Fishery Data Series No. 05-05

Alaska Department of Fish and Game Summary of the 2003 Mandatory Shellfish Observer Program Database for the General and CDQ Fisheries

by

Ryan Burt

and

David R. Barnard

February 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Department of Fish and Game	ADF&G
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 05-05

ALASKA DEPARTMENT OF FISH AND GAME SUMMARY OF THE 2003 MANDATORY SHELLFISH OBSERVER PROGRAM DATABASE FOR THE GENERAL AND CDQ FISHERIES

by

Ryan Burt
and
David R. Barnard

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

February 2005

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

Ryan Burt
Alaska Department of Fish and Game, Division of Commercial Fisheries
P.O. Box 920587, Dutch Harbor, AK 99692 USA
and
David R. Barnard
Alaska Department of Fish and Game, Division of Commercial Fisheries
211 Mission Road, Kodiak, AK 99615 USA

This document should be cited as:
Burt, R. and D.R. Barnard. 2005. Alaska Department of Fish and Game Summary of the 2003 Mandatory Shellfish Observer Program Database for the General and CDQ Fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 05-05, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

Appendix **Page**

LIST OF APPENDICES (Continued)

Appendix **Page**

ABSTRACT

Since 1988, the Alaska Department of Fish and Game (ADF&G) has required varying levels of observer coverage aboard vessels participating in Bering Sea and Aleutian Islands (BSAI) crab fisheries. This report summarizes data collected in 2003 by shellfish observers deployed on catcher-processor vessels, floater-processor vessels and catcher-only vessels. The data summaries include catch rates of targeted species by depth and soak time, female reproductive condition, total bycatch from sampled pot lifts, estimates and standard errors of catch per unit effort (CPUE), retained catch size frequency distributions, legal tally sample results, and sample pot lift locations by fishery. Shellfish species harvested commercially in 2003 from the BSAI area include red king crab *Paralithodes camtschaticus*, golden king crab *Lithodes aequispinus*, scarlet king crab *L. couesi,* and snow crab *Chionoecetes opilio*.

Key words: Alaska Department of Fish and Game, Bering Sea, Aleutian Islands, shellfish observers, red king crab *Paralithodes camtschaticus*, golden king crab *Lithodes aequispinus*, scarlet king crab *L. couesi,* and snow crab *Chionoecetes opilio*

INTRODUCTION

During the spring of 1988, the Alaska Board of Fisheries (BOF) mandated at-sea observer coverage for all vessels processing red king crabs *Paralithodes camtschaticus*, blue king crabs *Paralithodes platypus*, golden king crabs *Lithodes aequispinus,* and Tanner crabs *Chionoecetes bairdi* at sea in Alaska. In 1990 the BOF amended observer coverage regulations to include at-sea processors in the Bering Sea snow crab *C. opilio* fishery, and in 1995 observer requirements were adopted for vessels fishing king crabs in Aleutian Islands waters. In addition to establishing fixed levels of observer coverage in these fisheries, the BOF has granted the Alaska Department of Fish and Game (ADF&G) authority to place observers on commercial fishing vessels participating in other shellfish fisheries in circumstances when such action constitutes the only practical means for gathering data or enforcing regulations. Observer coverage implemented in recent years under this provision has included all vessels fishing for hair crabs *Erimacrus isenbeckii*, scarlet king crabs *Lithodes couesi, Paralomis multispina* (a deep-water king crab species), grooved Tanner crabs *C. tanneri,* and triangle Tanner crabs *C. angulatus*. Observer coverage has also been required on vessels participating in crab fisheries occurring under the Community Development Quota (CDQ) program. In 1999 the BOF adopted regulations expanding observer coverage to include catcher vessels participating in Bering Sea and Aleutian Islands (BSAI) crab fisheries. These new regulations were implemented during the 2000/2001 season crab fisheries. Observers are randomly assigned to approximately 10% of the general fishery catcher vessels participating in the following fisheries: Bristol Bay red king crab, St. Matthew blue king crab, Pribilof red and blue king crab, Bering Sea Tanner crab, and Bering Sea snow crab fisheries and all vessels fishing for golden king crab in the Pribilof and St. Matthew sections of the Bering Sea.

During most deployments, an observer's primary duties are to collect biological data and record vessel catch, bycatch, and effort statistics. However, in some situations their activities are prioritized to monitor and document vessel fishing activities for regulatory compliance. The data collected are used for a number of applications, including the development of models for estimating relative stock abundance, defining male and female crab size/age distributions, chronicling species reproductive cycles, quantifying levels of incidental bycatch, and producing preseason projections of fishery performance. Ultimately, the shellfish observer database provides a source of information crucial to the comprehensive management of Alaska's shellfish resources.

ADF&G Westward Region staff maintains the database of biological and regulatory compliance information generated by observer deployments. Archived information ranges from gear types fished, locations and soak times, to the species composition, size distribution and reproductive condition of the sampled catches.

This report summarizes data collected in 2002-2003 by shellfish observers deployed on catcher-processor vessels, floater-processor vessels and catcher-only vessels. Data compiled in this report were collected from general and CDQ fisheries that ended in the 2003 calendar year. Due to the substantial volume of available information, the scope of the data presented has been narrowed to include the size and shell ages of targeted crabs, the documented incidence of illegally retained crabs, and general catch and effort information resulting from sampled pot lifts. Since 1995, quantitative estimates of catch per pot lift and total catch of selected species and fisheries using harvest data have also been included. Additionally, a summary of all species encountered in pot lifts sampled from each fishery has been included.

Any inconsistencies between previously published shellfish observer database reports and findings presented in this document are the result of updated summaries and interpretation of historical data.

METHODS

Comprehensive shellfish observer sample methods are outlined in the most recent edition of the ADF&G Shellfish Observer Field Manual (ADF&G 2003). Methods described in this report correspond only to the data presented and are not inclusive of all observer sampling duties.

TERMS

For the purposes of this report, terms related to the discussion of sampled crabs are defined as follows:

Carapace Length (CL) –	the straight-line distance from the posterior margin of the right eye orbit to the medial-posterior carapace margin; the biological size measurement of hair crabs and all species of king crabs
Carapace Width (CW) –	the greatest straight-line distance perpendicular to a line midway between the eyes to the medial-posterior margin, not including the spines; the biological size measurement of snow crabs and all species of Tanner crab
Legal Measurement –	the greatest straight-line distance across the carapace of male crabs forming a right angle to a line midway between the eyes to the medial-posterior margin, including the spines
Catch per unit effort (CPUE) –	the value (or estimated value) representing the mean catch (number) of crabs for a standardized unit of fishing effort; in this report CPUE represents the mean catch per pot lift
Soft-shell –	0 to 2 weeks after molting, exoskeleton is not yet hardened
New pliable-shell –	2 to 8 weeks after molting, exoskeleton is thin, flexible and not fully calcified

New-shell –	exoskeleton 8 weeks to 12 months old (8 weeks to 18 months for golden king crabs).
Old-shell –	exoskeleton more than 12 months and up to 24 months old (up to 36 months for golden king crabs).
Very old-shell –	exoskeleton more than 24 months old (more than 36 months old for golden king crabs)
Uneyed eggs–	early developmental stages of an egg with no distinguishing markings
Eyed eggs –	later developmental stages of an egg distinguished by dark eye spots
Ovigerous –	bearing eggs, either eyed or uneyed (pertaining to female crabs)
Mated/barren –	not carrying eggs but displaying evidence of previous mating activity (pertaining to female crabs)
Non-mated/barren –	not carrying eggs and not displaying evidence of previous mating activity (pertaining to female crabs)
Recruit –	new-shell male crab of legal size in its first year of availability to the commercial fishery
Post-recruit –	all old-shell male crabs of legal size and all new-shell male crabs one or more molts larger than recruit size

SAMPLING DUTIES

During the 2003 BSAI shellfish fisheries, observers were deployed on floater-processor vessels, catcher-processor vessels, and catcher-only vessels. Observers deployed on floater-processors had access only to pre-sorted, retained catches, while those placed on catcher-processor and catcher-only vessels were able to examine the contents of pot lifts prior to sorting.

Floater-Processors

Principal sampling duties for observers on board floater-processors include monitoring deliveries from catcher-only vessels for regulation compliance regarding legal retention of crabs by species, size and sex. Sampling procedures consist of randomly selecting and examining up to 600 crabs from each vessel's catch. This sample type is referred to as a "legal tally". Additional data collected from deliveries to floater-processors include biological measurements of 100 crabs, randomly selected from each delivery, to determine carapace size distribution. This type of sampling is referred to as "biological measurements of retained crabs".

Catcher-Processors

Observers deployed on catcher-processors conduct a legal tally and take average weights and biological measurements of retained crabs each day the vessel retains catch. They also sample randomly selected pot lifts for catch composition. This is referred to as "bycatch sampling". Methods for collecting bycatch samples include identifying and enumerating all species in the pot and recording legal and retention status, biological size, shell age, sex, and general health and vitality of all commercially important crabs. Female crabs in sampled pot lifts are also evaluated for reproductive condition.

On occasions when catcher-only vessels make deliveries to catcher-processors, the observer samples the catch as if they were deployed on a floater-processor.

Catcher-Only Vessels

Data collection objectives for observers onboard catcher-only vessels are similar to those for catcher-processors, although pot lift sampling is usually the prioritized activity. Legal tally and biological measurements of the retained crabs are only conducted when the vessel delivers to a processing facility. If deliveries are made at-sea, the legal tally, biological measurements of retained crabs, and average weight samples are collected by the observer deployed on the catcher-only vessel.

Daily sampling goals for observers on board catcher-processor and catcher-only vessels (e.g., quantity of pot lifts examined and number of crabs measured) are dependent upon a number of variables unique to each fishery and year. These variables include weather, catch rates, special data collection projects, and the order of sampling priorities established by ADF&G. Fishery-specific sample goals are discussed in subsequent sections where appropriate.

Ad hoc research data-collection projects were assigned to observers deployed on catcher-processors and catcher-only vessels during 2003. These included: tag recovery from king crabs in Bristol Bay and the Aleutian Islands, and sampling crabs in the Bering Sea golden king crab fishery for handling injuries and on-deck air exposure resulting from catch sorting. The results of these investigations have not been included in this report. However, that information is available from ADF&G, Region IV.

ESTIMATION OF CPUE AND TOTAL FISHERY CATCH

Estimates for catch per unit effort (CPUE) and their standard errors were generated using weighted mean and variance formulas for stratified sampling (Cochran 1977; Appendices A1 and A2). With this technique each vessel-day was considered a separate stratum. The weights reflect the relative importance of a vessel's daily effort (pot lifts) compared to all the days for which that vessel fished. The greater the number of pot lifts on a given day, the greater the weight given to the samples collected on that day. Variances were calculated for each vessel-day and then summed over all vessels and all days for the entire fishery. In fisheries where only partial coverage of catcher-only vessels was employed, an additional stratum was used to account for vessel type and size (see Appendix A2)

Multiple estimates of CPUE exist depending on the source of the information used to calculate the estimate. The "stratified CPUE" with a standard error estimate uses the Cochran stratified technique as described above and in Appendices A1 and A2. The "sample CPUE" is generated from observer data and is based solely on the pot lifts sampled. It is calculated as total catch from the sampled pot lifts divided by the total number of sampled pot lifts. This estimate has been reported in past observer reports (Tracy 1994, 1995a,b). The "actual total fishery (ATF) CPUE" is based on fish ticket information as reported in the annual management reports for commercial crab fisheries in the BSAI management areas. The ATF CPUE is generated for retained legal crabs only.

An estimated total catch is derived from multiplying a CPUE estimate by the total number of pot lifts in the fishery. For those fisheries with 100% observer coverage, the total pot lifts information is taken from confidential interviews. Otherwise, the total pot lifts data are generated from fish ticket summaries.

When viewing CPUE and total catch estimates for both the directed catch and bycatch, the precision and accuracy of the estimates should be noted. Precision is indicated by the standard errors. Accuracy is gauged by the similarity of the estimates for legal retained crabs obtained from observer data to those obtained from confidential interviews and fish tickets. The reader should take note of whether the CPUE and total catch estimates provided here were based on data gathered by observers deployed on all participating fishing vessels, on a representative sample of all fishing vessels, or on catcher-processor vessels only. The application of CPUE estimates obtained from catcher-processor vessels to the entire fishing fleet assumes that catch rates for that distinct portion of the fleet are comparable to the remaining catcher-only vessel component of the fleet.

RESULTS

BERING SEA SNOW CRAB

General Fishery

During the 2003 fishing season observers were deployed on 5 catcher-processor vessels, 3 floating processor vessels and 18 catcher-only vessels. The bycatch-sampling goal for observers on catcher-processors was 4 pot lifts during each day of fishing activity. The bycatch-sampling goal for observers on catcher-only vessels was 6 pot lifts during each day of fishing activity. Due to the large number of crabs per pot lift routinely taken in this fishery, and the corresponding potential for excessive handling mortality attributable to sampling, catches in 3 of 4 pot lifts were identified to species, sex and legal status of males, and enumerated but not measured or otherwise assessed for ancillary characteristics. Cold weather exposure was not a concern and no modification of sample protocols were made for legal tallies and biological measurements of retained crabs collected from catcher-processors and deliveries to floater-processors. A total of 872 pot lifts selected for bycatch sampling accounted for less than 1% of the 139,903 pot lifts reported by vessel operators during the 10 day season (ADF&G 2004). The location of pot lifts sampled by observers during the 2003 Bering Sea snow crab fishery are displayed in Appendix B1.

Measurements and shell ages of 22,538 retained male snow crabs were taken throughout the season by onboard observers and ADF&G staff stationed at shoreside processing locations (Table 1). The mean CW of harvested crabs was 107.2 mm, more than 3 mm smaller than the 2002 season, and over 5 mm smaller than the 2001 season.

Measurements of CW were also taken from 46,996 male snow crabs in sampled pot lifts. The mean CW for all male snow crabs from sampled pot lifts was 99.5 mm. The size-frequency distribution of these size measurements revealed a prominent mode between 101 and 105 mm (Figure 1). These results are similar to the 2002 size-frequency distribution and indicate a continued downward shift in the size distribution of crabs in sampled pot lifts since 2000. The proportions of old-shell and very-old-shell male snow crabs in most intervals for the 2003 male snow crab catch were much less than those seen in the 2002 fishery. It should be noted that in 2002 ADF&G reviewed its snow crab shell-age classification to make it similar to NMFS survey protocols. A small number of female snow crabs (n = 62) observed in sampled pot lifts produced a mean CW of 64 mm (range: 53-78 mm).

The stratified CPUE estimate of 142.0 legal retained snow crabs per pot lift is over twice that of the 2002 fishery and the second highest since 1995 (Table 2; Figure 2). The estimated CPUE for

all legal retained crabs including Tanner crab x snow crab hybrids was 150.5 (SE = 10.6), twice the 2002 estimate. The precision of the stratified estimate for all legal retained crabs was good; the standard error is 7.1% of the estimated mean. The 95% confidence interval for the CPUE for legal retained male crabs estimated from the sampled pot lifts was 129.7 to 171.3 crabs per pot lift. This interval includes the ATF CPUE of 155, indicating the sampled pot lifts provided data for accurately estimating CPUE for the total fishery. The catch of legal-sized, non-retained male snow crab increased over 300% over the 2002 estimate. The 2000 fishery estimate of legal-sized, non-retained male snow crabs was the lowest since 1995, whereas the 2003 fishery estimate was the highest, representing an almost 600% increase in just three years (Figure 2). Approximately 50% of the total catch of snow crabs were discarded as bycatch, most of which were legal-sized crabs of less than 4 in CW (102 mm). Although the legal size for snow crabs is 3.1 inches CW (79 mm), processing plants do not generally accept crabs less that 4 inches CW. The CPUE estimate for female snow crabs was very small.

Total catches of all animals identified in sampled pot lifts during the 2003 season are provided in Appendix C1. Additional appendices contain CPUE by soak time (Appendix C2) and depth (Appendix C3), and the reproductive condition of female snow crabs from the bycatch (Appendix C4).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 73,694 crabs by the end of the 2003 season and comprised less than 1% of the cumulative reported harvest (Appendix C33). Just over 0.2% of sampled crabs were deemed illegal, either due to size, sex or species; over 0.3% lower than the 2002 season.

Community Development Quota Fishery

Observers were deployed on 1 catcher-processor and 8 of 9 catcher-only vessels participating in the 2003 Bering Sea CDQ snow crab fishery. The bycatch-sampling goal for observers was 6 pot lifts for catcher-only vessels and 4 pot lifts for the catcher-processor vessel during each day of fishing activity. On each vessel type, catches in 1 pot lift per day were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. Fishing began on 31 January and continued until 24 March. A total of 740 pot lifts selected for bycatch sampling accounted for 5.1% of the 14,583 pot lifts reported by vessel operators during the 2003 CDQ season (ADF&G 2004). Locations of pot lifts sampled by observers during the 2003 Bering Sea CDQ snow crab fishery are in Appendix B2.

Measurements and shell ages of 6,296 retained male snow crabs were taken throughout the season by onboard observers and ADF&G staff stationed at shoreside processing locations (Table 3). The mean CW of crabs harvested was 107.1 mm, a difference of less than 1 mm of the mean CW obtained from crabs sampled during the 2003 general fishery (Table 1).

Measurements of CW were also taken from 26,855 male snow crabs in sampled pot lifts. The mean CW for all male snow crabs from sampled pot lifts was 101.2 mm, which was nearly 2 mm greater than the mean CW from the general fishery. The size-frequency distribution of these size measurements revealed a single mode between 96 and 105 mm (Figure 3), similar to the 2003 general fishery (Figure 1) but with a lower proportion of old-shell males. The proportions of old-shell males in sampled pot lifts were reduced from the previous 3 years. The single female snow crab measured in sampled pot lifts had a CW of 62 mm.

The stratified estimate of 112.4 legal retained male snow crab per pot lift represents an almost 30% decrease from the 142.0 crabs per pot lift estimate for the 2003 general fishery (Table 4).

The CPUE estimate for all retained crabs (113.1, S.E. = 4.8), snow and Tanner crab x snow crab hybrids combined, was about 75% of the estimate for the general fishery. The estimated CPUE for legal male snow crabs that were not retained, 119.4 crabs per pot lift, was 12.5% less than the general fishery estimate. Catch rates for sublegal male and female snow crabs were lower than those in the general fishery. Catches of legal retained hybrid crabs were only 10% of those in the general fishery. The standard error estimate for all retained crabs was 4.2% of the estimated CPUE, meaning that the stratified mean estimate was precise. A 95% confidence interval for the population CPUE (103.7, 122.5) includes the ATF CPUE (119.9), indicating the accuracy of the stratified estimate.

Total catches of all animals identified in sampled pot lifts during the 2003 CDQ fishery are provided in Appendix C5. Additional appendices contain CPUE by soak time (Appendix C6) and depth (Appendix C7) and the reproductive condition of female snow crabs from the bycatch (Appendix C8).

Legal tallies conducted shoreside during vessel deliveries to processors totaled 32,323 crabs for the season and comprised 1.8% of the cumulative CDQ harvest (Appendix C33). Of sampled crabs, 0.36% were deemed illegal, either due to size, sex or species. As in the 2002 CDQ fishery, illegal crabs were sublegal male Tanner crabs and sublegal male snow crabs.

