Fishery Data Series No. 06-03

Alaska Department of Fish and Game Summary of the 2004 Mandatory Shellfish Observer Program Database for the General and CDQ Fisheries

by

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and

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

Symbols and Abbreviations

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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 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

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ABSTRACT

Since 1988, the Alaska Department of Fish and Game 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 2004 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, retained male catch size frequency distributions, legal tally sample results, and sample pot lift locations by fishery. In 2004, commercially harvested shellfish species from the BSAI area include red king crab *Paralithodes camtschaticus*, golden king crab *Lithodes aequispinus*, scarlet king crab *L. couesi*, snow crab *Chionoecetes opilio* and grooved Tanner crab *C. tanneri*.

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

INTRODUCTION

Regulations adopted by the Alaska Board of Fisheries (BOF) in 1999 have provided the Alaska Department of Fish and Game (ADF&G) with the full authority and responsibility for deploying onboard observers on any vessel participating in the commercial Bering Sea and Aleutian Islands (BSAI) crab fisheries or in any fishery conducted under a commissioner's permit as necessary for fishery management and data-gathering needs. Those regulations required deployment of observers on all vessels that process Tanner crab *Chionoecetes spp.*, red king crab *Paralithodes camtschaticus*, blue king crab *P. platypus*, or golden king crab *Lithodes aequispinus*. Additionally, those regulations charged ADF&G with deploying observers as needed on catcher-only vessels participating in commercial BSAI king and Tanner crab fisheries (excluding those of Norton Sound and St. Lawrence Island Sections). Bowers et al. (2005) provides details on the regulations pertaining to the State of Alaska Shellfish Onboard Observer Program and a history of that program from its inception in 1988.

Observers collect biological data from the catch in sampled pot lifts and from samples of retained or delivered catch, document vessel catch, bycatch, and effort, and monitor vessel activities for regulatory compliance. Those data are used in management and research applications to develop stock assessment models, to estimate the amount and composition of bycatch, to chronicle female reproductive cycles, and as an aid in preseason and inseason projections of fishery performance. ADF&G Westward Region staff maintains a database of data collected by observers that includes gear types fished, pot lift locations and soak times, and species composition, size distribution, and reproductive condition in sampled catches. That database provides a source of information crucial to the comprehensive management of Alaska's shellfish resources.

This report summarizes data collected by onboard observers during general and Community Development (CDQ) commercial crab fisheries that ended in calendar year 2004 and during the 2004/2005 Aleutian Islands golden king crab fishery, which ended on January 3, 2005. Those fisheries were: the 2004 Bering Sea snow crab *C. opilio* general and CDQ fisheries; the 2004 Bristol Bay red king crab general and CDQ fisheries; the 2004 Aleutian Islands golden king crab fishery east of 174º W longitude; the 2003/2004 Aleutian Islands golden king crab fishery west of 174º W longitude; the 2004/2005 Aleutian Islands golden king crab fishery west of 174º W longitude; the 2004 Bering Sea golden king crab fishery; and the 2004 Bering sea grooved

Tanner *C. tanneri* fishery. Observers were deployed on all catcher-processor and floating processor vessels that participated in each of those fisheries. Observers were also deployed on all catcher-only vessels that participated in the Aleutian Islands and Bering Sea golden king crab fisheries, the Bering Sea grooved Tanner crab fishery, and the Bering Sea snow crab CDQ fishery. During the Bering Sea snow crab and Bristol Bay red king crab general fisheries, observers were randomly assigned to approximately 10% of the participating catcher-only vessels and observers were deployed on 60% of the catcher-only vessels that participated in the Bristol Bay red king crab CDQ fishery. More details on the deployment of observers during those fisheries are provided in Bowers et al. (2005).

Due to the substantial volume of available information, the scope of the data presented here has been narrowed. For each fishery, this report includes estimates of catch and bycatch of crabs from sampled pot lifts, information on the size and shell ages of retained crabs and crabs captured as bycatch, and summaries of the catch composition for all species encountered in sampled pot lifts.

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 and observer sampling duties are defined as follows:

Bycatch sample – A randomly selected pot lift from which all species captured are identified and enumerated, and, from a subset of the selected pot lifts, the measurement and assessment of ancillary characteristics of selected species are recorded.

