1				CONFIDENTIAL				
1988	2				CONFIDENTIAL				
1989	2				CONFIDENTIAL				
1990					NO LANDINGS				
1991	1				CONFIDENTIAL				
1992	1				CONFIDENTIAL				
1993	5	15	17,643	67,458	15,395	1	3.8	NA	0
1994	3	5	21,477	88,985	1,845	12	4.1	NA	730
1995	7	22	82,456	341,700	9,481	9	4.1	NA	716
1996	6	32	91,947	329,009	9,952	9	3.6	NA	3,570
1997	7	23	43,305	179,249	4,673	9	4.1	NA	5,554
1998	3	9	9,205	35,722	1,530	6	3.9	NA	474
1999	3	9	44,098	177,108	2,995	15	4.0	NA	319
2000	7	19	29,145	127,217	5,450	5	4.4	NA	5,288
2001	6	14	33,723	145,876	4,262	8	4.3	143	8,227
2002	8	20	34,639	150,434	5,464	6	4.3	144	8,984
2003	3		CONFIDENTIAL		2,854	13	4.1	139	CONFIDENTIAL

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs retained per pot pull.
[d] Carapace length in millimeters.
NA: Not available.

Table 2-16. Pribilof District golden king crab fishery economic data, 1991-2003 seasons.

Season	Value		Season Length	
	Exvessel[a]	Fishery	Days	Dates
1991	CONFIDENTIAL		365	1/1-12/31
1992	CONFIDENTIAL		365	1/1-12/31
1993	$2.42	$163,248	365	1/1-12/31
1994	$3.81	$336,252	365	1/1-12/31
1995	$3.12	$1,056,900	365	1/1-12/31
1996	$2.02	$639,532	365	1/1-12/31
1997	$2.23	$387,340	365	1/1-12/31
1998	$2.06	$72,611	365	1/1-12/31
1999	$2.34	$413,686	162	1/1-6/10
2000	$3.22	$392,436	365	1/1-12/31
2001	$3.12	$429,464	105	1/1-4/15
2002	$3.10	$438,495	134	1/1-5/14
2003	CONFIDENTIAL		121	1/1-5/1

[a] Price per pound.

Table 2-17. Pribilof District commercial golden king crab fishery catch by statistical area, 2003.

Statistical area	Number of Landings	Number of Crab[a]	Harvest[a,b]	Pots lifted	Average CPUE[c]	Average Weight[b]	Deadloss[b]
	CONFIDENTIAL			2,854	13	4.1	CONFIDENTIAL

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs per pot lift.

Table 2-18. Saint Matthew Island Section commercial golden king crab fishery harvest data, 1982/83-2003 seasons.

	Number of						Average		
Season	Vessels	Landings	Crabs[a]	Harvest[a,b]	Pots lifted	CPUE[c]	Weight[b]	Length[d]	Deadloss[b]
1982/83	22	30	51,714	193,507	7,825	7	3.7	138	957
1983/84						NO LANDINGS			
1985						NO LANDINGS			
1986						NO LANDINGS			
1987	11	29	101,618	424,394	14,525	7	4.2	142	11,750
1988	11	23	36,270	160,441	11,672	3	4.4	150	14,000
1989	2					CONFIDENTIAL			
1990						NO LANDINGS			
1991						NO LANDINGS			
1992	1					CONFIDENTIAL			
1993						NO LANDINGS			
1994	1					CONFIDENTIAL			
1995	4	4	245	1,200	383	1	4.9	NA	0
1996	1					CONFIDENTIAL			
1997-2000						NO LANDINGS			
2001	1					CONFIDENTIAL			
2002						NO LANDINGS			
2003	1					CONFIDENTIAL			

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs retained per pot pull.
[d] In millimeters.
NA: Not available.

Table 2-19. Saint Matthew Island Section commercial golden king crab fishery economic data, 1991-2003 seasons.

Season	Value		Season Length	
	Exvessel[a]	Total	Days	Dates
1991	NO LANDINGS		365	1/1-12/31
1992	CONFIDENTIAL		365	1/1-12/31
1993	NO LANDINGS		365	1/1-12/31
1994	CONFIDENTIAL		365	1/1-12/31
1995	$3.12	$3,744	365	1/1-12/31
1996	CONFIDENTIAL		365	1/1-12/31
1997-2000	NO LANDINGS		365	1/1-12/31
2001	CONFIDENTIAL		365	1/1-12/31
2002	NO LANDINGS		365	1/1-12/31
2003	CONFIDENTIAL		365	1/1-12/31

[a] Price per pound.

Table 2-20. King crab Registration Area Q commercial scarlet king crab fishery data, 1992-2003.

Year	Number of Vessels	Harvest[a,b]	Pots Lifted	Value		Average		Deadloss[a]
				Exvessel[c]	Fishery[d]	Weight[a]	CPUE[e]	
1992-94					NO LANDINGS			
1995	4	26,684	24,551	$2.12	$0.06	2.4	1	465
1996	2				CONFIDENTIAL			
1997- 99					NO LANDINGS			
2000[f]	1				CONFIDENTIAL			
2001[f]	1				CONFIDENTIAL			
2002[f]					NO LANDINGS			
2003[f]	1				CONFIDENTIAL			

[a] In pounds.
[b] Deadloss included.
[c] Price per pound.
[d] In millions of dollars.
[e] Number of legal crabs retained per pot pull.
[f] Restricted to incidental harvest during Bering Sea golden king and grooved Tanner crab fisheries.

Table 2-21. Bering Sea District commercial Tanner crab fishery harvest data, 1969-2003.

Year	Number of Vessels	Number of Landings	Number of Crab[a]	Harvest[a] (pounds)	Number of Pots Registered	Number of Pots Pulled	CPUE[b]	Deadloss (pounds)
1969	NA	131	353,300	1,008,900	NA	29,800	12	NA
1970	NA	66	482,300	1,014,700	NA	16,400	29	NA
1971	NA	22	61,300	166,100	NA	7,300	8	NA
1972	NA	14	42,061	107,761	NA	4,260	10	NA
1973	NA	44	93,595	231,668	NA	15,730	6	NA
1974	NA	69	2,531,825	5,044,197	NA	22,014	115	NA
1974/75	28	80	2,773,770	7,028,378	NA	38,462	72	NA
1975/76	66	304	8,956,036	22,358,107	NA	141,206	63	NA
1976/77	83	541	20,251,508	51,455,221	NA	297,471	68	NA
1977/78	120	861	26,350,688	66,648,954	NA	516,350	51	218,099
1978/79	144	817	16,726,518	42,547,174	NA	402,697	42	76,000
1979/80	152	804	14,685,611	36,614,315	40,273	488,434	30	56,446
1981	165	761	11,845,958	29,630,492	42,910	559,626	21	101,594
1982	125	791	4,830,980	11,008,779	36,396	490,099	10	138,159
1983	108	448	2,286,756	5,273,881	15,255	282,006	8	60,029
1984	41	134	516,877	1,208,223	9,851	61,357	8	5,025
1985	44	166	1,283,474	3,151,498	15,325	104,707	12	14,096
1986				FISHERY	CLOSED			
1987				FISHERY	CLOSED			
1988	98	248	897,059	2,210,394	38,765	112,334	8	10,724
1989	109	359	2,907,021	7,012,965	43,607	184,892	16	34,664
1990	179	1,032	10,717,924	24,549,299	46,440	711,137	15	87,475
1990/91	255	1,756	16,608,625	40,081,555	75,356	883,391	19	210,769
1991/92	285	2,339	12,924,034	31,796,381	85,401	1,244,633	10	279,741

-Continued-

Table 2-21. (Page 2 of 2)

	Number of			Harvest[a]	Number of Pots			Deadloss
Year	Vessels	Landings	Crab[a]	(pounds)	Registered	Pulled	CPUE[b]	(pounds)
1992/93	294	2,084	15,265,880	35,130,866	71481	1,200,885	13	343,955
1993/94	296	862	7,235,498	16,891,320	116,039	576,464	13	258,389
1994	183	349	3,351,639	7,766,886	38,670	249,536	13	132,780
1995	196	256	1,877,303	4,233,061	40,827	247,853	8	44,508
1996[c]	196	347	734,296	1,806,077	68,602	149,289	5	14,608
1997 to 2003				FISHERY CLOSED				

[a] Deadloss included.
[b] Number of legal crabs retained per pot pull.
[c] Includes incidental catch with Bristol Bay red king crab and Tanner crab directed fishery totals.
NA: Not Available.

Table 2-22. Bering Sea District commercial Tanner crab fishery catch by subdistrict, 1974/75-2003.

Season	Subdistrict[a]	Vessels	Number of Landings	Number of Crab[b]	Harvest[b] (pounds)	Pots Pulled	Average Weight (pounds)	Average CPUE[c]	Deadloss (pounds)
1974/75	Southeastern		72	2,526,687	6,504,984	32,275	2.6	78	0
	Pribilofs		8	247,083	523,394	3,923	2.1	63	0
	TOTAL	28	80	2,773,770	7,028,378	38,462	2.5	72	0
1975/76	Southeastern		230	6,682,232	16,643,194	106,445	2.5	63	0
	Pribilofs		74	2,273,804	5,714,913	34,761	2.5	65	0
	TOTAL	66	304	8,956,036	22,358,107	141,206	2.5	63	0
1976/77	Southeastern		437	16,089,057	41,007,736	233,667	2.6	69	0
	Pribilofs		104	4,162,451	10,447,485	63,804	2.5	65	0
	TOTAL	83	541	20,251,508	51,455,221	297,471	2.5	68	0
1977/78	Southeastern		706	21,055,527	53,278,012	408,437	2.5	52	0
	Pribilofs		155	5,210,170	13,152,843	107,913	2.5	48	0
	TOTAL	120	861	26,350,688	66,648,954	516,350	2.5	51	218,099
1978/79	Southeastern		758	15,601,891	39,694,205	356,594	2.5	44	75,400
	Pribilofs		59	1,124,627	2,852,969	46,103	2.5	24	600
	TOTAL	144	817	16,726,518	42,547,174	402,697	2.5	42	76,000
1979/80	Southeastern		789	14,329,889	35,724,003	476,410	2.5	30	56,446
	Pribilofs		15	355,722	890,312	12,024	2.5	30	0
	TOTAL	152	804	14,685,611	36,614,315	488,434	2.5	30	56,446

-Continued-

Table 2-22. (page 2 of 4)

Season	Subdistrict[a]	Number of Vessels	Number of Landings	Number of Crab[b]	Harvest[b] (pounds)	Pots Pulled	Average Weight (pounds)	Average CPUE[c]	Deadloss (pounds)
1981	Southeastern		674	10,532,007	26,684,956	496,751	2.5	21	97,398
	Pribilofs		87	1,313,951	2,945,536	62,875	2.5	21	4,196
	TOTAL	165	761	11,845,958	29,630,492	559,626	2.5	21	101,594
1982	Southeastern		539	3,825,433	8,812,302	322,634	2.3	12	69,829
	Pribilofs		252	1,005,547	2,196,477	167,465	2.2	6	68,330
	TOTAL	125	791	4,830,980	11,008,779	490,099	2.3	10	138,159
1983	Northern		10	29,478	48,454	5,950	1.7	5	167
	Southeastern		287	1,984,673	4,633,354	192,538	2.3	10	52,879
	Pribilofs		151	272,505	592,073	83,528	2.2	3	6,983
	TOTAL	108	448	2,286,756	5,273,881	282,006	2.3	8	60,029
1984	Southeastern		91	470,181	1,099,142	44,546	2.3	11	4,688
	Pribilofs		43	46,759	109,081	16,811	2.3	3	337
	TOTAL	41	134	516,877	1,208,223	61,357	2.3	8	5,025
1985	Southeastern	38	143	1,278,109	3,139,041	96,976	2.4	13	14,096
	Pribilofs	15	23	5,365	12,457	7,731	2.3	1	0
	TOTAL	44	166	1,283,474	31,513,498	104,707	2.4	12	14,096
1986				FISHERY CLOSED					
1987				FISHERY CLOSED					

-Continued-

Table 2-22. (page 3 of 4)

Season	Subdistrict[a]	Number of Vessels	Landings	Crab[b]	Harvest[b] (pounds)	Pots Pulled	Average Weight (pounds)	CPUE[c]	Deadloss (pounds)
1988	Eastern	98	248	897,059	2,210,394	112,334	2.5	8	10,724
	Western	0	0	0	0	0	0	0	0
	TOTAL	98	248	897,059	2,210,394	112,334	2.5	8	10,724
1989	Eastern	109	359	2,907,021	7,012,965	184,892	2.4	16	34,664
	Western	0	0	0	0	0	0	0	0
	TOTAL	109	359	2,907,021	7,012,965	184,892	2.4	16	34,664
1990	Eastern		1,105	10,708,996	24,529,165	701,924	2.3	15	87,475
	Western		17	8,928	20,134	9,213	2.3	1	0
	TOTAL	179	1,032	10,717,924	24,549,299	711,137	2.3	15	87,475
1990/91	Eastern	255	1,756	16,608,625	40,081,555	883,391	2.4	19	210,769
	Western	0	0	0	0	0	0	0	0
	TOTAL	255	1,756	16,608,625	40,081,555	883,391	2.4	19	210,769
1991/92	Eastern	285	2,339	12,924,034	31,796,381	1,244,633	2.5	10	279,741
1992/93	Eastern	293	2,011	15,074,084	34,821,043	1,150,834	2.3	13	340,955
	Western	70	96	191,796	309,823	50,051	1.6	4	3,000
	TOTAL	294	2,084	15,265,880	35,130,866	1,200,885	2.3	13	343,955
1993/94	East of 168°[d]	283	347	1,696,430	4,114,949	250,501	2.4	7	103,715
	163° to 173°[e]	261	515	5,539,068	12,776,371	325,963	2.3	17	154,674
	TOTAL	296	862	7,235,498	16,891,320	576,464	2.3	13	258,389

-Continued-

Table 2-22. (page 4 of 4)

		Number of			Harvest[b]	Pots	Average		Deadloss
Season	Subdistrict[a]	Vessels	Landings	Crab[b]	(pounds)	Pulled	Weight (pounds)	CPUE[c]	(pounds)
1994	163° to 173°	183	349	3,351,639	7,766,886	249,536	2.3	13	132,780
1995	163° to 173°	196	256	1,877,303	4,233,061	247,853	2.3	8	44,508
1996	East of 168°[d]	192	195	393,257	994,776	75,753	2.5	5	8,464
	163° to 173°[e]	135	152	341,039	811,301	73,522	2.4	5	6,144
	TOTAL	196	347	734,296	1,806,077	149,275	2.5	5	14,608
1997 to 2003					FISHERY CLOSED				

[a] Prior to 1988, the subdistricts were: Southeastern, Pribilof, and Northern (includes the Norton Sound and General Sections).
[b] Deadloss included.
[c] Number of legal crabs retained per pot pull.
[d] Incidental harvest in Bristol Bay red king crab fishery.
[e] Directed Tanner crab fishery.

Table 2-23. Bering Sea District commercial Tanner crab fishery economic data, 1979/80-2003.

		Value		Season Length	
Year	GHL[a]	Exvessel (per lb.)	Total[b]	Days	Dates
1979/80	28-36	$0.52	$19.0	189	11/01-05/11
1981	28-36	$0.58	$17.2	88	01/15-04/15
1982	12-16	$1.06	$11.5	118	02/15-06/15
1983	5.6	$1.20	$6.2	118	02/15-06/15
1984	7.1	$0.95	$1.1	118	02/15-06/15
1985	3	$1.40	$4.3	149	01/15-06/15
1986		FISHERY CLOSED			
1987		FISHERY CLOSED			
1988	5.6	$2.17	$4.8	93	01/15-04/20
1989	13.5	$2.90	$20.3	110	01/15-05/07
1990[c]	29.5	$1.85	$45.3	89	01/15-04/24
1990/91	42.8	$1.12	$44.5	126	11/20-03/25
1991/92	32.8	$1.50	$47.3	137	11/15-03/31
1992/93	39.2	$1.69	$58.8	137	11/15-03/31
1993[d]	10.7	$1.90	$7.6	10	11/01-11/10
1993/94[e]	9.1	$1.90	$24.0	42	11/20-01/01
1994[e]	7.5	$3.75	$28.5	20	11/01-11/21
1995[e]	5.5	$2.80	$11.7	15	11/01-11/16
1996[d]	2.2	$2.51	$2.5	4	11/01-11/05
1996[e]	6.2	$2.48	$2.0	12	11/15-11/27
1997 to 2003		FISHERY CLOSED			

[a] Guideline harvest level, millions of pounds.
[b] Millions of dollars.
[c] Winter fishery.
[d] East of 168° West longitude (incidental to Bristol Bay red king crab).
[e] 163° -173° West longitude (directed fishery).

Table 2-24. Bering Sea District commercial Tanner crab fishery harvest composition by fishing season, 1972-2003.

Season	Average Weight (pounds)	Average Width (mm)	% New Shell
1972[a]	2.6	NA	NA
1973[a]	2.5	NA	NA
1974[a]	2	NA	NA
1974/75	2.5	NA	NA
1975/76	2.5	NA	NA
1976/77	2.5	NA	NA
1977/78	2.5	152.8	88.0
1978/79	2.5	152.7	95.0
1979/80	2.5	151.4	90.0
1981	2.5	149.4	86.6
1982	2.3	148.8	85.4
1983[b]	2.3	148.8	70.5
1984	2.3	146.5	40.0
1985	2.4	150.0	65.0
1986	FISHERY CLOSED		
1987	FISHERY CLOSED		
1988	2.5	143.5	70.2
1989	2.4	149.4	80.8
1990	2.3	148.1	96.5
1990/91	2.4	149.7	95.3
1991/92	2.5	150.4	93.2
1992/93	2.3	148.0	90.5
1993/94	2.4	150.7	93.9
1994	2.3	150.0	92.5
1995	2.3	149.3	58.6
1996[c]	2.5	152.1	46.6
1997 to 2003	FISHERY CLOSED		

[a] Incidental to the king crab fishery.

[b] Partial Bering Sea closure.

[c] Includes incidental catch with Bristol Bay red king crab and Tanner crab directed fishery totals.

NA: Not Available.

Table 2-25. Bering Sea District commercial snow crab fishery harvest data, 1978/79-2003.

Year	GHL[a]	Number of Vessels	Number of Landings	Number of Crab[b]	Harvest[b,c]	Pots Pulled	CPUE[d]	Deadloss[c]
1978/79		102	490	22,118,498	32,187,039	190,746	116	759,137
1979/80		134	597	25,286,777	39,572,668	255,102	99	228,345
1981	39.5-91.0	153	867	34,415,322	52,750,034	435,742	79	2,269,979
1982	16.0-22.0	122	803	24,089,562	29,355,374	469,091	51	1,092,655
1983[e]	15.8	109	461	23,853,647	26,128,410	287,127	83	1,324,466
1984[e]	49.0	52	367	24,009,935	26,813,074	173,591	138	798,795
1985[e]	98.0	75	718	52,903,246	65,998,875	372,045	142	1,064,184
1986[e]	57.0	88	992	76,499,123	97,984,539	543,744	141	1,378,533
1987[e]	56.4	103	1,038	81,307,659	101,903,388	616,113	132	978,449
1988[e]	110.7	171	1,285	105,716,337	135,354,637	776,907	136	3,260,020
1989[e]	132.0	168	1,341	112,618,881	149,455,848	663,442	170	1,844,682
1990[e]	139.8	189	1,565	128,977,638	161,821,350	911,613	141	1,796,664
1991[e]	315.0	220	2,788	265,123,960	328,647,269	1,391,583	191	3,464,036
1992	333.0	250	2,763	227,376,582	315,302,034	1,281,796	177	2,325,852
1993	207.2	254	1,836	169,558,842	230,787,000	971,046	175	1,573,952
1994	105.8	273	1,293	114,779,014	149,775,765	716,524	160	1,799,323
1995	55.7	253	869	60,611,411	75,252,677	506,802	117	1,287,169
1996	50.7	234	766	52,912,823	65,712,797	520,651	102	1,333,014
1997	117.0	226	1,127	99,975,539	119,543,024	754,140	133	2,351,555
1998[f]	225.9	229	1,767	186,543,734	243,341,381	891,268	207	2,893,945
1999[f]	186.2	241	1,630	143,296,568	184,529,821	899,043	158	1,828,313
2000[f]	26.4	229	287	23,265,802	30,774,838	170,064	137	338,057
2001[f]	25.3	207	293	17,185,523	23,382,046	176,930	97	429,884
2002[f]	28.5	191	403	23,303,975	30,252,501	307,666	76	582,589
2003[f,g]	23.7	192	230	21,637,019	26,341,958	139,903	155	665,199

[a] Guideline harvest level in millions of pounds.
[b] Deadloss included.
[c] In pounds.
[d] Number of legal crabs retained per pot pull.
[e] Partial district and subdistrict closures, see Table 2-26.
[f] General fishery only.
[g] Includes 181,457 pounds illegally taken in Russian waters.

Table 2-26. Bering Sea District commercial snow crab fishery season dates and area closures, 1977/78-2003.

Season	Opened	Closed	Comments
1977/78	09/15/77	09/23/78	Bering Sea District closure[a]
1978/79	11/01/78	09/03/79	Bering Sea District closure[a]
1979/80	11/01/79	08/15/80	Bering Sea District state closure
		09/03/80	Bering Sea District federal closure
1981	01/15/81	09/01/81	Bering Sea District closure[b]
1982	02/15/82	08/01/82	Bering Sea District closure[b]
1983	02/15/83	05/22/83	Bering Sea District closure south of 57°30' N. lat.[b]
		08/01/83	Bering Sea District closure north of 57°30' N. lat.[b]
1984	02/15/84	08/01/84	Bering Sea District closure south of 58° N. lat.[b]
		08/22/84	Bering Sea District closure north of 58° N. lat. to allow an orderly start to king crab season[b]
	09/15/84	12/31/84	Bering Sea District closure north of 58°N. lat. reopened after king season and Bering Sea District closure[b]
1985	01/15/85	05/08/85	Pribilof Subdistrict closure south of 58° N. lat.[b]
		08/01/85	Bering Sea District closure south of 58°39' N. lat.[b]
		08/22/85	Northern Subdistrict closure to allow an orderly start to king crab season[b]
	10/09/85	01/15/86	*Bering Sea District reopened, except east of 164° W. long. in Southeastern Subdistrict, *fishery was scheduled to close 12/31/85 but did not, it remained open until the start of the 1986 fishery
1986	01/15/86	04/21/86	Southeastern Subdistrict closure west of 164° W long.[b]
		06/01/86	Pribilof Subdistrict closure[b]
		08/01/86	Northern Subdistrict closure east of 175° W. long.[b]
		08/24/86	Northern Subdistrict closure west of 175° W. long.[b]
1987	01/15/87	04/12/87	Southeastern Subdistrict west of 164° W. long., and Pribilof Subdistrict closure
		06/01/87	Northern Subdistrict south of 60°30' N lat. and east of 178° W. long. closure

-Continued-

Table 2-26. (page 2 of 2)

Season	Opened	Closed	Comments
1987 (cont.)	01/15/87	06/22/87	Northern Subdistrict north of 60°30' N lat. and west of 178° W. long. closure
1988	01/15/88	03/29/88	Bering Sea District closure (Western Subdistrict to assist in an orderly closure)
	05/15/88	06/30/88	Western Subdistrict reopen and closure
1989	01/15/89	03/26/89	Eastern Subdistrict closure
		05/07/89	Western Subdistrict closure
1990	01/15/90	04/09/90	Eastern Subdistrict east of 165° W. long. closure
		04/24/90	Eastern Subdistrict west of 165° W. long. closure
		06/12/90	Western Subdistrict closure
1991	01/15/91	05/05/91	Eastern Subdistrict closure
		06/23/91	Western Subdistrict closure
1992	01/15/92	04/22/92	Bering Sea District closure
1993	01/15/93	03/15/93	Bering Sea District closure
1994	01/15/94	03/01/94	Bering Sea District closure
1995	01/15/95	02/17/95	Bering Sea District closure
1996	01/15/96	02/29/96	Bering Sea District closure
1997	01/15/97	03/21/97	Bering Sea District closure
1998	01/15/98	03/20/98	Bering Sea District closure
1999	01/15/99	03/22/99	Bering Sea District closure
2000	04/01/00	04/08/00	Bering Sea District closure
2001	01/15/01	02/14/01	Bering Sea District closure
2002	01/15/02	02/08/02	Bering Sea District closure
2003	01/15/03	01/25/03	Bering Sea District closure

[a] State managed domestic fishery.
[b] Concurrent state and federal date.

Table 2-27. 2003 Bering Sea snow crab fishery inseason harvest and effort projections.

		Projected					
Date	Report Day	Daily CPUE[a]	Pot lifts	Number of crabs	Daily Harvest[b]	Cumulative harvest[b]	Season CPUE[a]
(Jan) 16	1	73	2,179	161,518	197,052	197,052	74
17	2	114	14,972	1,709,055	2,085,047	2,282,099	109
18	3	136	15,310	2,063,748	2,517,772	4,799,871	121
19	4	152	15,571	2,327,809	2,839,927	7,639,798	130
20	5	149	16,307	2,388,727	2,914,247	10,554,045	134
21	6	158	15,917	2,478,908	3,024,268	13,578,313	139
22	7	157	12,642	1,972,501	2,406,451	15,984,764	141
23	8	151	15,130	2,279,766	2,781,314	18,766,078	142
24	9	153	16,785	2,567,630	3,132,508	21,898,586	144
25	10	152	18,906	2,464,428	3,006,602	24,905,188	142
Totals			143,719	20,414,089	24,905,188		142

[a] Number of legal crabs retained per pot pull.
[b] In pounds.

Table 2-28. Bering Sea District commercial snow crab fishery catch by statistical area, 2003.

Area	Number of Landings	Number of Crab[a]	Harvest[a,b]	Pots Pulled	Average CPUE[c]	Average Weight	Deadloss[b]
EASTERN SUBDISTRICT AREAS							
715600	3	5,347	6,791	185	29	1.27	35
715630	19	501,198	637,925	6,453	78	1.27	8,421
715700	3	54,305	67,231	520	104	1.24	1,253
725630	22	1,439,039	1,777,223	8,439	171	1.24	49,650
725700	20	1,076,681	1,307,713	6,342	170	1.21	29,076
725730	14	347,632	416,791	2,144	162	1.20	3,319
725800	8	200,820	247,022	2,162	93	1.23	10,181
Other[d]	13	306,305	395,911	3,060	100	1.29	4,659
Subtotal	102	3,931,327	4,856,607	29,305	134	1.24	106,594
WESTERN SUBDISTRICT AREAS							
735700	23	1,134,071	1,369,658	5,111	222	1.21	24,356
735730	47	3,021,445	3,628,171	16,436	184	1.20	48,174
735800	79	4,713,149	5,790,400	28,979	163	1.23	81,639
735830	25	1,343,353	1,609,513	9,169	147	1.20	31,812
735900	3	153,008	184,061	766	200	1.20	756
745800	27	740,910	888,446	6,281	118	1.20	14,188
745830	16	763,068	894,956	5,661	135	1.17	33,961
745900	12	104,596	130,880	1,068	98	1.25	1,304
745930	12	171,553	207,512	1,071	160	1.21	899
755900	13	663,271	799,870	3,689	180	1.21	35,382
755930	16	625,333	718,936	3,999	156	1.15	20,739
756000	3	3,090	3,194	151	20	1.03	63
765900	3	10,182	12,304	242	42	1.21	19
766000	6	41,464	50,149	532	78	1.21	1,064
755900	6	277,803	329,861	2,278	122	1.19	7,119
775930	32	1,752,751	2,103,897	12,619	139	1.20	38,410
776000	4	72,215	91,281	707	102	1.26	2,567
776030	3	27,169	23,160	90	302	0.85	388

-Continued-

Table 2-28. (page 2 of 2)

Area	Number of Landings	Number of Crab[a]	Harvest[a,b]	Pots Pulled	Average CPUE[c]	Average Weight	Deadloss[b]
785930	6	143,593	177,967	754	190	1.24	3,008
786000	8	520,549	629,824	2,662	196	1.21	183,490
786030	16	973,778	1,291,122	5,333	183	1.33	23,249
Other[e]	31	449,341	550,189	3,000	150	1.22	6,018
Subtotal	391	17,705,692	21,485,351	110,598	160	1.21	558,605
Total[f,g]	493	21,637,019	26,341,958	139,903	155	1.22	665,199

[a] Deadloss included.
[b] In pounds.
[c] Defined as catch of legal crabs per pot pull.
[d] Includes 12 statistical areas where less than three vessels made landings.
[e] Includes 13 statistical areas where less than three vessels made landings.
[f] General fishery only.
[g] Includes 181,457 pounds illegally taken in Russian waters.

Table 2-29. Bering Sea District commercial snow crab harvest by season and subdistrict, 1977/78-2003.

Season	Subdistrict	Number of Vessels	Number of Landings[a]	Number of Crab[b]	Harvest[b,c]	Pots Pulled	Average Weight[c]	CPUE[d]	Deadloss[c]
1977/78	Southeastern		33	1,063,872	1,439,959	11,560	1.4	92	NA
	Pribilof		5	203,674	276,165	1,687	1.4	121	NA
	TOTAL	15	38	1,267,546	1,716,124	13,247	1.4	96	NA
1978/79	Southeastern	101	476	21,279,794	31,102,832	184,491	1.5	115	659,137
	Pribilof	10	14	838,704	1,084,039	6,225	1.5	135	100,000
	TOTAL	102	490	22,118,498	32,187,039	190,746	1.5	116	759,137
1979/80	Southeastern	133	561	23,199,446	36,406,391	237,375	1.6	98	187,945
	Pribilof	19	36	2,087,331	3,166,777	17,727	1.5	118	40,400
	TOTAL	134	597	25,286,777	39,572,668	255,102	1.6	99	228,345
1981	Southeastern		624	24,498,642	37,866,229	309,304	1.6	79	1,475,078
	Pribilof		243	9,916,617	14,886,705	126,438	1.5	78	794,901
	TOTAL	153	867	34,415,322	52,750,034	435,742	1.5	79	2,269,979
1982	Southeastern		468	10,207,174	13,079,583	257,193	1.3	40	422,979
	Pribilof		335	13,882,388	16,276,421	211,898	1.2	66	669,676
	TOTAL	122	803	24,089,562	29,355,374	469,091	1.2	51	1,092,655
1983	Southeastern		153	3,553,281	4,197,304	94,470	1.2	38	165,298
	Pribilof		239	19,076,553	20,514,000	153,458	1.0	124	1,078,643
	Northern		69	1,223,813	1,417,106	39,199	1.1	31	80,525
	TOTAL	109	461	23,853,647	26,128,410	287,127	1.1	83	1,324,466

-Continued-

Table 2-29. (page 2 of 5)

Season	Subdistrict	Number of Vessels	Number of Landings[a]	Number of Crab[b]	Harvest[b,c]	Pots Pulled	Average Weight[c]	CPUE[d]	Deadloss[c]
1984	Southeastern		76	3,534,370	3,990,621	33,091	1.1	107	54,678
	Pribilof		230	17,909,096	19,727,493	112,078	1.1	160	708,706
	Northern		61	2,566,469	3,094,960	28,422	1.2	90	35,411
	TOTAL	52	367	24,009,935	26,813,074	173,591	1.1	138	798,795
1985	Southeastern	55	301	21,963,882	27,373,232	158,819	1.4	138	461,001
	Pribilof	60	301	24,089,526	29,804,093	142,937	1.2	169	505,146
	Northern	24	116	6,849,838	8,821,550	70,289	1.3	97	98,037
	TOTAL	75	718	52,903,246	65,998,875	372,045	1.3	142	1,064,184
1986	Southeastern	47	112	8,491,694	10,957,578	63,889	1.3	133	44,755
	Pribilof	80	508	39,851,767	50,525,150	281,337	1.3	142	472,342
	Northern	67	372	28,155,662	36,501,811	198,518	1.3	142	861,436
	TOTAL	88	992	76,499,123	97,984,539	543,744	1.3	141	1,378,533
1987	Southeastern	28	64	4,116,778	5,106,473	24,619	1.2	167	24,619
	Pribilof	94	458	38,604,802	47,676,734	261,337	1.2	148	261,337
	Northern	99	516	38,586,079	49,120,181	330,157	1.2	117	330,157
	TOTAL	103	1,038	81,307,659	101,903,388	616,113	1.2	132	978,449
1988	Eastern	162	770	59,811,702	75,781,258	431,310	1.3	139	775,104
	Western	151	515	45,904,635	58,278,927	335,597	1.3	137	2,484,916
	TOTAL	171	1,285	105,716,337	134,060,185	776,907	1.3	136	3,260,020
1989	Eastern	163	871	77,698,698	104,399,693	391,451	1.3	198	1,128,971
	Western	127	470	34,920,183	45,056,155	271,991	1.3	128	715,711
	TOTAL	168	1,341	112,618,881	149,455,848	663,442	1.3	170	1,844,682

-Continued-

Table 2-29. (page 3 of 5)

Season	Subdistrict	Number of Vessels	Number of Landings[a]	Number of Crab[b]	Harvest[b,c]	Pots Pulled	Average Weight[c]	CPUE[d]	Deadloss[c]
1990	Eastern	177	956	76,331,829	94,831,897	512,259	1.2	149	1,010,755
	Western	152	659	52,645,809	66,989,453	399,354	1.3	132	785,909
	TOTAL	189	1,565	128,977,638	161,821,350	911,613	1.3	141	1,796,664
1991	Eastern	218	2,013	190,139,612	240,090,666	912,751	1.3	208	1,593,021
	Western	186	867	74,984,348	88,556,603	478,832	1.2	157	1,871,015
	TOTAL	220	2,788	265,123,960	328,647,269	1,391,583	1.2	191	3,464,036
1992	Eastern	250	N/A	217,375,564	302,363,005	1,228,280	1.4	177	2,268,467
	Western	55	N/A	10,001,018	12,939,029	53,516	1.3	187	57,385
	TOTAL	250	2,763	227,376,582	315,302,034	1,281,796	1.4	177	2,325,852
1993	Eastern	251	1,384	110,760,099	151,328,721	675,996	1.4	164	1,108,520
	Western	185	633	58,798,743	79,458,279	295,050	1.4	199	465,432
	TOTAL	254	1,836	169,558,842	230,787,000	971,046	1.4	175	1,573,952
1994	Eastern	220	820	56,012,017	72,008,424	375,928	1.3	149	901,674
	Western	171	586	58,766,997	77,767,341	340,596	1.3	173	897,649
	TOTAL	273	1,293	114,779,014	149,775,765	716,524	1.3	160	1,799,323
1995	Eastern	217	627	32,630,348	39,736,986	313,910	1.2	104	657,051
	Western	153	357	27,981,063	35,515,691	192,892	1.3	145	630,118
	TOTAL	253	869	60,611,411	75,252,677	506,802	1.2	120	1,287,169
1996	Eastern	161	462	23,676,069	28,244,924	252,227	1.2	94	555,118
	Western	146	351	29,236,754	37,467,873	268,424	1.3	109	777,896
	TOTAL	234	766	52,912,823	65,712,797	520,651	1.2	102	1,333,014

-Continued-

Table 2-29. (page 4 of 5)

Season	Subdistrict	Number of			Harvest[b,c]	Pots	Average	CPUE[d]	Deadloss[c]
		Vessels	Landings[a]	Crab[b]		Pulled	Weight[c]		
1997	Eastern	225	1,040	88,486,602	105,648,771	649,319	1.2	136	2,115,217
	Western	83	164	11,488,937	13,894,253	104,821	1.2	110	236,338
	TOTAL	226	1,127	99,975,539	119,543,024	754,140	1.2	133	2,351,555
1998[e]	Eastern	228	1,724	177,781,444	232,485,209	855,393	1.3	205	2,787,292
	Western	44	88	8,762,290	10,856,172	35,875	1.2	242	106,653
	TOTAL	229	1,767	186,543,734	243,341,381	891,268	1.3	207	2,893,945
1999[e]	Eastern	236	1,386	102,209,222	134,135,696	656,276	1.3	156	1,237,770
	Western	121	388	39,646,982	48,565,812	242,767	1.2	163	590,543
	TOTAL	241	1,630	141,856,204	182,701,508	899,043	1.3	158	1,828,313
2000[e]	Eastern	168	217	15,269,109	20,941,389	110,127	1.4	139	200,748
	Western	82	91	7,996,693	9,833,449	59,937	1.2	133	137,309
	TOTAL	229	287	23,265,802	30,774,838	170,064	1.3	137	338,057
2001[e]	Eastern	163	219	8,877,103	12,575,815	114,044	1.4	78	224,266
	Western	85	115	8,308,420	10,806,231	62,866	1.3	132	205,618
	TOTAL	207	293	17,185,523	23,382,046	176,910	1.4	97	429,884

-Continued-

Table 2-29. (page 5 of 5)

Season	Subdistrict	Number of Vessels	Number of Landings[a]	Number of Crab[b]	Harvest[b,c]	Pots Pulled	Average Weight[c]	CPUE[d]	Deadloss[c]
2002[e]	Eastern	144	274	10,369,137	13,513,988	161,736	1.3	64	296,854
	Western	107	191	12,909,073	16,707,594	145,330	1.3	89	283,716
	TOTAL[f]	191	403	23,303,975	30,252,501	307,666	1.3	76	580,570
2003[e]	Eastern	66	102	3,931,327	4,856,607	29,305	1.2	134	106,594
	Western	158	155	17,705,692	21,485,351	110,598	1.2	160	558,605
	TOTAL[g]	192	257	21,637,019	26,341,958	139,903	1.2	155	665,199

[a] Number of subdistrict landings is greater than the total number of landings because a single vessel may fish in several statistical areas.
[b] Deadloss included.
[c] In pounds.
[d] Number of legal crabs retained per pot pull.
[e] General fishery only.
[f] Total harvest includes 30,919 pounds taken from an unidentified statistical area.
[g] Includes 181,457 pounds illegally taken in Russian waters.
NA: Not Available.

Table 2-30. Bering Sea District commercial snow crab fishery harvest composition by fishing season, 1978/79-2003.

Season	Average		Percent new	Percent <102 mm cw
	Weight (pounds)	Width (mm)	shell	landed
1978/79	1.5	113.1	83.0	NA
1979/80	1.6	118.1	90.0	NA
1981	1.5	117.0	79.2	NA
1982	1.2	109.4	78.0	NA
1983[a]	1.1	NA	NA	NA
1984[a]	1.1	105.4	78.0	NA
1985[a]	1.3	108.0	80.0	NA
1986[a]	1.3	109.5	73.7	NA
1987[a]	1.2	108.9	84.0	NA
1988[a]	1.3	109.5	71.2	NA
1989[a]	1.3	111.2	85.2	NA
1990[a]	1.3	109.1	97.4	NA
1991[a]	1.2	110.2	95.1	NA
1992	1.4	111.7	97.6	NA
1993	1.4	111.6	92.5	NA
1994	1.3	110.4	93.1	11.3
1995	1.2	108.6	89.6	17.2
1996	1.2	107.5	75.8	19.7
1997	1.2	107.3	96.5	17.3
1998[b]	1.3	111.1	97.0	7.3
1999[b]	1.3	110.3	97.7	8.0
2000[b]	1.3	111.3	95.2	6.5
2001[b]	1.4	111.3	95.2	5.3
2002[b]	1.3	110.4	69.0	12.2
2003[b]	1.2	107.2	83.8	10.2

[a] Partial district and subdistrict closures, see Table 2-26.
[b] General fishery only.
NA: Not Available.

Table 2-31. Bering Sea District commercial snow crab fishery economic data 1979/80-2003.

Year	Value		Registered	Seasor
	Exvessel	Fishery[a]	Pots[b]	Length[c]
1979/80	$0.21	$ 82.50	35,503	307
1981	$0.26	$ 13.10	39,789	229
1982	$0.73	$ 20.70	35,522	167
1983[d]	$0.35	$ 8.70	15,396	120
1984[d]	$0.30	$ 7.80	12,493	320
1985[d]	$0.30	$ 19.50	15,325	333
1986[d]	$0.60	$ 60.00	13,750	252
1987[d]	$0.75	$ 75.70	19,386	158
1988[d]	$0.77	$ 100.70	38,765	120
1989[d]	$0.75	$ 110.70	43,607	112
1990[d]	$0.64	$ 102.30	46,440	148
1991[d]	$0.50	$ 162.60	76,056	159
1992	$0.50	$ 156.50	77,858	97
1993	$0.75	$ 171.90	65,081	59
1994	$1.30	$ 192.40	54,837	45
1995	$2.43	$ 180.00	53,707	33
1996	$1.33	$ 85.60	50,169	45
1997	$0.79	$ 92.60	47,036	65
1998[e]	$0.56	$ 134.65	47,909	64
1999[e]	$0.88	$ 160.78	50,173	66
2000[e]	$1.81	$ 55.09	43,407	7
2001[e]	$1.53	$ 32.12	40,379	30
2002[e]	$1.49	$ 44.20	37,807	24
2003[e]	$1.83	$ 46.98	20,452	9

[a] Millions of dollars.
[b] Prior to 1992 includes Tanner crab gear.
[c] In days.
[d] Partial district and subdistrict closures, see Table 2-26.
[e] General fishery only.

Table 2-32. Bering Sea District commercial grooved Tanner crab fishery harvest data, 1992-2003.

Year	Number of Vessels	Number of Crabs[a]	Harvest[a,b]	Pots Pulled	Exvessel Value	Fishery Value[c]	Average Weight[b]	Average CPUE[d]	Deadloss
1992					CONFIDENTIAL				
1993	6	342,095	658,796	35,650	$0.94	$0.60	1.9	9	71,000
1994	4	165,365	332,454	13,739	$1.20	$0.40	2	11	30,585
1995	8	38,313	1,005,721	60,993	$1.40	$1.31	2.1	7	69,177
1996	3	40,849	106,886	14,504	$1.08	$0.10	2.1	3	11,186
1997-1999					NO LANDINGS				
2000	1				CONFIDENTIAL				
2001	1				CONFIDENTIAL				
2002					NO LANDINGS				
2003	1				CONFIDENTIAL				

[a] Deadloss included.
[b] In pounds.
[c] Millions of dollars.
[d] Number of legal crabs per pot lift.

Table 2-33. Bering Sea District commercial triangle Tanner crab fishery harvest data, 1992-2003.

	Number of			Pots	Exvessel	Fishery	Average		
Year	Vessels	Crabs[a]	Harvest[a,b]	Pulled	Value	Value[c]	Weight[b]	CPUE[d]	Deadloss
1992-1994					NO LANDINGS				
1995	4	41,914	49,007	22,180	$1.35	$0.05	1.2	1	14,147
1996	1				CONFIDENTIAL				
1997-1999					NO LANDINGS				
2000[e]	1				CONFIDENTIAL				
2001[e]	1				CONFIDENTIAL				
2002[e]					NO LANDINGS				
2003[e]	1				CONFIDENTIAL				

[a] Deadloss included.
[b] In pounds.
[c] Millions of dollars.
[d] Number of legal crabs per pot lift.
[e] Restricted to incidental harvest during grooved Tanner crab fishery.

Table 2-34. Bering Sea commercial hair crab fishery data, 1979-2003.

Year	Number of				Pots		Average		
	Vessels	Landings	Crabs[a]	Harvest[a,b]	Registered	Pulled	CPUE[c]	Weight[b]	Deadloss[b]
1979	11	16	2,457	5,213		9,908	<1	2.1	0
1980	9	17	25,417	53,914		14,506	2	2.1	0
1980/81	67	192	1,127,309	2,439,483		172,695	7	2.2	265,369
1981/82	48	159	466,560	932,584		117,518	4	2.0	29,749
1982/83	52	161	575,453	1,211,420		84,346	7	2.1	122,456
1983/84	19	48	200,670	406,538		20,414	10	2.0	28,062
1984[d]	7	26	197,209	396,630		22,392	9	2.0	19,436
1985[d]	3	9	34,410	66,042		3,905	9	2.0	593
1986	3	7	7,289	14,835		4,720	2	2.0	500
1987[e]	2				CONFIDENTIAL				
1988-90[d]					NO LANDINGS				
1991[d]	7	42	441,533	377,708		44,444	10	.9	0
1992[d,e]	9	20	203,758	240,767		38,808	5	1.2	11,495
1992[d,f]	10	47	1,127,948	1,198,590		125,943	9	1.1	65,674
1993[d,e]	4	5	2,347	3,038		9,345	<1	1.3	0
1993/94[d,f,g,h]	19	129	1,936,795	2,331,686		585,913	3	1.2	124,596
1994[d,f]	10	55	897,070	1,199,246	13,350	287,954	3	1.3	49,275
1995[d,f]	21	81	1,485,097	2,059,988	25,750	441,494	3	1.4	73,882

-Continued-

Table 2-34. (Page 2 of 2)

Year	Number of			Harvest[a,b]	Pots		Average		Deadloss
	Vessels	Landings	Crabs[a]		Registered	Pulled	CPUE[c]	Weight[b]	
1996[d]	19	99	485,735	745,804	20,680	410,548	1	1.5	32,495
1997[d]	16	52	420,121	668,096	18,180	211,970	2	1.6	17,522
1998[d]	12	31	188,784	307,739	14,330	128,495	2	1.6	17,392
1999[d]	8	27	139,894	221,656	9,840	92,333	1	1.6	4,677
2000[d]	3	3	1,058	1,546	3,900	3,300	<1	1.5	0
2001-2003[d]					FISHERY CLOSED				

[a] Deadloss included.
[b] In pounds.
[c] Number of legal crabs retained per pot pull.
[d] Permit Fishery.
[e] Spring Fishery.
[f] Fall Fishery.
[g] Fishery opened Nov. 1, 1993 and closed April 20, 1994.
[h] Includes seven vessels that landed hair crab incidental to Tanner crab.

Table 2-35. Bering Sea commercial hair crab fishery economic performance data, 1979-2003.

		Value		Season	
Year	GHL[a]	Exvessel[b]	Total[c]	Days	Dates
1979		$0.54	$.003	257	04/19-12/31
1980		$0.75	$0.04	244	01/01-08/30
1980/81		$0.80	$1.7	242	11/01-06/30
1981/82		$0.55	$0.5	288	11/01-08/15
1982/83		$0.65	$0.7	297	10/08-08/01
1983/84		$1.20	$0.5	335	08/01-06/30
1984		$1.60	$0.6	184	07/01-12/31
1985		$1.60	$0.1	365	01/01-12/31
1986		$1.15	$0.2	365	01/01-12/31
1987		CONFIDENTIAL		365	01/01-12/31
1988-90		NO LANDINGS		365	01/01-12/31
1991		$3.08	$1.2	365	01/01-12/31
1992		$2.25	$0.5	32	01/01-06/04
1992		$2.46	$2.8	156	10/01-11/01
1993		NA	NA	45	04/01-05/15
1993/94	3.0	$2.42	$5.3	171	11/01-04/20
1994	1.1	$3.55	$4.0	41	11/01-12/12
1995	1.8	$2.87	$5.7	25	11/01-11/26
1996	0.9	$2.65	$1.9	31	11/01-12/02
1997	0.8	$2.97	$1.9	25	11/01-11/25
1998	0.4	$2.70	$0.8	16	10/08-10/23
1999	0.3	$3.20	$0.7	37	10/30-12/07
2000	0.3	$3.84	$0.005	7	10/30-11/05
2001-2003			FISHERY CLOSED		

[a] Guideline harvest level, millions of pounds.
[b] Price per pound.
[c] In millions of dollars.
NA: Not Available.

Table 2-36. Bering Sea commercial octopus incidental harvest in groundfish fisheries, 1995-2003.

Year	Number of		Harvest[b]	
	Vessels	Landings[a]	Total[c]	Landed
1995[d]	30	76	17,730	11,967
1996	38	104	27,226	5,337
1997	27	47	12,232	6,997
1998	30	48	9,542	3,855
1999	7	8	6,961	376
2000	50	128	39,944	16,303
2001	62	163	50,947	8,982
2002	70	185	56,179	39,466
2003	78	237	122,423	94,462

[a] All landings incidental to other fisheries.
[b] Numbers from State Groundfish Tickets (Neptune database), in pounds.
[c] Discards at sea included.
[d] The 1995 directed fishery data is confidential, and is not included in this table.

Table 2-37. Bering Sea commercial snail catch data, 1992 - 2003.

	Number of		Number of Pots				Pounds	
Year	Vessels	Landings	Registered	Pulled	Harvest[a,b]	CPUE[c]	Per Pot[d]	Deadloss[b]
1992				CONFIDENTIAL				
1993	4	10	13,800	44,686	312,876	25	7	NA
1994	4	42	14,850	279,349	2,027,328	21	7.3	62,571
1995	4	38	18,800	262,096	2,352,825	28	9	22,371
1996	5	67	31,300	741,326	3,572,992	16	4.8	62,494
1997	3	17	14,500	191,893	932,048	16	4.9	77,131
1998-2003				NO LANDINGS				

[a] Deadloss included.
[b] In pounds.
[c] Number of snails per pot pull.
[d] Whole weight.
NA: Not Applicable.

Table 2-38. Bering Sea commercial snail fishery economic performance data, 1992-2003.

		Number of		Value	
Year	Harvest[a]	Vessels	Landings	Exvessel[b]	Total
1992			CONFIDENTIAL		
1993	312,876	4	10	$0.40	$125,150
1994	1,964,757	4	42	$0.34	$668,017
1995	2,330,454	4	38	$0.30	$699,136
1996	3,510,498	5	67	$0.30	$1,053,149
1997	854,917	3	17	$0.36	$307,770
1998-2003			NO LANDINGS		

[a] In pounds.
[b] Price per pound.

Table 2-39. North Peninsula District commercial Dungeness crab fishery data, 1992-2003.

Year	Number of Vessels	Number of Crabs[a]	Harvest[a,b]	Pots Pulled	Value Exvessel[c]	Value Total[d]	Average Weight[b]	Average CPUE[e]	Deadloss[b]
1992					NO LANDINGS				
1993	2				CONFIDENTIAL				
1994	2				CONFIDENTIAL				
1995	6	63,732	134,407	34,499	$1.32	$0.18	2.1	4	367
1996	1				CONFIDENTIAL				
1997	2				CONFIDENTIAL				
1998	1				CONFIDENTIAL				
1999					NO LANDINGS				
2000	1				CONFIDENTIAL				
2001					NO LANDINGS				
2002	3	11,173	21,871	2,431	$1.78	$0.04	2.0	5	236
2003					NO LANDINGS				

[a] Deadloss included.
[b] In pounds.
[c] Price per pound.
[d] Millions of dollars.
[e] Number of legal crabs per pot pull.

Table 2-40. The 2002-2005 Community Development Quota (CDQ) Program percent allocation by fishery to each participating CDQ group.

Fishery	Group[a]					
	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA
Bristol Bay Red King Crab	18	18	10	18	18	18
Pribilof Red & Blue King Crab	0	0	100	0	0	0
St. Mathew Blue King Crab	50	12	0	12	14	12
Norton Sound Red King Crab	0	0	0	0	50	50
Bering Sea Snow Crab	10	19	19	17	18	17
Bering Sea Tanner Crab	10	19	19	17	18	17

[a] APICDA (Aleutian Pribilof Island Community Development Association).
BBEDC (Bristol Bay Economic Development Corporation).
CBSFA (Central Bering Sea Fishermen's Association).
CVRF (Coastal Villages Region Fund).
NSEDC (Norton Sound Economic Development Corporation).
YDFDA (Yukon Delta Fisheries Development Association).

Table 2-41. The 1998-2003 crab Community Development Quota (CDQ) Program fisheries statistics.

Fishery	Allocation[a]	Number of Vessels	Number of Landings	Number of Crabs	Harvest[a,b]	Deadloss[a]	CPUE[c]
			Bristol Bay Red King Crab				
1998	525,115		Confidential				23
1999	580,641		Confidential				29
2000	610,265		Confidential				20
2001	617,623		Confidential				29
2002	714,239		Confidential				30
2003	1,167,040	13	20	174,651	1,166,662	2,197	30
			Pribilof Red King Crab				
1998	35,958 [d]		Confidential				6
1999			Fishery Closed				
2000			Fishery Closed				
2001			Fishery Closed				
2002			Fishery Closed				
2003			Fishery Closed				
			Pribilof Blue King Crab				
1998	35,958 [d]		Confidential				6
1999			Fishery Closed				
2000			Fishery Closed				
2001			Fishery Closed				
2002			Fishery Closed				
2003			Fishery Closed				
			St. Matthew Blue King Crab				
1998	99,512		Confidential				10
1999			Fishery Closed				
2000			Fishery Closed				
2001			Fishery Closed				
2002			Fishery Closed				
2003			Fishery Closed				
			Bering Sea Snow Crab				
1998	8,886,634	20	86	6,975,242	8,846,977	134,898	176
1999	9,674,326	23	104	7,747,876	9,670,084	92,871	167
2000	2,518,760		Confidential				144
2001	1,878,070		Confidential				98
2002	2,458,565	11	33	1,873,780	2,399,716	73,168	99
2003	2,120,637	10	29	1,747,935	2,119,027	18,379	120
			Bering Sea Tanner Crab				
1998			Fishery Closed				
1999			Fishery Closed				
2000			Fishery Closed				
2001			Fishery Closed				
2002			Fishery Closed				
2003			Fishery Closed				

[a] In pounds
[b] Includes deadloss.
[c] Defined as legal crabs per pot pull.
[d] Fishery was executed with an overall quota for both Pribilof red and blue king crab, harvest was tracked by species.

Table 2-42. The crab Community Development Quota (CDQ) Program economic overview.

Fishery	Harvest[a]	Exvessel Value	Fishery Value[b]	Average Weight[a]	Pots Registered	Pots Pulled
			Bristol Bay Red King Crab			
1998			Confidential			
1999			Confidential			
2000			Confidential			
2001			Confidential			
2002			Confidential			
2003	1,164,465	$ 4.67	$ 5,438,052	6.7	2,470	5,814
			Pribilof Red King Crab			
1998			Confidential			
1999			Fishery Closed			
2000			Fishery Closed			
2001			Fishery Closed			
2002			Fishery Closed			
2003			Fishery Closed			
			Pribilof Blue King Crab			
1998			Confidential			
1999			Fishery Closed			
2000			Fishery Closed			
2001			Fishery Closed			
2002			Fishery Closed			
2003			Fishery Closed			
			St. Matthew Blue King Crab			
1998			Confidential			
1999			Fishery Closed			
2000			Fishery Closed			
2001			Fishery Closed			
2002			Fishery Closed			
2003			Fishery Closed			
			Bering Sea Snow Crab			
1998	8,712,079	$ 0.54	$ 4,704,523	1.3	4,016	39,575
1999	9,577,213	$ 0.85	$ 8,140,631	1.2	5,250	46,490
2000			Confidential			
2001			Confidential			
2002	2,326,548	$ 1.33	$ 3,094,309	1.3	2,100	18,835
2003	2,100,648	$ 1.80	$ 3,781,166	1.2	1,670	14,583
			Bering Sea Tanner Crab			
1998			Fishery Closed			
1999			Fishery Closed			
2000			Fishery Closed			
2001			Fishery Closed			
2002			Fishery Closed			
2003			Fishery Closed			

[a]In pounds, live weight only.
[b]CDQ group portion estimated at 20 to 30% of fishery value.

Table 2-43. Pot limits for Bering Sea king and Tanner crab fisheries, 2003.

Fishery	GHL Range (Million Pounds)	Number of Vessels	Pot Limits <= 125' [a]	Pot Limits > 125' [a]
Bering Sea District snow crab [b]	15 >= or < 20	-	70	90
	20 >= or < 25	-	100	120
	>= 25	-	200	250
Eastern Aleutian District Tanner crab [c]	-	-	Total Allowable Pots 300	
St. Matthew Island Section king crab [d]	-	-	60	75
Pribilof District king crab [d]	-	-	40	50
Bristol Bay red king crab [e]	< 4.0	NA	NA	NA
	4.0 to 5.9	< 200	80	100
		200 to 250	60	75
		> 250	60	75
	6.0 to 8.9	< 200	120	150
		200 to 250	100	125
		> 250	100	125
	9.0 to 12	< 200	200	250
		200 to 250	160	200
		> 250	160	200
	> 12	Any	200	250
Petrel Bank red king crab [c]	-	-	Total Allowable Pots 1,250	

[a] Vessel Length Overall in feet.
[b] Multi-tier pot limits effective 2002.
[c] Total allowable pots divided into number of preseason registered vessels.
[d] Pot limits independent of number of registered vessels and GHL.
[e] Multi-tiered pot limits effective 1997.

Table 2-44. Number of Bering Sea buoy tags printed and issued by fishery, 2003.

Fishery	Number of Tags Ordered [a]	Tag Sets Issued		Total Sets	Tags Issued		Replct. Tags	Total Tags
		<= 125' [b]	> 125' [b]		<= 125' [b]	> 125' [b]		
South Peninsula grooved Tanner crab	Surplus Tags			NO FISHING EFFORT				
Pribilof red and blue king crab	Tags in Storage			NO COMMERCIAL FISHERY				
Pribilof red and blue king crab CDQ[c]	-			NO COMMERCIAL FISHERY				
Pribilof golden king crab	Surplus Tags	4	0	4	160	0	6	166
St. Matthew blue king crab	Tags in Storage			NO COMMERCIAL FISHERY				
St. Matthew blue king crab CDQ[c]	-			NO COMMERCIAL FISHERY				
Bristol Bay red king crab	65,000	176	76	252	31,175	18,023	0	49,198
Bristol Bay red king crab CDQ[c]	Surplus Tags	6	7	13	953	1,517	0	2,470
Bering Sea Tanner Crab	Tags in Storage			NO COMMERCIAL FISHERY				
Bering Sea Tanner Crab CDQ[c]	-			NO COMMERCIAL FISHERY				
Bering Sea snow crab	Surplus Tags	128	64	192	12,772	7,680	5	20,457
Bering Sea snow crab CDQ[c]	Surplus Tags	22	11	33	748	473	0	1,221
Total	65,000	336	158	494	45,808	27,693	11	73,512

[a] Tags ordered in sets of 250, then separated for each fishery pot limit.
[b] Vessel Length Overall in feet.
[c] Community Development Quota.

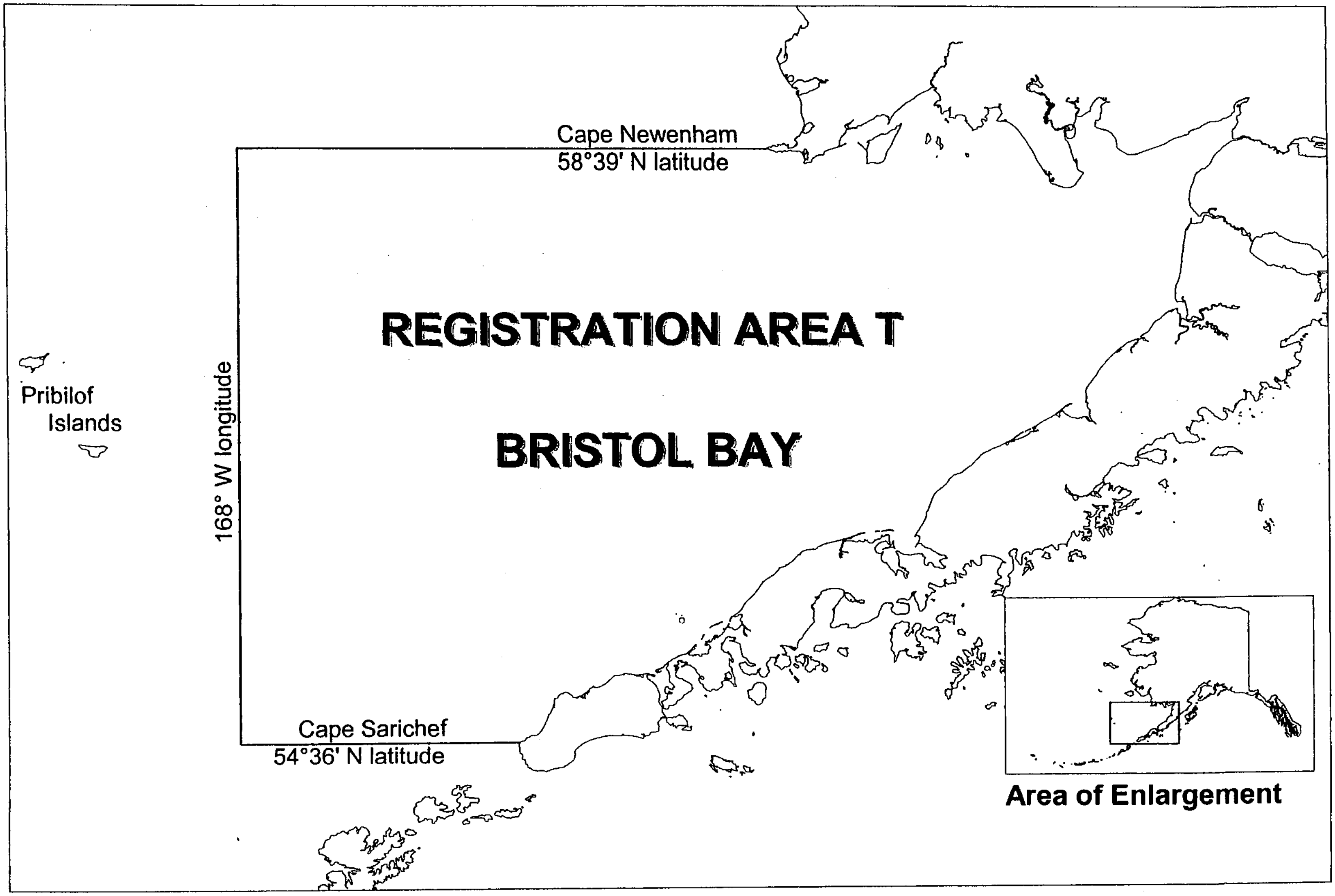


Figure 2-1. King crab Registration Area T (Bristol Bay).

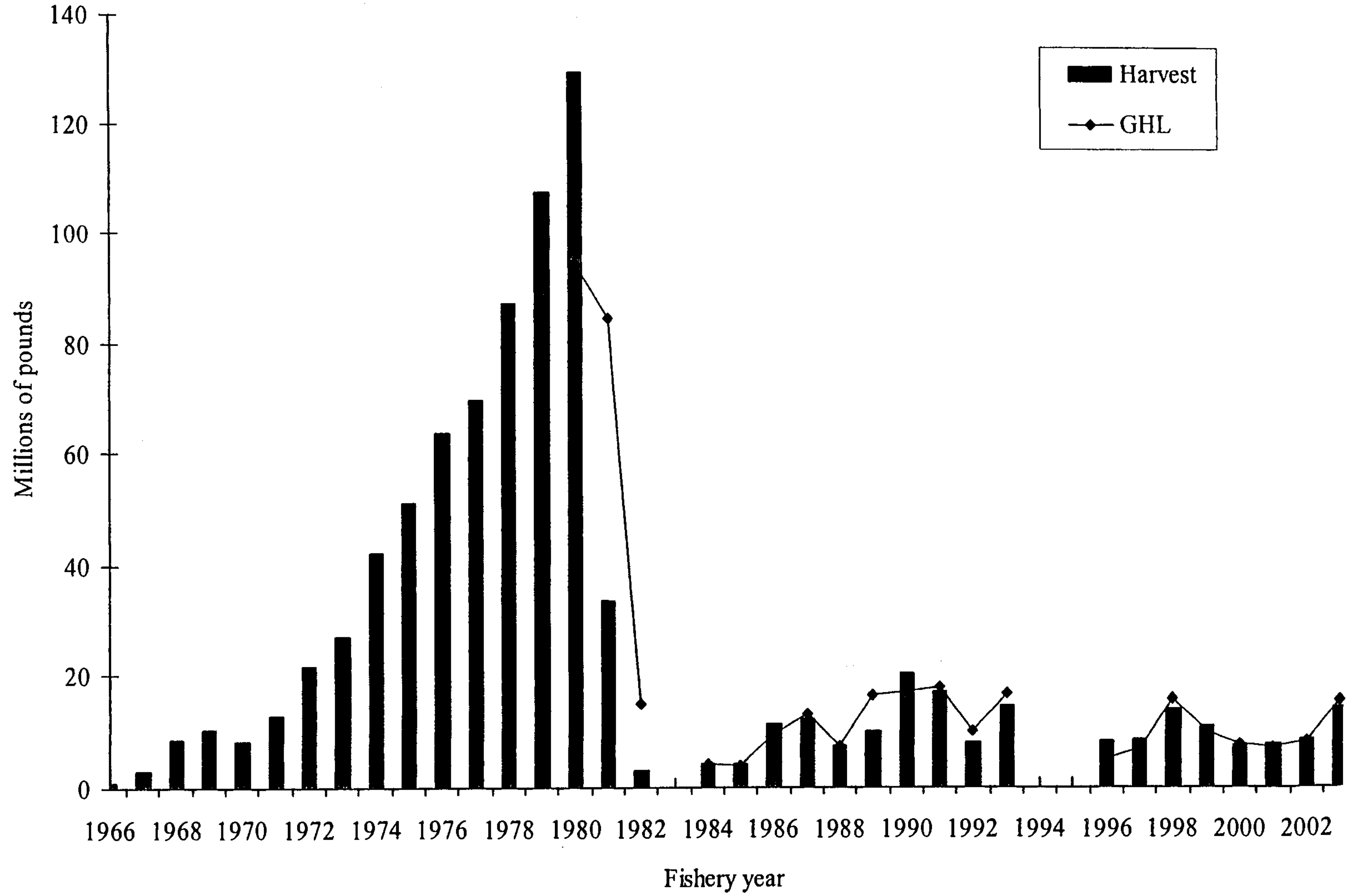


Figure 2-2. Bristol Bay commercial red king crab fishery harvest and guideline harvest levels, 1966-2003.

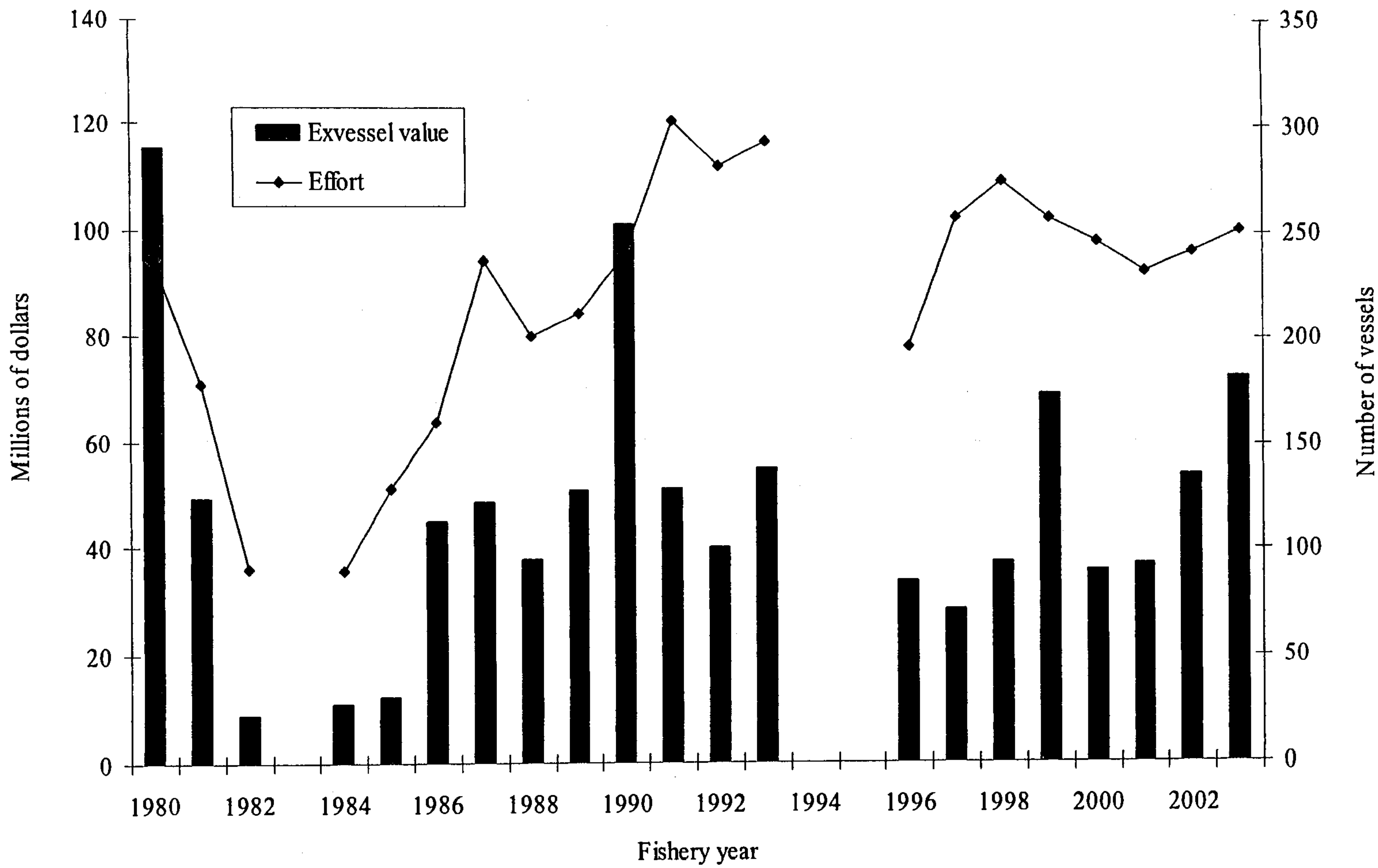


Figure 2-3. Bristol Bay commercial red king crab fishery effort and exvessel value, 1980-2003.

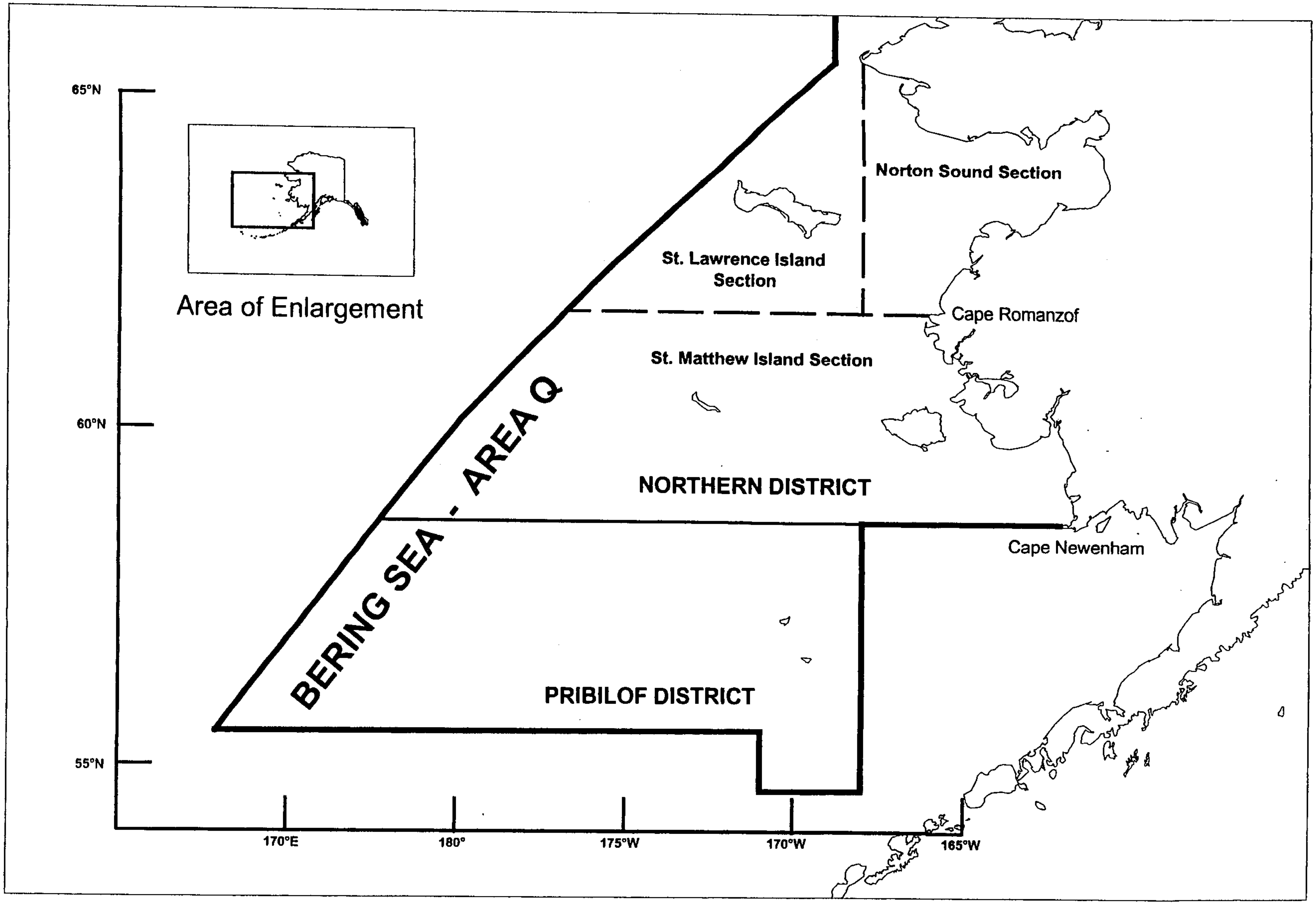


Figure 2-4. King crab Registration Area Q (Bering Sea).

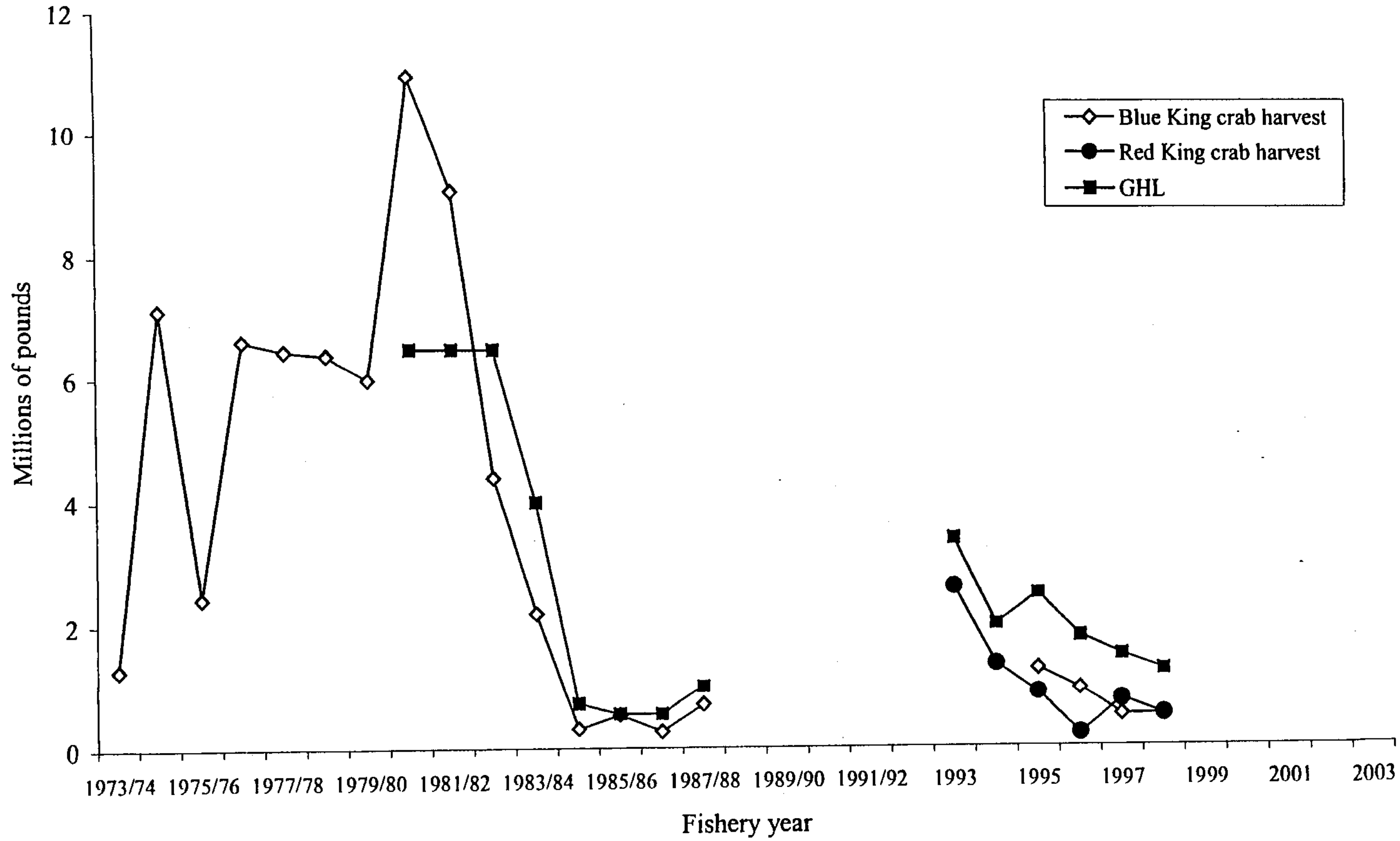


Figure 2-5. Pribilof District red and blue king crab harvest and guideline harvest level (GHL) 1973-2003. GHL for red and blue king crab is combined from 1995 onward.

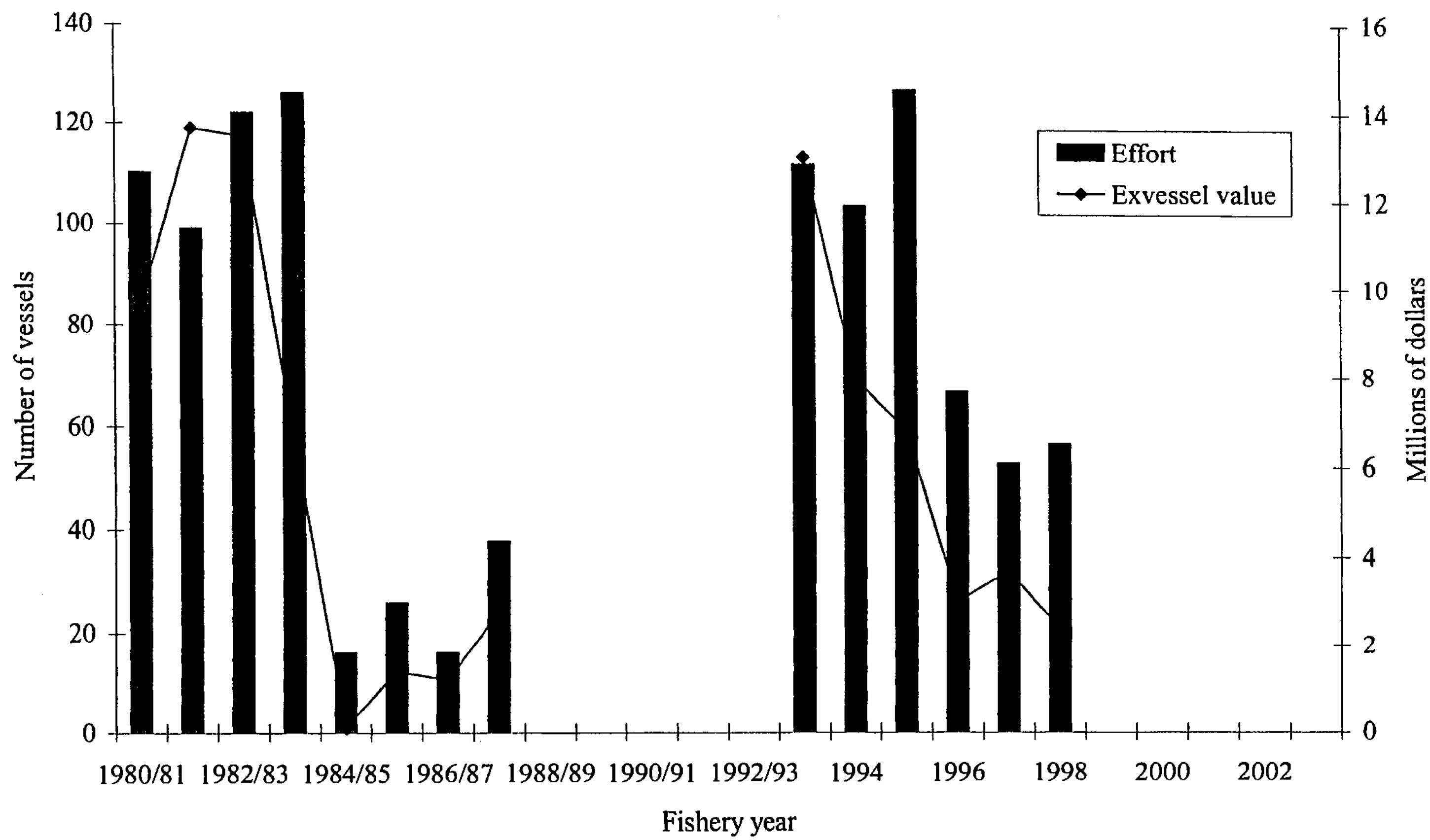


Figure 2-6. Pribilof District commercial red and blue king crab fishery effort and exvessel value, 1980-2003.

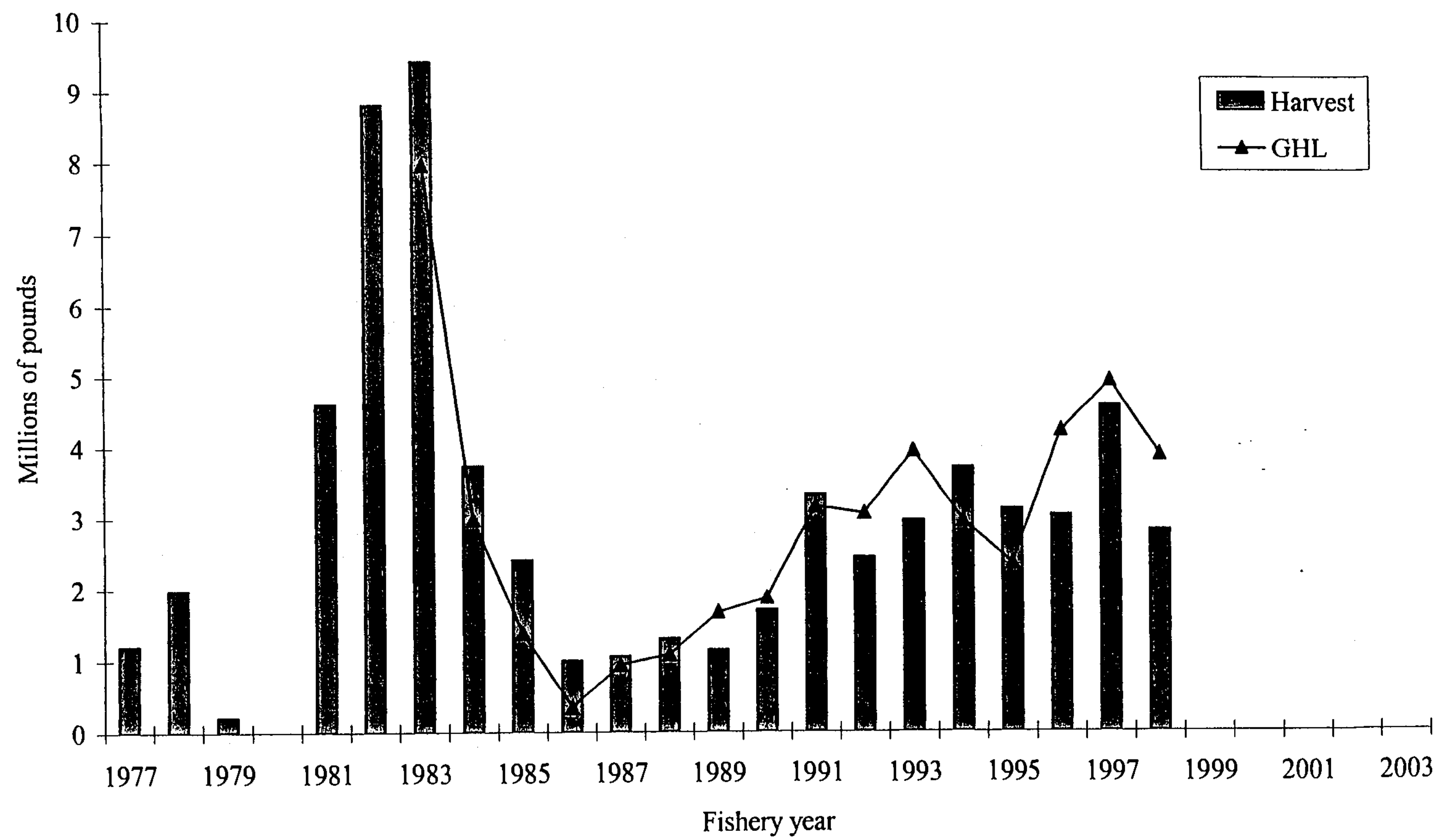


Figure 2-7. Saint Matthew Island Section commercial blue king crab fishery harvest and guideline harvest level, 1977 - 2003.

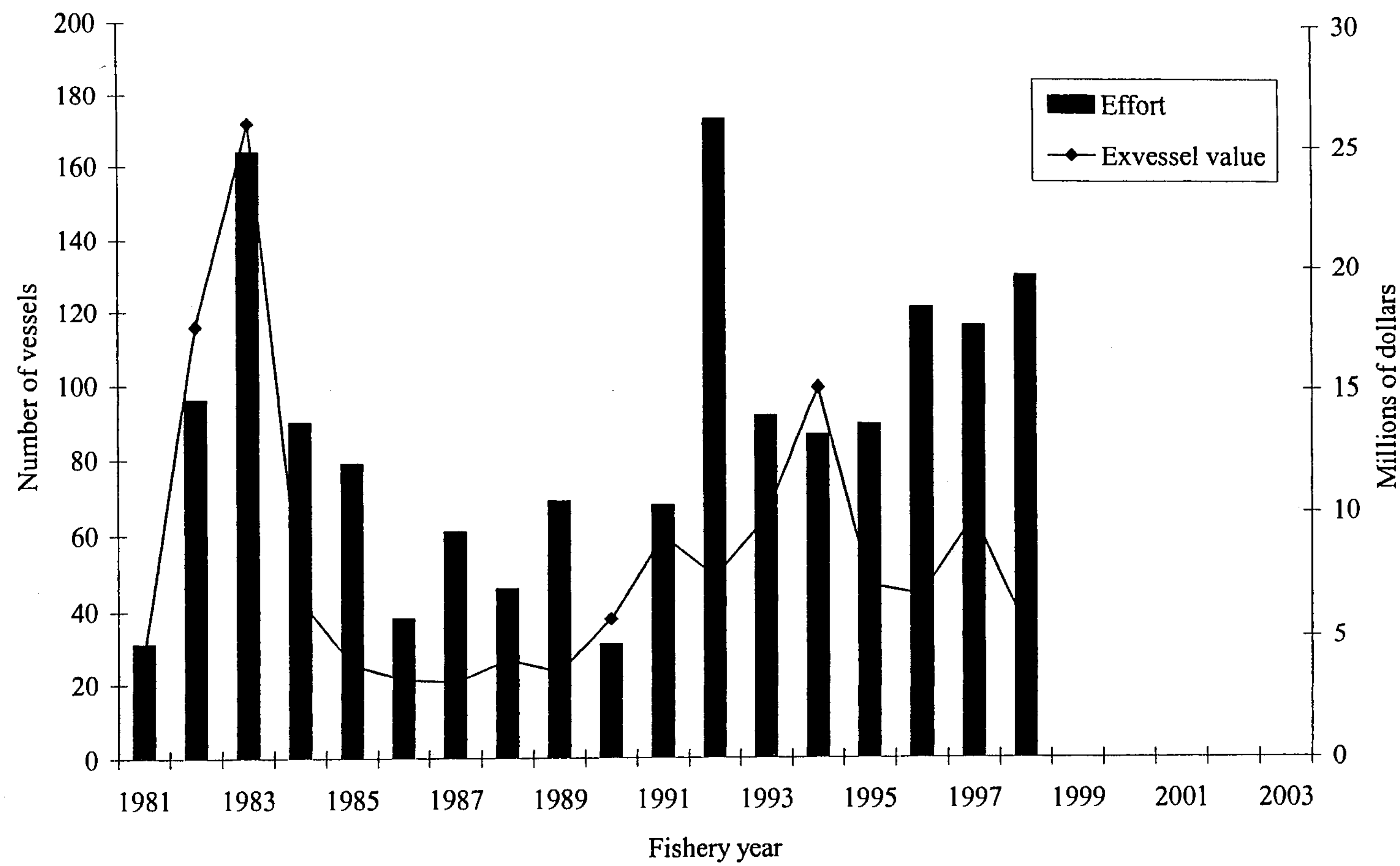


Figure 2-8. Saint Matthew Island Section commercial blue king crab fishery effort and exvessel value, 1981-2003.

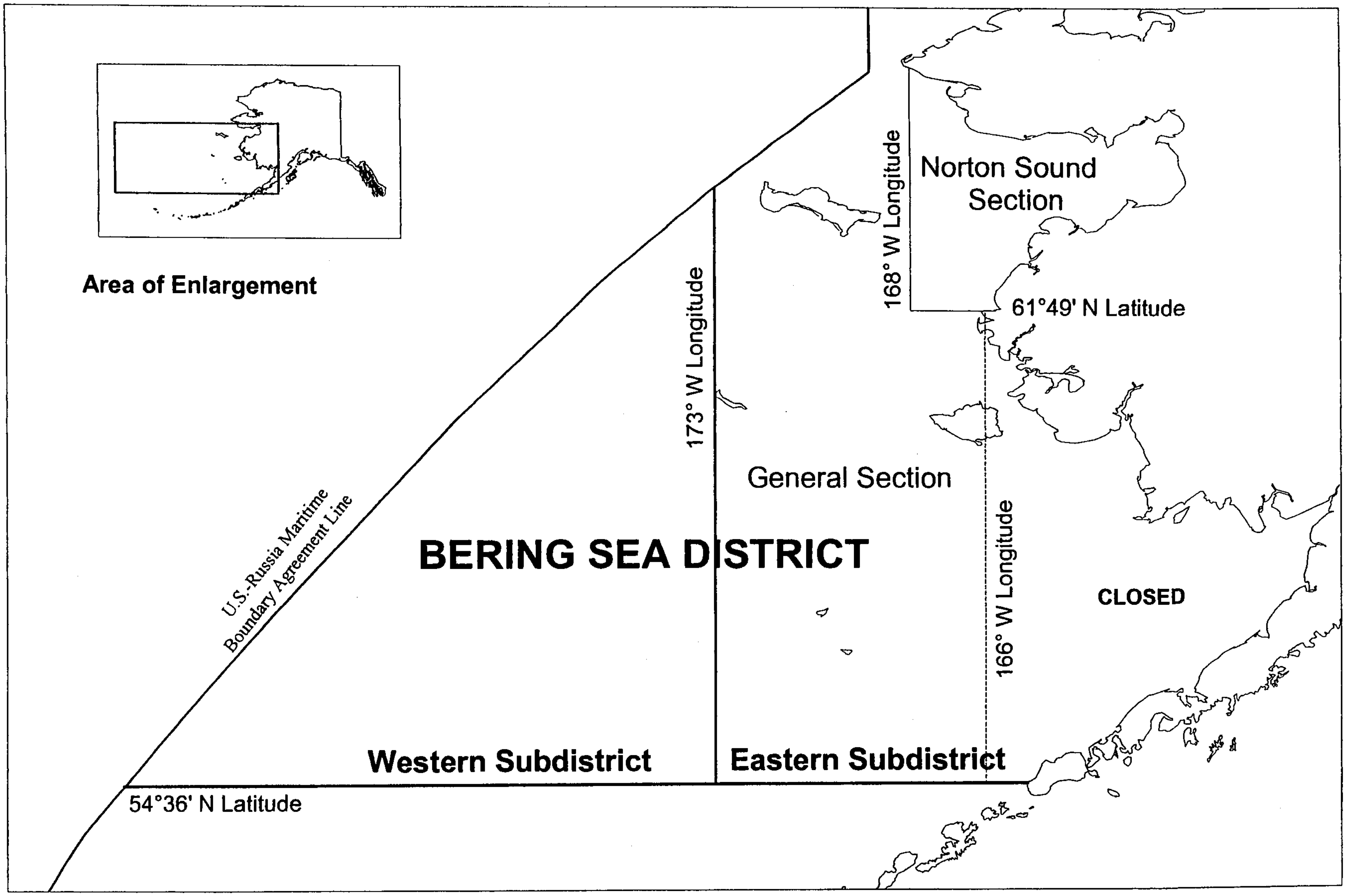


Figure 2-9. Bering Sea District of Tanner crab Registration Area J including subdistricts and sections.