BRISTOL BAY RED KING CRAB

General Fishery

At-sea observers were deployed on 23 catcher-only vessels, 8 catcher-processor vessels and 1 floating processor during the 2003 general fishery for Bristol Bay red king crab. The bycatch sampling goal for observers on catcher-processors and catcher-only vessels was 10 pot lifts during each day of fishing activity. Catches in all pot lifts sampled were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. A total of 731 pot lifts selected for bycatch sampling accounted for 0.6% of 129,019 pot lifts reported by vessel operators during the 5-day season (ADF&G 2004). The location of pot lifts sampled by observers during the 2003 Bristol Bay red king crab fishery are displayed in Appendix B3.

Measurements and shell ages of 16,218 retained male red king crabs were taken throughout the season by onboard observers and ADF&G staff stationed at shoreside processing locations (Table 5). The mean CL of male red king crabs harvested was 148.8 mm, which is nearly 2 mm smaller than the means for the 2000-2002 seasons. Retained crab CL values were mostly located around five 5 mm intervals in 2003, with 85% of the sampled crab falling between 136 and 160 mm, similar to previous years.

Measurements of CL were taken from 30,800 male red king crabs from sampled pot lifts. These are displayed in a size-frequency distribution in Figure 4. The mean CL for all male red king crabs from sampled pot lifts was 128.0 mm, almost 7 mm smaller than in 2002, and nearly 4 mm smaller than in 2000 and 2001. The proportion of recruit-sized crabs (137 to 154 mm CL), which had decreased slightly in 2001 and then increased in 2002, shows further increase in 2003 (Figure 4). An increase in the number of sublegal males was also seen in 2003 compared to 2002. The proportions of old-shell and very-old-shell male crabs were similar to 2002.

Measurements of CL were taken from 10,403 female red king crabs in sampled pot lifts, representing a dramatic increase from the 312 females sampled in 2002 and 4,575 in 2001 (Figure 5). The mean CL for all female red king crabs from sampled pot lifts was 106.1 mm, 10

mm larger than the mean CL from sample measurements taken during 2002. Two dominant modes can be seen in the 2003 length-frequency distribution, one at 86-90 mm and the other one at 111-115 mm CL, similar to the 2001 female red king crab distribution.

The stratified CPUE estimate of 17.8 legal-sized retained males per pot lift represents a decrease of 1.2% from the 2002 season estimate (Table 6, Figure 6). This estimate was slightly less precise than the 2002 stratified CPUE estimate as the standard error of the estimate for legal retained males represented 8.6% of the CPUE estimate relative to 7.4% the previous year. A 95% confidence interval for the population CPUE for retained crab (14.8, 20.8) includes the ATF CPUE of 18.1 indicating the accuracy of the stratified estimate. The estimates for sublegal male and female crabs were less precise but improved over the 2002 estimates, with the standard error accounting for about 13% of the mean for sublegal male crab and 18% for female crabs. Relative to 2002, bycatch rates of sublegal male crab increased by 24% and bycatch of females increased substantially by nearly 24 times the 2002 catch rate (0.7 female red king crab per pot lift). This was 35% more than the 2001 female catch rate. An estimated 60% of all male red king crabs captured during the 2003 fishery were discarded bycatch, increasing from 54% in 2002.

Total catches of all animals identified in sampled pot lifts during the 2003 season are provided in Appendix C9. Additional appendices contain CPUE by soak time (Appendix C10) and depth (Appendix C11), and the reproductive condition of female red king crabs from the bycatch (Appendix C12).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 28,644 crabs by the end of the 2003 season and comprised over 1.2% of the cumulative reported harvest (Appendix C33). Just over 1.1% of sampled crabs were deemed illegal, either due to size, sex or species, the highest sample proportion calculated for the preceding 5 years.

Community Development Quota Fishery

At-sea observers were deployed on 2 catcher-processor and 6 catcher-only vessels participating in the 2003 Bristol Bay red king crab CDQ season. The bycatch-sampling goal for observers was 10 pot lifts during each day of fishing activity. Catches of all pot lifts sampled were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. Fishing occurred from 27 October to 12 November. A total of 279 pot lifts were selected for bycatch sampling during the 17-day season. Locations of pot lifts sampled by observers during the 2003 Bristol Bay red king crab CDQ fishery are in Appendix B4.

Measurements and shell ages of 1,961 retained male red king crabs were taken throughout the season by onboard observers and ADF&G staff stationed at shoreside processing locations (Table 7). The mean CL of crabs harvested was 152.2 mm, which is 3.4 mm more than the mean for the general fishery.

Measurements of CL were also taken from 13,888 male red king crabs in sampled pot lifts. The mean CL for all male red king crabs from sampled pot lifts was 138.5 mm, 10.5 mm larger than the mean CL in the 2003 general fishery. The general size distributions and proportions of sublegal and legal male red king crabs differed from the 2003 general fishery (Figure 7). There were fewer immature male crabs and proportionally fewer old-shell crabs in the CDQ fishery.

Measurements of CL were taken from 2,146 female red king crabs in sampled pot lifts, representing an increase from 401 female crabs observed in 2002 and 869 female crabs observed in 2001. The mean CL for all female red king crabs from sampled pot lifts was 121.5 mm, 15.4

mm larger than the mean CL from the general fishery. The distribution of length frequencies for female crabs was similar to the general fishery with a prominent mode for immature females.

The stratified estimate of 30.1 legal retained males per pot lift represents a 69% increase from the estimated CPUE for the general fishery (Table 8). The estimated catch rate of sublegal red king crab males was nearly identical to the general fishery estimate. The female red king crab CPUE estimate was 47% smaller than the estimate for the general fishery. The precision of the stratified estimate of CPUE for legal retained crabs was acceptable, with a standard error of 11.0% of the estimated mean. A 95% confidence interval for the population CPUE for legal retained male king crabs was (23.6, 36.6) and includes the ATF CPUE (30.0) indicating the accuracy of the stratified estimate. Precision of the estimates for sublegal male and female red king crabs was less precise, with standard errors of 17% and 23% of their respective mean, which are improved over the precision of the 2002 CDQ estimates.

Total catches of all animals identified in sampled pot lifts during the 2003 CDQ season are provided in Appendix C13. Additional appendices contain CPUE by soak time (Appendix C14) and depth (Appendix C15), and the reproductive condition of female red king crabs from the bycatch (Appendix C16).

Legal tallies conducted shoreside during vessel deliveries to processors totaled 6,819 crabs (Appendix C33). Slightly over 0.50% of sampled crabs were deemed illegal due to size, sex or species, identical to the sample proportions calculated for the 2002 CDQ fishery.

ALEUTIAN ISLANDS GOLDEN KING CRAB

In March 1996, the BOF established the Aleutian Islands king crab registration area by combining the two existing areas, Dutch Harbor and Adak. The BOF then established 1 September as the opening date for the new area, and an annual closure would be by emergency order. The Board subsequently changed the season opening to 15 August. In addition the BOF directed the department to manage the golden king crab stocks of the Aleutians Islands east and west of 174° W longitude as two distinct stocks (ADF&G 1999). Past reports combined the data collected east and west of 174° W longitude into one section. The data included in this report were separated by area (east and west of 174° W longitude) and include the 2003 fishery east of 174° W longitude and the entire 2002/2003 season west of 174° W longitude.

Aleutian Islands East of 174° W Longitude

The 2003 Aleutian Islands golden king crab fishery east of 174° W longitude began 15 August and concluded 8 September. Regulations stipulate 100% observer coverage in this fishery. During the 2003 fishing season observers were deployed on 18 catcher-only vessels. The bycatch sampling goal for observers was 14 pot lifts during each day of fishing activity. Catches in 4 of 14 pot lifts were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. The remaining 10 pot lifts had their catches identified to species, sex and legal status and counted, but not measured or otherwise assessed for ancillary characteristics. A total of 3,960 pot lifts selected for bycatch sampling accounted for 6.7% of 58,973 pot lifts reported by vessel operators during the 25 day season (ADF&G 2004). The locations of pot lifts sampled by observers during this portion of the fishery are displayed in Appendix B5.

Measurements and shell ages of 2,865 retained male golden king crabs were taken throughout the season by onboard observers (Table 9). The mean CL of crabs harvested was 148.5 mm, within 0.5 mm of the previous season's mean CL.

Measurements of CL were also taken from 23,605 male golden king crabs in sampled pot lifts (Figure 8). The mean CL for all male golden king crabs in sampled pot lifts was 138.1 mm, which is 1.7 mm greater than that of the 2002 season and 3.8 mm greater than that of the 2001 season. The size frequency distribution of these measurements for the 2003 season and the previous three seasons are similar in distribution and shell composition.

Measurements of CL were taken from 8,042 female golden king crabs in sampled pot lifts (Figure 9). The mean CL for all female golden king crabs from sampled pot lifts was 119.2 mm, which is 3.7 mm more than the mean CL from 2002 and almost 8.1 mm more than the 2001 mean. The histogram of the female CL for the 2003 season revealed a similar size and shell age distribution to those of the 2000 and 2002 seasons. The mode for the 2001 season was less pronounced, was in a smaller size class (~ 110 mm) than the other three seasons and had a larger proportion of old-shell female crabs displayed than in the other years.

The stratified estimate of CPUE for legal retained crabs, 11.1, was essentially equal to that from fish tickets (Table 10). The estimated CPUE for legal retained male golden king crabs was very precise, as the standard error accounted for just 5% of the estimated CPUE. The 95% confidence interval for the stratified CPUE estimate is (10.1, 12.2). The bycatch of female and undersized male golden king crabs was lower than the previous season, which had decreased from the 2000 season (Figure 10). Two out of every 5 golden king crabs caught were returned to the sea as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2003 season are provided in Appendix C17. Additional appendices contain CPUE by soak time (Appendix C18) and depth (Appendix C19) and the reproductive condition of female golden king crabs from the bycatch (Appendix C20).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors from both east and west of 174° W longitude totaled 82,376 crabs by the end of the 2003 season (Appendix C33). Just under 0.50% of sampled crabs were deemed illegal due to size, sex or species, similar to sample proportions calculated for the preceding 4 years.

Aleutian Islands West of 174° W Longitude

The 2002/2003 Aleutian Islands golden king crab fishery west of 174^{o} W longitude began 15 August 2002 and concluded 8 March 2003; fishing activity occurred during every month of the season. Observer requirements stipulate 100% coverage in this fishery. During the 2002/2003 fishing season west of 174° W observers were deployed on 1 catcher-processor and 5 catcher-only vessels. The bycatch sampling goal for observers on catcher-processor vessels was 5 pot lifts during each day of fishing activity. Sampling goals for observers on catcher-only vessels was 10 pot lifts during each day of fishing activity. Catches in 6 of the 10 sampled pot lifts were identified to species, enumerated, measured, and assessed for other ancillary characteristics. The remaining pot lifts had their catches identified to species, sex and legal status and counted, but not measured or otherwise assessed for ancillary characteristics. A total of 2,509 pot lifts selected for bycatch sampling accounted for 2.6% of 95,581 pot lifts reported by vessel operators during the season (ADF&G 2004). The locations of pot lifts sampled by observers during this portion of the fishery are displayed in Appendix 6.

Measurements and shell ages of 17,527 retained male golden king crabs were taken throughout the season by onboard observers (Table 11). The mean CL of crabs harvested was 145.7 mm, a decrease of 1.3 mm from the previous season.

Measurements of CL were also taken from 43,068 male golden king crabs captured in sampled pot lifts (Figure 11). The mean CL for all male golden king crabs in sampled pot lifts was 132.6 mm, identical to the mean CL of the previous season. All four seasons displayed show similar size distributions and shell age characteristics.

Measurements of CL were taken from 22,562 female golden king crabs captured in sampled pot lifts (Figure 12). The mean CL for all female golden king crabs in sampled pot lifts was 124 mm, which was almost 2 mm smaller than the mean from the 2001/2002 season and 1.5 mm larger than the mean from the 2000/2001 season.

The stratified estimate of CPUE for legal retained crabs (8.3) was 1.3 crabs per pot lift larger than the fish ticket estimate (Table 12). The stratified estimated CPUE for legal retained male golden king crabs was very precise, as the standard error accounted for 4.9% of the estimated CPUE. The 95% confidence interval for the stratified CPUE estimate (7.5, 9.1) does not contain the ATF CPUE estimate (7.0). This indicates it is less accurate than previous CPUE estimates. CPUE estimates for female and sublegal male crabs were only slightly less precise with standard errors 5.6% and 9.1% of their mean estimates, respectively. Both the bycatch of female and sublegal male crabs exceeded the catch of legal retained male crabs; nearly 7 of every 10 golden king crabs caught were returned to the sea as bycatch. The 2002/2003 stratified CPUE estimate of legal-sized golden king crabs was slightly higher than the 2001/2002 estimate and was the highest in 4 years (Figure 13). Non-target golden king crab catch rates during the 2002/2003 season were similar to the previous 3 seasons. Overall, the ratios of sublegal crab CPUE to legal male crab CPUE has remained relatively constant during the 1998/1999 through the 2002/2003 seasons.

Total catches of all animals identified in sampled pot lifts during the 2002/2003 season are provided in Appendix C21. Additional appendices contain CPUE by soak time (Appendix C22) and depth (Appendix C23), and the reproductive condition of female golden king crabs from the bycatch (Appendix C24).

BERING SEA GOLDEN KING CRAB

2001 marked the first year that observers were deployed during the Bering Sea Golden King crab fishery. The 2003 Bering Sea golden king crab fishery began 28 March and concluded 1 May. Observer requirements stipulate 100% coverage in this fishery. During the 2003 fishing season observers were deployed on 3 catcher-only vessels. The bycatch sampling goal for observers was a minimum of 10 pot lifts during each day of fishing activity. Catches in all pot lifts sampled were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. A total of 593 pot lifts selected for bycatch sampling accounted for 20.8% percent of 2,854 pot lifts reported by vessel operators during the 35 day season (ADF&G 2004). The location of pot lifts sampled by observers during the 2003 Bering Sea golden king crab fishery are displayed in Appendix B7.

Measurements and shell ages of 565 retained male golden king crabs were taken throughout the season by onboard observers (Table 13). The mean CL of crabs harvested was 139.4 mm, 5 mm less than 2002. The distribution was grouped tightly around four 5 mm intervals, with 74% of the sampled crab falling between 126 mm and 150 mm.

Measurements of CL were also taken from 10,691 male golden king crabs captured in sampled pot lifts (Figure 14). The mean CL for all male golden king crabs in sampled pot lifts was 126.4

mm, 7 mm less than the previous season. The mode shifted from the 141-145 mm group to the 126-130 mm group.

Measurements of CL were taken from 2,227 female golden king crabs captured in sampled pot lifts (Figure 15). The mean CL for all female golden king crabs in sampled pot lifts was 102.3 mm, 2.9 mm smaller than female golden king crabs from the 2002 fishery.

The stratified estimate of 10.6 legal retained males per pot lift was greater than the estimate of 7.4 from the 2002 season (Table 14). This estimate was moderately precise as the standard error of the estimates for legal retained males represents 8.2% of the CPUE estimate. The 95% confidence interval for the stratified CPUE estimate (8.9, 12.6) covers the ATF CPUE of 12.6 indicating it is accurate. The estimates for sublegal males and females were less precise, with the standard error accounting for about 12% and 17% of the mean, respectively. Nearly 54% of all golden king crabs captured during the 2003 fishery were estimated to be bycatch and discarded.

Total catches of all animals identified in sampled pot lifts during the 2003 season are provided in Appendix C25. Additional appendices contain CPUE by soak time (Appendix C26) and depth (Appendix C27), and the reproductive condition of female golden king crabs from the bycatch (Appendix C28).

Legal tallies conducted shoreside during vessel deliveries to processors totaled 2,653 crabs by the end of the 2003 season (Appendix C33). Just over 0.60% of sampled crabs were deemed illegal due to size, sex or species.

PETREL BANK RED KING CRAB

The western Aleutian Islands red king crab fishery was closed in 1996. In September 1999, the North Pacific Fishery Management Council's Crab Plan Team determined that recent fishery-based assessments were not providing adequate data for fishery management. The Team recommended the development of a survey plan with industry participation in the design. The department conducted a survey of Petrel Bank, utilizing the commercial fishing fleet during January and February 2001; a second survey was conducted during November 2001 (Bowers et al. 2002). The observer data from the two surveys was summarized in Neufeld and Barnard 2003. The first general fishery since the 1996 closure was held in 2002.

The 2003 Petrel Bank red king crab fishery began 25 October and concluded 29 October. Observer requirements stipulate 100% coverage in this fishery. Thirty vessels participated in the fishery. The bycatch sampling goal for observers was 10 pot lifts during each day of fishing activity. Catches in all pot lifts sampled were identified to species, counted, measured, and otherwise assessed for ancillary characteristics. A total of 932 pot lifts selected for bycatch sampling accounted for 16.1% of 5,774 pot lifts reported by vessel operators during the 4 day season (ADF&G 2004). The location of pot lifts sampled by observers during the 2003 Petrel Bank red king crab fishery are displayed in Appendix B8.

Measurements and shell ages of 2,381 retained male red king crabs were taken throughout the season by onboard observers (Table 15). The mean CL of crabs harvested was 167.9 mm which is 5.5 mm larger than the 2002 fishery. Eighty two percent of retained crabs were between 156 mm and 180 mm.

Measurements of CL were taken from 10,112 male red king crabs captured in sampled pot lifts (Figure 16). The mean CL for all male red king crabs in sampled pot lifts was 160.9 mm, with most crabs sampled being between 155 mm and 180 mm. The proportions of old-shell male

crabs were slightly greater than the 2002 data. A small mode present at 81-85 mm CL in 2002 was more pronounced in 2003 with the mode shifted to 86-90 mm CL.

Measurements of CL were taken from 2,186 female red king crabs captured in sampled pot lifts (Figure 17). The mean CL for all female red king crabs in sampled pot lifts was 121.9 mm, 7.4 mm smaller than the 2002 fishery. The distribution of CL and proportions of shell ages for the 2003 fishery are very similar to the 2002 fishery. Similar to the male golden king crabs, a mode at 81-85 mm CL in 2002 was more prominent in 2003.

The estimated CPUE for legal retained male red king crabs was 10.6, 5.5 crabs per pot lift less than the 2002 fishery estimate (Table 16). The 2003 estimate for retained crab was more precise than the 2002 fishery, as the standard error accounted for 10.1% of the estimated CPUE. The estimate of CPUE for legal retained crabs is nearly identical to that from the ATF CPUE (a difference of 0.2 crabs per pot lift). The 95% confidence interval for the stratified CPUE estimate is (8.5, 12.7). The bycatch of female and undersized male red king crabs was low, at 2.6 for females and 0.8 for undersized males. Nearly 25% of the red king crabs captured in pots were returned to the sea as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2003 season are provided in Appendix C29. Additional appendices contain CPUE by soak time (Appendix C30) and depth (Appendix C31) and the reproductive condition of female red king crabs from the bycatch (Appendix C32).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 7,909 crabs by the end of the 2003 season (Appendix C33). Less than 0.01% of sampled crabs were deemed illegal due to size, sex or species.