Legal tally – Examination of up to 600 crabs randomly selected from the retained catch to assure regulatory compliance regarding the retention of crabs by species, size and sex.

Carapace Length (CL) – The biological size measurement of hair crabs and all species of king crabs taken as the straight-line distance from the posterior margin of the right eye orbit to the medial-posterior carapace margin.

Carapace Width (CW) – The biological size measurement of Dungeness crabs and all species of Tanner crab taken as the greatest straight-line distance perpendicular to a line midway between the eyes to the medial-posterior margin, not including the spines.

Legal Measurement – The greatest straight-line distance across the carapace of male crabs at a right angle to a line midway between the eyes to the medial-posterior margin including the spines.

Size frequency sample – Biological measurements of up to 100 randomly selected retained crabs for the purpose of determining carapace size and shell age distribution.

Catch per unit effort (CPUE) – 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 – Exoskeleton is not yet hardened, 0 to 2 weeks after molting.

New pliable-shell – Exoskeleton is thin, flexible and not fully calcified, 2 to 8 weeks after molting.

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 2004 BSAI crab 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 observers placed on catcher-processor and catcher-only vessels were able to examine the contents of pot lifts prior to sorting.

Floater-Processors

Observers deployed on floater-processors primarily monitor deliveries from catcher-only vessels. Sampling duties during each delivery included obtaining a size frequency sample and conducting legal tally.

Catcher-Processors

Sampling duties for observers deployed on catcher-processors included bycatch sampling, size frequency sampling, legal tallies and determination of average crab weight for each day the vessel retains catch. Occasionally, catcher-only vessels delivered to a catcher-processor. In those situations, the observer sampled the catcher-only vessel catch as if deployed on a floater-processor.

Catcher-Only Vessels

Sampling duties for observers deployed on catcher-only vessels included bycatch sampling, usually the main sampling activity for each day the vessel retained catch. When the vessel delivered to a processing facility (at-sea or on-shore), the observer obtained a size frequency sample, conducted a legal tally and determined average crab weight. If deliveries were made at-sea, all sampling was completed by the observer deployed on the catcher-only vessel.

Attaining daily sampling goals for observers on board catcher-processor and catcher-only vessels (e.g., quantity of bycatch samples conducted) was dependent upon a number of variables unique to each fishery and year. These variables include weather, catch rates, research data collection projects, and the order of sampling priorities established by ADF&G.

Ad hoc research data-collection projects were assigned to observers deployed on catcher-processors and catcher-only vessels during 2004. 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, but are available from ADF&G, Region IV.

For ease of reading, 2004 fishery specific methods, results and discussions are combined in the results section of this report. Inconsistencies between previously published shellfish observer database reports and results presented here are due to correction of errors and more complete interpretation of historical data.

ESTIMATION OF CPUE AND TOTAL FISHERY CATCH

CPUE estimates 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 where the weighting reflected the relative importance of each vessel's daily effort (number of pot lifts) compared to the vessel's total effort. 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 then summed over all vessels and all days for the entire fishery. In fisheries with partial coverage of catcher-only vessels, an additional stratum was used to account for vessel type and size (see Appendix A2).

Different estimates of CPUE were calculated depending on the information available. The "stratified CPUE" with standard error estimate used the Cochran stratified technique as described above and in Appendices A1 and A2. The "sample CPUE" was generated from observer data and is based solely on the pot lifts sampled and was calculated as total catch from the sampled pot lifts divided by the total number of sampled pot lifts. This estimate was reported in observer reports prior to 1996 (Tracy 1994, 1995a,b). The stratified estimates outlined in Appendix A1 were introduced in this report series in 1996, and the additional vessel-type stratum described in Appendix A2 was introduced in 2003. The "actual total fishery (ATF) CPUE" was based on fish

ticket information reported in the annual management reports for commercial crab fisheries in the BSAI management areas. The ATF CPUE was generated for retained legal crabs only.

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

When viewing CPUE estimates for the directed catch and bycatch, the precision and accuracy of the estimates should be noted. Precision is indicated by the standard error estimates. Accuracy may be 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 2004 fishing season, observers were deployed on 6 catcher-processor vessels, 3 floating processor vessels, and 19 of 183 catcher-only vessels participating in the fishery. 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. Fishing began on 15 January and continued until 23 January. Crab limb loss due to exposure to cold temperatures was not a concern during the fishery and no modifications of sample protocols were made. A total of 817 pot lifts selected for bycatch sampling accounted for 0.7% of the 110,087 pot lifts reported by vessel operators during the 7.3 day season (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Bering Sea snow crab fishery are displayed in Appendix B1.