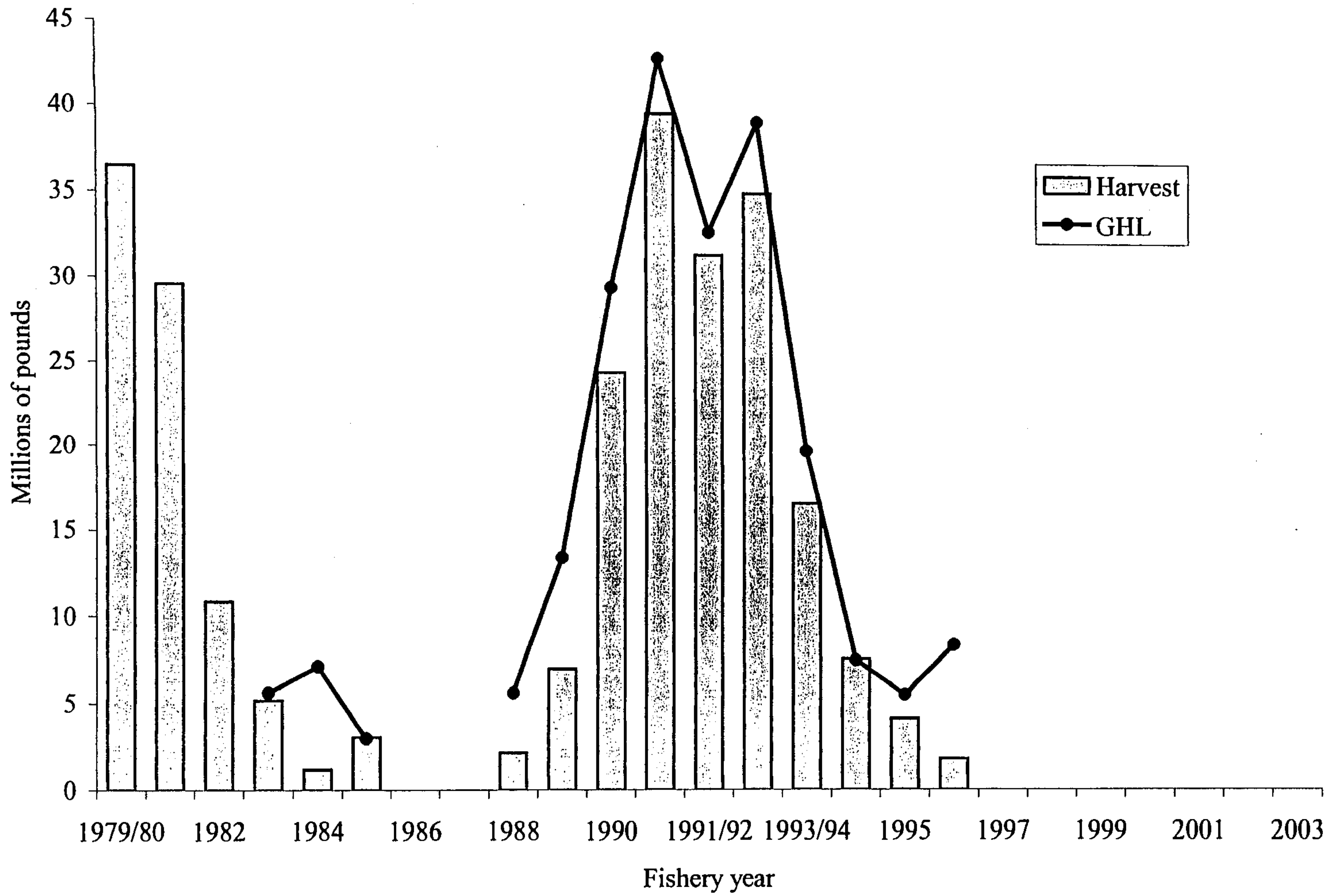


Figure 2-10. Bering Sea District commercial Tanner crab harvest and guideline harvest levels, 1979-2003.

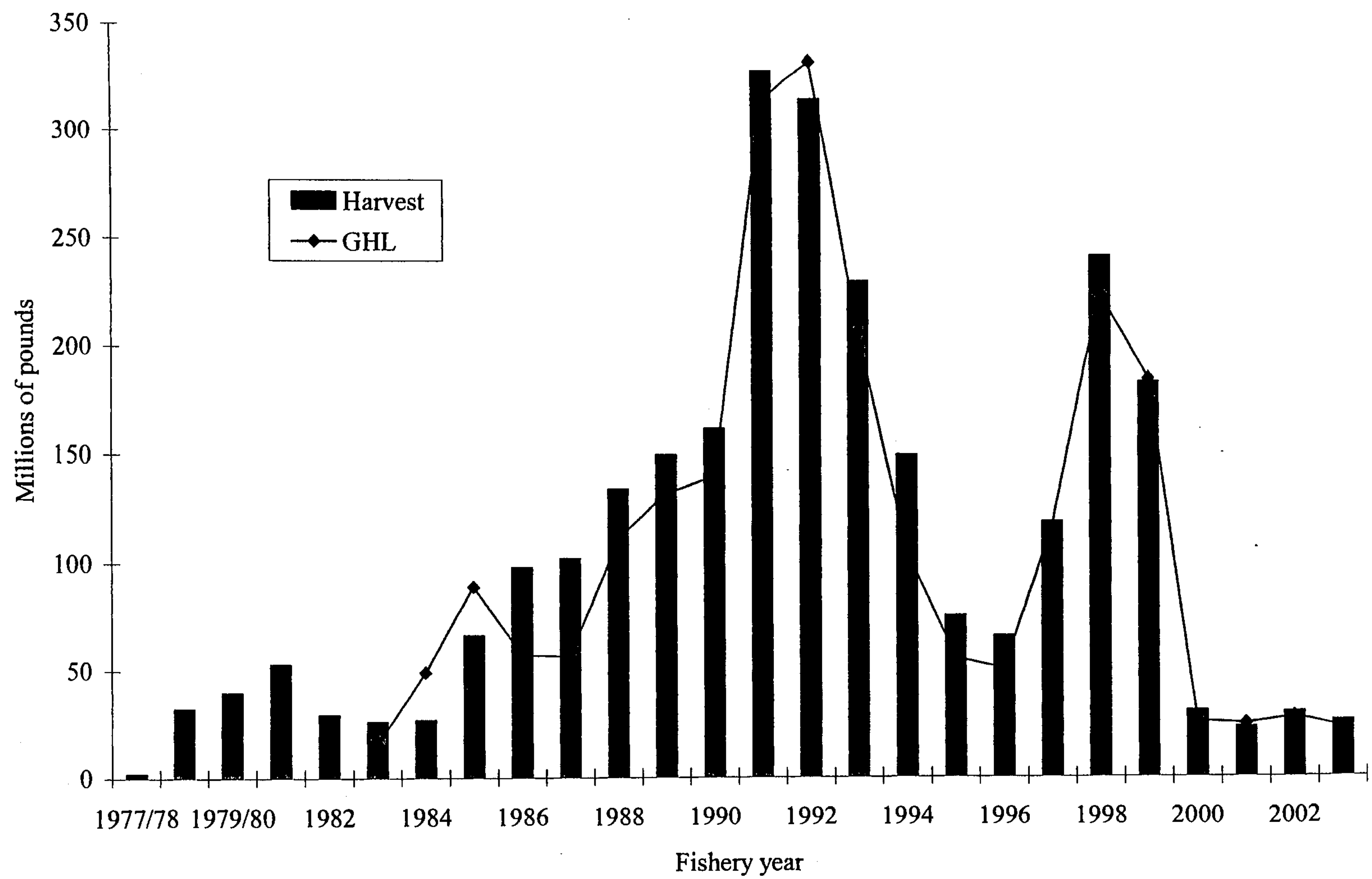


Figure 2-11. Bering Sea District commercial snow crab fishery harvest and guideline harvest level, 1977-2003.

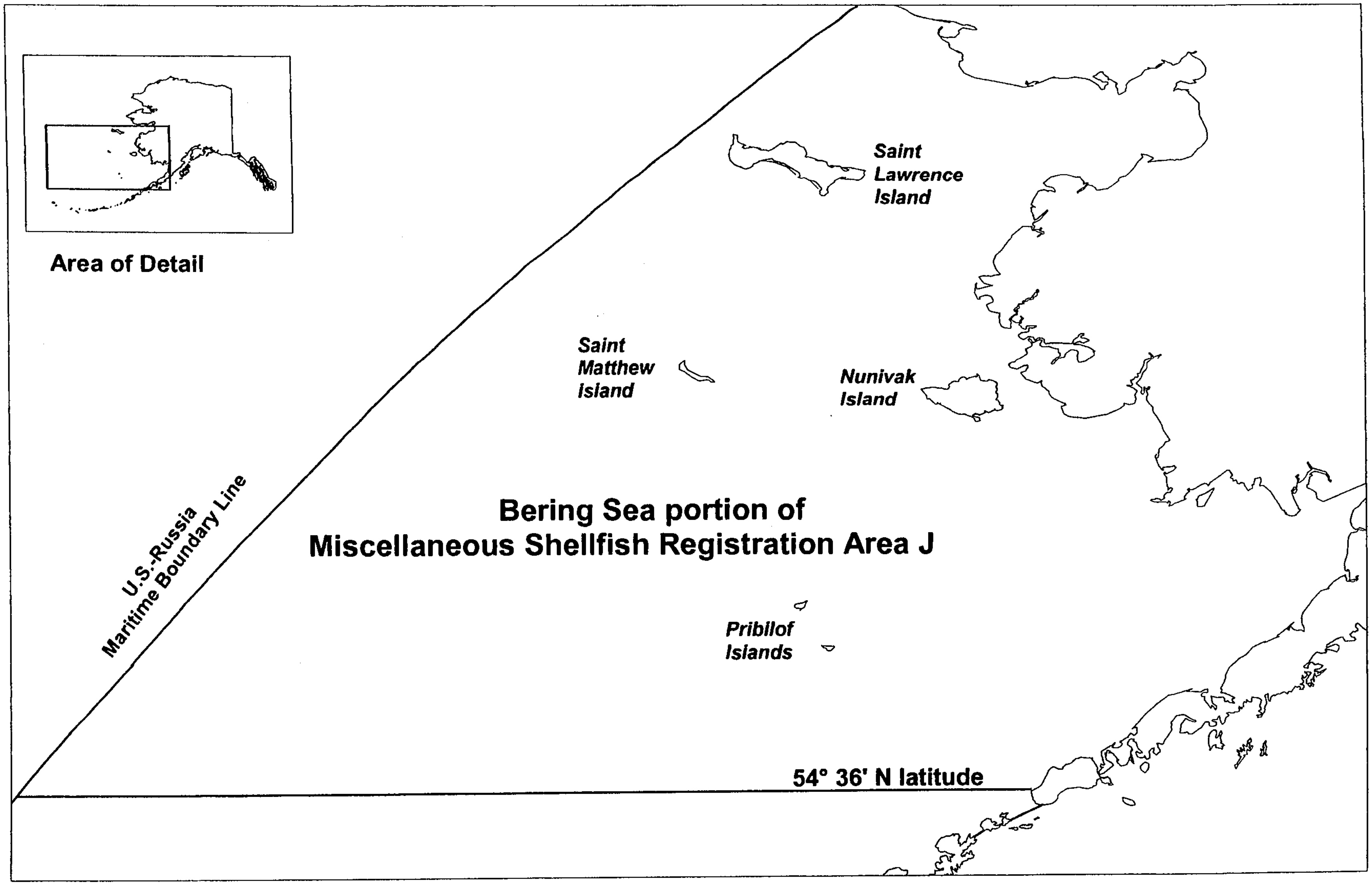


Figure 2-12. Bering Sea portion of miscellaneous shellfish Registration Area J.

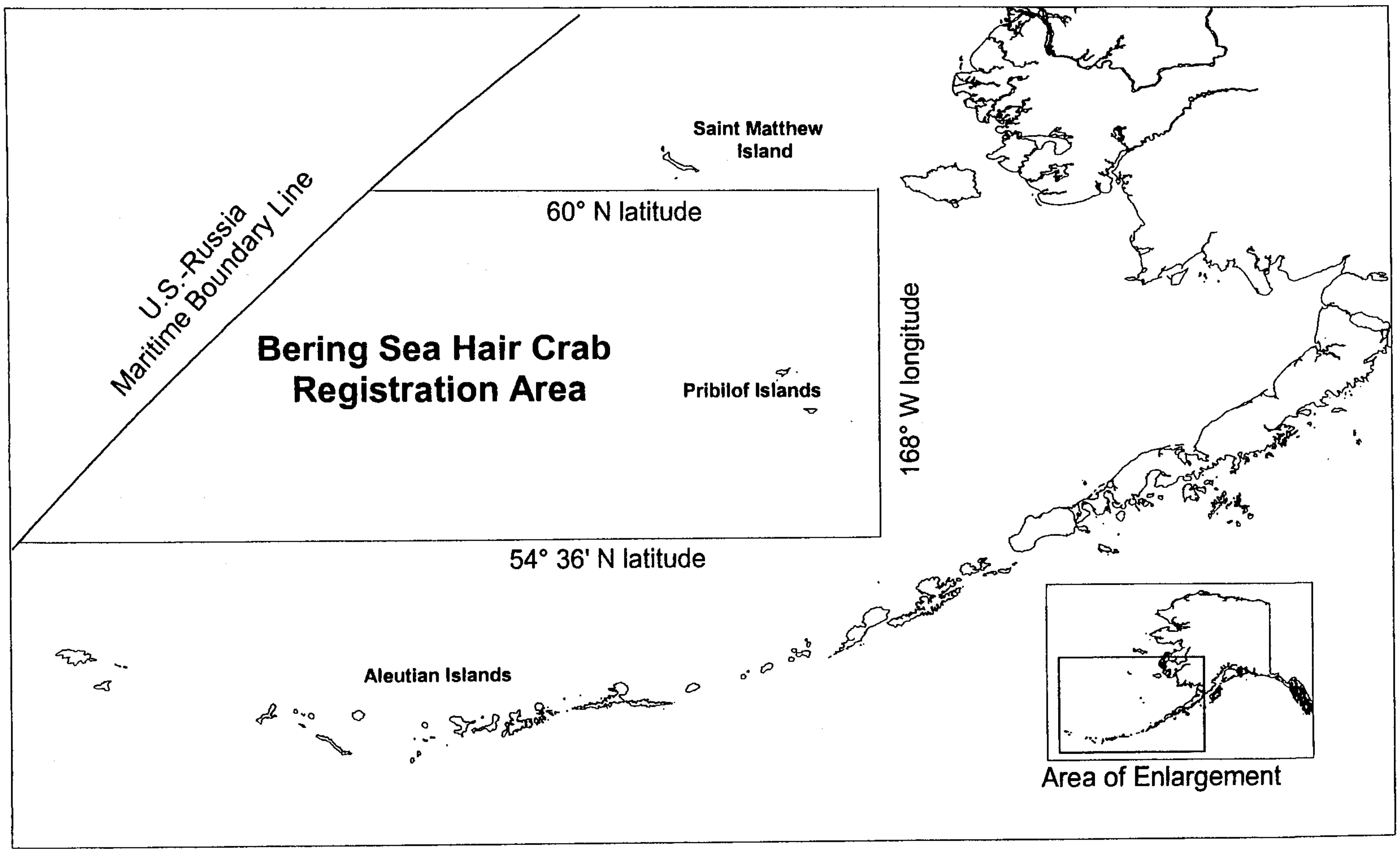


Figure 2-13. Bering Sea hair crab fishing area of miscellaneous shellfish Registration Area J.

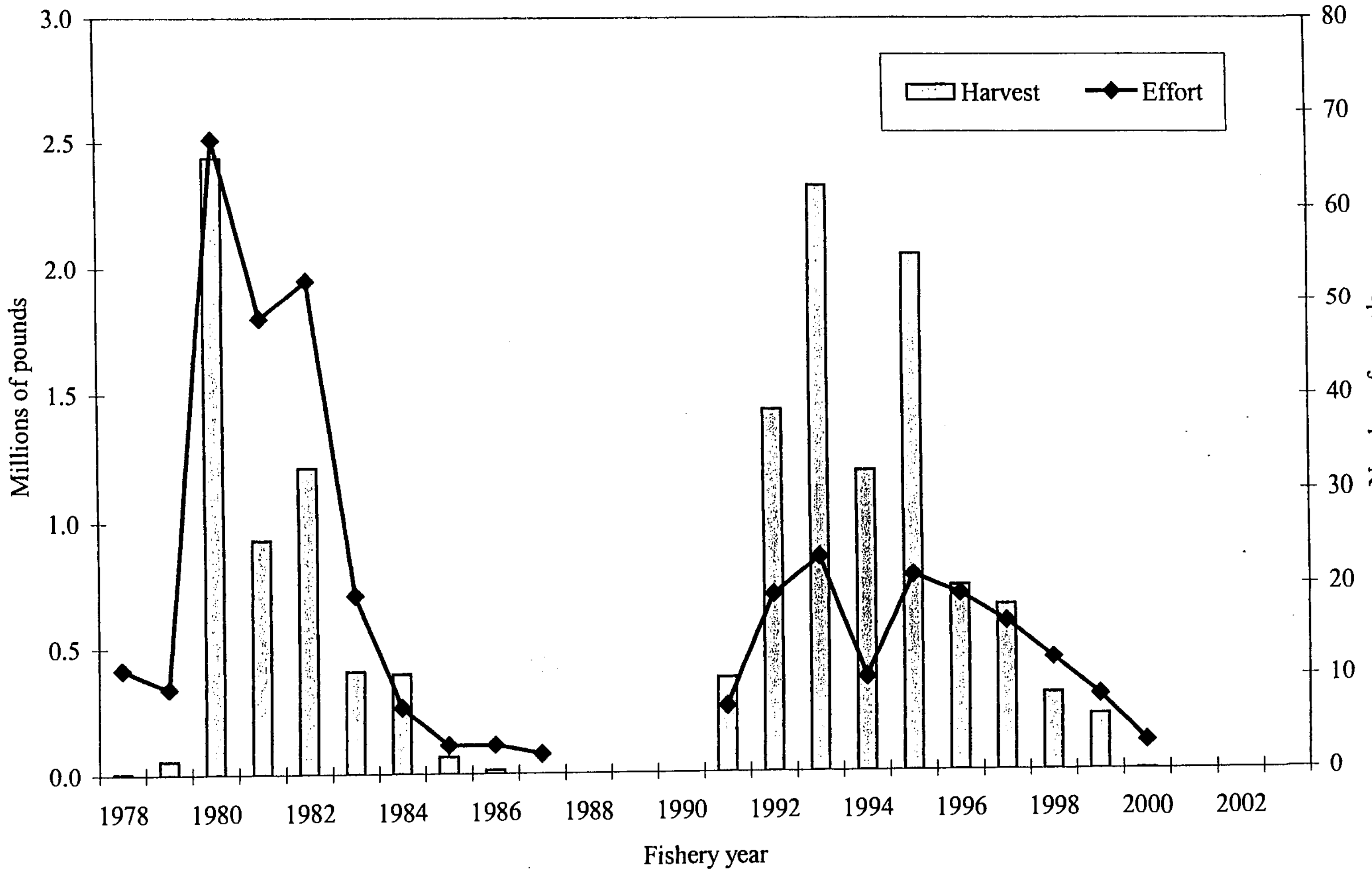


Figure 2-14. Bering Sea commercial hair crab fishery harvest and effort, 1978-2003.

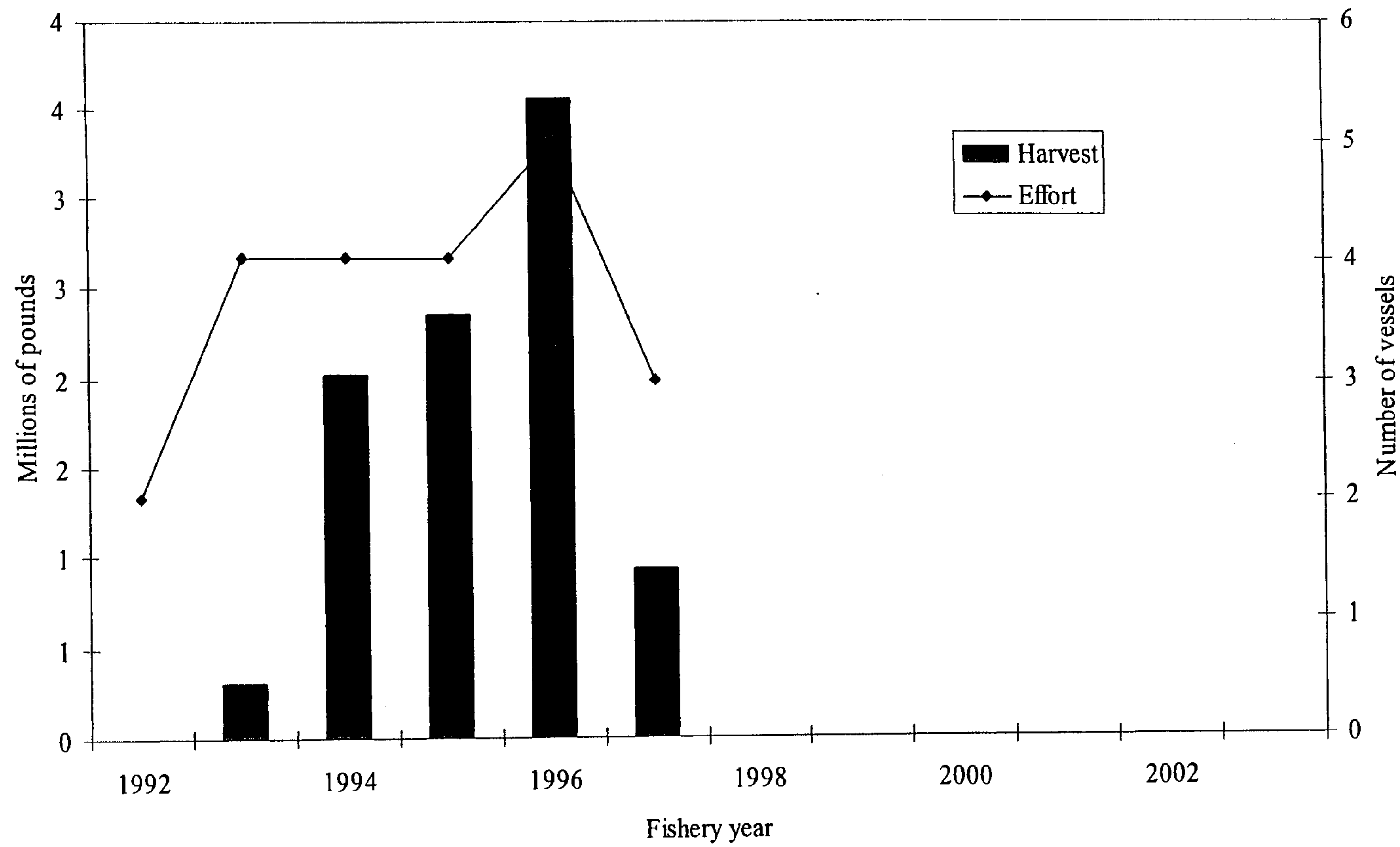


Figure 2-15. Bering Sea commercial snail fishery harvest and effort, 1992 - 2003.

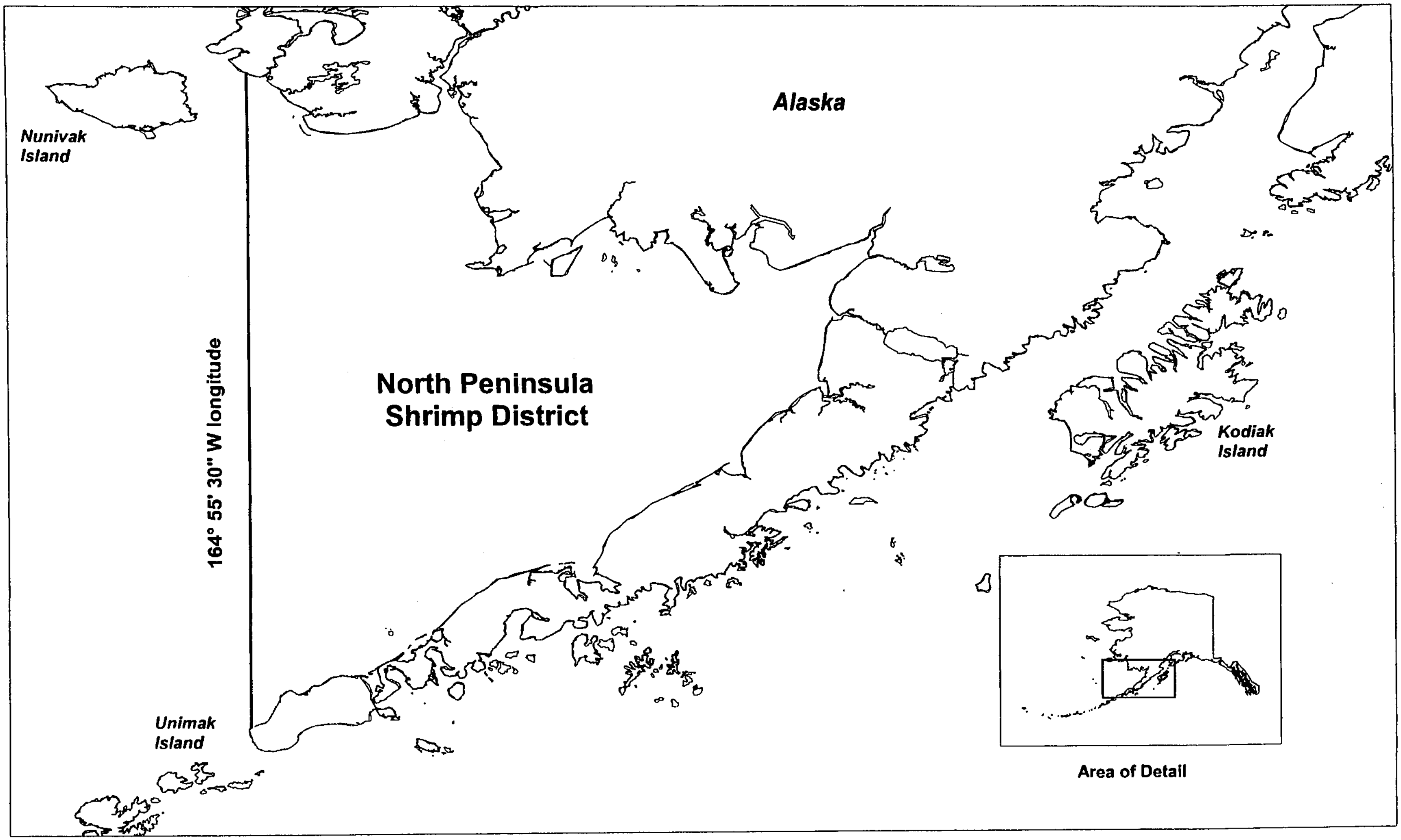


Figure 2-16. North Peninsula District of shrimp Registration Area J.

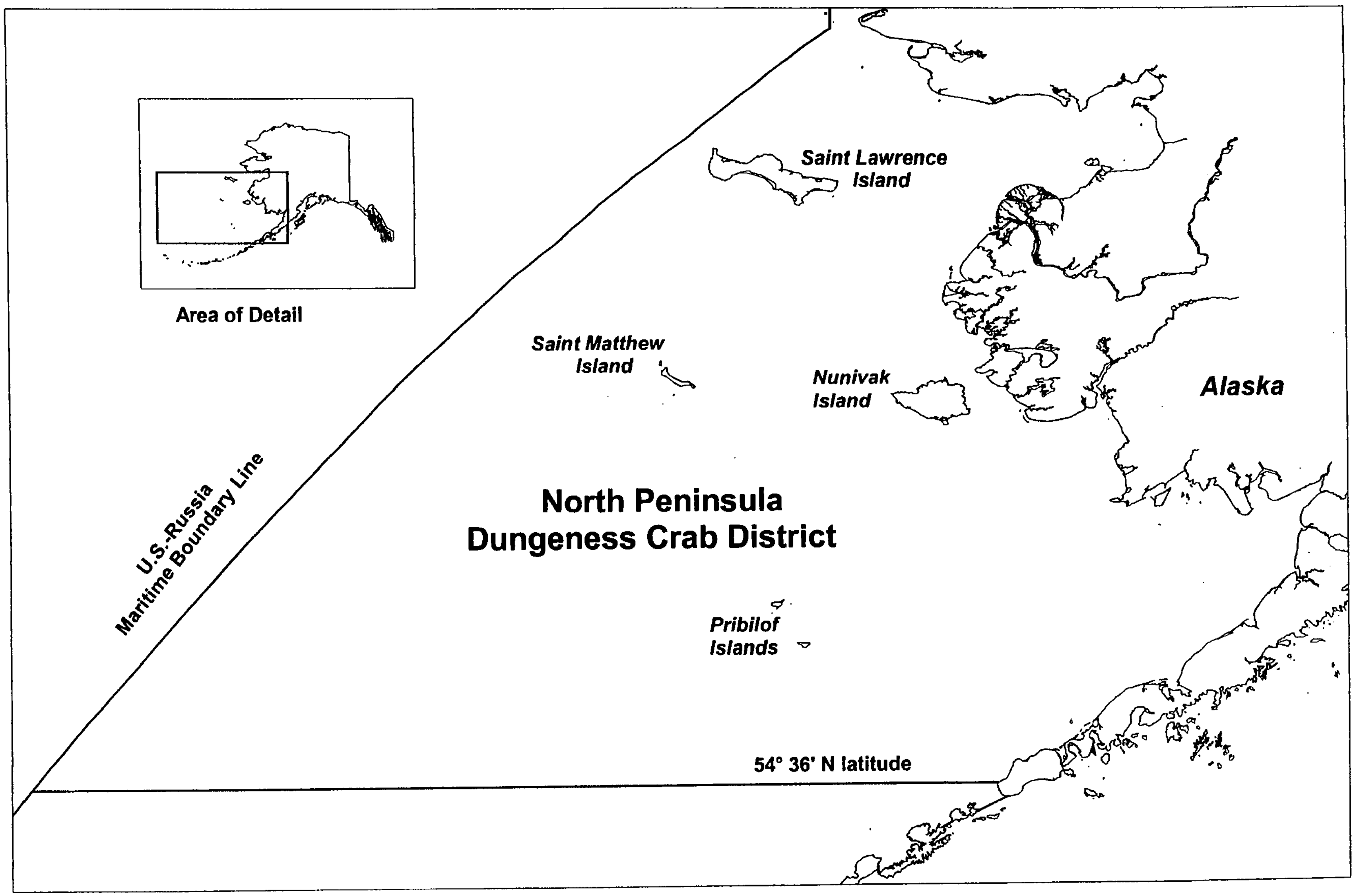


Figure 2-17. North Peninsula District of Dungeness crab Registration Area J.

Annual Report of the Onboard Observer Program for the Westward Region Crab and Statewide Scallop Fisheries

By

Mary Schwenzfeier
Shari Coleman
Jeff Barnhart
Melissa Salmon
and
Krista Milani

Dutch Harbor Area Office
P.O. Box 920587
Dutch Harbor, Alaska 99692

INTRODUCTION

Onboard observer data collection and fishery monitoring is an integral component of fisheries management. The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1996 states in Findings (8) "The collection of reliable data is essential to the effective conservation, management, and scientific understanding of the fishery resources of the United States" (U.S. Department of Commerce 1996).

The State of Alaska Shellfish Onboard Observer Program has evolved to help meet the MSFCMA National Standards. The Alaska Department of Fish and Game (ADF&G) commercial shellfish fishing regulation 5 AAC 39.645. SHELLFISH ONBOARD OBSERVER PROGRAM, states that onboard observers afford the only practical mechanism of gathering essential biological and management data in particular fisheries, and provide the only effective means to enforce regulations that protect the shellfish resource.

This report summarizes the activities of the ADF&G crab and scallop observer programs for calendar year 2003. Observer deployment activities in all observer-monitored crab fisheries are outlined for the 2003 fisheries, with the exception of the 2002/2003 Aleutian Islands golden king crab fishery. Scallop observer deployment activities are summarized for the 2003/2004 regulatory seasons.

HISTORY OF SHELLFISH OBSERVER PROGRAMS

Crab Observer Program

In April 1988, the Alaska Board of Fisheries (BOF) adopted regulations requiring observers on all vessels that process king crabs *Paralithodes spp.* and *Lithodes spp.*, and Tanner crabs *Chionoecetes bairdi* within waters under the jurisdiction of the state. The observer requirement was prompted by historic catch information collected by ADF&G, which suggested illegal processing of undersized and female crabs by catcher-processors (C/Ps) in the Bering Sea and Aleutian Islands (BSAI) fisheries. Catcher-processor reports showed consistently higher catch rates compared to catcher-only vessels (C/Vs). These regulations resulted in creation of the Shellfish Onboard Observer Program. At inception, the primary program goals were to monitor compliance of sex and size regulations of retained crabs and collect data for inseason management of BSAI fisheries. The cost of providing onboard observers is borne by the at-sea processors. The first observer deployments occurred in September 1988 during the Bristol Bay red king crab *Paralithodes camtschaticus* fishery.

In the spring of 1990, the BOF broadened observer coverage to include vessels processing snow crabs *Chionoecetes opilio.* This change was considered necessary based on reports of undersized Tanner crabs being processed and labeled as snow crabs. The BOF also defined observer qualification standards and observer duties and responsibilities. In the fall of 1991, the BOF adopted observer certification and decertification standards.

In 1993, the requirement to carry shellfish observers as a condition of the permit for fishing hair crabs *Erimacrus isenbeckii* in the Bering Sea was enacted. Regulations implemented in 1994 allow the department to require, as a condition of the commissioner's permit, 100% observer coverage on vessels targeting grooved Tanner crabs *C. tanneri,* triangle Tanner crabs *C. angulatus,* scarlet king crabs *Lithodes couesi,* and cherry crabs *Paralomis multispinus.* Management and research of these fisheries rely almost completely on observer-collected data to determine the impacts of fishing activities. In 1995, shellfish observers were required on all vessels fishing for king crabs in the Aleutian Islands Registration Area.

An Amendment to the MSFCMA provided for the development and implementation of a Community Development Quota (CDQ) program for crab fisheries occurring in the Bering Sea. The CDQ amendment was incorporated into the existing state-managed shellfish fisheries in 1998. Six separate CDQ groups are designated for the Bering Sea: Bristol Bay Economic Development Corporation (BBEDC), Coastal Villages Region Fund (CVRF), Central Bering Sea Fishermen's Association (CBSFA), Yukon Delta Fisheries Development Association (YDFDA), Norton Sound Economic Development Corporation (NSEDC), and Aleutian Pribilof Island Community Development Association (APICDA). Crab fisheries included in the CDQ program are Bristol Bay red king crab, Norton Sound red king crab, St. Matthew blue king crab *Paralithodes platypus*, Pribilof red and blue king crab, and Bering Sea Tanner and snow crab. Observer coverage levels have varied since initiation of the CDQ program, but all participating groups must adhere to the observer requirements regardless of vessel type.

In 1998, Congress passed the American Fisheries Act (AFA), which gave eligible walleye pollock *Theragra chalcogramma* fishers, exclusive fishing privileges in the Bering Sea walleye pollock fishery. To protect the interests of fishers not directly benefited by the AFA, sideboards were established for AFA boats qualified to participate in specific Bering Sea crab and statewide scallop fisheries. Partial observer coverage levels are required for the AFA fleet.

Since the inception of the observer program, the number of C/Ps participating in various BSAI fisheries has decreased, therefore reducing the number of deployed observers. Consequently, observer data no longer provided a representative sample of the fleet's activities in a particular fishery, thus hampering the department's ability to adequately monitor harvests and bycatch information. Therefore in 1999, the BOF granted ADF&G full authority and responsibility for deploying observers on any vessel participating in BSAI crab fisheries. The BOF also established a 15-member Crab Observer Oversight Task Force (COOTF) comprised of crab industry representatives to provide program recommendations to ADF&G. In addition to the pay-as-you-go funding mechanism, where vessels secure and pay for observer coverage, the BOF endorsed funding for additional observer deployments through ADF&G cost-recovery fishing. The test-fish funded portion of the program was initiated July 1, 2000. A detailed history of Alaska's Mandatory Shellfish Observer Program is in Boyle and Schwenzfeier (2000).

With an rapid increase in observer participation on catcher-only vessels, observer training and logistic efforts could not meet industry demands. Therefore in 2002 in an effort to address observer shortages, the BOF relaxed conflict of interest standards by increasing an observer's time on any one vessel in 12 consecutive months from 90 days to 120 days in particular fisheries. Additionally, as an effort to retain observers in spite of shorter fishing seasons, trainee permits may be extended to 365 days, and 270 days for crab and scallop observers, respectively, so that a trainee may gain the experience needed to obtain full certification.

Scallop Observer Program

From the inception of Alaska scallop fisheries in 1967 through mid-May 1993, management of the Westward Region scallop fisheries employed minimal management measures. Scallop dredges were restricted to rings four inches or greater inside diameter. Closed waters and seasons were established to protect crabs and crab habitat (Barnhart 2003).

During the early 1990s, an influx of vessels from the east coast of the U.S. into the Alaska weathervane scallop *Patinopecten caurinus* fishery, prompted concerns from both the scallop industry and ADF&G about scallop resource conservation and impacts on depressed stocks of red king crab and Tanner crabs (Barnhart 2003). Between 1990 and 1993 statewide scallop harvests were at levels comparable to those between 1968 and 1973, which proved to be unsustainable. Reduced scallop abundance was at least partly responsible for the fishery collapse in the 1970s (Kruse 1994). Therefore, the weathervane scallop fishery was designated as a high impact emerging fishery on May 21, 1993 and was closed until an interim management plan could be completed (Barnhart and Sagalkin 1998). The resulting interim Alaska Scallop Fishery Management Plan, effective July 1, 1993, included: (1) a requirement for 100% onboard observer coverage, (2) regulations that limited efficiency and slowed the pace of the fishery, (3) regulations that reduced the capture rate of small scallops, and (4) crab bycatch limits. Regulations specifically prohibited the use of mechanical shucking machines and chafing gear, restricted the number and size of dredges, required a minimum ring size, and allowed for no more than 12 crewmembers per vessel. A history of the weathervane scallop fisheries management is detailed in Barnhart (2000) and Barnhart (2003).

Data collection efforts in the early years of the observer program focused on detailed examination of crab bycatch and collection of baseline data relative to scallop biology. Since that time, data collection has evolved and expanded to help answer specific questions related to resource management. Data are collected on crab and halibut bycatch, discarded scallop catch, retained scallop catch, catch composition, scallop meat weight recovery, location, area, and depth fished, and catch per unit effort (Barnhart 1998). Summary and analysis reports of observer-collected data are produced from these data.

Data are used to manage the fishery inseason and to set guideline harvest ranges for the following season. Data are provided to local advisory committees, BOF, North Pacific Fisheries Management Council (NPFMC), National Marine Fisheries Service (NMFS), and the public. Observer-collected data have been used by the BOF and the NPFMC for making informed decisions regarding the scallop fishery and for preparing documents including Essential Fish Habitat and Habitat Areas of Particular Concern (Barnhart 2003).

SHELLFISH OBSERVER PROGRAM REGULATIONS AND GUIDELINES

Shellfish Observer Program guidelines were originally defined by the BOF in 1988. Current guidelines defining the responsibilities of each group (ADF&G, observer companies, observers, and vessels) involved in the observer program can be found in the Alaska Statutes Title 16, AS 16.05.050 POWERS AND DUTIES OF THE COMMISSIONER, AS 16.05.055 ON-BOARD OBSERVER PROGRAM, AS 16.05.251 REGULATIONS OF THE BOARD OF FISHERIES, Alaska Administrative Code, 5 AAC 39.141 ONBOARD OBSERVER PROGRAM, 5 AAC 39.142 CONFLICT OF INTEREST STANDARDS FOR ONBOARD OBSERVERS AND INDEPENDENT CONTRACTING AGENTS, 5 AAC 39.143 ONBOARD OBSERVER CERTIFICATION AND DECERTIFICATION, 5 AAC 39.144 ONBOARD OBSERVER INDEPENDENT CONTRACTING AGENT CERTIFICATION AND DECERTIFICATION, 5 AAC 39.146 ONBOARD OBSERVER BRIEFING AND DEBRIEFING, 5 AAC 39.645 SHELLFISH ONBOARD OBSERVER PROGRAM, and 5 AAC 39.646 SHELLFISH ONBOARD OBSERVER TRAINEE PROGRAM QUALIFICATIONS AND REQUIREMENTS.

Alaska Department of Fish and Game Responsibilities

The Alaska Department of Fish and Game is responsible for establishing policies and procedures for certification and decertification of contracting agents and observers. To promote data consistency and reliability, ADF&G developed observer training standards and sampling methodology and protocols. Department personnel continue to develop the program with a progressive outlook towards future data integrity and meeting the management needs for fisheries information.

Independent Contracting Agent Responsibilities

Independent contracting agent observer providers, also referred to as observer companies or contractors, are required by regulation to hire, train, deploy, and logistically support their observers with food, accommodations, sampling equipment, and transportation. Observer companies secure contracts for observer services directly with vessel owners, or the department depending on the funding source for observer coverage. In 2003, five independent contracting agents were authorized to provide onboard observers: Alaskan Observers, Inc. (AOI), Data Contractors, Inc. (DCI), Northwest Observers, Inc. (NWO), Saltwater, Inc. (SWI) and Techsea International (TSI).

Observer Responsibilities

Observer qualifications include a minimum of a Bachelor's degree in the sciences of biology or any branch of biology, or a valid NMFS observer certification, or other fisheries related experience or education. Observer candidates are required to undergo ADF&G approved training and must demonstrate 90% proficiency on the ADF&G shellfish observer written examination. As part of their training, crab observers must also participate in a practical training exercise administered by the observer program staff in Dutch Harbor. As representatives of ADF&G, observers are required to adhere to a detailed set of professional standards outlined in regulation. Prior to 1991, observer companies provided observer training. Currently, the University of Alaska Anchorage, North Pacific Fisheries Observer Training Center (OTC) in Anchorage conducts crab and scallop observer training. This facility is operated through funds provided by the University of Alaska Sea Grant Program. The OTC also trains groundfish fisheries observers for NMFS.

Vessel Owner and Operator Responsibilities

Regulations require the cost of observers to be borne by the shellfish industry or funded through ADF&G cost-recovery fishing. When required, vessel owners and operators are to procure and pay for observers through a qualified observer contractor and provide their observer with food and accommodations equal to that of the vessel's crew. The vessel must also dedicate a safe work area, necessary totes to hold the contents of sampled pots, and allow the observer opportunity and time to adequately sample the catch according to specific ADF&G data collection requirements. Accurate fishing effort and harvest data are to be provided daily to the observer, as well as access to communication equipment.

The MSFCMA and ADF&G commercial shellfish fishing regulations require that a vessel carrying an observer meets United States Coast Guard (USCG) commercial fishing vessel safety standards and must have a current Commercial Fishing Vessel Safety Examination (CFVSE) decal. Whenever possible before a fishery, USCG personnel will board and examine safety equipment on vessels that carry observers. Although a vessel possesses the CFVSE decal, the vessel's safety equipment may not meet the USCG requirements, usually because equipment currency dates have expired since the last CFVSE.

OBSERVER DUTIES

Observers are required to confirm that the vessel is displaying a current CFVSE decal, and that safety equipment on the vessel is current and in usable condition. This inspection is made when the observer first boards the vessel.

Observers record retained daily catch, fishing effort and location, and periodically report vessel and observer activity to ADF&G. Reports are coded and given via radio, marine satellite, or telephone. Scallop observers report scallop harvests, number of tows, areas fished, and crab bycatch.

Observers sample the retained catch and bycatch in a specified number of pots or tows each day. Sampling is an assessment of all the animals caught at a particular depth and location and with a specific gear type. Scallop observers sample a dredge to obtain species composition. Crab observers conduct either 'measurement' or 'count' sample pots. Measurement sample pots are sorted by species, of which prescribed crabs are sexed, measured, assessed for legality and retention, counted, and examined for shell age and fecundity. All other animals are identified to species and counted, with the exception of some finfish that are also measured. Count pot sampling requires animals be identified to species, and prescribed crabs enumerated based on legality, sex and retention.

Shellfish observers regularly monitor fishing operations for regulatory compliance. The Alaska Department of Public Safety, Bureau of Wildlife Enforcement (ABWE) assists OTC and ADF&G staff with instruction of observers for evidence collection, handling procedures, and proper chain-of-custody documentation. In the event that a potential violation is encountered, the ABWE will interview the observer and usually request a written statement.

Observers may also be assigned projects, ranging from collecting shellfish, finfish and other marine specimens, gathering tissue specimens for genetic stock identification, and the morphometric data collection of non-retained crabs. Observers also facilitate the tag-recovery studies of crab, and document specific seabird and mammal observations.

Crab Catcher-Processor Vessel

Daily duties specific to C/P vessel observers are: 1) interview the skipper for confidential catch and effort information, 2) conduct pot sampling of a specified number of randomly selected pots for retained catch and bycatch, 3) biological sampling of 100 retained crabs for size and shell age, 4) obtain average weights from a specified number of crab, and 5) obtain size, sex, and species compliance monitoring through a legal tally of 600 retained crabs conducted throughout the day. Observers are also asked to conduct processed crab section counts and case weights in the factory to verify catch data supplied by the vessel operator on a weekly basis.

Crab Floating Processor Vessel

Sampling duties specific to floating processor (F/P) vessel observers are: 1) interview the delivering vessel's skipper for confidential catch and effort information, 2) determine average weight of retained crabs, 3) conduct biological sampling of 100 retained crabs for size and shell age, and 4) obtain size, sex, and species compliance monitoring through a legal tally of 600 retained crabs during the delivery offload. Sampling duties are conducted on all vessels delivering to the processor.

Crab Catcher-Only Vessel

Daily observer duties specific to C/Vs include: 1) interviewing the skipper for confidential catch and effort information, and 2) conducting pot samples of a specified number of randomly selected pots for retained catch and bycatch. During deliveries the observer: 1) determines the average weight of retained crabs, 2) collects biological data from 100 retained crabs, and 3) monitors size, sex, and species compliance through a legal tally of 600 crabs in the live tank.

Scallop Catcher-Processor Vessel

Daily observer sampling duties on board a scallop vessel involve: 1) conducting a species composition assessment of a specified number of randomly selected tows, 2) measuring shell height and weighing 20 retained scallops per bycatch sample tow, 3) enumerating, measuring and assessing the condition of crab of commercial importance, Pacific halibut and scallops from a specified number of randomly selected tows, and 4) conducting a detailed examination of the descarded scallop catch. Observers also calculate catch per unit effort based on scallop meat weight recovery. Triweekly observer reports are used to manage the fishery inseason.

PROGRAM REVIEW

Observer Coverage and Cost-Recovery Funds

In addition to mandatory requirements for observer coverage on at-sea processing vessels, the BOF has given ADF&G the regulatory authority to deploy crab observers on an adequate number of C/Vs in each BSAI crab fishery. This regulatory authority allows ADF&G to collect much needed biological and fishery-based data necessary for resource management. It has also allowed ADF&G to meet requirements of the MSFCMA and the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner crabs (NPFMC 1998).

The COOTF and ADF&G agreed to continue the same observer coverage goals in fiscal year 2004 as those adopted for the 2002-2003 fisheries. Observer coverage levels remain at 100% and funded under the pay-as-you-go system for at-sea processors participating in BSAI king or Tanner crab fisheries, for all vessels in the Aleutian Islands king crab fisheries, and for all vessels participating in hair crab, deep water king crab, and deep water Tanner crab fisheries under a commissioner's permit. Likewise, observer coverage for vessels in the CDQ and AFA fisheries remains under the pay-as-you-go system (Table 3-1).

The Shellfish Onboard Observer Program has utilized test fish funding for a portion of the BSAI observer coverage costs since 1999 (Tables 3-2 and 3-3). The test fish authority was originally capped at $650,000 and structured as a revolving fund, which, if not used in one fiscal year, may be rolled into and available in the following fiscal year. A total of $669,500 in test fish funds was collected for the cost-recovery funded portion of the observer program from the harvest and sale of red king crab after the close of the 1999 Bristol Bay red king crab fishery. In 2000, the ADF&G and COOTF agreed that if the cost-recovery fund dropped below $300,000, a test fishery would be conducted to replenish it. The observer test fish fund balance at the end of fiscal year 2003 was not expected to fall below $300,000. Consequently, the department did not conduct a cost-recovery test fish charter in fiscal year 2004.

ADF&G's goal for the 2003-2004 season was to deploy observers on 10% of C/Vs in two vessel size categories, between 75 ft and 125 ft, and greater than 125 feet, with a minimum of five observers per vessel size category in selected fisheries. ADF&G deploys seasonal biologist staff observers and additional observers are obtained through a State of Alaska contract with observer providers. Observer coverage levels are depicted in Figure 3-1.

2003 OBSERVER PROGRAM ACTIVITY

Shellfish observer activities in this section of the report are documented by calendar year. The length of an observer deployment in observer days is defined as the total number of days from the observer's briefing to debriefing. One observer month is equivalent to 30 observer days.

Observer Training, Certification, and Decertification

Since the inception of the observer program in 1988, 37 crab observer classes have been held, resulting in the dispersion of 525 trainees into the field. During 2003, two crab observer training classes were conducted at the OTC in Anchorage. At the end of 2003, 71 crab observers either held a trainee permit or were certified in the crab observer program. The observer turnover in 2003 was 24%, up from 21% in 2002. During 2003, 11 observer certifications lapsed due to 12 months of inactivity or due to trainee permit expiration, and one observer was decertified. Crab observer training and participation levels from 1988 to 2003 are summarized in Table 3-4.

Two scallop observer training classes were held at the OTC during 2003. Six trainees were issued permits, of which five received full certification by the end of 2003. Conversely during 2003, five scallop observer certifications lapsed due to 12 months of inactivity or due to trainee permit expiration, resulting in a 33% turnover rate. No scallop observers were decertified for failure to comply with observer program standards. Ten certified scallop observers remained in the program as of December 31, 2003. Scallop observer training and participation levels from 1993 to present are summarized in Table 3-5.

Shellfish Observer Deployment Activity

The Shellfish Observer Program continues to develop its procedures and policies, with data integrity as the primary goal. Over the years ADF&G has found a need to increase the length of observer sessions (briefing, midtrip debriefing, debriefing) from the minimum 15 minutes to two or more hours in order to keep pace with data needs and data quality issues. Data requests have become more complex, and additionally, deployment dynamics and vessel differences more varied.

Observer deployment activity in 2003 decreased slightly from the previous year in terms of observer trips, but continued to remain at one of the highest levels in the past five years (Table 3-6). One hundred and one vessels carried observers during the course of the year and is the second largest coverage level in the history of the program. This can be attributed to the expansion of fleet coverage for the Bristol Bay red king and Bering Sea snow crab fisheries since 1999, despite a decrease in season lengths, which is evident by a diminution in observer months. A total of 167 briefings, 27 midtrip debriefings, and 169 debriefings were conducted in 2003 (Table 3-7).

Spikes of observer activity occurred during the months of January and October, coinciding with the Bering Sea snow crab and BSAI red king crab fisheries (Table 3-8 and Figure 3-2). Observers participating in the combined red king crab fisheries, including Bristol Bay general and CDQ fisheries and the Petrel Bank fishery, accounted for 156 (43%) of the 363 total number of observer sessions in 2003 (Table 3-7). All three fisheries opened and closed within a five-week period in October and November, putting a strain on observer resources and program staff. In order to alleviate the pressures of high-volume observer traffic, which puts at risk effective and productive observer management, several deployment strategies were employed. First, observers participating in the Bristol Bay and Petrel Bank red king crab general fisheries were briefed for both fisheries prior to the Bristol Bay season, and subsequently debriefed for all fisheries at the termination of the final trip. Although the tactic of double-briefing/debriefing observers increases the time spent in each session, it relieves logistical problems associated with deploying observers in successive fisheries. Second, observer staff was dispatched to Adak and Anchorage to conduct additional observer sessions for observers deployed from ports other than Dutch Harbor. Finally, department staff was sent from the regional headquarters in Kodiak to assist with the anticipated surge of observer activity in the Dutch Harbor office.

OBSERVER DEPLOYMENTS BY FISHERY

Observer coverage goals and requirements were met in most fisheries, with a total of 168 deployments, spanning 135 observer months (Table 3-9). Thirty-eight percent of the observer months were in deployments during the Aleutian Islands golden king crab *L. aequispina* fishery. Crab and scallop observers conducted a combined 12,318 samples for species composition, establishing an overall sampling rate of 5.7% (Table 3-10).

Shellfish observer deployments and vessel assignments in this section of the report are documented by fishing season.

2002-2003 Aleutian Islands Golden King Crab Fishery Observer Activity

The 2002-2003 Aleutian Islands golden king crab fishery opened at noon on August 15, 2002 with 22 vessels, including 21 C/Vs and one C/P. One hundred percent observer coverage was mandatory on all vessels and observers were secured and paid for by the vessel operator. Saltwater, Inc., AOI, DCI and TSI provided observers throughout the season for 33 total deployments.

Twenty-three briefings for both the eastern and western management areas took place August 10-13 in the Dutch Harbor office. Eleven more briefings were performed during the season in Dutch Harbor, Adak or Anchorage with the last occurring February 10, 2003. Sampling duties varied by vessel type and fishing location. For vessels fishing east of 174° W longitude, C/V observers were assigned 4 measurement and 10 count sample pots per fishing day, and C/P observers were required to sample four measurement and five count pots per fishing day. Harvest information and sampling effort was reported tri-weekly. For vessels fishing west of 174° W longitude, C/V and C/P observers were assigned six and five measurement sample pots per fishing day, respectively. Reports were transmitted on a weekly basis until a few weeks prior to the closure announcement, at which time report periods increased to tri-weekly. Observers were also required to measure and document all red king crab bycatch and tagged golden king crab caught in all pots.

The eastern management area closed on September 7, 2002, and 17 debriefings were conducted in Dutch Harbor September 9-13. The western management area closed six months later on March 8, 2003. Another 16 debriefings were held during and after the season in either Dutch Harbor or Adak, with the last debriefing occurring March 20, 2003. Throughout the course of the fishery, 18 midtrip debriefings took place in Dutch Harbor and Adak. In summary, 33 briefings, 18 midtrip debriefings, and 33 final debriefings were conducted throughout the fishery.

The entire fleet fished for a combined 864 days, landed 5,462,802 pounds of crab and made 115 deliveries to six different processors (Table 3-10). During 1,539 deployment days, observers sampled 6,494 (4.4%) of the 147,618 pots pulled by the entire fishing fleet. Observers on C/Vs sampled 5,834 pots and completed 81 biological measurements and 81 legal tallies, and observers on the C/P sampled 660 pots and completed 144 biological measurements and 146 legal tallies (Table 3-11). Observers and crewmembers collectively recovered 140 golden king crab tags and no evidence was collected for regulatory non-compliance. Observers reported 210 red king crabs caught in all pots pulled.

2003 Bering Sea Snow Crab General Fishery Observer Activity

The 2003 Bering Sea snow crab general fishery opened at noon on January 15, 2003 with 195 vessels; including 187 C/Vs, 5 C/Ps and 3 F/Ps, with 2 C/Ps participating as floating-processors at the closure of the fishery. The department set a goal of 10% observer coverage for the C/V fleet, and employed six staff biologists and contracted 12 observers from SWI and DCI. The C/Vs that carried observers were chosen at random from the preseason vessel registration list and observer costs paid through the state's observer test-fish funds. One hundred percent observer coverage was mandatory for C/Ps and F/Ps and observers were secured and paid for by the vessel operator. Alaskan Observers Inc., SWI, TSI, and NWO provided nine observers for the C/Ps and F/Ps.

Briefings for 19 of the 27 observers took place in Dutch Harbor January 6-11. Six observers who boarded their vessels in ports other than Dutch Harbor were briefed in Anchorage by department staff January 9-10. One observer was briefed for deployment on a floating processor on January 20 and another observer was briefed on February 8 to relieve a C/P observer. Seventeen observers boarded their vessels in Dutch Harbor, three boarded in Akutan, five boarded in King Cove and two in St. Paul. One observer resigned after briefing and was immediately debriefed and relieved of all observer duties, which dropped the coverage of the catcher-only fleet from 10 to 9.6%.

Observers on C/Vs were assigned a sampling goal of one measurement and five count sample pots per fishing day and observers on C/Ps were assigned one measurement and three count sample pots. Biological measurements, legal tallies and average weights were conducted daily on C/Ps and at each delivery on C/Vs. Observers assigned to F/Ps conducted skipper interviews and performed biological measurements and legal tallies for each delivering vessel. Observers were to collect hemolymph samples from crab found with bitter crab syndrome. All observers reported harvest and effort information every 24 hours to the department.

The fishery closed at 6:00 AM on January 25, 2003. Sixteen observers disembarked in Dutch Harbor, six disembarked in Akutan, four in King Cove and one in St. Paul. Debriefings were performed for 20 observers from January 28 through February 12 in Dutch Harbor.

The fleet pulled a total of 139,903 pots for the entire fishery, made 257 deliveries and landed 26,341,958 pounds of crab during the Bering Sea snow crab season. Observed C/Vs pulled 12,813 pots, made 21 deliveries, and landed 2,348,475 pounds of crab. The C/Ps pulled 3,623 pots, made 11 deliveries, landed 806,472 pounds of crab and took a total of 8 deliveries from C/Vs (Table 3-10). Floating processors took 55 deliveries.

During 618 deployment days, observers sampled 870 pots, which represented 5.3% of pots pulled on observed vessels. Catcher vessel observers sampled 741 of 12,813 pots pulled on observed C/Vs (5.8%) and conducted 20 biological measurements and 20 legal tallies. Observers on C/Ps sampled 129 of 3,623 pots pulled (3.6%) and conducted 47 biological measurements and 47 legal tallies. Catcher vessel observers sampled 0.5% and C/P observers sampled 0.1% of pots pulled by the entire fleet. Observers on all vessels sampled a total of 0.6% of all pots pulled. Observers on F/Ps performed 61 biological measurements and 61 legal tallies on retained catch (Table 3-12). Five hemolymph samples from bitter crab were collected and evidence of violations was collected on three vessels.

2003 Bering Sea CDQ Snow Crab Fishery Observer Activity

The 2003 Bering Sea CDQ snow crab fishery registration began on January 29. The six CDQ groups eligible to fish participated with a total of nine catcher vessels and one catcher-processor. The mandatory observer coverage was two observers per CDQ group for a total of nine observed vessels. Each group was responsible for securing an observer through a state-certified observer contractor and for all observer costs. Groups fishing with more than two vessels determined which vessels would carry the observers, with the exception of the C/P, where observer coverage is mandatory.

Data Contractors, AOI, and SWI supplied observers for the CDQ groups. Between the dates of January 28 and February 12, 10 CDQ observer briefings took place in Dutch Harbor. During the season, one CDQ vessel changed observers. Seven observers boarded in Dutch Harbor and three in St. Paul.

For each C/V deployment, the observers were assigned one measurement and five count sample pots for each day of fishing. On the C/P, the observers were required to complete one measurement and three count sample pots each day. Every Monday, harvest and effort information was reported to the department. Observers were to collect hemolymph samples from any bitter crab brought onboard their vessels.

The last delivery for the 2003 Bering Sea CDQ snow crab fishery occurred on March 26, 2003. Two observers had mid-trip debriefings in Dutch Harbor during the fishery. Two observers disembarked in Akutan, two in St. Paul and six in Dutch Harbor. All 10 debriefings took place in Dutch Harbor February 12 through March 26.

The entire CDQ fleet put in approximately 190 fishing days and delivered 2,124,584 pounds of crab. During 313 deployment days observers conducted 61 biological measurements, 61 legal tallies and sampled 746 (5.1%) of the 14,583 pots pulled by the entire fleet (Table 3-13). No evidence was collected during this fishery. No hemolymph samples were returned to the department.

2003 Bering Sea Golden King Crab Fishery Observer Activity

The 2003 Bering Sea golden king crab fishery opened at noon on January 1, 2003. Three catcher-only vessels registered to fish the Pribilof District, of which one vessel also registered for the Northern District. One hundred percent coverage was mandatory on all vessels and observers were secured and paid for by the vessels.

Scarlet king crab, grooved and triangle Tanner crab could be retained as bycatch while targeting golden king crab in Area Q under the conditions of a deep water Tanner crab and *L. couesi* crab permit. One catcher vessel obtained a permit. The observer was to follow the sampling and tallying guidelines established for the golden king crab fishery, but to maintain separate reporting forms for all other retained species.

During the course of three days, from March 25 through 27, three briefings for the Pribilof and Northern Districts were conducted in the Dutch Harbor office, and all observers boarded their vessels in Dutch Harbor. Saltwater, Inc., AOI, and DCI provided observer coverage for the vessels. All observers were assigned a sampling goal of ten measurement sample pots per fishing day. Tri-weekly harvest information and sampling effort was reported to the department.

The Pribilof District closed to commercial fishing on May 1, 2003, and the Northern District remained open until December 31, 2003, as stipulated by the conditions of the permit issued by the commissioner. Only one vessel opted to fish the Northern District after the Pribilof District closure. The last delivery for the 2003 Bering Sea golden king crab fishery occurred on May 20. All observers disembarked and debriefed in Dutch Harbor between May 5 and May 20, 2003. During 138 deployment days, observers conducted six biological measurements, six legal tallies and sampled 593 pots (Table 3-14). No evidence was collected during this fishery.

2003 Bristol Bay Red King Crab General Fishery Observer Activity

The 2003 Bristol Bay red king crab fishery opened at 4:00 PM October 15 with 253 vessels, including 244 C/Vs, 8 C/Ps, and 1 F/P. Three C/Ps participated as floating-processors at the closure of the fishery. Of the 244 C/Vs, 32 vessels participated under the American Fisheries Act. The department set a goal of 10% observer coverage on all catcher vessels. Observer costs for the non-AFA vessels were paid through the state's observer test-fish funds and AFA vessel observers were secured and paid for directly by the vessel operators. One hundred percent observer coverage was mandatory for the C/Ps and the F/P, and observers were secured and paid for directly by the vessel operators.

The department employed seven staff observers and contracted 13 observers from SWI and AOI for the non-AFA C/V fleet. Three observers were contracted from SWI for the AFA vessels. Saltwater Inc, TSI, NWO, and AOI provided nine observers for the catcher-processors and floating processor.

Briefings for 22 of the 37 observer trips occurred in Dutch Harbor October 8-11. Thirteen observers who boarded their vessels in ports other than Dutch Harbor were briefed in Anchorage by department staff October 8-11. Certified observers assigned to C/Vs were double-briefed for both the Bristol Bay and the Petrel Bank red king crab fisheries. Two observers were briefed in Dutch Harbor on October 21 for freight hauls to Seattle. Nineteen observers boarded in Dutch Harbor, three boarded in Akutan, five in False Pass, and five in King Cove. One observer who had been briefed and assigned to a C/V was unable to board due to cancelled flights, so C/V observer coverage fell short, covering 9.2% of the fleet instead of the intended 10%.

Observers on C/Ps and C/Vs were assigned a sampling goal of 10 measurement sample pots per fishing day. Biological measurements, legal tallies and average weights were to be conducted daily for C/Ps and at each delivery for C/Vs. Observers assigned to F/Ps conducted skipper interviews and performed biological measurements and legal tallies for each delivering vessel.

All observers were to collect information on all tagged crab found on their assigned vessels, and report harvest information twice daily to the department.

The fishery closed at 6:00 PM on October 20, 2003. Thirteen observers disembarked in Dutch Harbor, two disembarked in Akutan, one in False Pass, seven in King Cove, two in Kodiak and one in Sand Point. Thirteen observers were given waivers by the department to disembark their vessels prior to offloading in order to expedite their transition to the Petrel Bank fishery. Debriefings were performed for 26 observer trips in Dutch Harbor and 10 observer trips in Anchorage between October 21 and November 7. One observer was debriefed in Adak on November 4, 2003.

The fleet pulled 129,019 pots for the entire fishery, made 275 deliveries, and landed 14,530,248 pounds of crab during the Bristol Bay red king crab season. Observers sampled 731 pots, representing 4.4% and 0.6% of pots pulled on observed vessels and the entire fleet, respectively (Table 3-15).

The 210 non-AFA C/Vs pulled 111,120 pots, made 229 deliveries, and landed 12,660,773 pounds of crab. Of the 10,531 pots pulled by the observed vessels, observers sampled 485 (4.6%) and conducted 11 biological measurements and 11 legal tallies during the course of 300 deployment days. Likewise, the 32 AFA C/Vs pulled 12,913 pots, made 33 deliveries, and landed 1,188,781 pounds of crab. After 36 deployment days, observers sampled 71 (7.8%) of 911 pots pulled on observed AFA vessels, and conducted one biological measurement and one legal tally.

The C/Ps pulled 4,986 pots, made 13 deliveries, landed 680,694 pounds of crab and took 11 deliveries from C/Vs. Observers on C/Ps had a combined 108 deployment days, sampled 175 (3.5%) of 4,986 pots pulled and conducted 35 biological measurements and 32 legal tallies. Observers on F/Ps performed 16 biological measurements and 18 legal tallies.

Observers reported 49 (27.8%) of the 176 red king crab tags retrieved and evidence of violation was collected on three vessels.

2003 Bristol Bay Red King Crab CDQ Fishery Observer Activity

Registrations for the 2003 Bristol Bay CDQ red king crab fishery were available on October 24, 2003. The six CDQ groups eligible to fish participated with 11 C/Vs and 2 C/Ps. The 2003 season was the first year catcher-processors participated in the fishery since the inception of the CDQ program in 1998. The mandatory observer coverage was one observer per CDQ group for catcher vessels. All C/Ps were required to carry an observer, and groups using more than one C/V were responsible for determining which vessel would carry the observer. Each group was responsible for securing an observer through a state-certified observer contractor and for all observer costs.

Eight vessels, two of which were C/Ps, carried observers for the fishery. Alaskan Observers, Inc., TSI, NWO, and SWI provided eight observers for the CDQ groups. Observer briefings were conducted in Dutch Harbor between October 18 and November 5, 2003. All observers boarded their vessels in Dutch Harbor, with the exception of two observers who had remained on their vessel after the closure of the Bristol Bay red king crab general fishery.

The sampling goal for each C/V and C/P deployment was 10 measurement sample pots for each day of fishing. Harvest and effort information was reported tri-weekly to the department. All observers were to collect information on all tagged crab found on their assigned vessels.

The last delivery for the 2003 Bristol Bay CDQ red king crab fishery occurred on November 16, 2003. All observers disembarked in Dutch Harbor. Debriefings for the eight CDQ observers (nine deployments) took place in Dutch Harbor, ranging from October 31 to November 17, 2003.

The CDQ fleet put in approximately 61 combined fishing days before reaching all fishing allocations and pulled 5,704 pots, made 20 deliveries and landed 1,166,662 pounds of crab. Observers sampled 279 (6.4%) of the 4,372 pots pulled by all observed vessels and 4.9% of pots pulled by the entire CDQ fleet. During nine observer trips and 112 deployment days, observers had conducted 22 biological measurements and 12 legal tallies (Table 3-16). Observers reported 13 of the 15 red king crab tags retrieved (86.7% of all tags recovered). Evidence was collected on one observed vessel during the fishery.

2003 Petrel Bank Red King Crab Fishery Observer Activity

The 2003 Petrel Bank red king crab fishery opened on October 25, 2003 with 30 vessels, including 28 C/Vs and 2 C/Ps, one of which acted as an F/P after the fishery closure. All vessels were required to carry onboard observers 100% of the time, and observers were secured and paid for by the vessel operators.

Saltwater Incorporated, TSI, and DCI provided 30 observers. Observer program staff conducted briefings and debriefings in Dutch Harbor, Anchorage, and Adak. Briefings for 11 of the 30 observers took place in Anchorage from October 8 to 22, 2003. Three briefings occurred in Adak on October 22 and 23, and seventeen in Dutch Harbor between October 8 and October 22. One observer was briefed in Dutch Harbor but the vessel decided not to fish and the observer was debriefed four days later without boarding. Sixteen observers boarded their vessels in Dutch Harbor, seven boarded in Adak, one in King Cove, one in Cold Bay and five remained on previously assigned vessels. In order to help facilitate a rapid and expedient transition of observers between the Bristol Bay and Petrel Bank fisheries, nine certified observers were double-briefed for both fisheries even if they did not yet have vessel assignments for Petrel Bank. Five of these observers were deployed for the Petrel Bank fishery and four were never deployed.

Due to inclement weather conditions, some observers were unable to fly into Dutch Harbor to meet their vessels. Consequently, five vessels were allowed to register for the Petrel Bank red king crab fishery in Dutch Harbor on October 22 and travel to Adak without observers on board. Contractors then flew the observers directly to Adak where the vessels were required to pick up their observers before proceeding to the fishing grounds.

All observers were assigned a sampling goal of ten measurement sample pots per fishing day. Observers reported harvest and fishing effort information every 12 hours to the department.

The fishery closed at 6:00 AM on October 29, 2003. Seventeen observers disembarked in Dutch Harbor, nine in Adak, two in King Cove and two observers remained on their vessels for other crab fisheries. Debriefings were conducted with 18 observers from October 29 to November 3 in Dutch Harbor. Twelve debriefings took place in Adak from October 26 to November 1, and one debriefing was conducted in Anchorage on November 3.

During the 91-hour fishery, the fleet pulled 5,774 pots, made 31 deliveries, and landed 479,113 pounds of crab. Observers sampled 931 pots, which represented 16.1% of pots pulled during the fishery (Table 3-17). One C/V delivered to a catcher-processor. No evidence was collected during the fishery and no tags were recovered.

2003 Statewide Grooved Tanner Crab Fishery Observer Activity

A deep water Tanner crab and *L. couesi* crab permit was issued on June 19, 2003 for Area J/Bering Sea District. This fishery requires 100% mandatory observer coverage, which is secured directly by the vessel operators, paying all observer costs. Under the conditions of the commissioner's permit, the vessel could retain triangle Tanner crab and scarlet king crab as bycatch.

Saltwater, Inc. provided two certified observers during the course of the vessel's fishing activity. Observer briefings, midtrip debriefings, and final trip debriefings occurred in Dutch Harbor between June 20 and September 26, 2003. Both observers boarded the vessel in Dutch Harbor. The observers were assigned a sampling goal of ten measurement sample pots per fishing day. Harvest and fishing effort information was reported tri-weekly to the department.

After 97 observer deployment days, the observers conducted 10 legal tallies, 11 biological measurements and sampled 393 pots (Table 3-18). No evidence was collected.

2003 Norton Sound Red King Crab Fishery Observer Activity

No observer activity occurred in this fishery in 2003.

2003-2004 Weathervane Scallop Fisheries Observer Activity

The 2003/2004 scallop season opened in all state and federal waters on July 1, 2003. Throughout the 7.5 month season, two C/Ps fished in four registration areas, including Yakutat, Prince William Sound, Kodiak and the Bering Sea. All vessels were required to carry onboard observers 100% of the time, and observers were secured and paid for by the vessel operators. Saltwater, Inc. and AOI provided observers throughout the season for 13 total deployments.

The first two briefings occurred in Anchorage on June 27, 2003 for the Bering Sea registration area. Eleven additional briefings were conducted throughout the year in Kodiak, Yakutat and Dutch Harbor.

All observers were assigned a sampling goal of six tows per fishing day: One dredge is sampled each day for species composition and five dredges are sampled for crab and halibut bycatch and discarded/retained scallop catch monitoring. Other daily duties included measuring 100 scallops and collecting 10 scallops for age analysis. Observers reported harvest, fishing effort and location information on a tri-weekly basis. Bycatch of halibut, Dungeness crabs, red king crabs, snow crabs and Tanner crabs are estimated from observer data.

The last debriefing has held February 10, 2004 in Juneau. In addition to the 13 debriefings, eight midtrip debriefings were conducted throughout the season. Debriefings were conducted in Anchorage, Kodiak, Yakutat, Dutch Harbor, or Juneau.

For the 2003/2004 regulatory season, observers made 13 trips, accounting for nearly 13 deployment months, the lowest since 1995 (Table 3-19). Six of the thirteen observer trips were made in the Kodiak registration area, and accounted for 6.5 (50.3%) of the total observer deployment months (Table 3-20). No evidence was collected on any of the trips.

2003 Fisheries Evidence Collected by Observers

Shellfish observers collected evidence associated with potential illegal activities on seven observer trips in 2003. Evidence was collected in the Bristol Bay red king crab fishery and the Bering Sea snow crab fisheries. Of the seven cases, two plead no contest, three are under investigation, and in two circumstances, no charges were filed after investigation. Evidence collection remains low over the last five years, contrary to an increase in the catcher-only vessel coverage (Table 3-21).

OBSERVER DATA USE AND ANALYSIS

The MSFCMA mandates collection of reliable data for fisheries conservation and management. Although ADF&G continues to collect retained catch data shore-side, it relies on data collected on the fishing grounds by at-sea observers who are in a unique position to collect specific and accurate baseline data. The crab observer database has accumulated enough data to become an important source of objective information for fisheries management and research. Some of the applications of this data are discussed in Schwenzfeier et al., (2000). The observer program database staff summarizes the large volume of biological data collected by crab observers annually. The most recent summary and analysis of BSAI observer data is available in Barnard and Burt (2004).

LITERATURE CITED

Barnard, D. R., and R. Burt. 2004. Alaska Department of Fish and Game summary of the 2002 Mandatory Shellfish Observer Program database for the general and CDQ fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K04-27, Kodiak.

Barnhart, J. P. 1998. Weathervane scallop observer manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K98-32, Kodiak.

Barnhart, J. P. 2000. Annual management report for the weathervane scallop fisheries of the Westward Region, 1999/2000. *In* Annual management report for the shellfish Fisheries of the Westward Region, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K00-55, Kodiak.

Barnhart, J.P. 2003. Weathervane Scallop Fishery in Alaska with a focus on the Westward Region, 1967-2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K03-5.

Barnhart, J. P., and N. Sagalkin. 1998. Summary and analysis of onboard observer collected data from the 1996/1997 statewide commercial weathervane scallop fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 4K98-38, Kodiak.

Boyle, L., and M. Schwenzfeier. 2000. Alaska's Mandatory Shellfish Observer Program, 1988 - 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Contribution PP-206, Juneau.

Kruse, G. H. 1994. Fishery management plan for commercial scallop fisheries in Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, draft special publications No. 5, Juneau.

North Pacific Fishery Management Council (NPFMC). 1998. Fishery management plan for Bering Sea/Aleutian Islands king and Tanner crabs, Anchorage.

Schwenzfeier, M., H. Moore, R. Burt, and R. Alinsunurin. 2000. Inquiry for application of data collected by observers deployed in the eastern Bering Sea crab fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Contribution PP-207, Juneau.

U.S. Department of Commerce. 1996. Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-23.

Table 3-1. Observer coverage levels implemented by the Crab Observer Oversight Task Force for the 2003/2004 BSAI crab fisheries.

Fishery	Preseason Registration Deadline[a]	Catcher Vessels[b]		At-Sea Processors	
		Observer Coverage	Cost-Recovery Funded?	Observer Coverage	Cost-Recovery Funded?
St. Matthew blue king crab	24-Aug	Partial	YES	100%	NO
Pribilof red and blue king crab	24-Aug	Partial	YES	100%	NO
Bristol Bay red king crab	24-Sep	Partial	YES	100%	NO
Bering Sea Tanner crab	24-Sep	Partial	YES	100%	NO
Bering Sea snow crab	24-Dec	Partial	YES	100%	NO
St. Matthew golden king crab	none	100%	NO	100%	NO
Pribilof golden king crab	none	100%	NO	100%	NO
Hair crab	none	100%	NO	100%	NO
Triangle Tanner and grooved Tanner	none	100%	NO	100%	NO
Aleutian king crab (red or golden)	none	100%	NO	100%	NO

[a] When the pre-registration deadline occurs on a Saturday, Sunday, or state holiday, the deadline is extended to the next workday.
[b] AFA and CDQ catcher vessels are pay-as-you-go.

Table 3-2. Shellfish onboard observer program cost-recovery harvest statistics, 1999 - 2003.

Year	Number of		Harvest[a,b]	Number of	Average		Deadloss[a]
	Landings	Crabs		Pots Pulled	CPUE[c]	Weight[a]	
1999 [d]	2	16,930	106,179	541	31.0	6.3	245
2000			No cost-recovery fishing				
2001 [d]	2	13,065	90,151	463	28.2	6.9	103
2002 [d]	1	10,837	71,661	198	54.7	6.6	134
2003			No cost-recovery fishing				

[a] In pounds.
[b] Deadloss included.
[c] Number of legal crabs per pot lift.
[d] Cost-recovery fishing occurred after the general Bristol Bay red king crab fishery.

Table 3-3. Economic performance of the shellfish onboard observer program cost-recovery harvest, 1999 - 2003.

Year	Harvest[a]	Value		Charter Dates	Total Charter Days
		Exvessel[b]	Total		
1999	105,934	$6.32	$669,500	10/25-11/10	17
2000	No cost-recovery fishing				
2001	90,048	$5.12	$461,045	10/23-11/08	17
2002	71,527	$6.41	$458,488	10/17-10/27	10
2003	No cost-recovery fishing				

[a] In pounds, deadloss not included.
[b] Price per pound.

Table 3-4. Crab observer training and participation in the Shellfish Onboard Observer Program, 1988 - 2003.

Year Class	Number of		Certified at Year's End[a]	Percent Turnover	Certification Status for Year Class as of December 31, 2003		
	Classes	Trainees			Current[a]	Expired[b]	Other[c]
1988	3	81	80	1.0	0	67	14
1989	1	41	98	19.0	1	35	5
1990	3	27	121	3.2	0	25	2
1991	4	59	108	40.0	0	54	5
1992	3	40	104	29.7	1	38	1
1993	2	19	78	36.6	0	17	2
1994	1	14	65	29.3	0	11	3
1995	3	55	77	35.8	3	48	4
1996	3	36	72	36.3	3	33	0
1997	2	27	67	32.3	3	23	1
1998	2	22	54	39.3	3	19	0
1999	1	11	43	33.8	0	11	0
2000	2	14	37	35.1	3	11	0
2001	3	25	57	8.1	10	14	1
2002	2	28	67	21.2	18	8	2
2003	2	26	71	23.7	26	0	0
Totals	37	525	NA	NA	71	414	40

[a] Represents all crab observers who hold a certificate or trainee permit.
[b] Due to 12-month shellfish observer employment inactivity or trainee permit expiration.
[c] Certification revoked for non-compliance with shellfish observer program standards.
NA = not applicable

Table 3-5. Scallop observer training and participation in the Shellfish Onboard Observer Program, 1991 - 2003.

Year Class	Number of		Certified at Year's End[a]	Percent Turnover	Certification Status for Year Class as of December 31, 2003		
	Classes	Trainees			Current[a]	Expired[b]	Other[c]
1993	3	23	22	4.0	0	22	1
1994	3	16	5	86.8	0	13	3
1995	0	0	2	60.0	0	0	0
1996	2	10	5	58.3	0	10	0
1997	2	10	7	53.3	0	10	0
1998	1	8	5	66.7	0	8	0
1999	1	9	5	64.3	0	8	1
2000	1	6	6	45.5	0	6	0
2001	1	6	9	25.0	1	5	0
2002	1	5	9	35.7	3	2	0
2003	2	6	10	33.3	6	0	0
Totals	17	99	NA	NA	10	84	5

[a] Represents all scallop observers who hold a certificate or trainee permit.
[b] Due to 12-month shellfish observer employment inactivity or trainee permit expiration.
[c] Certification revoked for non-compliance with shellfish observer program standards.
NA = not applicable

Table 3-6. Summary of observer deployment activity in the shellfish onboard observer program, from July 1988 through December 2003.

Year	Vessels [a]					Observer	Deployed	Certified at	Observer	Number of	Active
	C/P	F/P	C/V	S/V	Total	Trips	Observers	Year's End [b]	Months	Sessions [c]	Contractors
1988	21	6	0	0	27	46	28	80	31.4	89	6
1989	22	12	0	0	34	124	53	98	124.0	252	7
1990	26	15	0	0	41	140	61	121	163.5	268	7
1991	33	18	0	1	52	282	105	114	352.2	651	6
1992	32	19	2	0	53	225	100	105	280.3	531	7
1993	29	21	14	11	75	235	80	102	216.8	412	7
1994	24	17	19	12	72	185	74	87	178.8	350	7
1995	21	15	50	8	94	211	91	95	213.0	478	5
1996	16	13	38	5	72	209	82	80	250.5	491	5
1997	15	11	30	6	62	157	71	78	184.4	347	5
1998	13	11	44	8	76	186	62	65	203.1	382	5
1999	11	11	42	8	72	152	48	55	148.5	345	4
2000	9	6	62	6	83	154	48	45	128.0	335	3
2001	9	5	62	4	80	161	59	64	150.3	364	4
2002	10	6	85	4	105	199	70	75	158.8	429	5
2003	9	7	83	2	101	171	70	80	137.6	363	5

[a] Unique vessels requiring observer coverage: C/P = Catcher-Processor, F/P = Floating Processor, C/V = Catcher-Only Vessel, and S/V = Scallop Vessel (C/P or C/V).
[b] Total number of observers who possess either a shellfish observer trainee permit or are currently certified on December 31st of each year.
[c] Includes briefings, midtrip debriefings and final debriefings.

Table 3-7. Number of shellfish observer sessions by fishery for calendar year 2003.

Fishery	Number of			Totals	Percent of
	Briefings	Midtrips	Debriefings		Total Sessions
Aleutian Islands golden king crab	33	11	33	77	21.2
Bering Sea golden king crab	3	3	3	9	2.5
Bering Sea snow crab	30	0	30	60	16.5
Bering Sea snow crab CDQ	10	3	10	23	6.3
Bristol Bay red king crab	37	0	37	74	20.4
Bristol Bay red king crab CDQ	9	0	9	18	5.0
Petrel Bank red king crab fishery	32	0	32	64	17.6
Bering Sea grooved Tanner	2	1	2	5	1.4
Statewide scallops, excluding Cook Inlet	11	9	13	33	9.1
Totals	167	27	169	363	100

Table 3-8. Number of shellfish observer sessions by month and year, including briefings, midtrip debriefings and final debriefings, 1988 - 2003.

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total
1988	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27	36	12	14	89
1989	9	3	9	4	15	9	13	51	56	55	12	16	252
1990	21	14	16	13	8	8	5	17	20	41	77	28	268
1991	73	56	94	68	63	49	24	7	24	43	96	54	651
1992	101	60	41	111	8	10	13	31	22	28	62	44	531
1993	71	24	75	15	4	14	14	20	42	35	62	36	412
1994	49	4	81	25	8	7	28	38	38	26	26	20	350
1995	41	70	20	23	31	17	16	36	44	84	65	31	478
1996	42	22	68	28	36	26	39	42	34	53	64	37	491
1997	37	22	54	14	15	10	10	25	27	38	82	13	347
1998	32	17	67	20	35	14	9	28	43	65	50	2	382
1999	23	8	43	33	22	10	13	29	39	74	36	15	345
2000	24	7	26	38	15	11	13	42	42	86	21	10	335
2001	27	43	25	20	20	10	9	41	29	104	25	11	364
2002	40	46	37	19	7	3	5	34	31	148	43	16	429
2003	58	31	13	2	4	3	7	35	22	146	30	12	363
Average	43	28	45	29	19	13	15	32	34	66	48	22	380

Table 3-9. Summary of observed vessels, observer trips, percentage of total observer trips, observer months at sea, and percentage of total observer months at sea by fishery in the shellfish onboard observer program, 2003.

Fishery	Observed Vessels			Observer Trips	% Total Observer Trips	Observer Months	% Total Observer Months	% Coverage		Vessel Participation
	C/P	F/P [a]	C/V [b]					C/P & F/P	C/V	
Aleutian Islands golden king crab[c]	1	0	21	33	19.5	51.3	38.1	100.0	100.0	22
Bering Sea golden king crab	0	0	3	3	1.8	4.6	3.4	NA	100.0	3
Bering Sea snow crab	5	5	18	30	17.8	20.6	15.3	100.0	9.6	195
Bering Sea snow crab CDQ	1	0	8	10	5.9	10.4	7.7	100.0	88.9	10
Bristol Bay red king crab[d]	8	4	22	37	21.9	16.4	12.2	100.0	9.1	252
Bristol Bay red king crab CDQ	2	0	6	9	5.3	3.7	2.7	100.0	54.5	13
Petrel Bank red king crab	2	1	28	31	18.9	11.6	8.6	100.0	100.0	30
Bering Sea grooved Tanner	0	0	1	2	1.2	3.2	2.4	NA	100.0	1
Statewide scallops[e]	2	0	0	13	7.7	12.9	9.6	100.0	NA	2
Totals[f]	11	7	83	168	NA	134.7	NA	NA	NA	NA

[a] May include vessels that also operated as a C/P during the same fishery.
[b] C/Vs required to carry onboard shellfish observers.
[c] 2002/2003 fishery.
[d] Includes three AFA vessels.
[e] 2003/2004 fisheries, excluding Cook Inlet.
[f] Vessels are unique.
NA = not applicable

Table 3-10. Observer sampling effort and fishing effort by vessel type on observed vessels for statewide scallop and BSAI crab fisheries, 2003.

Fishery	Vessel Type	Number of Sample Pots or Tows	Number of Pots or Tows	Percent Sampled	Number of Landings	Harvest[a]
Aleutian Islands golden king crab[b]	C/V	5,834		CONFIDENTIAL		
	C/P	660		CONFIDENTIAL		
	Total	6,494	147,618	4.4	115	5,462,802
Bering Sea snow crab	C/V	741	12,813	5.8	21	2,348,475
	C/P	129	3,623	3.6	11	806,472
	Total	870	16,436	5.3	32	3,154,947
Bering Sea snow crab CDQ	C/V	622		CONFIDENTIAL		
	C/P	124		CONFIDENTIAL		
	Total	746		CONFIDENTIAL		
Bering Sea golden king crab	C/V	593		CONFIDENTIAL		
Bristol Bay red king crab	C/V[c]	485	10,531	4.6	24	1,297,968
	AFA C/V	71	911	7.8	3	114,995
	C/P	175	4,986	3.9	13	680,694
	Total	731	16,428	4.6	40	2,093,657
Bristol Bay red king crab CDQ	C/V	184		CONFIDENTIAL		
	C/P	95		CONFIDENTIAL		
	Total	279	4,372	6.4	13	813,392
Petrel Bank red king crab	C/V	884		CONFIDENTIAL		
	C/P	47		CONFIDENTIAL		
	Total	931	5,774	16.1	31	479,113
Bering Sea grooved Tanner	C/V	393		CONFIDENTIAL		
Statewide scallops[d]	C/P	1,276	4,765	26.8	18	484,536
Totals		12,313	216,876	5.7	292	14,821,661

[a] In pounds, deadloss included.
[b] 2002/2003 fishery
[c] Non-AFA catcher vessels
[d] 2003/2004 fishery

Table 3-11. Aleutian Islands golden king crab observer sampling efforts for bycatch and retained catch by vessel type, 1996 - 2002.

Year	Vessel Type	Number of[a] Total Vessels	Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Observer Months	Sample Pots	Pot Pulls by Vessel Type	% Sample Pot Pulls by Vessel Type	% Sample Pot Pulls of Total Fleet	Number of Bio. Meas.[b]	Legal Tallies[c]
1996/1997	C/V	15	15	100.0	44	73.6	9,741	146,629	6.6	5.5	90	111
	C/P	3	3	100.0	11	16.0	1,610	32,023	5.0	0.9	239	257
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	18	18	100.0	55	88.6	11,351	178,652	NA	6.4	329	368
1997/1998	C/V	11	11	100.0	41	62.0	6,871	124,073	5.5	4.1	83	94
	C/P	4	4	100.0	12	18.8	1,388	41,922	3.3	0.8	267	259
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	15	15	100.0	53	80.8	8,259	165,995	NA	5.0	350	353
1998/1999	C/V	13	13	100.0	17	29.0	3,076	68,960	4.5	2.9	43	47
	C/P	3	3	100.0	7	13.0	1,293	37,584	3.4	1.2	230	233
	F/P	1	1	100.0	1	1.0	NA	NA	NA	NA	4	4
	TOTAL	17	17	100.0	25	43.0	4,369	106,544	NA	4.1	277	284
1999/2000	C/V	15	15	100.0	49	69.0	7,642	CONFIDENTIAL			97	121
	C/P	1	1	100.0	5	11.2	822	CONFIDENTIAL			228	230
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	16	16	100.0	54	80.2	8,464	186,430	NA	4.5	325	351
2000/2001	C/V	16	16	100.0	47	63.5	9,015	CONFIDENTIAL			102	106
	C/P	1	1	100.0	5	9.2	742	CONFIDENTIAL			183	174
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	17	17	100.0	52	72.7	9,757	173,241	NA	5.6	285	280

-Continued-

Table 3-11. (Page 2 of 2)

Year	Vessel Type	Number of[a] Total Vessels	Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Observer Months	Sample Pots	Pot Pulls by Vessel Type	% Sample Pot Pulls by Vessel Type	% Sample Pot Pulls of Total Fleet	Number of Bio. Meas.[b]	Legal Tallies[c]
2001/2002	C/V	20	20	100.0	44	58.7	8,344	CONFIDENTIAL			100	102
	C/P	1	1	100.0	4	7.7	700	CONFIDENTIAL			146	147
	F/P	1	1	100.0	1	0.1	NA	NA	NA	NA	1	1
	TOTAL	21	21	100.0	49	66.5	9,044	167,544	NA	5.4	247	250
2002/2003	C/V	21	21	100.0	31	44.3	5,834	CONFIDENTIAL			81	81
	C/P	1	1	100.0	2	7.0	660	CONFIDENTIAL			144	146
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	22	22	100.0	33	51.3	6,494	147,618	NA	4.4	225	227

[a] Some vessels participated as both a C/P and F/P, but are counted once in the total number of vessels.
[b] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[c] Each legal tally typically consists of 600 crab.
NA = not applicable

Table 3-12. Bering Sea snow crab observer sampling efforts for bycatch and retained catch by vessel type, 1995 - 2003.

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type[b]	Number of Pot Pulls by Total Vessel Type[b]	% Sample Pot Pulls of Obs. Fleet[b]	% Sample Pot Pulls of Total Fleet[b]	Number of Bio. Meas.[c]	Number of Legal Tallies[d]
1995	C/V	234	0	0.0	NA	NA	NA	NA	-	NA	NA	NA	NA
	C/P	19	19	100.0	36	31.6	1,574	-	-	-	-	465	475
	F/P	15	15	100.0	17	22.5	NA	NA	NA	NA	NA	-	-
	TOTAL	268	34	12.7	53	54.1	1,574	-	506,802	-	0.3	465	475
1996	C/V	219	0	0.0	NA	NA	NA	NA	-	NA	NA	NA	NA
	C/P	15	15	100.0	35	31.3	1,412	-	-	-	-	479	494
	F/P	13	13	100.0	15	25.1	NA	NA	NA	NA	NA	246	292
	TOTAL	247	28	11.3	50	56.4	1,412	-	520,651	-	0.3	725	786
1997	C/V	216	0	0.0	NA	NA	NA	NA	680,725	NA	NA	NA	NA
	C/P	14	14	100.0	24	33.5	1,728	73,415	73,415	2.4	0.2	607	621
	F/P	11	11	100.0	17	26.5	NA	NA	NA	NA	NA	440	447
	TOTAL	237	25	10.5	41	60.0	1,728	73,415	754,140	2.4	0.2	1,047	1,068
1998	C/V	217	0	0.0	NA	NA	NA	NA	825,832	NA	NA	NA	NA
	C/P	12	12	100.0	21	30.7	5,872	65,436	65,436	9.0	0.7	598	609
	F/P	11	11	100.0	14	26.9	NA	NA	NA	NA	NA	751	762
	TOTAL	240	23	9.6	35	57.6	5,872	65,436	891,268	9.0	0.7	1,349	1,371
1999	C/V	231	0	0.0	NA	NA	NA	NA	846,163	NA	NA	NA	NA
	C/P	10	10	100.0	15	24.6	1,593	52,880	52,880	3.0	0.2	694	8
	F/P	11	11	100.0	12	26.3	NA	NA	NA	NA	NA	736	683
	TOTAL	252	21	8.3	27	50.9	1,593	52,880	899,043	3.0	0.2	1,430	691

-Continued-

Table 3-12. (Page 2 of 2)

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type[b]	Number of Pot Pulls by Total Vessel Type[b]	% Sample Pot Pulls of Obs. Fleet[b]	% Sample Pot Pulls of Total Fleet[b]	Number of Bio. Meas.[c]	Number of Legal Tallies[d]
2000	C/V	220	0	0.0	NA	NA	NA	NA	161,579	NA	NA	NA	NA
	C/P	9	9	100.0	10	5.7	202	8,485	8,485	2.4	0.1	76	60
	F/P	5	5	100.0	5	3.5	NA	NA	NA	NA	NA	111	91
	TOTAL	234	14	6.0	15	9.2	202	8,485	170,064	2.4	0.1	187	151
2001	C/V	200	7	3.5	7	9.6	241	4,663	159,438	5.2	0.1	7	6
	C/P	7	7	100.0	10	9.4	487	17,492	17,492	2.8	0.3	162	83
	F/P	3	3	100.0	3	4.3	NA	NA	NA	NA	NA	74	64
	TOTAL	210	17	8.1	20	23.3	728	22,155	176,930	3.3	0.4	243	153
2002	C/V	183	10	5.5	12	11.8	809	16,021	292,846	5.0	0.3	29	21
	C/P	8	8	100.0	9	8.0	509	14,820	14,820	3.4	0.2	170	121
	F/P	5	5	100.0	5	4.0	NA	NA	NA	NA	NA	192	105
	TOTAL	194	21	10.8	26	23.8	1,318	30,841	307,666	4.3	0.4	391	247
2003	C/V	187	18	9.6	19	14.1	741	12,813	136,280	5.8	0.5	20	20
	C/P	5	5	100.0	5	3.0	129	3,623	3,623	3.6	0.1	47	47
	F/P	5	5	100.0	6	3.5	NA	NA	NA	NA	NA	61	61
	TOTAL	195	26	13.3	30	20.6	870	16,436	139,903	5.3	0.6	128	128

[a] Some vessels participated as both a C/P and F/P, but are counted once in the total number of vessels.
[b] Information is not available for 1995 - 1996.
[c] Biological measurements taken on retained catch; each data set typically consists of 100 crab. Information is not available for 1995.
[d] Each legal tally typically consists of 600 crab. Information is not available for 1995.
NA = not applicable

Table 3-13. Bering Sea snow crab CDQ observer sampling efforts for bycatch and retained catch by vessel type, 1998 - 2003.