Accuracy and Precision of CPUE Estimates

In using CPUE estimates based on observer data it is important to have some assessment of their reliability for observed vessels and, especially, for all vessels participating in a fishery. Although the observer data are the only source of information on bycatch CPUEs for the fisheries presented in this report, fish tickets also provide data for independent estimates of the CPUE of retained legal crabs. We can gain some understanding of the reliability of the estimated CPUE computed from observer sample data by comparing it to the ATF CPUE computed from fish ticket data.

Fish ticket data from all landings of all vessels participating in a fishery provide an independent estimate of the total fishery CPUE of retained legal crabs. This is particularly useful for fisheries in which observers were required on catcher-processor vessels and only a fraction of the catcher-only vessels. Since 1995 when stratified estimates of CPUE were first estimated from shellfish observer bycatch data, the snow crab fishery has been the most problematic in terms of observer-derived estimates agreeing with fish ticket data. The harvest of snow crabs has historically been the largest of all shellfish fisheries prosecuted in the BSAI area, in terms of total pot lifts, number and pounds of crabs, and average catch per pot lift. The pot lifts sampled by observers from 1995 through 2000 consisted of less than 0.3 % of the total pots lifted in the fishery. With the additional observer coverage on catcher-only vessels, the percentage of pot lifts sampled by observers in 2002 was 0.4%, and 0.6% in 2003. CPUE estimates computed from observer data for retained legal crabs in the 2003 Bering Sea snow crab fishery (150.5 crabs) differed from the ATF CPUE by 5.5 fewer crabs per pot lift (2.9%). This indicates a much-improved reliability for

observer bycatch sample data in providing CPUE estimates in this fishery relative to previous years.

With the exception of two fisheries, CPUE estimates for retained legal crabs computed from observer bycatch samples were within 6% of the ATF CPUE for all fisheries in which crab observers were deployed (Table 17). The close agreement between the observer-based and ATF CPUE estimates for retained legal crab in those BSAI crab fisheries indicated that observer bycatch sample data provide reliable estimates of CPUE for the entire fleet. The exceptions were the Bering Sea golden king crab fishery and the Aleutian Islands golden king crab fishery west of 174° W longitude.

CPUE estimates (10.6 crabs per pot lift) computed from observer data for retained legal crabs in the 2003 Bering Sea golden king crab fishery differed from the ATF CPUE by 2 fewer crab per pot lift (a 15.9% discrepancy). The 2003 estimates had similar reliability to the 2002 estimates (16.4% discrepancy), and the ATF CPUE was contained by the 95% confidence interval for the weighted CPUE estimate. It should be noted, however, that the difference represented only 2 crabs per pot lift, which is inflated by the small size CPUE.

The other fishery that was problematic during the 2003 fishing season was the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude. The 18.6% difference between observer and ATF CPUE estimates was 4.5 times the 2001/2002 difference for this fishery. There was a decrease in the percent of pot lifts sampled by observers from over 4% in 2000/2001 and 2001/2002 to 2.6% in 2002/2003. Again, the small CPUE estimates inflated the difference of 1.3 crabs per pot lift.

Comparing stratified CPUE estimates for retained legal crabs with the ATF CPUE in all the other fisheries with partial observer coverage indicated that partial observer coverage provided adequate data for estimation of CPUE for those fisheries. The Bristol Bay red king crab general and CDQ fisheries discussed in this report realized the best agreement between estimates. For the general fishery, improvement can probably be attributed to the increased observer coverage required for catcher-only vessels and the addition of a new stratum in the analytical design.

The "stratified" observer-based CPUE estimator used in this report is different from the "sample" observer-based CPUE estimate used in past Mandatory Shellfish Observer Database Summaries (e.g., Tracy 1994, 1995a,b). Although the stratified estimation method can provide more accurate and precise estimates, the stratified and sample CPUE estimates are generally very close to each other. Therefore, the stratified estimates presented here are comparable to those CPUE estimates included in previous observer data summaries. The value of using the stratified CPUE estimates is that the estimation method allows for computation of the standard errors of the CPUE estimates.

The standard errors provided in this report give a measure of the precision or repeatability of the CPUE estimates. Generally, the stratified CPUE estimates appeared to be precise, as reflected in the relatively small standard errors. We did compute confidence intervals for the CPUE estimates although the sample size within each stratum (vessel-day) was not large enough to assume an asymptotic normal distribution. Bootstrap simulation of observer data collected in the 1995 BSAI crab fisheries suggested that the stratified CPUE estimates plus or minus two standard errors was adequate to characterize the true CPUE of the targeted species (Byrne and Pengilly 1998).

REFERENCES CITED

Alaska Department of Fish and Game (ADF&G). 1999. Annual management report for the shellfish fisheries of the Westward Region, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K99-49, Kodiak. 312 pp.

Alaska Department of Fish and Game (ADF&G). 2003. Shellfish Observer Manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, Dutch Harbor. 211 pp.

Alaska Department of Fish and Game (ADF&G). 2004. 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, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K04-43, Kodiak. 235 pp.

Bowers, F., 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 No. 4K02-11, Kodiak. 92 pp.

Byrne, L. C. and D. Pengilly. 1998. Estimates of CPUE for the 1995 crab fisheries of the Bering Sea and Aleutian Islands based on observer data. Proceedings of the 15th Lowell Wakefield Fisheries Symposium. Fishery Stock Assessment Models for the 21st Century. University of Alaska Sea Grant College Program.

Cochran, W.G. 1977. Sampling Techniques. John Wiley and Sons. New York. 428 pp.

Neufeld, G., and D. Barnard. 2003. Alaska Department of Fish and Game Summary of the 2001 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. 4K03-2, Kodiak. 160 pp.

Tracy, D. A. 1994. Alaska Department of Fish and Game Summary of the 1992 Mandatory Shellfish Observer Program Database. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K94-10, Kodiak. 116 pp.

Tracy, D. A. 1995a. Alaska Department of Fish and Game Summary of the 1993 Mandatory Shellfish Observer Program Database. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K95-14, Kodiak. 128 pp.

Tracy, D. A. 1995b. Alaska Department of Fish and Game Summary of the 1994 Mandatory Shellfish Observer Program Database. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K95-32, Kodiak. 96 pp.

TABLES AND FIGURES

Table 1.-Carapace width (CW, mm) frequency distributions by shell age from biological measurements of retained snow crabs sampled during the 2003 Bering Sea snow crab general fishery.

Width (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
< 76	< 0.1	< 0.1	0	< 0.1
76-80	0.1	< 0.1	0	0.1
81-85	0.3	< 0.1	0	0.3
86-90	0.8	0.1	< 0.1	0.9
91-95	2.7	0.5	< 0.1	3.2
96-100	10.6	1.5	0.1	12.3
101-105	23.4	3.4	0.3	27.1
106-110	21.4	3.5	0.3	25.2
111-115	13.7	2.8	0.3	16.8
116-120	7.3	1.9	0.1	9.4
121-125	2.7	0.8	0.1	3.6
126-130	0.6	0.3	< 0.1	0.9
131-135	0.1	0.1	< 0.1	0.2
> 135	< 0.1	0	0	< 0.1
Total Crab	18,894	3,347	297	22,538
Total Percent	83.8	14.9	1.3	100.0

[a] Average CW = 107.2 mm.

Table 2.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Bering Sea snow crab general fishery. The estimates are from 860 pot lifts.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Snow Crab			
Legal males - retained	142.0[b]	10.79	19,866,100[c]
Legal males - not retained	136.5	18.06	19,102,400
Sublegal males	8.4	1.37	1,178,000
Females	0.2	0.07	22,600
Tanner x Snow Hybrid			
Legal males - retained	8.5[b]	3.89	1,193,400[c]
Legal males - not retained	5.5	2.77	768,000
Sublegal males	0.4	0.19	53,700
Females	0	0	0
Tanner Crab			
Legal males - not retained	0.2	0.09	23,400
Sublegal males	2.5	0.58	353,000
Females	0.5	0.22	73,800

[a] Estimated catch is the product of the CPUE estimate and 139,903, the total number of pot lifts for the 2003 Bering Sea snow crab general fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 155 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 21,637,019 (ADF&G 2004).

Table 3.-Carapace width (CW, mm) frequency distributions by shell age from biological measurements of retained snow crabs sampled during the 2003 Bering Sea snow crab CDQ fishery.

Width (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
76-80	0.1	< 0.1	0	0.1
81-85	0.2	0.1	0	0.3
86-90	0.7	< 0.1	0	0.7
91-95	3.8	0.1	< 0.1	3.9
96-100	13.5	0.1	< 0.1	13.7
101-105	25.1	0.5	0.1	25.6
106-110	23.9	0.4	< 0.1	24.4
111-115	16.8	0.5	0.1	17.3
116-120	9.5	0.4	0.1	10.0
121-125	2.8	0.1	< 0.1	3.0
126-130	0.7	0.1	0	0.8
131-135	0.1	0	0	0.1
136-140	< 0.1	0	0	< 0.1
Total Crab	6,122	156	18	6,296
Total Percent	97.2	2.5	0.3	100.0

[a] Average CW = 107.1 mm.

Table 4.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Bering Sea snow crab CDQ fishery. The estimates are from 740 pot lifts.

Species / Sex class	Sampled Fleet Estimates		
	CPUE	SE	Estimated Total Catch [a]
Snow Crab			
Legal males - retained	112.4[b]	4.75	1,639,000[c]
Legal males - not retained	119.4	4.90	1,740,700
Sublegal males	5.0	0.47	73,600
Females	< 0.1	0.02	400
Tanner x Snow Hybrid			
Legal males - retained	0.8[b]	0.23	11,000[c]
Legal males - not retained	0.3	0.07	4,500
Sublegal males	0.3	0.06	4,800
Females	0.0	0.01	100
Tanner Crab			
Legal males - not retained	1.4	2.08	20,000
Sublegal males	4.1	0.94	59,800
Females	0.7	0.32	9,700

[a] Estimated catch is the product of the CPUE estimate and 14,583, the total number of pot lifts for the 2003 Bering Sea snow crab CDQ fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 119.9 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 1,747,935 (ADF&G 2004).

Table 5.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained red king crabs sampled during the 2003 Bristol Bay red king crab general fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
96-100	< 0.1	0	0	< 0.1
101-105	0	0	0	0
106-110	0	0	0	0
111-115	< 0.1	0	0	< 0.1
116-120	< 0.1	0	0	< 0.1
121-125	< 0.1	0	0	< 0.1
126-130	0.2	0.1	0	0.3
131-135	3.4	0.7	0.1	4.2
136-140	14.8	2.5	0.3	17.6
141-145	18.6	3.3	0.4	22.3
146-150	14.7	3.0	0.4	18.2
151-155	10.7	2.6	0.6	13.9
156-160	6.3	2.3	0.5	9.1
161-165	4.4	1.8	0.6	6.7
166-170	2.7	1.2	0.4	4.3
171-175	1.5	0.6	0.2	2.3
176-180	0.4	0.2	0.1	0.7
181-185	0.1	0.1	< 0.1	0.2
186-190	< 0.1	< 0.1	< 0.1	< 0.1
191-195	< 0.1	0	0	< 0.1
Total Crab	12,663	2,978	577	16,218
Total Percent	78.1	18.4	3.6	100.0

[a] Average CL = 148.8 mm.

Table 6.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Bristol Bay red king crab general fishery. The estimates are from 722 pot lifts.

Species / Sex class	Sampled Fleet Estimates		
	CPUE	SE	Estimated Total Catch [a]
Red King Crab			
Legal males - retained	17.8[b]	1.54	2,299,500[c]
Legal males - not retained	0.2	0.09	24,600
Sublegal males	26.5	3.40	3,416,900
Females	16.5	3.05	2,126,300

[a] Estimated catch is the product of the CPUE estimate and 129,019, the total number of pot lifts for the 2003 Bristol Bay red king crab general fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 18.1 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 2,335,614 (ADF&G 2004).

Table 7.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained red king crabs sampled during the 2003 Bristol Bay red king crab CDQ fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
131-135	0.9	0.2	0.0	1.1
136-140	9.3	0.3	0.0	9.6
141-145	17.0	1.2	0.0	18.2
146-150	18.8	0.9	0.0	19.6
151-155	16.8	1.0	0.1	17.8
156-160	12.2	1.0	0.2	13.4
161-165	7.8	1.1	0.4	9.2
166-170	4.7	0.4	0.3	5.3
171-175	3.6	0.2	0.0	3.8
176-180	1.2	0.1	0.1	1.4
181-185	0.5	0.1	0.0	0.5
Total Crab	1,821	121	19	1961
Total Percent	92.9	6.2	1.0	100.0

[a] Average CL = 152.2 mm.

Table 8.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Bristol Bay red king crab CDQ fishery. The estimates are from 279 pot lifts.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Red King Crab			
Legal males - retained	30.1[b]	3.31	175,000[c]
Legal males - not retained	3.2	0.81	18,900
Sublegal males	26.9	4.68	156,600
Females	11.2	2.53	64,900

[a] Estimated catch is the product of the CPUE estimate and 5,814, the total number of pot lifts for the 2003 Bristol Bay red king crab CDQ fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 30.0 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 174,651 (ADF&G 2004).

Table 9.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained golden king crabs sampled during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
126-130	0.1	0	0	0.1
131-135	3.2	< 0.1	0	3.2
136-140	15.2	0.1	0	15.4
141-145	21.8	0.6	0	22.5
146-150	22.5	0.4	0	22.9
151-155	15.2	0.3	0	15.5
156-160	10.4	0.3	0	10.7
161-165	4.6	0.3	0	4.9
166-170	2.5	0.3	0	2.8
171-175	1.0	0.2	< 0.1	1.3
176-180	0.3	0	0	0.3
181-185	0.2	0.1	0	0.3
186-190	< 0.1	0	0	< 0.1
Total Crab	2,783	81	1	2,865
Total Percent	97.1	2.8	< 0.1	100.0

[a] Average CL = 148.5 mm.

Table 10.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude. The estimates are from 3,960 pot lifts.

Species / Sex class	Sampled Fleet Estimates		
	CPUE	SE	Estimated Total Catch [a]
Golden King Crab			
Legal males - retained	11.1[b]	0.56	657,200[c]
Legal males - not retained	0.1	0.04	4,600
Sublegal males	8.4	0.63	497,900
Females	7.9	0.84	463,900

[a] Estimated catch is the product of the CPUE estimate and 58,973, the total number of pot lifts for the 2003 eastern Aleutian Islands golden king crab fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 10.9 for all vessels (ADF&G 2004).

[c] Actual catch of reained legal crabs for the fishery was 643,868 (ADF&G 2004).

Table 11.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained golden king crabs sampled during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
121-125	< 0.1	0	0	< 0.1
126-130	0.1	0	0	0.1
131-135	5.8	< 0.1	< 0.1	5.8
136-140	21.3	0.1	< 0.1	21.4
141-145	27.3	0.3	< 0.1	27.6
146-150	20.7	0.4	< 0.1	21.1
151-155	12.9	0.4	< 0.1	13.3
156-160	5.7	0.2	< 0.1	5.9
161-165	2.5	0.2	< 0.1	2.7
166-170	1.1	0.1	0	1.2
171-175	0.5	< 0.1	< 0.1	0.5
176-180	0.1	< 0.1	< 0.1	0.1
181-185	0.1	0	0	0.1
186-190	< 0.1	0	0	< 0.1
Total Crab	17,199	302	19	17,527
Total Percent	98.1	1.7	0.1	100.0

[a] Average CL = 145.7 mm.

Table 12.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude. The estimates are from 2,505 pot lifts.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Golden King Crab			
Legal males - retained	8.3[b]	0.41	791,600[c]
Legal males - not retained	< 0.1	0.01	4,500
Sublegal males	10.0	0.56	952,300
Females	9.1	0.83	868,900

[a] Estimated catch is the product of the CPUE estimate and 95,581, the total number of pot lifts for the 2002/2003 western Aleutian Islands golden king crab fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 7.0 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 664,915 (ADF&G 2004).

Table 13.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained golden king crabs sampled during the 2003 Bering Sea golden king crab fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
116-120	0.4	0	0	0.4
121-125	7.8	0.2	0	8.0
126-130	14.7	0.9	0	15.6
131-135	16.8	1.9	0	18.8
136-140	14.5	3.0	0	17.5
141-145	11.3	1.6	0.2	13.1
146-150	6.7	1.9	0.4	9.0
151-155	5.7	1.2	0.2	7.1
156-160	5.5	0	0	5.5
161-165	2.3	0.5	0.2	3.0
166-170	1.2	0.4	0	1.6
171-175	0.4	0	0.2	0.5
Total Crab	493	66	6	565
Total Percent	87.3	11.7	1.1	100.0

[a] Average CL = 139.4 mm.

Table 14.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Bering Sea golden king crab fishery. The estimates are from 583 pot lifts.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Golden King Crab			
Legal males - retained	10.6 [b]	0.87	30,200[c]
Legal males - not retained	0.1	0.13	200
Sublegal males	8.3	0.99	23,600
Females	4.0	0.70	11,300

[a] Estimated catch is the product of the CPUE estimate and 2,854, the total number of pot lifts for the 2003 Bering Sea golden king crab fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 12.6 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 35,997 (ADF&G 2004).

Table 15.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained red king crabs sampled during the 2003 Petrel Bank red king crab fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
131-135	0	0	0	0
136-140	0.2	< 0.1	0	0.3
141-145	1.0	0.2	0	1.2
146-150	1.8	0.5	0	2.4
151-155	3.8	1.9	0.2	5.9
156-160	7.6	3.3	0.3	11.1
161-165	10.3	6.0	0.8	17.1
166-170	14.2	7.1	0.7	22.0
171-175	14.2	5.4	0.7	20.3
176-180	8.3	3.0	0.3	11.7
181-185	4.7	0.9	0.2	5.9
186-190	1.2	0.5	0	1.7
191-195	0.4	0.1	0	0.5
Total Crab	1,616	690	75	2,381
Total Percent	67.9	29.0	3.1	100.0

[a] Average CL = 167.9 mm.

Table 16.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2003 Petrel Bank red king crab fishery. The estimates are from 932 pot lifts.

Species / Sex class	Sampled Fleet Estimates		
	CPUE	SE	Estimated Total Catch [a]
Red King Crab			
Legal males - retained	10.6 [b]	1.07	61,300[c]
Legal males - not retained	< 0.1	0.01	70
Sublegal males	0.8	0.38	4,500
Females	2.6	1.81	15,300

[a] Estimated catch is the product of the CPUE estimate and 5,774, the total number of pot lifts for the 2003 Petrel Bank red king crab fishery (ADF&G 2004).

[b] Actual total fishery CPUE of retained legal crabs was 10.4 for all vessels (ADF&G 2004).

[c] Actual catch of retained legal crabs for the fishery was 59,828 (ADF&G 2004).

Table 17.-Observer coverage, pot lift sampling effort by observers, and relative difference of the weighted CPUE estimates for retained legal crabs from the Actual Total Fishery (ATF) CPUE. Data is from crab fisheries with mandatory observers.