Measurements of CW for size frequency samples were taken from 22,068 retained male snow crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 1). The mean CW of retained male snow crabs was 110.4 mm.

Measurements of CW from bycatch samples were taken from 24,539 male snow crabs throughout the season by onboard observers. The mean CW for male snow crabs from sampled pot lifts was 106.6 mm. The size frequency distribution revealed a prominent mode between 106 and 110 mm (Figure 1). The percentage of male snow crabs sampled that were categorized as old shell and very old shell was 22.1%. Measurements of CW were taken from 10 female snow crabs during bycatch sampling and the mean CW was 68.8 mm.

The stratified CPUE estimate of 149.6 legal retained snow crabs per pot lift (Table 2) was a 5.3% increase over the 2003 fishery estimate (Figure 2). The stratified CPUE estimate of 154.3 (SE = 11.8) for all legal retained crabs (including Tanner x snow crab hybrids) was a 2.5% increase over 2003. The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 8.6% of the estimated mean. The 95% confidence interval for the CPUE

of legal retained crabs estimated from sampled pot lifts was 131.2 to 177.4 crabs per pot lift. This interval included the ATF CPUE of 157, indicating that the sampled pot lifts were representative of the total fishery. Approximately 21% of the total catch of snow crabs were discarded as bycatch, most of which were legal-sized crabs < 4 inches CW (102 mm). Although the minimum legal size for snow crabs was 3.1 inches CW (79 mm), processing plants generally do not accept crabs < 4 inches CW. The stratified CPUE estimate for female snow crabs was 0.1.

Total catches of all animals identified in sampled pot lifts during the 2004 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 in bycatch samples (Appendix C4).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 69,995 crabs, which accounted for 0.40% of the cumulative reported harvest (Appendix C36). Of all sampled crabs, 0.24% were deemed illegal, either due to size, sex, or species.

Community Development Quota Fishery

Observers were deployed on the 1 catcher-processor vessel and all 9 catcher-only vessels during the 2004 fishing season. 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. Fishing began on 29 January and continued until 20 March. A total of 780 pot lifts selected for bycatch sampling accounted for 5.7% of the 13,622 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Bering Sea CDQ snow crab fishery are displayed in Appendix B2.

Size frequency measurements of CW were taken from 5,566 retained male snow crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 3). The mean CW of retained male snow crabs was 111.8 mm.

Bycatch sample measurements of CW were taken from 18,067 male snow crabs throughout the season by onboard observers. The mean CW for all male snow crabs from sampled pot lifts was 107.9 mm. The size frequency distribution of those measurements revealed a mode between 106 and 110 mm (Figure 3), similar to results from the general fishery. The percentage of sampled male snow crabs identified as old shell and very old shell was 22.6%. Bycatch sample measurements of CW were taken from 12 female snow crabs throughout the season by onboard observers. The mean CW for female snow crabs from sampled pot lifts was 73.3 mm.

The stratified CPUE estimate of 94.6 legal retained snow crabs per pot lift (Table 4) was a 15.8% decrease from the 2003 CDQ fishery estimate. The stratified CPUE estimate of 95.9 (SE = 4.7) for all legal retained crabs (including Tanner x snow crab hybrids) was a 15.2% decrease from the 2003 CDQ fishery estimate. The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 4.9% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 86.6 to 105.2 crabs per pot lift. This interval included the ATF CPUE of 98, indicating the sampled pot lifts provided data representative of the total fishery. Approximately 26% of the total catch of snow crabs were discarded as bycatch, most of which were legal-sized crabs < 4 inches CW (102 mm). The stratified CPUE estimate for female snow crabs was less than 0.1.

Total catches of all animals identified in sampled pot lifts during the 2004 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 on catcher-processors and catcher-only vessels delivering to processors totaled 33,100 crabs and comprised 2.5% of the cumulative reported harvest (Appendix C36). From all sampled crabs, 0.12% were deemed illegal, either due to size, sex or species.