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type	Number of Pot Pulls by Total Vessel Type	% Sample Pot Pulls of Obs. Fleet	% Sample Pot Pulls of Total Fleet	Number of Bio. Meas.[b]	Number of Legal Tallies[c]
1998	C/V	20	20	all vessels	25	34.0	1,726	39,333	39,333	4.4	4.4	80	82
	F/P	0	0	all F/Ps	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TOTAL	20	20		25	34.0	1,726	39,333	39,333	4.4	4.4	80	82
1999	C/V	23	21	1 per group	26	10.2	789	14,131	46,490	5.6	1.7	35	27
	F/P	1	1	all F/Ps	2	1.9	NA	NA	NA	NA	NA	24	19
	TOTAL	24	22		28	12.1	789	14,131	46,490	5.6	1.7	59	46
2000	C/V	13	12	2 per group	12	8.5	629	CONFIDENTIAL	12,570	CONFIDENTIAL	5.0	32	26
	F/P	0	0	all F/Ps	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TOTAL	13	12		12	8.5	629	CONFIDENTIAL	12,570	CONFIDENTIAL	5.0	32	26
2001	C/V	11	11	2 per group	11	9.9	771	14,270	14,270	5.4	5.4	33	11
	F/P	0	0	all F/Ps	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TOTAL	11	11		11	9.9	771	14,270	14,270	5.4	5.4	33	11
2002	C/V	11	11	2 per group	15	16.0	1,098	CONFIDENTIAL	18,845	CONFIDENTIAL	5.8	12	10
	F/P	0	0	all F/Ps	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TOTAL	11	11		15	16.0	1,098	CONFIDENTIAL	18,845	CONFIDENTIAL	5.8	12	10

-Continued-

Table 3-13. (Page 2 of 2)

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Bycatch Sample Pots	Number of Pot Pulls by Obs. Vessel Type	Number of Pot Pulls by Total Vessel Type	% Bycatch Sample Pot Pulls of Obs. Fleet	% Bycatch Sample Pot Pulls of Total Fleet	Number of Bio. Meas.[b]	Number of Legal Tallies[c]
2003[d]	C/V	9	8	2 per group	8	8.3	622	CONFIDENTIAL			4.3	21	21
	C/P	1	1	all C/Ps	2	2.1	124	CONFIDENTIAL			0.9	40	40
	F/P	0	0	all F/Ps	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TOTAL	10	9		10	10.4	746	CONFIDENTIAL	14,583	CONFIDENTIAL	5.1	61	61

[a] Vessels may not have had observer coverage for 100% of the fishing time.
[b] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[c] Each legal tally typically consists of 600 crab.
[d] 2003 was the first year a C/P participated in the fishery.
NA = not applicable

Table 3-14. Bering Sea golden king crab observer sampling efforts for bycatch and retained catch by vessel type in 1989, 1992, 2001 - 2003.

Year[a]	Vessel Type	Number of: Total Vessels	Number of: Obs. Vessels	% Obs. Coverage	Number of: Observer Trips	Number of: Observer Months	Number of: Sample Pots[b]	Number of: Pot Pulls by Vessel Type[b]	% Sample Pot Pulls by Vessel Type[b]	% Sample Pot Pulls of Total Fleet[a]	Number of: Bio. Meas.[b,c]	Number of: Legal Tallies[b,d]
1989	C/V	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	C/P	2	2	100.0	2	1.5	-	-	-	-	-	-
	TOTAL	2	2	100.0	2	1.5	-	-	-	-	-	-
1992	C/V	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	C/P	2	2	100.0	2	1.3	-	-	-	-	-	-
	TOTAL	2	2	100.0	0	1.3	-	-	-	-	-	-
2001	C/V	6	6	100.0	9	10.5	1,356	4,513	30.0	30.0	13	14
	C/P	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	6	6	100.0	9	10.5	1,356	4,513	NA	30.0	13	14
2002	C/V	8	8	100.0	11	11.4	1,505	5,464	27.5	27.5	9	10
	C/P	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	8	8	100.0	11	11.4	1,505	5,464	NA	27.5	9	10
2003	C/V	3	3	100.0	3	4.6	593	CONFIDENTIAL			6	6
	C/P	0	0	100.0	0	0	NA	NA	NA	NA	NA	NA
	TOTAL	3	3	100.0	3	4.6	593	CONFIDENTIAL			6	6

[a] Does not include years during which no observer participation occured.
[b] Information is not available for 1989 and 1992.
[c] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[d] Each legal tally typically consists of 600 crab.
NA = not applicable

Table 3-15. Bristol Bay red king crab observer sampling efforts for bycatch and retained catch by vessel type, 1988 - 2003.

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type[b]	Number of Pot Pulls by Total Vessel Type[b]	% Sample Pot Pulls of Obs. Fleet[b]	% Sample Pots for Total Fleet	Number of Bio. Meas.[c]	Number of Legal Tallies[b,d]
1988	C/V	180	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	20	20	100.0	20	8.4	31	-	-	-	<.1	0	-
	F/P	5	5	100.0	5	1.9	NA	NA	NA	NA	NA	0	-
	TOTAL	205	25	12.2	25	10.3	31	-	153,004	-	<.1	0	-
1989	C/V	193	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	18	18	100.0	18	10.9	94	-	-	-	<.1	110	-
	F/P	12	12	100.0	12	6.8	NA	NA	NA	NA	NA	101	-
	TOTAL	223	30	13.5	30	17.6	94	-	208,684	-	<.1	211	-
1990	C/V	220	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	20	20	100.0	20	11.9	140	-	-	-	0.1	-	-
	F/P	15	15	100.0	15	8.9	NA	NA	NA	NA	NA	-	-
	TOTAL	255	35	13.7	35	20.8	140	-	262,131	-	0.1	-	-
1991	C/V	277	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	25	25	100.0	26	14.2	272	-	-	-	0.1	163	-
	F/P	14	14	100.0	14	7.4	NA	NA	NA	NA	NA	130	-
	TOTAL	316	39	12.3	40	21.5	272	-	227,555	-	0.1	293	-
1992	C/V	263	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	18	18	100.0	19	9.0	290	-	-	-	0.1	99	-
	F/P	6	6	100.0	6	3.0	NA	NA	NA	NA	NA	80	-
	TOTAL	287	24	8.4	25	12.0	290	-	205,940	-	0.1	179	-
1993	C/V	275	0	0.0	0	0	NA	NA	-	NA	NA	NA	NA
	C/P	17	17	100.0	19	10.6	558	-	-	-	0.2	124	-
	F/P	7	7	100.0	7	4.5	NA	NA	NA	NA	NA	112	-
	TOTAL	299	24	8.0	26	15.1	558	-	253,794	-	0.2	236	-

-Continued-

Table 3-15. (Page 2 of 3)

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type[b]	Number of Pot Pulls by Total Vessel Type[b]	% Sample Pot Pulls of Obs. Fleet[b]	% Sample Pots for Total Fleet	Number of Bio. Meas.[c]	Number of Legal Tallies[b,d]
1994						NO COMMERCIAL FISHERY							
1995						NO COMMERCIAL FISHERY							
1996	C/V	192	0	0.0	0	0	0	NA	73,908	NA	NA	NA	NA
	C/P	4	4	100.0	7	2.0	84	2,525	2,525	3.3	0.1	19	19
	F/P	2	2	100.0	2	0.8	NA	NA	NA	NA	NA	26	62
	TOTAL	197	5	2.5	9	2.8	84	2,525	76,433	3.3	0.1	45	81
1997	C/V	248	0	0.0	0	0	0	NA	86,968	NA	NA	NA	NA
	C/P	8	8	100.0	12	3.9	146	3,542	3,542	4.1	0.2	28	28
	F/P	3	3	100.0	3	1.6	NA	NA	NA	NA	NA	52	56
	TOTAL	259	11	4.2	15	5.5	146	3,542	90,510	4.1	0.2	80	84
1998	C/V	263	0	0.0	0	0	0	NA	135,093	NA	NA	NA	NA
	C/P	11	11	100.0	19	6.7	131	6,614	6,614	2.0	0.1	48	52
	F/P	5	5	100.0	3	1.8	NA	NA	NA	NA	NA	37	52
	TOTAL	277	14	5.1	22	8.5	131	6,614	141,707	2.0	0.1	85	104
1999	C/V	249	0	0.0	0	0	0	NA	141,298	NA	NA	NA	NA
	C/P	8	8	100.0	10	4.6	135	5,699	5,699	2.4	0.1	46	56
	F/P	3	3	100.0	1	1.0	NA	NA	NA	NA	NA	22	26
	TOTAL	258	9	3.5	11	5.6	135	5,699	146,997	2.4	0.1	68	82
2000	C/V[e]	214	11	5.1	11	5.1	403	4,429	86,313	9.1	0.4	10	11
	AFA C/V	25	3	12.0	3	1.1	88	1,024	8,340	8.6	0.1	3	3
	C/P	7	7	100.0	9	3.4	156	4,041	4,041	3.9	0.2	28	29
	F/P	2	2	100.0	3	0.6	NA	NA	NA	NA	NA	14	17
	TOTAL	247	22	8.9	26	10.2	647	9,494	98,694	6.8	0.7	55	60

-Continued-

Table 3-15. (Page 3 of 3)

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Obs. Vessel Type[b]	Number of Pot Pulls by Total Vessel Type[b]	% Sample Pot Pulls of Obs. Fleet[b]	% Sample Pots for Total Fleet	Number of Bio. Meas.[c]	Number of Legal Tallies[b,d]
2001	C/V[e]	193	20	10.4	20	9.5	359	5,746	54,804	6.2	0.6	19	19
	AFA C/V	31	3	9.7	3	1.0	48	682	6,662	7.0	0.1	3	3
	C/P	6	6	100.0	7	2.3	97	1,776	1,776	5.5	0.2	13	13
	F/P	3	3	100.0	3	1.2	NA	NA	NA	NA	NA	19	19
	TOTAL	231	30	13.0	33	14.0	504	8,204	63,242	6.1	0.8	54	54
2002	C/V[e]	204	17	8.3	17	7.1	330	5,236	55,496	6.3	0.5	16	18
	AFA C/V	31	3	9.7	3	1.3	37	551	5,776	6.7	0.1	3	3
	C/P	7	7	100.0	8	2.3	144	2,556	2,556	5.6	0.2	21	21
	F/P	3	3	100.0	3	1.0	NA	NA	NA	NA	NA	9	9
	TOTAL	243	28	11.5	31	11.8	511	8,343	63,828	6.1	0.8	49	51
2003	C/V[e]	212	19	9.0	20	10.0	485	10,531	111,120	4.6	0.4	11	11
	AFA C/V	32	3	9.4	3	1.2	71	911	12,913	7.8	0.1	1	1
	C/P	8	8	100.0	10	3.6	175	4,986	4,986	3.5	0.1	35	32
	F/P	4	4	100.0	4	1.6	NA	NA	NA	NA	NA	16	18
	TOTAL	252	31	12.3	37	16.4	731	16,428	129,019	4.4	0.6	63	62

[a] Some vessels participated as both a C/P and F/P and are only counted once in the total number of vessels.
[b] Information is not available for 1988-1993.
[c] Biological measurements taken on retained catch; each data set typically consists of 100 crab. Information is not available for 1990.
[d] Each legal tally typically consists of 600 crab.
[e] Non-AFA catcher vessels.
NA = not applicable

Table 3-16. Bristol Bay red king crab CDQ observer sampling efforts for bycatch and retained catch by vessel type, 1998 - 2003.

Year	Vessel Type	Number of		% Obs. Coverage	Number of					% Sample Pot Pulls of Obs. Fleet	% Sample Pot Pulls of Total Fleet	Number of	
		Total Vessels	Obs. Vessels		Observer Trips	Observer Months	Sample Pots	Pot Pulls by Obs. Vessel Type	Pot Pulls by Total Vessel Type			Bio. Meas.[a]	Legal Tallies[b]
1998	C/V	7	7	all vessels	7	3.1	193	3,405	3,405	5.7	5.7	9	10
1999	C/V	10	10	all vessels	10	3.5	263	2,976	2,976	8.8	8.8	9	12
2000	C/V	11	11	all vessels	11	4.4	423	4,663	4,663	9.1	9.1	1	0
2001	C/V	10	6	1 per group	6	2.9	166	2,516	3,158	6.6	5.3	9	9
2002	C/V	10	6	1 per group	6	2.7	242	2,875	3,909	8.4	6.2	9	9
2003[c]	C/V	11	6	1 per group	7	2.8	184	CONFIDENTIAL				8	8
	C/P	2	2	all vessels	2	0.9	95	CONFIDENTIAL				14	4
	TOTAL	13	8		9	3.7	279	4,372	5,704	6.4	4.9	22	12

[a] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[b] Each legal tally typically consists of 600 crab.
[c] 2003 was the first year C/Ps fished Bristol Bay CDQ red king crab.

Table 3-17. Petrel Bank red king crab observer sampling efforts for bycatch and retained catch by vessel type, 2001 - 2003.

Year	Vessel Type	Number of[a] Total Vessels	Number of[a] Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Number of Pot Pulls by Vessel Type	% Sample Pot Pulls by Vessel Type	% Sample Pot Pulls of Total Fleet	Number of Bio. Meas.[b]	Number of Legal Tallies[c]
2001 [d]	C/V	3	3	100.0	4	3.3	105	524	20.0	8.8	3	3
	C/P	1	1	100.0	2	5.1	133	671	19.8	11.1	5	5
	F/P	0	0	NA	0	0.0	NA	NA	NA	NA	0	0
	TOTAL	4	4	100.0	6	8.4	238	1,195	NA	19.9	8	8
2002	C/V	31	30	96.8	30	11.9	579	CONFIDENTIAL			21	22
	C/P	2	2	100.0	2	1.2	18	CONFIDENTIAL			3	3
	F/P	1	1	100.0	1	0.6	NA	NA	NA	NA	0	0
	TOTAL	33	32	97.0	33	13.6	597	3,782	NA	15.8	24	25
2003	C/V	28	28	100	28	10.9	884	CONFIDENTIAL			25	25
	C/P	2	2	100	2	0.6	47	CONFIDENTIAL			4	4
	F/P	1	1	100	1	0.07	NA	NA	NA	NA	0	0
	TOTAL	30	30	100.0	31	11.6	931	5,774	NA	16.1	29	29

[a] Some vessels participated as both a C/P and F/P, but are counted once in the total number of vessels.
[b] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[c] Each legal tally typically consists of 600 crab.
[d] A survey in 2001 was conducted during the months of January and November.
NA = not applicable

Table 3-18. Statewide grooved Tanner crab observer sampling efforts for bycatch and retained catch by vessel type, 1994 - 2003.

Year	Vessel Type	Number of Total Vessels	Number of Obs. Vessels	% Obs. Coverage	Number of Observer Trips	Number of Observer Months	Number of Sample Pots	Pot Pulls by Vessel Type[a]	% Sample Pot Pulls by Vessel Type[a]	% Sample Pot Pulls of Total Fleet[a]	Number of Bio. Meas.[b]	Number of Legal Tallies[c]
1994	C/V	6	6	100.0	14	16.6	1,782	-	-	-	58	30
	C/P	2	2	100.0	3	2.3	336	-	-	-	46.0	45.0
	TOTAL	8	8	100.0	17	18.8	2,118	55,433	NA	3.8	104	75
1995	C/V	16	16	100.0	47	55.2	10,343	-	-	-	155	145
	C/P	2	2	100.0	8	6.2	620	-	-	-	66.0	85.0
	TOTAL	18	18	100.0	55	61.3	10,963	163,462	NA	6.7	221	230
1996	C/V	9	9	100.0	20	26.3	4,469	73,960	6.0	8.0	40	62
	C/P	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	9	9	100.0	20	26.3	4,469	73,960	NA	8.0	40	62
1997				NO VESSELS PARTICIPATED IN THE FISHERY								
1998				NO VESSELS PARTICIPATED IN THE FISHERY								
1999				NO VESSELS PARTICIPATED IN THE FISHERY								
2000	C/V	1	1	100.0	1	1.4	164	CONFIDENTIAL			3.0	3.0
	C/P	2	2	100.0	2	0.7	17	CONFIDENTIAL			5	0
	TOTAL	3	3	100.0	3	2.0	181				8	3
2001	C/V	2	2	100.0	4	2.7	258	CONFIDENTIAL			15	15
	C/P	0	0	100.0	0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	2	2	100.0	4	2.7	258	CONFIDENTIAL			15	15
2002						No vessels participated in the fishery						

-Continued-

Table 3-18. (page 2 of 2)

Year	Vessel Type	Number of		% Obs. Coverage	Number of				% Bycatch Sample Pot Pulls by Vessel Type	% Bycatch Sample Pot Pulls of Total Fleet	Number of	
		Total Vessels	Obs. Vessels		Observer Trips	Observer Months	Sample Pots	Pot Pulls by Vessel Type			Bio. Meas.[a]	Legal Tallies[b]
2003	C/V	1	1	100.0	2	3.2	393	CONFIDENTIAL			11	10
	C/P	0	0	100.0	0.0	0.0	NA	NA	NA	NA	NA	NA
	TOTAL	1	1	100.0	2	3.2	393	CONFIDENTIAL			11	10

[a] Information is not available for 1994 - 1995.
[b] Biological measurements taken on retained catch; each data set typically consists of 100 crab.
[c] Each legal tally typically consists of 600 crab.
NA = not applicable

Table 3-19. Yearly summary by region of observed scallop vessels, number of observer trips, and observer months at sea for Alaska weathervane scallop fisheries from 1993 - 2003, excluding Cook Inlet.

Year	Yakutat[a]			Prince William Sound			Westward[c]			Total		
	Vessel[b]	Trips	Months	Vessel[b]	Trips	Months	Vessel[b]	Trips	Months	Vessel[b]	Trips	Months
1993	7	8	4.1	7	7	2.3	11	62	35.0	10	77	41.4
1994/1995	10	15	6.8	0	0	0.0	12	50	35.2	12	65	42.0
1995/1996	8	9	8.1	2	2	1.0	1	4	2.4	8	15	11.5
1996/1997	4	7	5.7	0	0	0.0	5	12	11.7	5	19	17.4
1997/1998	4	4	4.2	1	1	0.4	6	20	17.0	6	25	21.6
1998/1999	8	10	7.7	2	2	0.7	8	28	18.0	8	40	26.5
1999/2000	3	4	6.1	2	2	0.5	7	21	15.1	8	27	21.7
2000/2001	3	10	8.4	3	3	1.4	6	14	10.4	7	27	20.2
2001/2002	2	4	3.8	1	2	1.0	4	11	9.9	4	17	14.7
2002/2003	2	2	3.9	2	2	0.9	3	13	10.0	4	17	14.8
2003/2004	2	3	4.3	1	2	0.7	2	8	7.9	2	13	12.9
Average	5	6.9	5.7	2	2.1	0.8	6	22.1	15.7	7	31.1	22.2

[a] Includes District 16.

[b] Number of unique vessels.

[c] Includes Kodiak, Alaska Peninsula, Dutch Harbor, Adak and Bering Sea registration areas.

Table 3-20. Scallop observer activity by area for the 2003/2004 regulatory season.

Area	Number of Vessels[a]	Observer Trips		Observer Months	Percent of Total Observer Months
		Number	Percent		
Yakutat	2	3	23.1	4.3	33.1
Prince William Sound	1	2	15.4	0.7	5.4
Kodiak	2	6	46.2	6.5	50.3
Bering Sea	2	2	15.4	1.4	10.8
Alaska Peninsula	0	0	0.0	0.0	0.0
Adak	0	0	0.0	0.0	0.0
Total	2	13	NA	12.9	NA

[a] Number of unique vessels.
NA = not applicable

Table 3-21. Summary of evidence collected by shellfish observers during fisheries in which observers were deployed.

Fishery	Year	Observer Trips	Trips with Evidence	Percent of Observed Trips[a]	Percent of Year's Evidence[b]
	1991	11	0	0.0	0.0
	1992	16	1	6.3	2.4
	1993	11	1	9.1	5.6
St. Matthew / Pribilof	1994	11	1	9.1	5.9
red and blue king crab	1995	7	1	14.3	4.0
	1996	7	4	57.1	16.7
	1997	4	0	0.0	0.0
	1998	8	1	12.5	3.0
	1991	4	1	25.0	2.4
Dutch Harbor area	1992	6	1	16.7	2.4
golden king crab	1993	2	0	0.0	0.0
	1994	2	1	50.0	5.9
	1995	19	0	0.0	0.0
	1991	23	3	13.0	7.1
Adak area	1992	12	5	41.7	11.9
red and golden king crab	1993	5	1	20.0	5.6
	1994	12	2	16.7	11.8
	1995	60	5	8.3	20.0
	1991	2	0	0.0	0.0
	1992	2	0	0.0	0.0
Adak area	1993	1	0	0.0	0.0
red king crab only	1994	4	1	25.0	5.9
	2001	6	0	0.0	0.0
	2002	46	0	0.0	0.0
	2003	31	0	0.0	0.0
	1996	34	12	35.3	50.0
	1997	53	15	28.3	57.7
Aleutian Islands golden king crab[c]	1998	25	3	12.0	9.1
	1999	54	3	5.6	25.0
	2000	52	2	3.8	40.0
	2001	49	5	10.2	71.4
	2002	33	0	0.0	0.0

-Continued-

Table 3-21. (Page 2 of 4)

Fishery	Year	Observer Trips	Trips with Evidence	Percent of Observed Trips[a]	Percent of Year's Evidence[b]
	1996	9	0	0.0	0.0
	1997	15	3	20.0	11.5
	1998	24	3	12.5	9.1
Bristol Bay red king crab	1999	15	3	20.0	25.0
	2000	26	1	3.8	20.0
	2001	33	2	6.1	28.6
	2002	33	0	0.0	0.0
	2003	37	3	8.1	42.9
	1991	151	18	11.9	42.9
	1992	107	19	17.8	45.2
	1993	63	8	12.7	44.4
	1994	55	8	14.5	47.1
	1995	53	14	26.4	56.0
Bering Sea snow crab	1996	50	3	6.0	12.5
	1997	41	4	9.8	15.4
	1998	35	11	31.4	33.3
	1999	27	5	18.5	41.7
	2000	15	0	0.0	0.0
	2001	20	0	0.0	0.0
	2002	26	3	11.5	100.0
	2003	30	3	10.0	42.9
	1991	52	12	23.1	28.6
	1992	42	8	19.0	19.0
Bering Sea Tanner crab	1993	22	5	22.7	27.8
	1994	10	2	20.0	11.8
	1995	12	2	16.7	8.0
	1996	3	0	0.0	0.0
	1992	10	0	0.0	0.0
Bering Sea hair crab	1993	27	0	0.0	0.0
	1994	12	1	8.3	5.9
	1995	22	0	0.0	0.0

-Continued-

Table 3-21. (Page 3 of 4)

Fishery	Year	Observer Trips	Trips with Evidence	Percent of Observed Trips[a]	Percent of Year's Evidence[b]
	1996	21	3	14.3	12.5
	1997	16	4	25.0	15.4
Bering Sea hair crab	1998	12	2	16.7	6.1
	1999	8	0	0.0	0.0
	2000	3	0	0.0	0.0
	1994	14	1	7.1	5.9
Grooved Tanner crab	1995	57	1	1.8	4.0
All areas[d]	1996	20	2	10.0	8.3
	2000	3	0	0.0	0.0
	2001	4	0	0.0	0.0
	2003	2	0	0.0	0.0
	1992	8	0	0.0	0.0
	1993	8	0	0.0	0.0
	1994	0	0	NA	0.0
	1995	15	2	13.3	8.0
Miscellaneous	1996	1	0	0.0	0.0
Fisheries[e]	1997	4	0	0.0	0.0
	1998	0	0	NA	0.0
	1999	0	0	NA	0.0
	2000	1	0	0.0	0.0
	2001	10	0	0.0	0.0
	2002	12	0	0.0	0.0
	2003	3	0	0.0	0.0
	1998	35	13	37.1	39.4
Community Development	1999	38	1	2.6	8.3
Quota fisheries[f]	2000	23	2	8.7	40.0
	2001	17	0	0.0	0.0
	2002	21	0	0.0	0.0
	2003	19	1	5.3	14.3
Statewide scallops	2001	15	0	0.0	0.0
	2002	17	0	0.0	0.0
	2003	13	0	0.0	0.0

-Continued-

Table 3-21. (Page 4 of 4)

Fishery	Year	Observer Trips	Trips with Evidence	Percent of Observed Trips[a]	Percent of Year's Evidence[b]
	1991	283	34	12.0	
	1992	228	34	14.9	
	1993	165	15	9.1	
	1994	120	17	14.2	
Summary	1995	245	25	10.2	
	1996	145	24	16.6	NA
	1997	133	26	19.5	
	1998	139	33	23.7	
	1999	142	12	8.5	
	2000	123	5	4.1	
	2001	154	7	4.5	
	2002	199	3	1.5	
	2003	168	7	4.2	

[a] Percentage of trips in which evidence was collected.

[b] Percentage of total evidence collected by fishery for the fishing season.

[c] In 1996 the Adak and Dutch Harbor king crab Registration Areas were consolidated into the Aleutian Islands Area 'O' king crab Registration Area and opened on September 1st, the traditional opening time of the former Dutch Harbor area.

[d] Grooved Tanner crab areas include the Bering Sea, Aleutian Islands, Kodiak, Alaska Peninsula, and Southeastern Alaska.

[e] Miscellaneous fisheries for all years can include: Bering Sea golden king crab, BSAI octopus, surf clam, snail, St. Lawrence blue king crab, Norton Sound red king crab, eastern Aleutian triangle Tanner crab, western Aleutian Tanner and hair crab, Southeast Alaska misc. (urchins, shrimp, etc.).

[f] CDQ fisheries include Bering Sea snow crab, St. Matthew blue king crab, Pribilof red and blue king crab, and Bristol Bay red king crab.

NA = not applicable

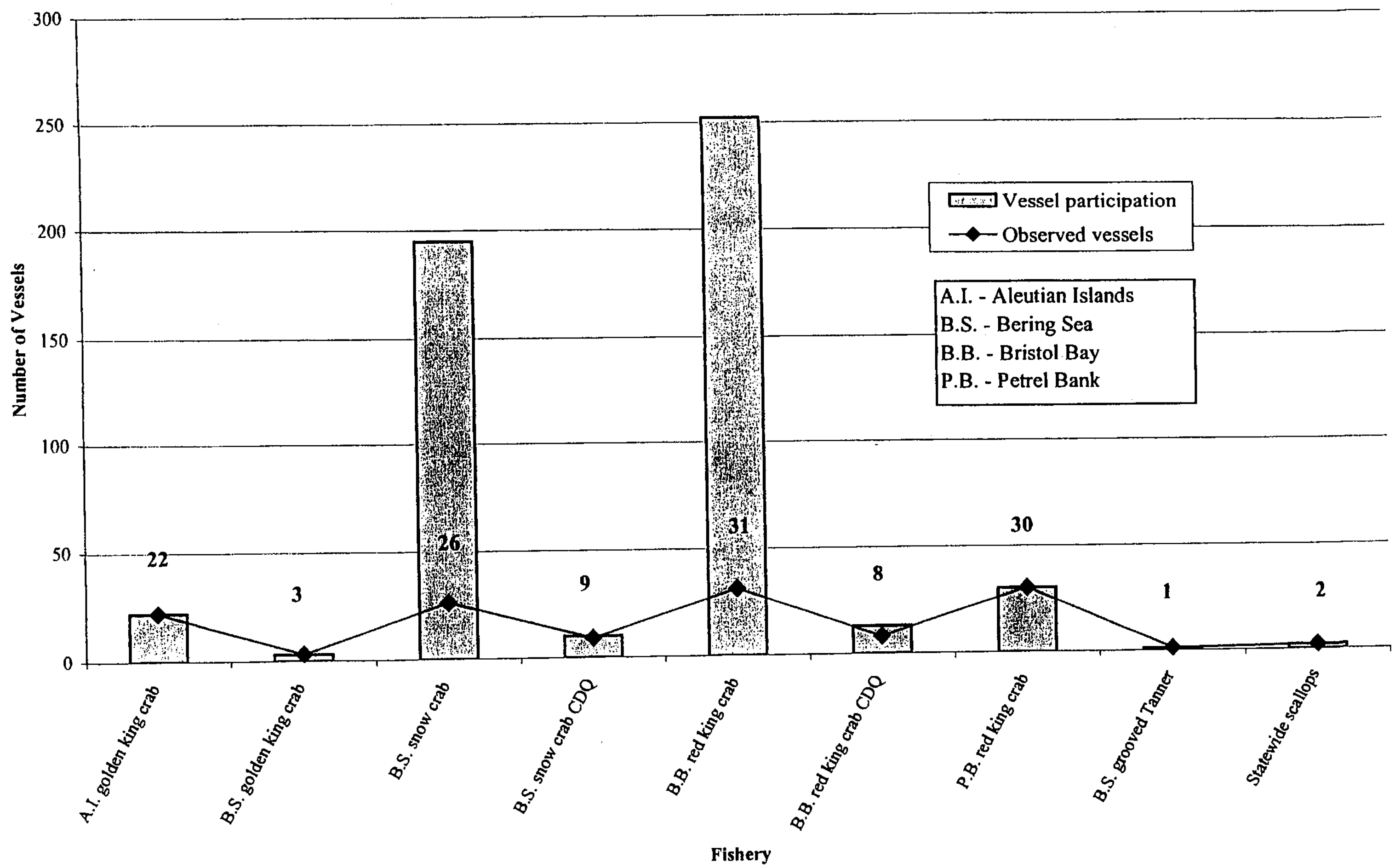


Figure 3-1. Level of observer coverage by fishery in 2003, and the 2002/2003 Aleutian Islands golden king crab fishery.

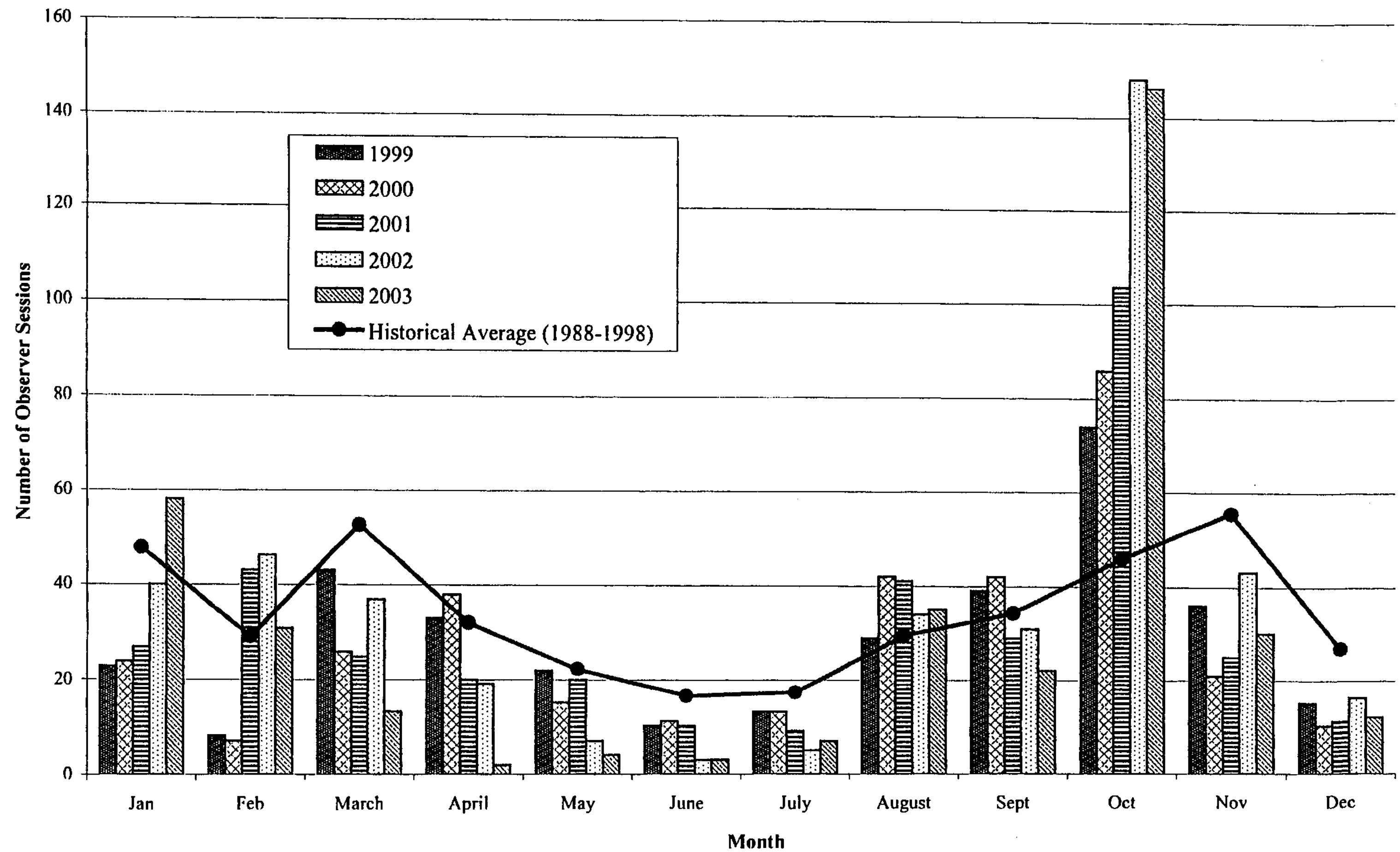


Figure 3-2. Comparison of the total number of crab and scallop observer sessions, including briefings, midtrips and debriefings for calendar years 1999, 2000, 2001, 2002 and 2003, and the historical average (1988 - 1998).

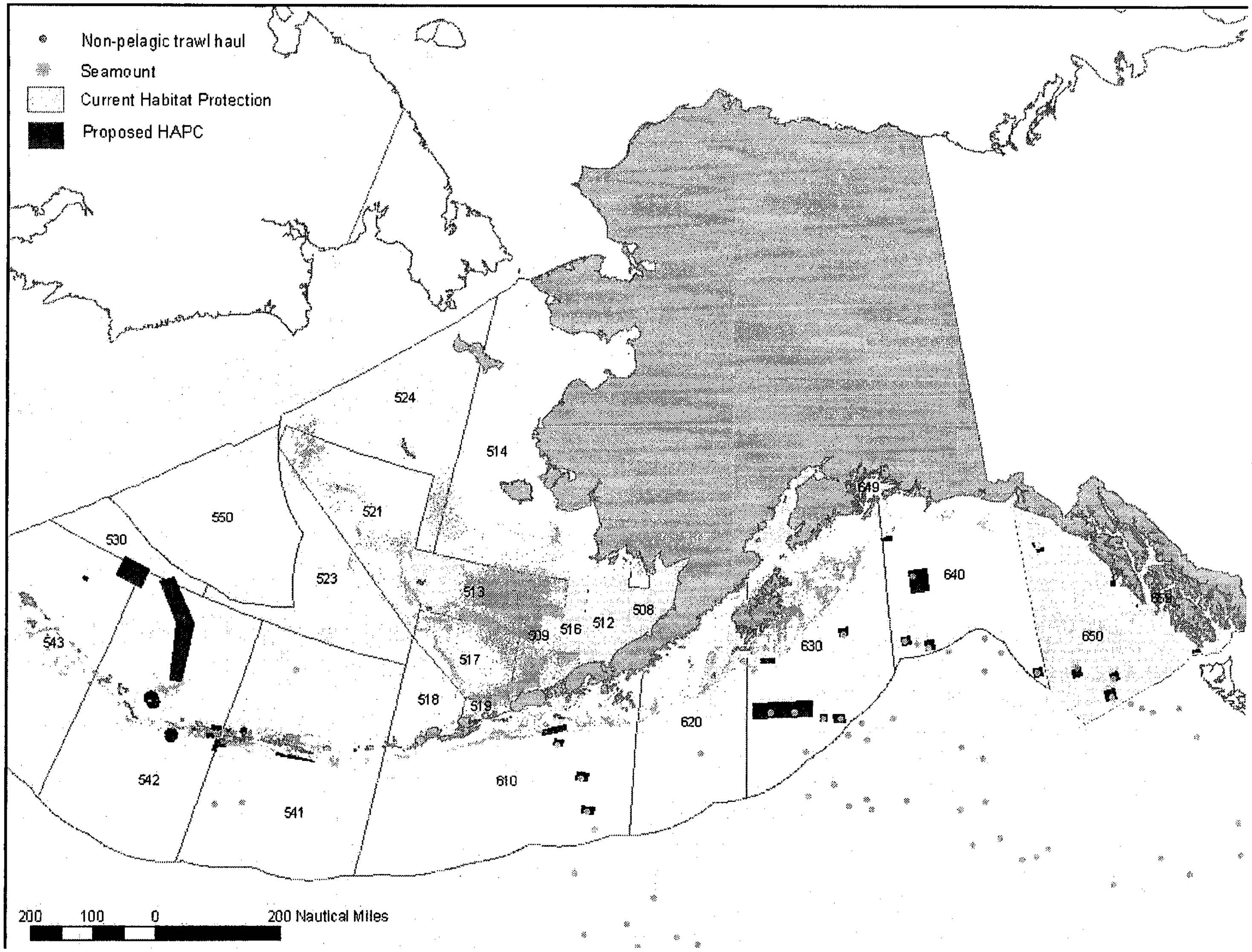


Figure 4-1. Current habitat protection in the EEZ and proposed HAPCs.

This figure depicts areas that have bottom-contact fishing restrictions currently in place in pink, including: Red King Crab Savings Area, Walrus Islands, St. Matthew, Kodiak, near-shore State of Alaska waters, Cook Inlet, and Nearshore Bristol Bay. HAPCs proposed in this document are shown in red. Green dots represent a sampling of non-pelagic trawl haul locations from 2000 and 2001. Orange dots are seamounts. [Note that other spatial fisheries restrictions do exist. This is not a comprehensive map.]

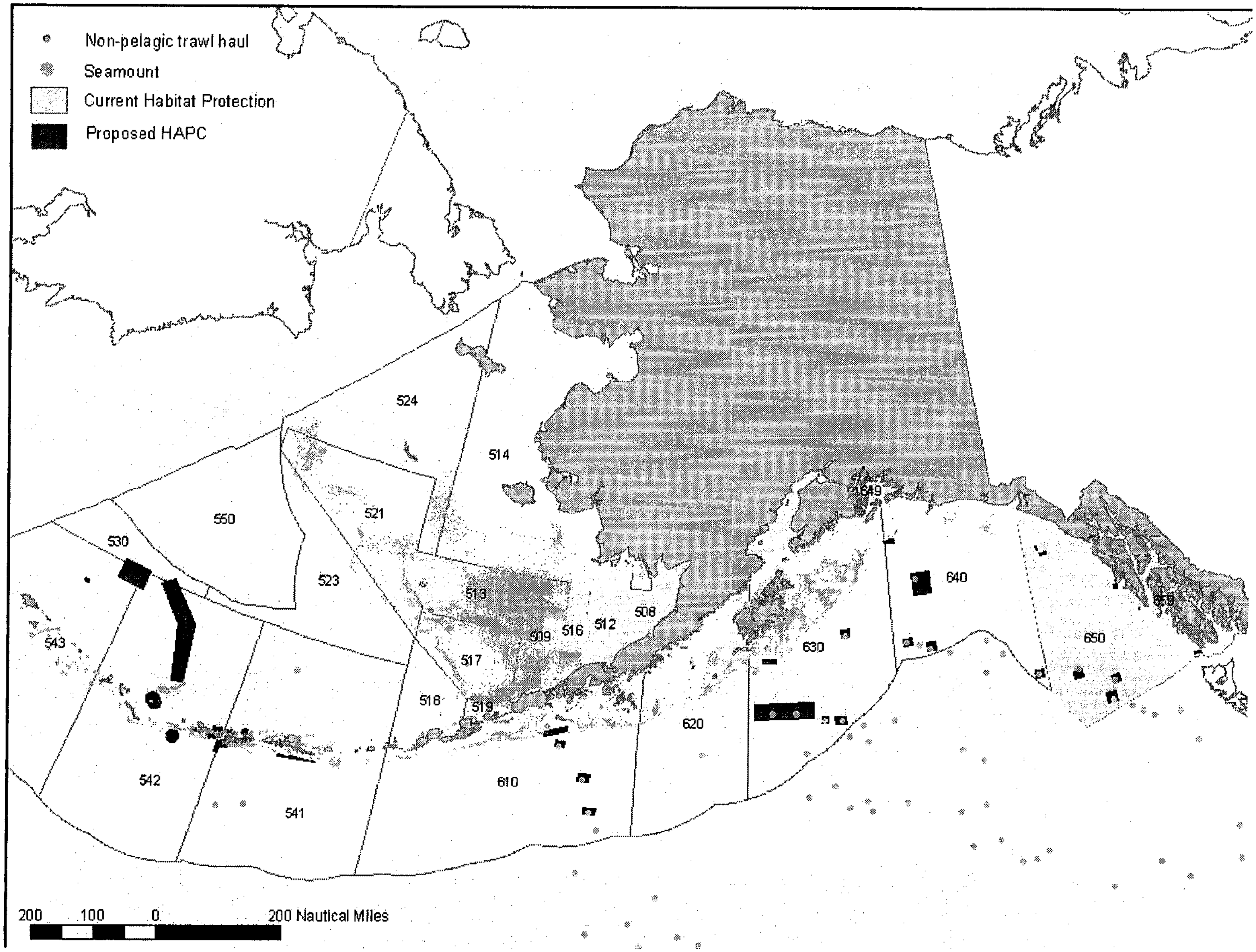


Figure 4-1. Current habitat protection in the EEZ and proposed HAPCs.

This figure depicts areas that have bottom-contact fishing restrictions currently in place in pink, including: Red King Crab Savings Area, Walrus Islands, St. Matthew, Kodiak, near-shore State of Alaska waters, Cook Inlet, and Nearshore Bristol Bay. HAPCs proposed in this document are shown in red. Green dots represent a sampling of non-pelagic trawl haul locations from 2000 and 2001. Orange dots are seamounts. [Note that other spatial fisheries restrictions do exist. This is not a comprehensive map.]

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Acting Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: January 3, 2003

TANK INSPECTIONS AND FISHERY MANAGEMENT FOR THE 2003 BERING SEA SNOW CRAB FISHERY

The 2003 Bering Sea snow crab fishery will open at noon on January 15 with a general fishery guideline harvest level (GHL) of 23.69 million pounds. The post-season community development quota is 1.92 million pounds.

Preseason tank inspections will begin on January 8 in Dutch Harbor, King Cove and Akutan and January 9 in False Pass pending arrival of ADF&G staff in those locations. Quick registration will begin at noon on January 13 in Dutch Harbor, Akutan, King Cove and False Pass. Tank inspections will be available at noon on January 14 in Saint Paul. Fishers are reminded that the holder of a 2003 T91Q or T09Q Bering Sea Tanner crab interim use permit card and the vessel's observer, if required, must be on the vessel at the time of registration and during all fishing operations. In addition, all pots onboard the vessel and in wet storage must be legally configured when the vessel is registered.

ADF&G will manage the 2003 Bering Sea snow crab fishery based on inseason reports from fishers. Reports will be taken once each day. The reporting period ends at 6:00 AM and is for the previous 24-hour period. Vessels reporting via single side band radio will report at 10:00 AM and vessels reporting via marine telex should report by 8:00 AM. ADF&G personnel will provide catch reporting information and will enlist vessels for daily reporting during preseason tank inspections and quick registration. Vessel operators may also obtain inseason catch reporting information from the ADF&G office in Dutch Harbor. Vessel operators are encouraged to participate in this voluntary reporting program.

Advance notice for the fishery closure will be based on actual and anticipated harvest rates. ADF&G will attempt to provide the greatest advance notice possible, however, the fishery could close on as little as 24-hours advance notice. ADF&G will broadcast the closure announcement on SSB 4125 mHz, by fax and e-mail to all persons and organizations on ADF&G's news release distribution list.

-continued-

News release January 3, 2003

Buoy tags may be purchased at the Dutch Harbor and Kodiak offices of ADF&G Monday through Friday, 8:00 AM until 4:30 PM. In addition, the ADF&G office in Dutch Harbor will be open for buoy tag sales from 9:00 AM until 4:30 PM on Saturday January 4, Saturday January 11 and Sunday January 12.

ADF&G, in conjunction with the United States Coast Guard and National Weather Service, will assess weather conditions prior to the start of tank inspections on January 13 for potential weather-related delay of the season opening, based on search and rescue criteria.

A current information packet for the 2003 Bering Sea snow crab fishery providing a brief overview of fishery management and regulations specific to this fishery is available at the Dutch Harbor and Kodiak ADF&G offices.

For further information contact the ADF&G in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Acting Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: January 13, 2003

SEASON OPENING OF THE 2003 BERING SEA SNOW CRAB FISHERY

The Alaska Department of Fish and Game, United States Coast Guard and National Weather Service have completed a review of weather conditions surrounding the opening of the Bering Sea snow crab fishery. Current and forecast weather and sea conditions in the operational area of vessels involved in the Bering Sea snow crab fishery have met United States Coast Guard search and rescue criteria and a delay in season opening is not warranted. Fishers are advised that the master of each vessel is responsible for the ultimate safety of the vessel.

As a result, the department will open the Bering Sea snow crab fishery at noon on January 15, 2003. Tank inspections and "quick registration" in Dutch Harbor, Akutan, King Cove and False Pass will begin at noon on January 13, 2003. Tank inspections in Saint Paul will begin at noon on January 14, 2003 if weather conditions allow vessels to enter the Saint Paul harbor.

For further information contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Acting Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: 2:00 PM, January 23, 2003

CLOSURE OF THE 2003 BERING SEA SNOW CRAB FISHERY

The Bering Sea District will close to commercial fishing for snow crab at 6:00 AM on Saturday January 25, 2003.

The Bering Sea District snow crab fishery was managed using inseason catch reports from fishers. Through 6:00 AM January 23, 2003, the total projected harvest is approximately 18.8 million pounds. At the current harvest rate, the 23.69 million pound general fishery guideline harvest level will be reached by 6:00 AM on January 25, 2003.

At the time of the closure all gear remaining on the fishing grounds must be unbaited with the doors secured fully open. All fishing gear must be in legal long-term wet storage or removed from the grounds within fourteen days of the closure.

Fishers delivering to a floating or shore-based processor in the Pribilof Islands must be at their delivery location within 48 hours of the closure. The northerly extent of sea ice during the 2003 season has allowed fishers to operate in locations requiring greater than 24 hours of travel time to the Pribilof Islands. Landing requirements for the Pribilof Islands are being extended an additional 24 hours thereby allowing fishers the opportunity to utilize all available fishing time.

Fishers delivering from the Eastern Subdistrict to Dutch Harbor, Adak, Akutan or King Cove must be at their delivery location within 24 hours of the closure. Fishers delivering from the Western Subdistrict to Dutch Harbor, Akutan, Adak or King Cove must be at their delivery location within 72 hours of the closure. Fishers delivering to Adak, King Cove and ports east of King Cove may request additional travel time by contacting ADF&G in Dutch Harbor within 24 hours of the closure.

For further information contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Acting Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: January 29, 2003

2003 BERING SEA CDQ SNOW CRAB FISHERY ALLOCATIONS

The 2003 general fishery for Bering Sea snow crab closed at 6:00 AM on January 25, 2003. The department estimates that the general fishery harvest will be 26,184,221 pounds. The 2003 Community Development Quota (CDQ) allocation is seven and one half percent of the total harvest of snow crab. The total harvest is defined as the general fishery harvest plus the CDQ harvest. The CDQ allocation based on the above harvest amount is 2,123,046 pounds. When processing of the general fishery harvest is complete, the department will amend CDQ fishing permits with the final CDQ allocation.

The CDQ groups are to direct fishing operations in a manner not to exceed their specific allocation. All deadloss must be included on the processor report and fish ticket; deadloss will be included in the total harvest for each group.

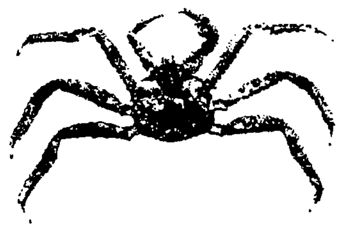
Allocations for the 2003 Bering Sea CDQ snow crab fishery are as follows:

APICDA	8%	169,844 pounds
BBEDC	20%	424,609 pounds
CBSFA	20%	424,609 pounds
CVRF	17%	360,918 pounds
NSEDC	18%	382,148 pounds
YDFDA	17%	360,918 pounds

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at 907-581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Acting Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L Granath
Assistant Area Management Biologist
Bering Sea / Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: February 28, 2003
4:00 PM

CLOSURE OF ALEUTIAN ISLANDS GOLDEN KING CRAB FISHERY WEST OF 174° W LONGITUDE

The Aleutian Islands (Area O) opened to commercial fishing for golden king crabs on August 15, 2002 with guideline harvest levels (GHL) of 3.0 million pounds east and 2.7 million pounds west of 174° W long. That portion of Area O east of 174° W long. closed to commercial fishing on September 7, 2002. Fishing effort west of 174° W long. has fluctuated throughout the season from one to six vessels, currently five vessels are participating. Weekly harvest has ranged from zero to 177,255 pounds per week and has averaged 99,000 pounds per week since January 5, 2003. Through February 27, 2003, approximately 2.56 million pounds of golden king crabs have been harvested from Area O west of 174° W long. and at the current harvest rate, the GHL of 2.7 million pounds will be reached by March 8, 2003. Therefore, the Aleutian Islands golden king crab fishery west of 174° W long. will close to commercial fishing at 11:59 PM March 8, 2003.

All golden king crab pots in Area O west of 174° W long. must be unbaited and have doors secured fully open by the time of the closure. Given fleet distribution during the 2002/03 fishery and distance from the most westerly grounds in the registration area to delivery locations in the eastern Aleutian Islands, landing requirements have been extended. Fishers delivering golden king crabs to processors in Dutch Harbor, Adak, or Akutan must be at their delivery location within 96 hours of the closure. Fishers delivering golden king crabs to King Cove or points east of King Cove may request additional time to reach those ports.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Wayne Donaldson
Regional Management Biologist

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 486-1840
Fax: (907) 486-1824

Date: April 2, 2003

REPORT AVAILABLE ON BRISTOL BAY RED KING CRAB HARVEST STRATEGY ANALYSIS

In September 2002, the Bering Sea/Aleutian Islands Crab Plan Team asked ADF&G to analyze the harvest strategy for Bristol Bay red king crabs. The analysis was undertaken to evaluate alternative harvest rates between the existing regulatory harvest rates of 10 and 15 percent. The ADF&G has completed the analysis and prepared a report for public review "Evaluation of Alternative Harvest Strategies For Bristol Bay Red King Crabs". The report is available on the department's web page at http://www.cf.adfg.state.ak.us/geninfo/pubs/rir/5j03-04.pdf. The file is large and may require several minutes to download.

The Board of Fisheries is not scheduled to discuss the Bristol Bay red king until the 2004/2005 meeting cycle. For further information, contact the Alaska Department of Fish and Game in Kodiak at (907) 486-1840.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: April 28, 2003
3:00 PM

PRIBILOF DISTRICT CLOSES TO COMMERCIAL FISHING FOR GOLDEN KING CRABS

The Pribilof District of king crab Registration Area Q (Bering Sea) opened to commercial fishing for golden king crabs at 12:01 AM January 1, 2003 with a guideline harvest level (GHL) of 150,000 pounds. A total of three vessels have participated in the fishery since the end of March. Through April 26, 2003, approximately 126,000 pounds of golden king crabs have been harvested and at the current harvest rate, the GHL will be reached by 11:59 PM Thursday, May 1, 2003. Therefore, the Pribilof District will close to commercial fishing for golden king crabs for the remainder of 2003 at 11:59 PM, Thursday, May 1, 2003.

Vessel operators are reminded that all pots must be unbaited and have doors secured fully open at the time of the closure. All vessels delivering to Dutch Harbor, Akutan, King Cove or the Pribilof Islands must be at their port of delivery within 30 hours of the closure except that vessels delivering to King Cove or ports east of King Cove may request additional delivery time. All pots must be in legal wet storage or removed from the water within 72 hours of the closure.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L. Granath
Assistant Area Management Biologist
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: July 15, 2003

ALEUTIAN ISLANDS GOLDEN KING CRAB FISHERY OPENS AUGUST 15
GUIDELINE HARVEST LEVELS ANNOUNCED

The 2003/04 Area O (Aleutian Islands) commercial golden king crab fishery will open at NOON on Friday, August 15, 2003. A guideline harvest level of 5.7 million pounds has been established for this fishery. The fishery will be managed to allow for a harvest of 3.0 million pounds of golden king crabs east of 174° west longitude with the remaining 2.7 million pounds available for harvest west of 174° west longitude. The fishery will be managed inseason using processor production reports, fishery performance data collected by observers stationed on each vessel registered for the fishery and reports from fishers.

Vessel registration will begin at NOON on Tuesday, August 12, 2003 in Dutch Harbor. Vessel tank inspections prior to gear loading will be available beginning at 9 AM, Thursday, August 7, 2003. An observer briefing must be scheduled and an individual holding a Commercial Fisheries Entry Commission 2003 Aleutian Islands king crab interim use permit card (K91O or K09O) must be aboard the vessel when it is registered. At the time of registration, all pots onboard the vessel or in wet storage must be in compliance with current Aleutian Islands commercial golden king crab fishing regulations.

For further details contact the Alaska Dept. of Fish & Game in Dutch Harbor at (907) 581-1239 or in Kodiak, at (907) 486-1840.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Mary Schwenzfeier
Shellfish Observer Coordinator
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: July 15, 2003

OBSERVER COVERAGE
FOR THE 2003/2004 BERING SEA – ALEUTIAN ISLANDS CRAB FISHERIES

The Crab Observer Oversight Task Force and the Alaska Department of Fish & Game announced the following observer coverage schedule for the 2003/2004 crab seasons in the Bering Sea and Aleutian Islands. Observer coverage and funding remain the same as the 2002/2003 crab seasons. Observer coverage is either paid directly by the vessel (pay-as–you-go), or funded by cost-recovery proceeds generated by department test fishing. Pre-registration is required in most fisheries prior to the regulatory opening. Pre-registration deadlines are listed below. For fisheries requiring observer coverage without a pre-registration deadline, vessel operators directly contact an observer contractor to procure observer coverage.

Pre-registration facilitates assignment of observers to vessels in fisheries with partial fleet coverage. After the pre-registration deadline, the department will randomly select catcher vessels that will be required to carry an observer during the fishery. The department will obtain and assign observers to the selected vessels prior to the fishery opening. Approximately 10% of the catcher vessels 75-125' overall length (OL) and 10% of the catcher vessels greater than or equal to 125' OL in the Bering Sea king and Tanner crab fisheries will carry observers. Vessels less than 75' OL participating in these fisheries will not be required to carry observers.

Observer coverage is also required for catcher vessels participating in the American Fisheries Act (AFA) crab fisheries for Bristol Bay red king crab and Bering Sea *C. bairdi* Tanner crab. For details on observer coverage in those fisheries contact the department. Observer coverage for the Bering Sea brown king crab fisheries will be 100 percent pay-as-you-go.

Observer coverage for at-sea processors participating in any king or Tanner crab fishery, for all vessels in the Aleutian Islands king or Tanner crab fisheries, and for all vessels in the commissioner's permit hair crab and deep-water king and Tanner crab fisheries will remain in

- continued -

effect under the pay-as-you-go system. Likewise, observer coverage for any vessel in the CDQ and AFA fisheries will be pay-as-you-go.

Fishery	Pre-registration Deadline [1]	Catcher Vessels [2]		At-sea Processors	
		Observer Coverage	Cost-Recovery Funded?	Observer Coverage	Cost-Recovery Funded?
St. Matthew blue king	August 24	Partial	YES	100%	NO
Pribilof red & blue king	August 24	Partial	YES	100%	NO
Bristol Bay red king	September 24	Partial	YES	100%	NO
Bering Sea *C. bairdi*	September 24	Partial	YES	100%	NO
Bering Sea *C. opilio*	December 24	Partial	YES	100%	NO
St. Matthew brown king	none	100%	NO	100%	NO
Pribilof brown king	none	100%	NO	100%	NO
Hair crab	none	100%	NO	100%	NO
C. tanneri & C. angulatus	none	100%	NO	100%	NO
Aleutian king crab (red or brown)	none	100%	NO	100%	NO
Paralomis & L. couesi	none	100%	NO	100%	NO

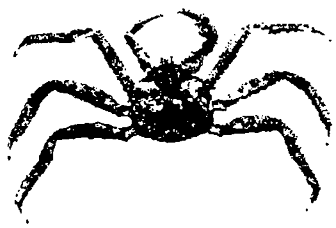
[1] When the pre-registration deadline occurs on a weekend or holiday, the deadline is extended to the next business day.
[2] AFA and CDQ catcher vessels are pay-as-you-go.

In fisheries where the cost of the observer is borne by the vessel, the vessel operator is responsible for arranging for observer coverage before fishing begins. Vessels participating in other shellfish fisheries should contact the department for permit and observer coverage requirements.

For additional information please contact: Mary Schwenzfeier at the Alaska Department of Fish and Game in Dutch Harbor (907-581-1239); Wayne Donaldson in Kodiak (907-486-1842); or the co-chairmen of the Crab Observer Oversight Task Force; Jeff Stephan (907-486-3453) and Arni Thomson (206-547-7560).

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Douglas Pengilly
Regional Shellfish Research Biologist

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 486-1865
Fax: (907) 486-1819

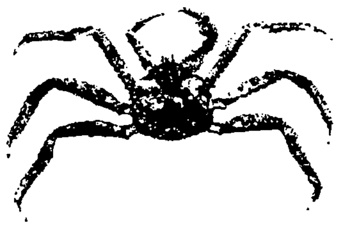
Date: August 8, 2003

REPORT AVAILABLE ON PRIBILOF ISLANDS BLUE KING CRAB HARVEST STRATEGY ANALYSIS

The Alaska Board of Fisheries is scheduled to consider adoption of a new harvest strategy for the Pribilof Islands blue king crab fishery on October 4, 2003. The Pribilof Islands blue king crab stock was declared "overfished" by the National Marine Fisheries Service in 2002 and, under the requirements of the Magnuson-Stevens Act, a rebuilding plan for the stock must be developed by the North Pacific Fishery Management Council. The harvest strategy for this stock adopted by the Alaska Board of Fisheries is an integral part of the rebuilding plan. The ADF&G has completed an analysis evaluating alternative harvest strategies for the Pribilof Islands blue king crab stock relative to effectiveness in allowing for stock rebuilding. The report on this analysis, "Evaluation of Alternative Rebuilding Strategies for Pribilof Islands Blue King Crabs," for review by the Board and public is available on the department's web page at http://www.cf.adfg.state.ak.us/geninfo/pubs/pubshome.htm#evaluation2. The file is large and may require several minutes to download.

For further information, contact the Alaska Department of Fish and Game in Kodiak at (907) 486-1865.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: August 15, 2003

ST. MATTHEW ISLAND SECTION AND PRIBILOF DISTRICT KING CRAB SEASONS

The Alaska Department of Fish & Game and the National Marine Fisheries Service (NMFS) have completed analysis of the 2003 NMFS trawl survey results for the Pribilof District and St. Matthew Island Section of the Bering Sea. King crab population and biomass estimates for these areas were computed from survey data. Based on the results, the St. Matthew blue king crab and the Pribilof red and blue king crab fisheries will remain closed for the 2003 season.

St. Matthew Island Section blue king crab: Survey estimates for St. Matthew blue king crabs indicate continued low abundance of mature male and female crabs. The stock is above the minimum threshold of mature males as defined in the state harvest strategy, 2.9 million pounds. However, the calculated guideline harvest level (GHL) is only 0.634 million pounds, well below the minimum GHL of 2.5 million pounds.

Pribilof District red and blue king crab: Survey results of Pribilof District blue king crabs indicate continued low abundance. The abundance in each size class of blue king crab estimated by ADF&G is lower in 2003 than for 2002. The minimum mature male threshold for a fishery is 770,000 king crabs, and the 2003 estimate is 291,000 mature male blue king crabs.

The estimate of mature male red king crabs in the Pribilof District declined slightly from the 2002 estimate. However, the confidence interval of the estimate is ± 54%. Given the poor precision in abundance estimate for this stock, stock levels and trends cannot be determined. Due to the continued decline in the blue king crab stock, the high degree of uncertainty surrounding

-continued-

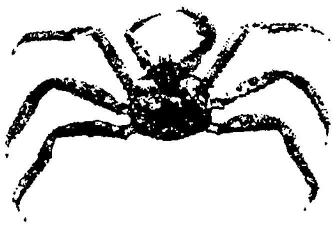
the estimate of red king crab abundance, poor fishery performance of recent years, and concern for blue king crab bycatch, the red and blue king crab fishery in the Pribilof District will remain closed for the 2003 season.

Bristol Bay red king and Bering Sea Tanner crab: The Bristol Bay red king crab and Bering Sea Tanner crab GHLs will be announced on Friday, August 29.

For further details contact the Alaska Dept. of Fish & Game in Dutch Harbor at (907) 581-1239 or in Kodiak, at (907) 486-1840.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: August 29, 2003

BRISTOL BAY RED KING AND BERING SEA TANNER CRAB SEASONS

The Alaska Department of Fish & Game and the National Marine Fisheries Service (NMFS) have completed analysis of NMFS trawl survey results for Bristol Bay red king and Bering Sea Tanner crabs. Abundance and biomass estimates were computed from survey data.

Bristol Bay red king crab:

The Bristol Bay red king crab stock is estimated to be above the minimum stock size and mature female abundance thresholds. The Effective Spawning Biomass (ESB) of the Bristol Bay red king crab stock is estimated to be 60.7 million pounds. Based on the 2003 data, ESB increased 27% between 2002 and 2003. Mature male abundance increased 16% over the 2002 estimate and legal male abundance increased 26%. Based on the ESB greater than 55.0 million pounds, a 15 percent exploitation rate is applied to the estimated mature male abundance to derive guideline harvest levels (GHL) for the 2003 season as follows:

Fishery	**GHL (million pounds)**
Bristol Bay red king crab	14.535 (general)[1]
Bristol Bay CDQ red king crab	1.178 (CDQ)
	15.713 (total)

[1] The North Pacific Fishery Management Council has capped the American Fisheries Act (AFA) vessels to their historic proportion of the Bristol Bay red king crab harvest during the general fishery. The 41 AFA vessels' harvest will be capped at 10.96 percent (1,593,036 pounds) of the general GHL.

-continued-

News Release August 29, 2003

The preseason vessel registration deadline to participate in the 2003 general Bristol Bay red king crab fishery is 5:00 PM Wednesday, September 24, 2003. Preseason registration forms must be received by the department by the deadline. Preseason registration forms are available on the web at **http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/03bbrkc_form.pdf** or via fax upon request.

A 2003 Commercial Fisheries Entry Commission permit card for Bristol Bay king crab, listing the vessel's ADF&G number, is required at the time of preseason registration. After the preseason registration deadline the department will announce the vessels selected to carry an onboard observer.

The following web site is available for vessel operators to verify the state's receipt of preseason registration: **http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/03bbrkc_reg.pdf.** This web site is updated three times per week.

Because the 2003 Bristol Bay red king crab GHL is greater than 12.0 million pounds, the number of vessels preseason registered is not used to determine the pot limit. The 2003 Bristol Bay red king crab pot limit is 200 pots for vessels less than or equal to 125 feet in overall length and 250 pots for vessels greater than 125 feet in overall length.

Tanner crab:

The Bering Sea Tanner crab biomass remains below the threshold necessary to allow a fishery. The Alaska Board of Fisheries harvest strategy for Bering Sea Tanner crabs specifies a mature female biomass threshold of 21.0 million pounds. In addition, a minimum GHL threshold of 4.0 million pounds applies in waters east of 168° W long. The 2003 survey estimated the mature female biomass to be 20.8 million pounds, a 51% increase from the 2002 mature female biomass estimate of 13.8 million pounds, however the estimate is still below the female biomass threshold for a fishery opening. Thus the entire Bering Sea District will remain closed to the harvest of Tanner crab for the 2003 season. Additionally, a GHL calculated for the Bering Sea would be 1.21 million pounds which is well below the minimum GHL threshold.

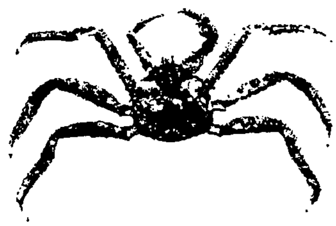
Snow crab:

Data analysis for Bering Sea snow crab is not complete. Results are expected to be released September 19, 2003.

For further information contact ADF&G in Dutch Harbor at (907) 581-1239 or in Kodiak (907) 486-1840.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L. Granath
Assistant Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: August 29, 2003

PETREL BANK RED KING CRAB FISHERY GUIDELINE HARVEST LEVEL AND SEASON ANNOUNCED

The Petrel Bank area of the western Aleutians will open to commercial fishing for red king crabs at noon on October 25, 2003. The Alaska Department of Fish & Game has established a GHL of 500,000 pounds of legal male red king crabs. The Petrel Bank area is defined as those waters of king crab Registration Area O west of 179° W long., east of 179° E long., and north of 51° 45' N lat. Only those waters in the above described area that are 125 fathoms or less in depth will be open to fishing for red king crabs. Fishers are reminded that although the Petrel Bank area is west of 169° 30' W long., and therefore in the Hawaii-Aleutian Time Zone, all regulatory times and management announcements will be based on the Alaska Time Zone.

The preseason registration deadline is 5:00 PM Monday, October 6, 2003. The aggregate pot limit for the fishery is 1,250 pots total. Vessels less than or equal to 125 feet will be allowed to have 4/5 the number of pots that vessels greater than 125 feet will be allowed. Individual pot limits will be determined based upon the preseason registration number of vessels compared to the 1,250 total pot limit. The maximum pot limit per vessel will be 40 pots for vessels less than or equal to 125 feet in overall length and 50 pots for vessels greater than 125 feet in overall length. Buoy tags for the fishery will be available for sale in Dutch Harbor and Kodiak beginning October 7, 2003. Buoy tags will not be available in Adak. Each pot must be configured so that 1/3 of one vertical side of the pot consists of nine inch or greater stretched mesh webbing.

Vessel registration and tank inspections will be available in Dutch Harbor, King Cove and Adak beginning at noon on October 22, 2003. Each vessel registered for the fishery must carry an observer during all fishing activities. Observer costs will be borne by the vessel. Vessel operators must provide accurate daily catch information to their observers. Observers will relay catch reports to ADF&G in Dutch Harbor for inseason management of the fishery.

-continued-

Observer briefings will be available in Dutch Harbor at the conclusion of the Bristol Bay red king crab fishery. Department staff will also be available in Adak for a maximum of eight scheduled briefings for the Petrel Bank fishery. However, staff priority will be conducting registrations and tank inspections during that time. Briefings will be available only after other fishery management duties are complete. All briefings must be scheduled at least 48 hours in advance with the Dutch Harbor observer staff. Briefings will be provided on a first-come, first-serve basis.

Golden king crab fishers participating in the Petrel Bank red king crab fishery are not required to remove golden king crab pots from the water, except from the area that is open to fishing for red king crabs. Pots used to take red king crabs may not be longlined and red king crab may not be harvested from longline gear. In addition, a person or vessel that operates longline, trawl, or pot gear in waters less than 125 fathoms in depth in a commercial, subsistence, personal use, or sport fishery in that portion of the Petrel Bank open to commercial red king crab fishing 30 days immediately before the scheduled opening date of the commercial red king crab fishery may not participate in the commercial red king crab fishery.

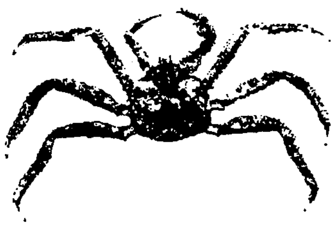
Preseason registration forms must be received by the Dutch Harbor or Kodiak offices by Monday, October 6, 2003. Preseason registration forms are available on the web at: **http;//www.cf.adfg.state.ak.us/region4/shellfish/crabs/03petrel_form.pdf** or via fax upon request.

A 2003 Commercial Fisheries Entry Commission permit card for Aleutian Islands king crab, listing the vessel's ADF&G number, is required at the time of preseason registration. After the preseason registration deadline the department will announce pot limits.

The web site for vessel operators to verify the state's receipt of vessel preseason registration is: **http://www.cf.adfg.state.ak.us/region4/shellfish/crabs/03petrel_reg.pdf.** This web site is updated three times per week.

For additional information, contact the Alaska Department of Fish and Game in Dutch Harbor (907) 581-1239 or in Kodiak (907-486-1840).

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L Granath
Assistant Area Management Biologist
Bering Sea / Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: September 3, 2003
12:00 NOON

EASTERN ALEUTIAN ISLANDS CLOSES TO GOLDEN KING CRAB FISHING

The commercial golden king crab fishery in that portion of Area O (Aleutian Islands) east of 174° W long. will close effective at 12:00 NOON on September 8, 2003. Inseason catch reports indicate that the guideline harvest level (GHL) of 3.0 million pounds will be reached by the September 8, 2003 closure.

At the time of the closure, all golden king crab pots east of 174° W long. must be unbaited and have the doors secured open. Within 72 hours of the closure, all golden king crab pots must be legally stored in waters 75 fathoms or less in depth, or be removed from the water. That portion of Area O west of 174° W long. has a GHL of 2.7 million pounds and will remain open until further notice.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Frank Rue, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: September 19, 2003

2004 BERING SEA SNOW CRAB SEASON
and
BUOY TAG SALES FOR BRISTOL BAY RED KING CRAB

The Alaska Department of Fish & Game and the National Marine Fisheries Service (NMFS) have completed analysis of NMFS trawl survey results for the Bering Sea District snow crab stock.

The total mature biomass (TMB) of male and female snow crabs in the Bering Sea is estimated to be above the minimum threshold for a fishery opening under the Alaska Board of Fisheries (BOF) harvest strategy. The 2004 snow crab guideline harvest level (GHL) is 20.831 million pounds. Of this total, 1.562 million pounds are available to the Community Development Quota fishery with the remaining 19.269 million pounds available to the general fishery.

Total mature snow crab biomass decreased 2% from the 2002 survey, to 306.2 million pounds, and is below the minimum stock size threshold of 460.8 million pounds. The 2003 TMB is the fourth lowest on record. The estimated abundance of males greater than four inches carapace width (CW) is 65 million crabs, a decrease from the 2002 abundance level of 76 million crabs. Old and very-old shell males constitute 30% of males greater than four inches CW, which is comparable to the 2002 estimate of 32%.

The 2004 Bering Sea snow crab pot limit will be 70 pots for vessels less than or equal to 125 feet in overall length and 90 pots for vessels greater than 125 feet in overall length. The regulatory opening date for this fishery is noon on January 15, 2004 in all waters of the Bering Sea District west of 166° W long. The preseason vessel registration deadline to participate in the 2004 Bering Sea snow crab fishery is 5:00 PM December 24, 2003. Preseason registration forms must be received by the department before the deadline. Preseason registration forms are available on

-continued-

the world wide web at http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/04opilio_form.pdf or via fax upon request. A 2003 or 2004 T09Q or T91Q Commercial Fisheries Entry Commission permit card listing the vessel's ADF&G number is required at the time of preseason registration.

The web site for vessel operators to verify the state's receipt of vessel preseason registration is http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/04opilio_reg.pdf . This web site is updated several times per week.

Bristol Bay red king crab buoy tag sales: Buoy tags for the Bristol Bay red king crab fishery are currently available for purchase during normal office hours at the Dutch Harbor and Kodiak ADF&G offices. In addition, buoy tags will be available for purchase in Dutch Harbor on Saturday, October 11 and Sunday, October 12, 2003 between 9:00 AM and 4:30 PM. Buoy tags will be available by mail order beginning Monday, September 22, 2003. Buoy tags will not be mailed after Wednesday, October 1, 2003.

Bering Sea hair crab: Analysis of hair crab survey data is not complete. Information on Bering Sea hair crab is expected to be available later in September.

For further details contact the Alaska Department of Fish & Game in Dutch Harbor at (907) 581-1239 or in Kodiak at (907) 486-1840.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Mary Schwenzfeier
Shellfish Observer Program Coordinator
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

September 25, 2003

Catcher Vessels Selected for Observer Coverage
2003 Bristol Bay Red King Crab Fishery

The following catcher vessels, randomly selected from the Bristol Bay red king crab fishery pre-season vessel registrations, will carry crab observers for the duration of the Bristol Bay general fishery:

Vessels 75 feet to 125 feet

Vessel Name	ADF&G #
Mar Del Sud	21652
Alaska Dawn	69765
Pacific Sun	35977
Denali	00951
Lady Jessie	44829
Cougar	06700
Atlantico	00037
Lady Aleutian	41715
Farrar Sea	61954
Maverick	45706
Lady Helen	00016
Lady Ann	39156
Lady Blackie	58129
Midnite Sun	00065
Sea Ern	06448
Alternates	
Storm Bird	46854
Windward	56992

Vessels greater than 125 feet

Vessel Name	ADF&G #
Northwestern	29962
Secret Island	61333
Bella K	55124
Billikin	20745
Aquila	62505
Bristol Mariner	08411
Alternates	
Pinnacle	71174
Notorious	00987

AFA crab vessels

Vessel Name	ADF&G #
Marcy J	00055
Starlite	34931
Elizabeth F	14767
Alternate	
Majesty	60650

-continued-

ADF&G or a state-contracted observer company will provide observers for the selected non-AFA catcher vessels. The observer must be on the selected vessel at the time of vessel registration validation on or before October 14. Selected vessels must provide proof of compliance with United States Coast Guard (USCG) vessel safety requirements. USCG dockside examinations are available in Puget Sound, Kodiak and Dutch Harbor.

Observer salary and travel costs for catcher vessels participating in the general fishery will be provided from cost-recovery funds. Costs for crab observers on the American Fisheries Act (AFA) catcher vessels will be borne by the AFA participants.

Observers will have their own rain gear, boots, gloves, survival suit and personal flotation device (PFD) for working on deck, along with their own bedding and personal items. Some of the regulatory requirements for vessels that carry observers include:

- Provide adequate food and accommodations for the observer equal to those provided for the vessel's crew;
- Provide to the observer daily catch information, including areas fished, number of crab retained, pot locations, number of pots pulled, and other information specified by the department;
- Provide a safe work area, and necessary gear including 2 to 3 totes for the observer to use at all times to hold the contents of crab pots for sampling;
- Assure observer access to single side band (SSB) radio, fax, telex, or telephone so that catch reports from observers are received at the Dutch Harbor ADF&G office in a timely manner.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 1, 2003

BERING SEA HAIR CRAB FISHERY CLOSED FOR 2003/2004 SEASON

The Alaska Department of Fish and Game (ADF&G) has completed analysis of hair crab data collected during the National Marine Fisheries Service eastern Bering Sea trawl survey. Due to low male abundance, the Bering Sea will not open to commercial fishing for hair crabs during the 2003/2004 season.

In the Northern District, the 2003 estimate of large male hair crab is 66% lower than the level at which the fishery was last opened in 2000. The commercial fishery in 2000 performed poorly and catch rates averaged less than one legal hair crab per pot lift. Fishery data indicate that the Northern District is not capable of sustaining hair crab harvests at the current abundance level. Small male abundance in the Northern District is less than one half the long-term average abundance level.

In the Pribilof District, male hair crab abundance has declined since 1995. Commercial fisheries from 1996 through 1999 failed to meet preseason GHLs. The fishery has been closed since 1999, however the stock has continued to decline. The current abundance estimate for large male hair crab is 5.4 percent of the 1989-2000 average and small male abundance is estimated at only 2.2 percent of the 1989-2000 average. No significant recruitment of small crab has occurred since 1993. The current estimate of total male abundance is the lowest on record.

In Bristol Bay, the estimated abundance of large male hair crab decreased from the 2002 level and is one half the long-term average abundance. The abundance estimate of small male crab is approximately twice the long-term average. The current estimate of total male abundance is slightly above the long-term average. Given the decrease in large male hair crab abundance and potential for red king crab bycatch in Bristol Bay, the commercial fishery will not open in 2003.

For further information, please contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 1, 2003

BRISTOL BAY RED KING CRAB FISHERY
REGISTRATION AND TANK INSPECTION

The Bristol Bay (Registration Area T) red king crab fishery will open at 4:00 PM on October 15. Vessel registration will begin 30 hours prior to the opening, at 10:00 AM on October 14 in Dutch Harbor, False Pass, Akutan and King Cove. ADF&G personnel will not be available in Saint Paul. As part of the "Quick Registration" process, inspection of vessel holding tanks and gear will be available beginning October 7, in Dutch Harbor and Akutan. Inspections at King Cove will begin October 8, and at False Pass October 10, pending staff arrival at those locations.

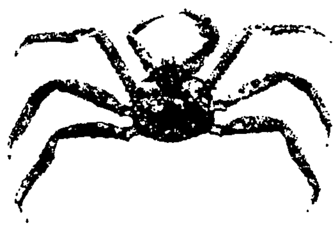
The holder of a 2003 KO9T or K91T interim use permit and the vessel's observer, if assigned, must be on the vessel at the time of registration and during all fishing operations. All crab pots used during the Bristol Bay red king crab fishery must conform to specifications of a king crab pot described in 5 AAC 34.050 LAWFUL GEAR FOR KING CRAB and 5 AAC 34.825 LAWFUL GEAR FOR REGISTRATION AREA T. Pot limits of 200 for vessels less than or equal to 125 feet in overall length and 250 for vessels in excess of 125 feet in overall length are in effect for the 2003 Bristol Bay red king crab fishery. All gear, both on the vessel and in wet storage, within Bristol Bay, must be tagged at the time of tank inspection. Only one buoy tag, valid for the current fishery, may be displayed.

The department is assessing the manageability of the 2003 Bristol Bay red king crab fishery and will announce by Friday October 10, whether the fishery will be managed inseason or with a closure date announced prior to the opening. In addition, ADF&G, in conjunction with the United States Coast Guard and National Weather Service, will assess weather conditions prior to the season opening for potential weather-related delay, based on search and rescue criteria, at the start of the season.

For more information contact the Alaska Department of Fish and Game at 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L. Granath
Assistant Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 7, 2003

PETREL BANK RED KING CRAB FISHERY POT LIMITS AND VESSEL REGISTRATION

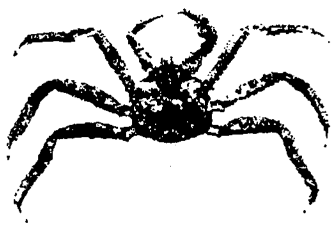
The Petrel Bank area of king crab Registration Area O will open to commercial red king crab fishing at noon (Alaska standard time) on October 25, 2003 with a guideline harvest level of 500,000 pounds of legal male red king crabs. The Petrel Bank area is defined at those waters of king crab Registration Area O west of 179° W long., east of 179° E long., and north of 51° 45' N lat. Only those waters in the above described area that are 125 fathoms or less in depth will be open to fishing for red king crabs.

Petrel Bank red king crab fishery preseason registrations were received from 34 vessels by the 5:00 PM October 6, 2003 deadline. Based on the 34 preseason vessel registrations, pot limits for the 2003 Petrel Bank red king crab fishery are set at 34 pots for vessels less than or equal to 125 feet length overall, and 43 pots for vessels greater than 125 feet length overall. Buoy tags for the fishery will be available for sale in Dutch Harbor and Kodiak beginning October 7, 2003. The department does not provide zip-ties for attaching buoy tags. It is the responsibility of the fisher to ensure that each pot has a securely attached buoy tag. ADF&G cautions that buoy tags are not designed to withstand the stress of being run through the crab block or similar stress during gear operations. Buoy tags should be secured on the main or trailer buoy in a manner minimizing handing stress.

Vessel registrations and tank inspections will be available in Dutch Harbor, King Cove, Akutan and Adak beginning at noon on October 22, 2003. "Quick registration" tank inspections prior to gear loading will be available beginning October 18, 2003. Each vessel registered for the fishery must carry an observer during all fishing activities. A K91O or K09O interim use permit holder and the vessel's observer must be onboard the vessel at the time of registration. For additional information, please contact the Alaska Department of Fish and Game in Dutch Harbor (907-581-1239) or in Kodiak (907-486-1840).

- end -

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 10, 2003

BRISTOL BAY RED KING CRAB FISHERY MANAGEMENT

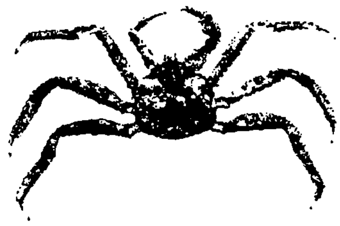
The Alaska Department of Fish and Game will manage the 2003 Bristol Bay red king crab fishery based on inseason reports from fishers. Reports will be taken every 12 hours at 6:00 AM and 6:00 PM from vessels reporting via electronic mail and each 24 hours at 10:00 AM from vessels reporting via single side band radio (SSB) or telephone. Department personnel will provide inseason catch reporting materials during the tank inspection and registration process as well as at the ADF&G office in Dutch Harbor. Vessel operators are strongly encouraged to participate in the catch reporting program that is essential for effective inseason management. Vessel operators reporting via electronic mail should be aware of the department's new electronic mail address: **adfg_dutch@fishgame.state.ak.us**.

The department will provide catch updates to the fleet on SSB 4125 kHz at noon and 9:00 PM daily beginning at 9:00 PM on October 16, however a closure announcement could occur at any time. The advance notice for the fishery closure will be based upon actual and anticipated harvest rates. The department will attempt to provide the greatest possible advance notice, however the fishery could close on very short notice. The department will broadcast the closure announcement on SSB 4125 kHz, by fax and electronic mail to all persons and organizations on the department's news release distribution list.

Vessel holding tank and gear inspections are currently available in Dutch Harbor, King Cove, Akutan and False Pass. No tank inspections or registrations will be available in Saint Paul. Prior to the season opening, the department in conjunction with the United States Coast Guard and National Weather Service, will evaluate weather conditions immediately preceding and at the start of the season for potential weather-related delay based on search and rescue criteria. For further information please contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE



Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 14, 2003

SEASON OPENING OF THE BRISTOL BAY RED KING CRAB FISHERY

The Alaska Department of Fish and Game, United States Coast Guard and National Weather Service have completed a review of weather conditions surrounding the opening of the Bristol Bay red king crab fishery. Current and forecast weather and sea conditions in the operational area of vessels involved in the Bristol Bay red king crab fishery have met United States Coast Guard search and rescue criteria. As a result, the department will open the Bristol Bay red king crab fishery at 4:00 PM October 15, 2003. Fishers are advised that the master of each vessel is responsible for the ultimate safety of the vessel. Tank inspections and "quick registration" will begin at 10:00 AM on October 14, 2003.

For further information contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 19, 2003
NOON

CLOSURE OF THE BRISTOL BAY RED KING CRAB FISHERY

The Alaska Department of Fish and Game announces closure of the Bristol Bay red king crab fishery at 6:00 PM, Monday, October 20, 2003. This closure applies to all vessels, including those participating in the American Fisheries Act cooperative fishery.

Voluntary catch reports from approximately 45% of the fleet indicate that 8.59 million pounds of red king crabs have been harvested to date. Reports through 6:00 AM October 19, 2003 indicate that the general fishery guideline harvest level of 14.535 million pounds of red king crabs will be reached by the fishery closure at 6:00 PM, October 20, 2003.

This announcement provides the fleet with more than 24 hours advance notice of the closure, thus the fleet must have all gear unbaited and stored with the doors open or removed from the water at the time of the closure. All gear must be placed in legal wet storage or removed from the water within 10 days of the closure.

Following the fishery closure, vessels delivering to Dutch Harbor, Akutan or King Cove must be at their delivery location within 30 hours. Vessels delivering to Adak, Saint Paul or ports east of King Cove are required to contact the Alaska Department of Fish and Game in Dutch Harbor prior to exiting Area T, and provide information regarding final delivery destination, number of crabs on board and estimated time of arrival.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Barbi Failor-Rounds
CDQ/Groundfish Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 24, 2003

CDQ ALLOCATION FOR THE 2003 BRISTOL BAY RED KING CRAB FISHERY

Preliminary harvest for the 2003 Bristol Bay red king crab general fishery, based on production records and hailed weights, is 14,505,744 pounds. The final harvest total will not be available for several weeks, but it is not expected to deviate significantly from this estimate.

The 2003 Bristol Bay red king crab CDQ allocation is 7.5 percent of the total harvest of Bristol Bay red king crab. The total harvest is defined as the general fishery harvest plus the CDQ harvest. The CDQ allocation based on the above preliminary harvest amount is 1,176,141 pounds. The individual group allocations are as follows:

Group	Allocation
APICDA	199,944 pounds
BBEDC	223,467 pounds
CBSFA	117,614 pounds
CVRF	211,705 pounds
NSEDC	211,705 pounds
YDFDA	211,705 pounds

These allocations may be slightly amended as the harvest estimate is refined; the groups will be advised of these amendments by NOON, October 27, 2003. The CDQ groups are to manage their fishing efforts in a manner not to exceed their allocation.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L. Granath
Assistant Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: October 28, 2003
8:00 PM

CLOSURE OF THE PETREL BANK RED KING CRAB FISHERY

The Petrel Bank area of king crab Registration Area O will close to commercial red king crab fishing at 6:00 AM, Wednesday, October 29, 2003. Fishers are reminded that Daylight Savings Time ended Sunday, October 26, and that this closure time is based on the Alaska Time Zone.

Inseason reports through 6:00 PM October 28, 2003 indicate that approximately 433,000 pounds of red king crabs have been harvested to date and the guideline harvest level (GHL) of 500,000 pounds will be reached by the fishery closure at 6:00 AM, Wednesday, October 29, 2003.

At the time of closure, all red king crab pots must be unbaited and have the doors secured open. Within 72 hours of the closure, all red king crab pots must be legally stored in waters 25 fathoms or less in depth, or be removed from the water. Vessels unable to unbait all gear at the time of the closure should contact ADF&G in Dutch Harbor or ABWE aboard the P/V Stimson as soon as possible.

Following the fishery closure, vessels delivering to Adak, Dutch Harbor, Akutan or King Cove must be at their delivery location within 72 hours, except that vessels delivering to King Cove may contact the department and request additional travel time. Vessels delivering to ports east of King Cove are required to contact the Alaska Department of Fish and Game in Dutch Harbor prior to exiting Area O, and provide information regarding final delivery destination, number of crabs onboard and estimated time of arrival.

For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: November 21, 2003

2004 EASTERN ALEUTIAN DISTRICT TANNER CRAB SEASON

The Alaska Department of Fish & Game has completed analysis of trawl and pot survey results for the Eastern Aleutian District (EAD) Tanner crab stock.

Trawl survey estimates of mature male abundance were used to set threshold levels for areas of historic Tanner crab abundance in the EAD. Thresholds were set at 50% of the long-term mature male abundance and were calculated for Beaver Inlet, Unalaska, Makushin and Akutan Bays. Threshold levels of abundance must be met prior to a fishery opening. In addition, minimum Guideline Harvest Levels (GHL) were set based on inseason fishery management criteria. The 2003 estimates of mature male abundance met threshold levels in Akutan, Makushin and Unalaska Bays. The threshold was not met in Beaver Inlet. Minimum GHLs were met in Makushin and Unalaska Bays, however the GHL calculated for Akutan Bay is less than the minimum GHL and Tanner crab abundance levels in Akutan Bay are decreasing. GHLs for the 2004 EAD Tanner crab fishery are as follows:

Locale	GHL
Makushin Bay	87,891 pounds
Unalaska Bay	47,219 pounds
Akutan Bay	Closed
Beaver Inlet	Closed

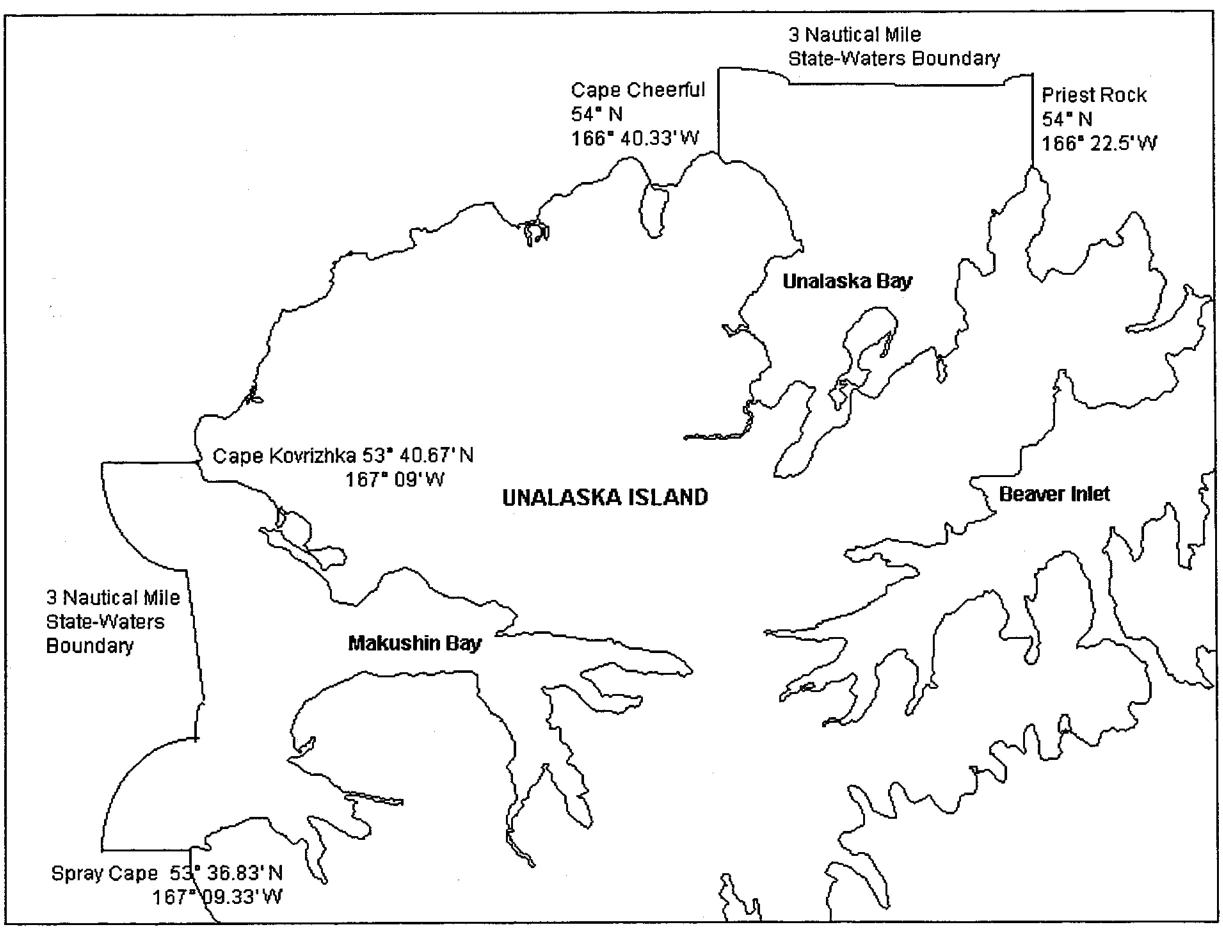
The EAD commercial Tanner crab fishery will open at NOON on January 15, 2004. A description of the areas open to commercial fishing for Tanner crabs in 2004 is available on the attached map. Fishers are reminded that in Unalaska Bay south of a line from Priest Rock to Cape Cheerful, vessels fishing for Tanner crabs are limited to 58 feet or less in overall length.

-continued-

The preseason registration deadline for the EAD Tanner crab fishery is 5:00 PM December 24, 2003. Preseason registration forms must be received by the department before the deadline. Preseason registration forms are available on the World Wide Web at http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/04eadtanner_form.pdf or via fax upon request. A 2003 or 2004 T09O or T91O Commercial Fisheries Entry Commission permit card listing the vessel's ADF&G number is required at the time of preseason registration. The web site for vessel operators to verify the state's receipt of vessel preseason registration is http://www.cf.adfg.state.ak.us/region4/shellfsh/crabs/04eadtanner_reg.pdf. This web site is updated several times per week.

The number of vessels preseason registered will be used to establish pot limits for the fishery. Details on pot limits, buoy tag sales and fishery management will be available in a news release occurring shortly after the preseason registration deadline.

Description of areas open to commercial Tanner crab fishing in the Eastern Aleutian District in 2004:



For further information, contact the Alaska Department of Fish and Game in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Forrest R. Bowers
Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: December 12, 2003

BERING SEA SNOW CRAB BUOY TAG SALES AND PRESEASON REGISTRATION

The 2004 Bering Sea snow crab fishery will open at NOON on January 15 with a general fishery guideline harvest level (GHL) of 19.269 million pounds. The post-season community development quota is 1.562 million pounds.