Fishery	Vessels		Pot Lifts		Percent difference of the weighted CPUE estimate from ATF CPUE[a]
	Observed	Total Fishery	Observed	Total Fishery	
Bering Sea snow crab (with legal hybrids)	23	190	872	139,903	-2.9[b]
Bering Sea snow crab CDQ (with legal hybrids)	9	10	740	14,583	-5.7[b]
Bristol Bay red king crab	29	231	731	129,019	-1.7[b]
Bristol Bay red king crab CDQ	8	13	279	5,814	0.3[b]
Aleutian Islands golden king crab east of 174° W	18	18	3,960	58,973	1.8[b]
Aleutian Islands golden king crab west of 174° W	6	6	2,505	95,581	18.6
Bering Sea golden king crab	3	3	593	2,854	-15.9[b]
Aleutian Islands red king crab	30	30	932	5,774	1.9[b]

[a] ATF CPUE is based on fish ticket data on all landings in the fishery. Percent difference is calculated as:

$$\left[\frac{(weightedCPUE)-(ATFCPUE)}{(ATFCPUE)}\right]\times 100\% .$$

[b] ATF CPUE is contained within the 95% confidence interval for the stratified, weighted CPUE estimate.

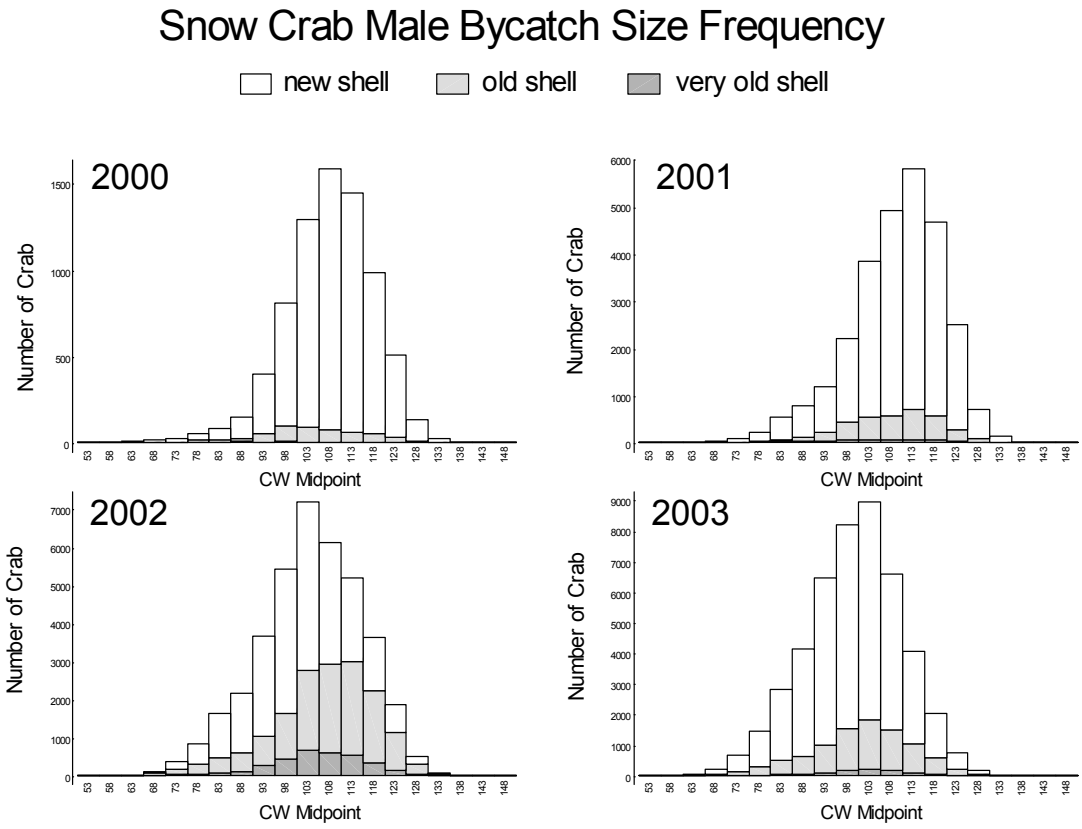

Figure 1.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for male snow crabs from pot lifts sampled during the 2000-2003 Bering Sea snow crab general fisheries.

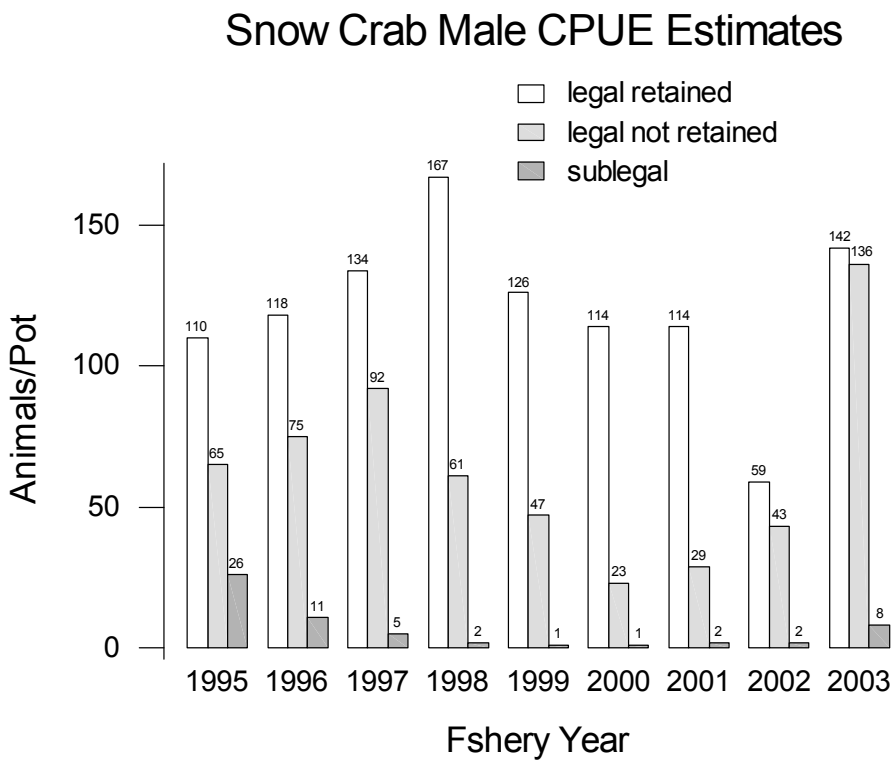

Figure 2.-Estimated CPUE of male snow crabs from pot lifts sampled during the 1995-2003 Bering Sea snow crab general fisheries.

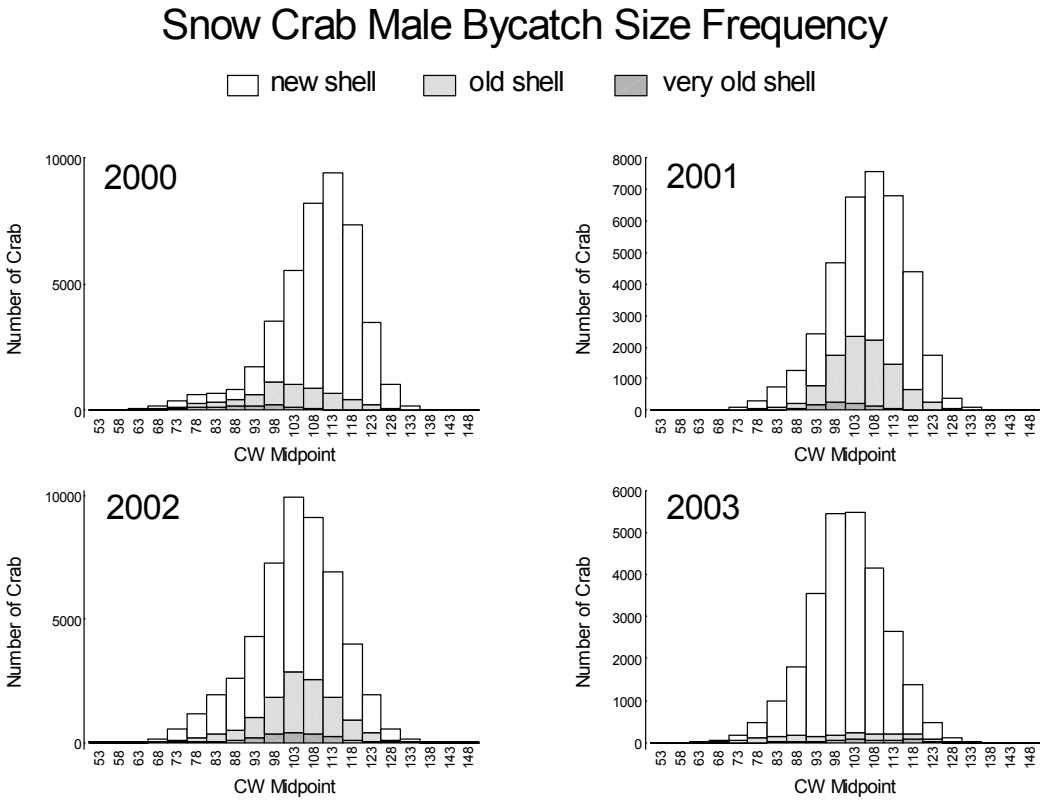

Figure 3.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for male snow crabs from pot lifts sampled during the 2000-2003 Bering Sea snow crab CDQ fisheries.

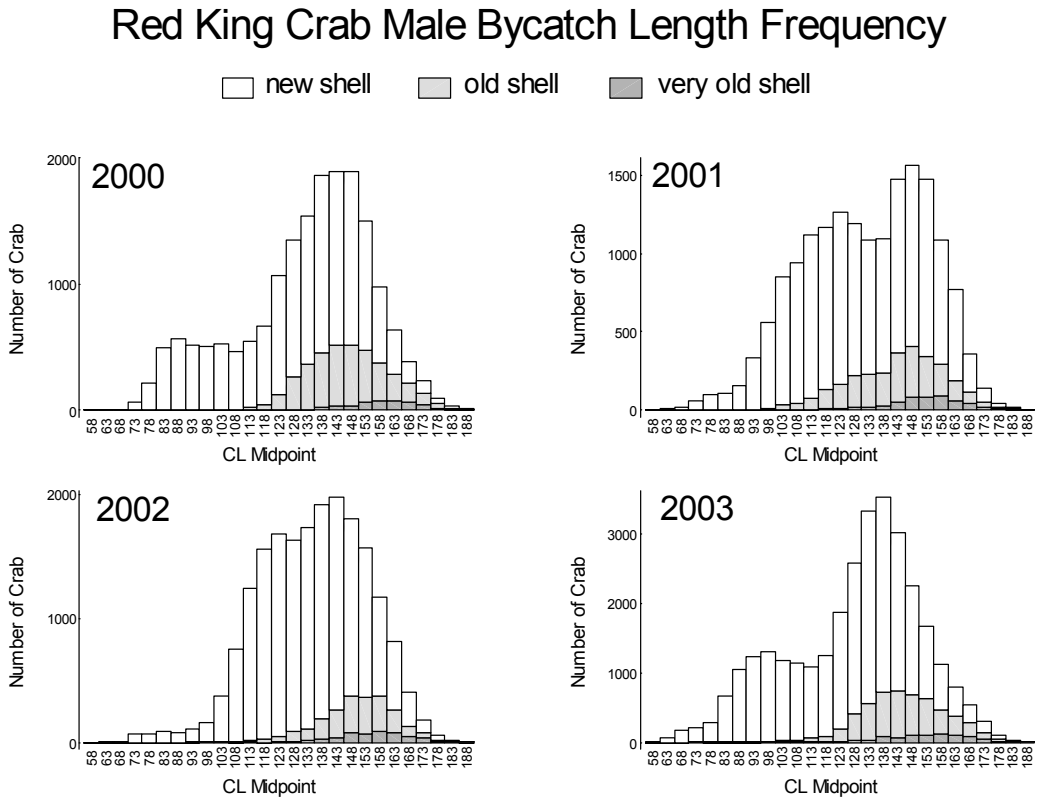

Figure 4.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male red king crabs from pot lifts sampled during the 2000-2003 Bristol Bay red king crab general fisheries.

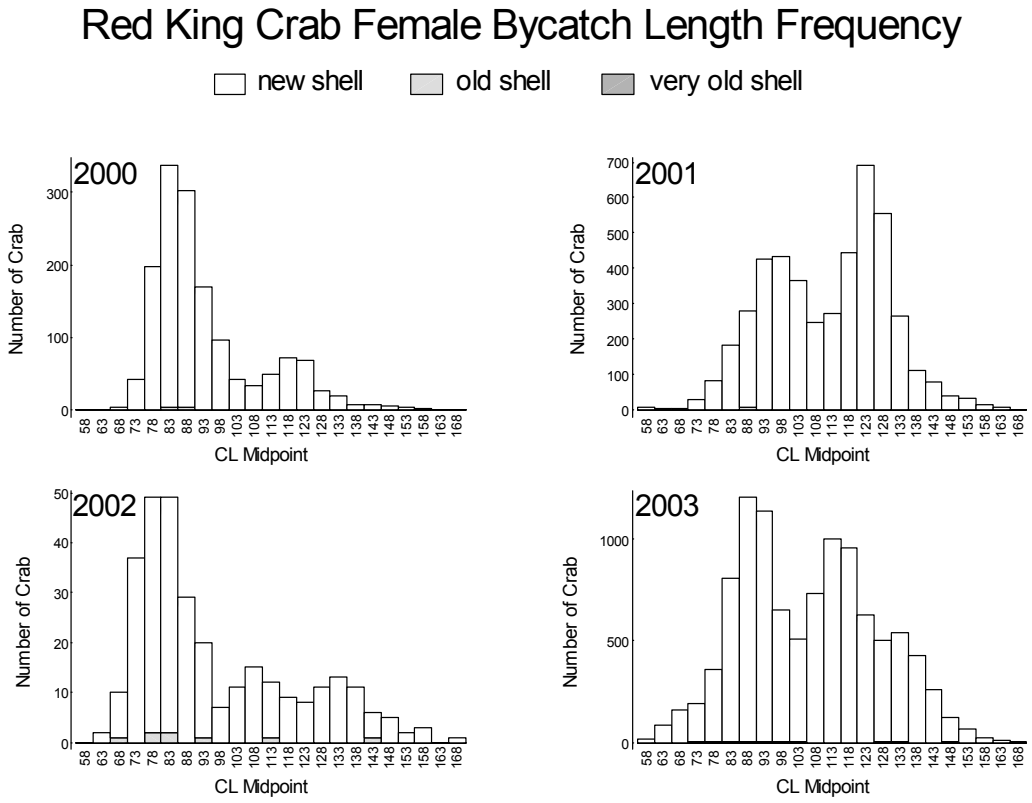

Figure 5.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female red king crabs from pot lifts sampled during the 2000-2003 Bristol Bay red king crab general fisheries.

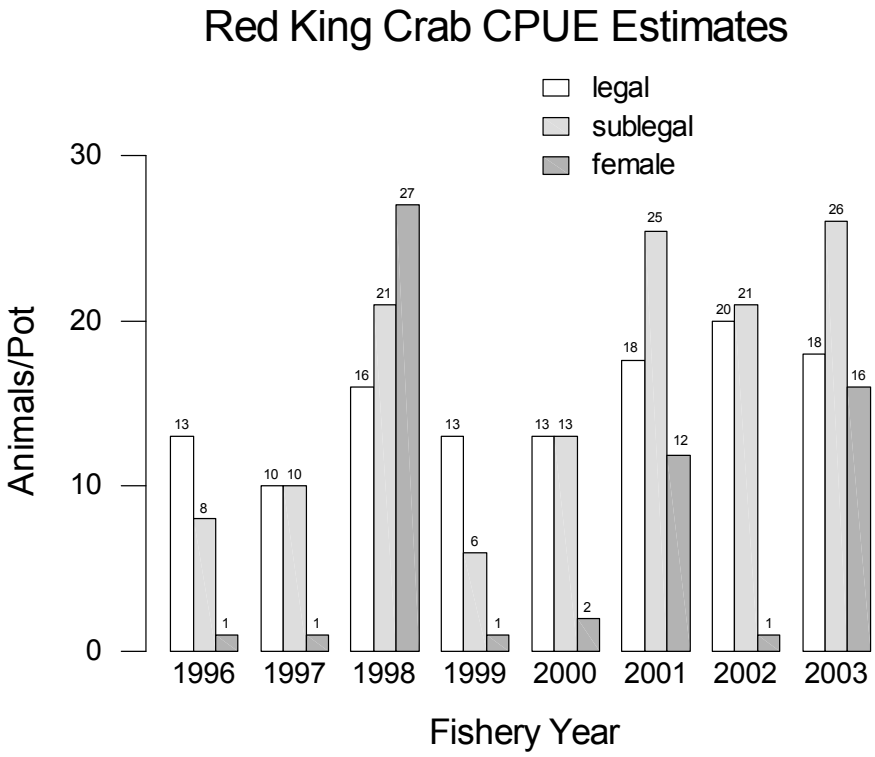

Figure 6.-Estimated CPUE of red king crabs from pot lifts sampled during the 1996-2003 Bristol Bay red king crab general fisheries.

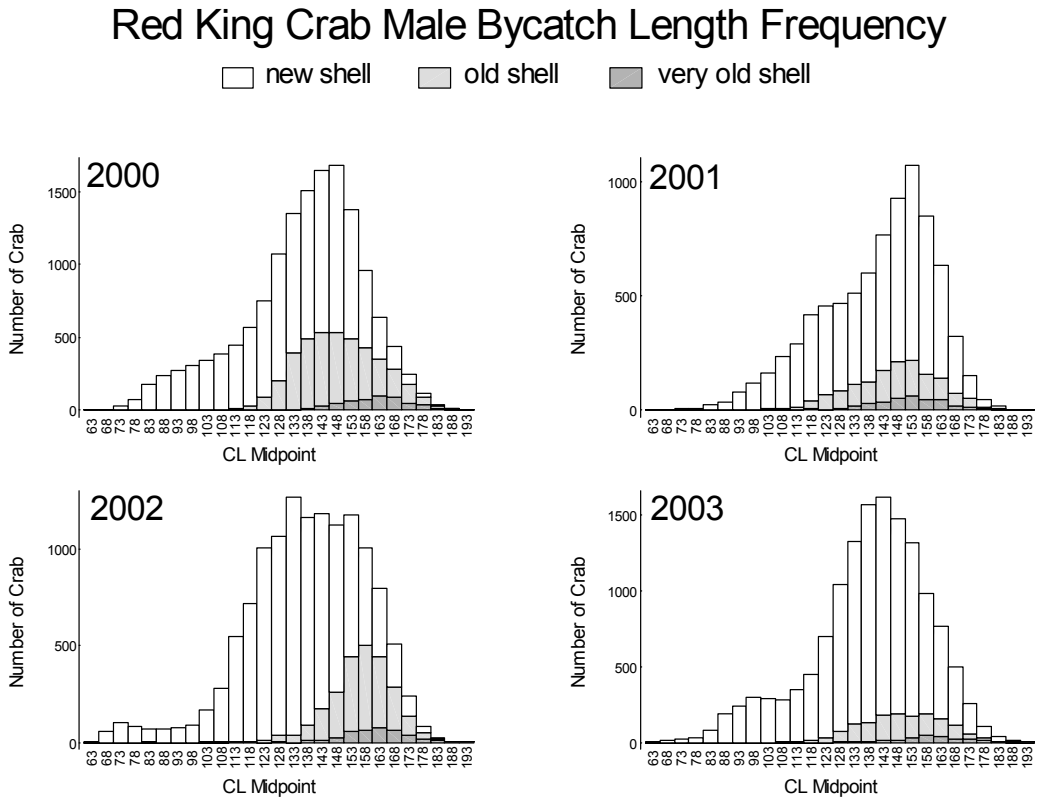

Figure 7.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male red king crabs from pot lifts sampled during the 2000-2003 Bristol Bay red king crab CDQ fisheries.