BRISTOL BAY RED KING CRAB

General Fishery

Observers were deployed on 8 catcher-processor vessels, 1 floating processor vessel, and 20 of 243 catcher-only vessels and during the 2004 general fishery. The bycatch-sampling goal for observers on catcher-processors and catcher-only vessels was 10 pot lifts during each day of fishing activity. Fishing began on 15 October and continued until 18 October. A total of 536 pot lifts selected for bycatch sampling accounted for 0.6% of the 90,972 pot lifts reported by vessel operators (Bowers et al. 2005). Locations of pot lifts sampled by observers during the 2004 Bristol Bay red king crab fishery are displayed in Appendix B3.

Size frequency sample measurements of CL were taken from 20,038 retained male red king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 5). The mean CL of retained male red king crabs was 153.7 mm.

Bycatch sample measurements of CL were taken from 21,237 male red king crabs throughout the season by onboard observers. The mean CL for all male red king crabs from sampled pot lifts was 136.8 mm. The size frequency distribution of these measurements reveals a prominent mode between 151 and 155 mm (Figure 4). The percentage of old-shell and very-old-shell male red king crabs in bycatch samples was 12.2%. Measurements of CL were taken from 4,113 female red king crabs (Figure 5). The mean CL for all female red king crabs from sampled pot lifts was 107.2 mm.

The stratified CPUE estimate of 23.1 legal retained red king crabs per pot lift (Table 6) was a 29.8% increase from the 2003 general fishery estimate (Figure 6). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 6.5% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 20.1 to 26.0 crabs per pot lift. This interval includes the ATF CPUE of 23, indicating the sampled pot lifts were representative of the total fishery. An estimated 38% of all male red king crabs captured during the 2004 fishery were discarded due to minimum size regulations.

Total catches of all animals identified in sampled pot lifts during the 2004 season are provided in Appendix C9. Additional appendices contain CPUE by soak time (Appendix C10), depth (Appendix C11), and the reproductive condition of female red king crabs from bycatch samples (Appendix C12).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 36,303 crabs by the end of the 2004 season and comprised 1.8% of the cumulative reported harvest (Appendix C36). Approximately 0.5% were deemed illegal due to size, sex or species regulations.

Community Development Quota Fishery

During the 2004 fishing season, observers were deployed on 2 catcher-processor vessels and 6 of 10 catcher-only vessels. The bycatch sampling goal for observers on catcher-processors and catcher-only vessels was 10 pot lifts during each day of fishing activity. Vessels were eligible to register for the fishery on 22 October and the final delivery was made on 15 November. A total of 226 pot lifts selected for bycatch sampling accounted for 4.2% of the 5,359 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Bristol Bay red king crab CDQ fishery are displayed in Appendix B4.

Size frequency sample measurements of CL were taken from 2,427 retained male red king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 7). The mean CL of retained male red king crabs was 154.5 mm..

Bycatch sample measurements of CL were taken from 17,539 male red king crabs throughout the season by onboard observers. The mean CL for all male red king crabs from sampled pot lifts was 130.6 mm. The size frequency distribution of these measurements reveal a prominent mode of legal sized crabs between 146 and 150 mm and another prominent mode of sub-legal sized crabs between 111 and 115 mm (Figure 7). The general size distributions and proportions of sublegal and legal male red king crabs were similar to the 2004 general fishery. The percentage of old-shell and very-old-shell male red king crabs sampled was 12.4%. Bycatch sample measurements of CL were taken from 2,553 female red king crabs throughout the season by onboard observers. The mean CL for all female red king crabs from sampled pot lifts was 109.2 mm.

The stratified CPUE estimate of 33.8 legal retained red king crabs per pot lift (Table 8) was a 12.3% increase from the 2003 CDQ fishery estimate. The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 6.2% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 29.7 to 37.9 crabs per pot lift. This interval includes the ATF CPUE of 31, indicating the sampled pot lifts were representative of the total fishery. An estimated 58% of all male red king crabs captured during the 2004 CDQ fishery were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2004 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 on catcher-processors and catcher-only vessels delivering to processors totaled 12,567 crabs by the end of the 2004 season and comprised 7.5% of the cumulative reported harvest (Appendix C36). From all sampled crabs, 0.54% were deemed illegal, either due to size, sex or species.