The preseason registration deadline is 5:00 PM, December 24, 2003. A preseason registration must be submitted for each vessel intending to participate in the snow crab fishery. In order for the preseason registration to be valid, the department must be able to verify that a T91Q or T09Q commercial fisheries entry commission permit card has been issued for the vessel. After the preseason registration deadline, ADF&G will randomly select up to ten percent of catcher vessels to carry an onboard observer.

Buoy tags may be purchased at the Dutch Harbor and Kodiak offices of ADF&G Monday through Friday, 8:00 AM until 4:30 PM. In addition, the ADF&G office in Dutch Harbor will be open for buoy tag sales from 9:00 AM until 4:30 PM on Saturday January 10 and Sunday January 11. The department will mail buoy tags up to three weeks prior to the fishery. For the 2004 Bering Sea snow crab fishery the cut-off date for mailing tags is 5:00 PM, December 24, 2003.

Fishery information packets for the 2004 Bering Sea snow crab fishery providing a brief overview of fishery management and current regulations will be available by December 31, 2003 at the Dutch Harbor and Kodiak offices of ADF&G. Details of vessel tank inspections, potential weather-related delay of season and inseason management will be available in forthcoming news releases. A list of vessels selected to carry an onboard observer will be available by 5:00 PM December 29, 2003.

For further information contact ADF&G in Dutch Harbor at (907) 581-1239.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Mary Schwenzfeier
Shellfish Observer Program Coordinator
Dutch Harbor

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

December 26, 2003

Catcher Vessels Selected for Observer Coverage
2004 Bering Sea Snow Crab Fishery

The following catcher vessels, randomly selected from the 2004 Bering Sea snow crab fishery pre-season vessel registrations, will carry crab observers for the duration of the general fishery:

Vessels 75 feet to 125 feet

Vessel Name	ADF&G #
Keta	07189
Controller Bay	72847
Kevleen K	00960
Aleutian Ballad	46553
Early Dawn	00103
Cascade Mariner	00064
Atlantico	00037
Arctic Wind	01112
Bering Sea	00052
Ramblin' Rose	59686
Kirsten Marie	00022
Zone Five	61718
Alternates	
Destination	42234
Andronica	39926

Vessels greater than 125 feet

Vessel Name	ADF&G #
Husky	00964
Labrador	12128
Lady Alaska	61351
Arctic Baruna II	68870
Karin Lynn	00524
Exito	54956
Alternates	
Northwestern	29962
Kodiak Queen	06459

-continued-

ADF&G or a state-contracted observer company will provide observers for the selected catcher vessels. The observer must be on the selected vessel on or before January 13, the time of vessel registration validation. By regulation, vessels that carry observers must provide proof of compliance with United States Coast Guard (USCG) vessel safety requirements. USCG dockside examinations are available in Puget Sound, Kodiak and Dutch Harbor.

Observer salary and travel costs for catcher vessels participating in the general fishery will be provided from cost-recovery funds.

Observers will have their own rain gear, boots, gloves, survival suit and personal flotation device (PFD) for working on deck, along with their own bedding and personal items. Some of the regulatory requirements for vessels that carry observers include:

- Provide adequate food and accommodations for the observer equal to those provided for the vessel's crew;
- Provide to the observer daily catch information, including areas fished, number of crab retained, number of pots pulled, and other information specified by the department;
- Provide a safe work area, and necessary gear such as 3 to 4 totes for the observer to use at all times to hold the contents of crab pots for sampling;
- Assure observer access to single side band (SSB) radio, fax, telex, or telephone so that catch reports from observers are received at the Dutch Harbor ADF&G office in a timely manner.

-end-

ALASKA DEPARTMENT OF FISH AND GAME
COMMERCIAL FISHERIES
NEWS RELEASE

Kevin Duffy, Commissioner

Doug Mecum, Director
Division of Commercial Fisheries
Juneau

Contact: Karla L. Granath
Assistant Area Management Biologist
Bering Sea/Aleutian Islands

Westward Region
211 Mission Road
Kodiak, AK 99615

Division of Commercial Fisheries
Phone: (907) 581-1239
Fax: (907) 581-1572

Date: December 26, 2003

EASTERN ALEUTIAN DISTRICT C. BAIRDI TANNER CRAB FISHERY POT LIMIT AND VESSEL REGISTRATION

The Eastern Aleutian District of Tanner crab Registration Area J will open to commercial C. bairdi Tanner crab fishing at noon on January 15, 2004 with a guideline harvest level of 87,891 pounds in Makushin Bay and 47,219 pounds in Unalaska Bay. The minimum size limit is 5.5 inches carapace length and only male crabs may be retained. The area opened to fishing is defined at those waters of Makushin Bay north of Spray Cape (53° 36.83' N lat. and 167° 09.33' W long.) and south of Cape Kovrizhka (53° 40.67' N lat. and 167° 09' W long.) to the three nautical mile state-waters boundary and those waters of Unalaska Bay west of Priest Rock (54° N lat. and 166° 22.5' W long.) and east of Cape Cheerful (54° N lat. and 166° 40.33' W long.) to the three nautical mile state-waters boundary. A map of the area open to fishing can be found attached to the ADF&G news release dated 11/21/03. Fishers are reminded that in Unalaska Bay south of a line from Priest Rock to Cape Cheerful, vessels fishing for Tanner crabs are limited to 58 feet or less in overall length. In addition, a person or vessel that operates commercial, subsistence, sport, or personal use pots, during the 14 days immediately before the opening of the commercial Tanner crab season, may not participate in the commercial Tanner crab fishery in the Tanner crab registration area where the fishing with pots occurred, according to 5 AAC 35.053 (1) OPERATION OF OTHER POT GEAR.

Eastern Aleutian District C. bairdi Tanner crab fishery preseason registrations were received from 25 vessels by the 5:00 PM December 24, 2003 deadline. Based on the 25 preseason vessel registrations and the fishery limit of 300 pots, the vessel pot limit for the 2004 Eastern Aleutian District C. bairdi Tanner crab fishery is set at 12 pots per vessel. Buoy tags for the fishery will be available for sale in Dutch Harbor beginning December 26, 2003 for $2.00 each. ADF&G cautions that buoy tags are not designed to withstand the stress of being run through the crab block or similar stress during gear operations. Buoy tags should be secured on the main or trailer buoy in a manner minimizing handing stress.

Vessel registrations and tank inspections will be available in Dutch Harbor beginning at noon on January 14, 2004. "Quick registration" tank inspections prior to gear loading will be available beginning January 8, 2004 and fishers are reminded that all gear onboard the vessel must meet all specifications in regulation including biodegradable escape mechanisms and escape rings or large mesh according to 5 AAC 35.525 (e) LAWFUL GEAR FOR REGISTRATION AREA J. A T91O or T09O interim use permit holder must be onboard the vessel at the time of registration.

For additional information, please contact the Alaska Department of Fish and Game in Dutch Harbor (907-581-1239) or in Kodiak (907-486-1840).

-end-

Economic Summary

prepared by J. Greenberg

In the 2002 SAFE Economic Summary, we highlighted the importance of obtaining more complete economic information relevant to evaluating net benefits, and their allocation, that flow from the BSAI crab fisheries. The importance of this information is enhanced by a major industry "shake-out" that is imminent as a crab rationalization program is implemented in 2005. This program includes harvester and processor transferable quotas, as well as community protection, and is referred to as the "three-pie voluntary cooperative program." Also, industry will determine whether to participate in a crab vessel buy-out program.

The transferable quota system will be unique among U.S. commercial fisheries, as both harvester-only and processor-only quota shares will be allocated to harvesters and processors. The rationalization program includes several features that address concerns about competitive pricing given this unique transferable quota program. One measure is allowing harvesters to deliver 10% of their allocated quota shares to any processor. The plan also includes non-binding and binding arbitration components. The non-binding arbitration involves a third party who will provide a pre-season benchmark price to processors and harvesters, possibly based on a price formula. This benchmark price would be used to assist processor-harvester negotiations and would also inform subsequent binding arbitration proceedings. The binding arbitration may be instigated by harvesters should price negotiations fail. In this case, both the processor and harvester (or group of harvesters in a coop) would submit their final offer and an arbitrator would select one of their offers. Voluntary cooperatives may also be formed between four or more harvesters and one or more processors as long as both harvesters and processors hold quota. Finally, the interests of fishery dependent communities are addressed through regional protection that define processor quota as "regionally designated" for two broad regions.

The need for more complete BSAI crab fishery socioeconomic data was noted in the 2002 SAFE report, where we included the following statement by the SSC (February 2002).

> A critical part of the Council's ability to understand the social and economic consequences of implementation of rationalization measures is mandatory reporting of socioeconomic data. For example, harvest and production costs, expenditure patterns, vessel ownership data including identifiers (name and address files), employment, and earnings data are absolutely necessary to determine the magnitude and distribution of net benefits that arise from the granting of an entitlement to a public resource. If these data had been required as a component of the plan amendments authorizing IFQs in the halibut/sablefish fisheries and co-ops in the pollock fishery, analysts would be in a much better position to identify the likely economic consequences of the rationalization alternatives currently under consideration for the crab fishery. The SSC recommends that provision of the data listed above be made mandatory. This action is necessary to fulfill the Council's stated desire to have the economic performance of the rationalized crab fishery evaluated.

To-date attempts at obtaining more detailed socioeconomic information on harvesters and processors have been unsuccessful. However, this should be remedied with a mandatory data collection program that is included as part of the crab rationalization program. The mandatory data collection program is described in the Final EIS for the BSAI King and Tanner Crab Fisheries (2004):

> A mandatory data collection program shall be developed and implemented as part of the crab rationalization program and continued through the life of the program. Cost, revenue, ownership and employment data will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the crab

rationalization program as well as collecting data that could be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities. This data collection effort is also required to fulfill the Council problem statement requiring a crab rationalization program that would achieve "equity between the harvesting and processing sectors" and to monitor the "...economic stability for harvesters, processors and coastal communities". Both statutory and regulatory language shall be developed to ensure the confidentiality of these data. (Appendix-1 RIR, pg. 498)

The reader is directed to the RIR for more detailed information on this program.

This more detailed socioeconomic information may be useful in future SAFE reports in addressing the economic status, trends, and health of the BSAI crab fisheries, as well as evaluating economic implications of crab management policies. However, at the present time we are limited to providing fishery-wide data on production and revenues that have been included in the ADFG Westward Annual Management Reports for the BSAI shellfish fisheries.

Table 1. Historic fishery performance data for 5 key BSAI crab fisheries, 1990-2002 or most recent opened season. (Source: Annual Management Report for the Commercial and Subsistence Shellfish Fisheries of the Aleutian Islands and Bering Sea and the Westward Region's Shellfish Observer Program, 2002, Published Sept. 2003).

Fishery	Season	Vessels	Season length*	Harvest (m.lbs.)	Exvessel Price ($/lb)	CPUE	Value ($m.)	Value Per Vessel ($,000)*
Bristol Bay Red King Crab	1990	240	12	20.36	5	1	101.2	421.67
	1991	302	7	17.18	3	12	51.2	69.54
	1992	281	7	8.04	5	6	40.2	143.06
	1993	292	9	14.63	3.8	9	55.1	188.70
	1994		Closed					
	1995		Closed					
	1996	196	4	8.41	4.01	16	33.6	171.43
	1997	256	4	8.76	3.26	15	28.5	111.33
	1998	274	5	14.23	2.64	15	37.4	136.50
	1999	257	5	11.09	6.26	12	69.1	268.87
	2000	246	4	7.55	4.81	12	36	146.34
	2001	230	3	7.79	4.81	19	37.5	163.04
	2002	242	3	8.86	6.14	20	54.2	223.97
Bering Sea Snow Crab	1990	189	148	161.82	0.64	141	102.3	541.27
	1991	220	159	328.65	0.5	191	162.6	739.09
	1992	250	97	315.30	0.5	177	156.5	626.00
	1993	254	59	230.79	0.75	175	171.9	676.77
	1994	273	45	149.78	1.3	160	192.4	704.76
	1995	253	33	75.25	2.43	117	180	711.46
	1996	234	45	65.71	1.33	102	85.6	365.81
	1997	226	65	119.54	0.79	133	92.6	409.73
	1998	229	64	243.34	0.56	207	134.65	587.99
	1999	241	66	184.53	0.88	158	160.78	667.14
	2000	229	7	30.77	1.81	137	55.09	240.57
	2001	207	30	23.38	1.53	97	32.12	155.17
	2002	191	24	30.25	1.49	76	44.2	231.41
Bering Sea Tanner Crab	1990	179	89	711.14	1.85	15	45.3	253.07
	1990/91	255	126	883.39	1.12	19	44.5	174.51
	1991/92	285	137	1244.63	1.5	10	47.3	165.96
	1992/93	294	137	1200.89	1.69	13	58.8	200.00
	1993/94	296	52	576.46	1.9	13	31.6	106.76
	1994	183	20	249.54	3.75	13	28.5	155.74
	1995	196	15	247.85	2.8	8	11.7	59.69
	1996	196	16	149.29	2.49	5	4.5	22.96

Table 1. continued.

Fishery	Season	Vessels	Season length*	Harvest (m.lbs.)	Exvessel Price ($/lb)	CPUE	Value ($m.)	Value Per Vessel ($,000)*
Aleutian Golden	1990/91	24	288	6.97	3	8	20.25	na
	1991/92	20	289	7.70	2.41	8	18.2	na
	1992/93	22	288	6.29	2.15	8	13.16	na
	1993/94	21	288	5.55	2.44	6	13.13	na
	1994/95	35	288	8.13	3.48	5	27.21	na
	1995/96	28	289	6.89	2.25	5	14.72	na
	1996/97	18	365	5.85	2.23	6	12.53	na
	1997/98	15	365	5.95	2.19	7	12.54	na
	1998/99	16	365	4.94	1.92	10	9.33	na
	1999/00	17	348	5.84	3.15	8	18.01	na
	2000/01	17	286	6.02	3.33	8	19.52	na
	2001/02	21	227	5.89	3.16	8	18.13	na
	2002/03	21	205	5.46	3.38	9	18.26	na
St. Mathew Blue Crab	1990	31	6	1.73	3.35	15	5.70	183.87
	1991	68	4	3.37	2.80	20	9.00	132.35
	1992	174	3	2.47	3.00	10	7.40	42.53
	1993	92	6	3.00	3.23	11	9.70	105.43
	1994	87	7	3.76	4.00	14	15.00	172.41
	1995	90	5	3.17	2.32	14	7.10	78.89
	1996	122	8	3.08	2.20	7	6.70	54.92
	1997	117	7	4.65	2.21	12	9.80	83.76
	1998	131	11	2.87	1.87	7	5.34	40.76

* Aluetian Golden king crab fishery values per vessel not reported because of separate fisheries for East and West of 172° West

This data is form the Annual Management Report for the Commercial and Subsistence Shellfish Fisheries of the Aleutian Islands and Bering Sea, Sept 2003

Table 1. Overview of BSAI crab fisheries landing, exvessel value and estimated exvessel prices.

Fishery	Season	Landed Pounds	Pounds Priced	Total Value	Ex-vessel Price
WAI Golden	1990_1991	1,796,371	.	$0	.
King	1991_1992	2,431,180	68.35	$3,297,409	**$1.984**
	1992_1993	3,632,021	63.93	$4,497,049	**$1.937**
	1993_1994	3,905,984	64.84	$6,940,551	**$2.740**
	1994_1995	5,190,845	98.68	$16,832,515	**$3.286**
	1995_1996	4,392,003	99.97	$9,190,622	**$2.093**
	1996_1997	1,327,012	99.99	$2,951,160	**$2.224**
	1997_1998	1,249,377	99.73	$2,663,475	**$2.138**
	1998_1999	577,648	100.00	$1,178,628	**$2.040**
	1999_2000	1,697,941	99.99	$5,326,299	**$3.137**
	2000_2001	1,993,874	100.00	$6,272,350	**$3.146**
Adak Red	1991_1992	266,383	70.26	$624,597	**$3.337**
King	1992_1993	806,524	31.12	$1,197,547	**$4.772**
	1993_1994	465,651	97.03	$1,590,137	**$3.519**
	1994_1995	98,102	84.21	$453,539	**$5.490**
	1995_1996	22,272	96.67	$56,834	**$2.640**
Bristol	1991_1991	14,360,990	.	$0	.
Bay	1992_1992	7,186,419	48.43	$17,279,406	**$4.965**
Red	1993_1993	13,053,109	10.49	$5,241,765	**$3.828**
King	1996_1996	7,897,131	97.54	$30,908,556	**$4.013**
	1997_1997	8,493,704	96.92	$26,821,854	**$3.258**
	1998_1998	12,634,107	97.55	$32,184,792	**$2.612**
	1999_1999	10,018,299	96.20	$60,357,026	**$6.262**
	2000_2000	7,172,614	90.70	$31,271,920	**$4.807**
BS	1991_1991	257,523,354	.	$0	.
C. opilio	1992_1992	259,777,128	84.04	$109,075,160	**$0.500**
	1993_1993	187,346,715	85.70	$104,157,710	**$0.649**
	1994_1994	126,126,831	87.41	$138,077,985	**$1.253**
	1995_1995	66,087,115	88.62	$142,271,956	**$2.429**
	1996_1996	54,738,161	91.34	$66,295,848	**$1.326**
	1997_1997	106,126,849	97.02	$80,851,245	**$0.785**
	1998_1998	224,132,005	97.01	$122,044,686	**$0.561**
	1999_1999	172,639,663	99.79	$151,841,907	**$0.881**
	2000_2000	28,318,872	97.06	$50,748,270	**$1.846**
BS	1990_1991	13,633,166	.	$0	.
C. bairdi	1991_1992	25,177,190	28.37	$11,968,818	**$1.676**
	1992_1993	30,354,794	76.15	$35,208,809	**$1.523**
	1993_1994	14,524,022	74.36	$19,370,649	**$1.794**
	1994_1994	7,003,122	88.47	$22,811,242	**$3.682**
	1995_1995	3,831,529	74.89	$7,958,508	**$2.773**
	1996_1996	1,754,467	87.28	$3,823,354	**$2.497**

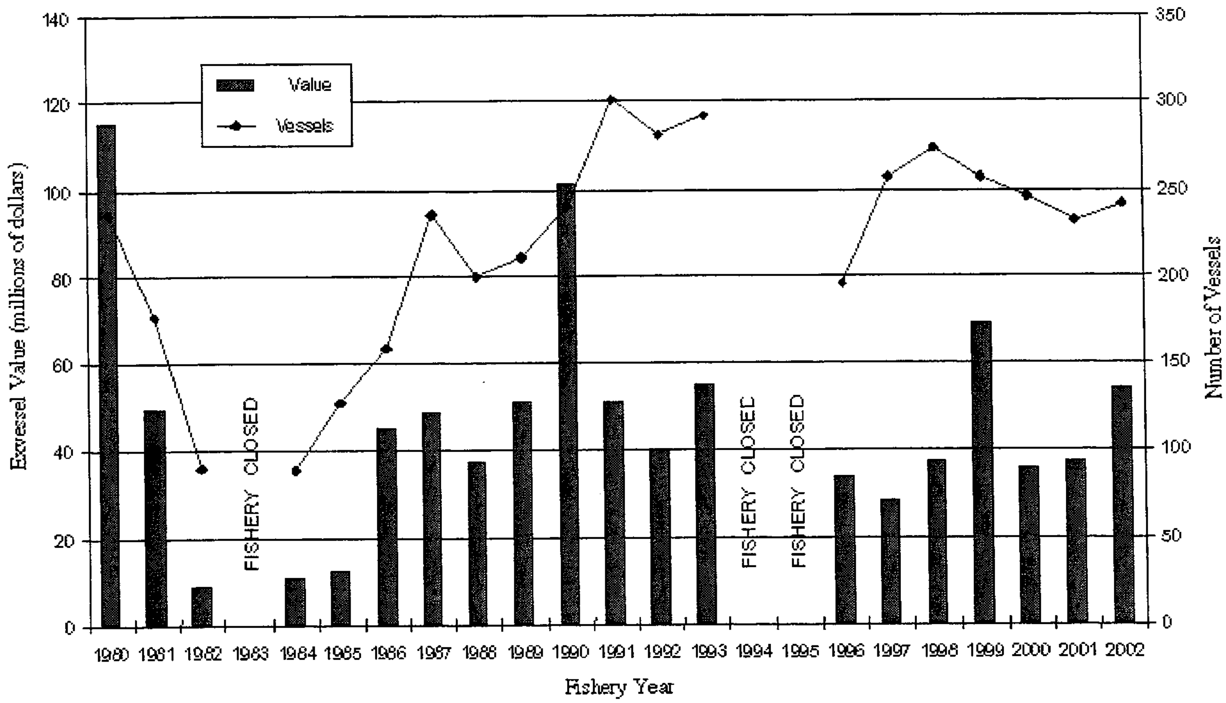


Figure 2-3. Bristol Bay red king crab fishery effort and exvessel value, 1980 - 2002.

Table 1. (Continued): Overview of Weighted Fish Ticket Prices by Fishery and Season (Catcher Processors and Catcher/sellers Excluded)

Fishery	Season	Total Landed Pounds	Percent Pounds Priced	Total Value	Weighted Ex-vessel Price
EAI Golden King	1991_1991	838,620	.	$0	.
	1992_1992	546,984	98.76	$1,205,709	**$2.232**
	1993_1994	908,136	100.00	$1,928,674	**$2.124**
	1994_1995	1,720,359	95.96	$6,412,973	**$3.885**
	1995_1995	1,649,978	95.66	$4,041,812	**$2.561**
	1996_1996	3,105,659	100.00	$6,938,551	**$2.234**
	1997_1998	2,981,457	100.00	$6,708,306	**$2.250**
	1998_1999	2,925,915	100.00	$5,466,986	**$1.868**
	1999_2000	2,755,684	100.00	$8,883,247	**$3.224**
	2000_2001	3,086,890	100.00	$10,812,630	**$3.503**
Pribilof Blue King	1995_1995	1,154,386	92.46	$3,120,211	**$2.923**
	1996_1996	909,713	92.40	$2,233,280	**$2.657**
	1997_1997	491,434	96.62	$1,337,639	**$2.817**
	1998_1998	494,424	95.94	$1,111,172	**$2.343**
Pribilof Red King	1993_1993	2,542,592	69.13	$7,915,389	**$4.503**
	1994_1994	1,336,024	88.47	$7,618,788	**$6.446**
	1995_1995	796,543	91.47	$2,452,168	**$3.366**
	1996_1996	199,718	96.64	$532,459	**$2.759**
	1997_1997	735,109	98.05	$2,224,857	**$3.087**
	1998_1998	501,042	99.56	$1,192,881	**$2.391**
St. Matt. Blue King	1991_1991	2,166,613	.	$0	.
	1992_1992	2,087,645	46.98	$2,752,901	**$2.807**
	1993_1993	2,834,296	58.29	$4,389,127	**$2.657**
	1994_1994	3,366,915	91.26	$12,749,429	**$4.149**
	1995_1995	3,022,097	95.77	$6,715,195	**$2.320**
	1996_1996	2,866,705	73.95	$4,664,292	**$2.200**
	1997_1997	4,426,626	100.00	$9,796,323	**$2.213**
	1998_1998	2,645,489	96.19	$4,752,367	**$1.867**

Stock Assessment of eastern Bering Sea snow crab

Benjamin J. Turnock
National Marine Fisheries Service

SUMMARY

A size based model was developed for eastern Bering Sea snow crab (*Chionoecetes opilio*) to estimate population biomass and harvest levels. Model estimates of mature biomass of snow crab increased from the early 1980's to a peak in 1990 of about 1,841 million lbs. Biomass declined in the late 1990's to about 528 million lbs. in 1999. The stock was declared overfished in 1999 because the survey estimate of mature biomass was below the minimum stock size threshold (MSST). Model estimates of mature biomass continued to decline after 1999 and were estimated at 370 million lbs. in 2004. Survey biomass estimates were lower in the mid-1980's than current survey estimates, however, 2004 model estimates are at historic lows.

Catch has followed survey abundance estimates of large males, since the survey estimates have been the basis for calculating the GHL (Guideline harvest level for retained catch). Retained catches increased from about 6.7 million lbs at the beginning of the directed fishery in 1973 to a peak of 328 million lbs in 1991, declined, then increased to another peak of 243 million lbs in 1998. Retained catch in the 2000 fishery was reduced to 33.5 million lbs due to the low abundance estimated by the 1999 survey. A harvest strategy was developed using a simulation model previous to the development of the current model (Zheng et al. 2002), that has been used to set the most recent GHL's. Retained catch in the 2004 fishery was 23.66 million lbs, about 14% above the GHL of 20.8 million lbs, which is an exploitation rate of 0.167 using the 2003 survey estimate of mature male abundance at the time the fishery occurred. The total catch (retained plus discard) was estimated at 27.54 million lbs (about 24 million crabs), which resulted in an exploitation rate on mature male biomass of 0.194.

Estimated discard (mostly undersized males and old shell males) in the directed pot fishery has averaged about 33% of the retained catch biomass since 1992 when observers were first placed on crab vessels. Discards prior to 1992 were estimated based on fishery selectivities estimated for the period with observer data.

Three model scenarios were run for this stock assessment. Estimates of Fmsy, Bmsy and the resulting catch estimates depend on the model scenario used, the steepness and R0 parameters of the spawner recruit curve, the assumptions about what size and shell condition males are that take part in mating, and the mating ratio (number of females that a male can fertilize in one mating season).

Using the base model, the stock is estimated to be at 32% of Bmsy in 2004. Using the base model estimated reference points and harvest control rule, the total catch (retained plus discard mortality) for the 2005 season is estimated at 11.1 million lbs and the 2005 retained catch (GHL) is estimated at 8.6 million lbs. The 2005 GHL using the mature male survey biomass (143.7 mill lbs) is estimated at 15.8 mill lbs, using the current harvest strategy. Total catch (retained plus discard mortality) would be estimated at 21.0 mill. lbs (assuming discard is 33% of retained catch).

Conservation concerns are that the stock is at its lowest level historically and that recruitment has been low for the past ten years. The stock is not expected to increase in the near future given past low recruitments. Survey mature biomass estimates were below the MSST in 1999, and in 2002 to 2004. Survey mature biomass estimates in 2004 were up slightly from 2003.

Exploitation rates in the southern portion of the range of snow crab may have been higher than target rates due the majority of catch occurring in the southern portion of the snow crab range, possibly contributing to the shift in distribution to less productive waters in the north.

Computing the GHL based on the complete survey biomass may result in exploitation rates higher than the target rate on crabs in the southern area of the distribution. One solution would be to split the GHL into two regions, north and south, according to the percent distribution of the survey estimate of large males or mature males from those regions. This would require knowing the location of catch inseason. Two other approaches would not require knowledge on inseason catch location. One approach would be to compute the GHL from that portion of the stock where most of the catch is extracted. Another approach would be to compute a GHL that would result in the target harvest rate for the southern portion of the stock and increase that GHL according to the percent catch in the north. Splitting the GHL by area would result in about 28% (the average percent catch for 2003 and 2004) of the GHL south of 58.5 deg N and 72% north. In 2003 and 2004 93% of the catch came from south of 60 deg N. Mature male abundance south of 60 deg N could be used in setting the GHL, which would result in an expected exploitation rate in the southern portion of the snow crab range closer to the target rate.

INTRODUCTION

Snow crab (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. In the Bering Sea, snow crab are common at depths less than about 200 meters. The eastern Bering Sea population within U.S. waters is managed as a single stock, however, the distribution of the population may extend into Russian waters to an unknown degree.

CATCH HISTORY

Snow crab were harvested in the Bering Sea by the Japanese from the 1960s until 1980 when the Magnuson Act prohibited foreign fishing. Retained catch in the domestic fishery increased in the late 1980's to a high of about 328 million lbs in 1991, declined to 65 million lbs in 1996, increased to 243 million lbs in 1998 then declined to 33.5 million lbs in the 2000 fishery (Table 1, Figure 1). Due to low abundance and a reduced harvest rate, retained catches remained low and were 32.7 million lbs in the 2002 fishery (36.2 million lbs total catch), 28.3 million lbs of retained catch in 2003 (39 million lbs total catch), and 23.66 million lbs of retained catch in 2004 (27.54 million lbs total catch).

Discard from the directed pot fishery was estimated from observer data since 1992 and ranged from 11% to 64% (averaged about 33%) of the retained catch of male crab biomass (Table 1). Female discard catch is very low and not a significant source of mortality. Trawl discard mortality was estimated at about 5.1 million lbs in 1974 then declined to less than 1 million lbs from 1976 to 1991. In 1992 trawl discard mortality was about 9 million lbs, then declined to about 2 to 3 million lbs until 1998, when it declined to below 1 million lbs. Most discard for the period 1997 to 2002 in groundfish fisheries came from the (in order of catch) yellowfin sole trawl fishery, flathead sole trawl fishery, Pacific cod bottom trawl fishery, rock sole trawl fishery and the pacific cod hook and line and pot fisheries.

Size frequency data and catch per pot have been collected by observers on snow crab fishery vessels since 1992. Observer coverage was 10% on catcher vessels larger than 125 ft (since 2001), and 100% coverage on catcher processors (since 1992). In the 2002 fishery about 0.5% of the total pot lifts were observed (Neufeld and Barnard 2003).

The average size of retained crabs has remained fairly constant over time, between 105 mm and 118 mm, most recently about 110 mm to 111 mm. The percent new shell animals in the catch has varied between 69% (2002 fishery) to 98% (1999), and was 95% to 98% for 1997 to 2001 fisheries. The average weight of retained crab has varied between 1.1 lbs (1983-1984) and 1.6 lbs(1979) and was about 1.3 lbs in the 2002 fishery.

Several modifications to pot gear have been introduced to reduce bycatch mortality. In the 1978/79 season, pots used in the snow crab fishery first contained escape panels to prevent ghost fishing. Escape panels consisted of an opening with one-half the perimeter of the tunnel eye opening laced with untreated cotton twine. No escape mechanisms for undersized crab were required until the 1997 season when at least one-third of one vertical surface had to contain not less than five-inch stretched mesh webbing or have no less than four circular rings of no less than three and three-quarter inches inside diameter. In the 2001 season the escapement for undersize crab was increased to at least eight escape rings of no less than four inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each side of the two sides of a four-sided pot, or one-half of one side of the pot must have a side panel composed of not less than five and one-quarter stretched mesh webbing. The size of the cotton laced panel to prevent ghost fishing was increased in 1991 to at least 18 inches in length.

ABUNDANCE AND EXPLOITATION TRENDS

Survey Biomass

Abundance is estimated from the annual Bering Sea bottom trawl survey conducted by NMFS (see Stevens et al. 2000 for design and methods). Since 1989, the survey has sampled stations farther north than previous surveys. In 1982 the survey net was changed resulting in a change in catchability. Juvenile crabs tend to occupy more inshore northern regions (up to about 63 degrees N) and mature crabs deeper areas to the south of the juveniles (Zheng et al. 2001).

The total mature biomass estimated from the survey declined to a low of 180 million lbs in 1985, increased to a high of 1,657 million lbs in 1991, then declined to 294 million lbs in 1999, when the stock was declared overfished (Table 2 and Figure 2). The mature biomass increased in 2000 and 2001, mainly due to a few large catches of mature females. The 2002 survey estimate of mature biomass was 314 million lbs, in 2003, 262 million lbs, and in **2004, 285 million lbs**. The total mature biomass includes mature females and morphometrically mature males. The term mature for male snow crab will be used here to mean morphometrically mature. Morphometric maturity for males refers to a change in chelae height, after which males are assumed to be effective at mating. Males are functionally mature at smaller sizes than when they become morphometrically mature.

Harvest rates

The Harvest rate used to set the GHL (Guideline harvest level of retained crab only) previous to 2000 was 58% of the number of male crab over 101 mm carapace width estimated from the survey (Snow crab rebuilding plan, 2000). The legal size limit for snow crab is 78 mm, however, the snow crab market generally accepts animals greater than 101 mm. The GHL divided by the survey abundance of male crab >101 mm was close to

58% for most years (Figure 5). In 2000, due to the decline in abundance and the declaration of the stock as overfished, the harvest rate for calculation of the GHL was reduced to 20% of male crab over 101 mm.

The actual retained catch typically exceeded the GHL, resulting in exploitation rates for the retained catch (using survey numbers) ranging from about 60% to 100% for most years. The actual exploitation fraction is calculated using the abundance for male crab over 101 mm estimated from the survey data reduced by the natural mortality from the time of the survey until the fishery occurs, which has been around 7 months since the late 1980's. Catches were greater than the abundance estimates from the survey because some crabs are retained that are less than 102 mm, discard mortality of small crabs is also included, and survey catchability may be less than 1.0. The exploitation fraction using the total catch divided by the mature male biomass estimated from the model, ranged from 10% to 75% (Figure 6). The exploitation fraction estimated by dividing the total catch by the model estimate of the crabs over 101 mm ranged from about 15% to 95% (Figure 6). The total exploitation rate on males > 101 mm was 65% to 85% for 1986 to 1994 and greater than 75% for 1998 and 1999 (year when fishery occurred).

The current harvest strategy uses a retained crab harvest rate on the mature male biomass of 0.1 at a total mature biomass greater than ½ MSST (230 million lbs), increasing linearly to 0.225 when biomass is equal to or greater than Bmsy (921.6 million lbs) (Zheng 2002). Bmsy is defined in the current crab FMP as the average total mature biomass (males and females) estimated from the survey for the years 1983 to 1997 (BSAI crab FMP 1998). MSST was defined as 50% of the Bmsy value (460 million lbs of total mature biomass). The GHL is actually set as the number of retained crab allowed in the harvest, which is calculated by dividing the GHL in lbs by the average weight of a male crab > 101 mm. If the GHL in numbers is greater than 58% of the estimated number of new shell crabs greater than 101 mm plus 25% of the old shell crab greater than 101 mm, the GHL is capped at 58%. If natural mortality is 0.2, then this actually results in a realized exploitation rate cap for the retained catch of 66% at the time of the fishery, when the fishery occurs 7 months after the survey.

Survey Size Composition

Carapace width is measured on snow crab and shell condition noted in the survey and the fishery. Snow crab cannot be aged at present (except by radiometric aging of the shell since last molt), however, shell condition has been used as a proxy for age. Shell condition is recorded as soft shell (SC1) (less than three months from molting), new shell (SC2) (three months to less than one year from molting), old shell (SC3) (one year to several years from molting), very old shell (SC4) (greater than one year, but unknown age), and very very old shell (SC5) (greater than one year, but unknown age). Radiometric aging of shells from terminal molt male crabs (after the last molt of their lifetime) has recently shed light on how shell condition relates to age, which will be discussed in a later section (Nevissi et al 1995 and Orensanz unpub. Data).

Survey abundance by size for males and females are shown in Figures 3 and 4.

Spatial distribution of catch and survey abundance

In 2003 and 2004, the majority of the fishery catch occurred south of 58.5 deg N., even though ice cover did not restrict the fishery moving farther north. In past years, most of the fishery catch occurred in the southern portion of the snow crab range due to ice cover and proximity to port. In 2003, 66% of the catch was south of 58.5 deg N. (Figure 45), and in 2004 78% of the catch was south of 58.5 deg N. (Figure 44). In 2003 and 2004 the ice edge was farther north than past years, allowing some fishing to occur as far north as 60-61 deg N.

In 2004 about 26 % of the survey abundance of male snow crab > 101 mm as well as most of the mature male biomass were south of 58.5 deg N.(Figure 50). About 53% of those males south of 58.5 deg N. were estimated to be new shell (which are preferred by the fishery). The 2003 survey estimated about 24% of the male snow crab >101mm were south of 58.5 deg N. About 48% of those males were estimated to be new shell. The 2004 fishery retained about 19 million crab of which about 14.8 million were caught south of 58.5 deg south (about 78%). The 2003 survey estimate of new shell male crab > 101 mm was about 7.6 million south of 58.5 deg N. which would have been fished on in the 2004 fishery. In the 2004 survey about 9.5 million new shell males >101mm were estimated south of 58.5 deg N. This indicates that survey catchability may be less than 1.0 and/or some movement occurs between the summer survey and the winter fishery. However, the exploitation rate on males south of 58.5 deg N probably exceeded the target rate, possibly resulting in a depletion of males from the southern part of their range. Snow crab larvae probably drift north and east after hatching in spring. Snow crab appear to move south and west as they age, however, no tagging studies have been conducted to estimate migration patterns. High exploitation rates in the southern area may have resulted in a northward shift in snow crab distribution. Lower egg production in the south from lower clutch fullness and higher percent barren females possibly due to insufficient males for mating may result in a change in distribution to the north. The northward shift in mature females would result in lower productivity due to the shift to biennial spawning of animals in waters < 1.5 deg C in the north. The lack of males in the southern areas at mating time (after the fishery occurs) may result in insufficient males for mating.

The centroids of mature female distribution have moved to the north over time (Figure 42). In the early 1980's the centroids were near 58.5 deg N, in the 1990's the centroids were about 59.5 deg N. The centroids of old shell male distribution was south of 58 deg N in the early 1980's, moved north in the late 1980's and early 1990's then shifted back to the south in the late 1990's (Figure 42). The distribution of males>101 mm was about at 58 deg N in the early 1980's, then was farther north (58.5 to 59 deg N) in the late 1980's and early 1990's, went back south in 1996 and 1997 then has moved north with the centroid of the distribution in 2001 just north of 59 deg N.(Figure 43). The centroids of the catch are generally south of 58 deg N, except in 1987 (Figure 43). The centroids of catch also moved north in the late 1980's and most of the 1990's. The centroids of the catch were about at 56.5 deg N in 1997 and 1998, then moved north to above 58.5 deg in 2002.

ANALYTIC APPROACH

Data Sources

I.

II. Catch data and size frequencies of retained crab from the directed snow crab pot fishery from 1978 to the 2004 season were used in this analysis. Observers were placed on directed crab fishery vessels starting in 1990. However, reliable size frequency data on the total catch (retained plus discarded) in the directed crab fishery were available from 1992 to 2004. Total discarded catch was estimated from observer data from 1992 to 2004(Table 1). The discarded male catch was estimated for 1978 to 1991 in the model using the estimated fishery selectivities based on the observer data for the period 1992 to 2004. The discard catch estimate was multiplied by the assumed mortality of discards from the pot fishery. In the model presented here mortality of discarded crab is assumed to be 100%. The estimated discards previous to 1992 may be underestimates due to the lack of escape mechanisms for undersized crab in the pots previous to 1997.

III.

IV. The following table contains the various data components used in the model.

Data component	Years
Retained male crab pot fishery size frequency by shell condition	1978-2004 (Year when fishery actually occurred)
Discarded male and female crab pot fishery size frequency	1992-2004
Trawl fishery bycatch size frequencies by sex	1990-2003
Survey size frequencies by sex and shell condition	1978-2004
Retained catch estimates	1978-2004
Discard catch estimates from snow crab pot fishery	1992-2004 estimated from observer data
Trawl bycatch estimates	1973-2003
Total survey biomass estimates and coefficients of variation	1978-2004

Model Structure

The model structure was developed following Fournier and Archibald's (1982) methods, with many similarities to Methot (1990). The model was implemented using automatic differentiation software developed as a set of libraries under C++(ADModel Builder). ADModel Builder can estimate a large number of parameters in a non-linear model using automatic differentiation software extended from Greiwank and Corliss(1991) and developed into C++ class libraries. This software provides the derivative calculations needed for finding the objective function via a quasi-Newton function minimization routine(e.g., Press et al. 1992). The model implementation language (ADModel Builder) gives simple and rapid access to these routines and provides the ability to estimate the variance-covariance matrix for all parameters of interest.

Details of the population dynamics and estimation equations, description of variables and likelihood equations are presented in Appendix A (Tables A.1, A.2 and A.3). The population dynamics equations, incorporating the growth transition matrix and molting probabilities are similar to other size based crab models (Zheng et al. 1995 and 1998). There were a total of 276 parameters estimated in the model (Table A.4). The 78 fishing mortality parameters (one set for the male catch, one set for the female discard catch, and one set for the trawl fishery bycatch) estimated in the model were constrained so that the estimated catch fit the observed catch closely. There were 51 recruitment parameters estimated in the model, one for the mean recruitment, 25 for females and 25 for males, which were constrained to be similar. There were 55 fishery selectivity parameters, 50 of which were length at 50% selected parameters to allow changing fishery selectivities by year.

Molting probabilities for mature males and females were fixed at 0, resulting in mature animals ceasing to growth when they mature. Molting probabilities were fixed at 1.0 for immature females and were estimated for immature males. The intercept and slope of the linear growth function of postmolt relative to premolt size were estimated in the model using parmeters estimated from growth measurements for Bering sea snow crab as prior distributions (Table A.5). A gamma distribution was used in the growth transition matrix with the beta parameters estimated for male and females.

The model separates crabs into mature, immature, new shell and old shell, and male and female for the population dynamics. The model estimate of survey mature biomass is fit to the observed survey mature biomass time series by sex. The model fits the size frequencies of the survey by new and old shell, immature and mature, and by sex. The model fits the size frequencies for the pot fishery catch by new and old shell and by sex.

Crabs over 25 mm CW (carapace width) were included in the model. There are 22 size bins of 5 mm each, from 25-29 mm to 130-135mm. In this report the term size as well as length will be considered synonymous with CW. Recruitment to the model was estimated separately for males and females. Recruits were distributed in the first few size bins using a two parameter gamma distribution with the parameters estimated in the model. Eighty-eight parameters were estimated for the initial population size composition of new and old shell males and females in 1978. Recruitment for males and females was constrained to be similar by adding a penalty to the likelihood. No spawner-recruit relationship was used in the population dynamics part of the model. Recruitment parameters were estimated in the model to fit the data.

The survey occurs in summer each year, however, in the model, the time of the survey is considered to be the start of the year (July). This results in the start of the year being July instead of January. The directed snow crab pot fishery has occurred generally in the winter months (January to February) over a short period of time, however in the early years the fishery occurred over a longer time period. The mean time of the fishery weighted by the catch was estimated for each year and the fishing mortality applied all at once at the mean time for that year. Natural mortality is applied to the population from the time the survey occurs until the fishery occurs, then catch is removed. After the fishery occurs, growth and recruitment take place (in spring), with the remainder of the natural mortality.

Weight - Size

The weight (kg) – size (mm) relationship was estimated from survey data, where weight = a* size^b. Female a= 0.00000253, b=2.56472, male a= 0.00000023, b=3.12948 (Figure 7).

Maturity

Maturity for females was determined by visual examination during the survey and used to determine the fraction of females mature by size for each year. Female maturity was determined by the shape of the abdomen, by the presence of brooded eggs or egg remnants. The average maturity curve which has a 50% value of about 49 mm with a slope of 0.16 (Figure 8), was used in the model to estimate mature female abundance and biomass.

Morphometric maturity for males is determined by chela height measurements, which are available starting from the 1989 survey (Otto 1998). The number of males with chela height measurements has varied between about 3,000 and 7,000 per year. In this report a mature male refers to a morphometrically mature male.

One maturity curve for males was estimated and applied to all years in the model. A two-parameter logistic function was used that fit the fraction mature for larger new shell males well, resulting in size at 50% mature for new shell males of 88 mm CW with a slope of 0.12 (Figure 9). The separation of mature and immature males by chela height at small widths may not be accurate given the current measurement to the nearest millimeter. Chela height measured to the nearest tenth of a millimeter (by Canadian researchers on North Atlantic snow crab) shows a clear break in chela height at small and large widths and shows fewer mature animals at small widths than the Bering sea data measured to the nearest millimeter. Measurements recently taken on Bering sea snow crab chela to the nearest tenth of a millimeter show a similar break in chela height to the Canadian data (Lou Rugolo, pers. comm.).

The average fraction mature for old shell males was used as the maturity curve for all years for old shell males. Maturity for old shell males is zero below 40 mm, increases from 83% at 45 mm to 95% at 115 mm.

Selectivity

Selectivity curves for the retained and total fishery catch were estimated as two-parameter ascending logistic curves. Fishery selectivities for new and old shell males are allowed to change by year by estimating one mean size at 50% selectivity parameter, with deviations for each year from 1978 to 2004. The yearly parameters are constrained by a penalty that results in a smooth trend in the parameters over time (Figures 10 and 11). The selectivities for the survey and trawl bycatch were estimated with two-parameter, ascending logistic functions. Survey selectivities were estimated using a two parameter logistic function that was equal for both males and females. Separate survey selectivities were estimated for the period 1978 to 1981, 1982 to 1988, and 1989 to the present. The maximum selectivity was fixed at 1.0. The separate selectivities were used due to the change in catchability in 1982 from the survey net change, and the addition of more survey stations to the north of the survey area after 1988.

Selectivities were estimated the same for new shell and old shell males for the total catch (retained plus discarded mortality) and separately for new and old shell for the retained catch. The probability of retaining crabs by size and shell condition was estimated as an ascending logistic function. The selectivities for the retained catch were estimated by multiplying the retention curve by the selectivities for the retained plus discarded size compositions.

Survey selectivities have been estimated for Bering Sea snow crab from underbag trawl experiments (Somerton and Otto 1999) (Figure 12). A bag underneath the regular trawl was used to catch animals that escaped under the footrope of the regular trawl. The selectivity was estimated to be 50% at about 74 mm, 0.73 at 102 mm, and reached about 0.88 at the maximum size in the model of 135 mm.

Growth

Very little information exists on growth for Bering Sea snow crab. Tagging experiments were conducted on snow crab in 1980 with recoveries occurring in the Tanner crab (*Chionoecetes bairdi*) fishery in 1980 to 1982 (Mcbride 1982). All tagged crabs were males greater than 80mm CW, which were released in late may of 1980. Forty-nine tagged crabs were recovered in the Tanner crab fishery in the spring of 1981 of which only 5 had increased in carapace width. It is not known if the tags inhibited molting or resulted in mortality during molting. One crab was recovered after 15 days in the 1980 fishery, which apparently grew from 108 mm to 123 mm carapace width. One crab was recovered in 1982 after almost 2 years at sea that increased from 97 to 107 mm.

Growth data from 14 male crabs collected in March of 2003 that molted soon after being captured were used to estimate a linear function between premolt and postmolt width (Lou Rugolo unpublished data, Figure 13). The crabs were measured when shells were still soft because all died after molting, so measurements are probably underestimates of postmolt width (Rugolo, pers. com.). However, growth appears to be greater than growth of some North Atlantic snow crab stocks (Sainte-Marie 1995). Growth from the 1980 tagging of snow crab was not used due to uncertainty about the effect of tagging on growth. No growth measurements exist for Bering sea snow crab females. North Atlantic growth data indicate growth is slightly less for females than males.

Growth was modeled using a linear function to estimate the mean width after molting given the mean width before molting (Figure 14),

$\text{Width}_{t+1} = a + b^* \text{ width}_t$

The parameters a and b estimated from the observed growth data for Bering sea snow crabs were used as prior means for the growth parameters estimated in the model.

Crab were assigned to 5mm width bins using a gamma distribution with mean equal to the growth increment by sex and length bin and a beta parameter (which determines the variance),

$$Gr_{s,l \to l'} = \int_{l'-2.5}^{l'+2.5} Gamma(\alpha_{s,l}, \beta_s)$$

Where Gr is the growth transition matrix for sex, s and length bin l. The Gamma distribution is,

$$g(x \mid \alpha_{s,l}, \beta_s) = \frac{x^{\alpha_{s,l}-1} e^{-\frac{x}{\beta_s}}}{\beta^{\alpha_{s,l}} \Gamma(\alpha_{s,l})} \quad .$$

Natural Mortality

Natural mortality is one of the most important parameters in a population dynamics model, and may have a large influence on optimal harvest rates. Natural mortality estimated in a population dynamics model may have high uncertainty and be correlated with other parameters, and therefore is usually fixed. However, a large portion of the uncertainty in model results (e.g. current biomass), will be due to uncertainty in natural mortality. The ability to estimate natural mortality in a population dynamics model is limited and depends on the how the true value varies over time as well as other factors (Fu and Quinn 2000, Schnute and Richards 1995).

In the 2003 snow crab SAFE, natural mortality has been assumed to be between 0.2 and 0.3 for males and females. A natural mortality of 0.3 would indicate a maximum age of about 14 years (Table 4)(Hoenig 1983). A maximum age of 20 years would result from an M of about 0.21 (Hoenig 1983). However, a 5% rule for deriving a value of natural mortality, would result in an M of 0.2 for a maximum observed age of 15 years which has been used proposed by Anthony (1982). A natural mortality of 0.3 results in about 5% of animals remaining after 10 yrs of age. Research is currently underway to assess a method using lipofuscin for age determination (Se-Jong, et al. 1999). A maximum age of about 13 years for females and 19 years for males has been hypothesized for North Atlantic snow crab by Comeau, et al (1998) based on size frequency analysis and growth data. Sainte-Marie, et al (1995) estimated an age of about 9 years for a 95 mm male snow crab and 11 years for a 131 mm crab for a different sub-population of Atlantic snow crab than Comeau, et al (1998) using size frequency analysis and growth data. A maximum time at large of 8 years for tag returns of mature male snow crab in the North Atlantic has been recorded since tagging started about 1993 (Sainte-Marie, pers.

comm.). Otto (1998) estimated natural mortality of male snow crab based on survey data and retained catches to be greater than 1.0. Otto (1998) overestimates M because the method assumed no time lapse between the survey and the fishery removals (during which natural mortality would be occurring) and no bycatch mortality. Otto (1998) also assumed survey selectivities were 1.0, shell condition is an accurate indicator of age since last molt (new shell less than one year, old shell crabs more than one, but less than two years from molting), and that new and old shell crabs were accurately categorized by shell condition. Zheng (unpub) investigated natural mortality of Bering Sea snow crab using a modeling approach, accounting for natural mortality between the time of the survey and the fishery. The snow crab fishery generally occurs over a short time span, about 7 months after the survey. Estimates of natural mortality ranged from 0.0 to 0.97, depending on assumptions made for molting probabilities, growth per molt and survey selectivities (Zheng unpub.).

Zheng et al. (1998) estimated natural mortality and bycatch mortality together to be about 0.5 for male and female Bering Sea Tanner crab (Chionecites bairdi) in a population dynamics model. He did not estimate bycatch mortality separately, but, natural mortality would have been less than the reported 0.5 value. Somerton (1981) estimated natural mortality for male Tanner crab less than commercial size to be 0.35. M was estimated to be between 0.13 and 0.28 for commercial size male Tanner crab (Somerton 1981).

Orensanz (unpub.) used radiometric techniques to estimate shell age from last molt (Table 4). The total sample size was 21 male crabs (a combination of Tanner and snow crab) from a collection of 105 male crabs from various hauls in the 1992 and 1993 NMFS Bering sea survey. Representative samples for the 5 shell condition categories were collected that made up the 105 samples. The oldest looking crab within shell conditions 4 and 5 were selected from the total sample of SC4 and SC5 crabs to radiometrically age (Orensanz, pers comm.). Shell condition (SC5) crab (very, very old shell) had a maximum age of 6.85 years (s.d. 0.58, 95% CI approximately 5.69 to 8.01 years). The average age of 6 crabs with SC4 (very old shell) and SC5, was 4.95 years. The range of ages was 2.70 to 6.85 years for those same crabs. Given the small sample size, crabs older than the maximum age of 7 to 8 years may be expected in the population.

Male snow crab during the mid to late 1980's were subjected to increasing exploitation with the maximum catch occurring in 1991. The maximum age in the sample of 6.85 years would be the result of fishing mortality as well as natural mortality. Using this maximum age would result in an upper bound on natural mortality. If crabs mature at about age 7 to 9, then adding another 7 or 8 years would give a maximum total age of about 14 to 17 years. However, due to exploitation occurring at the same time, the maximum age that would occur due to M alone would be greater than 14 to 17 years.

SC2 animals (new shell) were 0.33 to 1.07 years old (mean 0.69 yrs (8.2 months)) from the radiometric samples. This indicates that either some animals molted in summer to fall (C.I. for 1.07 is, 0.49 to 1.66), or some animals that did not molt the year before were misclassified as new shell animals. If there is misclassification, then new shell animals may be overestimated, and old shell animals (SC3) underestimated in the survey data. If molting occurs from January to May, with peak molting in March (Rugolo, pers comm.), then animals classified as SC2 that are older than about 6-7 months radiometric age may actually have molted the spring of the previous year. Of the six SC2 crabs in the radiometric sample, four (67%) had radiometric ages greater than 7 months. The average age of soft shell crab (SC1) was 0.15 yrs, if the SC1 and SC2 animals are combined (as it is for estimating new shell animals for harvest purposes) the average age is lower than for SC2 alone (mean = 0.42 yrs). However, the SC3 (old shell) animals were 0.85 to 1.1 years old (mean 1.02 yrs). There was only one animal between 1.1 years and 4.2 years old, which was a SC5 crab, 2.7 years old. Some overlap of ages would be expected between SC3, and SC4 and SC5 animals, however, that did not occur in the sample, probably due to the small sample size.
Tag recovery data for Bristol Bay red king crab males in the 1968 Japanese fishery contains shell condition and

carapace length at time of tagging and time of recapture (INPFC 1969). Thirty two of 98 animals tagged in July to August, 1967 and recaptured May to October 1968 did not grow, however, were assigned shell condition 2 (new shell) at recapture. Those 32 animals were 12 to 18 months from molting, if they had molted in spring of 1967. This would indicate that about 33% of animals that are clean shell (SC2) are actually more than a year from molting. There were 47 crabs assigned new shell of 52 animals that were at large more than two years that did not grow (tagged in 1966 and recaptured in 1968). These animals would have been at least 2 years from molting. Tagging of Bristol Bay male red king crab was also conducted in 1990, 1991 and 1993. Recoveries occurred in the fishery that took place in October to November of each year. Recovery information was recorded primarily by ADF&G research staff, dockside samplers and observers on board vessels. Only the 1991 tagging data had sufficient recaptures in 1992 and 1993 for analysis. There were 56 Animals that were recaptured in November, 1992 that were tagged in September to October, 1991 that had carapace length measured and were recorded as new shell at recapture. Of those 56 new shell animals, 21 did not grow in the 1 year between tagging and recapture. Those 21 animals (37.5 % of the new shell animals) were more than 1 ½ years from molting and were recorded as new shell. This is similar to the results from the 1968 tag recaptures, indicating that shell condition is not an accurate index of shell age. Based on these results, molting probabilities and natural mortality will be overestimated by using shell condition as an index of shell age.

Natural mortality was assumed to be 0.2 in all models run presented here.

Molting probability

Female and male snow crab have a terminal molt to maturity. Many papers have dealt with the question of terminal molt for Atlantic Ocean mature male snow crab (e.g., Dawe, et al. 1991). A laboratory study of morphometrically mature male Tanner crab, which were also believed to have a terminal molt, found all crabs molted after two years (Paul and Paul 1995). Bering Sea male snow crab appear to have a terminal molt based on recent data on hormone levels (Sherry Tamone, per. comm.) and findings from molt stage analysis via setagenesis (Lou Rugolo, pers. comm.). The models presented here have a terminal molt for both males and females.

Male Tanner and snow crabs that do not molt (old shell) may be important in reproduction. Paul, et al (1995) found that old shell mature male Tanner crab out-competed new shell crab of the same size in breeding in a laboratory study. Recently molted males did not breed even with no competition and may not breed until after about 100 days from molting (Paul, et al. 1995). Sainte-Marie (2002) states that only old shell males take part in mating for North Atlantic snow crab. If molting precludes males from breeding for a three month period, then males that are new shell at the time of the survey (June to July), would have molted during the preceding spring (March to April), and would not have participated in mating. The fishery targets new shell males, resulting in those animals that molted to maturity and to a size acceptable to the fishery of being removed from the population before the chance to mate. Animals that molt to maturity at a size smaller than what is acceptable to the fishery may be subjected to fishery mortality from being caught and discarded before they have a chance to mate.

Crabs in their first few years of life may molt more than once per year, however, the smallest crabs included in the model are probably 3 or 4 years old and would be expected to molt annually.

The growth transition matrix was applied to animals that grow, resulting in new shell animals. Those animals that don't grow become old shell animals. Animals that are classified as new shell in the survey are assumed to have molted during the last year. The assumption is that shell condition (new and old) is an accurate measure of whether animals have molted during the previous year. The relationship between shell condition and time from last molt needs to be investigated further. Additional radiometric aging for male and female snow crab shells is being investigated to improve the estimate of radiometric ages from Orensanz (unpub. data).

Mating ratio and reproductive success

Full clutches of unfertilized eggs may be extruded and appear normal to visual examination, and be retained for several weeks or months by snow crab (Rugolo, pers. comm., Alaska Fisheries Science Center, Seattle, Wa.). Resorbtion of eggs may occur if not all eggs are extruded resulting in less than a full clutch. Female snow crab at the time of the survey may have a full clutch of eggs that are unfertilized, resulting in overestimation of reproductive success. Male snow crab are sperm conservers, using less than 4% of their sperm at each mating. Females also will mate with more than one male. The amount of stored sperm and clutch fullness varies with sex ratio (Sainte-Marie 2002). If mating with only one male is inadequate to fertilize a full clutch, then females will need to mate with more than one male, necessitating a sex ratio closer to 1:1 in the mature population, than if one male is assumed to be able to adequately fertilize multiple females.

The fraction barren females and clutch fullness observed in the survey increased in the early 1990's then decreased in the mid- 1990's then increased again in the late 1990's (Figures 40 and 41). The highest levels of barren females coincides with the peaks in catch and exploitation rates that occurred in 1992 and 1993 fishery seasons and the 1998 and 1999 fishery seasons. While the biomass of mature females was high in the early 1990's, the rate of production from the stock may have been reduced due to the spatial distribution of the catch relative and the resulting sex ratio in areas of highest reproductive potential.

The fraction of barren females in the 2003 and 2004 survey south of 58.5 deg N was generally higher than north of 58.5 deg N (Figures 46 and 47). In 2004 the fraction barren females south of 58.5 deg N was greater for all shell conditions. In 2003, the fraction barren was greater for new shell and very very old shell south of 58.5 deg N.

Female opilio in waters less than 1.5 deg C and colder have been determined to be biennial spawners in the Bering Sea (Lou Rugolo, pers. comm.). Future recruitment may be affected by the fraction of biennial spawning females in the population as well as the estimated fecundity of females, which may depend on water temperature.

The centroids of the cold pool (<2.0 deg C) were estimated from the summer survey data for 1982 to 2003 (Figure 53). The centroid is the average latitude and average longitude. In the 1980's the cold pool was farther south(about 58 to 59 deg N) except for 1987 when the centroid shifted to north of 60 deg N. The cold pool moved north from about 58 deg N in 1999 to about 60.5 deg N in 2003. The cold pool was farthest south in 1989, 1999 and 1982 and farthest north in 1987, 1998, 2002 and 2003.

The clutch fullness and fraction of unmated females however, does not account for the fraction of females that may have unfertilized eggs. The fraction of barren females observed in the survey may not be an accurate measure of fertilization success because females may retain unfertilized eggs for months after extrusion. Rugolo (pers. comm.) sampled mature females from the Bering sea in winter and held them in tanks until their eggs hatched in March. All females then extruded a new clutch of eggs in the absence of males. All eggs were retained until the crabs were sacrificed near the end of August. Approximately 20% of the females had full clutches of unfertilized eggs. The unfertilized eggs could not be distinguished from fertilized eggs by visual inspection at the time they were sacrificed. Any index of fertilized females using the visual inspection method of assessing clutch fullness and percent unmated females may be an overestimate of fertilized females and not an accurate index of reproductive success.

McMullen and Yoshihara (1969) examined female red king crab around Kodiak Island in 1968 and found high percentages of females without eggs in areas of most intense fishing (up to 72%). Females that did not extrude eggs and mate were found to resorb their eggs in the ovaries over a period of several months. One trawl haul captured 651 post-molt females and nine male red king crab during the period April to May 1968. Seventy-six percent of the 651 females were not carrying eggs. Ten females were collected that were carrying eggs and had firm post-molt shells. The eggs were sampled 8 and 10 days after capture and were examined microscopically. All eggs examined were found to be infertile. This indicates that all ten females had extruded and held egg clutches without mating. Eggs of females sampled in October of 1968 appear to have been all fertile from a table of results in McMullen and Yoshihara(1969), however the results are not discussed in the text, so this is unclear. This may mean that extruded eggs that are unfertilized are lost between May and October.

RESULTS

Three model scenarios were run, one with discard mortality at 100% and survey selectivities estimated, one with discard mortality at 25%% and survey selectivities estimated, and one with discard mortality at 100% and survey selectivities fixed at values from Somerton and Otto (1999). The model with discard mortality at 100% and survey selectivities estimated is considered the base model. The fishery for snow crabs occurs in winter when low temperatures and wind may result in freezing of crabs on deck before they are returned to the sea. Short term mortality may occur due to exposure, which has been demonstrated in laboratory experiments Zhou and Kruse (1998) and Shirley (1998), where 100% mortality occurred under temperature and wind conditions that may occur in the fishery. Even if damage did not result in short term mortality, immature crabs that are discarded may experience mortality during molting some time later in their life.

Model estimates in Tables 3 and 6 and in Figures 2 through 38 are from the base model. Parameter estimates for the base model with are in Table 6. The total mature biomass increased from about 699 mill lbs (328 mt) in 1978 to the peak biomass of 1,841 mill lbs in 1990. Biomass declined sharply after 1996 to about 370 mill lbs in 2004 (Table 3 and Figure 2). Mature biomass estimated by the model is currently the lowest level estimated from 1978 to the present. The model is constrained by the population dynamics structure, including natural mortality, the growth and selectivity parameters and the fishery catches. Given the population dynamics structure and the parameters used, the model cannot account for the catches removed from the population unless population biomass is larger than observed from the survey. The low observed survey abundance in the mid-1980's were followed by an abrupt increase in the survey abundance of animals in 1987, which followed through the population and resulted in the highest catches recorded in the early 1990's. The model cannot fit the low survey abundance estimates in the mid-1980's, fit the high survey abundance in the 1990's, and extract the catches that occurred in the early 1990's. Average discard catch mortality for 1978 to 2003 was estimated to be about 44% of the retained catch, a little higher than the observed discards from 1992 to 2003 (33%) (Table 1 and Figure 15). During the last four years (2000 to 2003 fishery seasons) model estimates of discard mortality averaged 34% of the retained catch. Estimates of discard mortality ranged from 14% of the retained catch to 69% of the retained catch.

Mature male and female biomass show similar trends (Table 3 and Figures 16 and 17). Mature male biomass was about the same from 2003 (192 mill lbs) to 2004 (196 mill lbs), while survey biomass decreased (161 mill lbs to 142 mill lbs). Mature female biomass decreased from 187 mill lbs in 2003 to 175 mill lbs in 2004. Mature female biomass observed from the survey increased from 101 mill lbs in 2003 to 144 mill lbs in 2004.

Fishery selectivities and retention curves were estimated using ascending logistic curves (Figure 10, 11 and 18). Selectivities for trawl bycatch were estimated as ascending logistic curves (Figure 19). Plots of model fits to the survey size frequency data are presented in Figures 20 to 26. The model estimates higher numbers of mature old shell male and female crabs and lower numbers of new shell mature male and female crabs than observed from the survey. This could be due the size at maturity, which determines when males and females stop growing, or that shell condition is not an accurate estimator of shell age. Tagging results presented earlier indicate that animals that are more than one year from molting may be underestimated by using shell as a proxy for shell age. A method of verifying shell age is needed for all crab species.

Survey selectivities for the period 1978 to 1981 were estimated at 50% at about 21 mm and reached 95% at about 30mm (Figure 12). This indicates that the survey net used previous to 1982 was more efficient than the present survey net. Survey selectivities for the period 1982 to 1988 were estimated at 50% at about 65 mm and reached 95% at 145 mm. These selectivities were the best fit determined by the model, which are close to the values estimated by Somerton and Otto (1998). Survey selectivities for the period 1989 to the present were estimated at 50% at about 19 mm and reached 95% 106 mm. The survey selectivities are multiplied by the population numbers by length to estimate survey numbers for fitting to the survey data. Molting probabilities for immature males declined from 100% at 25 to 60 mm, to about 60% at 130 mm (Figure 27)

The estimated number of males > 101mm generally follows the observed survey numbers except at the end of the time series from 1997 to 2004 where model estimates are lower than the survey estimates (Figure 28).

Two main periods of high recruitment were estimated by the model, in 1980-81 (fertilization year) and in 1987-1988 (Figure 29). Recruits are 25mm to about 40 mm and may be about 4 years from hatching, 5 years from fertilization (Figure 30, although age is unknown). Low recruitments were estimated for the last 11 years. The estimated recruitments lagged by 5 years (approximate fertilization year) from the model coincide with the higher survey estimates of abundance of females with eggs and abundance of females with eggs multiplied by the fraction full clutch from 1975 to 1987 (Figure 48). Recruitment was low from 1988 to 1998, showing no relationship to the reproductive index. Exploitation rates were generally higher in 1986 to 1994, and in 1998-99 than prior to 1986 (Figure 6).

The size at 50% selected for the pot fishery varied between 93 mm and 105 mm for most years, and was about 103.5 mm in 2003 for males (Figure 11). Retention for old shell males was less than for new shell males (Figure 18 and 10). The fishery generally targets new shell animals with clean hard shells and all legs intact. Mortality of discarded crabs was assumed to be 100% in the model. The fits to the fishery size frequencies are in Figures 31 through 35. Fits to the trawl fishery bycatch size frequency data are in figures 36 and 37.

Harvest Strategy and Guideline Harvest Levels

Fmsy and Bmsy for Bering sea snow crab was estimated using the three model scenarios. Effective spawning biomass was estimated the same as Siddeek (2003), assuming only old shell males take part in mating and mating ratio is 2. If the numbers of old shell mature males (NMM_O) at the time mating occurs (accounting for natural mortality and removing the catch from the numbers at survey time) is less than the numbers of mature females (NMF) at the time mating occurs, divided by the mating ratio ($\eta = 2$), then the female mature biomass (fspbio) is reduced to estimate effective female spawning biomass (efspbio),

$$efspbio = fspbio * \frac{NMM_O * \eta}{NMF}$$

If the number of old shell mature males at mating time is more than the numbers of mature females at the time mating occurs, divided by the mating ratio ($\eta = 2$), then effective female spawning biomass is estimated to be equal to female spawning biomass, and the male mature biomass is reduced to estimate effective male spawning biomass,

If the numbers of old shell mature males (NMM_O) at the time mating occurs (accounting for natural mortality and removing the catch from the numbers at survey time) is more than the numbers of mature females (NMF) at the time mating occurs, divided by the mating ratio ($\eta = 2$), then the male mature biomass (mspbio) is reduced to estimate effective male spawning biomass (emspbio),

$$emspbio = mspbio * \frac{\frac{NMF}{\eta}}{NMM_O}$$

The effective female spawning biomass is added to the effective male spawning biomass to obtain total effective spawning biomass.

The parameters of the Beverton and Holt spawner recruit curve (steepness and R0) were estimated in a model separate from the population dynamics model using effective spawning biomass and recruits estimated from the population dynamics model for 1978 to 2004 (Figure 38),

$$\text{Re}\,cruits = \frac{(0.8 * R0 * h * \gamma_0)}{0.2 * \gamma_0 * R0 * (1-h) + (h - .2) * \gamma_c}$$

γ_c is effective total spawning biomass, γ_0 is effective total spawning biomass per recruit at F=0, R0 is the recruitment that would occur when the stock is at the effective spawning biomass for F=0, and h is the steepness parameter (Gabriel et al. 1989, Dorn 2002). Steepness is the proportion of R0 that recruits when the stock is reduced to 20% of the unfished effective total spawning biomass. When steepness is 1.0, recruits are independent of stock biomass, when steepness is at the lower limit (0.2) recruits linearly increase with stock biomass.

A normal prior distribution was used for the steepness parameter with a mean of 0.52 (the steepness estimated for Bristol Bay red king crab, Siddeek, pers. comm.) and a relatively large standard deviation of 0.6. A normal prior distribution was also used for the R0 parameter (the recruitment at B0) with a mean equal to the average model recruitment when effective spawning biomass was above the median, and a cv of 0.6.

Harvest strategy simulations are reported by Zheng et al. (2002) based on a model with structure and parameter values different than the model presented here. The harvest strategy by Zheng et al. (2002) was developed for use with survey biomass estimates and was applied to survey biomass estimates to calculate the 2004 fishery GHL. Bmsy is defined in the current crab FMP as the average total mature survey biomass for 1983 to 1997. MSST is defined as ½ Bmsy. The harvest strategy consists of a threshold for opening the fishery (MSST=230.4 million lbs of total mature biomass(TMB) (0.25*Bmsy), a minimum GHL of 15 million lbs for opening the fishery, and rules for computing the GHL.

Under current FMP (Fishery Management Plan) definitions for MSY biomass (B_{MSY} = 921.6 million pounds TMB) and overfishing rate (F_{MSY} =M=0.3), the fishing mortality rate to apply to current mature male biomass (MMB), is determined as a function of TMB as,

$$F = \frac{0.75 * Fmsy * \left[\frac{TMB}{Bmsy} - \alpha \right]}{(1-\alpha)}$$

for TMB ≥ 0.25*Bmsy and TMB<Bmsy, where α = -0.35, and,

- F = (Fmsy * 0.75) = 0.225, for TMB ≥ Bmsy, and F = 0 for TMB < 0.25*Bmsy.

The maximum for a GHL_{max} is determined by using the F determined from the control rule as an exploitation rate on mature male biomass at the time of the survey,

- GHL_{max} = F•MMB.

The F determined from the harvest control rule was used as an exploitation rate on mature male biomass instead of as a fishing mortality rate for the GHL calculation. The use of the equation, GHL = F*MMB, assumes that fishery selectivities were 1.0 for all mature male crabs and that the mature male biomass at the time of the survey is equal to the average over the year and that fishing mortality and natural mortality occur simultaneously throughout the year. However, the biomass at the time the survey occurs is after growth and recruitment occurs and before the fishery, resulting in the maximum in the year. The convention of setting Fmsy = M is for setting the instantaneous fishing mortality rate at M, not the exploitation rate on the stock. For example, if Fmsy = M = 0.3, then the F to apply when TMB is at or above Bmsy would be 0.225 to obtain the total catch (retained plus discard). The exploitation rate corresponding to F = 0.225 would be (F *(1-exp(-Z))/Z) = 0.175, where Z=M+F, if the fishery and natural mortality occur simultaneously throughout the year. This results in an overestimation of the exploitation rate and the GHL by about 28.5%. The exploitation rate corresponding to a pulse fishery would be 0.167 on MMB at the time of the survey for an F = 0.225, an overestimation of 34.7%. If F = 0.1 (the value when TMB is at 25% Bmsy) the exploitation rate would be 0.079 on MMB at the time of the survey, a 26.6% overestimation of the GHL.

The use of the value of the harvest control rule as an exploitation rate on mature male biomass at the time of the fishery is consistent with the harvest strategy simulations (Zheng et al 2002), however, it still underestimates the true exploitation rate and cannot be compared to Fmsy, for example to determine overfishing.

There is a 58% maximum harvest rate on exploited legal male abundance. Exploited legal male abundance is defined as the estimated abundance of all new shell legal males >=4.0-in (102 mm) CW plus a percentage of the estimated abundance of old shell legal males >=4.0-in CW. The percentage to be used is determined using fishery selectivities for old shell males.

The existing harvest control rule is used here with estimates of Bmsy and Fmsy from the current model and α = -0.25 (Figure 39). An α = -0.25 results in an F of 40% of the maximum F at 25% of Bmsy, which results in a slightly lower slope to the control rule than the existing harvest strategy (Zheng et al. 2002). The harvest strategy in Zheng et al. (2002) has a value of α = -0.35, resulting in a harvest rate of 0.1 on mature male biomass at 25% Bmsy. The above formulation of the harvest control rule is the same as that used for North Pacific groundfish, except a value of 0.05 is used instead of -0.25 (BSAI SAFE 2002). Using a value of 0.05 as is used for groundfish means F will be zero when current biomass is 5% of Bmsy. The slope of the control rule is less for snow crab resulting in a relatively higher F than the groundfish control with α = 0.05, until current biomass is below 0.25 Bmsy, when F would be 0 for snow crab, but would still be greater than 0 for the groundfish rule (Figure 39). For the groundfish rule the maximum F applied when biomass is at or above Bmsy depends on the amount of information available about Fmsy.

The catch is estimated by the following equation,

$$catch = \sum_{s}\sum_{l} \; (1-e^{-(F*Sel_{s,l})})w_l N_{s,l}\, e^{-M*.62}$$

Where $N_{s,l}$ is the 2004 numbers at length(l) for mature males by shell condition(s) at the time of the survey estimated from the population dynamics model, M is natural mortality, 0.62 is the time elapsed (in years) from when the survey occurs to the fishery, F is the value estimated from the harvest control rule using 2004 total mature biomass, and w_l is weight at length. $Sel_{s,l}$ are the fishery selectivities by length and shell condition for the total catch (retained plus discard) or for the retained catch estimated from the population dynamics model averaged over the last three years (2002 to 2004 fishery seasons) (Figure 14).

Fmsy and 2005 catches as well as other reference points were estimated for each of the scenarios (Table 6). The Fmsy (full selection F) was 0.70 for the base model (scenario 1, survey selectivity estimated in the model and mortality of discards 100%). The 2005 GHL was estimated at 8.6 mill lbs. The total catch for 2005 was estimated at 11.1 mill lbs. There is uncertainty in the estimation of the spawner recruit curve which is important in the determination of the reference points. However, all harvest strategies for crab stocks with models have used estimated spawner recruit curves including the current harvest strategy for snow crab. Analysis of the influence of the shape of the spawner recruit curve and proxy values for reference points should improve the estimation of harvest strategies and overfishing definitions (work currently in progress by the crab overfishing definitions working group).

For comparison, the GHL using the estimates of Fmsy = M = 0.3 and Bmsy = 921.6 mill lbs was calculated using 2004 survey biomass estimates. The survey biomass estimate for total mature biomass in 2004 was 285.2 mill lbs and mature male biomass was 141.5 mill lbs. The F for 2005 estimated from the harvest control rule with Fmsy = 0.3, Bmsy = 921.6 mill lbs and α = -0.35, was 0.11.

Using the F = 0.11 as an exploitation rate as has been used previously (F * MMB at survey time) would result in the 2005 GHL = 15.8 mill lbs. Total catch (retained plus discard mortality) would be estimated at 21.0 mill lbs using 33% discard.

Computing the GHL based on the complete survey biomass may result in exploitation rates higher than the target rate on crabs in the southern area of the distribution. One solution would be to split the GHL into two regions, north and south, according to the percent distribution of the survey estimate of large males or mature males from those regions. This would require knowing the location of catch inseason. Two other approaches would not require knowledge on inseason catch location. One approach would be to compute the GHL from that portion of the stock where most of the catch is extracted. Another approach would be to compute a GHL that would result in the target harvest rate for the southern portion of the stock and increase that GHL according to the percent catch in the north. In 2003 and 2004 93% of the catch came from south of 60 deg N.

Conservation concerns

- The Bering Sea snow crab model estimate of 2004 mature biomass is currently at its lowest level over the 25 year time period from 1978 to 2004.
- Survey biomass estimates have declined from a peak in 1991 to below 50% Bmsy in 1999 and in 2002 through 2004.
- Recruitment has been at low levels for the last 10 years (since 1994). Based on those low recruitment estimates, the stock would not be expected to increase in the near future.
- There is uncertainty in discard mortality due to low coverage of total pot lifts and only 10% coverage of catcher vessels which only started in 2001. Higher discard mortality would necessitate lower retained catches.
- Exploitation rates in the southern portion of the range of snow crab may have been higher than target rates, possibly contributing to the shift in distribution to less productive waters in the north.

Research Needs

Research is needed to improve our knowledge of snow crab life history and population dynamics to reduce uncertainty in the estimation of current stock size, stock status and optimum harvest rates.

Tagging programs need to be initiated to estimate longevity and migrations. Studies and analyses are needed to estimate natural mortality. Additional sampling of crabs that are close to molting is needed to estimate growth for immature males and females.

The lower number of mature old shell male crabs in the observed survey compared to what are expected in the model needs to be reconciled. Harvest rates and status of the stock are highly dependent on what the discrepancy is due to. The differences could be due to higher fishery discard mortality, higher natural mortality of mature animals, differential catchability of new and old shell animals in the survey, or the estimation of when maturity occurs, which determines when animals stop growing and subsequently move from new shell to old shell animals. In addition, the assignment of crabs to new and old shell condition used in the survey data may not be an accurate measure of time from the last molt.

Increased observer coverage is needed on catcher vessels in the directed snow crab fishery to improve estimates of discards. Field studies are needed to estimate mortality of discards in the winter snow crab pot fisheries where freezing temperatures and wind chill are important factors.

Some method of aging crab needs to be developed. Current research is being conducted using lipofuscin to age crabs and continued radiometric aging of shells of mature crabs is also being conducted (results may be available the end of 2004). However, at this time it is not known if the lipofuscin method will be successful, and radiometric aging is time consuming, so only small numbers of animals can be aged at present. Aging methods will provide information to assess the accuracy of assumed ages from assigned shell conditions (i.e. new, old, very old, etc), which have not been verified, except with the 21 radiometric ages reported here from Orensanz (unpub data).

Which males are effective at mating and how many females they can successfully mate with in a mating season is critical to population dynamics and optimum harvest rates. At the present time it is assumed that when males reach morphometric maturity they stop growing and they are effective at mating. Field studies are needed to determine how morphometric maturity corresponds to male effectiveness in mating. In addition the uncertainty associated with the determination of morphometric maturity (the measurement of chelae height and the discriminate analysis to separate crabs into mature and immature) needs to be analyzed and incorporated into the determination of the maturity by length for male snow crab.

The experiment to estimate catchability of the survey trawl net needs to be repeated with larger sample sizes to allow the estimation of catchability by length, sex and shell condition for snow crab (and Tanner crab). This is needed to determine if the number of mature old shell crabs in the observed survey (which are lower than expected in the model) are due to mortality (fishery discard or natural mortality) or due to lower catchability in the trawl survey.

Female opilio in waters less than 1.5 deg C and colder have been determined to be biennial spawners in the Bering Sea (Lou Rugolo, pers. comm.). Future recruitment may be affected by the fraction of biennial spawning females in the population as well as the estimated fecundity of females, which may depend on water temperature.

Analysis needs to be conducted to determine a method of accounting for the spatial distribution of the catch and abundance in computing quotas.

Literature Cited

Anthony, V.C. 1982. The calculation of F0.1: a plea for standardization. NAFO SCR Doc. 82/VI/64. Serial NO. N557. 16pp.

Bering sea and Aleutian Islands Crab SAFE. 2002. North Pacific Fishery Management Council, P. O. Box 103136, Anchorage, Ak 99510.

Bering Sea snow crab rebuilding plan, 2000. Bering Sea Crab Plan Team, North Pacific Fishery Management Council, P. O. Box 103136, Anchorage, Ak 99510.

BSAI SAFE. 2002. Bering Sea and Aleutian Islands stock assessment and fishery evaluation for North Pacific Groundfish.

Comeau, M., Conan, G.Y. Robichaud., G., and Jones, A. 1991. Life history and population fluctuations of snow crab (Chionoecetes opilio) in the fjord of Bonne Bay on the west coast of Newfoundland, Canada—from 1983 to 1990. Can.Tech.Rep.Fish.Aquat.Sci. 1817.

Comeau, M., G.Y. Conan, F. Maynou, G. Robichaud,J. Therriault, and M. Starr. 1998. Growth, spatial distribution, and abundance of benthic stages of the snow crab (Chionoecetes opilio) in Bonne Bay, Newfoundland, Canada. Can.J. Fish. Aquat. Sci. 55: 262-279.

Crab FMP 1998. Bering Sea Crab Plan Team, North Pacific Fishery Management Council, P. O. Box 103136, Anchorage, Ak 99510.

Dawe, E.G., D.M. Taylor, J.M. Hoenig, W.G. Warren, and G.P. Ennis. 1991. A critical look at the idea of terminal molt in male snow crab (*Chionoecetes opilio*). Can. J. Fish. Aquat. Sci. 48: 2266-2275.

Dorn, M.W. 2002. Advice on west coast rockfish harvest rates from Bayesian meta-analysis of stock-recruit relationships. North American Journal of Fisheries Management 22:280-300.

Fournier, D.A. and C.P. Archibald. 1982. A general theory for analyzing catch-at-age data. Can.J.Fish.Aquat.Sci. 39:1195-1207.

Fu and T.J. Quinn. 2000.

Gabriel, W.L., M.P. sissenwine, and W.J. Overholtz. 1989. Analysis of spawning biomass per recruit: an example for Georges Bank haddock. North American Journal of Fisheries Management 9:383-391.

Greiwank, A. and G.F. Corliss(eds). 1991. Automatic differentiation of algorithms: theory, implementation and application. Proceedings of the SIAM Workshop on the Automatic Differentiation of Algorithms, held Jan. 6-8, Breckenridge, CO. Soc. Indust. And Applied Mathematics, Philadelphia.

Hoenig, J. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. 82: 898-903.

INPFC. 1969. Release and recovery information for united states king crab tags recovered by the Japanese in 1968. INPFC Document no. 1171.

Mcbride (1982). Tanner crab tag development and tagging experiments 1978-1982. In Proceedings of the International Symposium of the Genus Chionoecetes. Lowell Wakefield Fish. Symp. Ser., Alaska Sea Grant Rep. 82-10. University of Alaska, Fairbanks, Alaska. Pp. 383-403.

McMullen, J.C. and H.T. Yoshihara. 1969. Fate of unfertilized eggs in king crabs *Paralithodes camtschatica (Tilesius)*. Department of Fish and Game. Informational Leaflet 127. INPFC document no. 1151. 14pp.

Methot, R. D. 1990. Synthesis model: An adaptable framework for analysis of diverse stock assessment data. Int. N. Pac. Fish. Comm. Bull. 50:259-277.

Nevissi, A.E., J.M. Orensanz, A.J.Paul, and D.A. Armstrong. 1995. Radiometric Estimation of shell age in Tanner Crab, Chionoecetes opilio and C. bairdi, from the eastern Bering Sea, and its use to interpret indices of shell age/condition. Presented at the International symposium on biology, management and economics of crabs from high latitude habitats October 11-13, 1995, Anchorage, Alaska.

Neufeld, G and D.R. Barnard. 2003. Alaska department of fish and game summary of the 2001 mandatory shellfish observer program database for the general and cdq fisheries. Regional Information Report No. 4K03-2. Alaska Department of Fish and Game. 160pp.

Otto, R.S. 1998. Assessment of the eastern Bering Sea snow crab, Chionoecetes opilio, stock under the terminal molting hypothesis. In Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Edited by G.S. Jamieson and A. Campbell. Can. Spec. Publ. Fish. Aquat. Sci. 125. pp. 109-124.

Paul, A.J. and J.M. Paul. 1995. Molting of functionally mature male *Chionoecetes bairdi* Rathbun (Decapoda: Majidae) and changes in carapace and chela measurements. Journal of Crustacean Biology 15:686-692.

Paul, A.J., J.M. Paul and W.E. Donaldson. 1995. Shell condition and breeding success in Tanner crabs. Journal of Crustacean Biology 15: 476-480.

Press, W.H., S.A. Teukolsky, W.T.Vetterling, B.P. Flannery. 1992. Numerical Recipes in C. Second Ed. Cambridge Univ. Press. 994 p.

Sainte-Marie, B., Raymond, S., and Brethes, J. 1995. Growth and maturation of the male snow crab, *Chionoecetes opilio* (Brachyura: Majidae). Can.J.Fish.Aquat.Sci. 52:903-924.

Sainte-Marie, B., J. Sevigny and M. Carpentier. 2002. Interannual variability of sperm reserves and fecundity of primiparous females of the snow crab (Chionoecetes opilio) in relation to sex ratio. Can.J.Fish.Aquat.Sci. 59:1932-1940.

Schnute, J. and L. Richards. 1995. The influence of error on population estimates from catch-age models. Can. J. Fish. Aquat. Sci. 52: 2063-2077.

Se-Jong, J., D.H. Secor, H.R. Harvey. 1999. Use of extractable lipofuscin for age determination of blue crab *Callinectes sapidus*. Marine Ecology Progress series. Vol 185: 171-179.

Shirley, T.C. 1998. Appendix D: Crab handling mortality and bycatch reduction. In: King and Tanner crab research in Alaska: Annual report for July 1, 1997 through June 30, 1998. Alaska Department of Fish and Game Regional Information Report No. 5J98-07.

Siddeek, M.S.M., B. Sainte-Marie, J. Boutillier and G. Bishop. 2003. Some reference points used in US and Canada crab fisheries and a comparison of a referential system estimated using a length-based method for snow crab (*Chionoecetes opilio*) and Dungeness crab (*Cancer magister*).

Somerton, D.A. 1981. Life history and population dynamics of two species of Tanner crab, Chionoecetes bairdi and C. opilio, in the eastern Bering Sea with implications for the management of the commercial harvest. Ph.D. dissertation. University of Washington, Seattle, Wash. 220 p.

Somerton, D.A. and R.S. Otto. 1999. Net effeciency of a survey trawl for snow crab, *Chionoecetes opilio*, and Tanner crab, *C. Bairdi*. Fish.Bull. 97:617-625.

Stevens, B.G., J.A. Haaga, R.A. MacIntosh, R.S. Otto, and L. Rugolo. 2000. Report to industry on the 2000 Eastern Bering Sea crab survey. AFSC Processed Report 2000-07.

Zheng, J., S. Siddeek, D. Pengilly, and D. Woodby. 2002. Overview of recommended harvest strategy for snow crabs in the Eastern Bering Sea. Regional Information Report No. 5J02-03. Alaska Department of Fish and Game. Juneau, Alaska.

Zheng, J. unpublished. Uncertainties of natural mortality estimates for Eastern Bering Sea snow crab, *Chionoecetes opilio*. Alaska Department of Fish and Game. Juneau, Alaska.

Zheng, J., G.H. Kruse, and D.R. Ackley. 2001. Spatial distribution and recruitment patterns of snow crabs in the eastern Bering Sea. Spatial Processes and management of marine populations. Alaska sea grant college program. AK-SG-01-02, 2001.

Zheng, J., G.H. Kruse, and M.C. Murphy. 1998. A size-based approach to estimate population abundance of Tanner crab, Chionoecetes bairdi, in Bristol Bay, Alaska. In Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Edited by G.S. Jamieson and A. Campbell. Can. Spec. Publ. Fish. Aquat. Sci. 125. pp. 97-105.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995. A length-based population model and stock-recruitment relationships for red king crab, Paralithodes camtschatics, in Bristol Bay, Alaska. Can. J.Fish. Aquat. Sci. 52: 1229-1246.

Zhou, S. and G.H. Kruse. 1998. Appendix C: Crab handling mortality and bycatch reduction. In: King and Tanner Crab research in Alaska: Annual Report for July 1, 1997 through June 30, 1998. Alaska Department of Fish and Game Regional Information Report No. 5J98-07.

Table 1. Catch (1,000s of lbs) for the snow crab pot fishery and groundfish trawl bycatch. Retained catch for 1973 to 1981 contain Japanese directed fishing. Discarded catch is the total estimate of discards which assumes 100% mortality. Discards from 1992 to 2002 were estimated from observer data.

Year fishery occurred	retained catch(1,000s of lbs)	Observed Discard male catch	Retained + discard male catch	Model estimate of male discard	Discard female catch	Year of trawl bycatch	trawl bycatch
1973	6,711					1973	30,046
1974	5,033					1974	41,582
1975	8,250					1975	16,096
1976	10,050					1976	6,975
1977	16,284					1977	4,722
1978-79	52,272			12,862	73	1978	5,422
1979-80	75,025			13,822	91	1979	4,331
1980-81	66,933			68,005	81	1980	3,150
1982	29,355			21,670	46	1981	1,314
1983	26,128			19,374	62	1982	535
1984	26,813			25,520	44	1983	689
1985	65,999			76,566	43	1984	732
1986	97,984			116,190	44	1985	628
1987	101,903			68,405	96	1986	2,699
1988	135,355			34,206	139	1987	8
1989	149,456			72,064	148	1988	968
1990	161,821			56,513	192	1989	1,124
1991	328,647			127,556	204	1990	860
1992	315,302	96,214	402,897	310,002	234	1991	9,401
1993	230,787	124,865	355,652	123,644	481	1992	4,552
1994	149,776	38,922	188,698	49,820	321	1993	2,892
1995	75,253	29,436	104,689	33,578	232	1994	3,219
1996	65,713	42,104	107,817	36,660	63	1995	1,794
1997	119,543	54,391	173,934	57,529	277	1996	2,063
1998	243,342	41,982	294,171	102,815	22	1997	2,884
1999	194,000	34,158	228,358	116,409	26	1998	2,146
2000	33,500	3,790	37,081	5,150	2	1999	788
2001	25,256	4,537	29,794	5,833	2	2000	611
2002	32,722	13,824	46,546	15,622	17	2001	
2003	28,307	9,938	38,245	14,706	3	2002	
2004	23,663	4,196	27,859	6,097	6	2003	

Table 2. Observed survey female, male and total spawning biomass(millions of lbs) and numbers of males > 101mm (millions of crab).

Year	Observed survey female mature biomass	Observed survey male mature biomass	Observed survey total mature biomass	Observed number of males > 101mm (millions)
1978	273.0	398.6	671.6	163.4
1979	584.9	443.9	1,028.9	169.1
1980	733.8	315.7	1,049.5	109
1981	391.8	200.7	592.5	45.4
1982	411.2	334.1	745.3	65
1983	260.2	319.0	579.2	71.5
1984	118.5	375.3	493.9	154.2
1985	17.4	162.4	179.8	78.2
1986	45.8	174.1	219.9	80
1987	365.7	372.0	737.7	141.9
1988	451.9	443.1	895.0	167.3
1989	825.6	604.1	1,429.7	175.4
1990	529.6	1,025.0	1,554.6	407.2
1991	650.3	1,006.6	1,656.9	466.6
1992	376.1	507.0	883.0	251.4
1993	416.3	334.5	750.7	140.8
1994	387.9	282.5	670.4	80.3
1995	514.1	360.2	874.3	69
1996	362.6	642.7	1,005.3	170.1
1997	322.7	762.7	1,085.4	308.5
1998	237.6	512.6	750.2	244
1999	93.4	200.4	293.8	92.2
2000	307.2	187.6	494.8	75.6
2001	258.9	255.7	514.6	79.4
2002	98.3	216.0	314.3	73.5
2003	101.1	160.5	261.7	61.2
2004	143.7	141.5	285.2	58.7

Table 3. Model estimates of population biomass, population numbers, male, female and total mature biomass(million lbs) and number of males greater than 101 mm in millions. Recruitment is lagged 5 years to approximate fertilization year.

Year	Biomass(million lbs 25mm+)	numbers (million crabs 25mm+)	female mature biomass	Male mature biomass	total mature biomass	Number of males >101mm (millions)	Recruitment (millions, 25 mm to 50 mm, lag 5 yr to fertilization year)
1978	1,030	6,156	318	381	699	93	225
1979	1,062	5,652	430	394	823	110	871
1980	995	4,911	450	321	771	70	10,514
1981	902	4,361	421	255	675	40	1,272
1982	895	3,632	370	347	717	83	1,971
1983	958	5,348	325	414	738	128	1,148
1984	963	4,546	293	409	703	135	632
1985	946	4,427	274	326	600	99	685
1986	1,471	13,889	350	316	666	80	1,659
1987	1,822	12,458	560	434	994	149	3,294
1988	2,134	12,027	782	517	1,299	146	454
1989	2,324	10,788	828	730	1,558	166	207
1990	2,397	9,267	768	1,074	1,841	320	305
1991	2,039	7,855	684	967	1,650	281	246
1992	1,481	7,365	606	551	1,156	187	287
1993	1,330	8,968	560	367	928	124	499
1994	1,303	7,613	545	305	850	83	238
1995	1,387	6,327	522	397	918	94	315
1996	1,471	5,383	467	630	1,097	170	355
1997	1,369	4,485	401	765	1,165	252	457
1998	971	3,649	342	521	863	157	554
1999	622	3,199	296	232	528	47	
2000	570	2,827	260	216	476	42	
2001	535	2,604	231	206	438	39	
2002	499	2,444	206	193	400	34	
2003	479	2,419	187	192	379	39	
2004	484	2,510	175	196	370	42	

Table 4. Radiometric ages for male crabs for shell conditions 1 through 5.

			Radiometric age		
Shell Condition	description	sample size	Mean	minimum	maximum
1	soft	6	0.15	0.05	0.25
2	new	6	0.69	0.33	1.07
3	old	3	1.02	0.92	1.1
4	very old	3	5.31	4.43	6.6
5	very very old	3	4.59	2.7	6.85

Table 5. Natural mortality estimates for Hoenig (1983) and the 5% rule given the oldest observed age.

	Natural Mortality	
oldest observed age	Hoenig (1983) empirical	5% rule
10	0.42	0.3
15	0.28	0.2
17	0.25	0.18
20	0.21	0.15

Table 6. Estimated reference points, fishing mortality and catch for 2005 Bering Sea snow crab fishery. Biomass is in millions of lbs. Scenario 1 has survey selectivities estimated in the model and mortality on discarded crab at 100%. Scenario 2 has survey selectivities fixed at the Somerton and Otto (1999) values and mortality on discarded crab at 100%. Scenario 3 has survey selectivities estimated in the model and mortality on discarded crab at 25%.