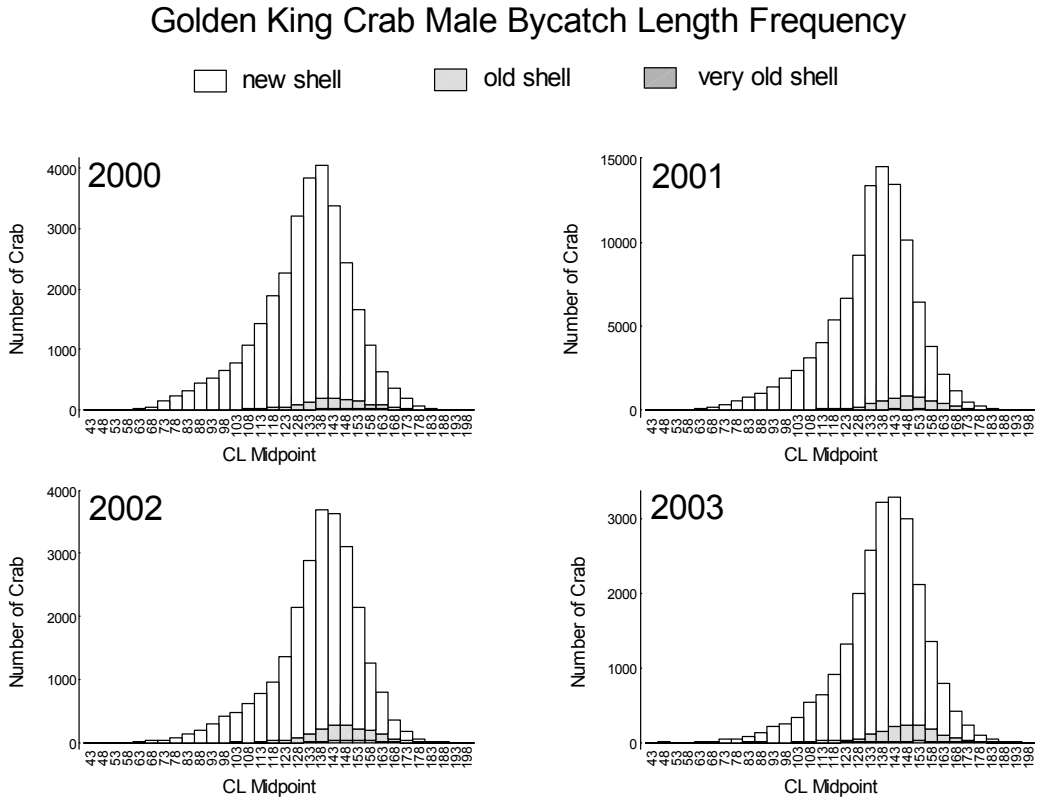

Figure 8.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 2000-2003 Aleutian Islands golden king crab fisheries east of 174° W longitude.

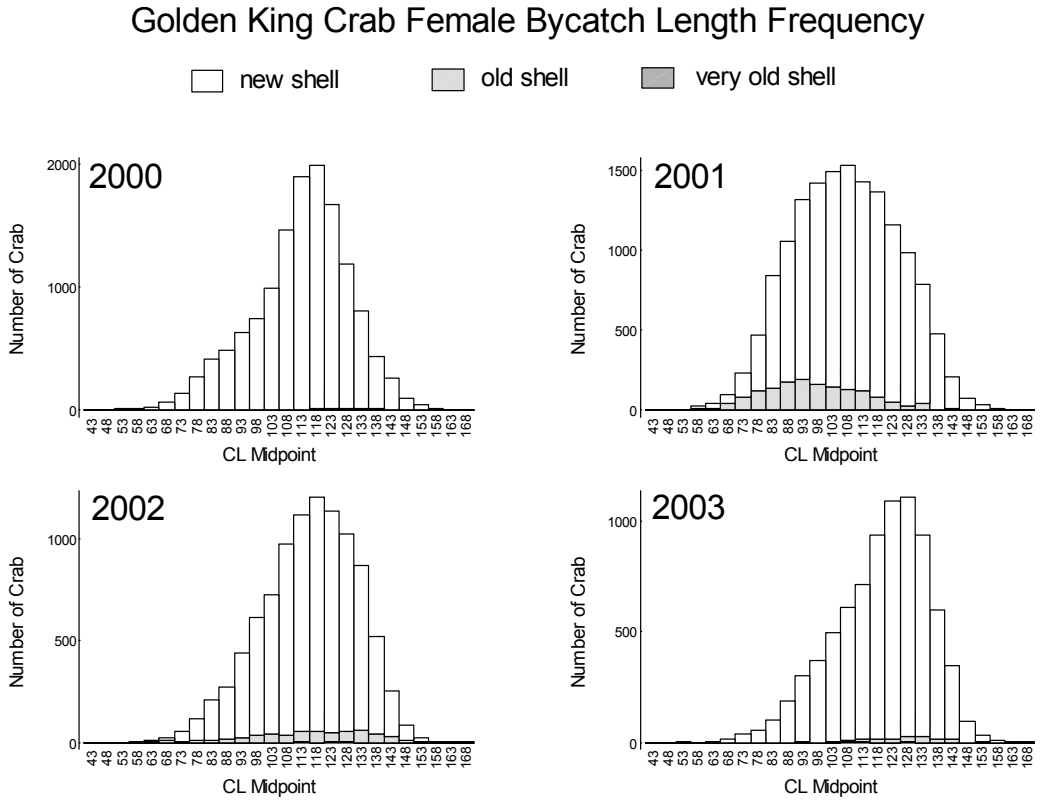

Figure 9.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 2000-2003 Aleutian Islands golden king crab fisheries east of 174° W longitude.

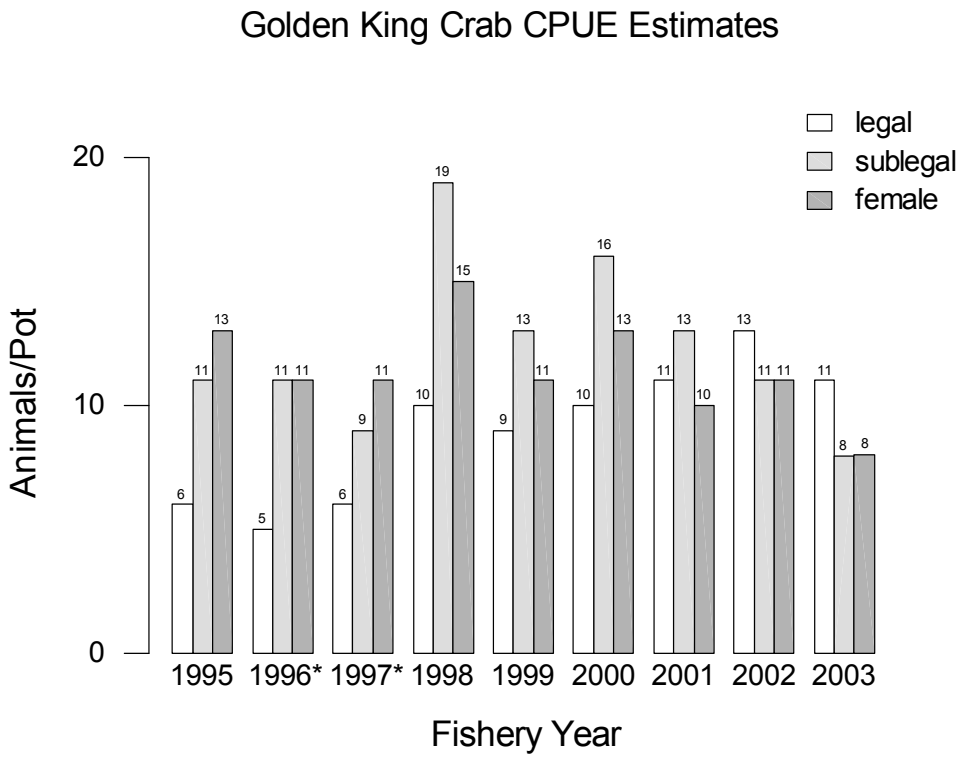

Figure 10.-Estimated CPUE of male golden king crabs from pot lifts sampled during the 1995-2003 Aleutian Islands golden king crab fisheries east of 174° W longitude.

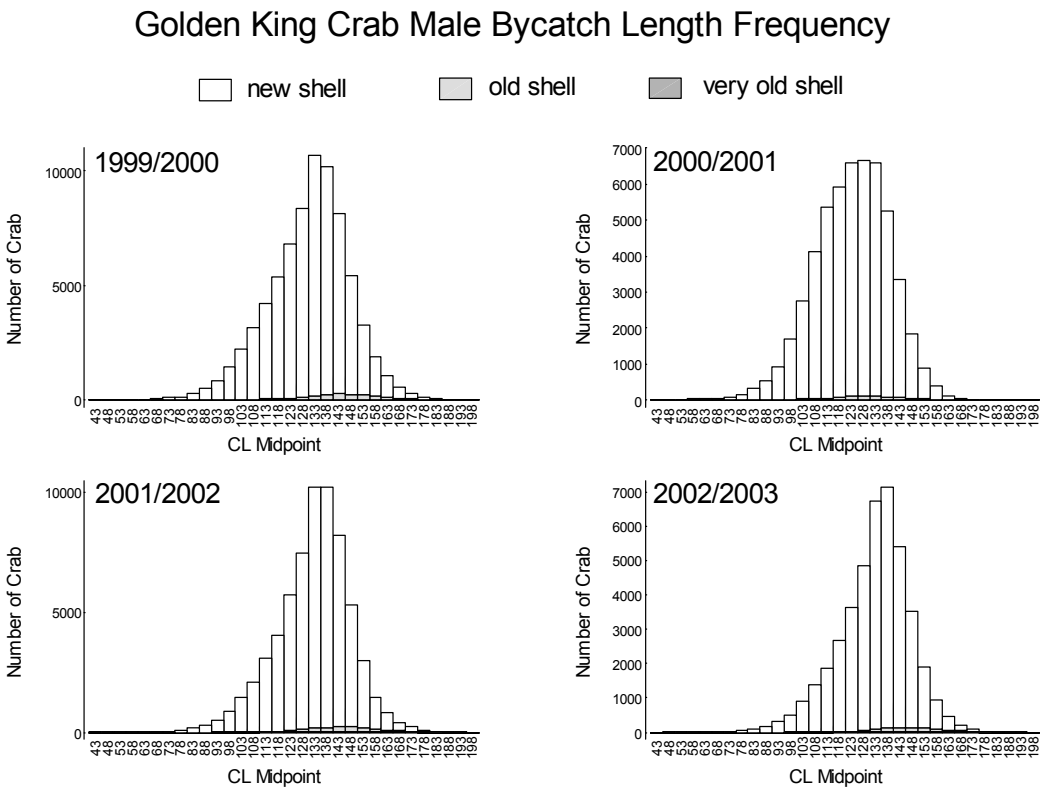

Figure 11.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 1999/2000-2002/2003 Aleutian Islands golden king crab fisheries west of 174° W longitude.

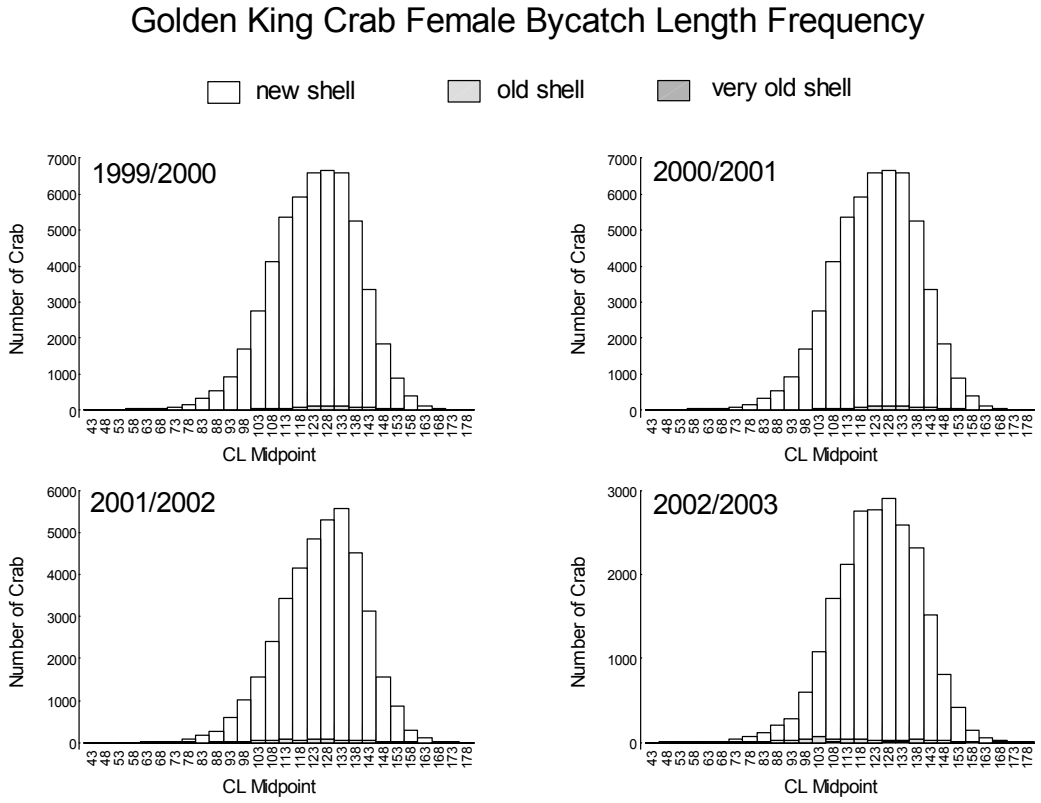

Figure 12.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 1999/2000-2002/2003 Aleutian Islands golden king crab fisheries west of 174° W longitude.

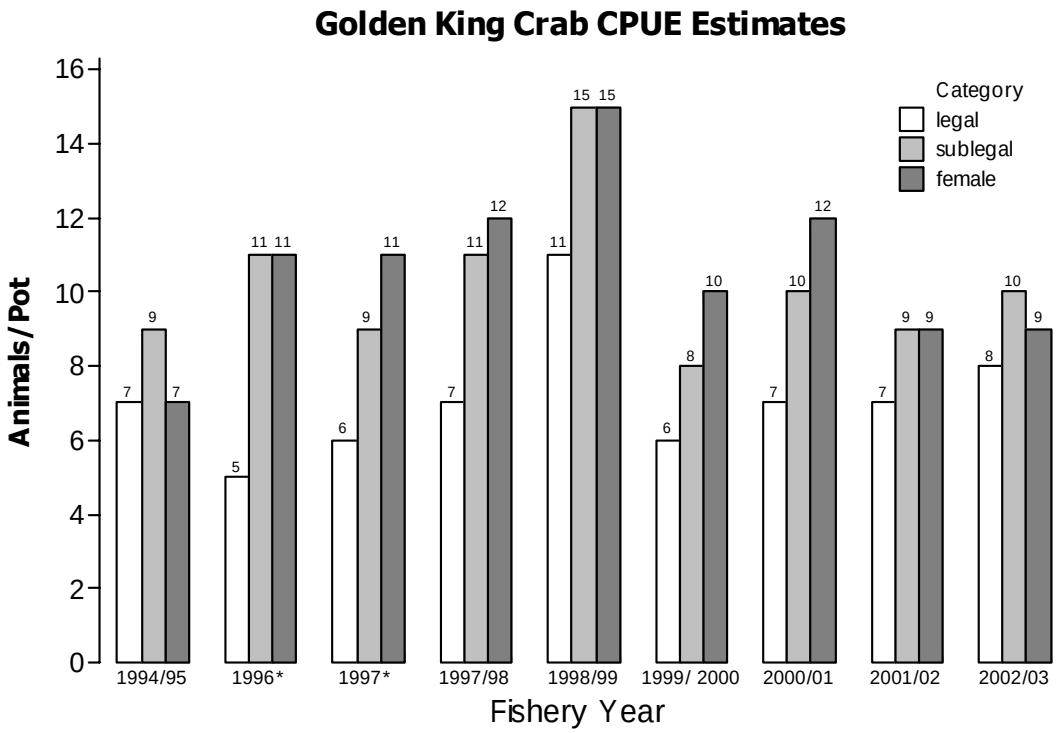

Figure 13.-Estimated CPUE of golden king crabs from pot lifts sampled during the 1994/1995-2002/2003 Aleutian Islands golden king crab fisheries west of 174° W longitude.

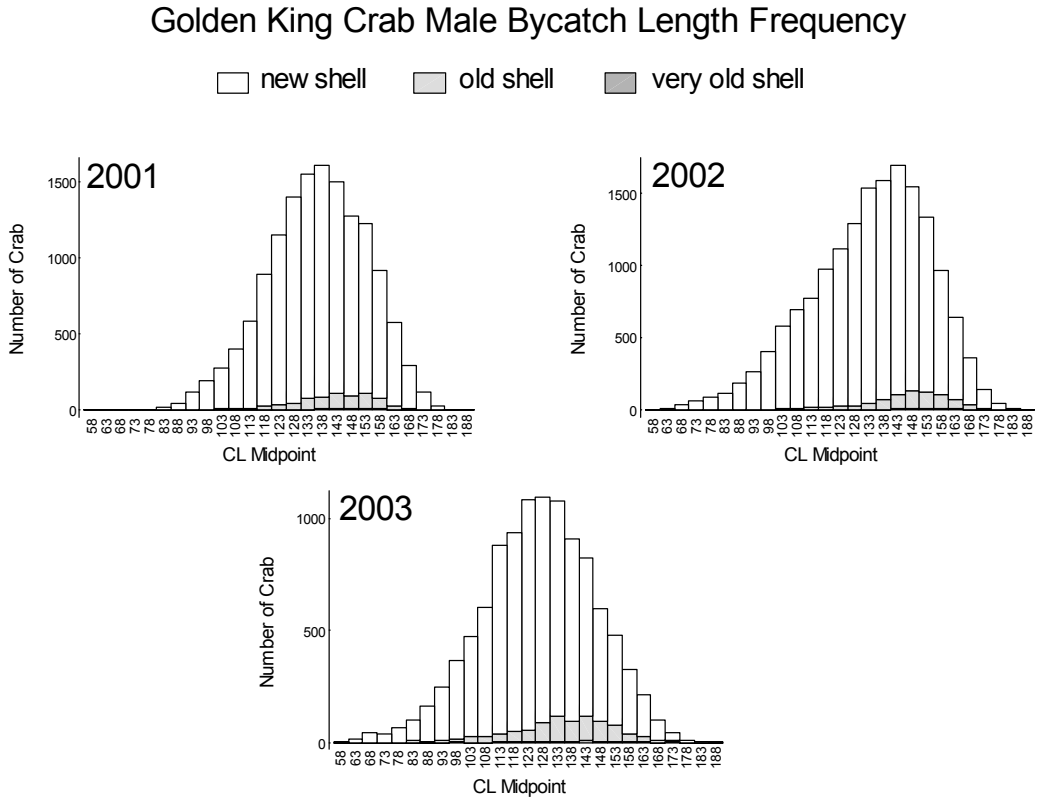

Figure 14.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 2001-2003 Bering Sea golden king crab fisheries.

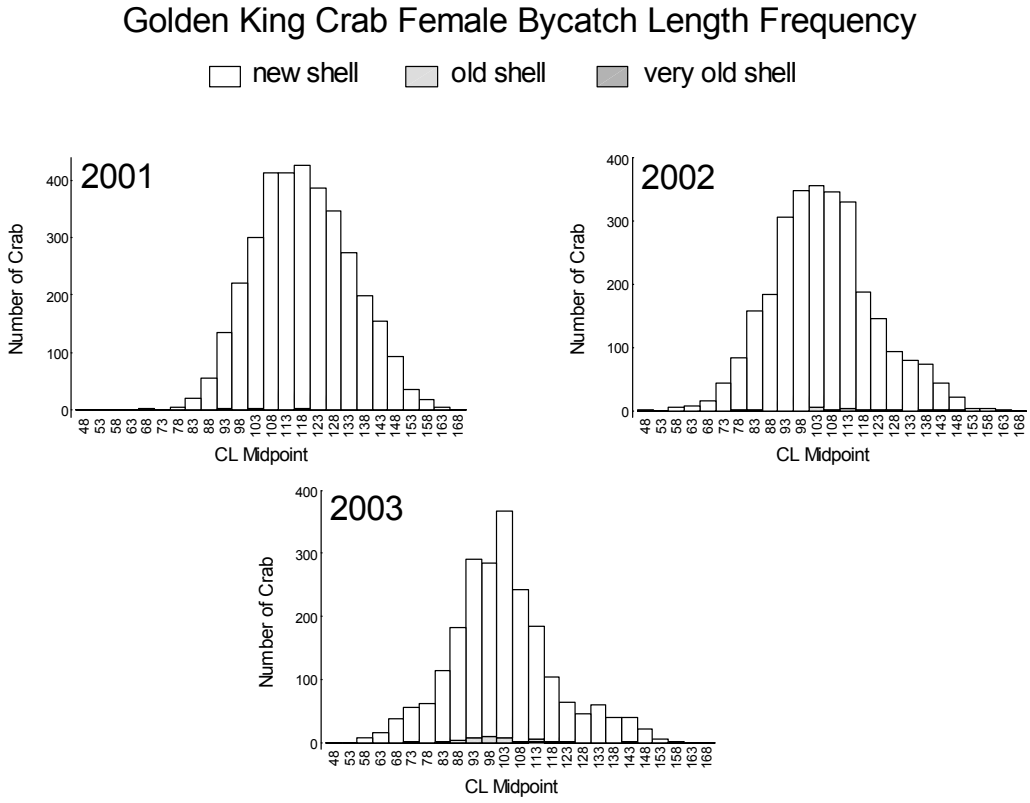

Figure 15.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 2001-2003 Bering Sea golden king crab fisheries.

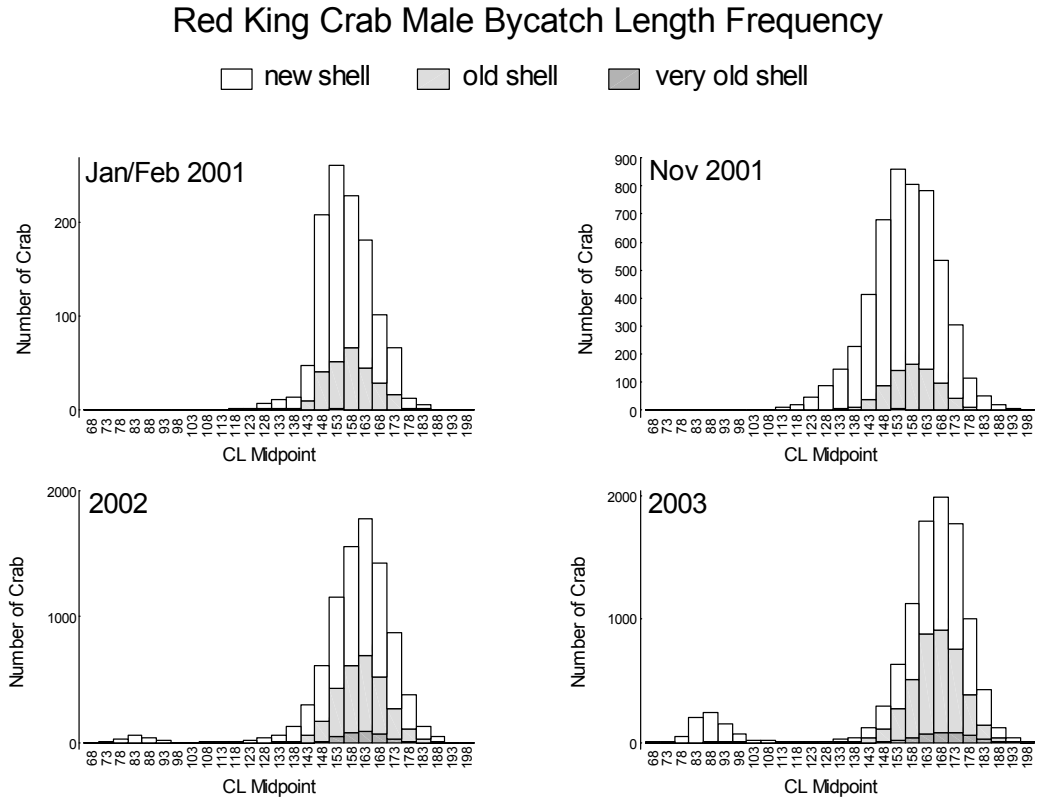

Figure 16.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male red king crabs from pot lifts sampled during the 2001 surveys and the 2002 and 2003 Petrel Bank red king crab fisheries.

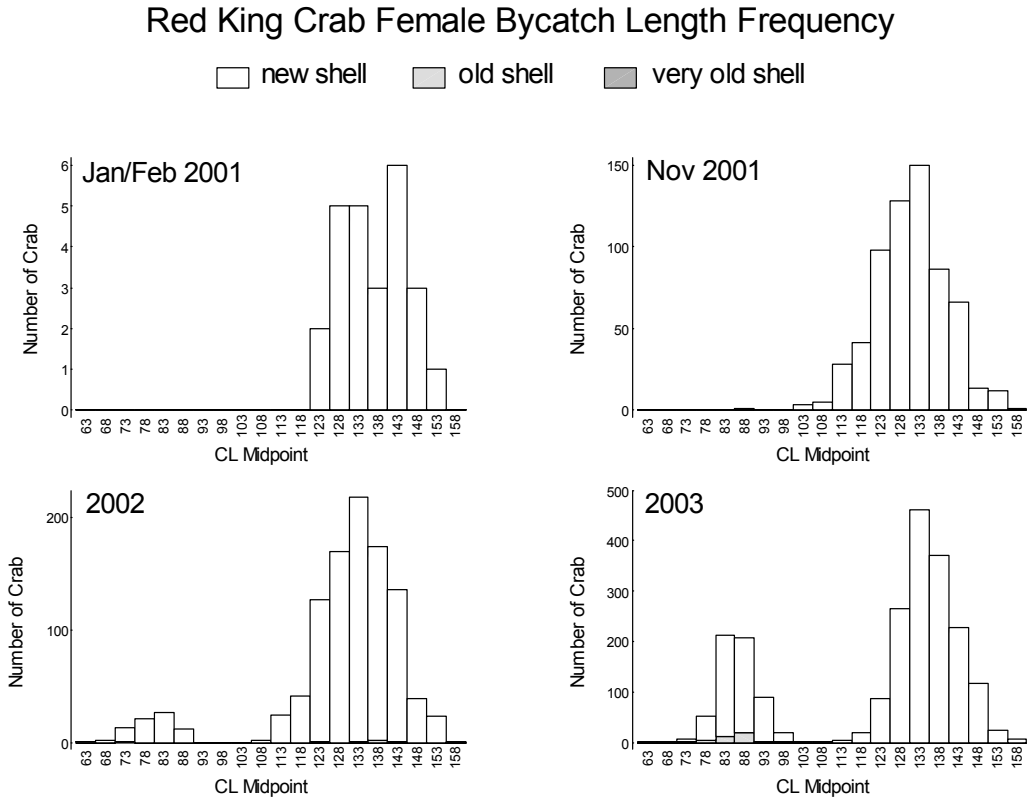

Figure 17.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female red king crabs from pot lifts sampled during the 2001 surveys and the 2002 and 2003 Petrel Bank red king crab fisheries.

APPENDIX A: FORMULAS USED TO CALCULATE WEIGHTED MEAN AND VARIANCE ESTIMATES

Appendix A1.-Formulas used to calculate weighted mean and variance estimates for CPUE in fisheries with 100% observer coverage.

For a given fishery, observers are instructed to randomly sample n potlifts per day. In practice this number will vary by day, vessel and observer. Observers actually sample n_{jk} pots per day from a total of N_{jk} pots pulled by vessel j on day k. Formulas follow Cochran (1977).

The mean CPUE for vessel j on day k is $$\bar{c}_{jk.} = \frac{1}{n_{jk}}\left(\sum_{l} c_{jkl}\right)$$

and the variance for this estimator is $$\hat{\text{var}}\left(\bar{c}_{jk.}\right) = \frac{1}{n_{jk}}\left[\frac{\sum_{l}\left(c_{jkl} - \bar{c}_{jk.}\right)^2}{n_{jk} - 1}\right]$$

where c_{jkl} is the number of crab in a sampled pot lift where

j is the vessel

k is the day

l is the pot sampled

n is the number of pots sampled.

It follows that

the estimated total catch by vessel j on day k is $\left(\bar{c}_{jk.} \times N_{jk}\right)$,

the estimated total catch by vessel j over the fishery is $\sum_{k}\left(\bar{c}_{jk.} \times N_{jk}\right)$,

the estimated weighted mean catch per pot lift by vessel j over the fishery is

$$\frac{1}{N_{j.}}\left[\sum_{k}\left(\bar{c}_{jk.} \times N_{jk}\right)\right]$$

$$= \sum_{k}\left(\bar{c}_{jk.} \times w_{jk}\right)$$

$$= \bar{c}_{j..}$$

and $$\hat{\text{var}}\left(\bar{c}_{j..}\right) = \sum_{k}\left[\hat{\text{var}}\left(\bar{c}_{jk.}\right) \times w_{jk}^2\right]$$

where $w_{jk} = N_{jk} / N_j$. The weights reflect the importance of a day's sampling based on the number of pots lifted on day k by vessel j relative to the total number of pots lifted by vessel j over the course of the fishery.

-Continued-

The estimated mean catch per pot lift for all vessels over the fishery is

$$\begin{aligned}
\bar{c}_{...} &= \frac{1}{N_{..}}\left[\sum_j \left(\bar{x}_{j..} \times N_{j.}\right)\right] \\
&= \frac{1}{N_{..}}\left[\sum_j \left(\sum_k \left(\bar{c}_{jk.} \times w_{jk}\right)\right) \times N_{j.}\right] \\
&= \frac{1}{N_{..}}\left[\sum_j \left(\sum_k \left(\bar{c}_{jk.} \times \frac{N_{jk}}{N_{j.}}\right)\right) \times N_{j.}\right] \\
&= \frac{1}{N_{..}} \sum_j \sum_k \left(\bar{c}_{jk.} \times N_{jk}\right).
\end{aligned}$$

The variance of this estimator is

$$\begin{aligned}
\hat{\mathrm{var}}\left(\bar{c}_{...}\right) &= \sum_j \left[\hat{\mathrm{var}}\left(\bar{c}_{j..}\right) \times w_{j.}^2\right] \\
&= \sum_j w_{j.}^2 \left\{\sum_k \left[\hat{\mathrm{var}}\left(\bar{c}_{jk.}\right) \times w_{jk}^2\right]\right\} \\
&= \sum_j \left(\frac{N_{j.}}{N_{..}}\right)^2 \left\{\sum_k \left[\hat{\mathrm{var}}\left(\bar{c}_{jk.}\right) \times \left(\frac{N_{jk}}{N_{j.}}\right)^2\right]\right\} \\
&= \sum_j \left\{\sum_k \left[\hat{\mathrm{var}}\left(\bar{c}_{jk.}\right) \times \left(\frac{N_{jk}}{N_{..}}\right)^2\right]\right\} \\
&= \frac{1}{N_{..}^2} \sum_j \sum_k \left[\hat{\mathrm{var}}\left(\bar{c}_{jk.}\right) \times N_{jk}^2\right]
\end{aligned}$$

where $w_{j.} = N_{j.} / N_{..}$.

Appendix A2.-Formulas used to calculate weighted mean and variance estimates for CPUE in fisheries with partial observer coverage.

In an effort to improve estimates of CPUE and its variance for the BSAI crab fisheries, we have changed the methodology used to arrive at these estimates in fisheries with partial observer coverage. Previous estimates have been based on daily vessel performance with no distinction of vessel type or size. This assumes that data collected for catcher-processors (CP, 100% observer coverage and less than 5% of the fishery) are equivalent to catcher-only vessels (CV, ~10% observer coverage). It also assumes equal performance for catcher-only vessels ≤ 125 ft and catcher-only vessels > 125 ft, although larger vessels carry more pots and are less subject to weather-related effects. We have included vessel type and individual vessel effects in a new set of estimators. This effort was prompted by increased observer coverage beginning in 2001 and bycatch concerns in the Bering Sea opilio fishery. The formulas used follow Cochran (1977).

Let c_{ijkl} = number of crabs in sampled pot lift *l* for day *k* on vessel *j* of type *i*

n_{ijk} = number of sampled pot lifts for day *k* on vessel *j* of type *i*

N_{ijk} = total number of pot lifts pulled for day *k* on vessel *j* of type *i*

m_i = number of vessels observed in stratum *i*

M_i = number of vessels in stratum *i*

where *i* = vessel type (CP, CV > 125 ft, CV ≤ 125 ft), a stratum

j = vessel observed, element of a simple random sample

k = day fished, a stratum

l = pot lift sampled, element of a simple random sample

For each observed vessel, consider each day fished as a separate stratum where the sampled pot lifts (n_{ijk}) are a simple random sample of all pot lifts pulled (N_{ijk}) for vessel *j* of type *i* on day *k*. Then the estimated mean number of crabs per pot lift (and its variance) for day *k* on vessel *j* of type *i* is

$$\bar{c}_{ijk.} = \frac{1}{n_{ijk}} \sum_{l} c_{ijkl} \qquad \text{and} \qquad \hat{v}(\bar{c}_{ijk.}) = \frac{1}{n_{ijk}} \left[\frac{\sum_{l} (c_{ijkl} - \bar{c}_{ijk.})^2}{(n_{ijk} - 1)} \right]. \qquad \textbf{(A)}$$

This formulation ignores the finite population correction factor (fpc), the penalty being an overestimation of the population variance as the ratio, $n_{ijk}/N_{ij.}$, is usually less than 10% for the fisheries in question

---

-Continued-

It follows from (A) that the estimated weighted mean number of crabs per pot lift (and variance) for vessel *j* of type *i* over the fishery is

$$\bar{c}_{ij..} = \sum_k (\bar{c}_{ijk.} \times w_{ijk}) \quad \text{and} \quad \hat{v}(\bar{c}_{ij..}) = \sum_k \left[\hat{v}(\bar{c}_{ijk.}) \times w_{ijk}^2\right] \quad \text{where } w_{ijk} = \frac{N_{ijk}}{N_{ij.}}. \qquad \textbf{(B)}$$

This is a straightforward, weighted, stratified, mean estimate for vessel *j* of type *i*.

Vessel *j* is a randomly chosen element from the vessel type stratum *i*. After Cochran (1977) it follows from (B) that the vessel stratum estimates are

$$\bar{c}_{i...} = \frac{1}{m_i}\sum_j \bar{c}_{ij..} \quad \text{and} \quad \hat{v}(\bar{c}_{i...}) = \left[\frac{M_i - m_i}{M_i} \times \frac{1}{m_i}\left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)}\right)\right] + \left[\frac{1}{M_i m_i}\sum_j \hat{v}(\bar{c}_{ij..})\right] \qquad \textbf{(C)}$$

The first term of the variance estimator accounts for the error among vessels in stratum *i* and includes the fpc. The fpc may be ignored if m_i/M_i is negligible. The second term is the mean within vessel variance for the sampled vessels in stratum *i*. No weighting was used at this stage as it was assumed that all vessels within a stratum were treated as equal in terms of catch.

The final stage combined the results of the separate strata into an overall estimate of mean catch. Taking the results in (C), we arrive at

$$\bar{c}_{....} = \sum_i \left(\bar{c}_{i...} \times \frac{M_i}{M_.}\right) \quad \text{and} \quad \hat{v}(\bar{c}_{....}) = \sum_i \left(\hat{v}(\bar{c}_{i...}) \times \frac{M_i^2}{M_.^2}\right) \qquad \textbf{(D)}$$

Again, this is a straightforward, weighted stratified estimate.

Calculating forms

The estimated mean catch for the fishery, we can substitute results for the means from (C), (B) and (A) into (D) to arrive at the following

$$\begin{aligned}
\bar{c}_{....} &= \sum_i \left(\frac{1}{m_i}\sum_j \bar{c}_{ij..} \times \frac{M_i}{M_.}\right) = \sum_i \frac{M_i}{m_i M_.}\sum_j \bar{c}_{ij..} \\
&= \sum_i \frac{M_i}{m_i M_.}\sum_j \left(\sum_k (\bar{c}_{ijk.} \times w_{ijk})\right) \\
&= \sum_i \frac{M_i}{m_i M_.}\sum_j \left[\frac{1}{N_{ij.}}\sum_k \left(\bar{c}_{ijk.} \times N_{ijk}\right)\right] \qquad \textbf{(E)}
\end{aligned}$$

-Continued-

Similarly, the estimated variance of the mean estimate is

$$\hat{v}(\bar{c}_{....}) = \sum_i \left[\frac{M_i^2}{M_.^2} \left(\left[\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right] + \left[\frac{1}{M_i m_i} \sum_j \hat{v}(\bar{c}_{ij..}) \right] \right) \right]$$

$$= \sum_i \frac{M_i^2}{M_.^2} \left[\left(\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right) + \frac{1}{M_i m_i} \sum_j \left(\sum_k \left[\hat{v}(\bar{c}_{ijk.}) \times \left(\frac{N_{ijk}}{N_{ij.}} \right)^2 \right] \right) \right]$$

$$= \sum_i \frac{M_i^2}{M_.^2} \left[\left(\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right) + \frac{1}{M_i m_i} \sum_j \left(\sum_k \left[\hat{v}(\bar{c}_{ijk.}) \right] \times \left(\frac{N_{ijk}}{N_{ij.}} \right)^2 \right) \right]$$

Let $\hat{v}(\bar{a}_i) = \left(\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right)$ and $\hat{v}(\bar{b}_i) = \left(\frac{1}{M_i m_i} \sum_j \left(\frac{1}{N_{ij.}^2} \sum_k \left[\hat{v}(\bar{c}_{ijk.}) \right] \times N_{ijk}^2 \right) \right)$

Then $\hat{v}(\bar{c}_{....}) = \sum_i \frac{M_i^2}{M_.^2} \left[\left(\hat{v}(\bar{a}_i) \right) + \left(\hat{v}(\bar{b}_i) \right) \right]$ **(F)**

APPENDIX B: LOCATIONS OF POT LIFTS

CONFIDENTIAL

Appendix B1.-Locations of pot lifts sampled by observers during the 2003 Bering Sea snow crab general fishery.