Scenario	1	2	3
Fmsy (overfishing)(full selection F)	0.70	0.915	1.06
F maximum (0.75*Fmsy)	0.525	0.686	0.793
Exploitation rate for total catch at Fmsy on MMB at time of the fishery	0.165	0.150	0.162
Exploitation rate for retained catch at Fmsy on MMB at time of the fishery	0.121	0.106	0.135
B0 total mature biomass at survey time	2,375	2,378	1,560
Bmsy total mature biomass at survey time	1,155	1,187	765
MSST total mature biomass at survey time (1/2 Bmsy)	578	594	383
MSY total catch	128	119	83
MSY retained catch	94	84	69
2004 model estimate of total mature biomass at survey time	370	567	323
Percent of Bmsy for 2004 model estimate of total mature biomass at survey time	32%	48%	42%
R0 (billion crabs)	1.68	1.99	1.12
Steepness	0.61	0.591	0.60
F 2005 fishery	0.24	0.434	0.46
2005 Male mature biomass at time of fishery	173	276	176
2005 total catch(discard + retained)	11.1	22.4	14.1
2005 retained catch (GHL)	8.6	16.6	12.1
2005 total catch/male mature biomass at time of fishery	0.064	0.081	0.080
2005 retained catch/male mature biomass at time of fishery	0.050	0.060	0.069

Table 7. Parameters values for model, excluding recruitments, changing fishery selectivity and fishing mortality parameters.

Natural Mortality	0.2
Female intercept (a) growth	12.724
Male intercept(a) growth	8.748
Female slope(b) growth	1.000
Male slope (b) growth	1.180
Mean length of recruits	
Beta for gamma distribution of recruits	3.012
Beta for gamma distribution female growth	0.714
Beta for gamma distribution male growth	1.494
Immature male molting probability slope	0.049
Immature male molting probability length at 50% molting	152.006
Fishery selectivity total new and old shell slope	0.209
Fishery selectivity retention curve new shell slope	0.332
Fishery selectivity retention curve new shell length at 50%	97.364
Fishery selectivity retention curve old shell slope	0.232
Fishery selectivity retention curve old shell length at 50%	106.063
Pot Fishery discard selectivity female slope	1.005
Pot Fishery discard selectivity female length at 50%	130.000
Trawl Fishery selectivity female slope	1.005
Trawl Fishery selectivity female length at 50%	130.000
Trawl Fishery selectivity male slope	0.237
Trawl Fishery selectivity male length at 50%	68.865
Survey Q 1978-1981	1.000
Survey 1978-1981 length at 95% selected	30.000
Survey 1978-1981 length at 50% selected	20.796
Survey Q 1982-1988	1.000
Survey 1982-1988 length at 95% selected	145.208
Survey 1982-1988 length at 50% selected	64.582
Survey Q 1989-present	1.000
Survey 1989-present, length at 95% selected	105.531
Survey 1989-present length at 50% selected	19.311
Fishery cpue q	0.001245

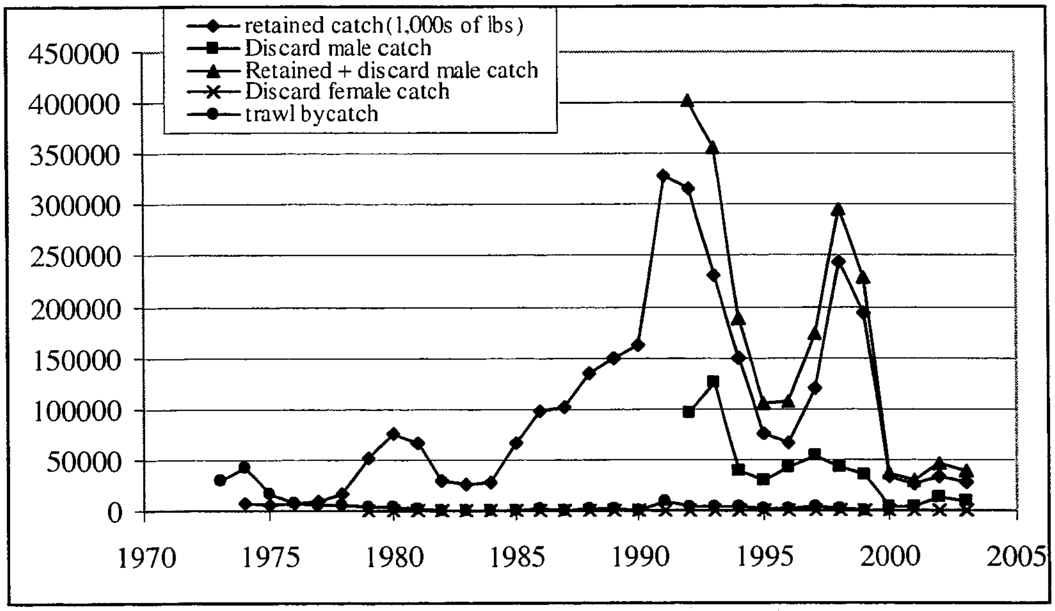


Figure 1. Catch (1,000s lbs) from the directed snow crab pot fishery and groundfish trawl bycatch. Retained and total catch are males only, female catch is the discard mortality from the directed pot fishery and trawl is male and female bycatch from groundfish trawl fisheries.

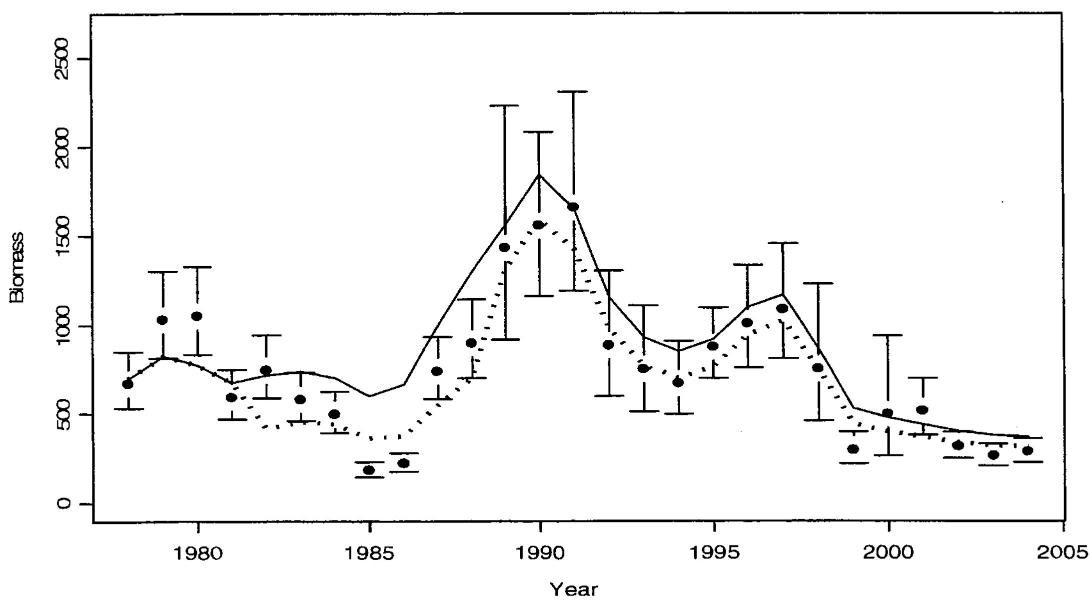


Figure 2. Population total mature biomass (millions of pounds, solid line), model estimate of survey mature biomass (dotted line) and observed survey mature biomass with approximate lognormal 95% confidence intervals.

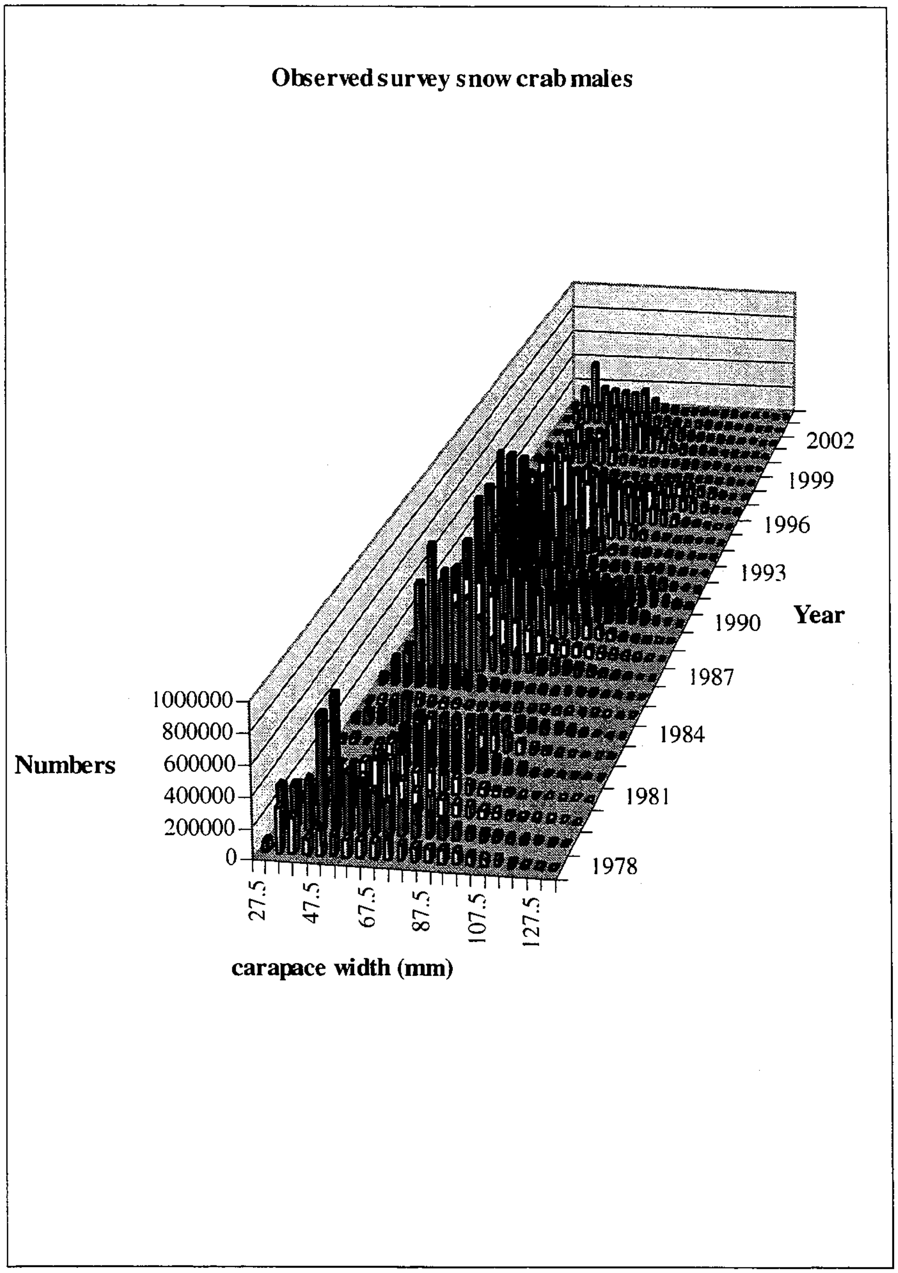


Figure 3. Observed survey numbers by carapace width and year for male snow crab.

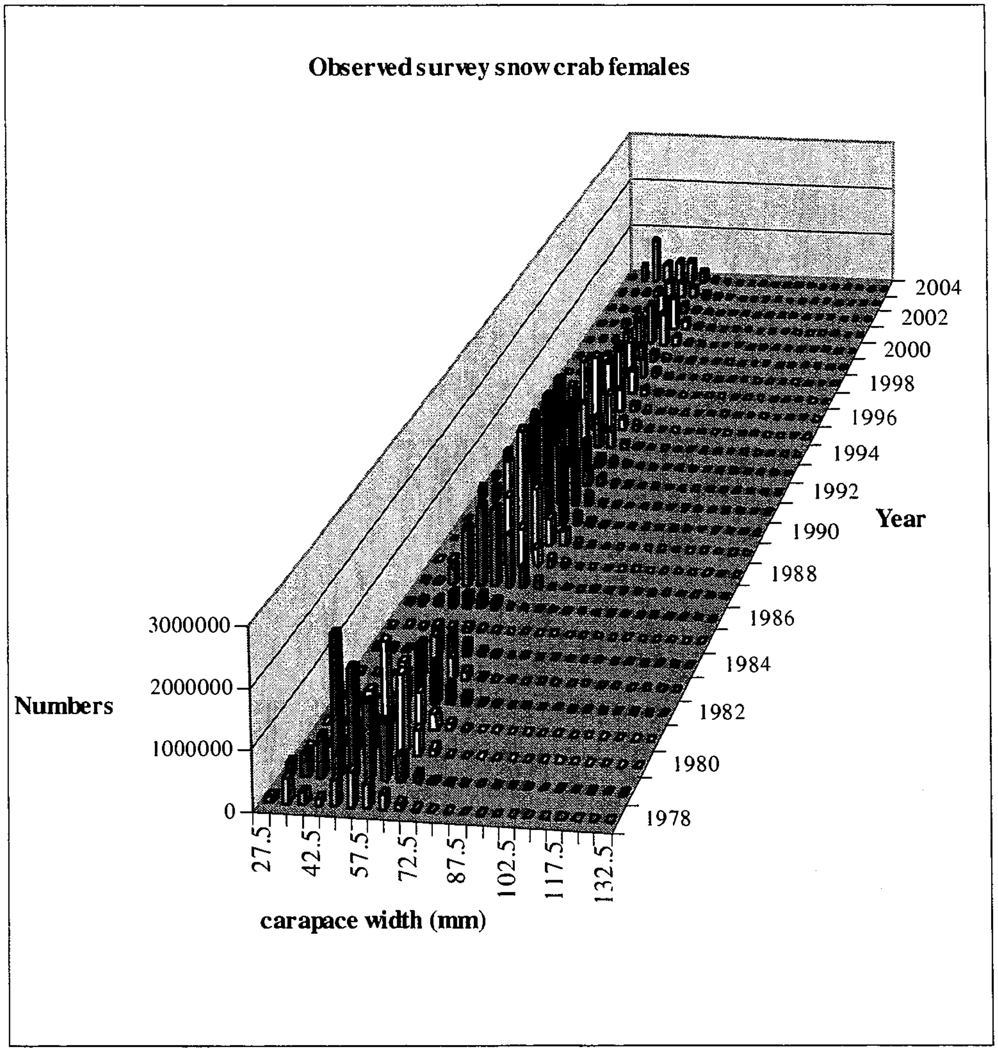


Figure 4. Observed survey numbers by carapace width and year for female snow crab.

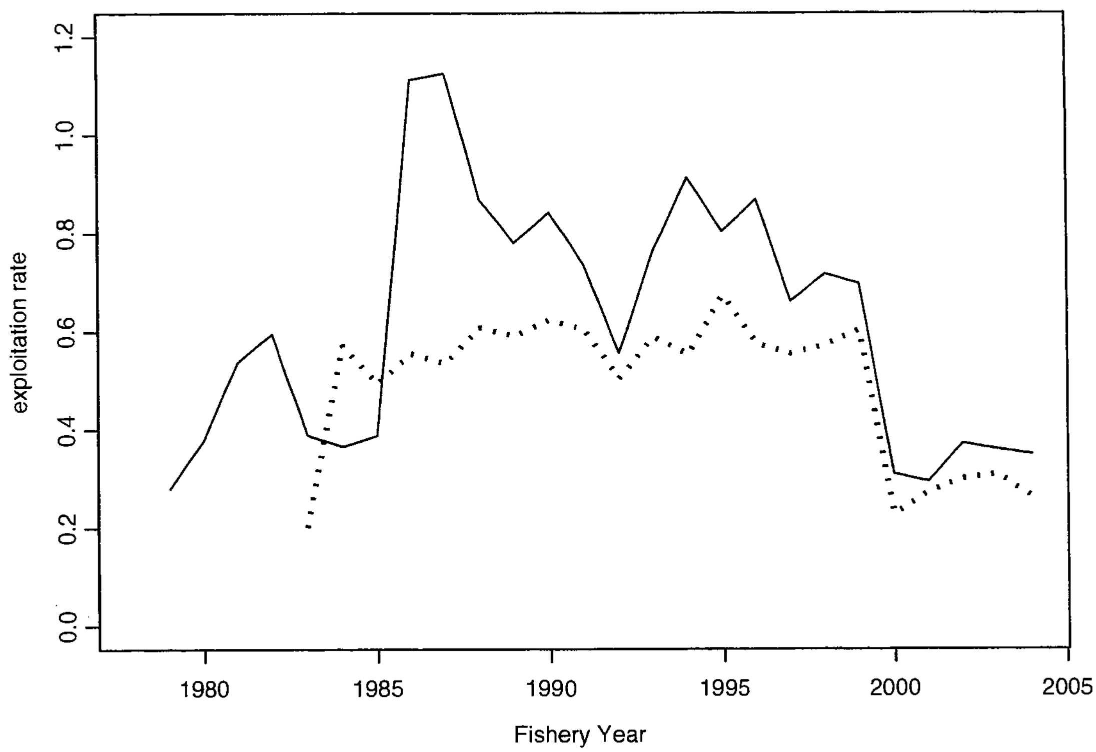


Figure 5. Exploitation rate estimated as the preseason GHL divided by the survey estimate of large male biomass (>101 mm) at the time the survey occurs (dotted line). The solid line is the retained catch divided by the survey estimate of large male biomass at the time the fishery occurs. Year is the year the fishery occurred.

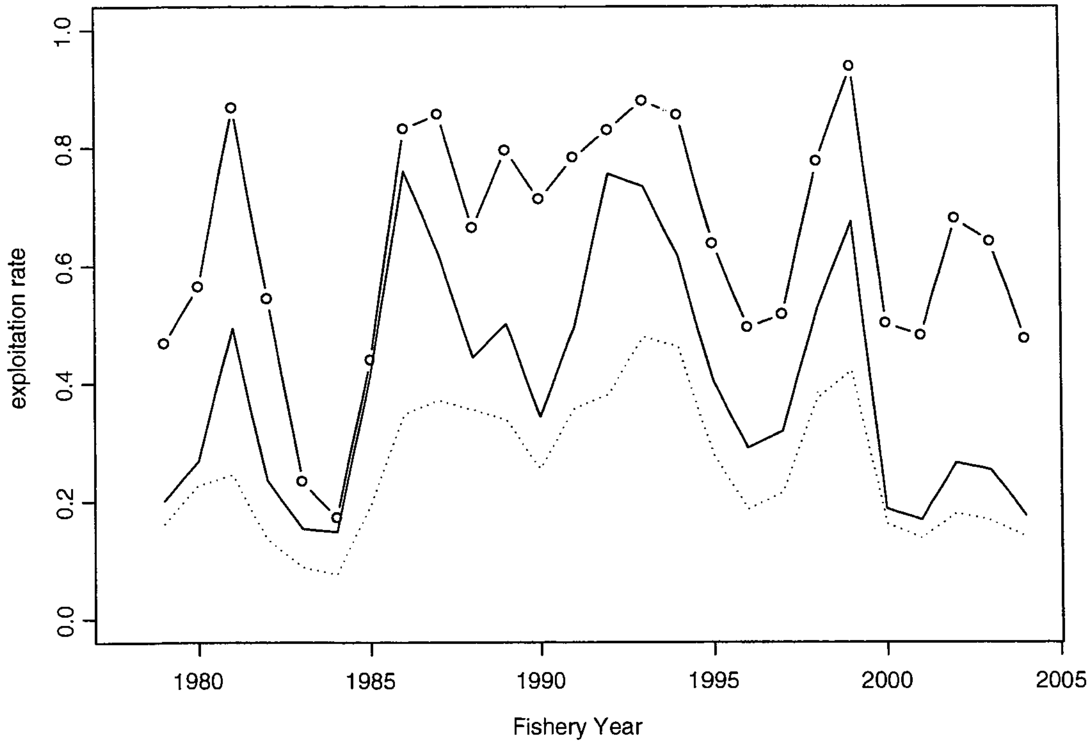


Figure 6. Exploitation fraction estimated as the catch biomass (total or retained) divided by the mature male biomass from the model at the time of the fishery (solid line and dotted line). The exploitation rate for total catch divided by the male biomass greater than 101 mm is the solid line with dots. Year is the year of the fishery.

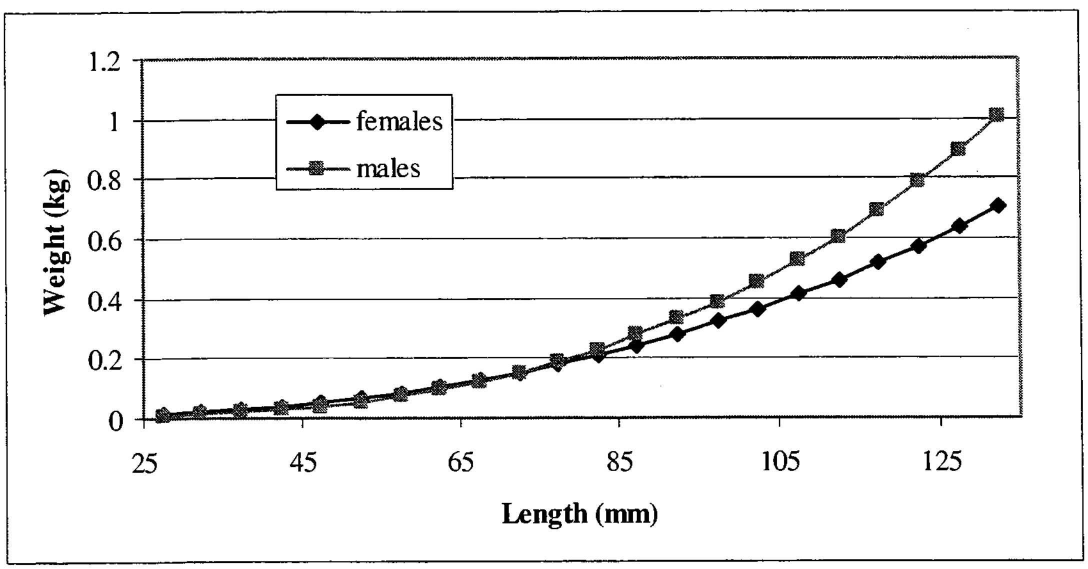


Figure 7. Weight (kg) – size (mm) relationship for male and female snow crab.

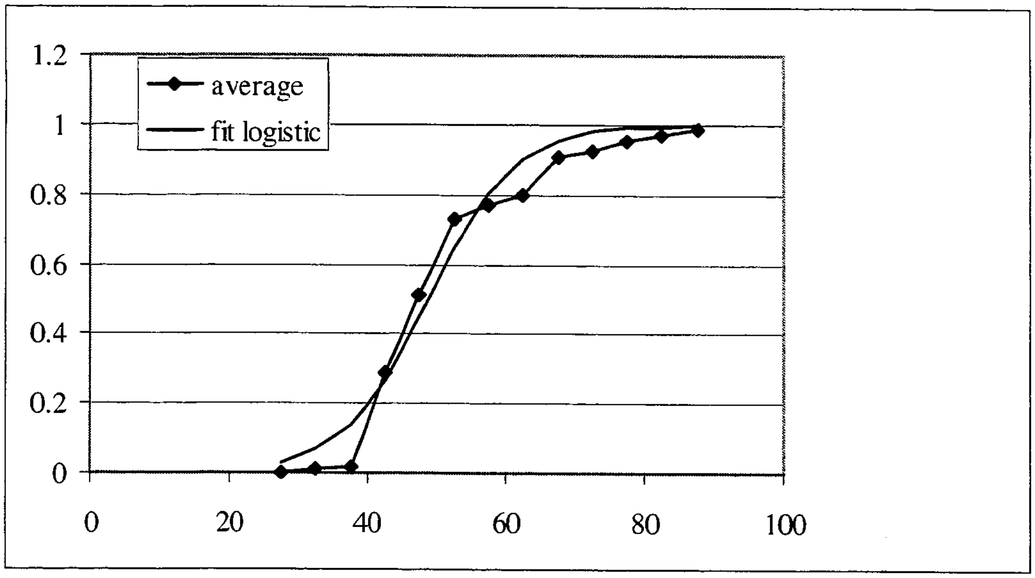


Figure 8. Average maturity for females from the survey 1978 to 2000 (not used in the model). Females were determined to be mature or immature based on visual examination in the survey. Line labeled logistic has a slope of 0.163 and size at 50% of 48.8 mm for comparison only.

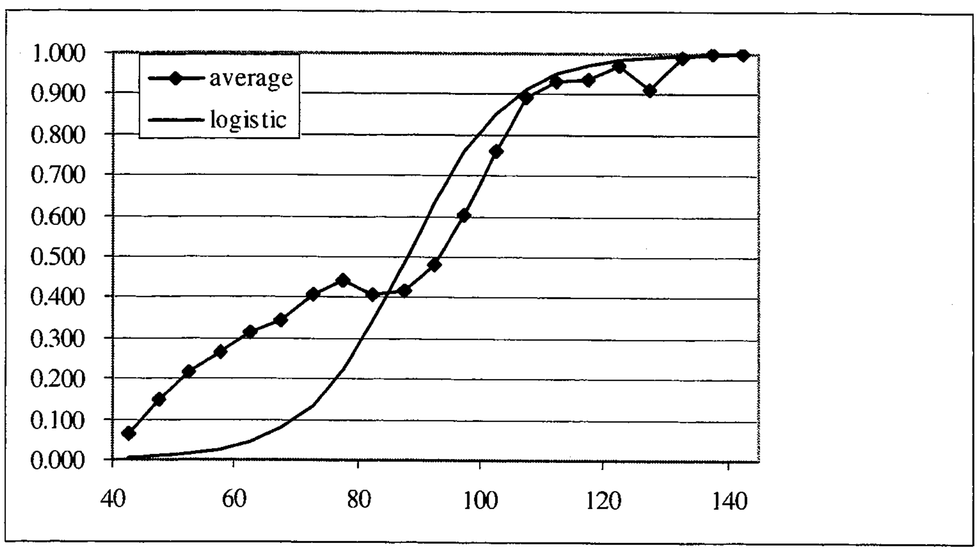


Figure 9. Maturity curve for new shell males. Line labeled average is the average maturity for new shell males from the survey 1989 to 2000. Line labeled logistic is the curve used in the model (slope 0.12, size at 50% 88.0mm).

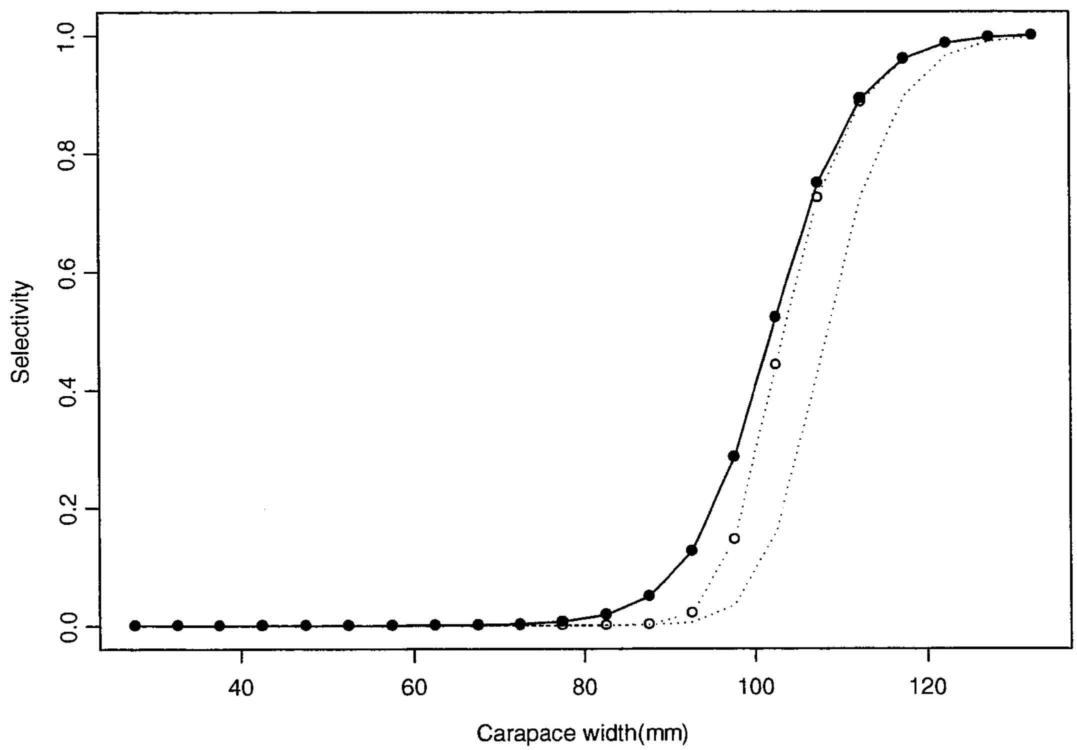


Figure 10. Selectivity curves for total catch (discard plus retained, new and old shell the same, solid line with filled circles) and retained catch of male snow crab by new (dotted line with open circles) and old shell condition (dotted line) averaged over the last three years (2002 to 2004 fishery seasons).

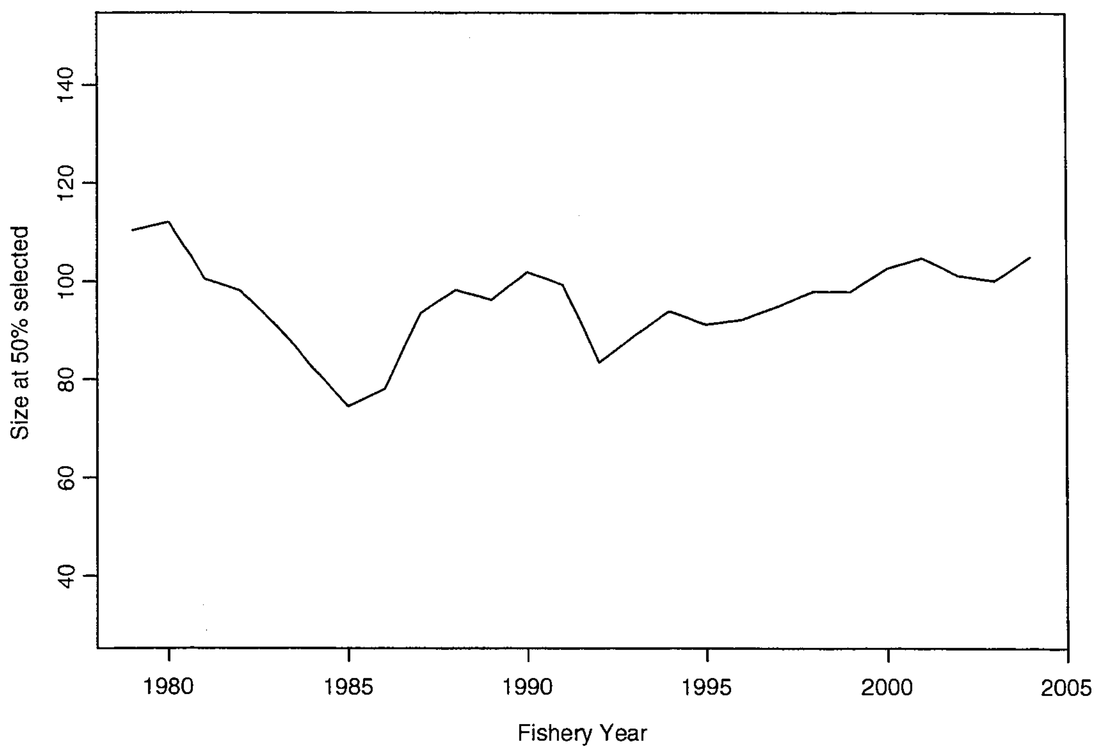


Figure 11. Size at 50% selected parameter for pot fishery selectivities of male crab 1978 to 2004.

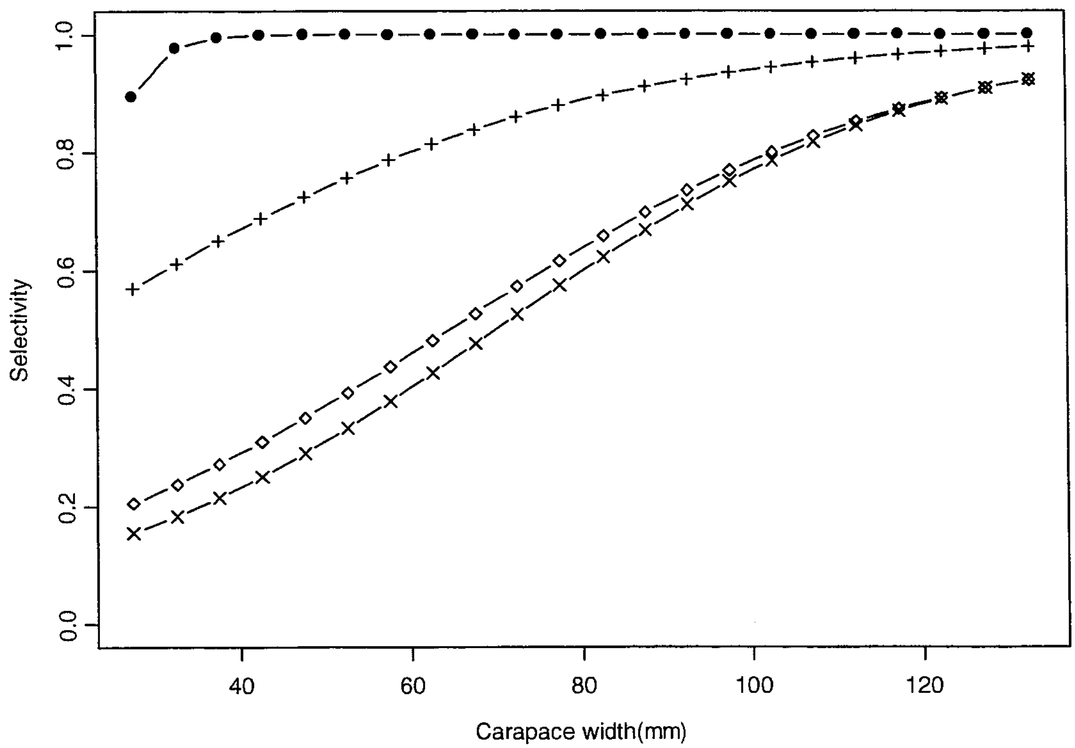


Figure 12. Survey selectivity curves for female and male snow crab estimated by the model for 1978-1981(solid line with circles), for 1982 to 1988 (solid line with diamonds), and 1989 to present (solid line with pluses). Survey selectivities estimated by Somerton and Otto (1998) are the solid line with crosses.

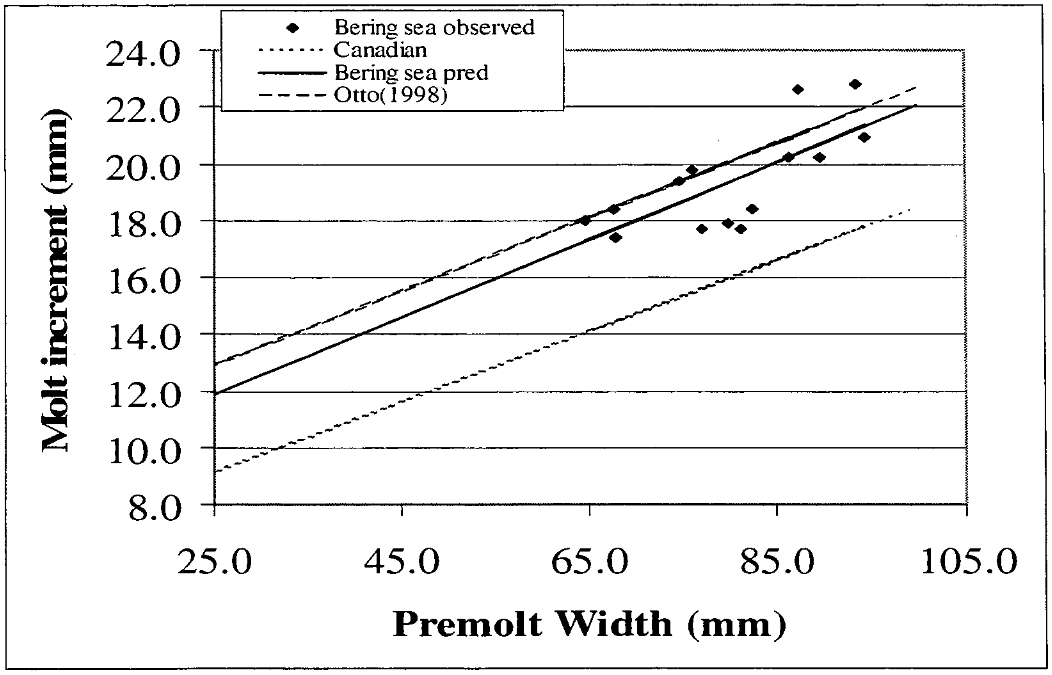


Figure 13. Growth increment as a function of premolt size for male snow crab. Points labeled Bering sea observed are observed growth increments from Rugolo (unpub data). The line labeled Bering sea pred is the predicted line from the Bering sea observed growth, which is used as a prior for the growth parameters estimated in the model. The line labeled Canadian is estimated from Atlantic snow crab (Sainte-Marie data). The line labeled Otto(1998) was estimated from tagging data from Atlantic snow crab less than 67 mm, from a different area from Sainte-Marie data.

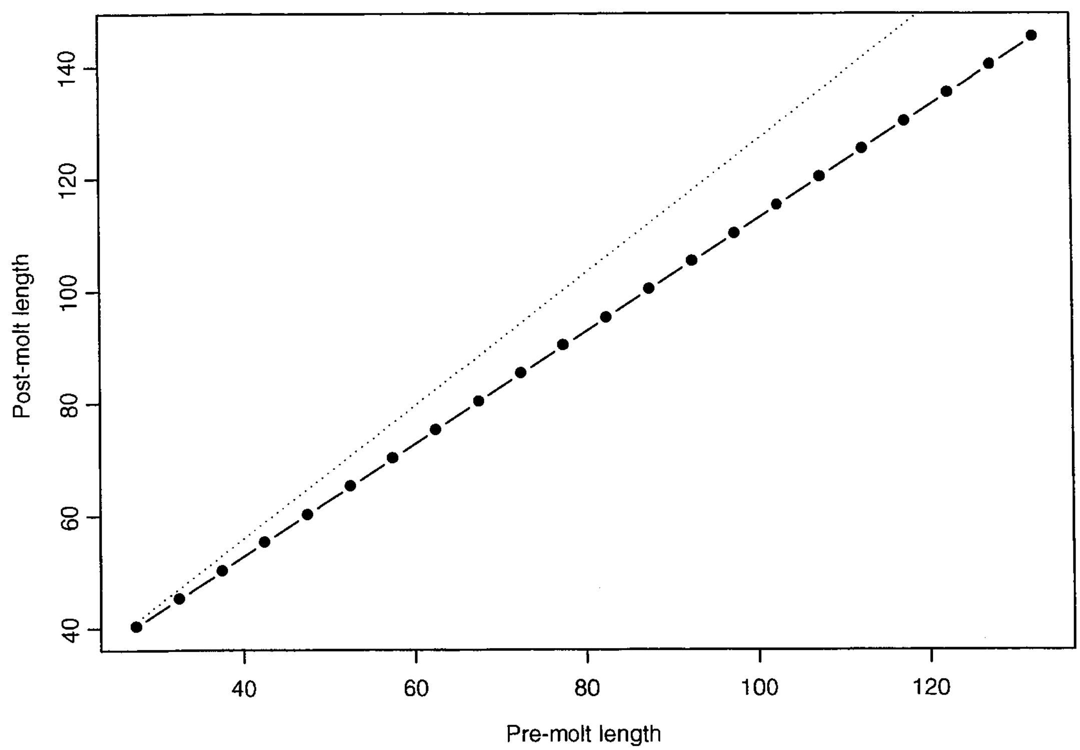


Figure 14. Growth(mm) for male(dotted line) and female snow crab (solid line with circles) estimated from the model.

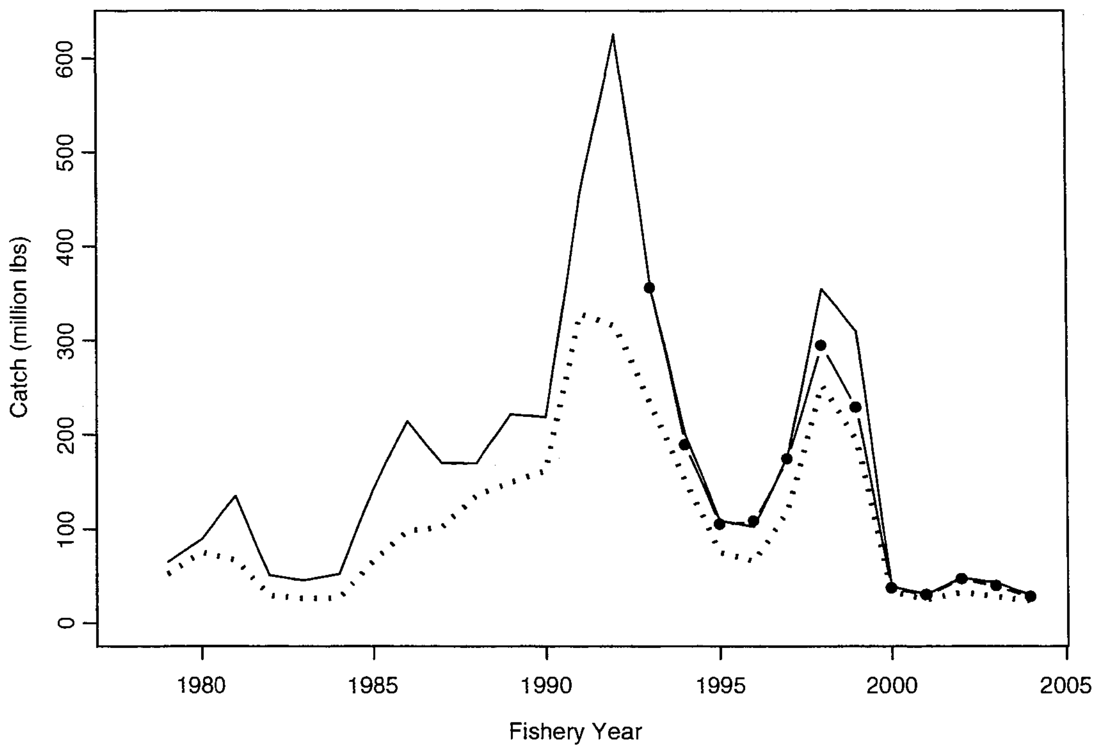


Figure 15. Estimated total catch(discard + retained) (solid line), observed total catch (solid line with circles) and observed retained catch (dotted line) for 1978 to 2004 fishery seasons.

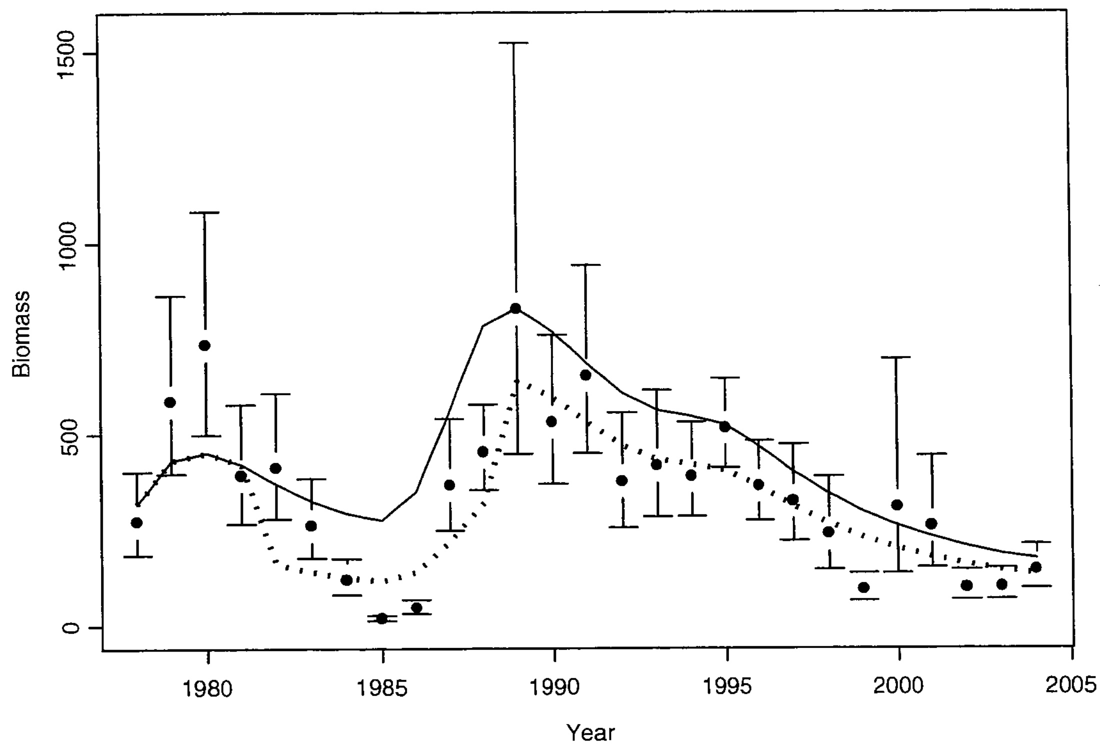


Figure 16. Population female mature biomass (millions of pounds, solid line), model estimate of survey female mature biomass (dotted line) and observed survey female mature biomass with approximate lognormal 95% confidence intervals.

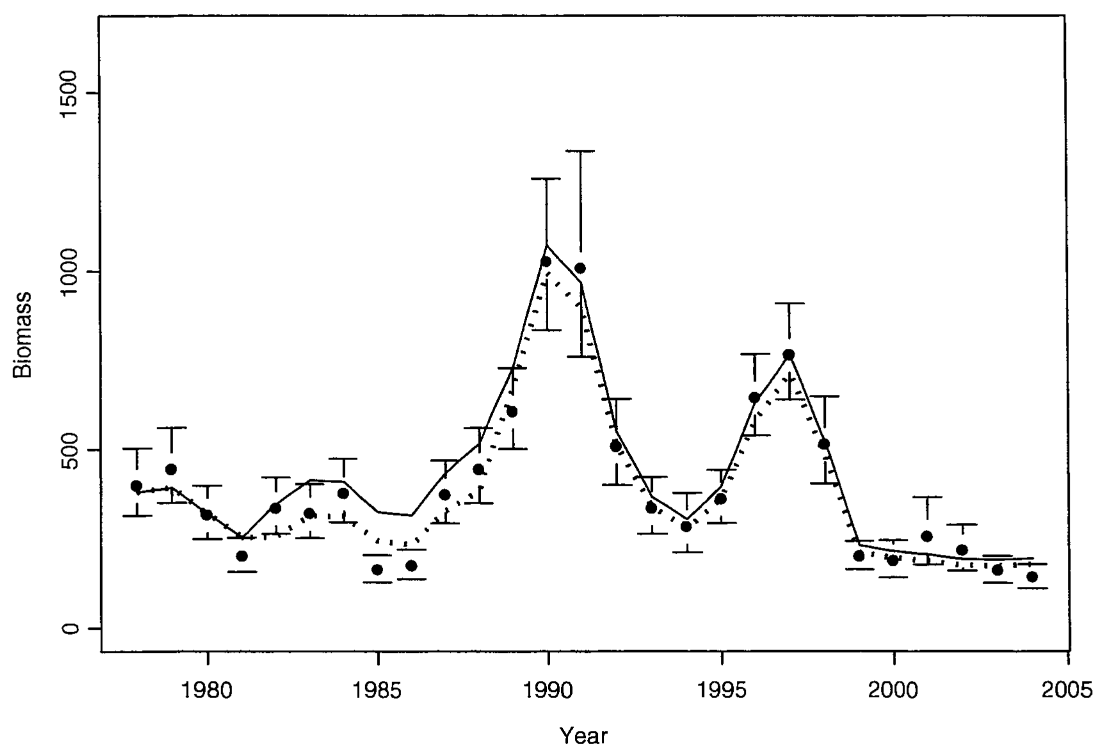


Figure 17. Population male mature biomass (millions of pounds, solid line), model estimate of survey male mature biomass (dotted line) and observed survey male mature biomass with approximate lognormal 95% confidence intervals.

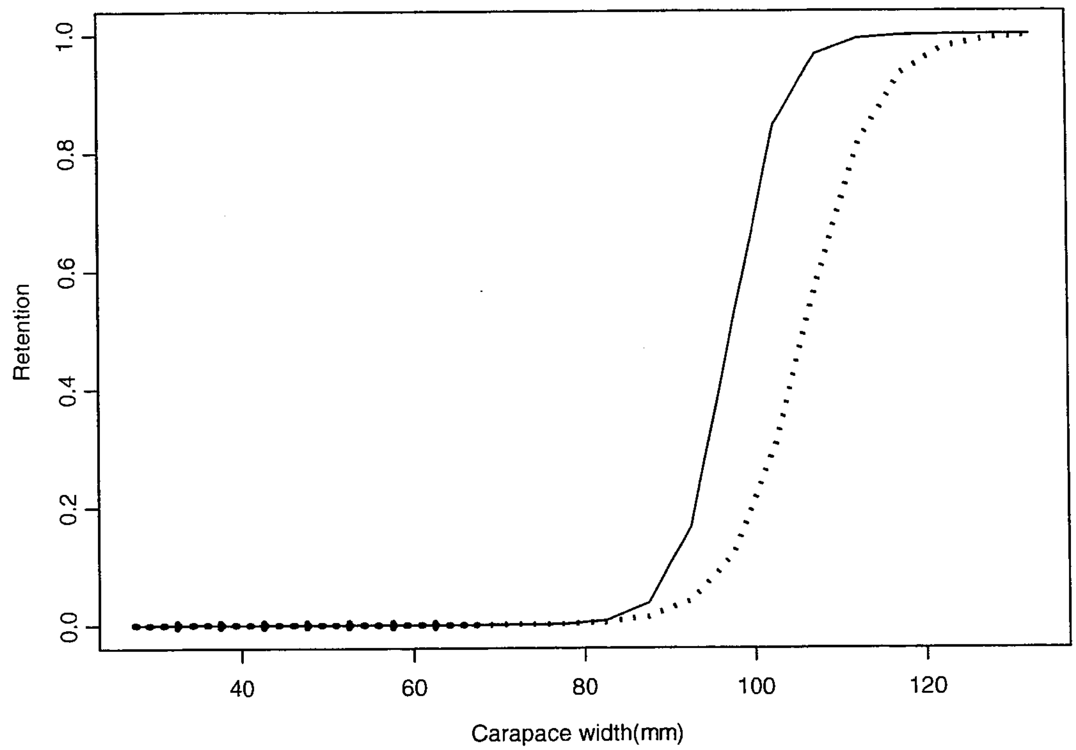


Figure 18. Model estimated fraction of the total catch that is retained by size for new(solid line) and old(dotted line) shell male snow crab.

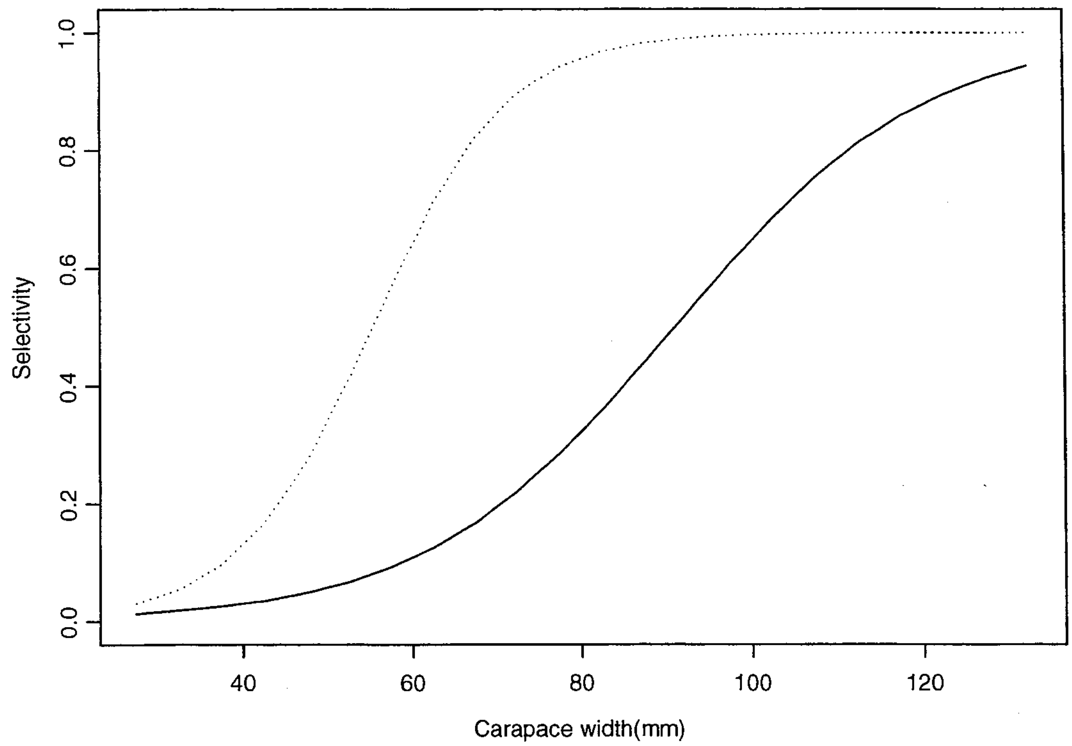


Figure 19. Selectivity curves estimated by model for the bycatch in the groundfish trawl fishery for females (solid line) and males (dotted line).

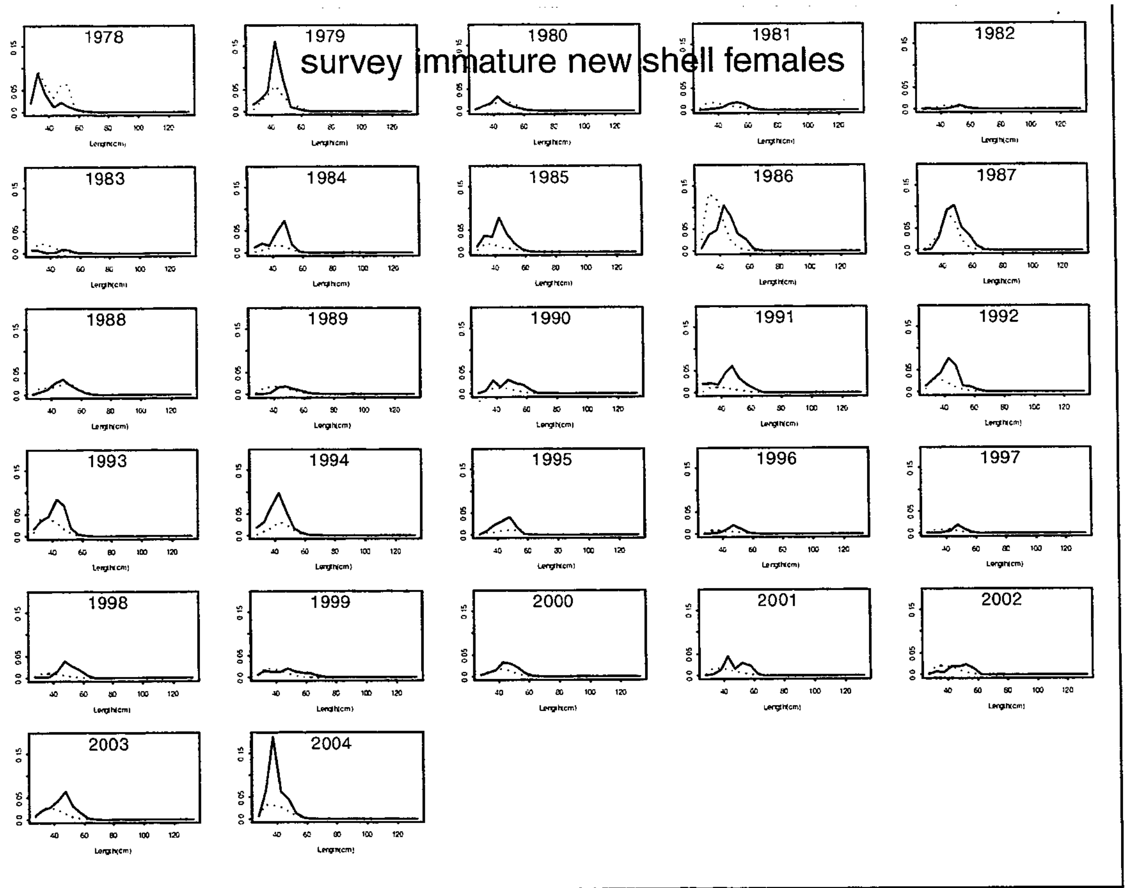


Figure 20. Model fit to the survey immature female new shell size frequency data. Dotted line is the model fit.

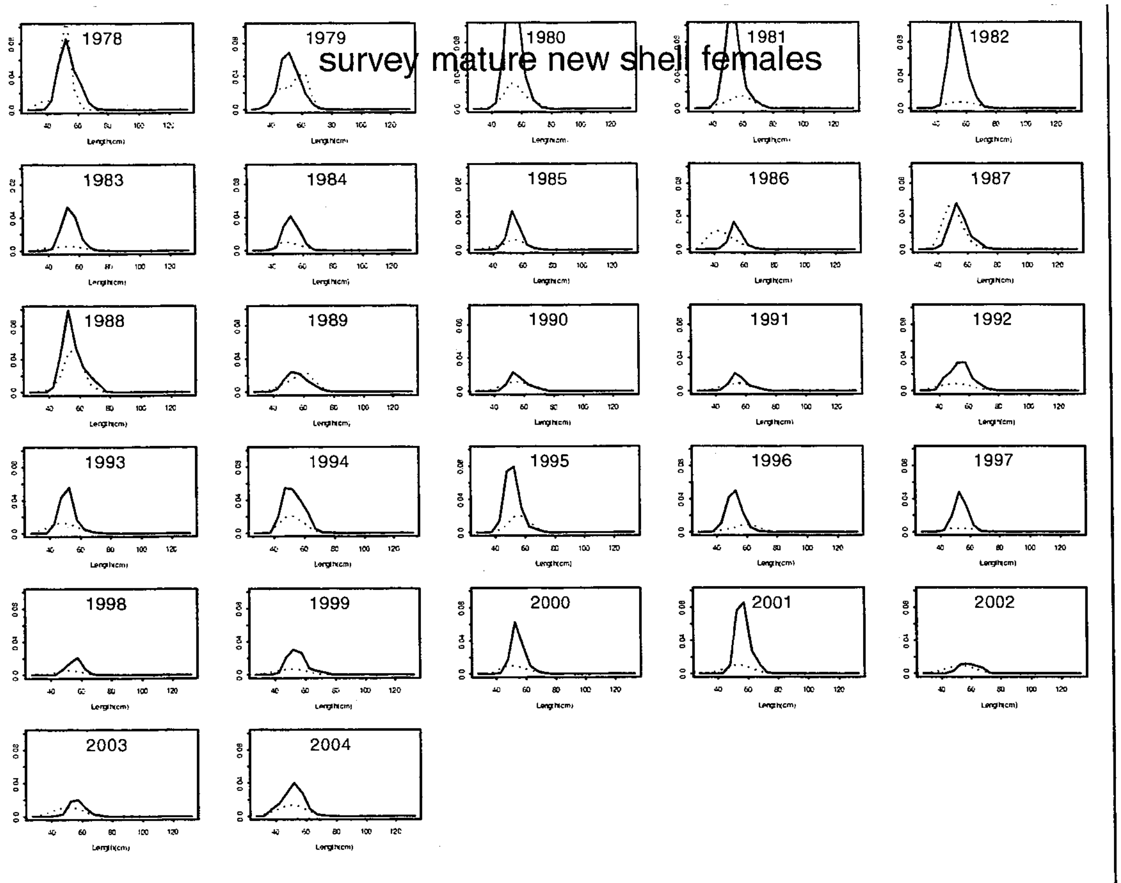


Figure 21. Model fit to the mature survey female new shell size frequency data. Dotted line is the model fit.

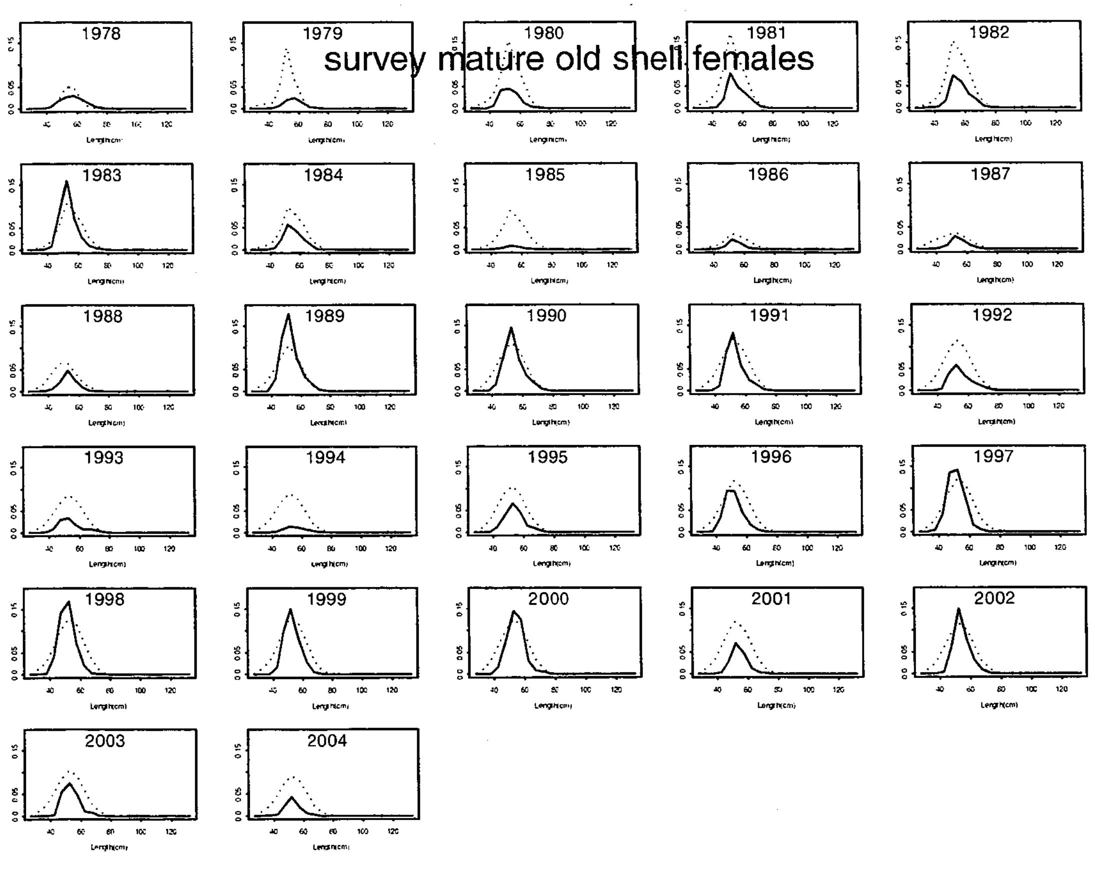


Figure 22. Model fit to the mature survey female old shell size frequency data. Dotted line is the model fit.

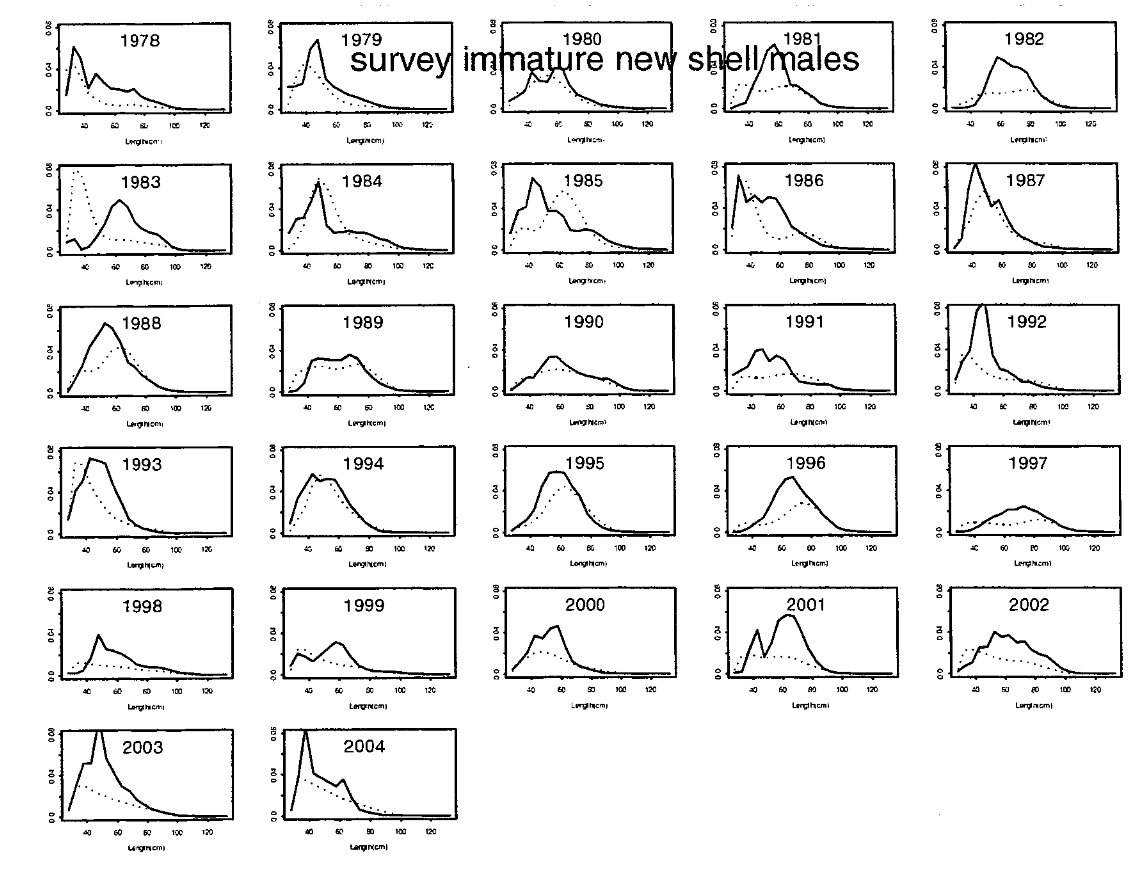


Figure 23. Model fit to the immature survey male new shell size frequency data. Dotted line is the model fit.

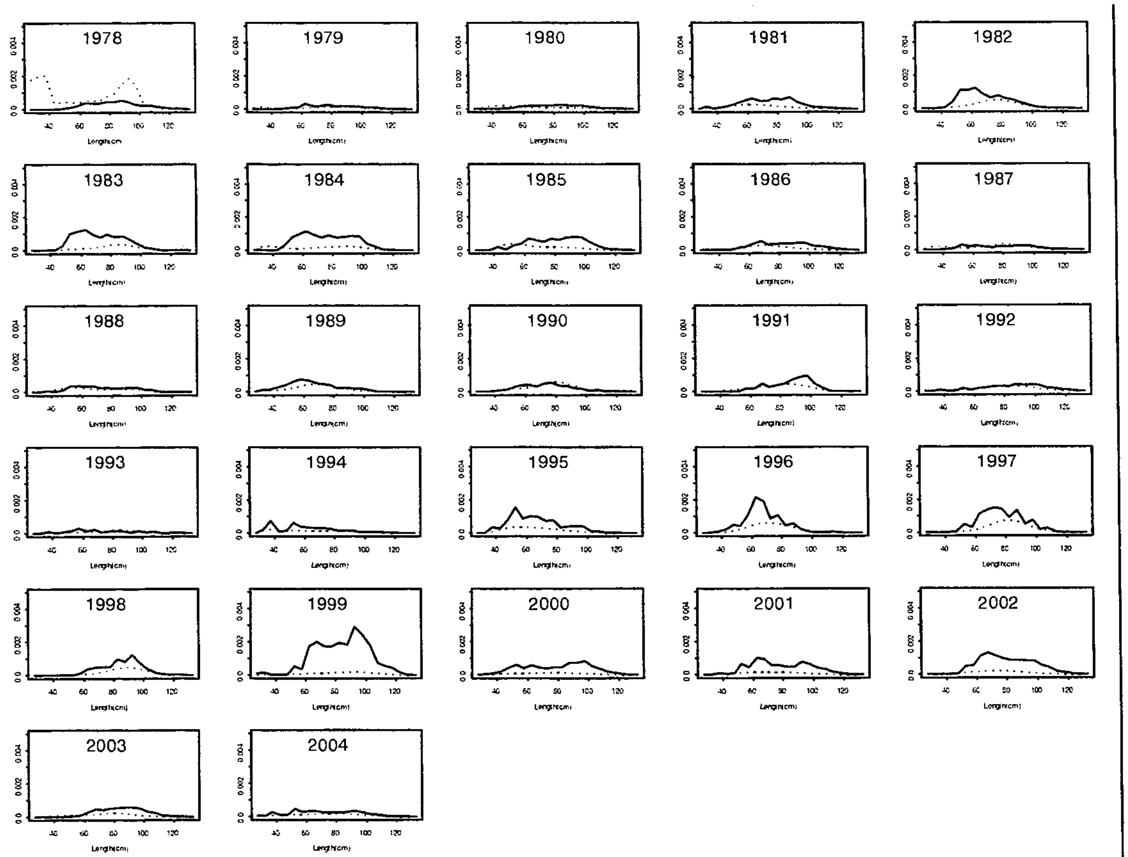


Figure 24. Model fit to the immature survey male old shell size frequency data. Dotted line is the model fit.

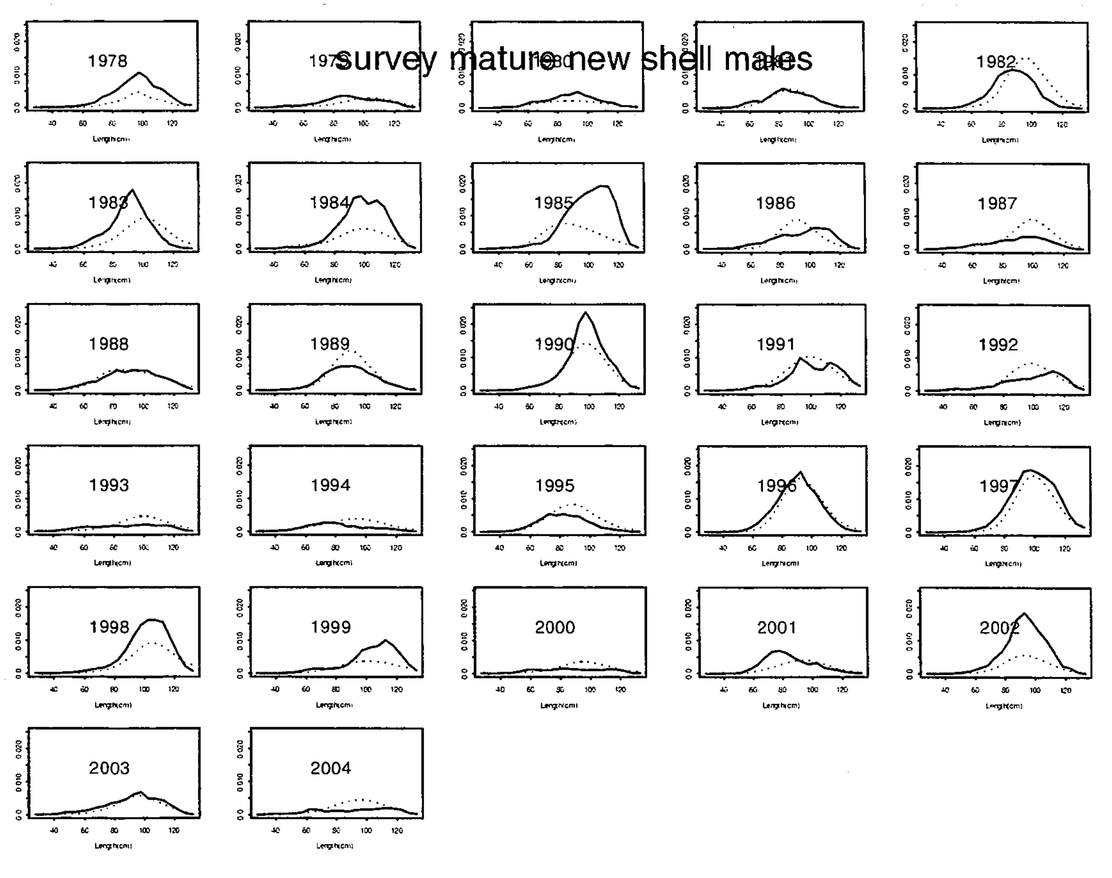


Figure 25. Model fit to the mature survey male new shell size frequency data. Dotted line is the model fit.

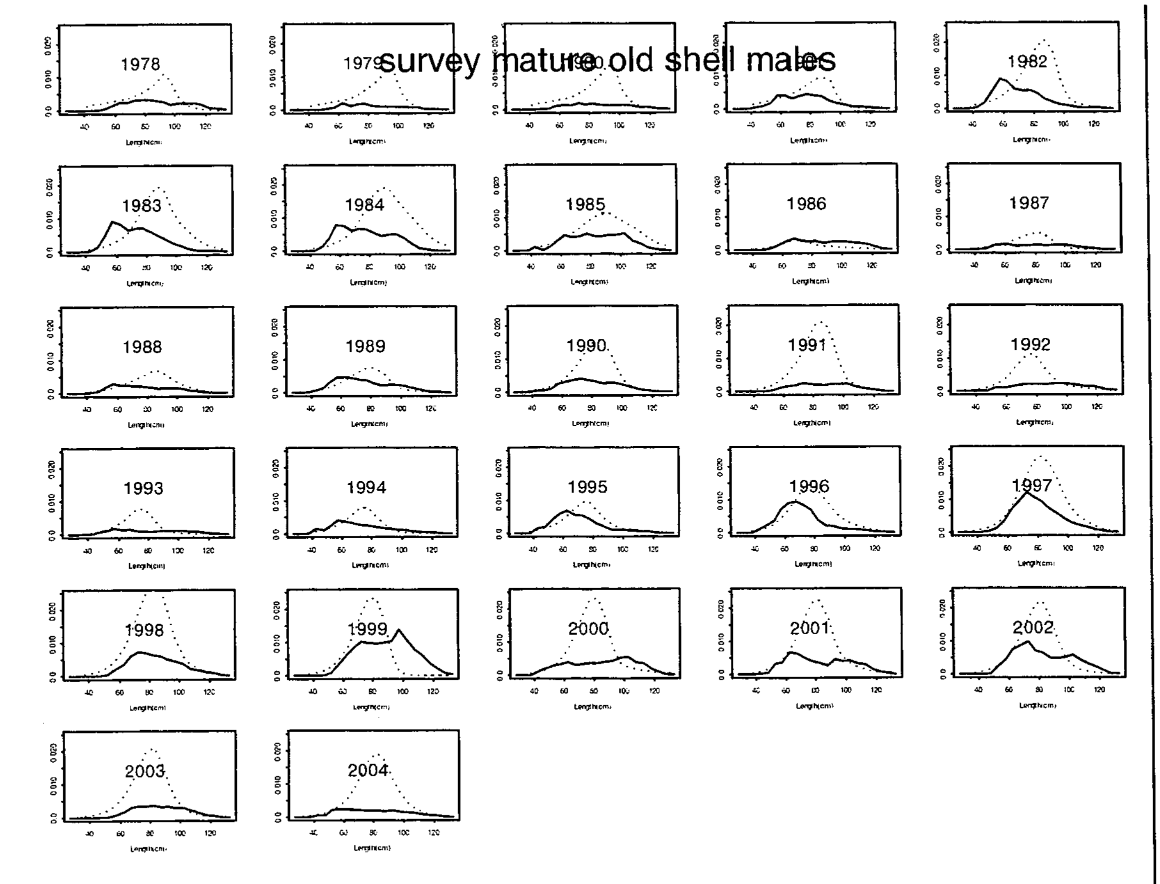


Figure 26. Model fit to the mature survey male old shell size frequency data. Dotted line is the model fit.

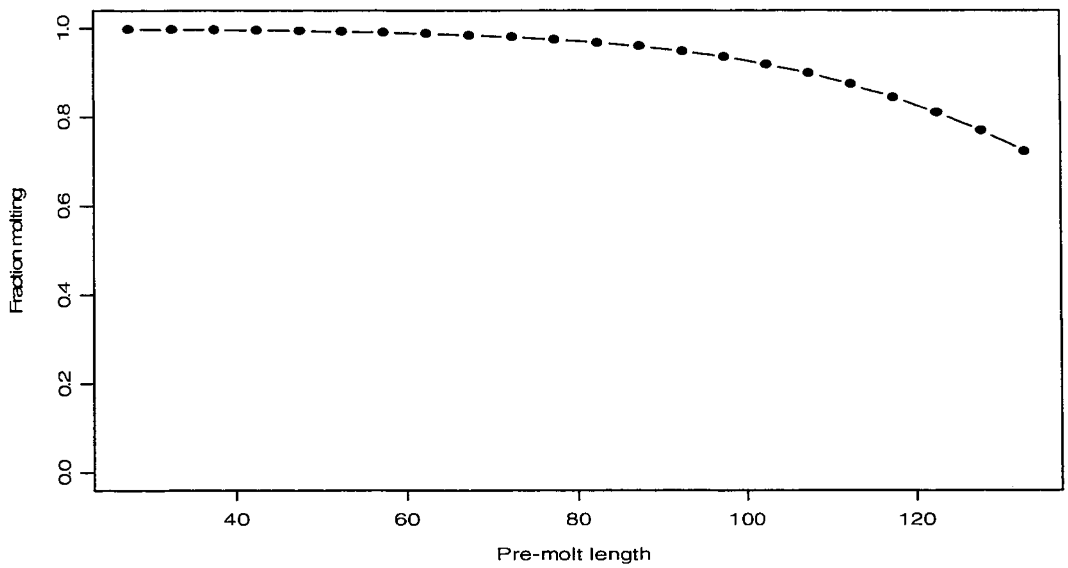


Figure 27. Molting probabilities for immature male crabs.

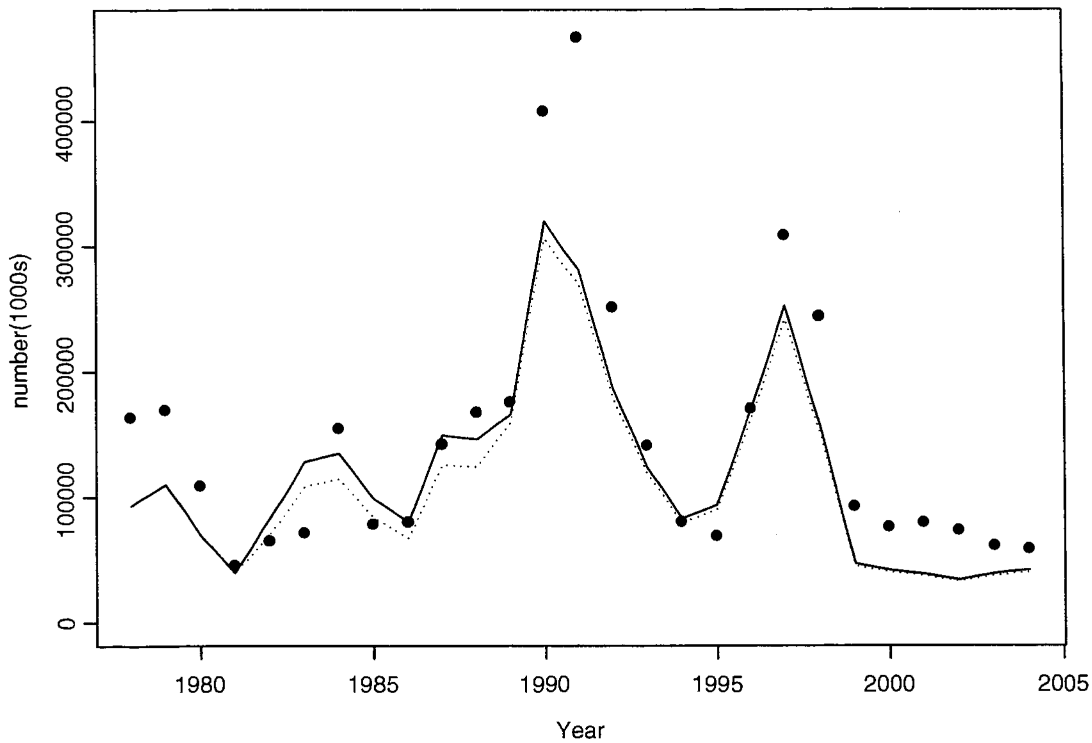


Figure 28. Observed survey numbers of males >101mm (circles) and model estimates of the population number of males >101mm(solid line) and model estimates of survey numbers of males >101 mm (dotted line).

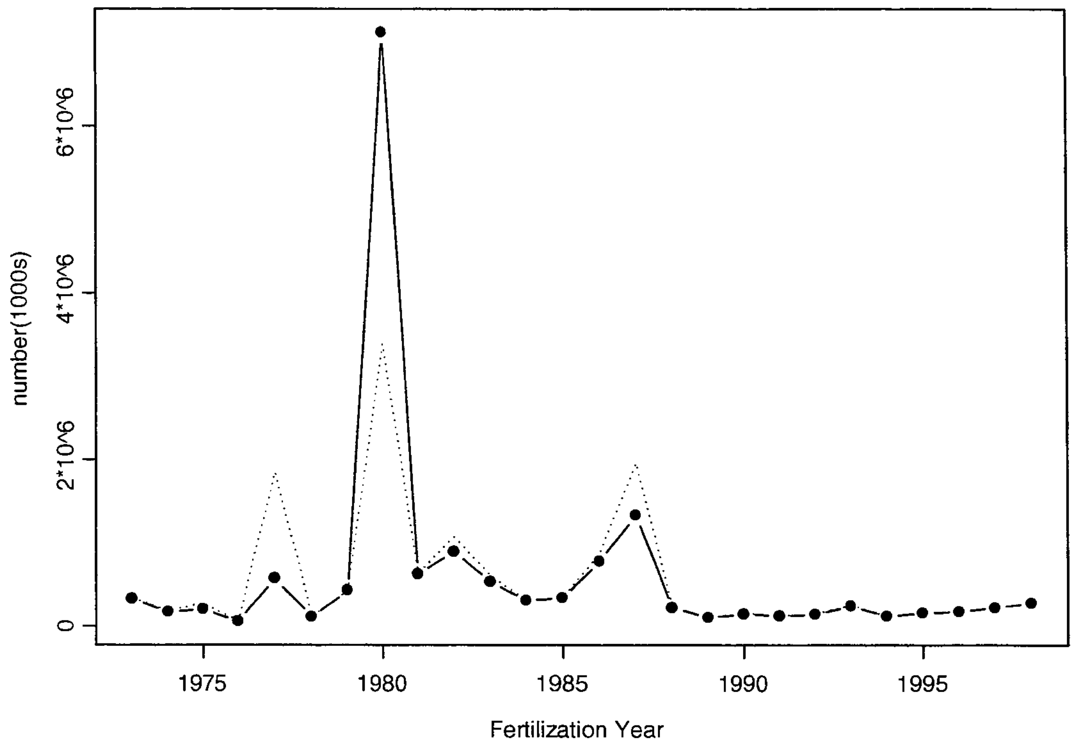


Figure 29. Recruitment to the model of male (dotted line) and female (solid line with dots) crab 25 mm to 50 mm.

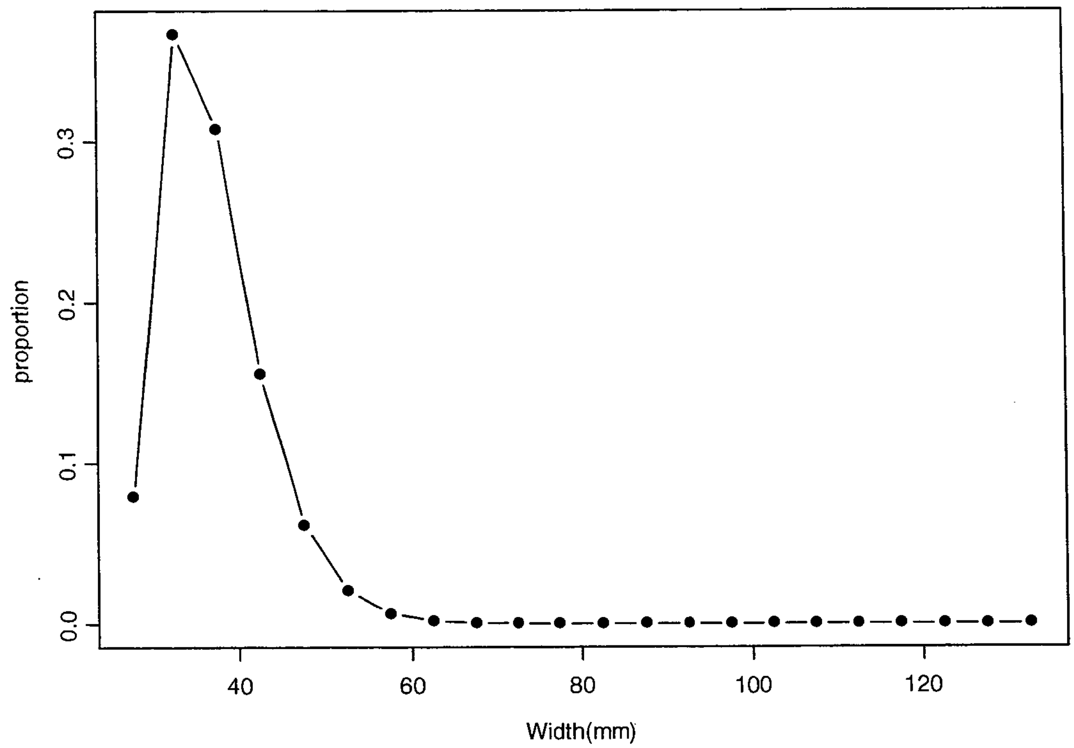


Figure 30. Distribution of recruits to length bins estimated by the model.

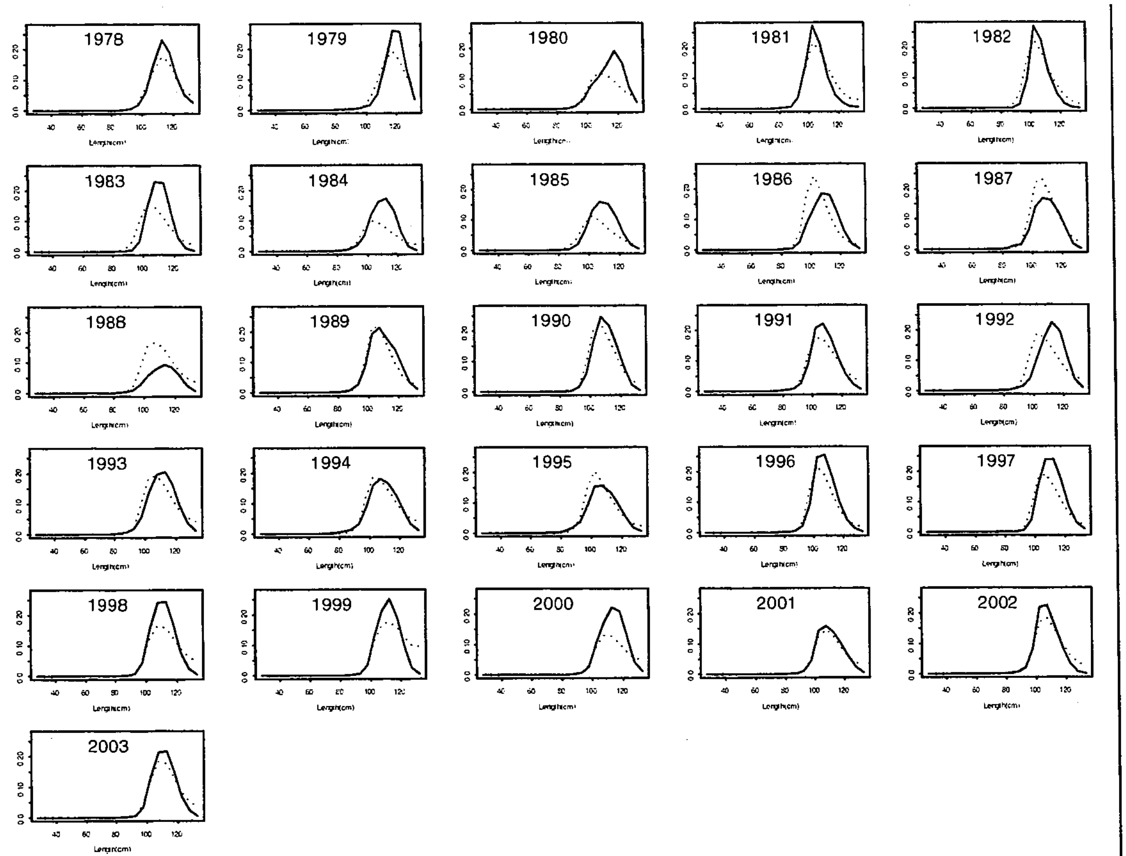


Figure 31. Model fit to the retained male new shell size frequency data. Dotted line is the model fit. Year is the survey year.

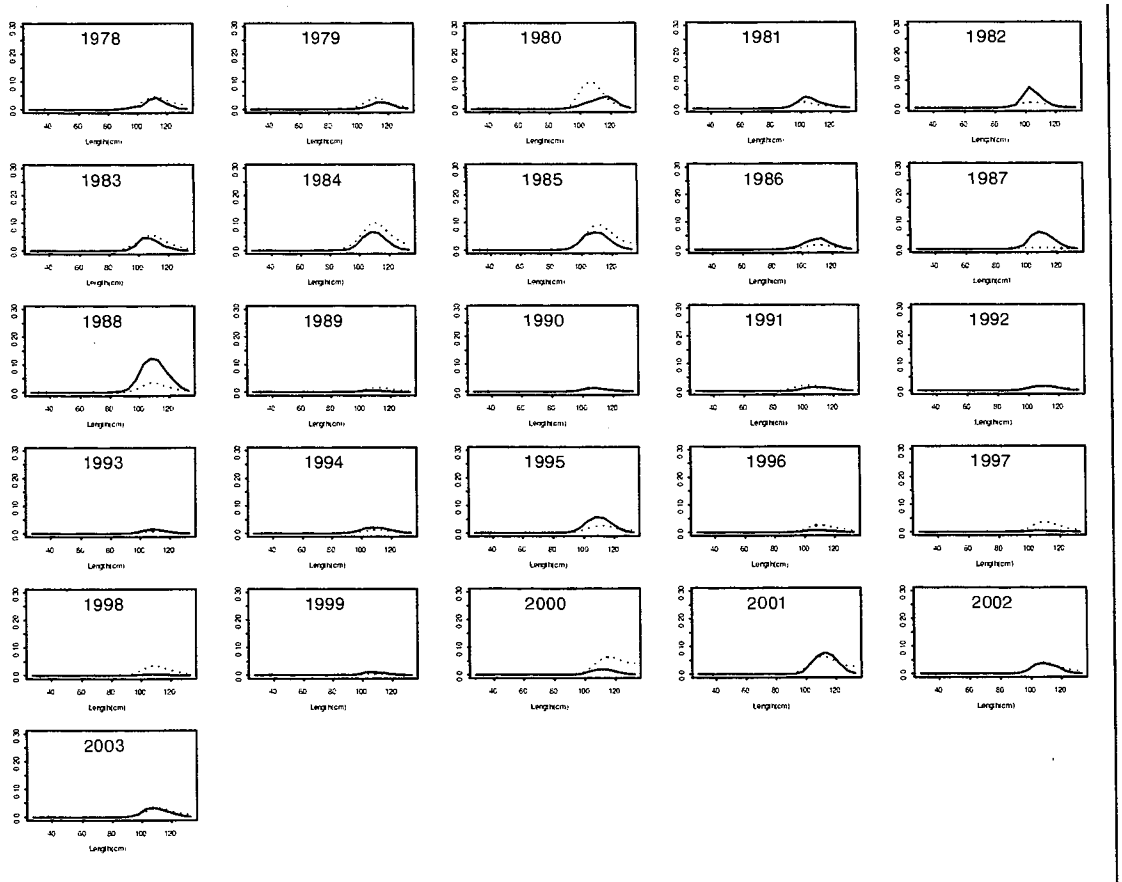


Figure 32. Model fit to the retained male old shell size frequency data. Dotted line is the model fit. Year is the survey year.

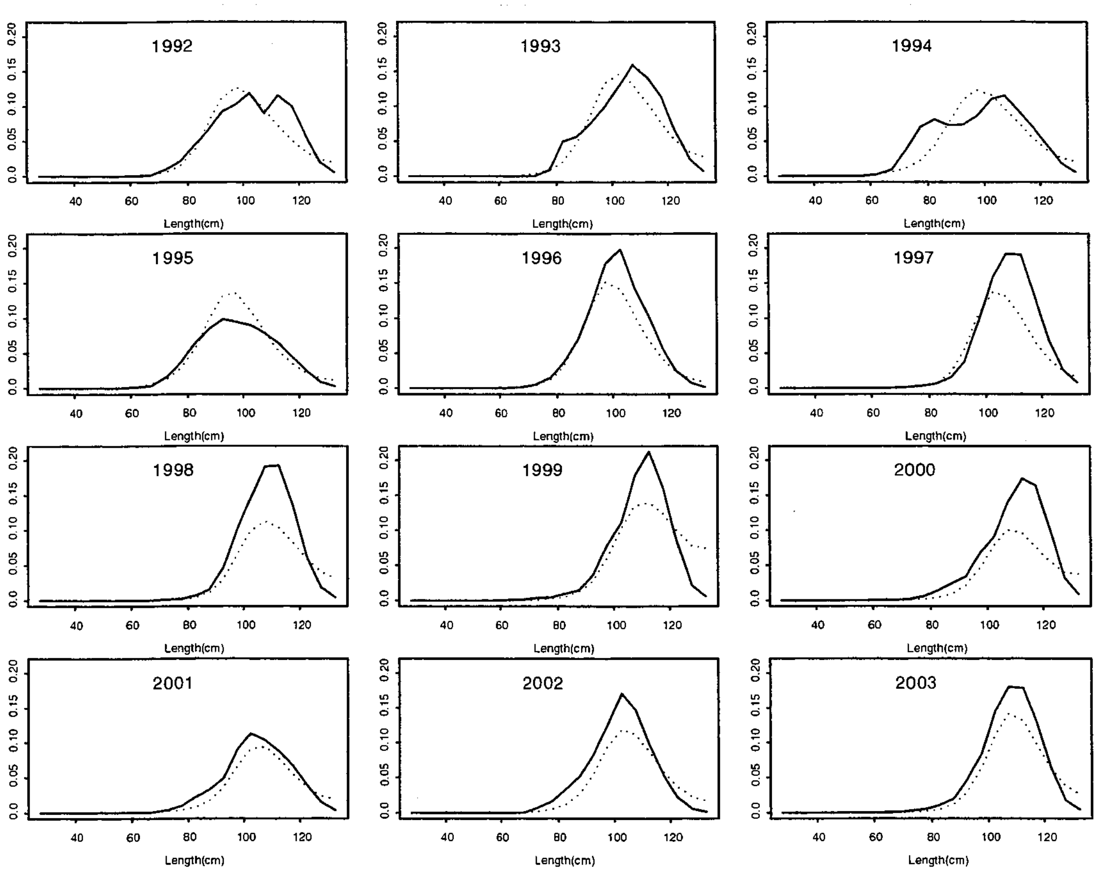


Figure 33. Model fit to the total (discard plus retained) male new shell size frequency data. Dotted line is the model fit. Year is the survey year.

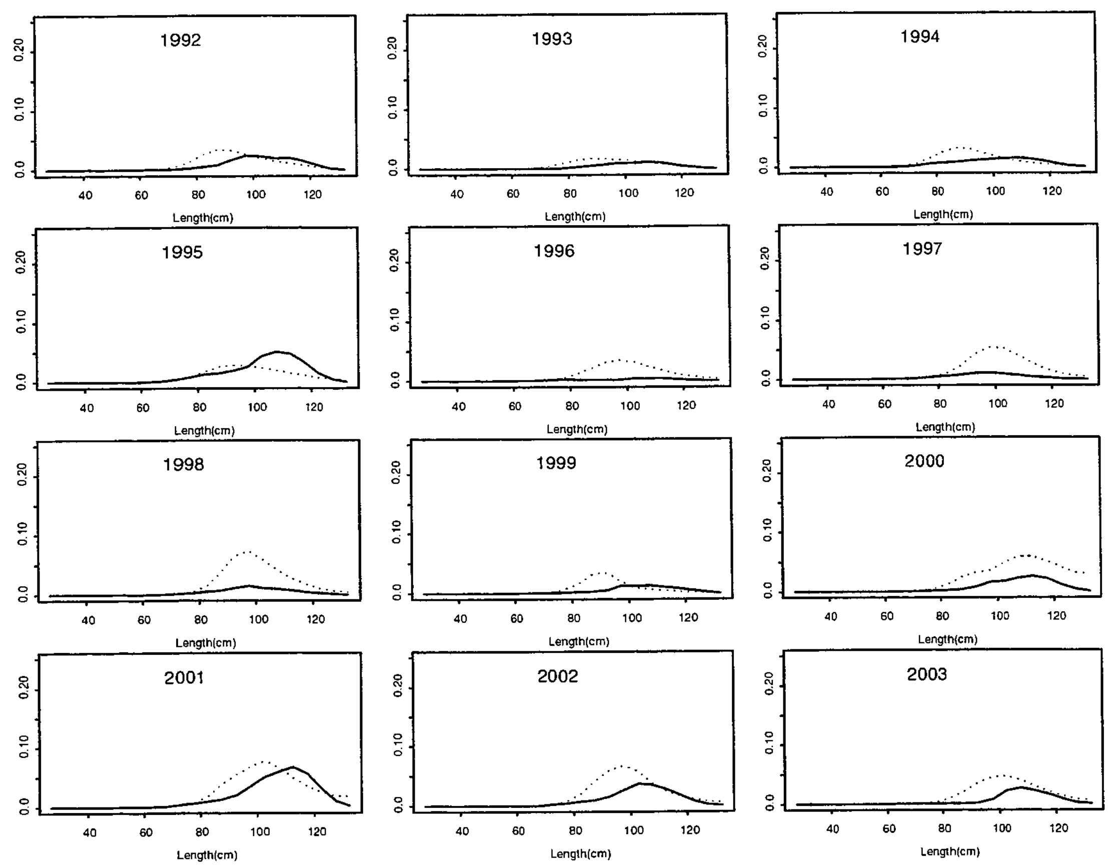


Figure 34. Model fit to the total (discard plus retained) male old shell size frequency data. Dotted line is the model fit. Year is the survey year.

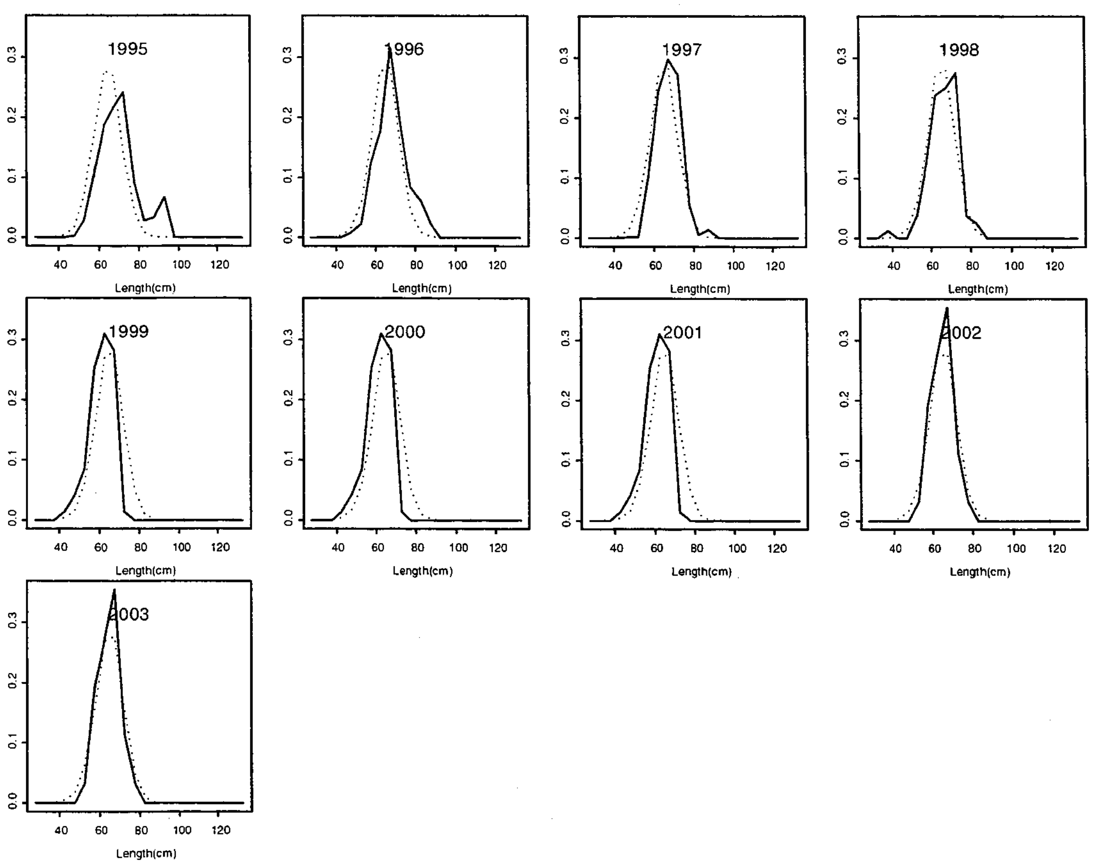


Figure 35. Model fit to the discard female size frequency data. Dotted line is the model fit. Year is the survey year.

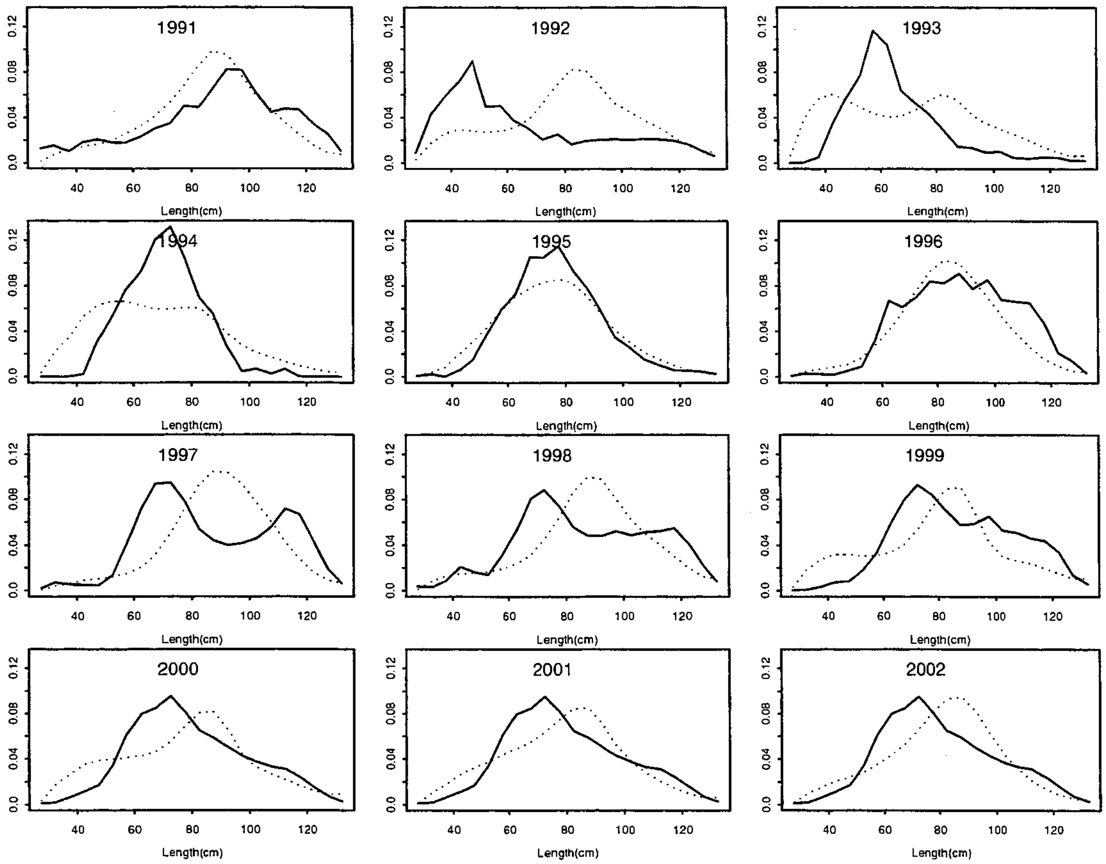


Figure 36. Model fit to the groundfish trawl discard male size frequency data. Dotted line is the model fit. Year is the survey year.

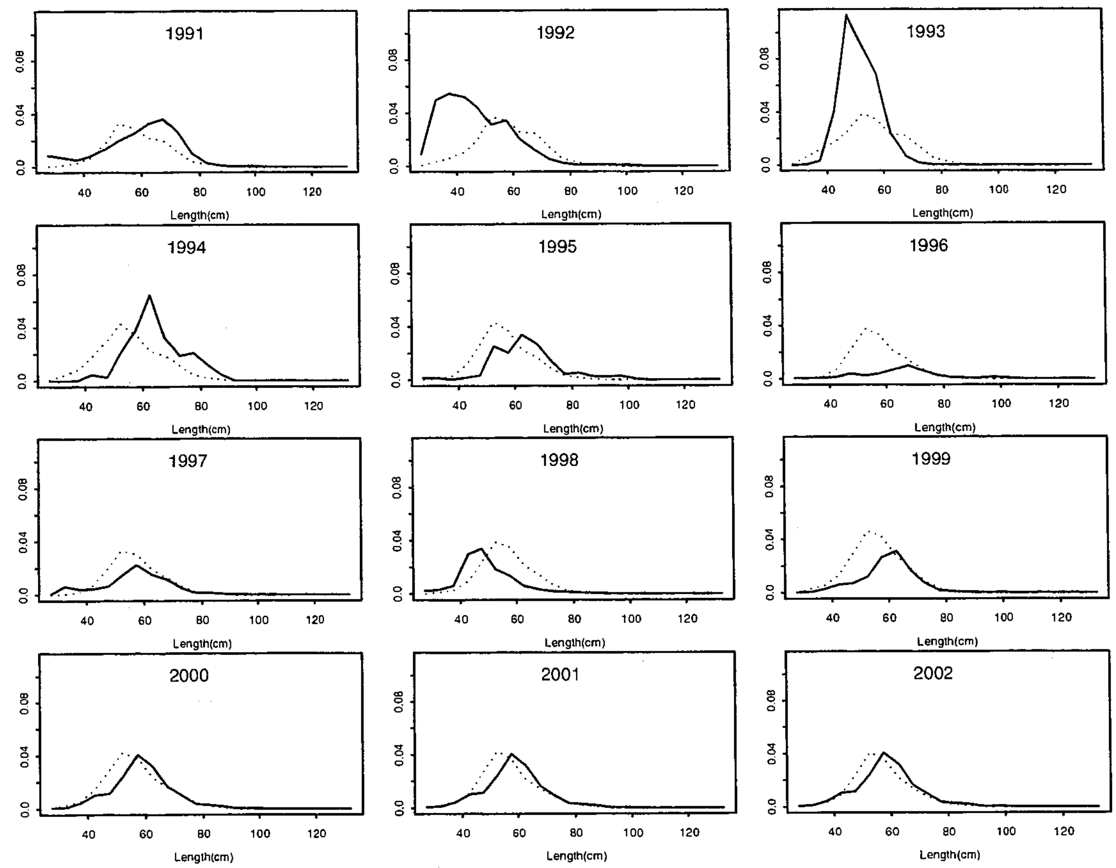


Figure 37. Model fit to the groundfish trawl discard female size frequency data. Dotted line is the model fit.

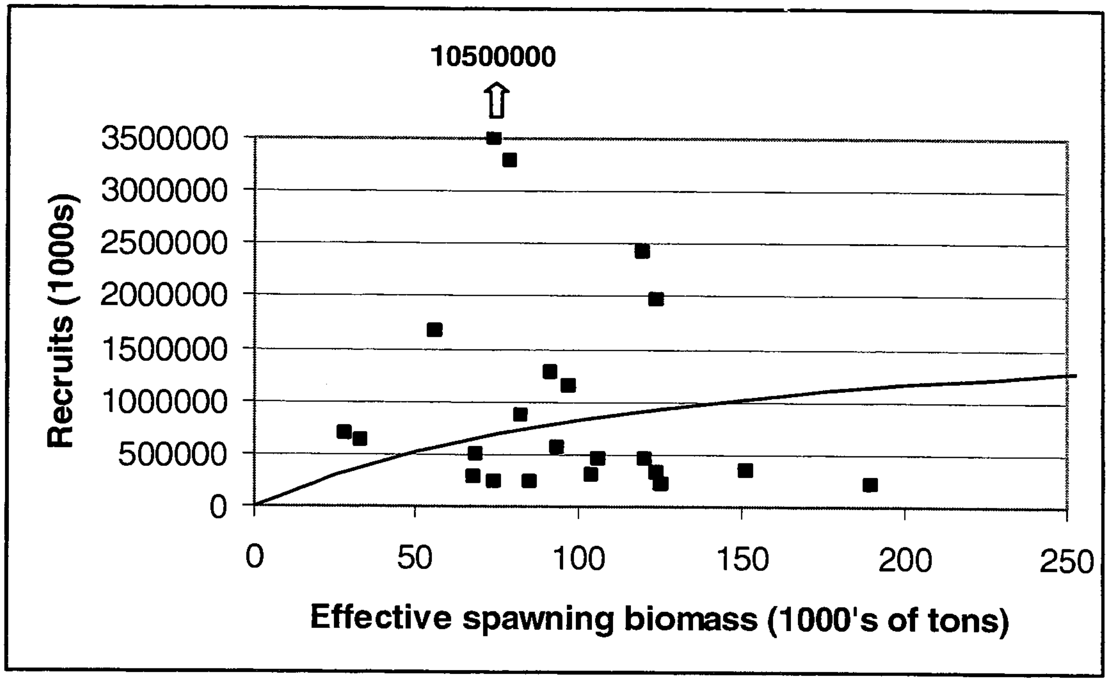


Figure 38. Spawner recruit curve using total effective spawning biomass at time of mating. Curve has a steepness parameter of 0.61 and R0 of 1.68 billion recruits.

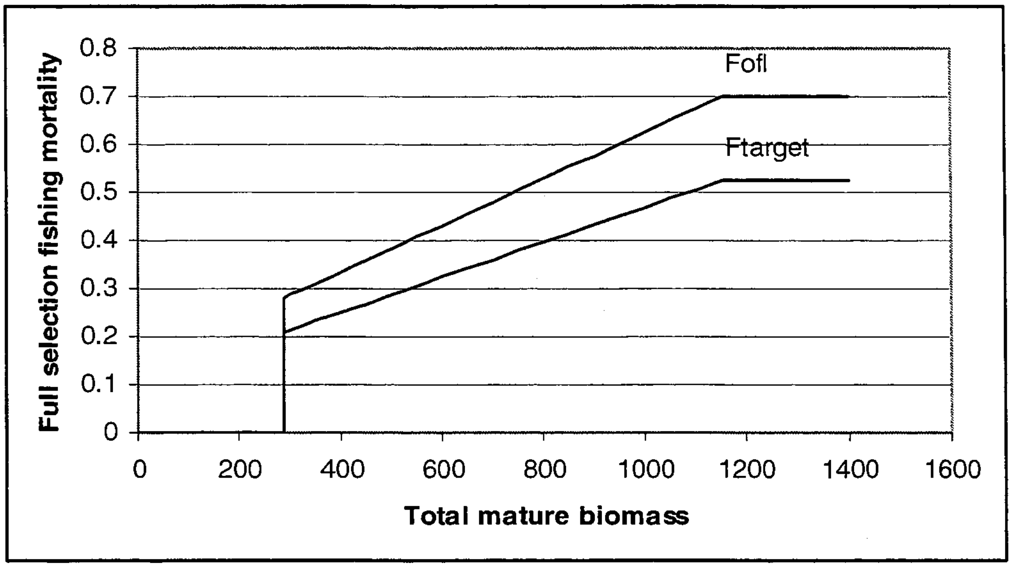


Figure 39. Harvest control rules. Line labeled Fofl is the overfishing harvest control rule using Fmsy = 0.7, Bmsy = 1155 million lbs and alpha = -0.25. Lower line labeled Ftarget is for target harvest control rule.

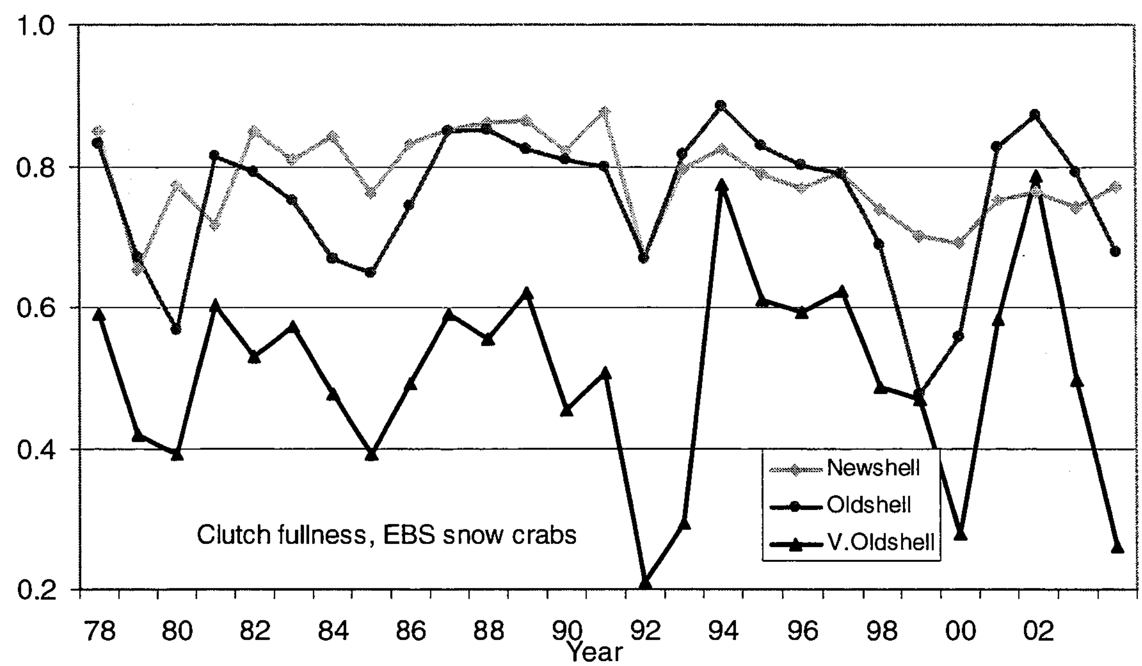


Figure 40. Clutch fullness for Bering sea snow crab survey data by shell condition for 1978 to 2004.

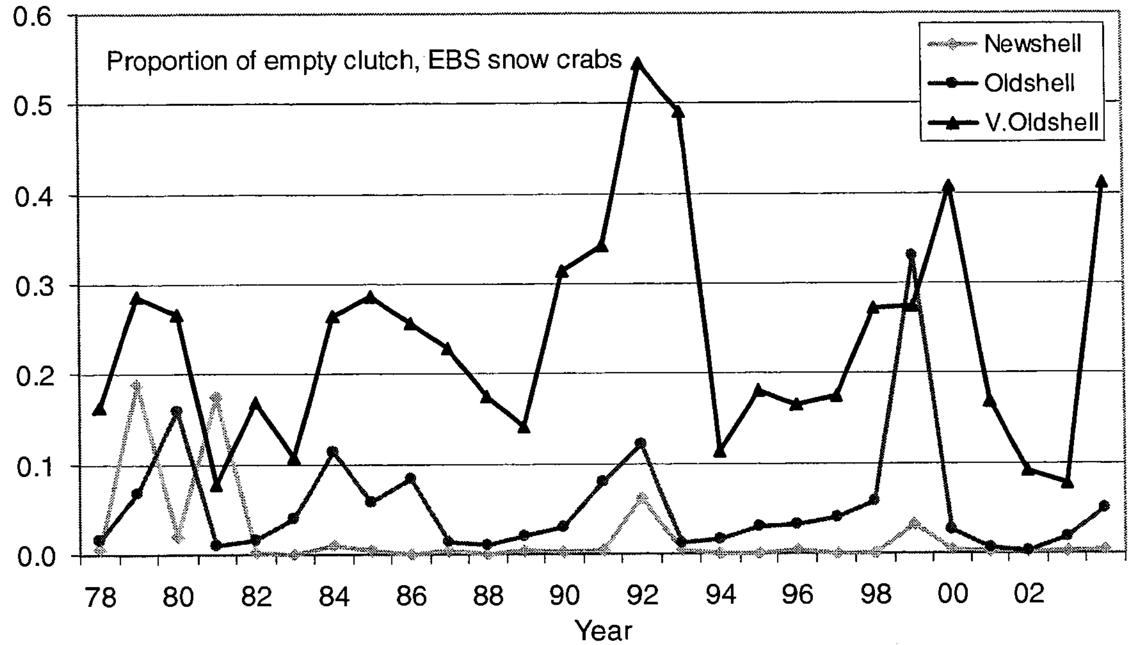


Figure 41. Proportion of barren females by shell condition from survey data 1978 to 2004.

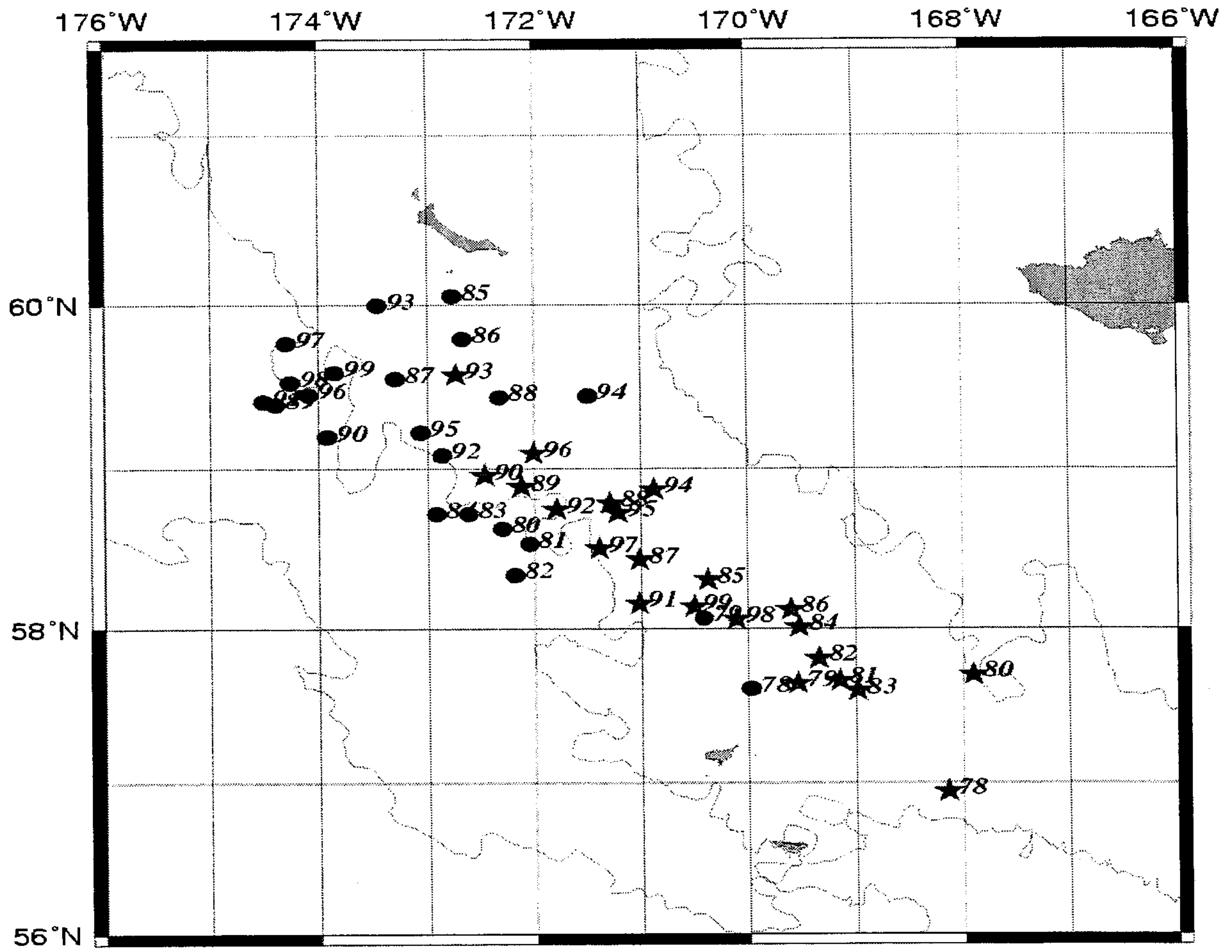


Figure 42. Centroids of abundance of mature female snow crabs (shell condition 2+) in blue circles and mature males (shell condition 3+) in red stars. Reprinted from Orensanz, Armstong and Ernst (in press).

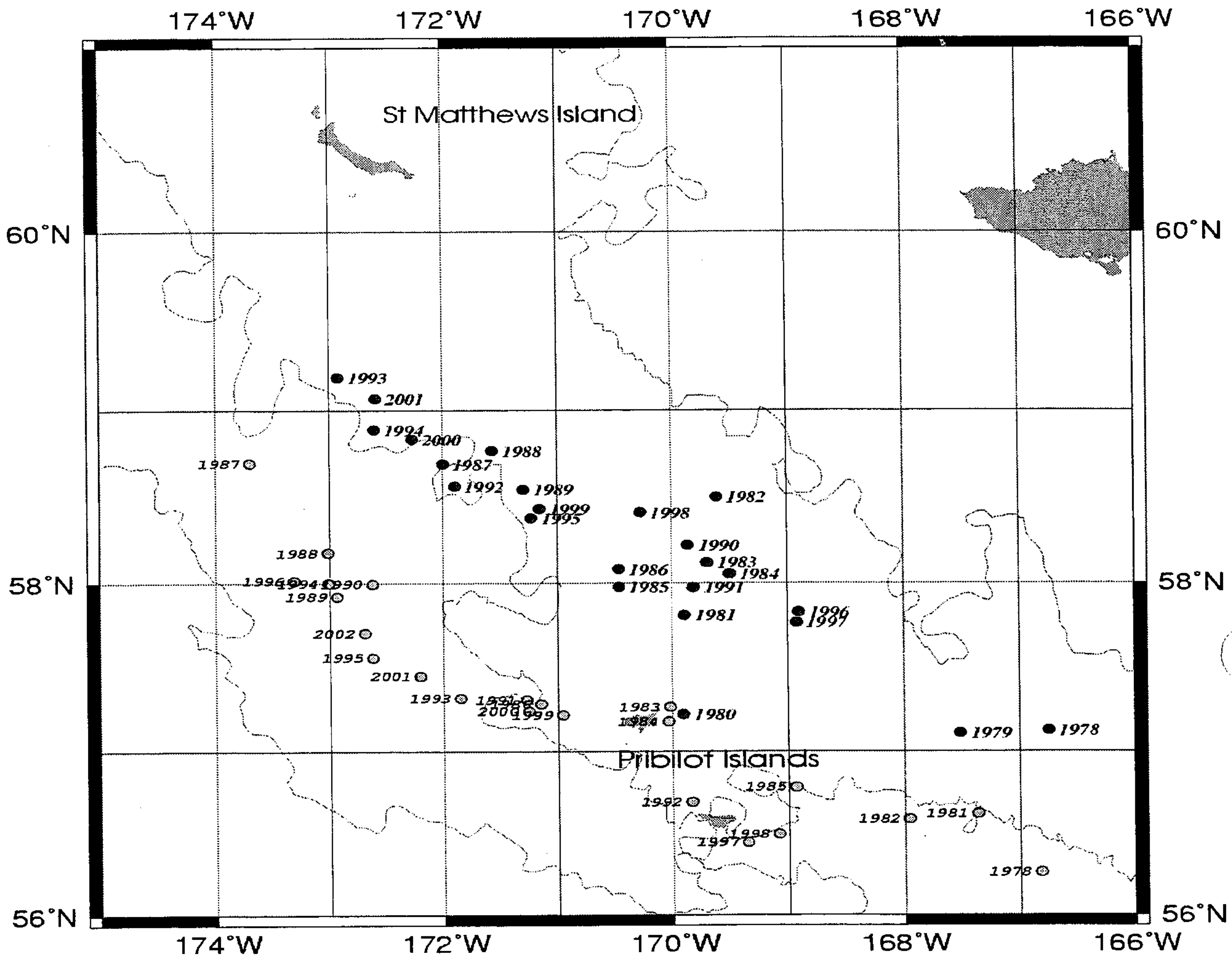


Figure 43. Centroids abundance (numbers) of snow crab males > 101 mm from the summer NMFS trawl survey (red) and from the winter fishery (blue-green), from Orensanz, Armstong and Ernst (in press).

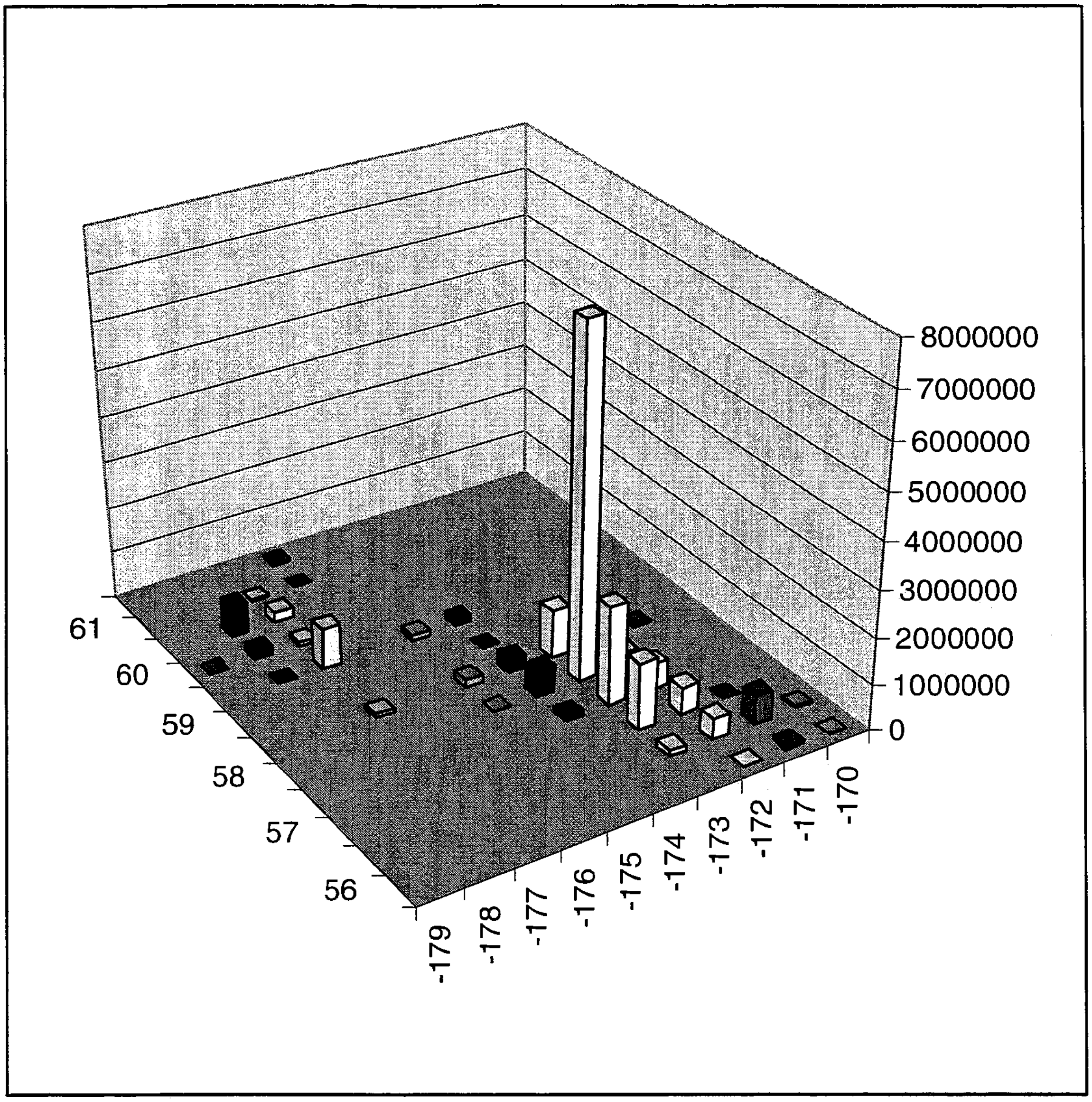


Figure 44. 2004 pot fishery retained catch in numbers by statistical area. Longitude in negative degrees. Areas are 1 degree longitude by 0.5 degree latitude.

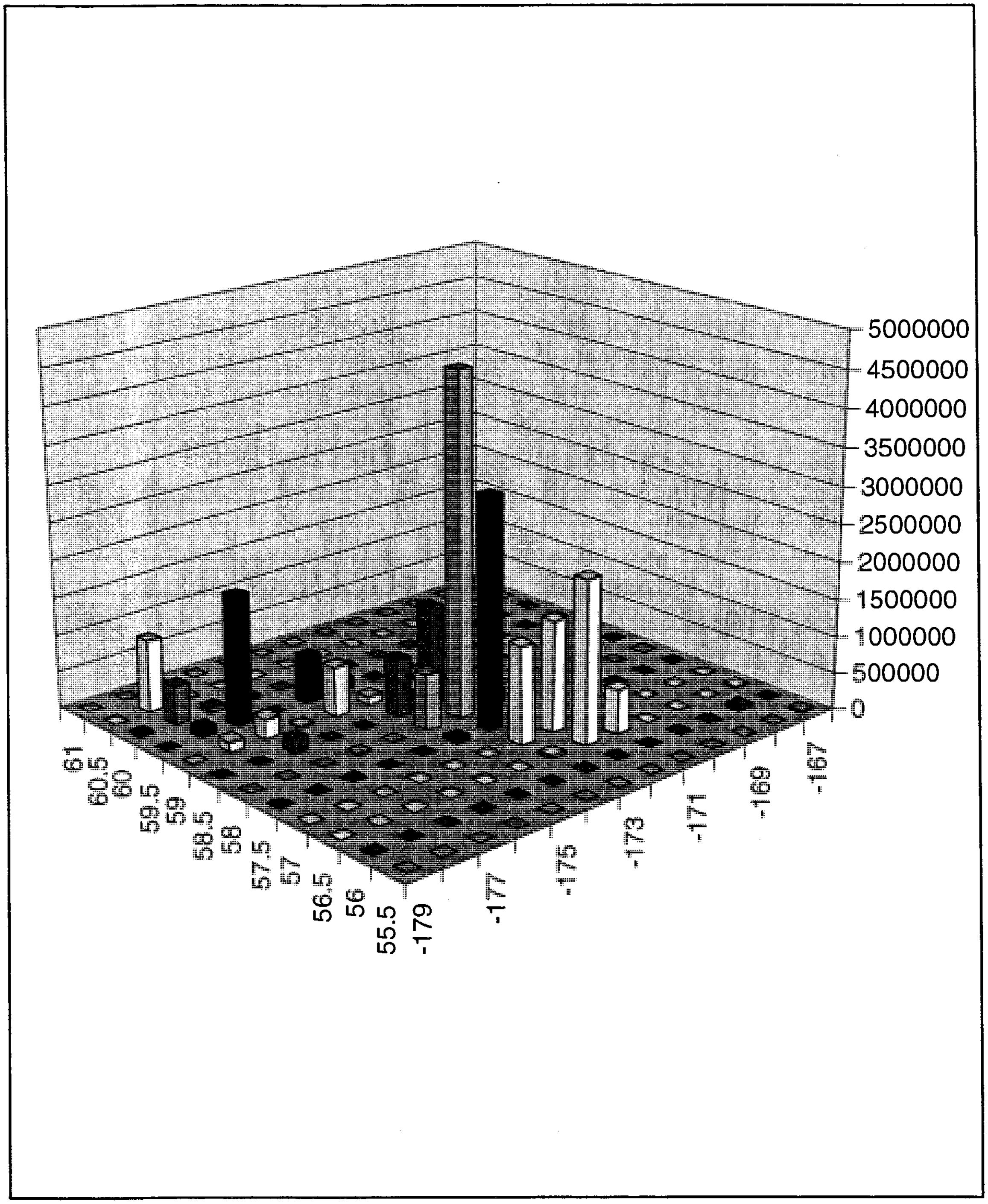


Figure 45. 2003 pot fishery retained catch in numbers by statistical area. Longitude in negative degrees. Areas are 1 degree longitude by 0.5 degree latitude.

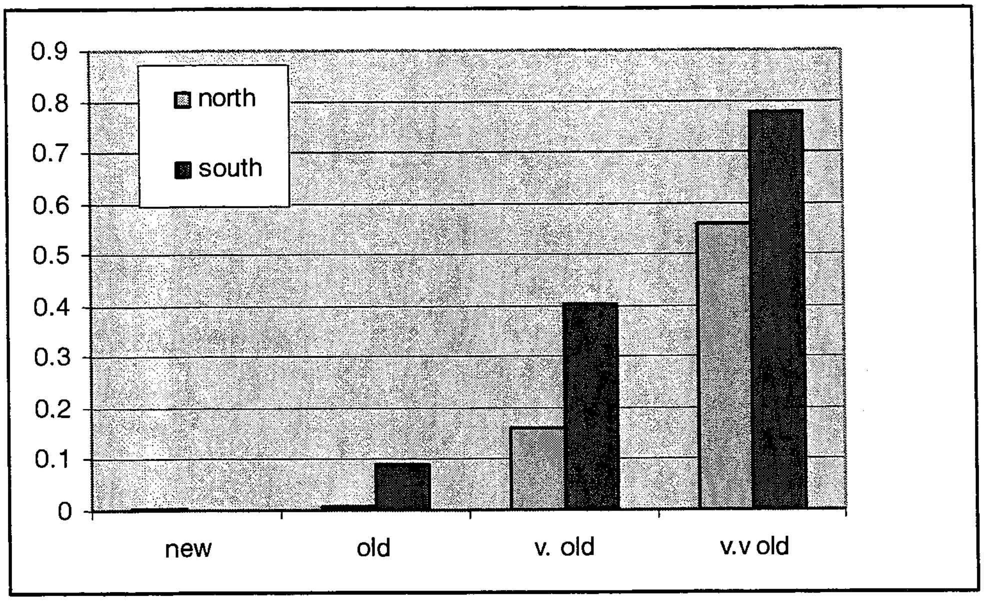


Figure 46. Fraction of barren females in the 2004 survey by shell condition and area north of 58.5 deg N and south of 58.5 deg N.

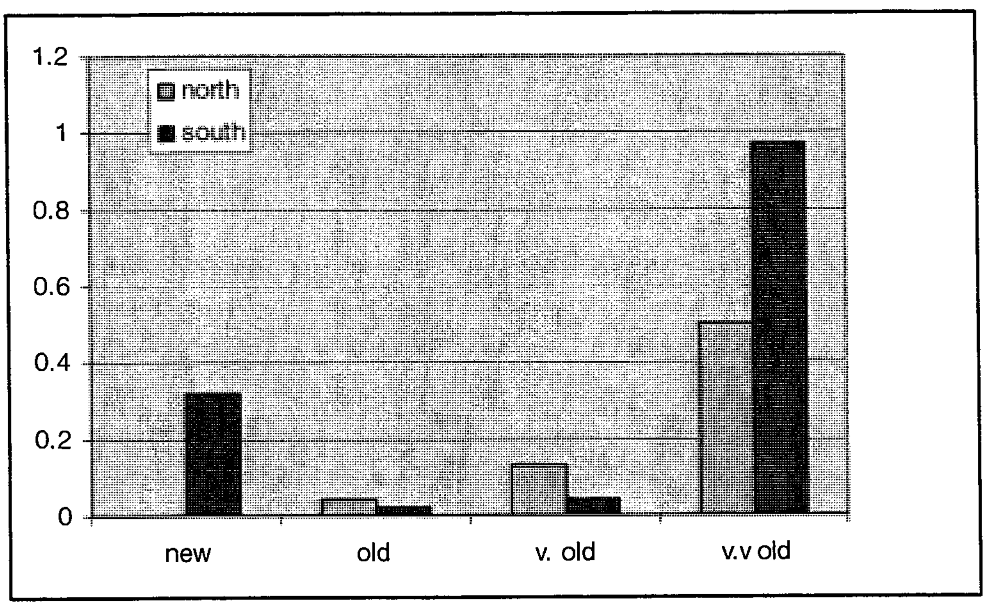


Figure 47. Fraction of barren females in the 2003 survey by shell condition and area north of 58.5 deg N and south of 58.5 deg N. The number of new shell mature females south of 58.5 deg N was very small in 2003.

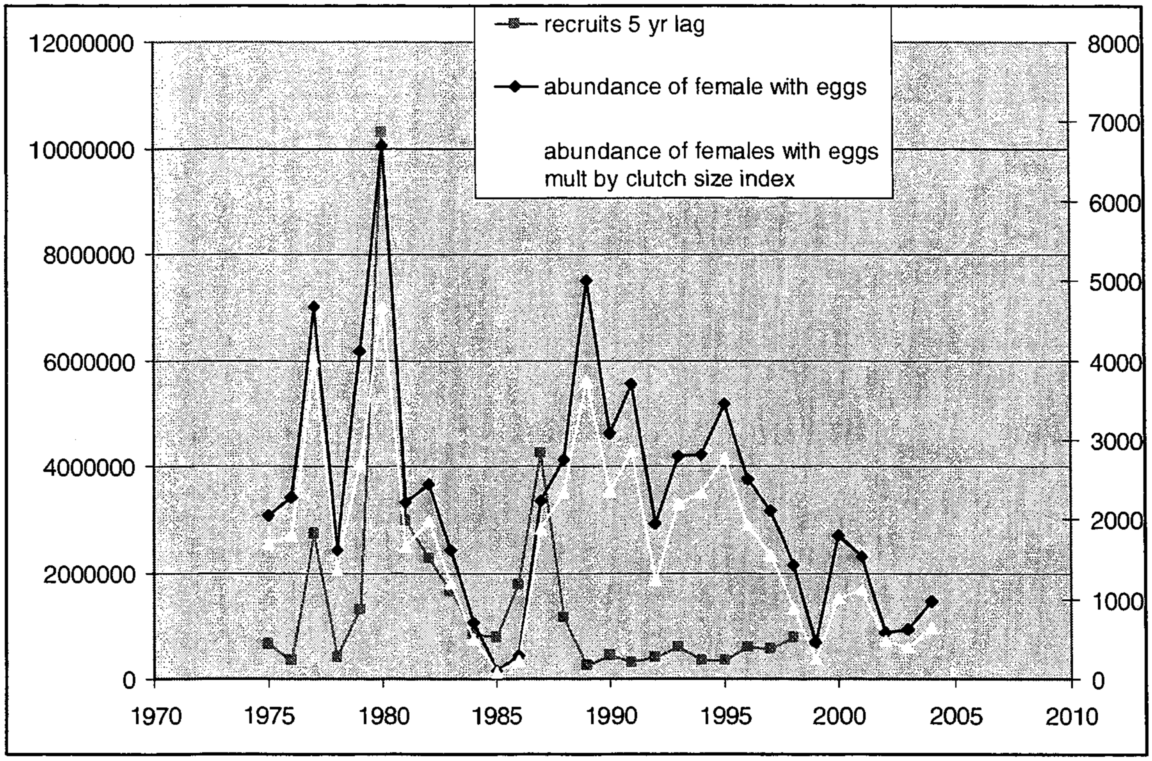


Figure 48. Model estimates of recruitment (fertilization year), survey abundance of females with eggs, and abundance of females with eggs multiplied by the fraction of full clutch from 1975 to 2004.

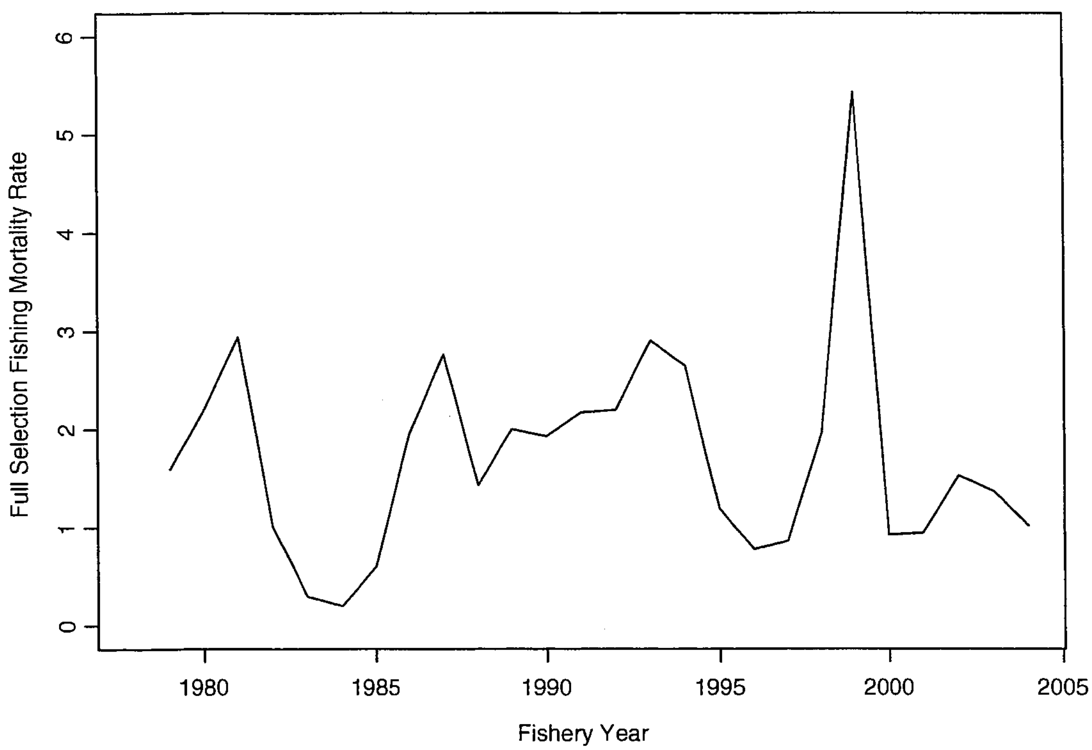


Figure 49. Full selection fishing mortality estimated in the model from 1978 to 2004.

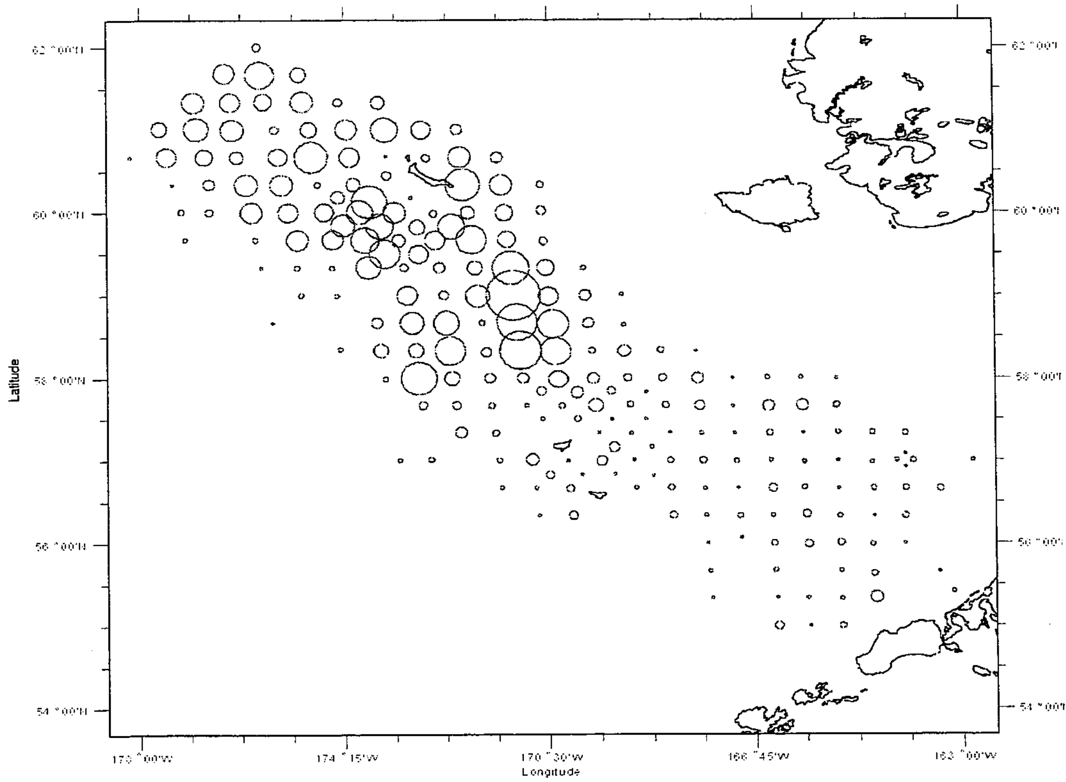


Figure 50. Survey abundance of males > 79 mm (approximately mature abundance) by tow. Abundance is proportional to the area of the circle (not on same scale as female abundance in Figure 51).

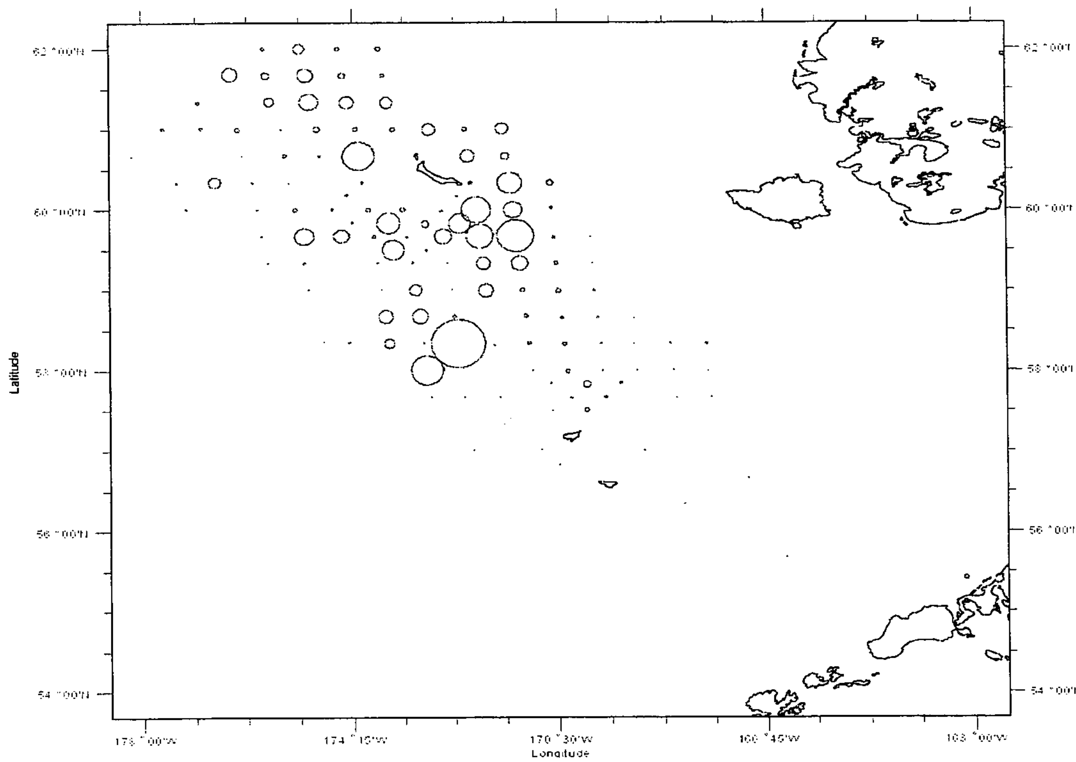


Figure 51. Survey abundance of females > 49 mm (approximately mature abundance) by tow. Abundance is proportional to the area of the circle (not on the same scale as male abundance in Figure 50).

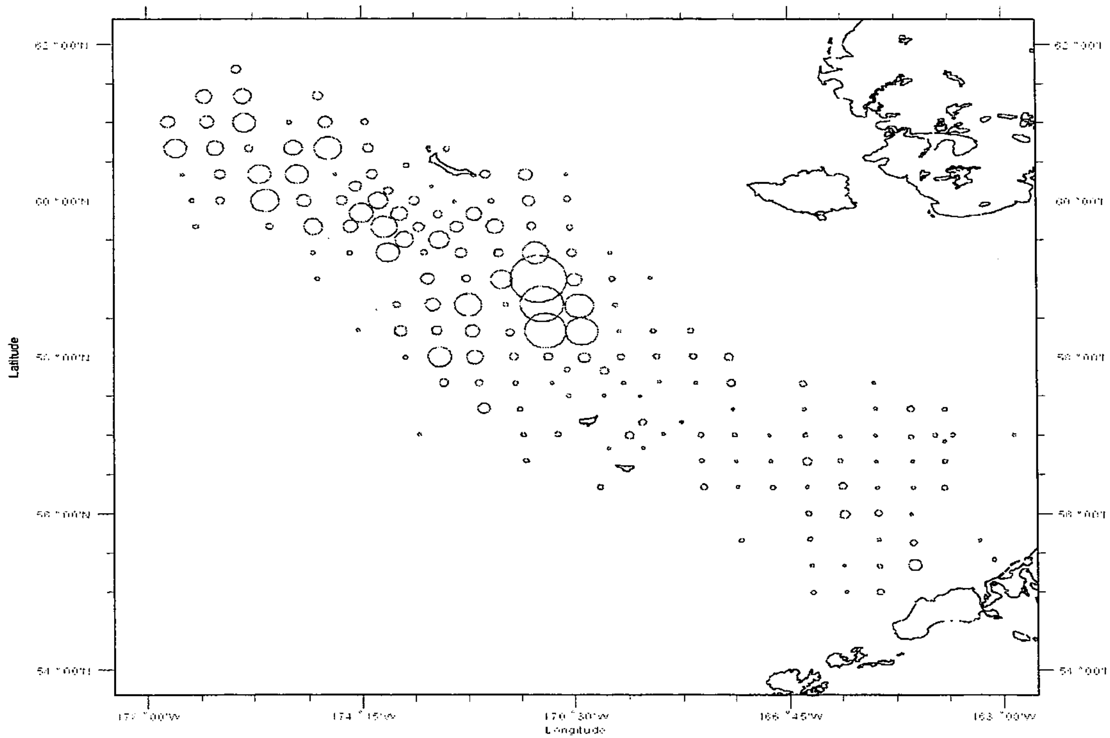


Figure 52. Survey abundance of males > 101 mm by tow. Abundance is proportional to the area of the circle.

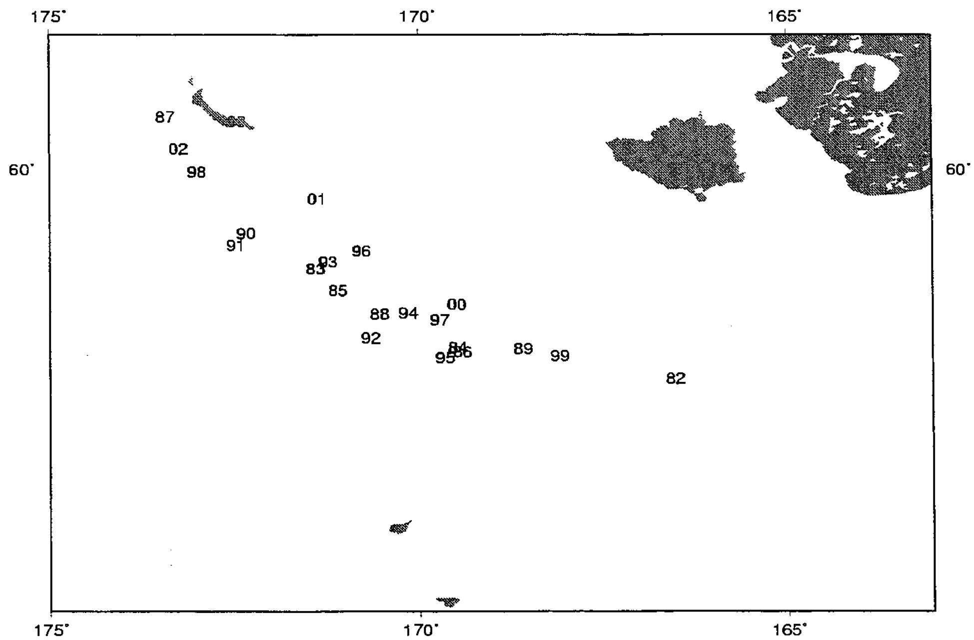


Figure 53. Centroids of cold pool (<2.0 deg C). Centroids are average latitude and longitude.

Appendix A.

Table A.1. Model equations describing the population dynamics.

$N_{s,t,1} = R_{s,t} = R_{0,s} e^{\tau_{s,t}}$	$\tau_{s,t} \sim N(0, \sigma$	Recruitment
TOTAL POT CATCH $C_{t,totalpotfishery,s,sh,l} = \sum_{mature,immature} \frac{F_{s,totalpotfishery,mat,sh,t,l}}{F_{s,mat,sh,t,l}} (1 - e^{-F_{s,mat,sh,t,l}}) e^{-M_{s,mat,sh} Cmid_t} N_{s,mat,sh,t,l}$ RETAINED POT CATCH $C_{t,retainedfishery,s,sh,l} = \sum_{mature,immature} \frac{F_{s,retainedfishery,mat,sh,t}}{F_{s,mat,sh,t,l}} (1 - e^{-F_{s,mat,sh,t,l}}) e^{-M_{s,mat,sh} Cmid_t} N_{s,mat,sh,t,l}$ TRAWL BYCATCH $C_{t,trawlfishery,s,sh,l} = \sum_{mature,immature} \frac{F_{s,ftrawlishery,mat,sh,t,l}}{F_{s,mat,sh,t,l}} (1 - e^{-F_{s,mat,sh,t,l}}) e^{-M_{s,mat,sh} Cmid_t} N_{s,mat,sh,t,l}$	$1 \le t \le$ $1 \le l \le$	Catch taken as a pulse fishery at midpoint of catch(survey is considered start of the year).
$Nimmature_{new,t+1,s,l+1} =$ $(Nimmature_{new,t,s,l} e^{-Zimmat_{new,t,s,l}}) Gr_{s,l} (1 - \phi_{s,l})$ $Nmature_{new,t+1,s,l+1} =$ $(Nimmature_{new,t,s,l} e^{-Zimmat_{new,t,s,l}}) Gr_{s,l} (\phi_{s,l})$ $Nmature_{old,t+1,s,l+1} =$ $(Nmature_{new,t,s,l} e^{-Zmat_{new,t,s,l}}) + (Nmature_{old,t,s,l} e^{-Zmat_{old,t,s,l}})$	$1 \le t <$ $1 \le l \le$	Numbers at size
$SB_{t,s} = \sum_{l=1}^{L} w_{s,l} (Nmature_{new,t,s,l} + Nmature_{old,t,s,l})$		spawning biomass by sex

Table A.1. continued.

$Z_{t,s,sh,l} = \sum_{fishery} F_{t,fishery,s,sh,l} + M$			Total Mortality
$C_{t,fishery} = \sum_{s}\sum_{sh}\sum_{l} C_{t,fishery,s,sh,l}$			Total Catch in numbers
$p_{t,sh,l} = C_{t,sh,l} / C_t$			proportion at size in the catch
$Y_t = \sum_{l=1}^{L} w_{t,l} C_{t,l}$			Catch biomass
$F_{t,fishery,s,sh,l} = s_{t,s,sh,l} F_{t,fishery}$			Fishing mortality
$F_{t,s,sh,l} = \sum_{fishery} F_{t,fishery,s,sh,l}$			Total F over all fisheries (total pot and trawl fisheries)
$S_{t,s,sh,l} = \frac{1}{1+e^{-a_{s,sh}(l-b_{t,s,sh})}}$			Fishery selectivity for total catch sex or shell condition s and size bin l. The 50% parameter changes over time.
$S_{male,t,sh,l} = \frac{1}{1+e^{-a_{male,sh}(l-b_{t,male,sh})}} \frac{1}{1+e^{-c_{sh}(l-d_{sh})}}$			Fishery selectivity for male retained catch by shell condition sh and size bin l is the selectivity for total catch multiplied by the retention curve

Table A.1. continued. $S_{surv,l} = q\frac{1}{1+e^{-a_{surv}(l-b_{surv})}}$ $S_{trawl,s,l} = \frac{1}{1+e^{-a_{s,trawl}(l-b_{s,trawl})}}$ $MP_l = 1 - \frac{1}{1+e^{-a(l-b)}}$			Survey selectivity by size – same for males and females Trawl bycatch selectivity by size and sex Declining logistic for Molting probability by size
$SB_{s,t} = \sum_{s} \sum_{l=1}^{L} w_{s,l} s_{surv,l} N_{s,t,l}$ $Gr_{s,l \to l'} = \int_{l'-2.5}^{l'+2.5} Gamma(\alpha_{s,l}, \beta_s)$ $width_{t+1} = a_s + b_s width_t$			Total Survey biomass Growth transition matrix using a Gamma distribution Mean post-molt width given pre-molt width

Table A.2. Negative log likelihood components.

$\lambda \sum_{t=1}^{T} \left[\log(C_{t,fishery.obs}) - \log(C_{t,fishery.pred})\right]^2$	Catch using a lognormal distribution.
$-\sum_{t=1}^{T} \sum_{l=1}^{L} nsamp_t * p_{obs.t.l} \log(p_{pred.t.l})$ - offset	size compositions using a multinomial distribution. Nsamp is the observed sample size. Offset is a constant term based on the multinomial distribution.
offset = $\sum_{t=1}^{T} \sum_{a=1}^{A} nsamp_t * p_{obs.t.a} \log(p_{obs.t.a})$	the offset constant is calculated from the observed proportions and the sample sizes.
$\sum_{t=1}^{ts} \left[\dfrac{\log\left[\dfrac{SB_{obs.t}}{SB_{pred.t}}\right]}{sqrt(2) * s.d.(\log(SB_{obs.t}))} \right]^2$	Survey biomass using a lognormal distribution, ts is the number of years of surveys.
$s.d.(\log(SB_{obs.t})) = sqrt(\log((cv(SB_{obs.t}))^2 + 1))$	
$\lambda \sum_{s=1}^{2} \sum_{t=1}^{T} (e^{\tau_{s.t}})^2$	Recruitment, where $\tau_{s.t} \sim N(0, \sigma_R^2)$
$\lambda \sum_{t} \left[\log(\dfrac{R_{male.t}}{R_{female.t}}) \right]^2$	Sex ratio penalty
$\lambda \sum_{t=1}^{t=T-1} \left[\log(s_{50\%.sh.t+1}) - \log(s_{50\%.sh.t})\right]^2$	Constraint on size at 50% for fishery selectivity

Table A.3. List of variables and their definitions used in the model.

Variable	Definition
T	number of years in the model(t=1 is 1978 and t=T is 2003
L	number of size classes (L =22)
W_l	mean body weight(kg) of crabs in size group l.
ϕ_l	proportion mature at size l.
R_t	Recruitment in year t
R_0	Geometric mean value of recruitment
τ_t	Recruitment deviation in year t
$N_{l,a}$	number of fish in size group l in year t
$C_{t,l}$	catch number of size group l in year t
$p_{t,l}$	proportion of the total catch in year t that is in size group l
C_t	Total catch in year t
Y_t	total yield in year t
$F_{t,s,sh,l}$	Instantaneous fishing mortality rate for size group l, sex s, shell condition sh, in year t
M	Instantananeous natural mortality rate
E_t	average fishing mortality in year t
ε_t	Deviations in fishing mortality rate in year t
$Z_{t,l}$	Instantantaneous total mortality for size group l in year t
GR	Growth transition matrix
$S_{s,l}$	selectivity for size group l, sex or shell condition s.

Table A.4. Estimated parameters for the model. There were 213 total parameters estimated in the model.

Parameter	Description
$\log(R_0)$	log of the geometric mean value of recruitment, one parameter
τ_t $1978 \le t \le 2002$, 25 parameters for each sex.	Recruitment deviation in year t
Initial numbers by length for each sex and shell condition, 88 parameters.	Initial numbers by length
$\log(f_0)$	log of the geometric mean value of fishing mortality
ε_t $1978 \le t \le 2002$, 25 parameters, one set for retained catch, one set for female discard, and one set for trawl bycatch equals 75 total.	deviations in fishing mortality rate in year t
Slope and 50% selected parameters of the logistic curve	selectivity parameters for the total catch (retained plus discard) of new and old shell males.
Slope and 50% selected parameters of the logistic curve(2 parameters new shell, 2 parameters old shell)	Retention curve parameters for the retained males.
Slope and 50% selected parameters of the logistic curve (6 parameters)	Selectivity parameters for survey male and female crabs for three survey periods (1978-81, 82-88,89 to present).
Slope and 50% selected parameters of the logistic curve(2 parameters male, 2 parameters female)	Selectivity parameters for trawl bycatch male and female
Slope and 50% selected parameters of the logistic curve(2 parameters)	Selectivity parameters for crab fishery female bycatch
Size at 50% selected for fishery new and old shell 1978 to 2002, 2*25 paramaters plus 2 means	Changing fishery selectivity over time

Table A.5. Fixed parameters in the Admodel builder model.

Parameter	Description
M	Natural mortality
Q = 1.0 for 1982 to present surveys	Survey catchability
Parameters for the linear growth function, intercept a and slope b (2 parameters male, 2 parameters female). Standard deviation of size at the first size bin and standard deviation of size for the last size bin.	Growth parameters estimated from Bering sea snow crab data (14 observations).
Slope and 50% parameters of the declining logistic curve	molting probabilities for immature male crabs

Draft

BRISTOL BAY RED KING CRAB STOCK ASSESSMENT IN 2004

Jie Zheng
Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 25526
Juneau, AK 99802-5526, USA
Phone: (907) 465-6102
Fax: (907) 465-2604
Email: Jie_zheng@Fishgame.state.ak.us

EXECUTIVE SUMMARY

A length-based analysis was applied to eastern Bering Sea trawl survey, catch sampling, and commercial catch data to estimate stock abundance of Bristol Bay red king crabs (*Paralithodes camtschaticus*) during 1972-2004. Four scenarios with different levels of natural mortality and weighting factors were compared. The base scenario with 3 levels of male natural mortality and 4 levels of female natural mortality over time fit the data very well, and its results were used to construct stock–recruitment relationships and determine the preseason guideline harvest level (GHL). Due to a sharp decline of survey abundance during the early 1980s, the constant natural mortality scenario fit the data poorly.

Due to above average year classes 1990, 1994 and 1997, abundances of mature males, legal males, and mature females all increased from last year and are at the highest levels since 1982. Abundance of mature males increased from 15.1 million in 2003 to 16.0 million in 2004, and legal male abundance increased from 10.1 to 10.4 million. Mature female abundance increased from 28.1 million to 35.3 million crabs, and effective spawning biomass increased from 57.6 to 61.9 million pounds. The effective spawning biomass is above the target rebuilding level of 55 million pounds; thus, a 15% harvest rate is applied. By multiplying the 15% harvest rate times mature male abundance times an average weight of 6.44 pounds per legal crab, an overall GHL of 15.424 million pounds is set. A total of 7.5% of the GHL or 1.157 million pounds is reserved for the community

development quota (CDQ) fishery resulting in a GHL of 14.267 million pounds for the open access fishery. The open access fishery will open October 15, 2001.

INTRODUCTION

Stock Structure

Red king crabs (RKC), *Paralithodes camtschaticus*, are found in several areas of the Aleutian Islands and eastern Bering Sea: off the Aleutian Islands, the Pribilof Islands and St. Lawrence Island and in Bristol Bay and Norton Sound. The State of Alaska divides the Aleutian Islands and eastern Bering Sea into three management registration areas to manage RKC fisheries: Aleutian Island, Bristol Bay, and Bering Sea (ADF&G 2002). The Aleutian Islands area covers two stocks, Adak and Dutch Harbor, and the Bering Sea area contains two other stocks, the Pribilof Islands and Norton Sound. The largest stock is found in the Bristol Bay area, which includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168° W long., and south of the latitude of Cape Newneham (58°39' N lat.) (ADF&G 2002). Besides these five stocks, RKC stocks elsewhere in the Aleutian Islands and eastern Bering Sea are too small to support a fishery. This report summarizes the stock assessment results for the Bristol Bay RKC stock.

Fishery

The RKC stock in Bristol Bay, Alaska, supports one of the most valuable fisheries in the United States (ADF&G 2003). The Japanese fleet started the fishery in the early 1930s, stopped fishing from 1940 to 1952, and resumed the fishery from 1953 until 1974 (ADF&G 2003). The Russian fleet fished for RKC from 1959 through 1971. The Japanese fleet employed primarily tanglenets with a very small proportion of catch caught by trawl and pots. The Russian fleet used only tanglenets. U.S. trawlers started to fish for Bristol Bay RKC in 1947 and effort and catches declined in the 1950s (ADF&G 2003). The domestic RKC fishery began to expand in the late 1960s and peaked in 1980 with a catch of 59,000 t, worth an estimated $115.3 million ex-vessel value (ADF&G 2003). The catch declined dramatically in the early 1980s and has stayed at low levels during the last two decades (Table 1). The Bristol Bay RKC fishery currently takes place during a short period in the fall (usually lasting less than a week), and the catch quota is based on the stock assessment conducted in the previous summer (Zheng and Kruse 2002a). Historical guideline harvest levels and actual catch are compared in Table 2. The implementation errors are quite high for some years, and total actual catch from 1980 to 2003 is about 8% less than the GHLs (Table 2).

Fisheries Management

King and Tanner crab stocks in the Bering Sea and Aleutian Islands are managed by the State of Alaska through a federal king and Tanner crab fishery management plan (FMP). Under the FMP, management measurements are divided into three categories: (1) fixed in the FMP, (2) frameworked in the FMP, and (3) discretion of the State of Alaska. The State of Alaska is responsible for developing harvest strategies to determine GHLs under the framework in the FMP.

Harvest strategies for the Bristol Bay RKC fishery have changed over time. Two major management objectives for the fishery are to maintain a healthy stock that ensures reproductive viability and to provide for sustained levels of harvest over the long term (ADF&G 2002). In attempting to meet these objectives, the GHLs are coupled with size-sex-season restrictions. Only males ≥ 6.5-in carapace width (equivalent to 135-mm carapace length, CL) may be harvested and no fishing is allowed during molting and mating periods (ADF&G 2002). Specification of GHLs is based on a harvest rate strategy. Before 1990, harvest rates on legal males were based on population size, abundance of prerecruits to the fishery, and postrecruit abundance, and varied from less than 20% to 60% (Schmidt and Pengilly 1990). In 1990, the harvest strategy was modified, and a 20% mature male harvest rate was applied to the abundance of mature-sized (≥ 120-mm CL) males with a maximum 60% harvest rate cap of legal (≥ 135-mm CL) males (Pengilly and Schmidt 1995). In addition, a threshold of 8.4 million mature-sized females (≥ 90-mm CL) was added to existing management measures to avoid recruitment overfishing (Pengilly and Schmidt 1995). Based on a new assessment model and research findings (Zheng et al. 1995a, 1995b, 1997a, 1997b), the Alaska Board of Fisheries adopted a new harvest strategy in 1996. That strategy had two mature male harvest rates: 10% when effective spawning biomass (ESB) is between 14.5 and 55 million pounds and 15% when ESB is at or above 55 million pounds (Zheng el al. 1996). The maximum harvest rate cap of legal males was changed from 60% to 50%. An additional threshold of 14.5 million pounds of ESB was also added. In 1997, a minimum threshold of 4 million pounds was established as the minimum GHL for opening the fishery and maintaining fishery manageability when the stock abundance is low. In 2003, the Board adopted the current harvest strategy by adding a mature harvest rate of 12.5% when the stock is between 34.75 and 55 million pounds of ESB. The current harvest strategy is illustrated in Figure 1.

The purpose of this report is to document the stock assessments for Bristol Bay RKC. This report includes (1) all data used to conduct the stock assessments, (2) details of the analytic approach, (3) an evaluation of the assessment results, and (4) an evaluation of the implications of the assessments to fishery management.

DATA

Catch Data

Landings of Bristol Bay RKC by length and year and catch per unit effort data were obtained from annual reports of the International North Pacific Fisheries Commission from 1960 to 1973 (Hoopes et al. 1972; Jackson 1974; Phinney 1975) and from the Alaska Department of Fish and Game from 1974 to 2003 (ADF&G 2003). Bycatch data are available starting from 1990 and were obtained from the ADF&G observer database and reports (ADF&G 2003). Sample sizes for catch by length and shell condition are summarized in Table 3. Relatively large samples were taken from the retained catch each year. Sample sizes for trawl bycatch were the annual sums of length frequency samples in the National Marine Fisheries Service (NMFS) database.

Catch Biomass

Retained catch and estimated bycatch biomasses are summarized in Table 1. Retained catch and estimated bycatch from the directed fishery include both the general open access fishery and the CDQ fishery. Starting in 1973, the fishery generally occurred during the late summer and fall. Before 1973, a small portion of retained catch in some years was caught from April to June. Because most crab bycatch from the groundfish trawl fisheries occurred during the spring, the years in Table 1 are one year less than those from the NMFS trawl bycatch database to approximate the annual bycatch for seasons defined as June 1 to May 31, e.g., year 2002 in Table 1 corresponds to what is reported for year 2003 in the NMFS database. Catch biomass is shown in Figure 2.

Catch Size Composition

Retained catch by length and shell condition and bycatch by length, shell condition, and sex are summarized in Tables 4-6. From 1960 to 1966, only retained catch length compositions from the Japanese fishery were available. Retained catches from the Russian and U.S. fisheries were assumed to have the same length compositions as the Japanese fishery during this period. From 1967 to 1969, the length compositions from the Russian fishery were assumed to be the same as those from the Japanese and U.S. fisheries. After 1969, foreign catch declined sharply and only length compositions from the U.S. fishery were used to distribute catch by length. Retained catch data are illustrated in Figure 3.

Catch per Unit Effort

Catch per unit effort (CPUE) is defined as number of retained crabs per tan (a unit fishing effort for tanglenets) for the Japanese and Russian fisheries and number of retained crabs per potlift for the U.S. fishery (Table 7). Although soak time is an important factor influencing CPUE, it is difficult to standardize it. Furthermore, complete historical soak time data from the U.S. fishery are not available. Based on the approach of Balsiger (1974), all fishing efforts from Japan, Russia, and U.S. were standardized as the Japanese tanglenet from 1960 to 1971, and the CPUE was standardized as crabs per tan. The U.S. CPUE data do not match very well with survey legal abundance after 1967 (Figure 4).

Survey Data

NMFS has performed annual trawl surveys of the eastern Bering Sea since 1968. Two vessels, each equipped with an eastern otter trawl with an 83 ft headrope and a 112 ft footrope, conduct this multispecies, crab-groundfish survey during the summer. Stations are sampled in the center of a systematic 20 X 20 nm grid overlaid in an area of ≈140,000 nm^2. Since 1972 the trawl survey has covered the full stock distribution. The survey on Bristol Bay area occurs primarily during late May and June. Tow-by-tow trawl survey data for Bristol Bay RKC during 1975-2003 were provided by NMFS.

Abundance estimates by sex, carapace length, and shell condition were derived from survey data using an area-swept approach without post-stratification (Table 8; Figure 5). If multiple tows were made for a single station in a given year, the average of the abundances from all tows was used as the estimate of abundance for that station. NMFS used a post-stratification approach until the late 1980s and has assumed Bristol Bay as a single stratum since then. If more than one tow is conducted in a station because of high RKC abundance (i.e., the station is a "hot spot"), NMFS regards the station as a separate stratum. Due to poor documentation, it is difficult to duplicate NMFS post-stratifications. A "hot spot" was not surveyed with multiple tows during the early years. Two such "hot spots" affected the survey abundance estimates greatly: station H13 in 1984 (mostly juvenile crabs 75-90 mm CL) and station F06 in 1991 (mostly newshell legal males). The tow at station F06 was discarded in the NMFS abundance estimates (Stevens et al. 1991). In this study, the average abundances from all tows in the 9 stations (the station itself and the 8 adjacent stations) were used as the estimates of abundance for station H13 in 1984 and station F06 in 1991.

The approach here results in estimates close to those made by NMFS with some exceptions (Figure 6). Two surveys were conducted for Bristol Bay red king crabs in 1999 and 2000: the standard survey that was performed in late May (about two weeks earlier than historic surveys) and a resurvey of 31 stations (1999) and 23 stations (2000) with high female density that was performed in late July. The resurveys were necessary because most females had not yet molted or mated prior to the standard surveys. Differences in area-swept estimates of abundance between the standard surveys and resurveys of these same stations can be attributed to survey measurement errors or, possibly, to seasonal changes in distribution between survey and resurvey. The size distribution of females was significantly larger in the resurveys than during the standard surveys because most mature females had not molted prior to the standard surveys. NMFS included all survey tows in its estimates. I used data from both surveys to assess male abundance but only the resurvey data, plus the standard survey data outside the resurveyed stations, to assess female abundance during these two years.

For 1968-1970 and 1972-1974, abundance estimates were obtained from NMFS directly because the original survey data by tow are not currently available. There were spring and fall surveys in 1968 and 1969. The average of estimated abundances from spring and fall surveys was used for those two years. Different catchabilities were assumed for survey data before 1973 because of an apparent change in survey catchability. A footrope chain was added to the trawl gear starting in 1973, and the crab abundances in all length classes in 1973 and beyond were much greater than those estimated prior to 1973 (Reeves et al. 1977).

ANALYTIC APPROACH

To reduce annual measurement errors associated with abundance estimates derived from the area-swept method, the Alaska Department of Fish and Game developed a length-based analysis (LBA) in 1993 that incorporates multiple years of data and multiple data sources in the estimation procedure. Annual abundance estimates of the Bristol Bay RKC stock from the LBA have been used to manage the directed crab fishery and to set crab bycatch limits in the groundfish fisheries since 1995 (Figure 1). Alternative LBAs (not included in this report) were developed in 2004 to include small size groups and extend to the data before 1972. A stock-recruitment (S-R) relationship, estimated from the results of the LBA, was used to develop the current harvest strategy.

Population Model

A male population model is the original LBA model that was described in detail by Zheng et al. (1995a, 1995b) and Zheng and Kruse (2002a). Pulse fishing was assumed for the model. The model was fitted to the abundance data after 1971 because shell condition data were limited to that period. Crab abundances by carapace length and shell condition in any one year are modeled to result from abundances in the previous year minus catch and handling and natural mortalities, plus recruitment and additions to or losses from each length class due to growth:

$$
\begin{aligned}
N_{l+1,t+1} &= \sum_{l'=1}^{l'=l+1} \{P_{l',l+1}[(N_{l',t}+O_{l',t})\,e^{-M_t} - C_{l',t}\,e^{(y_t-1)M_t}]\,m_{l',t}\} + R_{l+1,t+1}, \\
O_{l+1,t+1} &= [(N_{l+1,t}+O_{l+1,t})\,e^{-M_t} - C_{l+1,t}\,e^{(y_t-1)M_t}](1-m_{l+1,t}),
\end{aligned}
\qquad (1)
$$

where

$N_{l,t}$	is newshell crab abundance in length class l and year t,
$O_{l,t}$	is oldshell crab abundances in length class l and year t,
M_t	is the instantaneous mortality in year t, which includes natural mortality and indirect fishing mortality;
$m_{l,t}$	is the molting probability for length class l in year t,
$R_{l,t}$	is recruitment into length class l in year t,
y_t	is the lag in years between assessment survey and the fishery in year t,
$P_{l',l}$	is the proportion of molting crabs growing from length class l' to l after one molt, and
$C_{l,t}$	is the catch of length class l in year t.

The minimum carapace length is set at 95 mm for males and crab abundance is modeled with a length-class interval of 5 mm. The last length class includes all crabs ≥160-mm CL. There are 14 length classes/groups (1-14). $P_{l',l}$, $m_{l,t}$, and $R_{l,t}$ are computed as follows.

Mean growth increment per molt is assumed to be a linear function of pre-molt length:

$$G_l = a + b\,\iota, \qquad (2)$$

where a and b are constants. Growth increment per molt is assumed to follow a gamma distribution:

$$g(x\,|\,\alpha_l,\beta) = x^{\alpha_l-1}\; e^{-x/\beta}/[\beta^{\alpha_l}\;\Gamma(\alpha_l)]. \qquad (3)$$

The expected proportion of molting individuals growing from length class l_1 to length class l_2 after one molt is equal to the sum of probabilities within length range $[\iota_1,\ \iota_2)$ of the receiving length class l_2 at the beginning of the next year:

$$P_{l_1,l_2} = \int_{l_1-\iota}^{l_2-\iota} g(x \mid \alpha_\iota, \beta) dx, \tag{4}$$

where ι is the mid-length of length class l_1. For the last length class L, $P_{L,L} = 1$.

The molting probability for a given length class l and time t is modeled by an inverse logistic function:

$$m_{l,t} = 1 - \frac{1}{1+\alpha_t e^{-\beta_t \iota}}, \tag{5}$$

where

α_t, β_t are parameters, and

ι is the mid-length of length class l.

Three logistic functions were used to describe the molting probability during different periods (Zheng et al. 1995a): high molting probabilities with α_1 and β_1 during 1972-1979, low molting probabilities with α_2 and β_2 during 1980-1984, 1992-1994, 1997, 1999, and 2001, and intermediate molting probabilities with α_3 and β_3 during 1985-1991, 1995-1996, 1998, 2000, and 2002-2004. Grouping of years for molting probabilities is based on the fit of newshell and oldshell crab abundances.

Recruitment is defined as recruitment to the model and survey gear rather than recruitment to the fishery. Recruitment is separated into a time-dependent variable, R_t, and size-dependent variables, U_l, representing the proportion of recruits belonging to each length class. R_t was assumed to consist of crabs at the recruiting age with different lengths and thus represents year class strength for year t. $R_{l,t}$ is computed as

$$R_{l,t} = R_t U_l, \tag{6}$$

where U_l is described by a gamma distribution similar to equations (3) and (4) with a set of parameters α_r and β_r.

The female crab model is the same as the male crab model except that catch equals zero and molting probability equals 1.0 to reflect annual molting (Powell 1967). The minimum carapace length is set at 90 mm for females, and the last length class includes all crab ≥140-mm CL, corresponding to length groups 1-11 with 5 mm length intervals.

Model Scenarios

A variety of scenarios were run for the model; the results for each scenario were compared. Four scenarios were examined in this report:

A1-1: 4 levels of M for females and 3 levels of M for males over time,

A1-2: 2 levels of M over time,

A1-3: a constant M, and

A1-4: 4 levels of M for females and 3 levels of M for males over time with 50% weight for the terminal year 2004.

The results from scenario A1-1 have been used for management during the last 10 years and is referred as the base scenario in the report. Scenarios A1-3 and A1-4 were suggested by NMFS scientists Jack Turnock and Lou Rugolo.

Parameters Estimated Independently

Length-weight relationships and mean growth increments per molt were estimated independently outside of the model. Mean length of recruits to the model depends on growth and was assumed to be 95 mm for females and 102 mm for males.

Length-weight Relationship

Length-weight relationships for males and females were obtained from B. Stevens of the NMFS Alaska Fisheries Science Center, Kodiak:

Immature Females: $W = 0.010271\ L^{2.388}$,

Ovigerous Females: $W = 0.02286\ L^{2.234}$,

Males: $W = 0.000361\ L^{3.16}$,

where

W is weight in grams, and

L is CL in mm.

Growth Increment per Molt

A variety of data are available to estimate male mean growth increment per molt for Bristol Bay RKC. Tagging studies were conducted during the 1950s, the 1960s and the 1990s, and mean growth increment per molt data from these tagging studies in the 1950s and the 1960s were analyzed by Weber and Miyahara (1962) and Balsiger (1974). Modal analyses were conducted for the data during 1957-1961 and the 1990s (Weber 1967; Loher et al. 2001). Mean growth increment per molt may be a function of body size and shell condition and vary over time (Balsiger 1974; McCaughran and Powell 1977); however, for simplicity, mean growth increment per molt was assumed to be a function of body size only in the models. Based on two points of the mean growth increment of pre-molt length 54-118 mm in the modal analysis of the 1990s data as the growth increment for pre-molt length 67.5 mm and the mean increment of tagging data during the 1990s as the growth increment for pre-molt length 162.5 mm, growth increment per molt was estimated as a linear function of pre-molt length for male crabs (Figure 7). The line is about parallel to and slightly lower than that estimated from the tagging data during the 1950s and 1960s (Figure 7). Since the models primarily used the survey data after 1971, the growth increment per molt function estimated from the 1990s data was used in the LBA. The results from modal analyses of 1957-1961 and the 1990s were used to estimate mean growth increment per molt for immature females, and the data presented in Gray (1963) were used to estimate those for mature females (Figure 7). To make a smooth transition of growth increment per molt from immature to mature females, the weighted average of growth increment of 70% from matures and 30% from immatures was used for pre-molt length 92.5 mm and that of 90% from matures and 10% from immatures was used for pre-molt length 97.5 mm. These percentages are roughly close to the composition of maturity. Once mature, the growth increment per molt for male crabs increases slightly and annual molting probability decreases, whereas the growth increment for female crabs decreases dramatically but annual molting probability remains constant at 1.0 (Powell 1967).

Trawl Survey Catchability

Trawl survey selectivities/catchability were fixed at 1. As a comparison, lower catchabilites were estimated by Weinberg (2004) based on a trawl experiment (Figure 8).

Parameters Estimated Conditionally

The following model parameters were estimated separately for male and female crabs: recruits for each year (year class strength R_t for t = 1973 to 1994-2004), total abundance in the first year (1972), parameters β and β_r, and instantaneous natural mortality M_t. Molting probability parameters α_1, α_2, α_3, β_1, β_2, and β_3 were also estimated for male crabs. M_t was assumed to be a function of time and independent of body size in the assessments with terminal years 1994-2004. There were 3 levels of M_t for females and 2 levels for males in the assessments with terminal years 1994-1997 and 4 levels of M_t for females and 3 levels for males in the assessments with terminal years 1998-2004 (for females: M_1 for 1972-80, M_2 for 1981-84, M_3 for 1985-93 and 1998-2000, and M_4 for 1994-97 and 2001-04; for males: M_1 for 1972-79 and 1985-93, M_2 for 1980-84, and M_3 for 1994-97 and 2001-2004). These levels were determined interactively by searching for the best fit of area-swept estimates of abundances to the population model. To increase the efficiency of the parameter-estimation algorithm, I assumed that the relative frequencies of length and shell classes from the first survey year (1972) approximate the true relative frequencies within sexes. Thus, only total abundances of males and females for the first year were estimated; 3n unknown parameters, where n is the number of length-classes, for the abundances in the first year were reduced to 2 under this assumption.

Parameter Estimation

Measurement errors were assumed to be log-normally distributed, and parameters of the model were estimated using a nonlinear least squares approach, which minimized the residual sum of squares (RSS), or measurement errors:

$$RSS = \sum_{l,t}\{[\ln(N_{l,t}+\kappa) - \ln(\tilde{N}_{l,t}+\kappa)]^2 + [\ln(O_{l,t}+\kappa) - \ln(\tilde{O}_{l,t}+\kappa)]^2\}, \tag{7}$$

where

$\tilde{N}_{l,t}, \tilde{O}_{l,t}$ are area-swept estimates of abundances of newshell and oldshell crabs in length class l and year t from trawl survey data, and

κ is a constant set equal to 0.1 millions of crabs (<0.7% and 0.3% of the largest observed male and female abundances by length).

Constant κ was used to prevent taking the logarithm of zero and to reduce the effect of length classes with zero or very low abundances on parameter estimation. A smaller κ gives a heavier weight for low abundances, and vice versa. This constant functions similar to the constant used in the robust likelihood function by Fournier et al. (1990).

The annual abundance data can be weighted by the inverse of variance if good estimates of the annual variance are available. Because of aggregation of crabs, a huge catch may occur occasionally if the trawl hits a "hot spot". If a "hot spot" was not surveyed with multiple tows, the NMFS usually lumped the "hot spot" tow together with all other tows as a single stratum for Bristol Bay to estimate the variance, resulting in a high estimate of the coefficient of variation. Thus, using the inverse of variance as an annual weight may somewhat reduce the influence of a single tow on a "hot spot". However, if multiple tows were conducted on a "hot spot", the NMFS would regard the "hot spot" as a single stratum, thus reducing the estimate of the coefficient of variation. Because red king crabs do not uniformly distribute within Bristol Bay, variance estimates depend on how the survey data are stratified. The current NMFS approach regards Bristol Bay as a single stratum. Because there were usually tows without any crabs in some marginal areas, high population abundances most likely result in high estimates of the coefficient of variation with the current approach (Figure 9). Unless the estimates of variance can be improved, the inverse of variance may not be a good weighting factor. Thus, annual survey data were weighted equally in the current LBA. There was one exception. In 2001, the survey estimate of mature male abundance was much lower than expected based on previous surveys and the survey estimate of female abundance in 2001. To reduce the influence of the 2001 survey estimate of male abundance on the terminal population estimates, a 50% weight on it was used in the 2001 assessment. The surveys during 2002-2004 also indicate that the estimated survey male abundance in 2001 was much too low. This weight was changed back to 100% for later assessments due to its small influence on the estimates of terminal year abundances after 2001.

S-R MODELS

The results from the LBA were used to estimate the parameters of S-R models. I followed Zheng et al. (1995a) and Zheng and Kruse (2003) to estimate effective spawning biomass for Bristol Bay RKC. Male reproductive potential is defined as the mature male abundance by carapace length multiplied by the maximum number of females with which a male of a particular length can mate (Zheng et al. 1995a; Table 9). The maximum mating ratios (Table 9) used in this study are conservative and less than those observed in the laboratory studies (Powell and Nickerson 1965; Powell et al. 1974; Paul and Paul 1980, 1997). If mature female abundance was less than male reproductive potential, then mature female abundance was used as female spawning abundance. Otherwise, female spawning abundance was set equal to the male reproductive potential. The female spawning abundance was converted to biomass, defined as the effective spawning biomass SP_t. The S–R relationships of Bristol Bay RKC were modeled using a general Ricker curve:

$$R_t = SP_{t-k}^{r1}\, e^{r2 - r3\, SP_{t-k} + v_t}, \qquad (8)$$

and an autocorrelated Ricker curve:

$$R_t = SP_{t-k}\; e^{r2 - r3\, SP_{t-k} + \upsilon_t}, \qquad (9)$$

where

$\upsilon_t = \delta_t + a1\ \upsilon_{t-1}$,

v_t, δ_t are environmental noises assumed to follow a normal distribution $N(0,\sigma^2)$,

$r1$, $r2$, $r3$, and $a1$ are constants.