CONFIDENTIAL

Appendix B2.-Locations of pot lifts sampled by observers during the 2003 Bering Sea snow crab CDQ fishery.

CONFIDENTIAL

Appendix B3.-Locations of pot lifts sampled by observers during the 2003 Bristol Bay red king crab general fishery.

CONFIDENTIAL

Appendix B4.-Locations of pot lifts sampled by observers during the 2003 Bristol Bay red king crab CDQ fishery.

CONFIDENTIAL

Appendix B5.-Locations of pot lifts sampled by observers during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude.

CONFIDENTIAL

Appendix B6.-Locations of pot lifts sampled by observers during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude.

CONFIDENTIAL

Appendix B7.-Locations of pot lifts sampled by observers during the 2003 Bering Sea golden king crab fishery.

CONFIDENTIAL

Appendix B8.-Locations of pot lifts sampled by observers during the 2003 Aleutian Islands red king crab fishery.

APPENDIX C: ADDITIONAL CATCH AND BIOLOGICAL INFORMATION

Appendix C1.-Total catches of all animals from 872 pot lifts sampled during the 2003 Bering Sea snow crab general fishery.

Species	Total Catch	Species	Total Catch
Snow Crab		Neptune snail (unidentified)	52
Legal males	236,884	Buccinum snail (unidentified)	47
Sublegal males	6,239	Sea star (unidentified)	33
Females	185	Bryozoan (unidentified)	23
		Sea anemone (unidentified)	22
Tanner x Snow Crab Hybrid		Octopus	15
Legal males	4,030	*Buccinum scalariforme*	13
Sublegal males	435	Walleye pollock	12
Females	3	Pacific halibut	11
		Sea jelly (unidentified)	11
Tanner Crab		Hairy triton	7
Legal males	177	Sculpin (unidentified)	6
Sublegal males	2,133	Snailfish (unidentified)	6
Females	408	*Stylaster* spp.	4
		Lyre crab	4
Golden King Crab		Flathead sole	3
Legal males	1	Basket sea star (unidentified)	2
Sublegal males	3	Skate (unidentified)	2
Females	5	Yellow Irish lord	2
		Arrowtooth flounder	1
Snail (unidentified)	2,713	Nudibranch unidentified	1
Hermit crab (unidentified)	418	Sea cucumber unidentified	1
Pacific cod	328	Yellowfin sole	1
Neptunea pribilofensis	254		

Appendix C2.-CPUE by soak times for 866 pot lifts sampled during the 2003 Bering Sea snow crab general fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
1-6	0.1	75.0	89.0	4.0	0	168.0
7-12	2.1	89.2	73.5	7.2	0.9	170.8
13-18	6.6	86.5	79.8	5.6	0.1	172.0
19-24	32.3	117.6	125.0	7.9	0.1	250.7
25-30	33.1	151.0	155.4	7.5	0.2	314.2
31-36	16.1	157.6	137.3	4.4	0.1	299.5
37-42	6.5	169.4	144.9	9.2	< 0.1	323.6
43-48	1.8	179.9	202.2	11.3	2.5	395.9
49-54	0.9	116.1	122.6	4.3	0	243.0
55-60	0.1	9.0	10.0	0.0	0	19.0
61-66	0.2	7.0	10.5	0.0	0	17.5
67-72	0.1	147.0	136.0	2.0	0	285.0

[a] Mean soak time = 27.4 hours.

Appendix C3.-CPUE by depth for 866 pot lifts sampled during the 2003 Bering Sea snow crab general fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
16-20	0.1	27.0	44.0	0	0	71.0
21-25	0.1	147.0	136.0	2.0	0	285.0
26-30	0.2	274.5	361.0	10.5	0	646.0
--	--	--	--	--	--	--
56-60	5.5	122.3	88.2	4.5	0.3	215.3
61-65	24.2	117.5	132.0	11.3	0.4	261.1
66-70	27.8	153.9	172.4	10.1	0.3	336.7
71-75	22.5	152.5	158.8	4.9	0.1	316.3
76-80	2.1	98.8	119.4	3.8	0	221.9
81-85	0.6	29.2	22.0	0.6	0	51.8
86-90	0.9	110.0	78.6	0.5	0	189.1
91-95	3.9	134.1	92.1	1.4	0	227.5
96-100	1.2	96.8	54.6	0.4	0	151.8
101-105	2.7	147.3	48.4	0.4	0	196.1
106-110	2.9	122.1	61.5	0.6	0.1	184.4
111-115	1.5	114.6	47.5	0.8	0	162.9
116-120	0.5	97.5	63.0	1.0	0	161.5
121-125	1.5	119.9	57.9	1.5	0	179.3
126-130	0.2	148.5	42.0	0.5	0	191.0
131-135	--	--	--	--	--	--
136-140	0.6	97.4	59.2	0	0	156.6
141-145	0.3	94.3	69.0	0.3	0	163.7
146-150	0.3	220.7	82.3	0.3	0	303.3
151-155	0.1	51.0	15.0	0	0	66.0
156-160	0.1	203.0	81.0	0	0	284.0

[a] Mean depth = 74.2 fathoms.

Appendix C4.-Reproductive condition of female snow crabs from pot lifts sampled during the 1995-2003 Bering Sea snow crab general fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1995	423	80.4	12.5	6.1	0.9
1996	136	59.6	3.7	16.2	20.6
1997	789	40.9	0.6	30.4	28.0
1998	90	21.1	8.9	37.8	32.2
1999	99	68.7	5.1	22.2	4.0
2000	6	0	16.7	16.7	66.6
2001	11	18.2	36.4	0	45.4
2002	19	26.3	57.9	10.5	5.3
2003	62	41.9	45.2	9.7	3.2

Appendix C5.-Total catches of all animals from 740 pot lifts sampled during the 2003 Bering Sea snow crab CDQ fishery.

Species	Total Catch	Species	Total Catch
Snow Crab			
Legal males	169,351	Sea star (unidentified)	78
Sublegal males	3,637	Brittle star (unidentified)	73
Females	27	Octopus	34
		Sculpin (unidentified)	17
Tanner x Snow Crab Hybrid		Lyre crab	12
		Pacific halibut	8
Legal males	592	Sea urchin (unidentified)	4
Sublegal males	220	Walleye pollock	4
Females	6	Sea pen (unidentified)	3
		Yellow Irish lord	3
Tanner Crab		Arrowtooth flounder	2
Legal males	544	Sea jelly (unidentified)	2
Sublegal males	2,900	Skate (unidentified)	2
Females	477	Snailfish (unidentified)	2
		Worm (unidentified)	2
Snail (unidentified)	4,819	Grenadier (unidentified)	1
Hermit crab (unidentified)	383	Clam (unidentified)	1
Pacific cod	352	Mussel (unidentified)	1
Sea anemone (unidentified)	175	Squid (unidentified)	1
Basket star (unidentified)	133		

Appendix C6.-CPUE by soak times for 737 pot lifts sampled during the 2003 Bering Sea snow crab CDQ fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
1-12	0.1	51.0	6.0	1.0	0	58.0
13-24	11.5	104.3	114.5	5.4	0.1	224.2
25-36	22.3	95.7	116.2	5.8	< 0.1	217.7
37-48	30.9	108.3	111.0	4.7	< 0.1	224.1
49-60	12.3	126.8	121.5	5.0	0	253.3
61-72	8.3	123.9	133.0	4.5	< 0.1	261.4
73-84	3.1	127.7	128.6	4.6	0	261.0
85-96	2.2	113.5	78.4	1.5	0	193.4
97-108	1.8	155.5	168.3	6.8	0.1	330.6
109-120	1.2	170.7	213.1	6.8	0.8	391.3
121-132	1.1	70.1	76.1	2.5	0	148.7
133-144	1.1	103.0	76.1	3.5	0	182.6
145-156	0.4	164.0	153.3	4.3	0.7	322.3
157-168	0.7	164.6	86.2	5.2	0	256.0
169-180	0.9	161.9	68.7	3.0	0	233.6
181-192	0.3	115.0	29.0	0.5	0	144.5
--	--	--	--	--	--	--
229-240	0.1	219.0	142.0	0	0	361.0
241-252	0.7	242.0	154.6	0	0	396.6
253-264	0.1	276.0	276.0	2.0	0	554.0
265-276	0.7	14.0	12.2	0	0	26.2
277-288	--	--	--	--	--	--
289-300	0.1	277.0	269.0	8.0	0	554.0

[a] Mean soak time = 53.9 hours.

Appendix C7.-CPUE by depth for 737 pot lifts sampled during the 2003 Bering Sea snow crab CDQ fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
56-60	7.2	87.4	105.7	7.1	< 0.1	200.2
61-65	42.6	106.9	112.1	5.5	< 0.1	224.5
66-70	37.9	126.1	131.4	4.8	< 0.1	262.4
71-75	10.9	103.3	102.1	2.1	< 0.1	207.5
76-80	0.1	323.0	73.0	0	0	396.0
--	--	--	--	--	--	--
106-110	0.1	56.0	6.0	0	0	62.0
111-115	0.3	141.0	16.5	0	0	157.5
116-120	0.1	0	0	0	0	0
121-125	0.1	51.0	6.0	1.0	0	58.0
126-130	0.5	98.3	7.3	0.5	0	106.0
131-135	0.1	78.0	9.0	0	0	87.0

[a] Mean depth = 66.4 fathoms.

Appendix C8.-Reproductive condition of female snow crabs from pot lifts sampled during the 1999-2003 Bering Sea snow crab CDQ fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1999	11	45.5	27.2	27.2	0
2000	93	19.4	79.6	0	1.1
2001	4	0	75.0	25	0
2002	534	40.8	44.0	5.1	10.1
2003	1	100.0	0	0	0

Appendix C9.-Total catches of all animals from 731 pot lifts sampled during the 2003 Bristol Bay red king crab general fishery.

Species	Total Catch	Species	Total Catch
Red King Crab			
Legal male	12,775	Yellowfin sole	805
Sublegal male	18,025	Pacific cod	490
Female	10,390	Sea star (unidentified)	178
		Snail (unidentified)	145
Tanner Crab		Sculpin (unidentified)	72
Legal male	127	Pacific halibut	40
Sublegal male	315	Neptune snail (unidentified)	36
Female	40	Sea jelly (unidentified)	33
		Hermit crab (unidentified)	26
Snow Crab		Great sculpin	13
Legal male	107	Tunicate (unidentified)	8
Sublegal male	10	Bigmouth sculpin	2
Female	1	Walleye pollock	2
		Yellow Irish lord	1
Tanner x Snow Crab		Soft coral (unidentified)	1
Hybrid		Lyre crab	1
Legal male	6	Sponge (unidentified)	1
Sublegal male	4	Basket star (unidentified)	1
Female	0	Bryozoan (unidentified)	1
		Rock sole	1
Hair crab		Sea anemone	1
Legal male	4	Sea cucumber (unidentified)	1
Sublegal male	1	Skate (unidentified)	1
Female	2	Starry flounder	1

Appendix C10.-CPUE by soak times for 727 pot lifts sampled during the 2003 Bristol Bay red king crab general fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-6	0.1	0	0	0	0
7-12	2.1	8.4	25.7	29.7	63.8
13-18	7.4	7.9	11.5	12.5	31.9
19-24	23.2	13.4	23.6	10.5	47.4
25-30	19.7	13.5	23.4	22.6	59.5
31-36	19.3	22.5	23.7	8.8	55.0
37-42	14.6	19.9	26.4	13.7	60.0
43-48	8.1	27.3	40.7	16.0	84.0
49-54	3.3	20.6	23.4	15.6	59.5
55-60	0.3	22.0	18.5	15.0	55.5
61-66	0.1	74.0	83.0	8.0	165.0
67-72	1.1	46.9	43.9	8.3	99.0
73-78	0.1	2.0	6.0	140.0	148.0
79-84	0.3	17.5	8.5	3.5	29.5
85-90	0.3	27.0	21.0	3.0	51.0

[a] Mean soak time = 31.2 hours.

Appendix C11.-CPUE by depth for 727 pot lifts sampled during the 2003 Bristol Bay red king crab general fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
24-25	0.1	8.0	22.0	2.0	32.0
--	--	--	--	--	--
31-32	0.4	27.7	19.3	18.3	65.3
33-34	3.9	17.9	22.2	29.5	69.6
35-36	7.4	19.8	21.3	23.1	64.2
37-38	12.0	17.3	23.5	16.3	57.1
39-40	15.4	20.4	24.2	16.0	60.5
41-42	16.8	17.1	26.5	10.2	53.8
43-44	20.4	14.1	29.9	10.3	54.4
45-46	12.5	16.7	21.7	12.9	51.4
47-48	9.9	19.1	19.5	9.8	48.4
49-50	1.2	17.6	35.4	42.1	95.1

[a] Mean depth = 41.5 fathoms.

Appendix C12.-Reproductive condition of female red king crabs from pot lifts sampled during the 1996-2003 Bristol Bay red king crab general fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1996	11	0	0	0	100.0
1997	70	65.7	18.6	0	15.7
1998	4,091	45.6	51.8	<0.1	2.6
1999	36	0	86.1	2.8	11.1
2000	1,486	4.0	22.3	0.5	73.2
2001	4,574	66.0	18.7	0.3	15.0
2002	311	32.1	2.6	0.6	64.6
2003	10,391	9.1	51.5	3.4	35.9

Appendix C13.-Total catches of all animals from 279 pot lifts sampled during the 2003 Bristol Bay red king crab CDQ fishery.

Species	Total Catch	Species	Total Catch
Red King Crab			
Legal male	8,775	Pacific cod	276
Sublegal male	6,008	Snail (unidentified)	258
Female	2,581	Yellowfin sole	207
		Sea jelly (unidentified)	18
Tanner Crab		Sculpin (unidentified)	12
Legal male	38	Hermit crab (unidentified)	11
Sublegal male	89	Great sculpin	9
Female	5	Sea star (unidentified)	7
		Pacific halibut	7
Snow Crab		Lyre crab	3
Legal male	48	Octopus	1
Sublegal male	4	Sea cucumber (unidentified)	1
Female	0		
Tanner x Snow Crab Hybrid			
Legal male	7		
Sublegal male	3		
Female	0		

Appendix C14.-CPUE by soak times for 279 pot lifts sampled during the 2003 Bristol Bay red king crab CDQ fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
7-12	1.4	3.8	1.3	0	5.0
13-18	1.1	10.3	2.3	0.3	13.0
19-24	4.7	20.1	22.1	14.5	56.7
25-30	17.9	19.9	12.4	8.1	40.5
31-36	21.5	27.6	21.6	10.6	59.8
37-42	12.9	26.6	24.6	6.9	58.1
43-48	16.5	38.2	26.8	6.5	71.5
49-54	3.9	45.6	12.1	22.0	79.7
55-60	7.5	33.7	11.5	2.2	47.5
61-66	1.8	56.2	64.2	21.4	141.8
67-72	5.4	46.7	29.0	19.5	95.3
73-78	1.1	52.3	16.3	2.0	70.7
79-84	3.2	68.9	47.7	8.2	124.8
85-90	0.7	50.5	27.0	11.0	88.5
91-96	0.4	34.0	8.0	8.0	50.0

[a] Mean soak time = 41.8 hours.

Appendix C15.-CPUE by depth for 279 pot lifts sampled during the 2003 Bristol Bay red king crab CDQ fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
33-34	1.1	3.3	5.0	11.3	19.7
35-36	1.1	5.0	9.0	18.0	32.0
37-38	1.4	2.5	0	0	2.5
39-40	4.3	19.8	13.7	8.1	41.5
41-42	12.9	41.4	24.8	20.1	86.2
43-44	27.6	41.2	41.9	16.2	99.4
45-46	31.5	26.8	14.7	4.3	45.8
47-48	20.1	26.4	7.0	0.8	34.2

[a] Mean depth = 44.2 fathoms.

Appendix C16.-Reproductive condition of female red king crabs from pot lifts sampled during the 1999-2003 Bristol Bay red king crab CDQ fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1999	4	50.0	0	0	50.0
2000	6,984	27.3	61.8	0.2	10.7
2001	869	26.5	64.7	0.2	8.6
2002	402	13.4	7.2	1.5	77.9
2003	2,117	15.2	63.7	0.1	20.9

Appendix C17.-Total catches of all animals from 3,960 pot lifts sampled during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude.