Equation (8) was linearized as

$$\ln(R_t) = r2 + r1\ \ln(SP_{t-k}) - r3\ SP_{t-k} + v_t, \qquad (10)$$

and equation (9) as

$$\ln(R_t / SP_{t-k}) = r2 - r3\ SP_{t-k} + \upsilon_t. \qquad (11)$$

An ordinary linear regression was applied to equation (10) to estimate model parameters $r1$, $r2$ and $r3$, and an autocorrelation regression (procedure AUTOREG, SAS Institute Inc. 1988) with a maximum likelihood method was used to estimate parameters $r2$, $r3$ and $a1$ for equation (11). A time lag of 8 years from mating to recruitment was used (Loher et al. 2001; Zheng and Kruse 2003).

To include the maximum range of available S–R data in the study of S–R relationships, I estimated the effective spawning biomass from 1968 to 1971 using survey abundance and the estimated survey catchability in 1972. The catchability for the survey gear in 1972 was estimated by comparing survey and model estimates. I assumed that the catchability for the survey gears in 1968-1971 was the same as in 1972 because the survey gears and methods were identical during these years (Reeves et al. 1977). Thus, the relative abundances from 1968 to 1971 were divided by the estimated catchability in 1972 to obtain the absolute abundances. The absolute abundances from 1968 to 2004 were used to construct S-R relationships.

Because of the regime shift in climate and physical oceanography that occurred in 1976–77 (Hare and Mantua 2000), it may not be realistic to expect the strong recruitment from hatching years before 1976 to occur in the near future. Also the Crab Plan Team does not consider levels of mature biomass prior to 1983 to be representative of that attainable under the current environmental conditions (NPFMC 1998). Therefore, a normal Ricker S–R curve was also fit to the S–R data from hatching years after 1975 to estimate an alternative S–R relationship under the current environmental conditions.

RESULTS

Model Evaluation

Model parameter estimates for four scenarios are summarized in Tables 10 and 11, and estimated mature male and female abundances are compared in Figure 10. Common features of the four scenarios were strong recruitment in the 1970s and relatively weak recruitment during the last 20 years. However, recruitment was much lower in the early 1980s for scenario A1-3 (constant M) than for the other three scenarios. Abundances estimated with scenarios A1-1 and A1-4 are pretty much identical except in the terminal year, in which the lower weight on the 2004 data (scenario A1-4) resulted in slightly higher mature and legal male abundance estimates. These two scenarios fit closely to the survey abundance with RSS of male crabs 145.04 and 141.15 and female crabs 43.90 and 43.69. The model of constant natural mortality (scenario A1-3) did not fit the data well (RSS = 264.61 for males and 261.01 for females); the survey abundance was underestimated before 1983 and overestimated during the mid and late 1980s. Scenario A1-2 fit the male abundance nearly as well as scenario A1-1 except that the estimated abundance was slightly lower during the 1970s, higher during the mid 1980s, and lower in the last three years than the fit of scenario A1-1 (Figure 10). Scenario A1-1 fit the female abundance (RSS = 43.90) much better than scenario A1-2 (RSS = 69.08).

It is not surprising that the constant *M* scenario did not fit the data as well as the variable *M* scenarios. Zheng et al. (1995a, 1995b) used the *F* statistic test (Schnute 1981) to test the null hypothesis that the constant *M* scenario is the same as the variable *M* scenario and concluded that the variable *M* scenario fit the survey data statistically much better than the constant *M* scenario. The survey abundance declined sharply during the early 1980s (Table 8 and Figure 5), which explains why the constant *M* scenario performed so poorly.

The RSS is not comparable between scenarios A1-1 and A1-4 because of different weighting factors. The survey abundance in 2004 is consistent with the survey abundances during the last few years except that the survey estimate of oldshell male abundance was lower than expected. Therefore, it is difficult to justify a different weight for the 2004 data from the previous 32 years of data. Scenario A1-4 serves as a comparison only.

Population Abundance

LBA estimates of Bristol Bay RKC abundance and 95% bootstrap confidence limits for 2004 under the base scenario (A1-1) are shown in Table 12. Mature crab abundance increased to a peak in the late 1970s, decreased dramatically in the early 1980s, remained at low levels during the 1980s and early 1990s, and increased somewhat since the mid 1990s due to the above average year classes (termed the 1990, 1994 and 1997 year classes in this report based on estimated hatching year; Figure 10). As most male crabs from the above average year class 1994 entered the legal-sized population this year, abundance of large-size groups continued to increase from last year. Prerecruit male abundance increased from 7.7 million to 11.3 million crabs, mature male abundance increased from 15.1 million to 16.0 million crabs, and legal males increased from 10.1 million to 10.4 million from 2003 to 2004 (Table 12). Due to the above average year class 1997, mature female abundance also continued to increase from last year (35.3 million crabs in 2004 from 28.1 million crabs in 2003). Effective spawning biomass in 2004 (61.9 million pounds) was higher than that in 2003 (57.6 million pounds).

The model scenario A1-1 closely fit the survey abundance by length, shell condition, and sex (Figure 11). It appeared that model estimates of oldshell male crabs in 1974, 1980, 1985, 1988, 2001, and 2004 were much higher than those of the survey. The abundance of newshell males was much higher than the oldshell males in the 1970s.

Molting Probabilities

Three levels of molting probabilities were estimated for different periods. Molting probabilities were very high during 1972-1979, low during 1980-1984 and 1992-1994, and intermediate during 1985-1991, 1995-1996, and 2002-2004 (Figure 12). Estimated molting probabilities during these periods were consistent with that estimated from the 1966-1969 tagging data (Balsiger 1974) but lower than those estimated from the tagging data during 1954-1961 (Balsiger 1974) (Figure 12).

Natural Mortality

Estimated natural mortality was much higher for females than males. For the base scenario, estimated natural mortality was very high in the early 1980s and very low in the mid 1990s and the recent years (Tables 10 and 11). The high natural mortality is consistent with survey data (Table 8 and Figure 5), which show a sharp decline of crab abundances in the early 1980s. Factors causing the high natural mortality are not clear. Physical environmental conditions, predation, disease, and handling mortality or a combination of all these factors may have contributed to high natural mortality (Otto 1986; Blau 1986). Senescence may also play a role for high natural mortality (Stevens 1990); however, high mortality seems to occur for almost all sizes of crabs in the early 1980s.

Exploitation

The RKC fishery in Bristol Bay harvests only legal crabs. Mature male and legal male harvest rates were computed by dividing total catch by the mature male abundance and legal crab abundance estimated in the base scenario, respectively. The legal male harvest rates ranged from 0.18 to 0.55 in the 1970s and the early 1980s and fluctuated around 0.19 since the current harvest strategy was adopted in 1996 (Figure 13). The mature male harvest rates were close to 0.2 in the early and middle 1970s and peaked at 0.35 in 1980 (Figure 13). These high harvest rates and legal crab abundances produced the record catches in the late 1970s and early 1980s, which were followed by the quick collapse of the population. Harvest not only removes legal male crabs but also reduces abundances of sublegal male and female crabs through handling mortality. Although the bycatch mortality biomass was very low relative to the retained catch biomass based on the assumed handling mortality rates (Figure 2), the bycatch handling mortality rate could be higher than those assumed during extremely cold years (Carls and O'Clair 1990). In summary, it appears that high natural mortality coupled with high harvest rates may have contributed to the collapse of the Bristol Bay RKC population in the early 1980s (Zheng et al. 1995a). The current conservative harvest strategy (low harvest rates) and low natural mortality since the mid 1990s may be helping the gradual recovery of the stock.

One assumption needed to estimate natural mortality from the survey data is that trawl catchability is equal to 1 during 1973-2004. The recent experiment shows that survey catchability may be less than 1 (Figure 8). Harvest rates would be lower than estimated in Figure 12 if the real catchability is lower than my assumption.

Retrospective Analysis

Past assessments were summarized for a retrospective analysis. The assessment under the base scenario in 2004 serves as the baseline estimates. The long-term trends of abundance estimates made by LBA assessments in terminal years 1994-2004 were similar (Figures 14 and 15). Abundance increased sharply from the early 1970s to the late 1970s and then dropped dramatically during the early 1980s. Abundance fluctuated around a low level during the last two decades.

The baseline total abundance estimates and the estimates made for terminal years 1994-2004 differed. The biggest difference for total abundance occurred in 1996 with a -19% relative error (Table 13). In addition to the survey measurement errors, this difference may also be due to assumptions about natural mortality (i.e., process errors). Natural mortality from 1985 to 1997 was assumed constant for the stock assessments conducted before 1998 (Zheng et al. 1997). Consistently lower model estimates than area-swept estimates of large-sized crab abundance from 1995 to 1997 (Figure 14) prompted reevaluation of the assumption of natural mortality. In the 1998 and 1999 assessments, a new level of natural mortality was estimated after 1993, which was much lower than estimated natural mortalities from 1972 to 1993 (Figure 16; Zheng et al. 1998; Zheng and Kruse 1999). The fishery was closed in 1994 and 1995, and RKC bycatch in the groundfish fisheries was further reduced because of the depressed crab stock. Both factors may have lowered indirect fishing mortality, part of the natural mortality in the model. Overestimates of 1994-1997 natural mortality during the assessments in terminal years 1995-1997 partially caused underestimates of large-sized crab abundance in those terminal years.

Relative errors for Bristol Bay RKC stock estimates are smaller than those for many groundfish stock estimates. Relative errors range from –19% to 12% for total crab abundance, whereas relative errors of biomass could range from –57% to 27% for some eastern Bering Sea groundfish stocks (Zheng and Kruse 2002a; Ianelli et al. 2003). In a retrospective catch-at-age analysis for Pacific halibut (*Hippoglossus stenolepis*) from 1944 to 1990, Parma (1993) indicated that historical estimates could be several times higher than the most recent estimates. As a contrast to the results by Parma (1993) that historical assessments tended to greatly overestimate Pacific halibut abundance during the 1960s and 1970s, historical assessments substantially underestimated pollock abundance in the eastern Bering Sea (Ianelli et al. 2003). In both stocks, historical errors in abundance estimates were highly autocorrelated over time. Such large errors were most likely caused by mis-specification of survey or fishery catchabilities (Parma 1993).

Even though the estimated historical errors of total crab abundance estimates are relatively small, their impacts on annual GHL can be substantial (Table 13). Mature female abundance assessed in 1995 was close to the threshold level, and the fishery was closed due to conservation concerns. Under the current model assessment of abundance in 1995, the fishery would have been opened. The estimated mature male harvest rates are close to the targeted rates in 1996, 1997, and 1999, but are much higher in 1998. Because the step harvest rates are based on effective spawning biomass (Figure 1), the higher estimated effective spawning biomass in 1998 resulted in a target rate of 15%. The current model assessment would have triggered a target rate of 10%. Model assessment errors could greatly affect annual GHLs if effective spawning biomass is near transition points between 0% and 10% and 10% and 15% harvest rates, as in 1995 and 1998. However, over a period of years, total GHL may not be affected much by assessment errors: total estimated GHL from 1994 to 2004 is very close to that derived from the current model assessment.

Overall, abundance estimates by the length-based model and area-swept method had the same trends over time (Zheng et al. 1995a, 1995b; Zheng and Kruse 2002a). The model provides smoother, more consistent abundance estimates than the area-swept method, and it is considered to be an improvement over a single-year point estimate of abundance derived from the area-swept method. The reduction of annual assessment error estimates with the model decreases estimated errors in setting annual GHLs.

The LBA for Bristol Bay RKC is flexible, and I intend to continue to improve the model by incorporating new knowledge and data as they become available. One potential improvement is to improve growth parameter estimates. The 1990, 1994 and 1997 year classes show distinctive modes over time and provides good information for future modal analysis for estimating growth parameters. Another potential improvement is to incorporate length-dependent catchability for trawl survey data. Data on males < 95-mm and females < 90-mm CL could also be incorporated to reduce measurement error estimates of recruitment, particularly as new strong year classes become recruited to the survey gear and model. The new model is being developed to incorporate these elements and expand to the data before 1972. The standardized CPUE data will be used in the new model to tune the length-based model in the early years (before 1972) due to lack of survey data. The new model will also estimate pot and trawl bycatches to improve natural mortality estimates.

S–R Relationships

I estimated S-R relationships for Bristol Bay RKC from the results of the LBA base scenario (Figure 17). Generally, strong recruitment occurred with intermediate levels of effective spawning biomass, and very weak recruitment was associated with extremely low levels of effective spawning biomass. These features suggest a density-dependent S–R relationship. On the other hand, strong year classes occurred in the late 1960s and early 1970s, and weak year classes occurred in the 1980s and 1990s. Therefore recruitment is highly autocorrelated, so environmental factors may play an important role in recruitment success. I used the general Ricker curve to describe the density-dependent relationship and the autocorrelated Ricker curve to depict the autocorrelation effects. Because the autocorrelated curve regards the strong recruitment during the late 1960s and early 1970s as a result of autocorrelation, the recruitment associated with intermediate effective spawning biomass is much lower for the autocorrelated curve than for the general curve (Figure 17). Likewise, because the autocorrelated curve is less density-dependent, it has much higher recruitment than the general curve when effective spawning biomass is very high. Overall, the general Ricker curve (R^2=0.53, *df*=26) fit the data better than the autocorrelated curve (R^2=0.45, *df*=26), in contrast to the earlier results when S–R data were fitted up to the 1987 brood year (Zheng et al., 1995a, 1995b). The autocorrelation parameter fit the residuals well only before the 1982 year class and then fit the residuals poorly.

Egg clutch data collected during summer surveys may provide information about mature female reproductive conditions. Egg clutch data are subject to subjective rating errors as well as sampling errors, but their trends over time may be useful. Proportions of empty clutches for newshell mature females >89 mm CL were high during some years before 1990 and have been very low since 1990 (Figure 18). The highest proportion of empty clutches was in 1986 with 0.20, and they were found with primarily soft shell females (shell condition 1). Clutch fullness fluctuated annually around their average levels during two periods: before 1991 and after 1990 (Figure 18). The average clutch fullness was almost identical for these two periods (Figure 18).

The recruitment strength and the Aleutian Low Pressure index were examined by Zheng and Kruse (2000) and are compared in Figure 19. The average seasonal index of

December-March with a 3-point running average was used. The recruitment trends of Bristol Bay RKC may partly relate to decadal shifts in physical oceanography: all strong year classes occurred before 1977 when the Aleutian Low was weak. The largest year class during the last 20 years, the 1990 year class, was also coincidental with the weak Aleutian Low index during 1989-1991.

Many Alaskan RKC stocks, like Bristol Bay, tend to have periods of weak recruitment that coincide with decades of strong winter Aleutian Lows, the opposite of trends for many fish stocks (Hollowed and Wooster 1992; Beamish and Bouillon 1993). The mechanisms are uncertain, but food availability is hypothesized to be important to RKC (Zheng and Kruse 2000) because their larvae suffer reduced survival and feeding capability if they do not feed within the first 2-6 days after hatching (Paul and Paul 1980). Diatoms such as *Thalassiosira* are important food for first-feeding RKC larvae (Paul et al. 1989) and they predominate the spring bloom in years of light winds when the water column is stable (Ziemann et al. 1991; Bienfang and Ziemann 1995). One hypothesis is that years of strong wind mixing associated with intensified Aleutian Lows may depress RKC larval survival and subsequent recruitment (Zheng and Kruse 2000).

FISHERY MANAGEMENT IMPLICATIONS

Directed Crab Fishery.

The Alaska Board of Fisheries harvest strategy for Bristol Bay RKC sets a GHL by harvest rate coupled to a fishery threshold (Figure 1). When the stock is not above the threshold of 8.4 million mature females (> 89 mm CL) and 14.5 million pounds of ESB, the fishery is closed. When the stock is above threshold, GHL is determined by the ESB and abundance of mature and legal-sized males. A mature male harvest rate of 10% or 12.5% is applied to promote stock rebuilding when ESB is below the target rebuilding level of 55 million pounds. Once the stock is at or above 55 million pounds of ESB, a 15% harvest rate is applied to mature male abundance. To prevent a disproportionate harvest of large male crabs, the GHL is capped so that no more than 50% of the legal male crabs may be harvested in any one year.

In 2004 the estimates of mature female abundance and ESB were 35.3 million and 61.9 million pounds, respectively, both above the thresholds needed to conduct a directed commercial fishery. Because ESB is above the target rebuilding level of 55 million pounds, a 15% harvest rate is applied. Applying this harvest rate times mature male abundance of 15.967 million results in a harvest of 2.395 million crabs. Because 2.395 million is only 23.1% of the legals, the 50% cap is not required. By multiplying 2.395 million crabs times an average weight of 6.44 pounds per legal crab, a preseason GHL of 15.424 million pounds was established for the 2004 fishery. A total of 7.5% of the GHL or 1.157 million pounds is reserved for the community development quota (CDQ) fishery, resulting in a GHL of 14.267 million pounds for the open access fishery. The actual CDQ harvest level will be based on a percentage of the total catch from the open-access commercial fishery.

Implications on the Bering Sea Groundfish Trawl Fisheries

Prohibited species catch (PSC) limits for RKC caught during groundfish trawl fisheries are set annually as a function of estimated ESB of Bristol Bay RKC (Figure 1). When ESB exceeds 14.5 million pounds but is less than 55 million pounds, the PSC is 97,000 crabs. When ESB exceeds 55 million pounds, the PSC is 197,000 crabs. Given the estimate of 61.9 million pounds of ESB for 2004, the RKC PSC limit for the Bering Sea will be set at 197,000 crabs for groundfish trawl fisheries in 2005.

A portion of the year-round closure to non-pelagic trawling in the RKC Savings Area (162° to 164° W, 56° to 57° N) is open to the rock sole fishery in years when there is a RKC fishery in Bristol Bay (Witherell and Roberts 1996). Thus, the portion of the RKC Savings Area bounded by 56° to 56° 10' N latitude will remain open to the rock sole fishery in 2005. A separate bycatch limit is established for this area not to exceed 35% of the RKC PSC limits apportioned to the rock sole fishery by the NPFMC.

PROJECTIONS AND FUTURE OUTLOOK

Future population projections primarily depend on future recruitment predictions. Crab recruitment is extremely difficult to predict. Therefore, unless the projections are required for regulatory purposes, no projections are made in the stock assessment report.

Due to above average year classes 1990, 1994 and 1997, abundances of mature males, legal males, and mature females all increased from last year and are at the highest levels since 1982. Another potential above average year class may be possible with lengths centered around 67.5 mm (Figure 20), although it is still too early to determine year class strength for this cohort due to unreliable survey estimates of juvenile crabs. The trawl survey next year will help determine the strength of this cohort. Due to these above average year classes, mature and legal crabs should maintain relatively high levels compared to those during the last 20 years if natural mortality does not increase greatly, as in the early 1980s for this stock and in 1999 for St. Matthew Island blue king crabs (Zheng and Kruse 2002b). Current crab abundance is still very low relative to those in the late 1970s, and without favorable environmental conditions, recovery to the high levels of the late 1970s may be difficult.

ACKNOWLEDGMENTS

I thank Doug Woodby, Doug Pengilly and Shareef Siddeek for reviewing the earlier draft of this manuscript and Jack Turnock and Lou Rugolo for suggesting the scenario of a smaller weight for the survey data in 2004. This report is funded in part by a cooperative agreement from the National Oceanic and Atmospheric Administration. The views expressed herein are those of the author and do not necessarily reflect the views of NOAA or any of its sub-agencies.

REFERENCES

Alaska Department of Fish and Game (ADF&G). 2002. Commercial shellfish fishing regulations, 2002-2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau. 232 pp.

Alaska Department of Fish and Game (ADF&G). 2003. Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands and Bering Sea and the Westward Region's shellfish observer program, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak. 247 pp.

Balsiger, J.W. 1974. A computer simulation model for the eastern Bering Sea king crab. Ph.D. dissertation, Univ. Washington, Seattle, WA. 198 pp.

Beamish, R.J., and D.R. Bouillon. 1993. Pacific salmon production trends in relation to climate. Can. J. Fish. Aquat. Sci. 50:1002-1016.

Bienfang, P.K., and D.A. Ziemann. 1995. APPRISE: A multi-year investigation of environmental variation and its effects on larval recruitment. Pages 483-487 *In* R.J. Beamish (ed.). Climate change and northern fish populations. Can. Spec. Publ. Fish. Aquat. Sci. 121.

Blau, S.F. 1986. Recent declines of red king crab (*Paralithodes camtschatica*) populations and reproductive conditions around the Kodiak Archipelago, Alaska. Pages 360-369 *In* G. S. Jamieson and N. Bourne (eds). North Pacific Workshop on stock assessment and management of invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. 92.

Carls, M.G., and C.E. O'Clair. 1990. Influence of cold air exposures on ovigerous red king crabs (*Paralithodes camtschatica*) and Tanner crabs (*Chionoecetes bairdi*) and their offspring. Proc. Int. Symp. King & Tanner Crabs, Alaska Sea Grant Rep. 90-04: 329-343.

Fournier, D.A., J.R. Sibert, J. Majkowski, and J. Hampton. 1990. MULTIFAN a likelihood-based method for estimating growth parameters and age composition from multiple length frequency data sets illustrated using data for southern bluefin tuna (*Thunnus maccoyii*). Can. J. Fish. Aquat. Sci. 47:301-317.

Gray, G.W. 1963. Growth of mature female king crab *Paralithodes camtschatica* (Tilesius). Alaska Dept. Fish and Game, Inf. Leafl. 26. 4 pp.

Hare, S.R., and N.J. Mantua. 2000. Empirical evidence for North Pacific regime shifts in 1977 and 1989. Progress in Oceanography 47:103–145.

Hollowed, A.B., and W.S. Wooster. 1992. Variability of winter ocean conditions and strong year classes of Northeast Pacific groundfish. ICES Mar. Sci. Symp. 195:433-444.

Hoopes, D.T., J.F. Karinen, and M. J. Pelto. 1972. King and Tanner crab research. Int. North Pac. Fish. Comm. Annu. Rep. 1970:110-120.

Ianelli, J.N., S. Barbeaux, G. Walters, and N. Williamson. 2003. Eastern Bering Sea walleye Pollock stock assessment. Pages 39-126 *In* Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pacific Fishery Management Council, Anchorage.

Jackson, P.B. 1974. King and Tanner crab fishery of the United States in the Eastern Bering Sea, 1972. Int. North Pac. Fish. Comm. Annu. Rep. 1972:90-102.

Loher, T., D.A. Armstrong, and B.G. Stevens. 2001. Growth of juvenile red king crab (*Paralithodes camtschaticus*) in Bristol Bay (Alaska) elucidated from field sampling and analysis of trawl-survey data. Fish. Bull. 99:572-587.

McCaughran, D.A., and G.C. Powell. 1977. Growth model for Alaskan king crab (*Paralithodes camtschatica*). J. Fish. Res. Board Can. 34:989-995.

North Pacific Fishery Management Council (NPFMC). 1998. Fishery management plan for Bering Sea/Aleutian Islands king and Tanner crabs. North Pacific Fishery Management Council, Anchorage, Alaska.

Otto, R.S. 1986. Management and assessment of eastern Bering Sea king crab stocks. Pages 83-106 *In* G. S. Jamieson, and N. Bourne (eds.). North Pacific Workshop on stock assessment and management of invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. 92.

Parma, A.M. 1993. Retrospective catch-at-age analysis of Pacific halibut: implications on assessment of harvesting policies. Pages 247-266 *In* G. Kruse, D.M. Eggers, R.J. Marasco, C. Pautzke, and T.J. Quinn II (eds.). Proceedings of the international symposium on management strategies for exploited fish populations. University of Alaska Fairbanks, Alaska Sea Grant Rep. 90-04.

Paul, A.J., and J.M. Paul. 1980. The effect of early starvation on later feeding success of king crab zoea. J. Exp. Biol. Ecol. 44:247-251.

Paul, J.M., and A.J. Paul. 1990. Breeding success of sublegal size male red king crab *Paralithodes camtschatica* (Tilesius, 1815) (Decapopa, Lithodidae). Journal of Shellfish Research 9:29-32.

Paul, A.J., and J.M. Paul. 1997. Breeding success of large male red king crab *Paralithodes camtschaticus* with multiparous mates. J. Shellfish Res. 16, 379-381.

Paul, A.J., J.M. Paul, and K.O. Coyle. 1989. Energy sources for first-feeding zoea of king crab *Paralithodes camtschatica* (Tilesius) (Decapoda, Lithodidae). J. Exp. Mar. Biol. Ecol. 130:55-69.

Pengilly, D., and D. Schmidt. 1995. Harvest strategy for Kodiak and Bristol Bay red king crab and St. Matthew Island and Pribilof Islands blue king crab. Alaska Dep. Fish and Game, Comm. Fish. Manage. and Dev. Div., Special Publication 7. Juneau, AK. 10 pp.

Phinney, D.E. 1975. United States fishery for king and Tanner crabs in the eastern Bering Sea, 1973. Int. North Pac. Fish. Comm. Annu. Rep. 1973: 98-109.

Powell, G.C. 1967. Growth of king crabs in the Vicinity of Kodiak, Alaska. Alaska Dept. Fish and Game, Inf. Leafl. 92. 106 pp.

Powell, G.C., K.E. James, and C.L. Hurd. 1974. Ability of male king crab, *Paralithodes camtschatica*, to mate repeatedly, Kodiak, Alaska, 1973. Fish. Bull., U.S. 72(1):171-179.

Powell, G.C., and R.B. Nickerson. 1965. Reproduction of king crabs, *Paralithodes camtschatica* (Tilesius). J. Fish. Res. Board Can. 22(1):101-111.

Reeves, J.E., R.A. MacIntosh, and R.N. McBride. 1977. King and snow (Tanner) crab research in the eastern Bering Sea, 1974. Int. North Pac. Fish. Comm. Annu. Rep. 1974:84-87.

SAS Institute Inc. 1988. SAS/ETS user's guide, version 6, first edition. SAS Institute Inc., Cary, NC. 560 pp.

Schmidt, D., and D. Pengilly. 1990. Alternative red king crab fishery management practices: modelling the effects of varying size-sex restrictions and harvest rates, p.551-566. *In* Proc. Int. Symp. King & Tanner Crabs, Alaska Sea Grant Rep. 90-04.

Schnute, J. 1981. A versatile growth model with statistically stable parameters. Can. J. Fish. Aquat. Sci. 38:1128-1140.

Stevens, B.G. 1990. Temperature-dependent growth of juvenile red king crab (*Paralithodes camtschatica*), and its effects on size-at-age and subsequent recruitment in the eastern Bering Sea. Can. J. Fish. Aquat. Sci. 47:1307-1317.

Stevens, B.G., R.A. MacIntosh, and J.A. Haaga. 1991. Report to industry on the 1991 eastern Bering Sea crab survey. Alaska Fisheries Science Center, Processed Rep. 91-17. 51 pp. NMFS, NOAA, 7600 Sand Point Way NE, Seattle, WA 99115.

Weber, D.D. 1967. Growth of the immature king crab *Paralithodes camtschatica* (Tilesius). Int. North Pac. Fish. Comm. Bull. 21:21-53.

Weber, D.D., and T. Miyahara. 1962. Growth of the adult male king crab, *Paralithodes camtschatica* (Tilesius). Fish. Bull. U.S. 62:53-75.

Weinberg, K.L., R.S. Otto, and D.A. Somerton. 2004. Capture probability of red king crab (*Paralithodes camtschaticus*) for a survey trawl with analyses of observed factors contributing to escapement. Manuscript.

Witherell, D., and L. Roberts. 1996. Regulatory and closure areas for the groundfish fisheries in the Bering Sea and Aleutian Islands. North Pacific Fishery Management Council, Anchorage.

Zheng, J., and G.H. Kruse. 1999. Stock status of king crabs in the eastern Bering Sea in 1999. Alaska Dept. Fish and Game, Commercial Fisheries Division, Reg. Inf. Rep. 5J99-09, Juneau. 19 pp.

Zheng. J., and G.H. Kruse. 2000. Recruitment patterns of Alaskan crabs and relationships to decadal shifts in climate and physical oceanography. ICES J. Mar. Sci. 57:438-451.

Zheng, J., and G.H. Kruse. 2002a. Retrospective length-based analysis of Bristol Bay red king crabs: model evaluation and management implications. Pages 475-494 *In* A.J. Paul, E.G. Dawe, R. Elner, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley, and D. Woodby (eds.). Crabs in Cold Water Regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks.

Zheng, J., and G.H. Kruse. 2002b. Assessment and management of crab stocks under uncertainty of massive die-offs and rapid changes in survey catchability. Pages 367-384 *In* A.J. Paul, E.G. Dawe, R. Elner, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley, and D. Woodby (eds.). Crabs in Cold Water Regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks.

Zheng, J., and G.H. Kruse. 2003. Stock-recruitment relationships for three major Alaskan crab stocks. Fish. Res. 65:103-121.

Zheng, J., G.H. Kruse, and M.C. Murphy. 1997. Stock status of king crabs in the Eastern Bering Sea in 1997. Alaska Dept. Fish and Game, Commercial Fisheries Division, Reg. Inf. Rep. 5J97-13, Juneau. 21 pp.

Zheng, J., G.H. Kruse, and M.C. Murphy. 1998. Stock status of king crabs in the Eastern Bering Sea in 1998. Alaska Dept. Fish and Game, Commercial Fisheries

Division, Reg. Inf. Rep. 5J98-06, Juneau. 18 pp.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995a. A length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Can. J. Fish. Aquat. Sci. 52:1229-1246.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995b. Updated length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus,* in Bristol Bay, Alaska. Alaska Fish. Res. Bull. 2:114-124.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1996. Overview of population estimation methods and recommended harvest strategy for red king crabs in Bristol Bay. Alaska Department of Fish and Game, Regional Information Report 5J96-04, Juneau, Alaska. 37 pp.

Zheng, J. M.C. Murphy, and G.H. Kruse. 1997a. Analysis of the harvest strategies for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Can. J. Fish. Aquat. Sci. 54:1121-1134.

Zheng, J. M.C. Murphy, and G.H. Kruse. 1997b. Alternative rebuilding strategies for the red king crab *Paralithodes camtschaticus* fishery in Bristol Bay, Alaska. J. Shellfish Res. 16:205-217.

Ziemann, D.A., L.D. Conquest, M. Olaizola, and P.J. Bienfang. 1991. Interannual variability in the spring phytoplankton bloom in Auke Bay, Alaska. Mar. Biol. 109:321-334.

Table 1. Bristol Bay red king crab annual catch and bycatch mortality biomass (million lbs) from June 1 to May 31. A handling mortality rate of 20% for pot and 80% for trawl was assumed to estimated bycatch mortality biomass.

	Retained Catch				Pot Bycatch		Trawl
Year	U.S.	Cost-recovery	Foreign	Total	Males	Females	Bycatch
1960	0.600		26.898	27.498			
1961	0.427		44.592	45.019			
1962	0.068		54.275	54.343			
1963	0.653		54.963	55.616			
1964	0.823		58.170	58.993			
1965	1.429		41.294	42.723			
1966	0.997		42.356	43.353			
1967	3.102		33.636	36.738			
1968	8.686		27.469	36.155			
1969	10.403		14.383	24.786			
1970	8.559		12.984	21.543			
1971	12.946		6.134	19.080			
1972	21.745		4.720	26.465			
1973	26.914		0.228	27.142			
1974	42.266		0.476	42.742			
1975	51.326		0.000	51.326			
1976	63.920		0.000	63.920			1.426
1977	69.968		0.000	69.968			2.685
1978	87.618		0.000	87.618			2.757
1979	107.828		0.000	107.828			2.783
1980	129.948		0.000	129.948			2.135
1981	33.591		0.000	33.591			0.448
1982	3.001		0.000	3.001			1.201
1983	0.000		0.000	0.000			0.885
1984	4.182		0.000	4.182			2.316
1985	4.175		0.000	4.175			0.829
1986	11.394		0.000	11.394			0.432
1987	12.289		0.000	12.289			0.311
1988	7.388		0.000	7.388			1.174
1989	10.265		0.000	10.265			0.374
1990	20.362	0.081	0.000	20.443	1.139	1.154	0.501
1991	17.178	0.206	0.000	17.384	0.881	0.142	0.576
1992	8.043	0.074	0.000	8.117	1.191	0.780	0.571
1993	14.629	0.053	0.000	14.682	1.649	1.133	0.836
1994	0.000	0.093	0.000	0.093	0.000	0.000	0.180
1995	0.000	0.080	0.000	0.080	0.000	0.000	0.213
1996	8.406	0.108	0.000	8.514	0.356	0.002	0.238
1997	8.756	0.155	0.000	8.911	0.528	0.034	0.168
1998	14.757	0.188	0.000	14.946	2.074	1.547	0.355
1999	11.670	0.186	0.000	11.856	0.679	0.015	0.408
2000	8.154	0.086	0.000	8.241	0.779	0.078	0.230
2001	8.403	0.120	0.000	8.523	0.902	0.309	0.330
2002	9.570	0.096	0.000	9.666	0.956	0.013	0.245
2003	15.697	0.034	0.000	15.731	1.945	0.709	

Table 2. Comparison of GHL and actual catch (million lbs) of Bristol Bay red king crabs.

Year	GHL Range	GHL Mid-point	Actual Catch	Rel.Error	%Rel.Error
1980	70-120	95.00	129.95	34.95	36.79
1981	70-100	85.00	33.59	-51.41	-60.48
1982	10-20	15.00	3.00	-12.00	-79.99
1983	0	0.00	0.00	NA	NA
1984	2.5-6	4.25	4.18	-0.07	-1.59
1985	3-5	4.00	4.18	0.18	4.38
1986	6-13	9.50	11.39	1.89	19.94
1987	8.5-17.7	13.10	12.29	-0.81	-6.19
1988		7.50	7.39	-0.11	-1.50
1989		16.50	10.26	-6.24	-37.79
1990		17.10	20.36	3.26	19.08
1991		18.00	17.18	-0.82	-4.57
1992		10.30	8.04	-2.26	-21.91
1993		16.80	14.63	-2.17	-12.93
1994		0.00	0.00	0.00	
1995		0.00	0.00	0.00	
1996		5.00	8.41	3.41	68.11
1997		7.00	8.76	1.76	25.09
1998		16.40	14.76	-1.64	-10.02
1999		10.66	11.67	1.01	9.48
2000		8.35	8.15	-0.20	-2.34
2001		7.15	8.40	1.25	17.52
2002		9.27	9.57	0.30	3.24
2003		15.71	15.70	-0.01	-0.08
Total		391.59	362.01	-29.58	-7.59

Table 3. Annual sample sizes for catch by length and shell condition for retained catch and bycatch of Bristol Bay red king crabs.

	Trawl Survey		Retained	Pot Bycatch		Trawl Bycatch	
Year	Males	Females	Catch	Males	Females	Males	Females
1960			3960				
1961			3116				
1962			9120				
1963			9600				
1964			13080				
1965			10559				
1966			11772				
1967			21834				
1968	3684	2165	18044				
1969	6144	4992	22812				
1970	1546	1216	3394				
1971			10340				
1972	1106	767	15046				
1973	1783	1888	11848				
1974	2505	1800	27067				
1975	2943	2139	29570				
1976	4724	2956	26450			2327	676
1977	3636	4178	32596			14014	689
1978	4132	3948	27529			8983	1456
1979	5807	4663	27900			7228	2821
1980	2412	1387	34747			47463	39689
1981	3478	4097	18029			42172	49634
1982	2063	2051	11466			84240	47229
1983	1524	944	0			204464	104910
1984	2679	1942	4404			357981	147134
1985	792	415	4582			169767	30693
1986	1962	367	5773			62023	20800
1987	1168	1018	4230			60606	32734
1988	1834	546	9833			102037	57564
1989	1257	550	32858			47905	17355
1990	858	603	7218	873	699	5876	2665
1991	1378	491	36820	1801	375	2964	962
1992	513	360	23552	3248	2389	1157	2678
1993	1009	534	32777	5803	5942		
1994	443	266	0	0	0	4953	3341
1995	2154	1718	0	0	0	1729	6006
1996	835	816	8896	230	11	24583	9373
1997	1282	707	15747	4102	906	9035	5759
1998	1097	1150	16131	11079	9130	25051	9594
1999	820	540	17666	1048	36	16653	5187
2000	1278	1225	14091	8970	1486	36972	10673
2001	611	743	12854	9102	4567	56070	32745
2002	1032	896	15932	9943	302	27705	25425
2003	1669	1311	16212	17998	10327		

Table 4. Estimated annual retained catch by length (1000 crabs) based on catch sampling and fish ticket reporting for Bristol Bay red king crabs from June 1 to May 31.

Year	Carapace Length (mm)										
	112.5	117.5	122.5	127.5	132.5	137.5	142.5	147.5	152.5	157.5	162.5+
1960	0.0	0.0	10.7	32.0	53.3	134.4	298.7	462.9	603.7	680.5	1755.7
1961	16.9	50.6	97.0	168.6	219.2	240.3	286.7	459.5	691.3	919.0	3385.0
1962	0.0	69.7	145.7	202.7	297.7	430.7	557.3	671.3	798.0	937.3	3869.7
1963	31.9	106.4	202.1	308.5	436.2	659.6	808.5	851.1	851.1	861.7	3478.8
1964	17.6	52.9	101.4	211.6	357.1	573.2	806.8	925.9	996.4	992.0	3782.9
1965	0.0	0.0	37.0	103.0	221.8	459.5	720.9	937.4	1090.6	1032.5	2062.3
1966	0.0	0.0	129.7	358.9	485.5	618.2	769.0	787.1	775.0	741.9	2240.7
1967	0.0	0.0	13.0	173.1	366.6	580.1	827.6	926.5	934.8	834.1	2091.7
1968	0.0	0.0	23.6	151.1	297.5	415.5	590.2	613.8	651.6	533.5	1463.7
1969	0.0	1.3	102.2	252.9	375.6	431.0	511.8	457.9	399.2	279.5	567.9
1970	0.0	18.5	149.9	350.2	568.3	637.9	511.7	423.7	275.4	190.6	381.9
1971	0.0	0.0	0.0	18.1	333.8	720.1	788.2	617.7	460.3	300.1	371.2
1972	0.0	0.0	0.0	38.6	585.7	973.8	1001.4	851.7	611.5	378.7	445.4
1973	0.0	0.0	0.4	34.4	488.3	872.5	821.3	722.8	584.2	358.8	419.5
1974	0.0	0.0	0.0	90.7	945.4	1716.3	1735.5	1408.3	912.7	542.2	543.7
1975	0.0	0.0	0.0	62.1	648.0	1504.8	1958.4	1855.8	1280.0	750.0	686.1
1976	0.0	0.0	0.0	17.2	307.7	1503.1	2456.1	2331.2	1733.8	1135.8	1118.5
1977	0.0	0.0	0.0	19.8	225.7	1621.2	2864.9	2612.2	1883.6	1219.9	1285.8
1978	0.0	0.0	0.0	17.1	308.0	2125.4	3816.5	3540.1	2466.6	1423.7	1048.2
1979	0.0	0.0	0.0	21.1	200.6	1256.2	2771.5	3357.7	3368.0	2616.1	3217.4
1980	0.0	0.0	0.0	16.3	288.0	1915.9	3691.1	4064.2	3734.6	2926.1	4209.2
1981	0.0	0.0	0.0	3.3	119.2	617.9	925.2	908.2	841.0	681.4	1211.8
1982	0.0	0.0	0.0	0.0	29.4	139.4	151.6	90.2	45.3	27.5	57.7
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.2	1.8	51.9	246.9	248.9	140.0	67.2	25.5	11.5
1985	0.0	0.0	0.4	3.5	62.9	228.4	246.6	151.1	68.5	24.4	10.3
1986	0.0	0.0	0.0	3.4	111.4	548.6	690.6	437.6	205.3	73.9	28.8
1987	0.0	0.0	0.0	2.8	60.3	402.2	646.2	535.3	301.5	120.0	54.1
1988	0.0	0.0	0.0	0.0	25.0	160.0	327.1	305.4	231.9	127.7	58.9
1989	0.0	0.0	0.0	0.8	31.5	204.0	372.1	368.9	321.5	201.6	184.4
1990	0.0	0.0	0.9	0.0	45.6	276.7	562.1	532.6	539.1	446.6	716.8
1991	0.0	0.1	0.3	1.3	37.2	223.1	434.3	470.8	457.5	376.8	629.3
1992	0.0	0.3	0.2	0.6	11.4	76.4	157.6	200.2	209.1	195.8	345.4
1993	0.0	0.0	0.0	3.2	31.0	211.3	402.3	391.0	359.0	299.4	551.7
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.7	0.7	16.4	98.7	178.2	205.1	224.3	211.6	330.9
1997	0.0	0.0	0.5	0.4	18.5	120.3	199.0	214.6	227.6	212.7	345.4
1998	0.7	0.8	0.4	1.8	49.9	263.0	353.5	330.0	317.3	308.8	589.3
1999	0.0	0.1	0.0	0.1	27.9	250.3	490.7	436.8	309.5	183.1	207.2
2000	0.3	0.0	0.2	0.4	13.9	117.1	244.7	265.6	229.3	156.9	229.7
2001	0.3	0.3	0.3	1.6	23.2	107.6	216.2	255.5	251.3	193.8	236.6
2002	0.4	0.1	0.0	0.3	22.4	160.3	279.7	284.3	249.8	198.1	289.2
2003	0.5	0.2	0.6	2.2	61.0	367.6	582.4	469.8	375.8	249.4	400.9

Table 5a. Estimated annual male bycatch by length (1000 crabs) based on observer data from the directed pot fishery for Bristol Bay red king crabs from June 1 to May 31.

Year	Carapace Length (mm)															
	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5+	Total
1990	1.9	0.0	1.9	13.8	7.9	21.7	11.9	65.0	86.6	131.8	210.7	261.8	320.9	419.4	147.6	15.8	1719
1991	4.8	14.7	28.6	31.1	35.2	57.3	47.4	91.6	90.7	100.6	93.2	163.5	230.6	313.1	136.5	14.7	1454
1992	0.0	2.1	2.8	25.6	51.2	126.6	200.4	263.5	272.8	283.6	272.1	288.4	256.4	186.1	67.6	6.5	2305
1993	5.1	12.1	15.3	13.4	16.7	32.8	83.9	153.5	209.1	290.3	358.6	415.0	408.0	458.3	200.8	14.8	2688
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1996	0.0	0.0	0.0	7.8	31.2	49.4	44.1	18.2	28.6	41.6	36.4	59.7	88.4	119.5	62.4	7.8	595
1997	0.0	0.2	0.5	0.6	1.4	17.9	50.3	99.2	115.4	118.7	93.8	91.2	116.0	129.6	68.3	6.9	910
1998	0.6	1.6	2.5	14.0	22.2	31.7	33.0	55.5	124.1	307.8	444.9	654.3	649.5	574.6	226.6	30.8	3174
1999	0.0	0.0	0.0	7.9	7.9	2.7	7.0	7.9	13.2	26.4	58.1	116.2	195.3	299.1	173.3	7.0	922
2000	0.4	7.1	26.7	67.3	85.4	80.2	82.9	80.9	74.1	77.7	99.2	147.5	208.5	216.5	124.7	13.5	1393
2001	2.6	9.3	15.1	18.7	25.2	49.0	92.2	140.6	163.8	194.2	201.2	229.1	214.1	183.1	78.1	7.3	1624
2002	1.8	9.3	9.2	13.9	9.9	15.9	20.3	51.2	96.2	174.4	235.6	260.4	250.7	241.6	122.6	14.2	1527
2003	28.7	42.2	51.8	112.4	195.7	236.1	255.3	237.5	227.6	212.4	232.2	339.7	468.7	605.6	276.9	22.7	3546

Table 5b. Estimated annual female bycatch by length (1000 crabs) based on observer data from the directed pot fishery for Bristol Bay red king crabs from June 1 to May 31.

Year	Carapace Length (mm)															
	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5+	Total
1990	0.0	3.7	7.7	7.7	15.2	19.2	38.2	179.5	271.4	462.3	450.8	569.4	363.0	191.0	64.9	26.7	2671
1991	2.6	11.6	29.7	46.4	64.5	77.3	59.3	34.8	33.5	27.1	33.5	38.7	16.8	5.1	2.6	1.3	485
1992	1.9	3.1	7.0	42.4	192.4	423.2	467.5	408.0	230.7	196.5	139.0	97.8	97.8	62.4	28.2	11.1	2409
1993	4.2	6.8	12.4	16.6	36.6	91.8	284.5	449.5	406.4	320.0	254.7	240.1	235.0	208.3	122.1	125.5	2815
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1996	0.0	0.0	0.0	0.9	6.4	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
1997	0.0	0.0	0.1	0.1	0.7	2.0	2.7	3.5	5.2	10.4	12.5	10.8	8.8	8.1	4.6	5.6	75
1998	0.8	1.6	3.9	10.1	24.9	70.1	222.1	706.4	898.9	595.0	322.6	333.2	225.2	200.3	131.3	150.4	3897
1999	0.0	0.0	0.0	0.8	0.8	0.8	1.7	0.0	0.0	3.4	4.2	2.5	3.4	3.4	2.5	6.7	30
2000	0.0	5.3	31.5	67.9	63.6	40.1	23.5	9.8	6.4	9.6	13.7	15.7	7.0	4.3	1.4	4.1	304
2001	2.1	3.9	11.9	25.9	46.2	68.1	76.3	68.1	45.2	41.3	68.7	109.4	111.7	51.0	22.9	33.5	786
2002	1.2	5.7	6.9	7.4	5.5	3.1	1.2	1.1	2.6	2.0	1.7	1.2	1.5	1.7	1.5	3.2	48
2003	28.3	37.5	51.1	144.2	223.8	232.0	149.0	95.5	132.6	180.9	202.9	125.9	99.7	101.1	92.2	108.3	2005

Table 6a. Estimated annual male bycatch by length (1000 crabs) based on observer data from the trawl fisheries for Bristol Bay red king crabs from June 1 to May 31 (data in 1993 are not available).

Year	Carapace Length (mm)																			
	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5	147.5	152.5	157.5	162.5+	Total
1976	0.0	0.0	0.0	0.0	0.0	5.0	3.3	1.7	8.3	3.3	10.0	15.0	16.7	25.0	38.3	33.3	28.3	35.0	25.0	50.0	298
1977	2.8	0.7	0.7	0.7	2.0	2.8	6.2	7.6	25.0	38.2	47.2	78.5	85.4	98.5	81.9	83.3	79.1	49.9	25.7	34.7	751
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.8	1.6	9.6	17.7	33.0	56.4	80.5	74.9	51.5	63.6	43.4	121.5	556
1979	13.1	1.0	1.8	1.0	1.8	5.6	2.8	1.8	1.0	4.6	3.8	8.4	16.8	40.9	42.8	52.1	66.1	63.3	59.6	136.8	525
1980	60.6	23.6	11.0	15.4	16.2	18.6	31.3	30.0	43.4	42.8	48.2	45.0	42.0	43.0	35.7	26.4	23.6	16.2	15.0	30.2	618
1981	7.0	0.7	1.2	1.8	3.0	4.7	7.5	9.3	10.3	13.5	11.6	12.8	7.7	8.9	6.4	5.7	3.0	1.7	1.4	2.3	120
1982	55.1	21.0	19.4	25.6	28.0	34.8	32.1	31.7	31.5	37.3	33.5	37.6	31.8	25.6	17.1	12.0	6.6	4.1	3.0	7.8	496
1983	11.4	10.5	16.6	17.0	15.3	15.7	18.6	21.9	23.3	23.2	22.5	21.5	20.2	20.4	18.3	13.9	10.1	6.4	4.7	8.9	320
1984	42.8	18.2	17.2	23.2	31.5	40.0	46.6	47.5	50.3	55.6	59.7	69.6	69.4	65.8	55.3	41.5	30.8	19.9	12.7	17.1	815
1985	1.4	0.4	0.9	1.6	2.7	4.5	7.0	10.9	9.8	12.3	14.8	17.5	23.2	23.7	24.3	23.2	17.5	12.5	8.2	15.9	232
1986	2.2	0.4	1.3	1.7	2.5	3.2	3.8	4.2	3.9	5.0	6.3	8.5	11.8	12.3	12.8	11.2	9.6	6.3	5.2	6.4	119
1987	0.2	0.3	0.7	0.9	1.4	2.1	2.9	3.6	4.1	4.3	5.9	6.3	6.8	7.7	8.0	7.6	7.2	4.4	2.9	3.2	81
1988	9.8	0.4	0.6	1.0	1.9	4.1	6.7	9.2	10.8	12.0	12.5	14.3	16.8	20.3	26.0	30.0	33.0	27.3	18.5	16.9	272
1989	0.1	0.1	0.1	0.1	0.3	0.4	0.9	1.1	1.7	2.5	3.3	5.2	5.5	6.7	8.6	9.3	8.8	8.4	7.0	10.0	80
1990	4.1	1.0	1.5	0.5	1.8	1.3	5.1	2.8	5.7	6.2	4.1	5.4	5.4	7.5	11.8	12.9	13.1	11.1	5.9	11.8	119
1991	8.8	5.3	4.1	1.2	4.1	2.4	3.0	3.0	7.1	4.1	7.7	5.9	5.9	4.1	5.9	13.6	6.5	9.4	9.4	27.1	139
1992	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	3.8	4.7	5.7	11.4	10.5	11.4	10.5	7.6	6.7	1.9	8.6	85
1993																					
1994	0.3	0.3	0.3	0.4	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.4	0.7	1.0	2.1	2.0	2.6	3.8	13.9	28
1995	2.1	0.2	0.9	0.7	0.4	0.9	1.7	1.7	1.0	1.7	1.6	0.7	1.2	1.0	1.0	1.7	2.6	2.1	0.4	1.2	25
1996	0.0	0.0	0.1	0.1	0.7	1.5	2.4	3.2	3.4	3.5	3.5	3.6	3.0	4.0	2.5	3.2	2.9	3.5	3.4	10.8	55
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.9	1.6	2.2	2.4	2.5	3.1	2.8	2.5	2.7	2.2	6.6	30
1998	0.2	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.5	0.7	1.5	2.0	4.2	6.3	7.1	8.5	8.1	7.8	6.3	13.8	68
1999	0.6	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.5	0.9	1.6	4.3	7.4	9.2	12.3	12.1	10.5	7.1	5.8	11.0	84
2000	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	1.4	1.7	1.7	2.0	2.2	2.4	2.6	3.8	4.6	4.9	4.3	12.2	45
2001	0.0	0.0	0.1	0.0	0.2	0.6	0.6	0.8	1.4	1.7	2.1	2.1	2.4	2.9	3.6	4.0	5.4	5.2	5.7	17.9	57
2002	0.0	0.0	0.2	0.5	0.7	0.8	0.9	0.5	0.5	0.5	0.9	1.7	2.1	2.5	3.8	4.1	4.2	3.8	3.7	8.2	40

Table 6b. Estimated annual female bycatch by length (1000 crabs) based on observer data from the trawl fisheries for Bristol Bay red king crabs from June 1 to May 31 (data in 1993 are not available).

Year	Carapace Length (mm)															
	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5+	Total
1976	0.0	0.0	0.0	0.0	0.0	0.0	5.0	3.3	8.3	10.0	11.7	21.7	5.0	10.0	1.7	10.0	87
1977	0.0	0.7	0.7	0.0	0.0	0.7	2.0	4.2	5.5	6.9	4.9	4.2	3.5	2.0	0.7	0.7	37
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	3.2	4.8	16.9	20.9	39.4	90
1979	9.6	1.0	0.0	0.0	4.6	2.8	11.2	34.5	26.1	28.9	40.0	15.8	12.1	13.0	1.0	10.2	211
1980	49.4	18.3	11.0	21.6	32.1	46.7	56.7	53.9	55.8	59.9	41.3	30.2	15.3	9.2	4.5	4.6	510
1981	16.3	6.5	6.5	11.7	14.4	16.2	14.0	11.4	8.4	10.2	8.3	7.1	6.4	4.2	2.5	2.3	147
1982	49.6	18.5	18.6	22.4	29.8	32.4	26.1	19.3	14.9	13.9	12.3	11.3	8.2	6.3	2.7	3.8	290
1983	13.8	11.5	17.3	17.9	17.6	20.1	19.3	15.6	10.9	7.6	4.9	4.3	3.2	2.1	1.5	2.0	170
1984	46.7	18.2	18.1	24.6	34.8	40.2	46.6	41.9	33.5	17.6	9.9	7.0	4.9	3.6	2.2	3.4	353
1985	0.9	0.4	0.7	1.3	2.6	4.7	5.4	5.3	4.5	3.5	3.3	3.0	3.0	1.6	0.7	1.8	43
1986	2.3	0.8	1.3	2.1	3.9	4.7	6.2	5.3	4.9	3.2	2.2	1.1	0.9	0.5	0.4	0.9	41
1987	0.4	0.2	1.5	3.1	3.4	5.1	6.8	6.0	5.4	3.7	2.8	2.1	1.1	0.6	0.3	1.3	44
1988	10.3	1.5	2.6	4.8	9.4	15.8	22.4	19.2	20.0	18.7	13.6	7.7	4.9	2.7	1.1	3.4	158
1989	0.1	0.0	0.1	0.3	0.9	1.4	1.6	3.5	3.6	3.8	3.3	2.8	2.4	1.8	1.0	2.5	29
1990	0.3	0.8	1.8	1.5	1.5	1.8	4.4	4.9	8.5	6.9	6.9	5.7	3.1	1.5	0.3	2.8	53
1991	1.8	0.6	1.2	0.6	0.0	1.2	0.6	1.2	4.7	2.4	3.0	4.7	3.0	4.7	0.6	14.8	45
1992	0.0	0.0	0.0	1.0	13.3	20.0	15.2	15.2	14.3	15.2	20.0	21.9	15.2	14.3	12.4	18.1	196
1993																	
1994	1.5	0.1	0.4	1.3	1.4	1.9	1.3	2.9	1.9	0.7	0.6	0.5	0.7	0.9	0.9	3.1	20
1995	2.3	0.2	0.7	1.0	1.7	0.9	2.4	4.3	5.9	7.7	13.7	11.8	8.0	7.3	5.7	7.8	82
1996	0.0	0.0	0.1	0.3	1.0	1.8	1.9	1.8	2.2	2.2	2.0	1.7	1.6	1.3	0.8	2.7	21
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	1.4	2.2	1.7	1.5	2.0	1.4	1.5	5.6	19
1998	0.0	0.0	0.0	0.0	0.1	0.2	1.0	3.0	3.6	2.5	2.2	1.5	1.8	1.9	2.3	5.7	26
1999	0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.2	0.8	1.6	2.3	3.0	4.5	3.5	2.3	7.3	26
2000	0.1	0.0	0.0	0.1	0.0	0.2	0.5	0.7	0.4	0.7	1.6	2.3	1.8	1.3	0.9	2.5	13
2001	0.1	0.0	0.1	0.1	0.4	0.6	1.0	1.4	1.5	1.8	3.0	5.2	4.6	3.0	2.5	7.9	33
2002	0.0	0.1	0.1	0.4	0.8	0.8	0.6	1.1	2.0	2.2	2.2	3.3	4.1	4.3	4.3	10.2	36

Table 7. Annual catch (millions of crabs) and catch per unit effort of the Bristol Bay red king crab fishery.

Year	Japanese Tanglenet Catch	Japanese Tanglenet Crabs/tan	Russian Tanglenet Catch	Russian Tanglenet Crabs/tan	U.S. Pot/trawl Catch	U.S. Pot/trawl Crabs/potlift	Standardized Crabs/tan
1960	1.949	15.2	1.995	10.4	0.088		15.8
1961	3.031	11.8	3.441	8.9	0.062		12.9
1962	4.951	11.3	3.019	7.2	0.010		11.3
1963	5.476	8.5	3.019	5.6	0.101		8.6
1964	5.895	9.2	2.800	4.6	0.123		8.5
1965	4.216	9.3	2.226	3.6	0.223		7.7
1966	4.206	9.4	2.560	4.1	0.140	52	8.1
1967	3.764	8.3	1.592	2.4	0.397	37	6.3
1968	3.853	7.5	0.549	2.3	1.278	27	7.8
1969	2.073	7.2	0.369	1.5	1.749	18	5.6
1970	2.080	7.3	0.320	1.4	1.683	17	5.6
1971	0.886	6.7	0.265	1.3	2.405	20	5.8
1972	0.874	6.7			3.994	19	
1973	0.228				4.826	25	
1974	0.476				7.710	36	
1975					8.745	43	
1976					10.603	33	
1977					11.733	26	
1978					14.746	36	
1979					16.809	53	
1980					20.845	37	
1981					5.308	10	
1982					0.541	4	
1983					0.000		
1984					0.794	7	
1985					0.796	9	
1986					2.100	12	
1987					2.122	10	
1988					1.236	8	
1989					1.685	8	
1990					3.120	12	
1991					2.631	12	
1992					1.197	6	
1993					2.249	9	
1994					0.000		
1995					0.000		
1996					1.267	16	
1997					1.339	15	
1998					2.216	15	
1999					1.906	12	
2000					1.258	12	
2001					1.287	19	
2002					1.484	20	
2003					2.510	18	

Table 8a. Area-swept survey estimates of male newshell crabs (millions of crabs) by length for Bristol Bay red king crabs.

Year	Carapace Length (mm)																				
	52.5	57.5	62.5	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5	147.5	152.5	157.5	162.5+
1968	0.234	0.691	1.498	1.612	0.947	1.011	1.309	1.898	2.650	3.449	3.432	2.565	2.024	1.939	1.736	1.639	1.505	1.197	1.268	1.392	1.127	0.827	1.384
1969	0.713	0.884	1.757	2.614	2.070	1.565	2.387	3.074	4.235	4.934	6.008	4.958	4.794	4.247	2.757	2.524	2.213	1.827	1.789	1.296	0.931	0.531	0.690
1970	0.071	0.098	0.101	0.211	0.502	1.282	1.418	1.251	0.982	1.260	1.100	1.052	1.684	1.450	1.532	1.890	1.803	1.711	1.312	1.176	0.552	0.271	0.227
1972	0.000	0.000	0.028	0.140	0.498	0.873	1.950	2.293	2.932	3.158	2.401	1.882	1.631	1.860	1.311	1.689	1.591	1.396	1.392	0.540	0.873	0.230	0.484
1973	0.697	1.073	0.861	1.977	4.164	4.670	4.839	3.672	5.491	4.960	6.206	8.050	6.607	5.010	5.426	4.283	3.923	2.919	2.127	1.998	1.046	0.784	0.808
1974	1.112	3.311	4.055	3.569	4.841	7.395	7.098	6.798	5.793	4.056	5.585	4.961	6.096	5.080	6.792	6.595	6.377	5.602	4.815	3.230	1.684	2.993	0.749
1975	1.090	4.520	6.508	7.784	14.116	8.647	9.650	9.656	7.420	7.347	5.614	6.019	6.909	6.363	6.317	6.700	6.021	4.906	5.079	4.085	2.390	1.701	2.409
1976	0.000	0.021	0.282	0.760	4.080	8.908	15.613	18.620	14.306	14.928	10.810	9.218	8.711	9.022	9.701	7.768	8.024	7.205	5.096	4.591	3.196	1.980	1.967
1977	4.757	2.903	1.230	2.535	2.208	2.581	4.178	6.913	12.888	15.097	15.083	13.631	14.761	13.660	13.031	9.761	10.555	10.371	7.905	5.229	3.821	2.808	3.568
1978	2.189	1.042	0.622	1.287	3.590	4.165	6.877	4.941	4.847	4.725	7.817	7.493	8.613	9.143	8.552	9.039	10.316	10.614	9.576	9.529	6.344	5.317	4.512
1979	3.433	6.105	4.266	2.319	2.117	2.812	3.595	3.418	3.995	3.268	3.331	3.270	3.538	4.555	6.253	6.932	6.863	5.819	5.558	5.111	4.281	2.556	4.035
1980	1.715	0.647	0.228	1.372	2.713	5.689	6.266	6.585	6.700	5.622	5.689	5.063	4.267	4.855	4.189	5.993	6.044	6.575	7.520	6.167	5.469	4.348	5.554
1981	0.494	2.111	5.336	4.295	2.750	2.347	3.792	5.633	4.660	4.670	4.566	4.152	4.336	2.866	2.415	1.508	1.456	1.128	0.931	0.576	0.497	0.224	0.747
1982	0.341	2.403	9.787	18.860	19.247	16.186	6.664	5.468	7.149	8.071	6.686	4.439	3.769	4.247	3.014	2.251	1.639	1.040	0.803	0.536	0.128	0.097	0.198
1983	1.538	1.689	1.247	2.427	2.639	3.699	4.987	5.881	5.845	4.242	3.188	2.676	2.573	1.717	1.620	1.004	0.767	0.589	0.139	0.064	0.033	0.000	0.000
1984	0.017	0.057	0.489	1.844	5.165	6.775	7.359	5.085	4.438	3.742	3.943	3.380	2.972	2.300	1.736	1.095	1.169	0.646	0.580	0.241	0.135	0.003	0.036
1985	0.000	0.038	0.030	0.104	0.513	0.977	1.578	2.357	2.328	1.687	1.609	2.370	2.401	2.038	2.002	1.724	1.649	0.947	0.911	0.072	0.129	0.166	0.000
1986	0.000	0.035	0.115	0.494	0.785	1.055	0.932	1.105	0.789	1.850	1.924	2.271	1.599	1.759	1.788	1.500	1.734	1.708	1.015	0.921	0.340	0.054	0.006
1987	0.068	0.189	0.108	0.119	0.575	2.625	4.105	3.688	2.528	2.345	2.348	2.448	1.978	2.518	1.888	2.399	1.913	1.630	1.419	1.153	1.093	0.278	0.219
1988	0.000	0.000	0.000	0.054	0.045	0.280	0.456	0.501	0.897	1.806	1.798	1.532	1.595	1.180	1.316	0.764	1.325	0.989	1.483	1.054	0.697	0.431	0.343
1989	0.993	0.290	0.118	0.065	0.011	0.000	0.103	0.622	1.380	0.731	1.505	0.881	1.705	1.367	1.304	1.792	2.116	1.466	1.350	1.052	0.992	0.555	0.855
1990	0.328	0.132	0.230	0.064	0.515	0.747	1.724	1.562	0.475	0.341	0.283	0.610	1.001	0.906	0.935	0.969	1.009	0.781	1.073	0.755	0.505	0.498	0.892
1991	0.000	0.000	0.029	0.057	0.485	1.186	0.857	1.363	1.081	0.624	1.197	1.007	0.576	0.147	0.523	0.843	0.891	1.087	1.355	1.090	0.727	0.760	1.280
1992	0.056	0.056	0.028	0.029	0.000	0.057	0.328	0.758	0.991	1.511	1.465	1.012	0.994	0.833	1.072	0.700	0.436	0.339	0.484	0.389	0.430	0.357	0.880
1993	0.000	0.030	0.000	0.080	0.432	0.509	0.357	0.331	0.547	0.442	0.753	0.713	1.242	0.990	1.645	0.860	0.670	0.396	0.335	0.297	0.355	0.232	0.320
1994	1.405	1.288	0.351	0.034	0.000	0.064	0.439	0.367	0.261	0.228	0.228	0.357	0.679	0.648	0.587	0.806	1.078	0.427	0.519	0.555	0.418	0.227	0.322
1995	0.000	0.061	0.214	0.921	2.223	1.820	0.733	0.367	0.522	0.706	0.771	0.878	0.974	0.695	0.761	0.845	0.806	1.228	0.757	0.608	0.511	0.216	0.392
1996	0.210	0.574	1.661	1.330	0.621	1.375	2.503	2.873	2.801	1.282	0.937	0.525	0.702	0.639	0.492	0.428	0.152	0.290	0.342	0.318	0.448	0.530	0.606
1997	0.032	0.053	0.056	0.000	0.262	0.160	0.375	0.922	4.092	6.900	7.839	6.599	3.688	2.032	0.979	0.882	0.699	0.842	0.989	1.152	0.767	0.738	1.959
1998	0.131	0.129	0.517	1.521	1.267	0.748	0.913	0.874	0.744	0.994	1.096	1.533	3.311	3.211	2.969	2.613	1.381	0.495	0.563	0.325	0.222	0.096	0.269
1999	0.064	0.250	1.440	1.875	1.123	0.571	0.555	0.551	0.395	0.472	0.455	0.359	0.456	0.630	1.044	1.738	1.882	2.319	2.252	1.438	0.980	0.471	0.538
2000	0.035	0.000	0.113	0.096	0.358	0.909	1.910	1.732	1.245	1.313	1.030	1.363	0.745	0.645	0.978	0.593	0.961	0.594	0.860	0.643	0.404	0.167	0.437
2001	0.030	0.124	0.210	0.300	0.218	0.471	0.667	0.687	1.831	1.592	2.346	1.560	0.919	0.995	0.603	0.452	0.551	0.349	0.252	0.477	0.452	0.451	0.529
2002	0.119	0.542	1.503	3.882	4.724	3.243	1.982	0.878	0.574	0.434	0.526	1.094	1.511	1.513	1.693	0.741	0.624	0.711	0.453	0.382	0.626	0.441	0.353
2003	0.034	0.157	0.811	1.412	0.640	1.305	2.142	3.684	2.944	2.830	1.539	0.803	1.171	0.952	1.924	1.585	2.425	1.961	2.019	1.245	0.809	0.665	1.803
2004	0.584	1.547	3.045	4.385	3.428	3.199	2.319	2.230	1.908	2.766	3.900	3.495	3.416	2.574	1.947	1.204	1.210	1.233	1.764	1.514	2.056	1.146	2.459

Table 8b. Area-swept survey estimates of male oldshell crabs (millions of crabs) by length for Bristol Bay red king crabs.

Year	Carapace Length (mm)																					
	52.5	57.5	62.5	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5	147.5	152.5	157.5	162.5+
1968	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1969	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1970	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1972	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.031	0.000	0.000	0.000	0.025	0.028	0.134	0.263	0.053	0.134	0.155	0.236	0.163	0.079	0.059
1973	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.097	0.179	0.111	0.258	0.206	0.274	0.263	0.282	0.123	0.040
1974	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.000	0.000	0.046	0.036	0.011	0.114	0.145	0.161	0.183	0.233	0.446	0.505	0.218
1975	0.000	0.000	0.000	0.000	0.026	0.000	0.061	0.000	0.031	0.000	0.185	0.201	0.407	0.242	0.345	0.421	0.376	0.502	1.021	0.512	0.588	0.435	0.180
1976	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.005	0.000	0.000	0.003	0.159	0.133	0.229	0.929	0.688	1.363	1.345	0.980	1.290	1.499	0.779	0.504
1977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.140	0.169	0.061	0.228	0.279	0.349	0.809	0.821	0.717	0.936	1.041	0.621	1.153	0.479	0.870
1978	0.000	0.000	0.000	0.043	0.167	0.146	0.556	0.330	1.154	0.782	0.608	0.595	0.524	0.549	0.913	1.299	2.042	1.368	1.042	0.650	0.355	0.377	0.376
1979	0.071	0.163	0.269	0.031	0.186	0.123	0.139	0.139	0.234	0.066	0.128	0.141	0.219	0.303	0.510	0.475	0.893	0.971	0.962	1.196	1.029	0.484	0.983
1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.046	0.000	0.000	0.034	0.081	0.056	0.137	0.183	0.392	0.483	0.305	0.484	0.207	0.555
1981	0.034	0.000	0.000	0.017	0.013	0.066	0.000	0.109	0.124	0.179	0.335	0.351	0.726	0.664	0.878	1.049	1.145	0.889	0.968	0.876	1.074	0.709	1.379
1982	0.000	0.000	0.000	0.000	0.000	0.000	0.133	0.223	0.191	0.288	0.156	0.278	0.330	0.409	0.319	0.848	0.237	0.523	0.219	0.402	0.000	0.000	0.253
1983	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.109	0.030	0.251	0.347	0.355	0.461	0.663	0.682	0.411	0.206	0.219	0.124	0.123	0.091	0.000	0.000
1984	0.000	0.000	0.000	0.000	0.032	0.034	0.018	0.047	0.037	0.159	0.082	0.093	0.274	0.212	0.126	0.248	0.284	0.176	0.194	0.010	0.118	0.000	0.069
1985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.036	0.000	0.070	0.221	0.000	0.138	0.033	0.000	0.061	0.000	0.000
1986	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.066	0.000	0.101	0.035	0.201	0.323	0.460	0.683	0.315	0.230	0.201	0.000	0.066	0.105
1987	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.075	0.000	0.050	0.063	0.140	0.170	0.288	0.530	0.877	0.701	0.895	0.379	0.189	0.029	0.125
1988	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.088	0.000	0.000	0.000	0.000	0.000	0.065	0.116	0.202	0.307	0.354	0.646	0.513	0.290	0.020	0.044
1989	0.032	0.032	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.000	0.001	0.064	0.212	0.076	0.031	0.336	0.430	0.976	1.402	1.124	1.112	0.647	0.332
1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.030	0.032	0.115	0.192	0.153	0.459	0.478	0.687	0.887	0.806	0.617	0.996	0.401	0.617
1991	0.000	0.000	0.000	0.000	0.000	0.031	0.031	0.063	0.094	0.122	0.209	0.090	0.292	0.181	0.226	0.326	0.293	0.875	0.806	0.766	0.509	0.388	0.683
1992	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000	0.064	0.123	0.116	0.129	0.186	0.096	0.097	0.345	0.397	0.365	0.216	0.301	0.497	0.150	0.628
1993	0.000	0.000	0.000	0.000	0.000	0.029	0.056	0.030	0.085	0.143	0.181	0.479	0.437	0.852	0.872	1.111	0.980	0.942	0.804	0.933	0.778	0.661	1.267
1994	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.122	0.057	0.028	0.135	0.092	0.064	0.217	0.259	0.501	0.775	0.569	0.447	0.436	0.261	0.260	0.738
1995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.029	0.095	0.060	0.059	0.185	0.158	0.338	0.562	0.460	0.712	0.488	0.302	0.152	0.488
1996	0.000	0.000	0.030	0.030	0.030	0.030	0.000	0.129	0.030	0.031	0.130	0.033	0.155	0.033	0.222	0.229	0.467	0.736	0.442	0.591	0.375	0.344	0.600
1997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.057	0.060	0.154	0.185	0.206	0.281	0.216	0.246	0.560	0.478	0.545	0.987
1998	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.161	0.190	0.221	0.443	0.983	0.768	0.796	0.891	0.586	1.136	0.789	0.505	1.571
1999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.064	0.105	0.050	0.162	0.186	0.106	0.385	0.584	0.541	0.406	0.489	0.420	0.506	0.741
2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.079	0.065	0.161	0.514	1.007	1.537	1.450	1.157	1.143	0.731	0.257	0.795
2001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.066	0.032	0.033	0.000	0.163	0.164	0.190	0.371	0.251	0.258	0.508	0.421	0.415	0.924
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.085	0.117	0.246	0.567	0.653	1.006	0.648	0.727	1.206	0.514	0.966	1.053	0.975	1.305	1.892
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.033	0.066	0.033	0.160	0.132	0.132	0.297	0.301	0.525	0.755	0.610	0.625	0.551	0.496	1.215
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.047	0.013	0.033	0.032	0.000	0.033	0.007	0.040	0.361	0.362	0.373	0.485	0.358	0.981

Table 8c. Area-swept survey estimates of female crabs (millions of crabs) by length for Bristol Bay red king crabs.

Year	Carapace Length (mm)																	
	52.5	57.5	62.5	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5	127.5	132.5	137.5	142.5+
1968	0.332	1.339	0.975	0.979	2.030	1.789	1.413	2.447	4.373	4.156	4.094	3.806	3.500	2.983	3.293	2.682	2.469	1.149	3.094
1969	1.062	0.961	1.693	3.028	1.516	1.169	1.634	2.952	4.530	4.362	2.911	2.184	2.219	1.965	2.206	1.653	1.344	0.965	1.927
1970	0.085	0.101	0.035	0.204	0.355	1.288	1.391	1.412	2.071	1.980	2.411	1.366	0.868	0.989	0.739	0.758	0.499	0.469	0.774
1972	0.000	0.000	0.000	0.087	0.415	1.451	2.241	3.484	3.404	3.624	2.318	1.622	0.894	0.737	0.322	0.264	0.206	0.081	0.227
1973	0.993	0.486	1.698	1.842	2.622	3.002	4.532	5.945	10.067	12.519	14.971	10.565	7.761	5.601	5.294	3.379	2.350	1.871	1.791
1974	1.064	3.276	3.627	2.986	6.102	6.674	5.884	7.750	11.208	13.628	14.619	9.089	8.656	4.103	4.702	2.291	1.734	1.275	0.738
1975	1.772	4.556	4.634	10.954	13.018	12.940	12.134	14.583	10.803	9.832	10.093	7.956	7.016	3.944	3.726	2.805	1.133	0.749	0.733
1976	0.000	0.345	0.058	0.993	2.915	9.612	17.071	20.650	17.358	13.589	8.493	5.971	6.804	5.062	4.118	2.068	1.320	0.369	0.970
1977	6.879	3.605	3.259	2.888	4.208	3.355	7.756	12.866	25.368	29.362	26.334	16.724	16.264	15.849	13.273	6.424	4.114	1.513	1.772
1978	2.454	0.944	0.832	1.876	3.488	5.805	6.154	7.017	12.818	26.631	34.097	22.320	12.175	7.038	5.631	3.483	2.328	0.625	1.333
1979	5.775	11.350	6.124	2.903	2.171	2.477	4.122	5.506	6.422	10.610	16.293	20.373	19.788	10.863	5.964	4.529	2.013	0.918	1.047
1980	1.217	0.610	0.142	0.897	4.527	6.887	5.725	13.114	18.207	9.992	10.844	10.558	8.186	5.984	2.599	1.925	1.099	0.657	0.399
1981	0.569	1.510	5.072	5.664	3.358	2.831	3.747	5.769	6.607	6.423	6.667	7.737	9.324	9.293	5.640	2.803	1.732	0.466	0.352
1982	0.345	1.891	5.993	12.756	22.657	14.326	8.976	10.020	11.399	9.432	5.533	4.543	6.136	6.688	4.818	2.763	1.484	0.571	0.203
1983	2.023	1.773	1.713	1.291	2.841	3.527	4.699	4.817	2.955	2.522	1.135	0.796	0.316	0.665	0.427	0.463	0.153	0.101	0.000
1984	0.000	0.069	0.550	2.298	5.426	7.565	6.500	4.665	4.083	3.377	1.941	0.672	0.445	0.088	0.139	0.022	0.049	0.029	0.000
1985	0.000	0.000	0.034	0.034	0.621	1.514	2.087	2.575	2.215	2.049	1.556	0.639	0.270	0.000	0.000	0.058	0.000	0.000	0.000
1986	0.000	0.033	0.117	0.546	0.983	1.544	1.172	1.186	1.455	1.569	1.649	1.164	0.488	0.333	0.035	0.017	0.000	0.033	0.000
1987	0.016	0.060	0.097	0.102	0.947	4.050	7.038	5.955	3.689	3.525	4.538	3.239	2.312	1.426	0.620	0.137	0.032	0.000	0.000
1988	0.000	0.000	0.000	0.026	0.325	0.270	0.236	0.652	2.968	3.990	4.191	2.969	2.445	1.708	0.761	0.230	0.316	0.000	0.000
1989	0.702	0.256	0.096	0.064	0.000	0.075	0.325	1.227	3.027	2.712	2.877	2.340	1.605	1.319	0.784	0.239	0.202	0.000	0.001
1990	0.331	0.331	0.294	0.196	0.262	1.175	2.579	2.644	0.356	1.296	2.885	3.578	3.375	2.950	1.895	0.955	0.270	0.176	0.173
1991	0.029	0.064	0.030	0.229	0.628	1.060	1.738	1.173	1.925	1.934	1.736	2.051	1.827	1.567	2.447	1.301	0.617	0.377	0.161
1992	0.000	0.028	0.056	0.000	0.158	0.217	0.589	1.094	1.224	1.889	1.355	1.050	0.951	1.328	1.194	0.786	0.619	0.479	0.351
1993	0.079	0.142	0.062	0.257	0.316	0.694	0.302	0.520	0.990	1.683	2.466	2.290	0.971	1.043	1.022	0.931	1.514	0.583	0.748
1994	1.823	0.429	0.214	0.000	0.034	0.092	0.061	0.352	0.194	0.259	0.447	0.907	0.867	0.759	0.588	0.829	0.983	0.616	0.673
1995	0.000	0.000	0.241	0.956	1.571	1.026	0.487	0.459	0.612	0.537	0.840	0.774	1.104	0.900	0.764	0.792	0.486	0.673	0.505
1996	0.030	0.453	1.449	1.270	1.053	2.044	3.779	3.767	2.112	1.091	1.056	1.195	0.961	0.771	1.367	1.160	0.747	0.415	1.130
1997	0.027	0.053	0.083	0.030	0.268	0.117	0.145	1.061	5.752	7.033	4.486	1.560	1.009	0.694	1.062	1.068	0.786	0.624	1.496
1998	0.033	0.129	0.544	1.062	1.437	0.729	0.634	0.813	0.843	2.222	7.741	8.543	4.360	2.280	1.913	1.709	1.756	1.741	2.498
1999	0.032	0.030	0.352	1.197	0.826	0.622	0.568	0.218	0.271	0.469	0.819	2.561	4.025	2.911	1.714	1.680	0.941	0.593	1.259
2000	0.000	0.000	0.065	0.097	0.375	1.207	1.949	1.854	1.532	1.361	1.198	1.981	2.920	3.776	3.366	2.319	1.160	0.968	2.378
2001	0.032	0.000	0.245	0.246	0.738	0.854	0.597	1.138	2.656	3.503	2.594	1.769	1.807	1.308	3.119	2.558	1.193	0.470	0.938
2002	0.183	0.566	1.601	3.717	5.733	3.617	1.816	1.639	1.295	1.657	3.864	2.963	2.186	1.195	1.523	1.506	1.631	0.515	0.997
2003	0.000	0.156	0.566	1.563	0.542	1.304	2.934	3.937	4.380	2.272	2.716	3.298	4.992	4.906	3.357	2.041	2.460	2.001	3.315
2004	0.404	1.482	3.615	3.298	3.864	2.318	1.425	2.184	3.119	4.741	4.974	3.358	2.473	2.432	2.779	2.209	1.977	1.538	2.786

Table 9. Average weight and assumed maximum number of female mates for male red king crabs in Bristol Bay by length-class.

Male Carapace Length (mm)	Average Male Weight (kg)	Number of Female Mates
0-119		0.0
120-124	1.43	1.0
125-129	1.63	1.2
130-134	1.84	1.4
135-139	2.06	1.6
140-144	2.31	1.8
145-149	2.58	2.1
150-154	2.86	2.4
155-159	3.17	2.7
160+	3.50	3.0

Table 10. Summary of parameter estimates for a length-based population model of male red king crabs in Bristol Bay with four model scenarios. The abundance in 1972, N_{72}, recruits, R_t, and mature males are in millions of crabs.

Parameter	Scenario A1-1	A1-2	A1-3	A1-4
N_{72}	37.430	35.760	40.358	37.345
β	0.653	0.651	0.787	0.660
β_r	1.252	1.172	1.120	1.255
α_1	345288.69	376486.69	332286.34	356668.22
α_2	35281.22	38864.70	12632.92	34667.24
α_3	353885.31	363124.81	309133.34	327676.17
β_1	0.082	0.083	0.082	0.082
β_2	0.081	0.081	0.073	0.081
β_3	0.090	0.090	0.089	0.090
M_1	0.225	0.192	0.273	0.224
M_2	1.050	1.061	NA	1.049
M_3	0.122	NA	NA	0.116
R_{73}	31.186	27.566	36.914	31.053
R_{74}	23.006	21.118	24.693	22.932
R_{75}	33.469	30.589	36.790	33.331
R_{76}	45.692	41.184	50.734	45.565
R_{77}	57.617	51.887	46.921	57.378
R_{78}	25.185	23.679	11.056	25.108
R_{79}	13.885	13.658	4.623	13.862
R_{80}	25.140	25.463	4.756	25.095
R_{81}	17.928	18.367	4.071	17.899
R_{82}	22.069	22.481	4.936	22.072
R_{83}	12.180	12.364	4.347	12.202
R_{84}	18.272	18.142	7.489	18.414
R_{85}	9.730	8.406	9.757	9.780
R_{86}	7.096	6.366	8.635	7.076
R_{87}	6.800	6.078	8.064	6.760
R_{88}	7.072	6.322	8.952	7.019
R_{89}	5.787	5.233	7.595	5.708
R_{90}	1.620	1.563	1.708	1.608
R_{91}	4.359	4.310	5.748	4.300
R_{92}	5.993	6.351	9.720	5.918
R_{93}	2.572	2.847	3.625	2.542
R_{94}	1.187	1.322	1.502	1.175
R_{95}	2.929	3.483	4.729	2.883
R_{96}	3.191	3.600	4.549	3.152
R_{97}	13.326	14.360	21.136	13.171
R_{98}	3.283	3.157	3.633	3.272
R_{99}	1.459	1.451	1.551	1.455
R_{00}	3.767	3.872	4.459	3.753
R_{01}	8.017	9.125	11.095	8.170
R_{02}	2.368	2.498	2.512	2.515
R_{03}	5.817	6.052	6.272	6.048
R_{04}	15.132	15.174	15.200	14.975
RSS	145.037	147.480	264.610	141.145
df	853	854	855	853
Mature males	15.967	14.348	12.172	16.533

Table 11. Summary of parameter estimates for a length-based population model of female red king crabs in Bristol Bay with four model scenarios. The abundance in 1972, N_{72}, recruits, R_t, and mature females are in millions of crabs.

Parameter	Scenario A1-1	A1-2	A1-3	A1-4
N_{72}	59.465	40.054	58.027	59.434
$ß$	1.018	1.108	1.183	0.890
$ß_r$	0.456	0.465	0.618	0.464
M_1	0.496	0.318	0.510	0.498
M_2	1.765	1.934	NA	1.768
M_3	0.361	NA	NA	0.364
M_4	0.064	NA	NA	0.059
R_{73}	35.233	18.274	31.297	35.220
R_{74}	28.883	17.636	24.232	28.826
R_{75}	22.344	15.740	17.719	22.346
R_{76}	34.160	24.456	28.138	34.155
R_{77}	74.977	49.893	37.978	74.829
R_{78}	49.568	38.722	1.000	49.524
R_{79}	21.499	19.347	21.482	21.558
R_{80}	36.208	32.597	1.000	36.253
R_{81}	14.205	14.377	1.000	14.241
R_{82}	18.166	20.719	1.000	18.211
R_{83}	4.566	4.873	2.474	4.562
R_{84}	7.928	8.314	3.707	7.910
R_{85}	5.615	5.302	4.061	5.614
R_{86}	4.038	3.717	4.661	4.042
R_{87}	10.317	9.503	19.535	10.345
R_{88}	6.279	6.349	11.895	6.288
R_{89}	5.945	6.218	12.116	5.970
R_{90}	0.938	0.964	1.131	0.944
R_{91}	3.853	4.515	6.998	3.856
R_{92}	3.356	4.870	9.416	3.335
R_{93}	2.229	3.084	4.504	2.225
R_{94}	0.404	0.469	0.512	0.404
R_{95}	1.592	2.128	2.384	1.587
R_{96}	4.375	5.807	6.034	4.347
R_{97}	16.284	25.184	53.803	16.244
R_{98}	1.774	1.769	2.074	1.794
R_{99}	0.654	0.645	0.687	0.663
R_{00}	4.719	4.975	5.345	4.694
R_{01}	7.658	11.361	15.986	7.894
R_{02}	2.632	3.101	3.701	2.713
R_{03}	7.473	8.559	9.901	7.694
R_{04}	9.052	9.691	10.679	8.959
RSS	43.900	69.082	261.005	43.687
df	314	316	317	314
Mature females	35.345	27.276	23.793	36.030

Table 12. Annual abundance estimates (millions of crabs), effective spawning biomass (ESB, millions of pounds), and 95% confidence intervals for 2004 for red king crabs in Bristol Bay estimated by length-based analysis from 1972-2004 for the base scenario (A1-1). Size measurements are mm CL.

Year	Males					Females		ESB
Year	Recruits	Small	Prerec.	Mature	Legal	Recruits	Mature	ESB
mm→	(to model)	(95-109)	(110-134)	(>119)	(>134)	(to model)	(>89)	(M lbs)
1972	NA	13.120	14.608	17.962	9.706	NA	59.465	53.833
1973	31.186	21.480	25.116	22.155	10.489	35.233	71.189	61.959
1974	23.006	16.309	33.797	33.826	14.968	28.883	71.981	93.023
1975	33.469	23.099	34.851	40.407	20.849	22.344	65.969	116.699
1976	45.692	31.582	44.437	48.454	25.234	34.160	74.172	128.012
1977	57.617	39.925	59.079	61.709	30.446	74.977	119.899	165.008
1978	25.185	18.526	59.814	76.460	40.132	49.568	122.040	203.999
1979	13.885	10.047	37.336	74.481	48.631	21.499	95.459	170.907
1980	25.140	17.257	25.851	59.805	44.502	36.208	94.185	167.942
1981	17.928	12.868	16.814	18.066	9.423	14.205	71.300	58.815
1982	22.069	15.427	15.017	9.691	2.911	18.166	30.342	22.963
1983	12.180	8.924	12.255	8.423	2.429	4.566	9.723	16.363
1984	18.272	12.687	11.573	7.363	2.271	7.928	9.583	14.387
1985	9.730	7.147	9.809	6.439	1.688	5.615	7.239	10.773
1986	7.096	5.134	11.887	11.216	4.290	4.038	9.036	14.338
1987	6.800	4.828	10.619	13.164	6.595	10.317	16.581	26.006
1988	7.072	4.995	9.855	13.933	8.029	6.279	17.749	29.561
1989	5.787	4.143	9.374	15.167	9.496	5.945	18.262	31.756
1990	1.620	1.304	7.145	14.960	10.123	0.938	13.616	26.238
1991	4.359	2.988	4.843	11.785	8.661	3.853	13.334	25.775
1992	5.993	4.176	5.955	9.906	6.761	3.356	12.616	24.651
1993	2.572	2.194	6.836	10.077	5.998	2.229	10.994	22.146
1994	1.187	1.042	5.311	8.586	4.893	0.404	8.047	17.552
1995	2.929	2.093	4.566	9.314	6.228	1.592	9.138	20.178
1996	3.191	2.400	5.113	10.222	7.088	4.375	12.931	26.710
1997	13.326	9.073	8.496	11.533	7.517	16.284	28.369	39.183
1998	3.283	3.332	13.109	15.306	7.817	1.774	28.210	51.427
1999	1.459	1.145	8.033	15.806	9.742	0.654	20.299	43.336
2000	3.767	2.654	5.733	12.872	8.859	4.719	18.860	39.589
2001	8.017	5.672	7.228	11.732	7.813	7.658	20.762	40.912
2002	2.368	2.294	9.289	13.552	7.943	2.632	22.027	45.900
2003	5.817	4.027	7.661	15.064	10.054	7.473	28.111	57.625
2004	15.132	10.381	11.339	15.967	10.358	9.052	35.345	61.868

95% Confidence Limits in 2004

Lower	10.842	NA	9.035	12.332	7.630	7.176	29.276	NA
Upper	24.103	NA	14.000	18.943	12.814	14.930	45.044	NA

Table 13. Summary of 1994-2004 effective spawning biomass and mature male abundance estimates made in the terminal years and 2004, GHLs estimated from abundance assessments in the terminal years and 2004, actual GHLs set, and mature

male harvest rates based on the actual GHLs and targeted mature male harvest rates based on the abundance assessments made in 2004 under the base scenario.

Year	Effe. Spa. Biomass (millions of pounds)		Mature Males (millions of crabs)		GHL (millions of pounds)			Mature Male Harvest Rate	
	2004	Terminal	2004	Terminal	2004	Terminal	Actual	Actual	Target[1]
1994	17.553	18.064	8.586	9.124	0.00	0.00	0.00	0.00	0.00
1995	20.177	18.119	9.314	8.484	10.93	0.00	0.00	0.00	0.20
1996	26.711	20.263	10.222	7.795	6.50	4.96	5.00	0.08	0.10
1997	39.183	31.414	11.533	10.495	7.57	6.88	7.00	0.09	0.10
1998	51.427	56.323	15.306	17.314	9.64	16.36	16.40	0.17	0.10
1999	43.336	47.074	15.806	18.063	9.33	10.66	10.66	0.11	0.10
2000	39.588	39.936	12.872	13.663	7.86	8.35	8.35	0.10	0.10
2001	40.911	40.594	11.732	10.998	7.63	7.15	7.15	0.09	0.10
2002	45.900	37.706	13.552	14.262	8.81	9.27	9.27	0.11	0.10
2003	57.624	60.698	15.064	16.368	14.46	15.71	15.71	0.16	0.15
2004	61.868	61.868	15.967	15.967	15.42	15.42	15.42	0.15	0.15
Total	406.55	395.87	139.95	142.53	98.15	94.76	94.96		

[1]Target harvest rate was fixed at 0.2 before 1996, and from 1996 to 2004, target harvest rates were determined from Figure 1.

Figure Captions

Figure 11a. Comparison of area-swept and model estimated length frequencies of Bristol Bay newshell male red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (3 *M*) and dotted lines for A1-3 (1 *M*)).

Figure 11b. Comparison of area-swept and model estimated length frequencies of Bristol Bay oldshell male red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (3 *M*) and dotted lines for A1-3 (1 *M*)).

Figure 11c. Comparison of area-swept and model estimated length frequencies of Bristol Bay female red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (4 *M*) and dotted lines for A1-3 (1 *M*)).

Figure 12. Comparison of estimated probabilities of molting of male red king crabs in Bristol Bay for different periods. Molting probabilities for periods 1954-1961 and 1966-1969 were estimated by Balsiger (1974) from tagging data. Molting probabilities for the other periods were estimated under the base scenario.

Figure 13. Retained catch, mature male crab harvest rate, and legal male crab harvest rate of red king crabs in Bristol Bay from 1972 to 2004 under the base scenario. The harvest rates in 2004 were obtained from the current harvest strategy.

Figure 14. Comparison of mature (top) and legal (bottom) male abundance estimates of Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-2004 under the base scenario and by area-swept methods. Legend shows the year in which the assessment was conducted. For each assessment year, abundances were estimated from 1972 to the terminal year.

Figure 15. Comparison of mature female abundance estimates (top) and effective spawning biomass estimates (bottom) of Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-2004 under the base scenario and by area-swept methods. Legend shows the year in which the assessment was conducted. For each assessment year, abundances were estimated from 1972 to the terminal year.

Figure 16. Estimates of natural mortalities of male (top) and female (bottom) Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-

2004 under the base scenario. Legend shows the year in which the assessment was conducted.

Figure 17. Relationships between effective spawning biomass and total recruits at age 7 (i.e., 8-year time lag) for Bristol Bay red king crabs under the base scenario. Numerical labels are brood year (year of mating), the solid line is a general Ricker curve, the dotted line is an autocorrelated Ricker curve without υ_t values (equation 9), and the dashed line is a Ricker curve fit to recruitment data after 1974 brood year. The vertical dotted line is the targeted rebuilding level of 55 million lbs of effective spawning biomass.

Figure 18. Average clutch fullness and proportions of empty clutches of newshell (shell conditions 1 and 2) mature female crabs >89 mm CL from 1975 to 2004 from survey data. Oldshell females were excluded.

Figure 19. Recruits of Bristol Bay red king crabs and anomalies of the Aleutian Low index. A 7-year lag from hatching to recruitment was used.

Figure 20. Length frequency distributions of male (top panel) and female (bottom panel) red king crabs in Bristol Bay from NMFS trawl surveys during 1999-2004. For purposes of these graphs, abundance estimates are based on area-swept methods.