Species	Total Catch	Species	Total Catch
Golden King Crab		Worm (unidentified)	32
Legal male	43,579	Tubeworm (unidentified)	32
Sublegal male	33,435	Plexauridae (unidentified)	29
Female	30,722	*Crypthelia* spp.	27
		Clavularia spp.	23
Scarlet King Crab		Primnoidae (unidentified)	20
Legal male	7	*Primnoa* spp.	18
Sublegal male	1	Sablefish	18
Female	1	Sculpin (unidentified)	15
		Calcigorgia spp.	14
Red King Crab		Octopus	10
Legal male	1	Hydroid (unidentified)	10
Sublegal male	0	Yellow Irish lord	9
Female	0	Rockfish (unidentified)	8
		Neptune snail (unidentified)	7
Grooved Tanner Crab		Shrimp (unidentified)	7
Legal male	3	Atka mackerel	7
Sublegal male	1	Barnacle (unidentified)	7
Female	0	Greenland turbot	6
		Coral (unidentified)	6
Hair crab		Grenadier (unidentified)	6
Legal male	0	Neptunea pribilofensis	6
Sublegal male	2	Lyre crab	5
Female	0	Shortspine thornyhead	5
		Scale worm (unidentified)	5
Sponge (unidentified)	967	Turbot (unidentified)	5
Basket star (unidentified)	838	Sea spider (unidentified)	5
Stylaster spp.	379	Leech (unidentified)	4
Sea star (unidentified)	379	Pacific ocean perch	4
Pacific halibut	343	Scallop (unidentified)	3
Pacific cod	176	Sea cucumber (unidentified)	3
Primnoa Group I	164	Lamp shell (unidentified)	3
Brittle star (unidentified)	161	Clam (unidentified)	3
Soft coral (unidentified)	145	Sea pen (unidentified)	3
Snail (unidentified)	144	Scaled crab	2
Hydrocoral (unidentified)	128	Red banded rockfish	2
Cyclohelia spp.	104	Sea anemone (unidentified)	2
Invertebrate (unidentified)	102	Mussel (unidentified)	2
Bryozoan (unidentified)	95	Hairy triton	2
Sea urchin (unidentified)	72	Sand dollar (unidentified)	2
Arrowtooth flounder	62	Sea pansy (unidentified)	1
Sea jelly (unidentified)	59	Flatfish (unidentified)	1
Distichopora spp.	56	Dusky rockfish	1
Fanellia spp.	50	*Javiania* spp.	1
Paragorgia spp.	49	Rougheye rockfish	1
Tunicate (unidentified)	47	Black coral (unidentified)	1
Skate (unidentified)	43	Snailfish (unidentified)	1
Cup coral (unidentified)	40	Pacific oyster	1
Arthrogorgia spp.	33	Rock sole	1
Anthomastus spp.	32	Decorator crab (unidentified)	1
Errinopora spp.	32	Sea whip (unidentified)	1
		Stylantheca spp.	1

Appendix C18.-CPUE by soak times for 3,957 pot lifts sampled during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-24	0.1	9.0	0.0	1.3	10.3
25-48	2.3	5.7	0.0	7.5	13.2
49-72	27.9	8.6	0.3	9.8	18.6
73-96	35.1	11.8	0.8	7.5	20.2
97-120	17.4	12.5	0.7	7.5	20.6
121-144	7.9	11.6	0.8	6.4	18.8
145-168	4.2	13.9	0.3	4.0	18.3
169-192	1.9	12.5	0.0	6.3	18.7
193-216	1.0	11.4	1.1	5.1	17.6
217-240	0.6	13.3	0.0	1.5	14.8
241-264	0.5	20.6	0.0	8.3	28.9
265-288	0.3	13.5	0.0	2.8	16.2
289-312	0.4	12.3	3.2	3.0	18.5
313-336	0.2	10.5	0.0	1.2	11.7
337-360	0.3	1.4	0.0	0.4	1.8

[a] Mean soak time = 97.0 hours.

Appendix C19.-CPUE by depth for 3,957 pot lifts sampled during the 2003 Aleutian Islands golden king crab fishery east of 174° W longitude.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-25	0.1	6.7	0	1.0	7.7
26-50	0.1	4.7	0	0.3	5.0
51-75	0.7	6.5	1.0	0.5	8.0
76-100	8.3	10.7	2.7	4.2	16.9
101-125	13.1	10.0	0.5	7.5	18.0
126-150	16.1	11.4	0.3	7.1	18.8
151-175	15.0	9.1	0.1	8.7	18.0
176-200	11.7	9.9	< 0.1	8.4	18.3
201-225	12.2	11.7	< 0.1	9.0	20.8
226-250	8.1	13.7	0.5	8.0	22.2
251-275	5.0	13.2	0.9	6.2	20.2
276-300	5.1	11.9	1.3	9.8	23.1
301-325	3.0	13.3	2.8	7.4	23.5
326-350	1.1	12.7	2.8	8.3	23.8
351-375	0.3	15.4	0	17.6	33.0
376-400	0.2	6.5	0	29.9	36.4

[a] Mean depth = 179.1 fathoms.

Appendix C20.-Reproductive condition of female golden king crabs from pot lifts sampled during the 1996-2003 Aleutian Islands golden king crab fisheries east of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1996	59,210	20.8	22.5	18.6	38.1
1997	54,383	25.2	19.3	22.1	33.4
1998	44,352	18.1	21.0	23.9	37.0
1999	36,695	22.1	21.0	23.1	33.8
2000	13,615	26.9	18.7	20.1	34.3
2001	14,912	20.4	12.5	15.4	51.1
2002	9,651	29.6	19.2	18.9	32.3
2003	7,990	20.9	33.2	13.6	31.5

Appendix C21.-Total catches of all animals from 2,509 pot lifts sampled during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species	Total Catch	Species	Total Catch
Golden King Crab		Pacific halibut	28
Legal male	19,475	*Crypthelia* spp.	24
Sublegal male	23,726	Soft coral (unidentified)	23
Female	22,914	Pacific ocean perch	22
		Anthomastus spp.	19
Scarlet King Crab		Barnacle (unidentified)	19
Legal male	82	Bryozoan (unidentified)	15
Sublegal male	14	Yellow Irish lord	15
Female	12	*Cyclohelia* spp.	14
		Distichopora spp.	14
Red King Crab		Skate (unidentified)	13
Legal male	122	Sea cucumber (unidentified)	12
Sublegal male	6	Snailfish (unidentified)	12
Female	9	Sculpin (unidentified)	11
		Arrowtooth flounder	9
Grooved Tanner Crab		Pacific cod	8
Legal male	1	Rockfish (unidentified)	8
Sublegal male	1	Sablefish	8
Female	0	Walleye pollock	8
		Greenland turbot	7
Paralomis spp.		Shortspine thornyhead	7
Legal male	0	*Clavularia* spp.	6
Sublegal male	0	*Errinopora* spp.	6
Female	1	Grenadier (unidentified)	6
		Sea anemone (unidentified)	6
Sponge (unidentified)	509	Cup coral (unidentified)	5
Sea urchin (unidentified)	224	Sea spider (unidentified)	5
Sea star (unidentified)	222	Tubeworm (unidentified)	5
Stylaster spp.	198	*Calcigorgia* spp.	4
Brittle star (unidentified)	194	Primnoidae (unidentified)	4
Basket star (unidentified)	168	Hydrocoral (unidentified)	3
Primnoa Group I	137	*Stylantheca* spp.	3
Snail (unidentified)	113	Leech (unidentified)	3
Hairy triton	107	Scale worm (unidentified)	3
Stony coral (unidentified)	86	Sea pen (unidentified)	3
Tunicate (unidentified)	82	*Carophyllia* spp.	2
Plexauridae (unidentified)	77	Atka mackerel	1
Fanellia spp.	57	*Gersemia* spp.	1
Coral (unidentified)	53	Bigmouth sculpin	1
Balanophyllia spp.	47	Dusky rockfish	1
Invertebrate (unidentified)	43	Rougheye rockfish	1
Paragorgia spp.	42	Scaled crab	1
Neptunea pribilofensis	34	Feather star (unidentified)	1
Octopus	31	Shrimp (unidentified)	1

Appendix C22.-CPUE by soak times for 2,496 pot lifts sampled during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-48	0.4	2.6	12.3	19.5	34.4
49-96	10.7	3.5	3.4	4.4	11.3
97-144	9.9	3.6	4.2	5.0	12.8
145-192	8.1	5.6	7.2	11.7	24.5
193-240	14.0	8.6	15.9	17.4	41.8
241-288	23.1	9.2	15.7	10.9	35.8
289-336	13.8	9.1	8.5	8.4	26.0
337-384	4.0	7.4	5.8	5.4	18.6
385-432	2.5	9.1	6.4	9.5	25.0
433-480	2.8	8.7	5.6	5.8	20.1
481-528	1.7	12.5	6.5	5.0	24.0
529-576	0.8	9.4	3.4	1.4	14.1
577-624	0.8	7.9	3.5	9.4	20.8
625-672	1.7	12.8	3.5	6.2	22.5
673-720	2.2	11.6	5.9	2.4	19.8
721-768	0.6	6.0	1.4	3.6	11.0
769-816	--	--	--	--	--
817-864	0.2	24.0	10.2	1.7	36.0
865-912	0.1	3.0	1.0	1.5	5.5
913-960	0.1	2.0	0	0	2.0
961-1008	0.7	14.2	2.7	4.2	21.1
1009-1056	1.4	10.5	5.2	3.9	19.7
1057-1104	0.2	12.7	1.3	0.3	14.3
1105-1152	0.1	22.0	9.3	0.7	32.0

[a] Mean soak time = 290.6 hours.

Appendix C23.-CPUE by depth for 2,496 pot lifts sampled during the 2002/2003 Aleutian Islands golden king crab fishery west of 174° W longitude.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-25	0.1	5.5	20.0	9.0	34.5
26-50	< 0.1	1.0	0.0	1.0	2.0
51-75	0.3	9.4	1.6	0.4	11.4
76-100	1.8	8.1	2.8	1.7	12.6
101-125	7.3	8.1	7.3	3.4	18.8
126-150	22.2	9.1	11.1	5.0	25.2
151-175	26.1	7.1	8.4	9.0	24.5
176-200	19.2	7.5	10.3	12.4	30.3
201-225	10.8	7.3	10.5	14.6	32.4
226-250	6.8	7.3	9.2	13.3	29.9
251-275	2.5	8.0	9.7	13.1	30.8
276-300	1.7	9.0	7.2	7.1	23.3
301-325	1.1	3.9	6.5	6.0	16.4
326-350	0.1	3.0	15.7	24.7	43.3
351-375	< 0.1	17.0	27.0	20.0	64.0

[a] Mean depth = 174.3 fathoms.

Appendix C24.-Reproductive condition of female golden king crabs from pot lifts sampled during the 1996/1997-2002/2003 Aleutian Islands golden king crab fisheries west of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
1996/1997	67,314	23.6	25.5	21.2	29.6
1997/1998	39,343	24.0	26.8	19.8	29.4
1998/1999	22,208	23.4	25.9	16.3	34.4
1999/2000	45,645	21.3	29.6	19.1	29.9
2000/2001	53,716	26.2	28.7	17.1	27.9
2001/2002	38,829	26.6	27.8	22.4	23.2
2002/2003	22,479	32.8	20.9	11.9	33.9

Appendix C25.-Total catches of all animals from 593 pot lifts sampled during the 2003 Bering Sea golden king crab fishery.

Species	Total Catch	Species	Total Catch
Golden King Crab		Basket star (unidentified)	251
Legal male	6,169	Arrowtooth flounder	240
Sublegal male	4,522	Pacific halibut	172
Female	2,228	Bryozoan (unidentified)	72
		Snail (unidentified)	45
Grooved Tanner Crab		Pacific cod	36
Legal male	537	Brittle star (unidentified)	26
Sublegal male	91	Sea star (unidentified)	18
Female	3	Skate (unidentified)	17
		Tube worm (unidentified)	14
Tanner Crab		Clam (unidentified)	12
Legal male	0	Sea anemone (unidentified)	11
Sublegal male	10	Sablefish	10
Female	4	Greenland turbot	8
		Snailfish (unidentified)	8
Snow Crab		Octopus	6
Legal male	0	Hermit crab (unidentified)	5
Sublegal male	1	Rockfish (unidentified)	5
Female	0	Sculpin (unidentified)	5
		Pacific sleeper shark	3
Triangle Tanner Crab		Flathead sole	3
Legal male	1	Sponge (unidentified)	3
Sublegal male	0	Barnacle (unidentified)	2
Female	0	Flatfish (unidentified)	2
		Sea jelly (unidentified)	2
Tanner x Snow Crab Hybrid		Sea cucumber (unidentified)	2
Legal male	0	Sea urchin (unidentified)	2
Sublegal male	2	Lyre crab	1
Female	1	Shortspine thornyhead	1
		Rougheye rockfish	1
Scarlet King Crab		Cup coral (unidentified)	1
Legal male	9	*Gersemia* spp.	1
Sublegal male	3	Plexauridae (unidentified)	1
Female	3	Primnoidae (unidentified)	1
		Great sculpin	1
		Soft coral (unidentified)	1
		Northern rockfish	1

Appendix C26.-CPUE by soak times for 593 pot lifts sampled during the 2003 Bering Sea golden king crab fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-12	2.7	6.0	9.1	4.9	20.0
13-24	72.3	9.8	7.4	3.6	20.8
25-36	16.0	9.1	6.1	4.2	19.4
37-48	4.4	17.8	10.3	2.9	31.0
49-60	0.7	14.8	14.3	5.3	34.3
61-72	0.5	29.0	24.0	5.7	58.7
73-84	1.2	24.6	7.7	3.0	35.3
85-96	1.2	15.3	14.7	2.7	32.7
97-108	0.7	28.3	17.3	9.0	54.5
--	--	--	--	--	--
133-144	0.3	3.5	1.0	0	4.5

[a] Mean soak time = 27.1 hours.

Appendix C27.-CPUE by depth for 593 pot lifts sampled during the 2003 Bering Sea golden king crab fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
101-120	3.9	2.7	0.8	4.6	8.1
121-140	3.4	0.5	0.2	2.3	3.0
141-160	1.0	0.3	0.3	2.5	3.2
161-180	2.4	3.7	1.3	0.0	5.0
181-200	3.4	6.0	3.0	0.3	9.3
201-220	12.8	9.0	9.0	2.9	21.0
221-240	21.8	12.0	11.6	4.8	28.5
241-260	20.2	12.9	11.1	5.1	29.1
261-280	21.4	13.3	5.7	4.1	23.1
281-300	5.2	11.1	5.1	2.2	18.4
301-320	0.8	4.6	0.8	0.2	5.6
321-340	2.0	3.8	0.8	0.2	4.8
341-360	0.7	3.5	1.0	0.3	4.8
361-380	0.7	1.3	1.0	2.0	4.3
381-400	0.3	4.0	0.5	0	4.5

[a] Mean depth = 237.6 fathoms.

Appendix C28.-Reproductive condition of female golden king crabs from pot lifts sampled during the 2001 - 2003 Bering Sea golden king crab fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
2001	3,506	17.8	25.9	20.9	28.7
2002	2,849	21.5	12.4	2.1	64.0
2003	2,224	13.3	13.3	6.0	66.5

Appendix C29.-Total catches of all animals from 932 pot lifts sampled during the 2003 Petrel Bank red king crab fishery.

Species	Total Catch	Species	Total Catch
Red King Crab		Skate (unidentified)	14
Legal male	9,327	Leech (unidentified)	13
Sublegal male	787	Cup coral (unidentified)	12
Female	2,186	*Paragorgia* spp.	12
		Walleye pollock	12
Tanner Crab		Primnoa Group I	11
Legal male	0	Sea anemone (unidentified)	10
Sublegal male	64	Pacific halibut	8
Female	54	Basket star (unidentified)	8
		Sea urchin (unidentified)	8
Tanner x Snow Crab Hybrid		Tube worm (unidentified)	8
Legal male	0	Sea jelly (unidentified)	7
Sublegal male	1	Snail (unidentified)	7
Female	0	*Anthomastus* spp.	6
		Clavularia spp.	6
Golden King Crab		Coral (unidentified)	6
Legal male	11	*Distichopora* spp.	6
Sublegal male	2	Soft coral (unidentified)	6
Female	126	Sea cucumber (unidentified)	6
		Dusky rockfish	5
Hair Crab		Hairy triton	5
Legal male	47	Arctic lyre crab	4
Sublegal male	257	Northern rockfish	4
Female	36	Rock sole	4
		Scale worm (unidentified)	4
Lyre crab	4,071	Spiny head sculpin	4
Scallop (unidentified)	930	Rockfish (unidentified)	3
Pink scallop (unidentified)	847	Turbot (unidentified)	3
Brittle star (unidentified)	557	Black coral (unidentified)	2
Sponge (unidentified)	351	*Calcigorgia* spp.	2
Yellow Irish lord	326	*Caryophyllia* spp.	2
Atka mackerel	196	Pacific ocean perch	2
Hydrocoral (unidentified)	148	Primnoidae (unidentified)	2
Stylaster spp.	124	Chiton (unidentified)	2
Bryozoan (unidentified)	112	Arrowtooth flounder	2
Weathervane scallop	110	Great sculpin	2
Sculpin (unidentified)	99	Snailfish (unidentified)	2
Sea star (unidentified)	45	Invertebrate (unidentified)	2
Clam (unidentified)	41	Alaska plaice	1
Cyclohelia spp.	35	*Errinopora* spp.	1
Hermit crab (unidentified)	24	Pacific oyster	1
Pacific cod	22	Prowfish	1
Worm (unidentified)	21	Ribbed Neptune snail	1
Octopus	20	Sea spider (unidentified)	1
Tunicate (unidentified)	16	Yellowfin sole	1

Appendix C30.-CPUE by soak times for 929 pot lifts sampled during the 2003 Petrel Bank red king crab fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
1-6	12.7	7.3	0.9	3.1	11.3
7-12	49.8	8.9	0.8	1.5	11.2
13-18	15.2	13.2	1.4	3.6	18.3
19-24	15.7	11.6	0.8	4.1	16.5
25-30	6.0	11.2	0	0.1	11.3
31-36	0.3	14.0	0	0	14.0
37-42	0.1	70.0	0	0	70.0
43-48	0.1	54.0	0	0	54.0

[a] Mean soak time = 12.9 hours.

Appendix C31.-CPUE by depth for 929 pot lifts sampled during the 2003 Petrel Bank red king crab fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
21-30	0.1	5.0	0	0	5.0
41-50	0.1	0	0	0	0
51-60	1.4	2.0	0.1	12.1	14.2
61-70	26.8	7.7	0.9	5.3	13.8
71-80	28.1	10.4	0.6	1.4	12.4
81-90	18.9	12.4	1.5	1.3	15.2
91-100	10.1	11.5	0.6	0.5	12.6
101-110	6.2	11.6	1.6	1.2	14.3
111-120	4.3	8.6	0.2	0.2	9.1
121-130	3.0	8.0	0	0	8.0
131-140	0.6	17.8	0	0	17.8
141-150	0.2	25.0	0	0	25.0

[a] Mean depth = 82.4 fathoms.

Appendix C32.-Reproductive condition of female red king crabs from pot lifts sampled during the 2001-2003 Petrel Bank red king crab fisheries.

Year	Crabs Sampled	Eyed Eggs Percent	Uneyed Eggs Percent	Barren, Matted Percent	Barren, Non-matted Percent
Jan.-Mar. 2001	25	32.0	56.0	4.0	8.0
Nov. 2001	632	2.7	94.8	0.6	1.9
2002	1,028	21.6	69.4	0.9	8.1
2003	2,182	2.2	69.5	0.5	27.5

Appendix C33.-Results of legal tally samples taken during the 2003 Bering Sea and Aleutian Islands crab fisheries.

Fishery	Sample Size	Male Target Species Percent Illegal	Female Target Species Percent Illegal	Non-target Species Percent Illegal	Total Percent Illegal	Estimated Number of Illegal Crabs[a]
Bering Sea snow crab	73,694	0.09	< 0.01	0.15	0.24	5,226
Bering Sea snow crab CDQ	32,323	0.07	< 0.01	0.29	0.36	6,327
Bristol Bay red king crab	28,644	1.06	0.06	0.01	1.12	26,256
Bristol Bay red king crab CDQ	6,819	0.48	0.01	0.01	0.51	891
Aleutian Islands golden king crab	82,376	0.45	0.03	0	0.48	6,344
Bering Sea golden king crab	2,653	0.53	0.07	0	0.60	217
Petrel Bank red king crab	7,909	0.04	0.01	0.01	0.06	38

[a] Estimated number of illegal crabs derived from percentage of total illegal crabs multiplied by number of crabs harvested during the fishery.