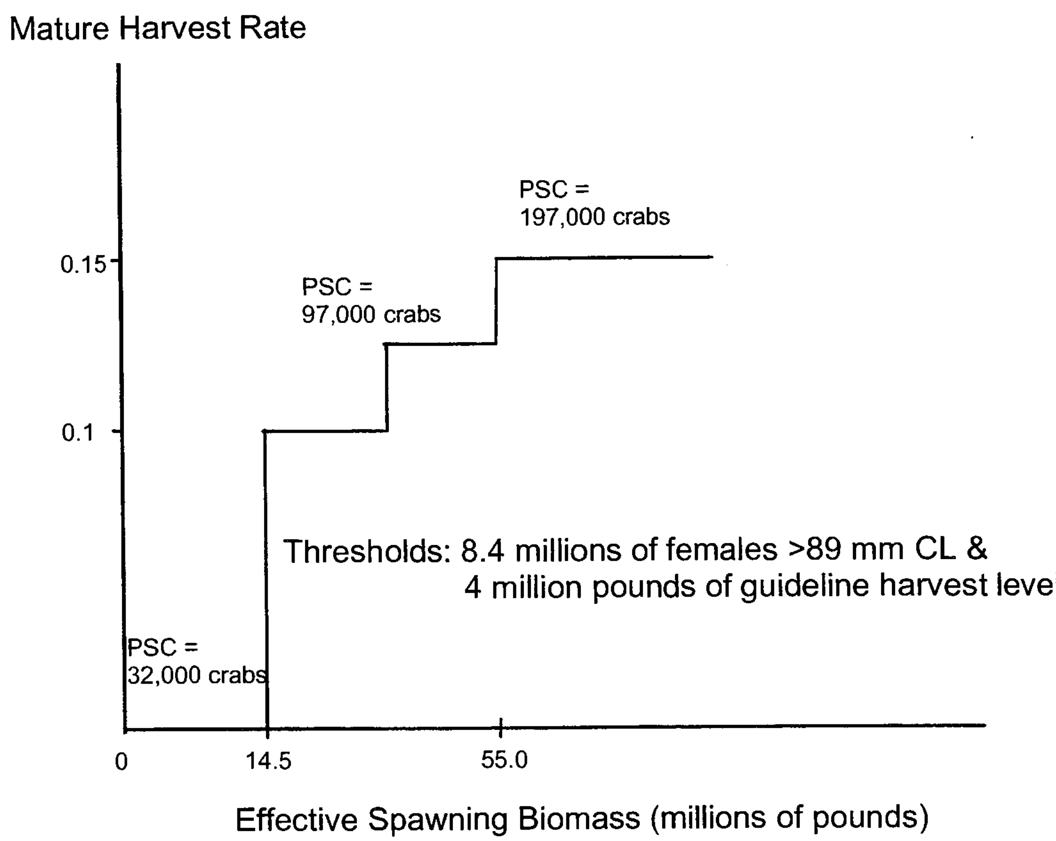


Figure 1. Current harvest rate strategy (line) for the Bristol Bay red king crab fishery and annual prohibited species catch (PSC) limits (numbers of crabs) of Bristol Bay RKC in the groundfish fisheries in zone 1 in the eastern Bering Sea. Harvest rates are based on current-year estimates of effective spawning biomass (ESB), whereas PSC limits apply to previous-year ESB.

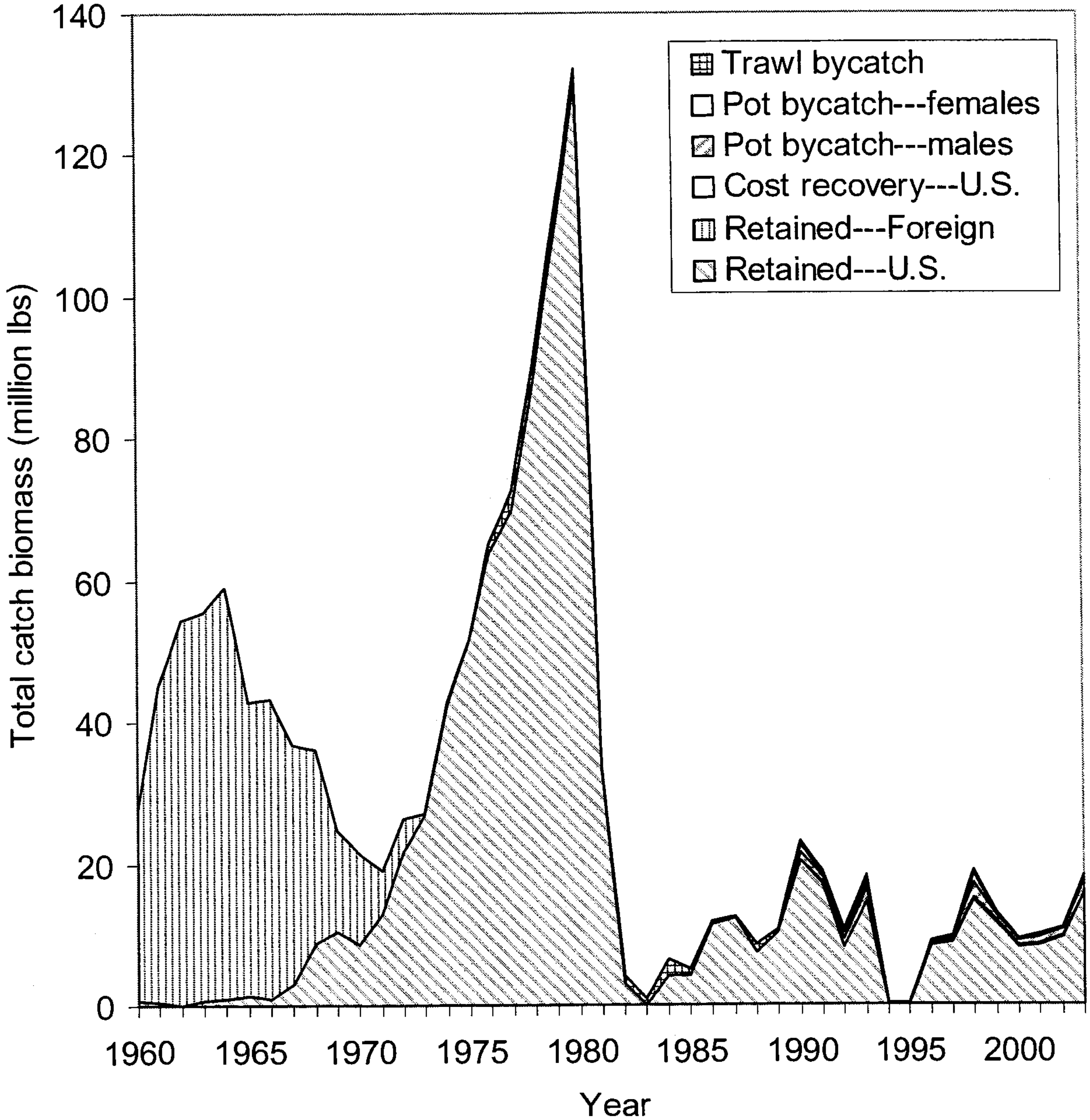


Figure 2. Retained catch biomass and bycatch mortality biomass (million lbs) for Bristol Bay red king crabs from 1960 to 2003. Handling mortality rates were assumed to be 0.2 for the directed pot fishery and 0.8 for the trawl fisheries.

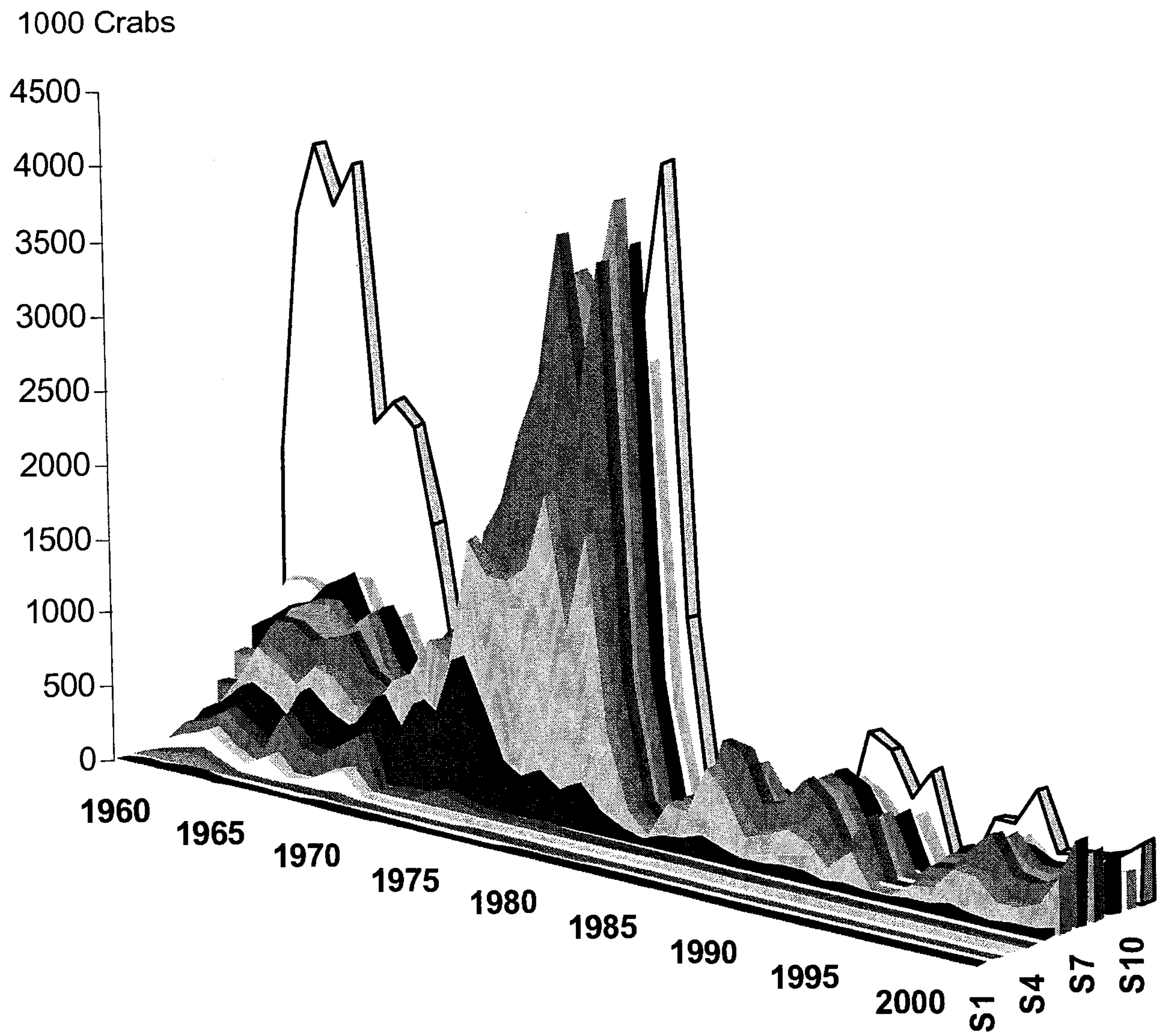


Figure 3. Retained catches by length for Bristol Bay red king crabs from 1960 to 2003. "S1"..."S11" represent size groups 112.5 mm to 162.5+ mm CL.

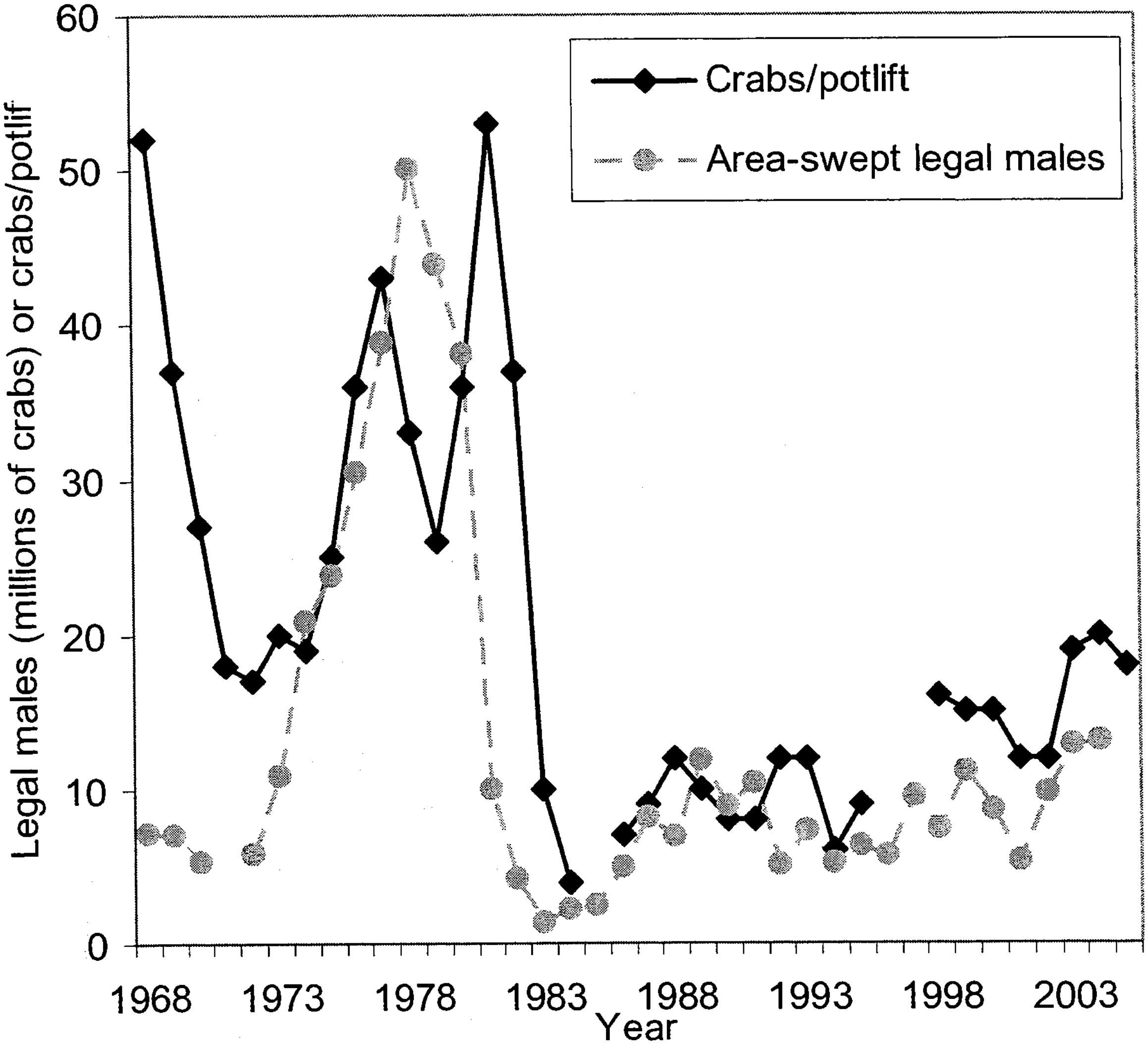


Figure 4. Comparison of survey legal male abundances and catches per unit effort for Bristol Bay red king crabs from 1968 to 2003.

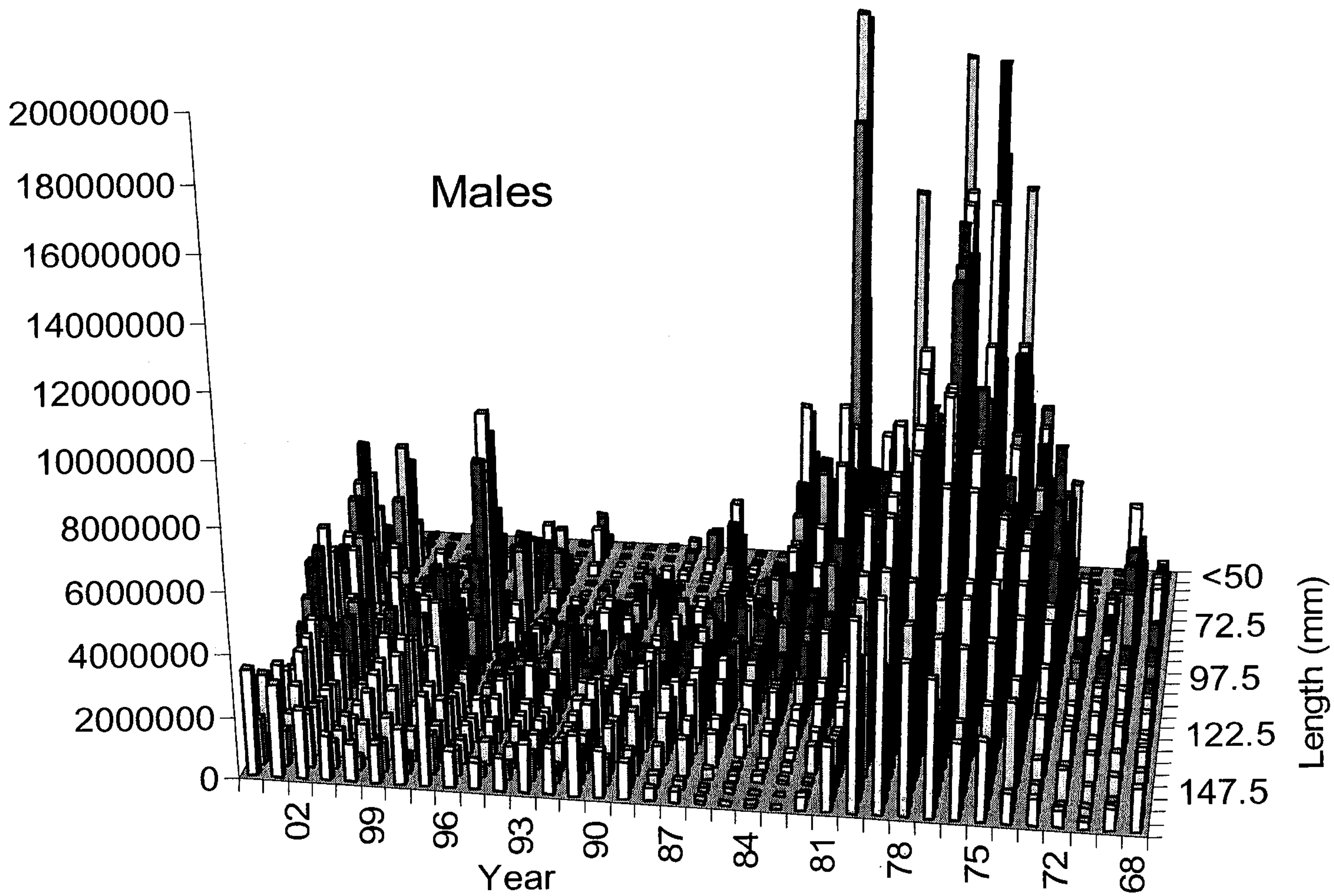


Figure 5a. Survey abundances by length for male Bristol Bay red king crabs from 1968 to 2004.

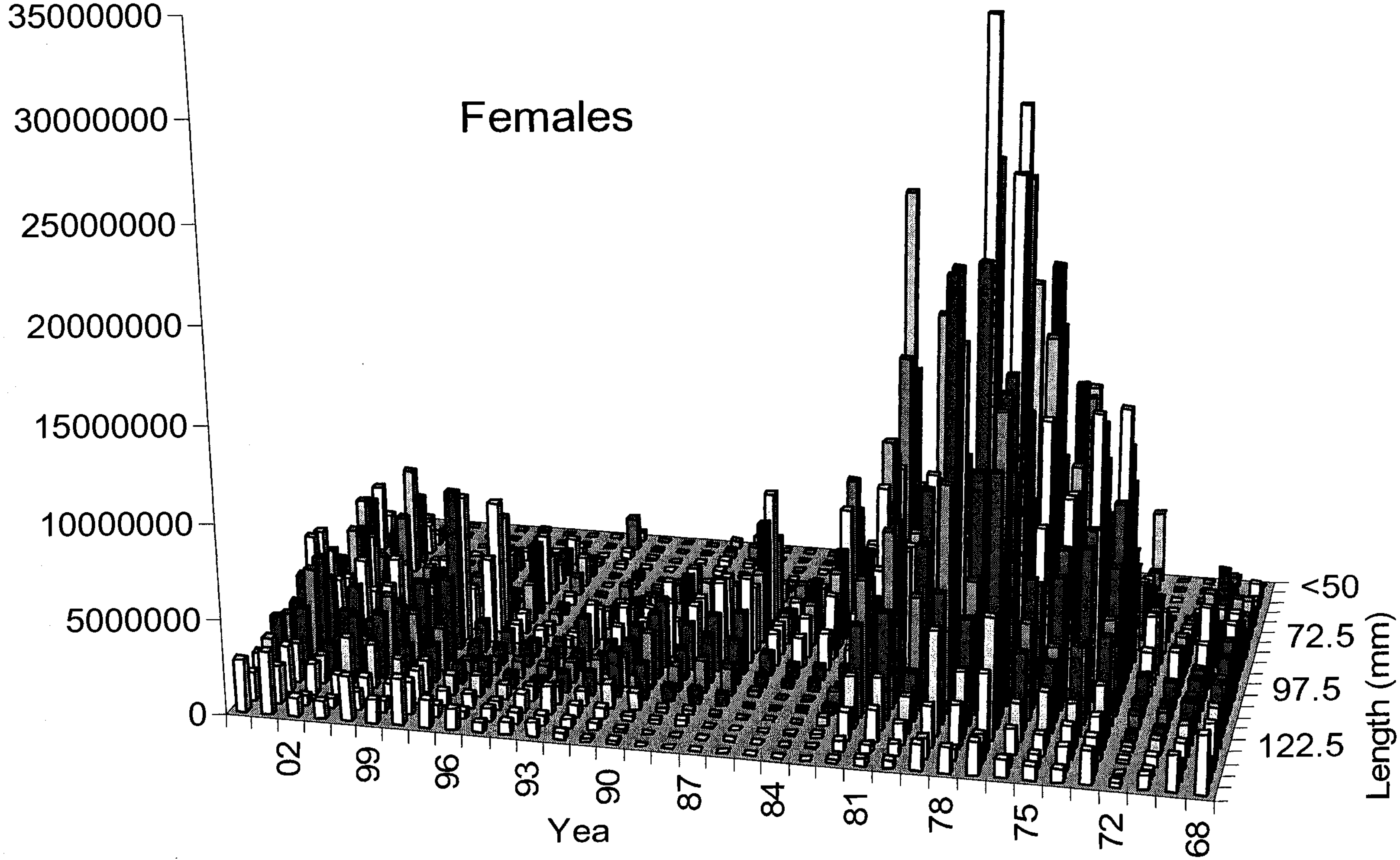
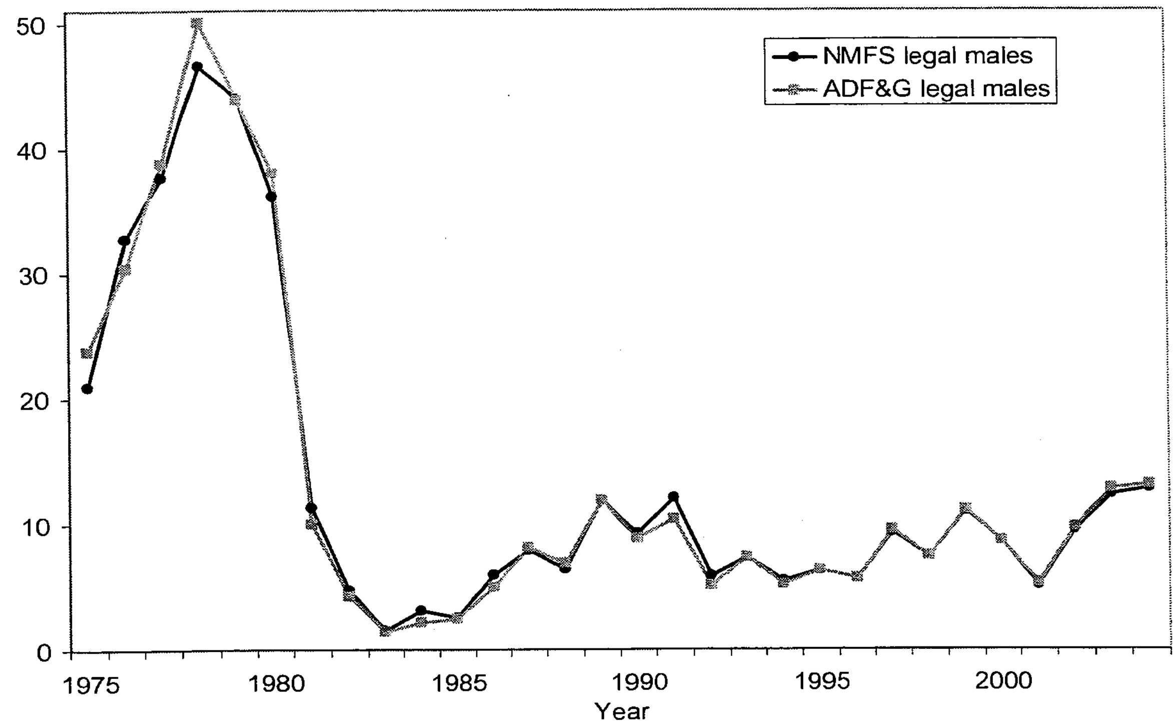


Figure 5b. Survey abundances by length for female Bristol Bay red king crabs from 1968 to 2004.



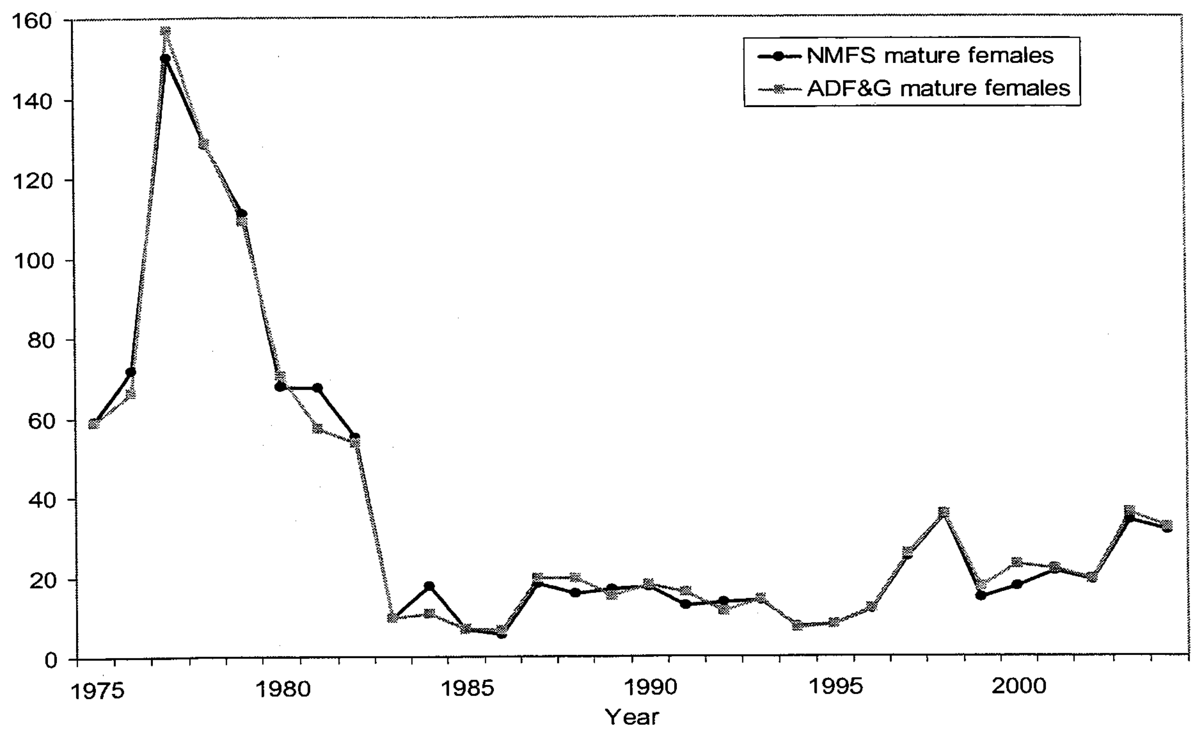
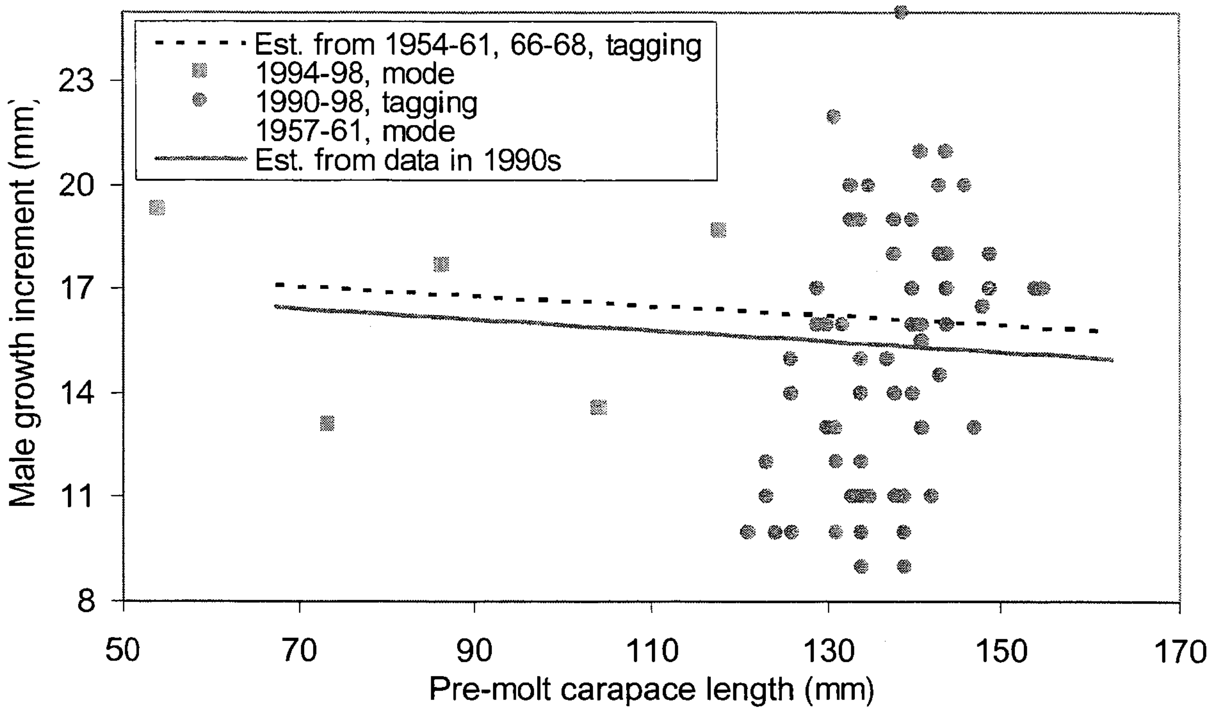


Figure 6. Comparison of survey abundance estimates (millions of crabs) by NMFS and ADF&G for Bristol Bay red king crabs from 1975 to 2004.



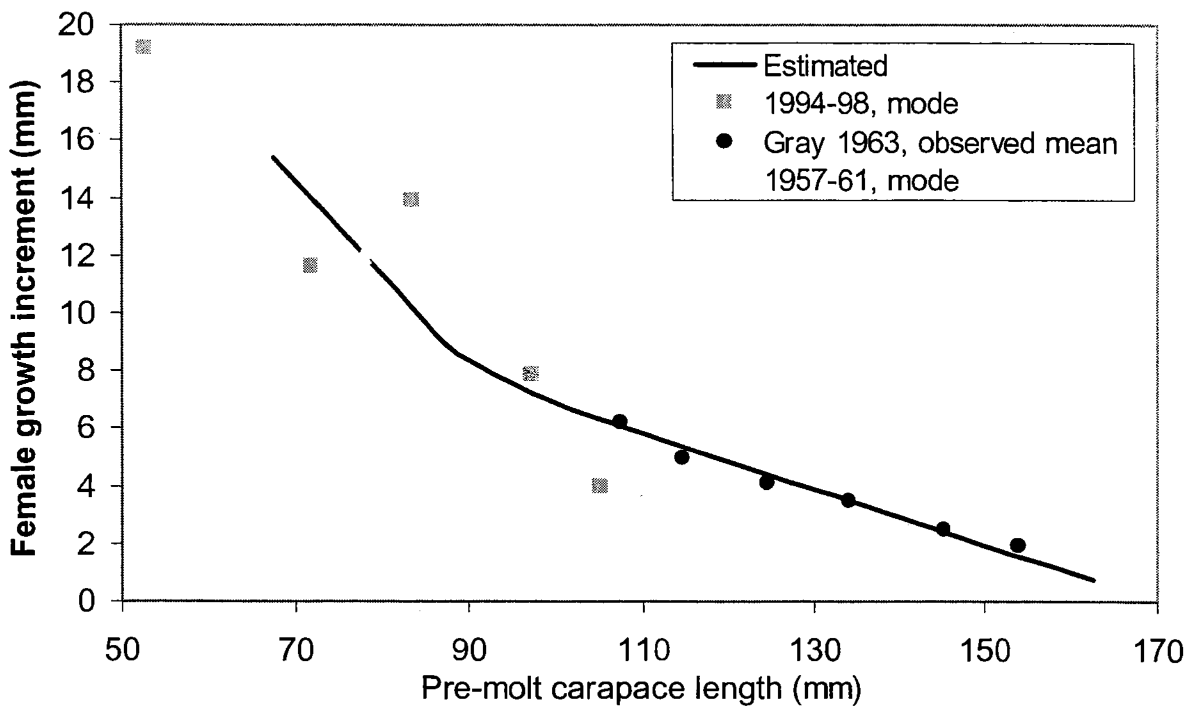


Figure 7. Mean growth increments per molt for Bristol Bay red king crabs. Note: "tagging"---based on tagging data; "mode"---based on modal analysis.

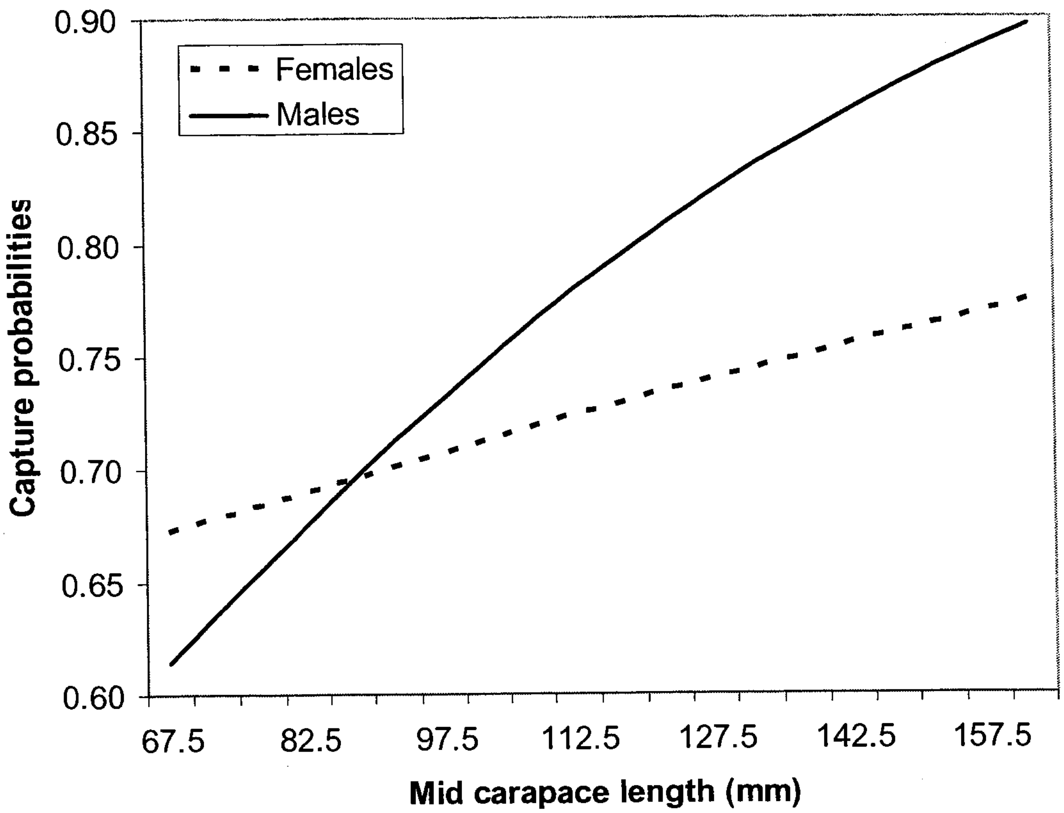


Figure 8. Estimated capture probabilities for Bristol Bay red king crab trawl survey by Weinberg et al. (2004).

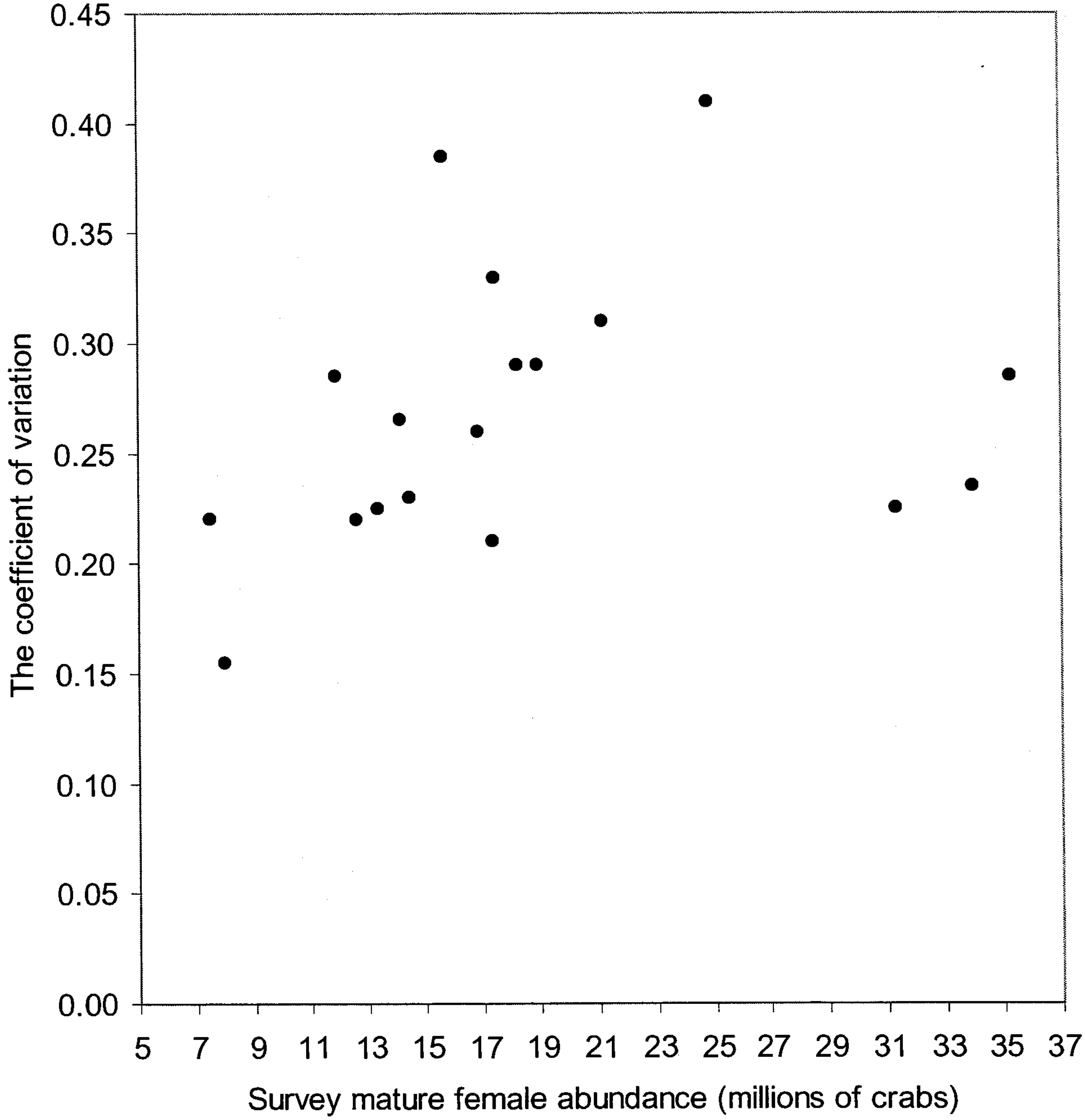


Figure 9. The relationship between estimated survey mature female abundance and the coefficient of variation estimated by NMFS from 1987 to 2004 for Bristol Bay red king crabs.

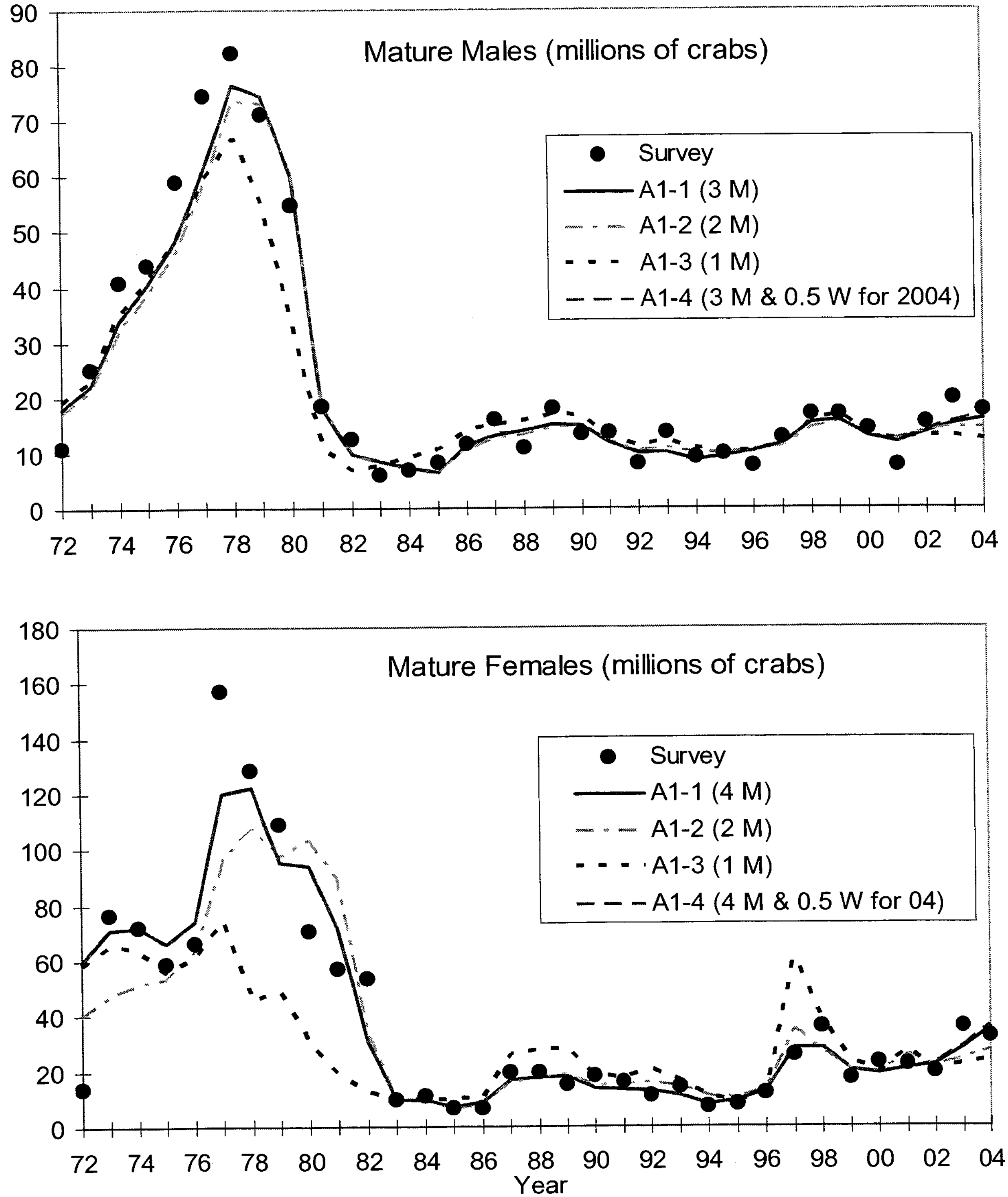


Figure 10. The length-based analysis fit (lines) to area-swept estimates (dots) of mature male (top panel) and mature female (bottom panel) Bristol Bay red king crab abundance (millions of crabs) for four model scenarios A1-1 – A1-4 with different levels of natural mortality.

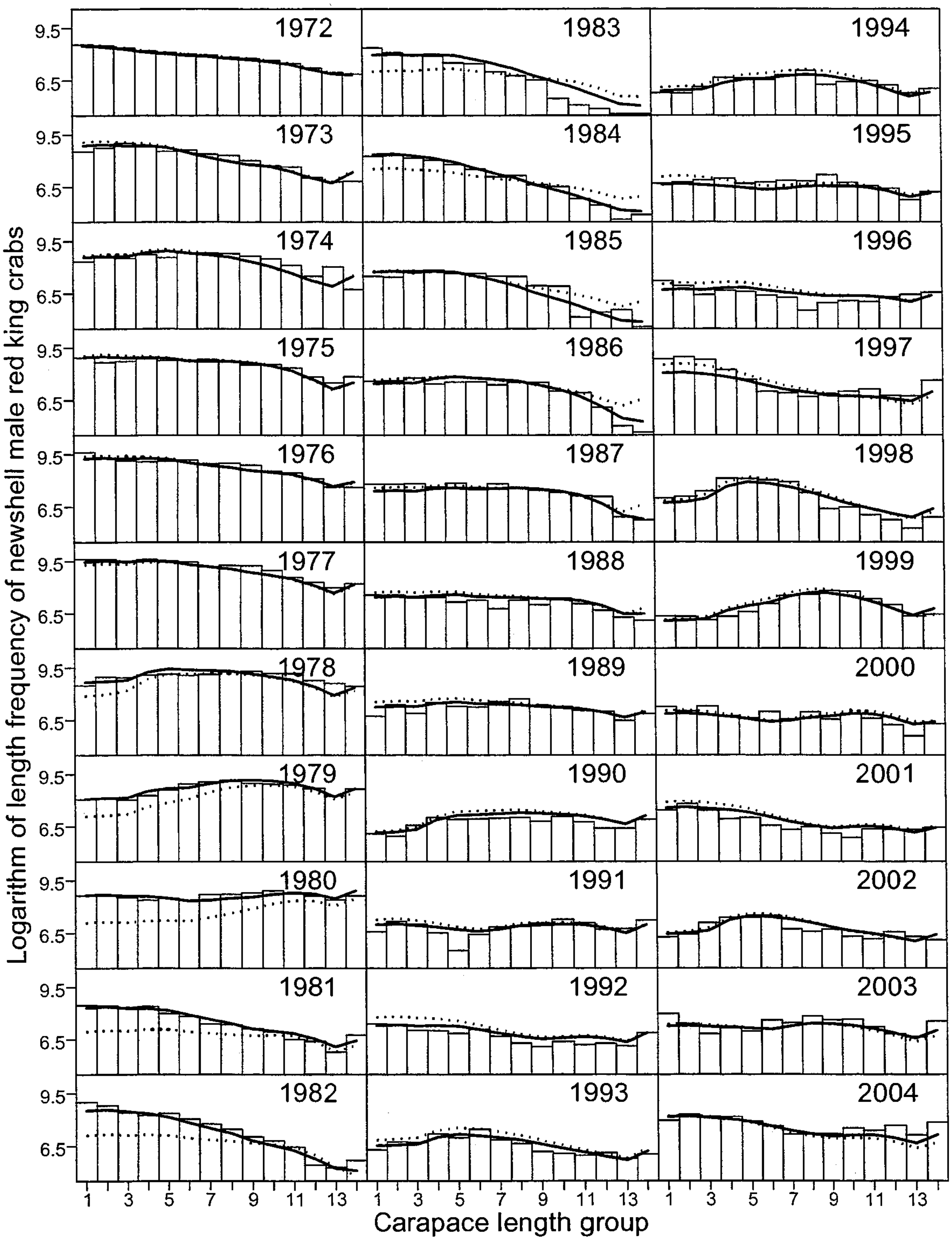


Figure 11a. Comparison of area-swept and model estimated length frequencies of Bristol Bay newshell male red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (3 *M*) and dotted lines for A1-3 (1 *M*)).

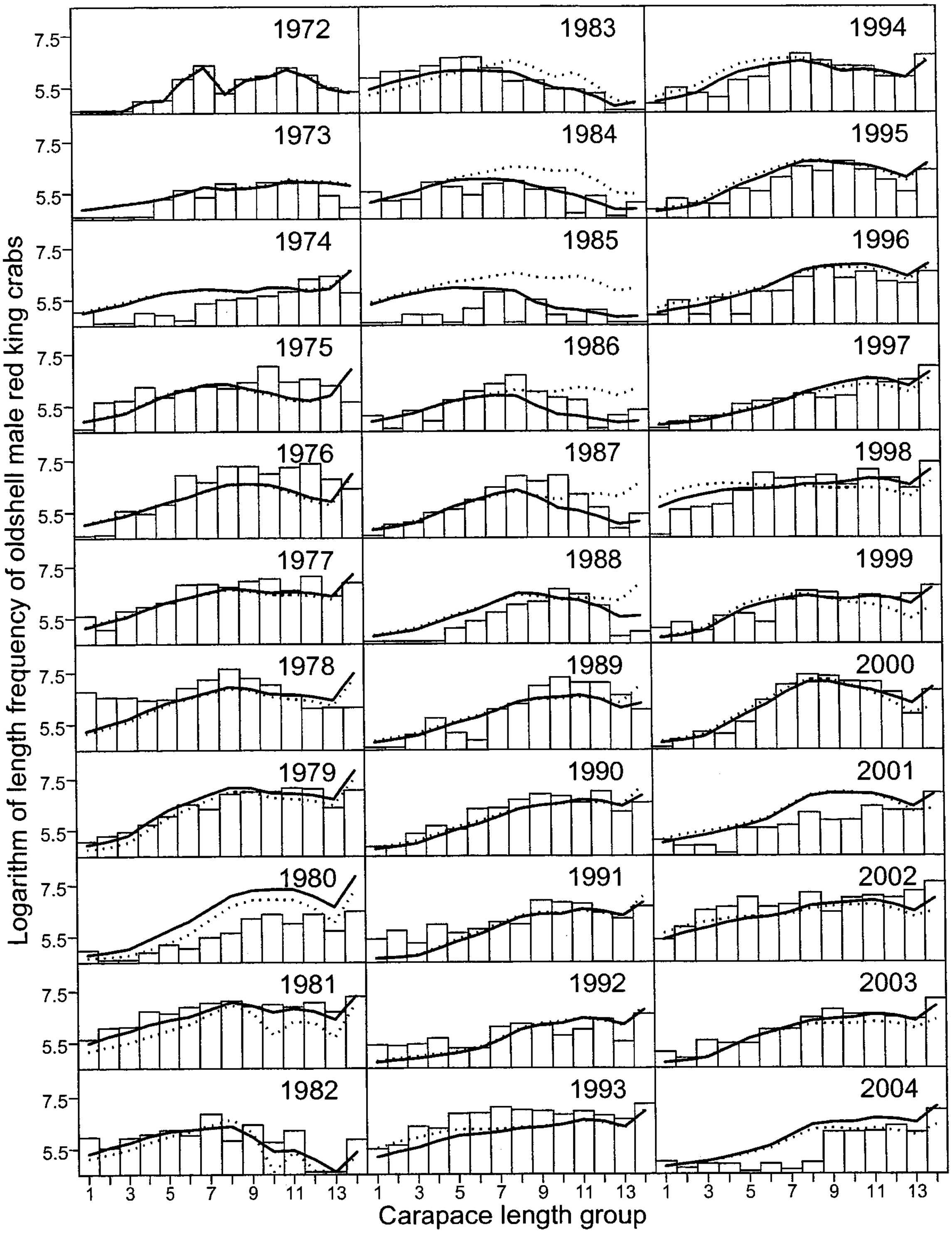


Figure 11b. Comparison of area-swept and model estimated length frequencies of Bristol Bay oldshell male red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (3 *M*) and dotted lines for A1-3 (1 *M*)).

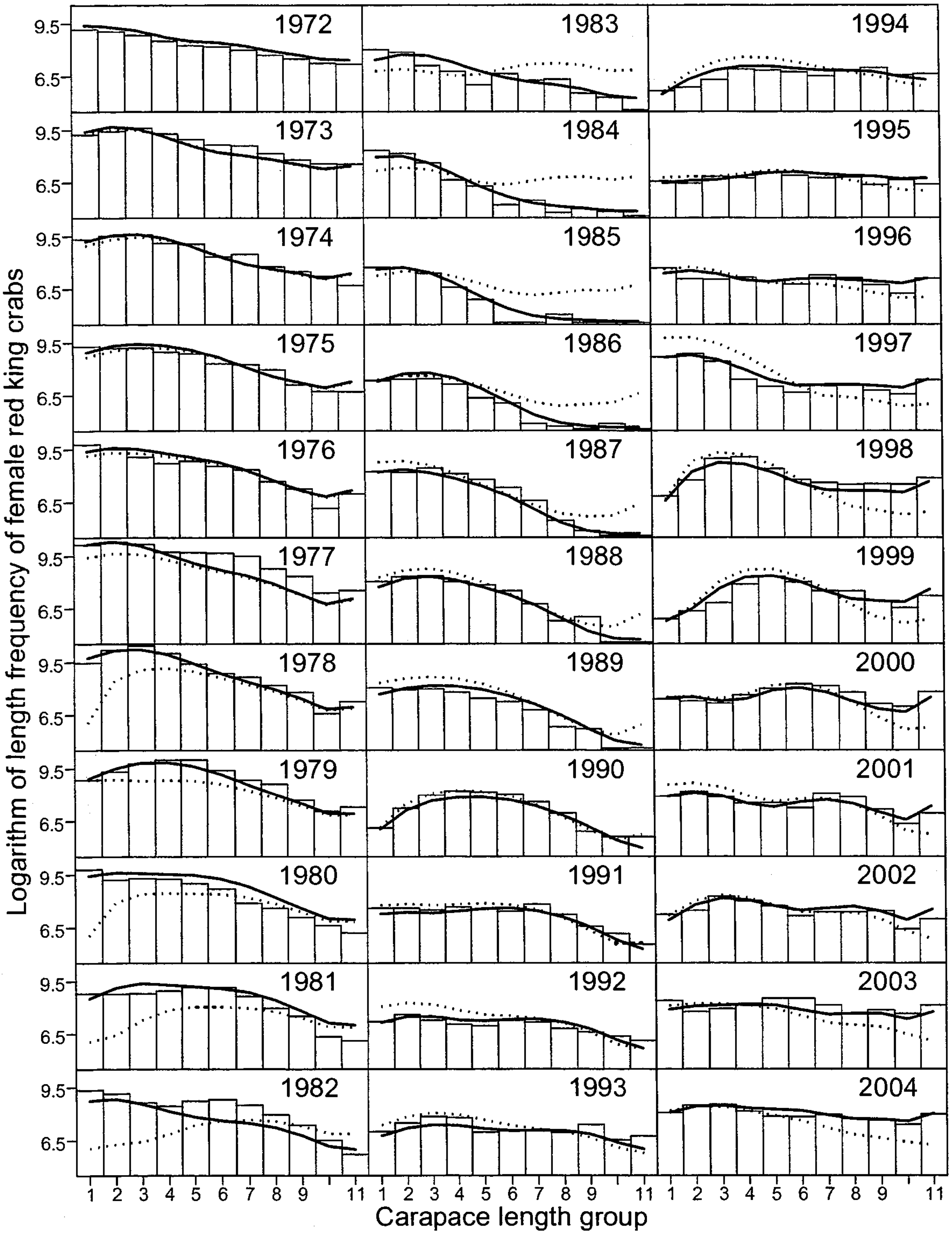


Figure 11c. Comparison of area-swept and model estimated length frequencies of Bristol Bay female red king crabs by year for two scenarios of instantaneous natural mortality (solid lines for A1-1 (4 *M*) and dotted lines for A1-3 (1 *M*)).

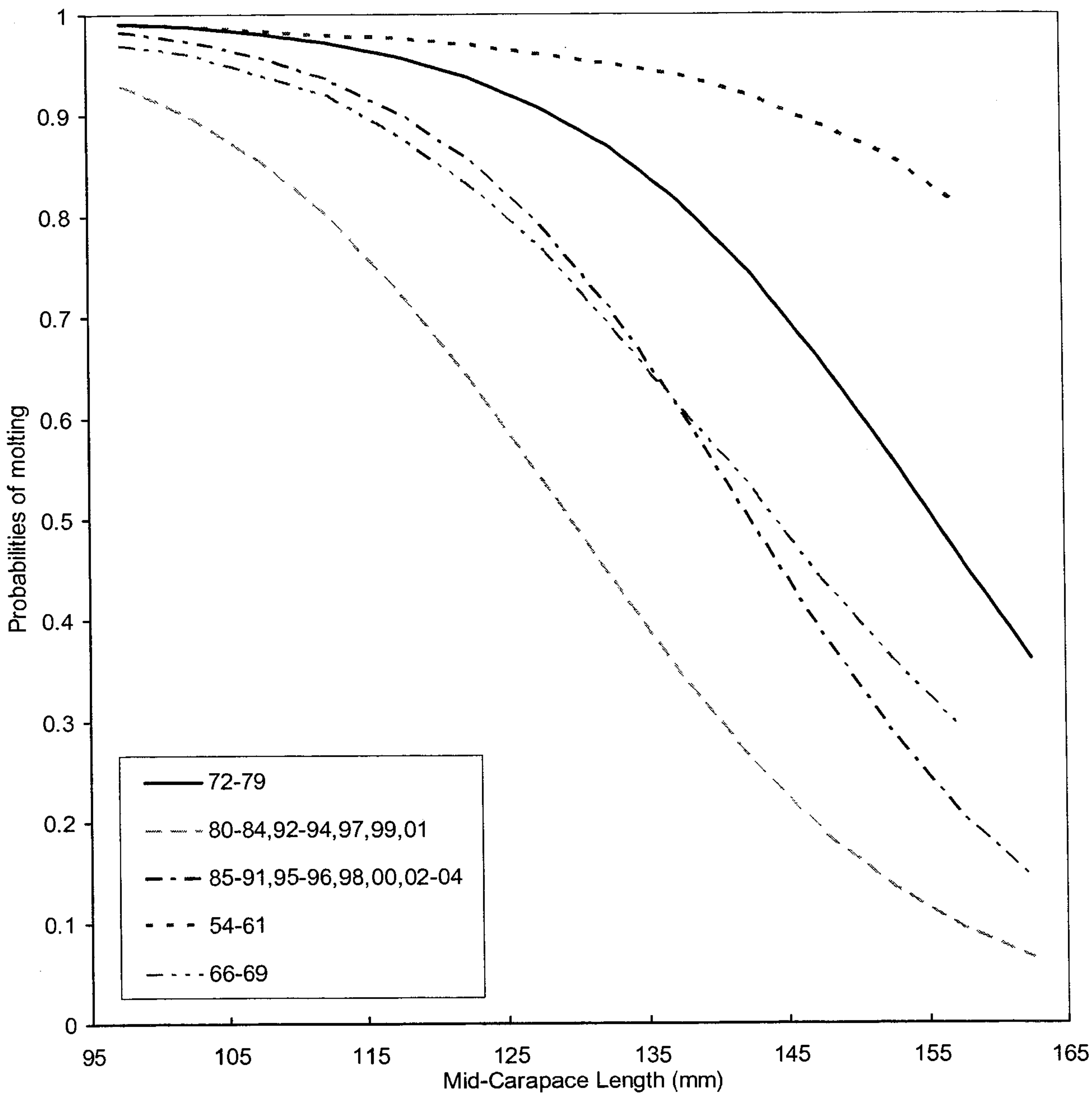


Figure 12. Comparison of estimated probabilities of molting of male red king crabs in Bristol Bay for different periods. Molting probabilities for periods 1954-1961 and 1966-1969 were estimated by Balsiger (1974) from tagging data. Molting probabilities for the other periods were estimated under the base scenario.

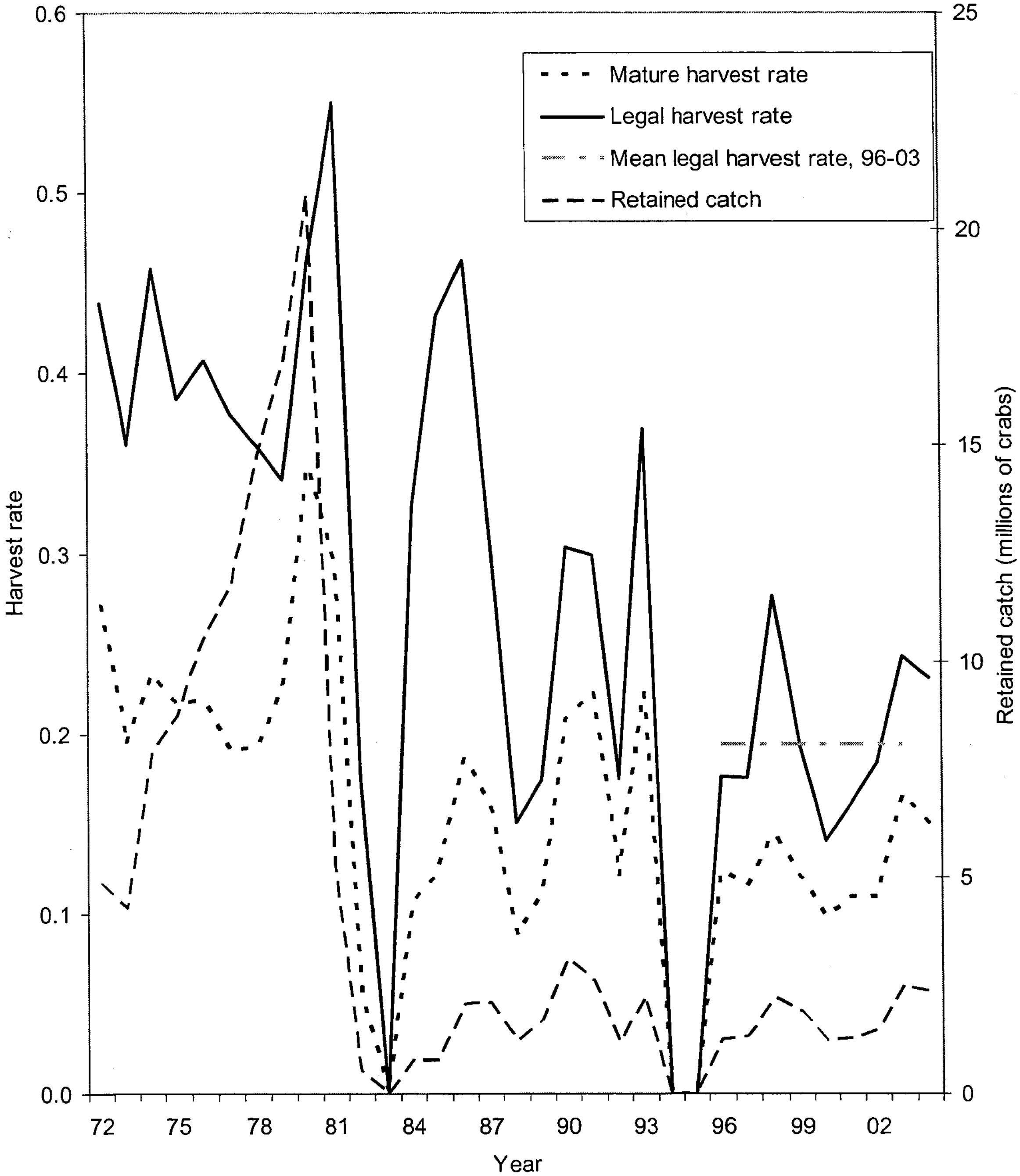
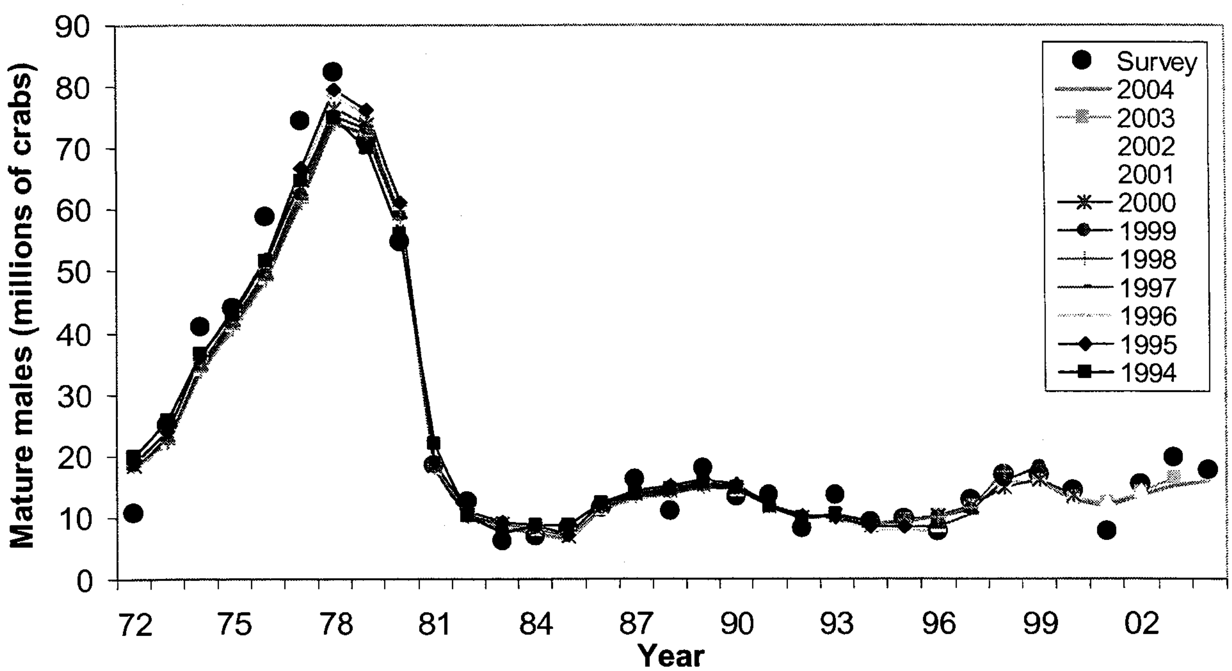


Figure 13. Retained catch, mature male crab harvest rate, and legal male crab harvest rate of red king crabs in Bristol Bay from 1972 to 2004 under the base scenario. The harvest rates in 2004 were obtained from the current harvest strategy.



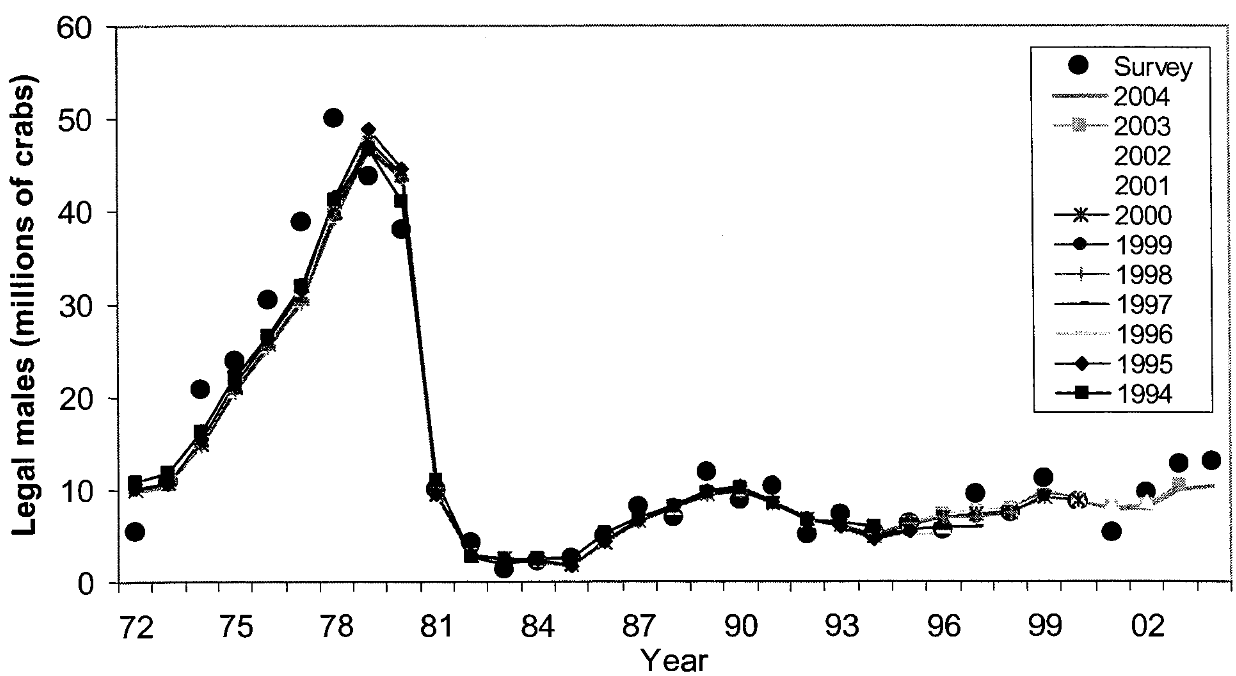
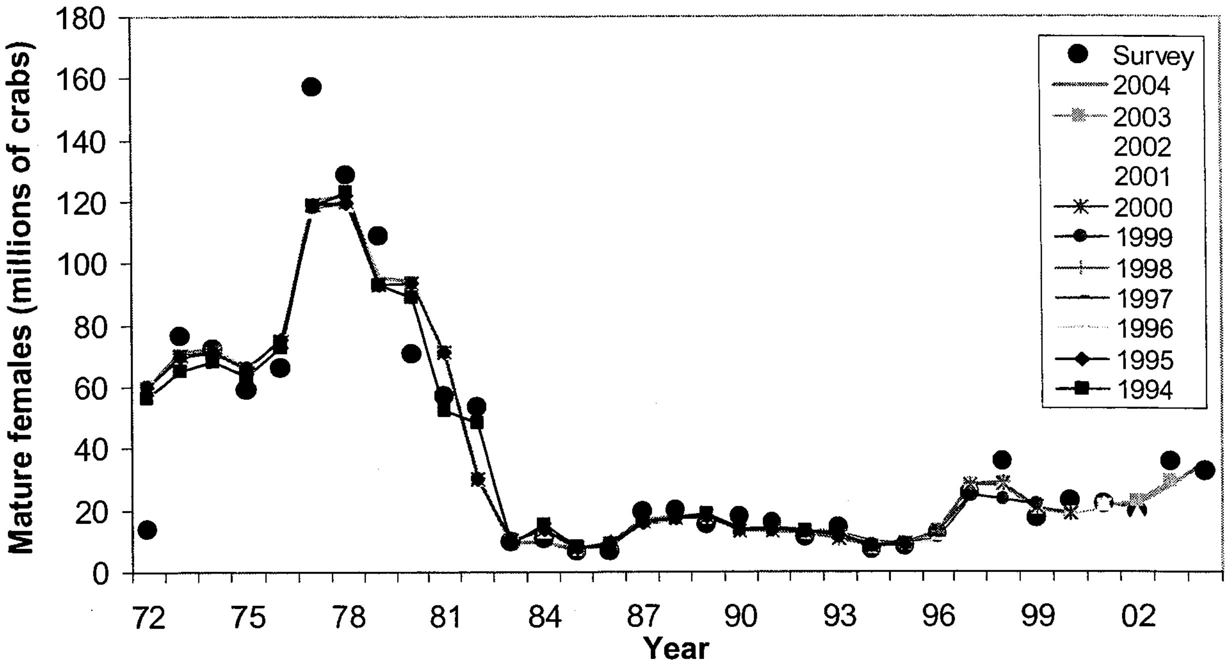


Figure 14. Comparison of mature (top) and legal (bottom) male abundance estimates of Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-2004 under the base scenario and by area-swept methods. Legend shows the year in which the assessment was conducted. For each assessment year, abundances were estimated from 1972 to the terminal year.



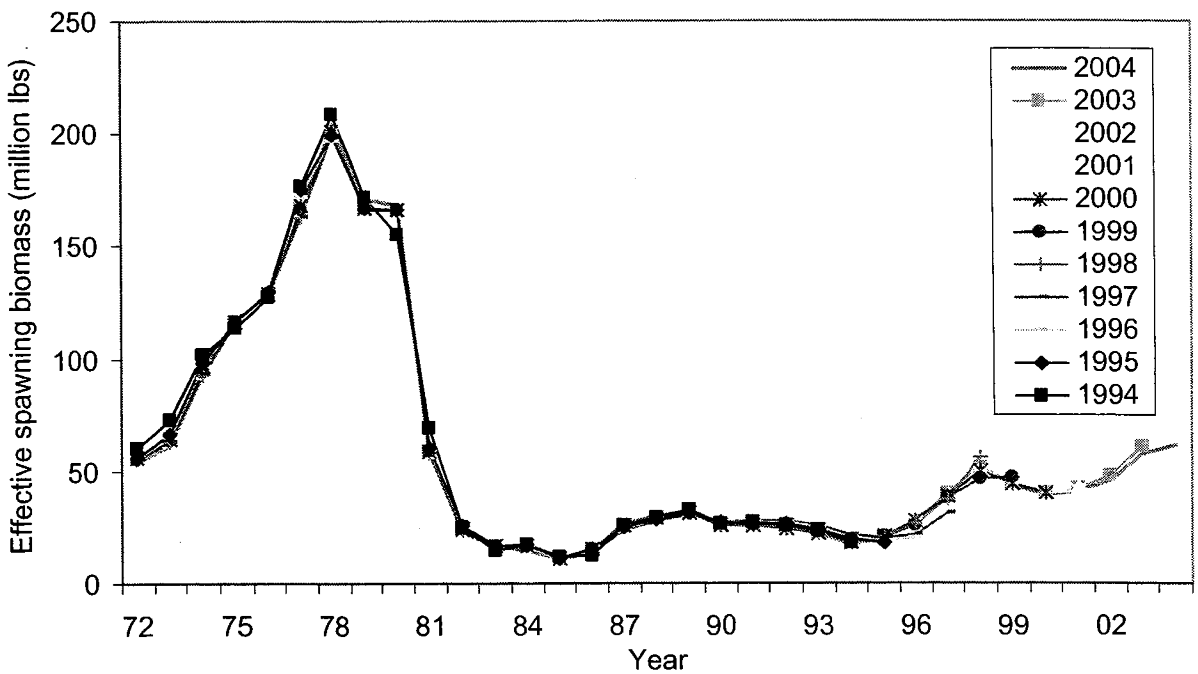


Figure 15. Comparison of mature female abundance estimates (top) and effective spawning biomass estimates (bottom) of Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-2004 under the base scenario and by area-swept methods. Legend shows the year in which the assessment was conducted. For each assessment year, abundances were estimated from 1972 to the terminal year.

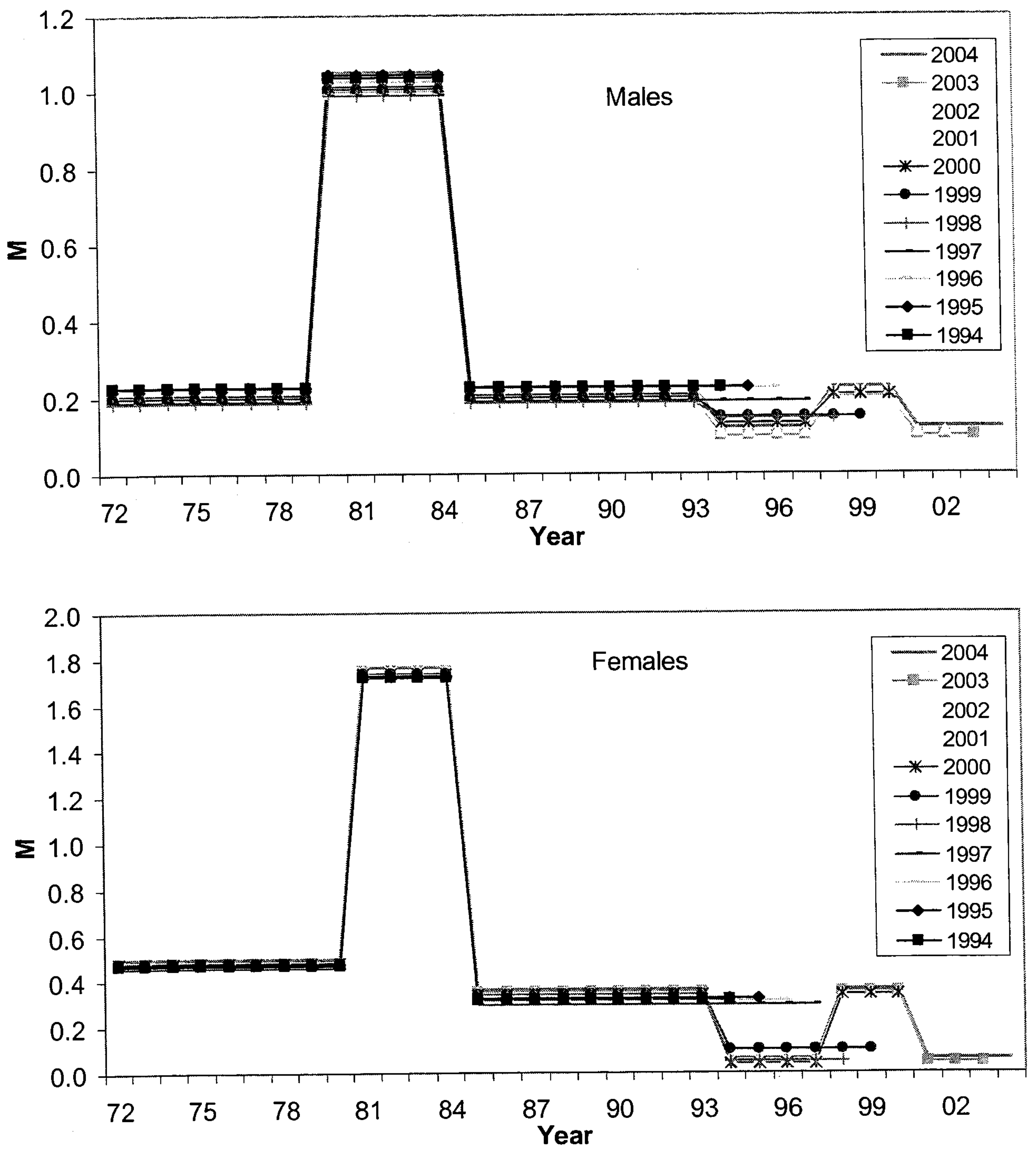


Figure 16. Estimates of natural mortalities of male (top) and female (bottom) Bristol Bay RKC from 1972 to 2004 made by LBA assessments with terminal years 1994-2004 under the base scenario. Legend shows the year in which the assessment was conducted.

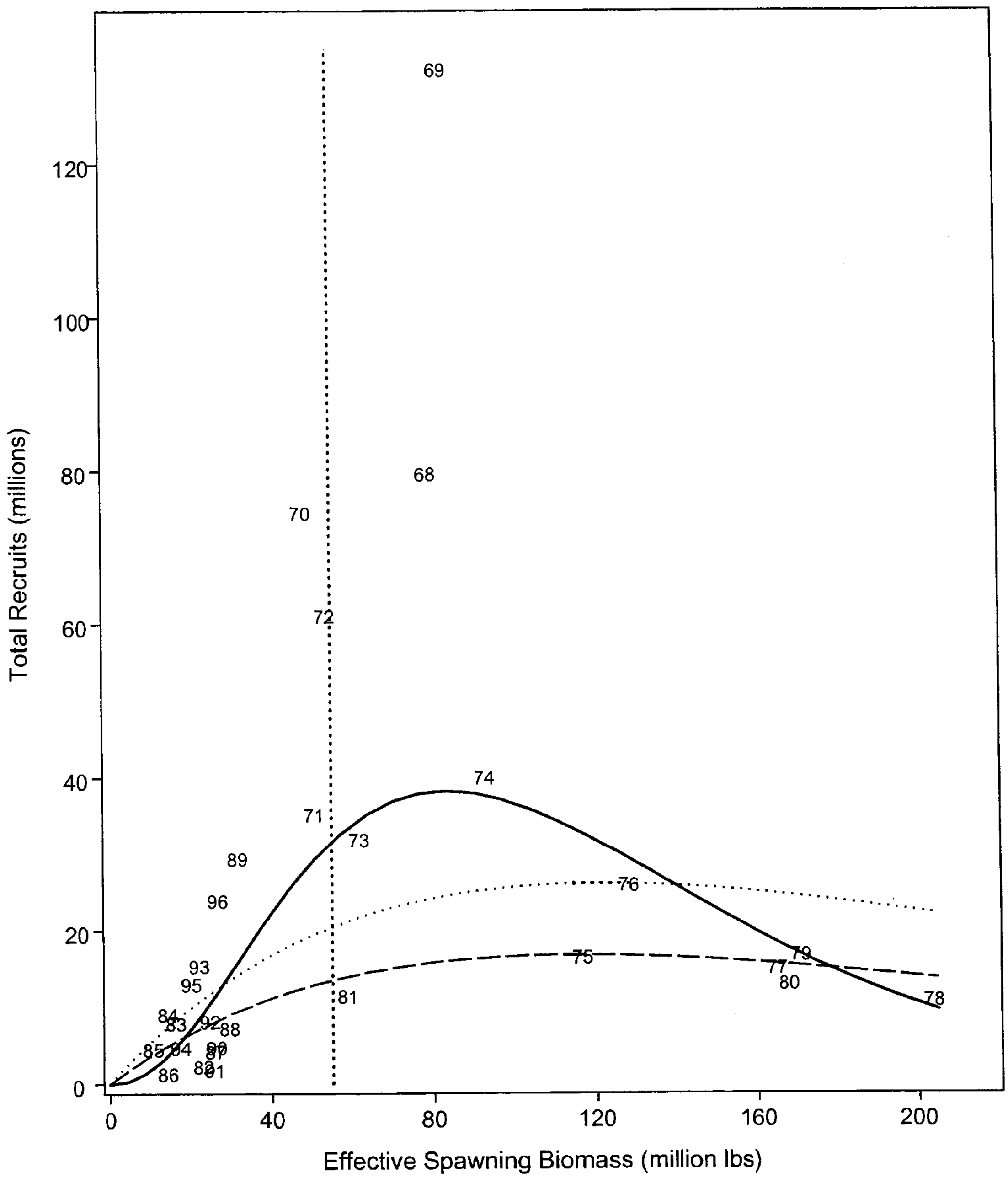


Figure 17. Relationships between effective spawning biomass and total recruits at age 7 (i.e., 8-year time lag) for Bristol Bay red king crabs under the base scenario. Numerical labels are brood year (year of mating), the solid line is a general Ricker curve, the dotted line is an autocorrelated Ricker curve without υ_t values (equation 9), and the dashed line is a Ricker curve fit to recruitment data after 1974 brood year. The vertical dotted line is the targeted rebuilding level of 55 million lbs effective spawning biomass.

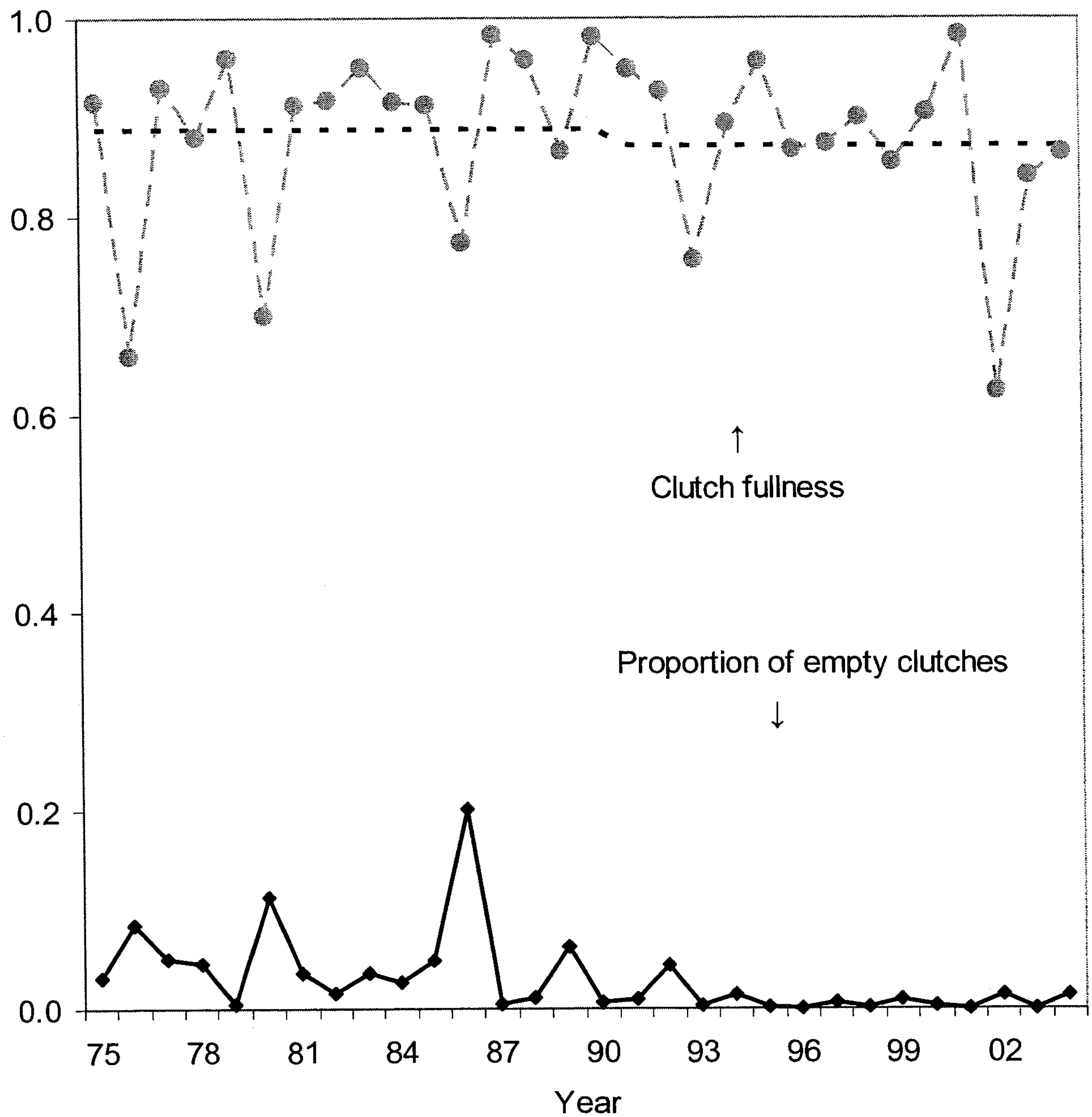


Figure 18. Average clutch fullness and proportions of empty clutches of newshell (shell conditions 1 and 2) mature female crabs >89 mm CL from 1975 to 2004 from survey data. Oldshell females were excluded.

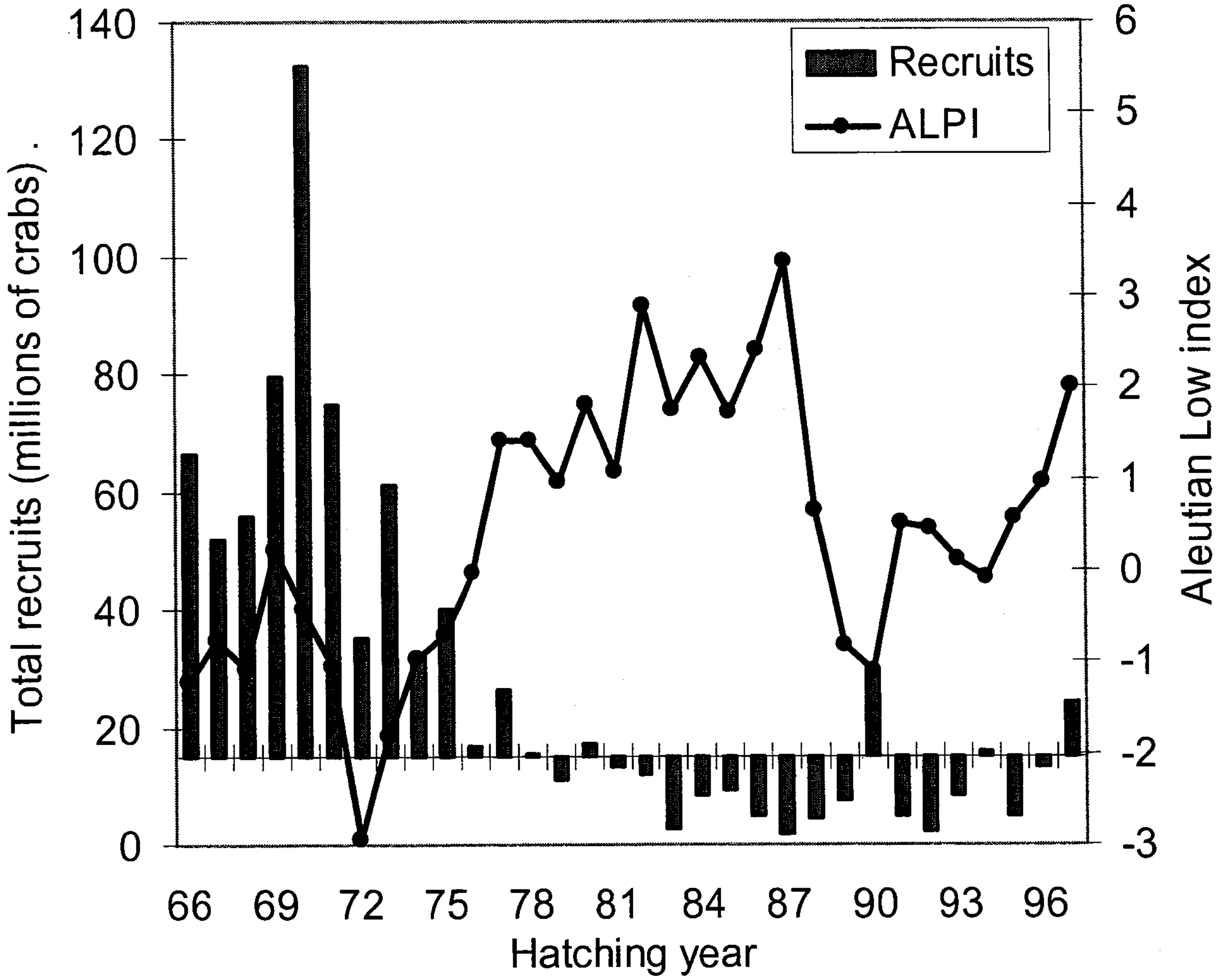


Figure 19. Recruits of Bristol Bay red king crabs and anomalies of the Aleutian Low index (December-March, 3-year moving average). A 7-year lag from hatching to recruitment was used.

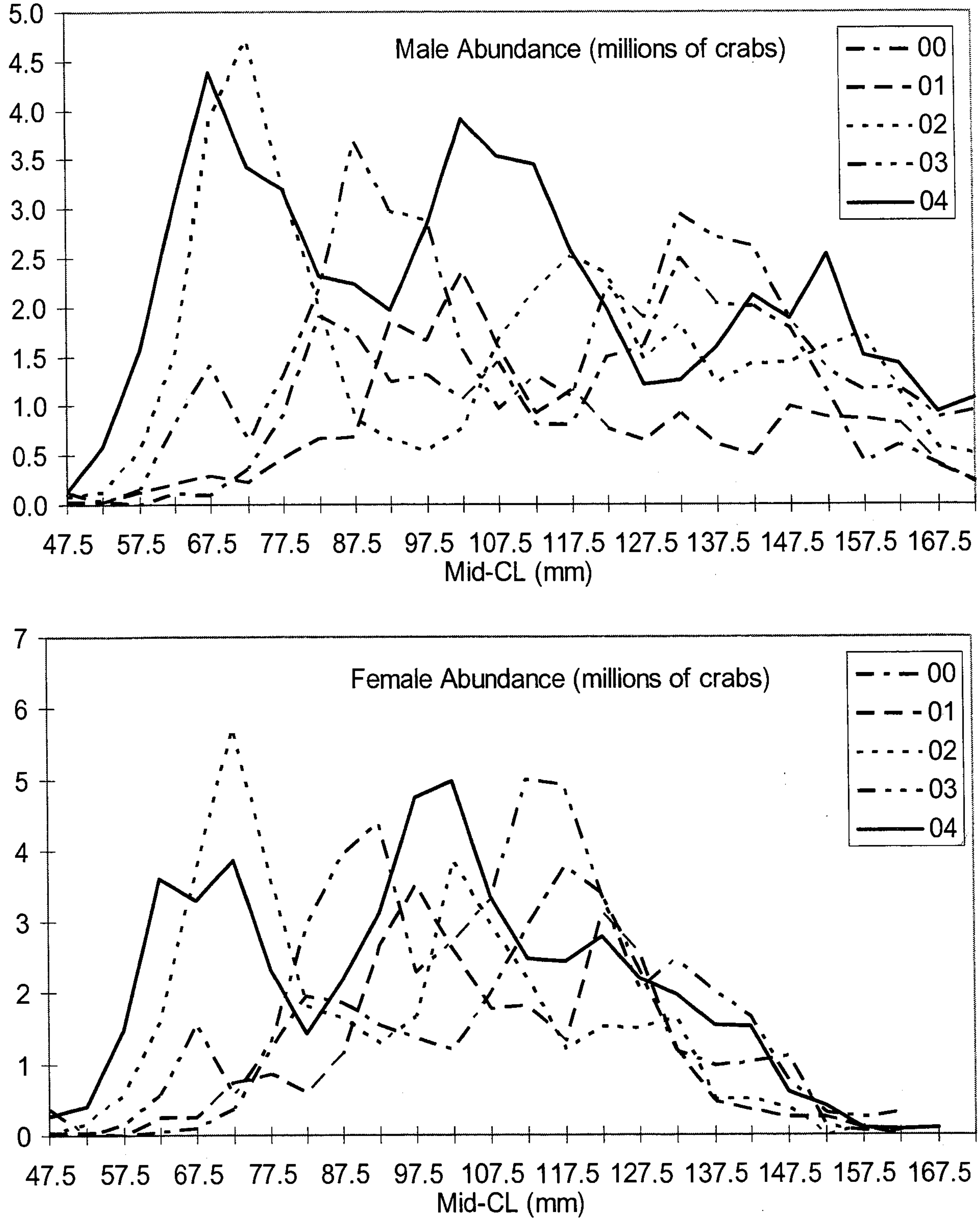


Figure 20. Length frequency distributions of male (top panel) and female (bottom panel) red king crabs in Bristol Bay from NMFS trawl surveys during 2000-2004. For purposes of these graphs, abundance estimates are based on area-swept methods.