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, and 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 (Bowers et al. 2005). Results from three fishery seasons are reported on here: the 2004 fishery east of 174° W longitude, the 2003/2004 fishery west of 174° W longitude, and the 2004/2005 fishery west of 174° W longitude. Results from the 2004/2005

fishery west of 174° W longitude are included in this report because it is the last BSAI crab fishery to take place before new regulations resulting from Bering Sea crab rationalization are implemented.

Aleutian Islands East of 174° W Longitude, 2004

During the 2004 Aleutian Islands golden king crab fishery east of 174° W longitude, observers were deployed on 19 catcher-only vessels. The bycatch-sampling goal for observers on catcher-only vessels was 14 pot lifts per fishing day. Fishing began 15 August and continued until 29 August. A total of 2,206 pot lifts selected for bycatch sampling accounted for 6.3% of the 34,925 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Aleutian Islands golden king crab fishery east of 174° W longitude are displayed in Appendix B5.

Size frequency sample measurements of CL were taken from 3,240 retained male golden king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 9). The mean CL of retained male golden king crabs was 148.4 mm.

Bycatch sample measurements of CL were taken from 19,993 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot lifts was 139.3 mm. The general size and shell age distributions and proportions of sublegal and legal male golden king crabs are similar to the previous three seasons (Figure 8). Bycatch samples, measurements of CL were taken from 5,442 female golden king crabs throughout the season by onboard observers. The mean CL for all female golden king crabs from sampled pot lifts was 118.6 mm. The general size and shell age distributions and proportions of female golden king crabs are similar to the 2003 fishery (Figure 9).

The stratified CPUE estimate of 17.3 legal retained golden king crabs per pot lift (Table 10) was a 64.2% increase from the 2003 fishery estimate (Figure 10). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 6.3% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 15.2 to 19.5 crabs per pot lift. This interval includes the ATF CPUE of 18, indicating the sampled pot lifts were representative of the total fishery. An estimated 55% of all golden king crabs captured during the 2004 fishery were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2004 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 red 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 78,760 crabs by the end of the 2004 season and comprised 5.9% of the cumulative reported harvest (Appendix C36). From all sampled crabs, 0.44% were deemed illegal, either due to size, sex or species.

Aleutian Islands West of 174° W Longitude, 2003/2004

During the 2003/2004 Aleutian Islands golden king crab fishery west of 174° W longitude, observers were deployed on 5 catcher-only vessels and 1 catcher-processor vessel. The bycatch-sampling goal for observers on catcher-only vessels was 10 pot lifts and for observers on catcher-processor vessels was 5 pot lifts during each day of fishing activity. Fishing began 15

August 2003 and continued until 6 February 2004. A total of 3,324 pot lifts selected for bycatch sampling accounted for 5.0% of the 66,255 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2003 Aleutian Islands golden king crab fishery west of 174° W longitude are displayed in Appendix B6.

Size frequency sample measurements of CL were taken from 12,331 retained male golden king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 11). The mean CL of retained male golden king crabs was 146.4 mm.

Bycatch sample measurements of CL were taken from 39,000 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot lifts was 136.8 mm. The general size and shell age distributions and proportions of sublegal and legal male golden king crabs are similar to the 2002/2003 fishery (Figure 11). Bycatch sample measurements of CL were taken from 15,403 female golden king crabs throughout the season by onboard observers. The mean CL for all female golden king crabs from sampled pot lifts was 127.8 mm. The general size and shell age distributions and proportions of female golden king crabs are similar to the previous season (Figure 12).

The stratified CPUE estimate of 9.7 legal retained golden king crabs per pot lift (Table 12) was a 16.9% increase from the 2002/2003 fishery estimate (Figure 13). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 5.0% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 8.8 to 10.7 crabs per pot lift. This interval includes the ATF CPUE of 10, indicating the sampled pot lifts were representative of the total fishery. An estimated 63% of all golden king crabs captured during the 2003/2004 fishery were discarded bycatch.

Total catches of all animals identified in sampled pot lifts during the 2003/2004 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).

Aleutian Islands West of 174° W Longitude, 2004/2005

During the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude, observers were deployed on 5 catcher-only vessels and 1 catcher-processor vessel. The bycatch sampling goal for observers on catcher-only vessels was 10 pot lifts and for observers on catcher-processor vessels was 5 pot lifts during each day of fishing activity. Fishing began 15 August, 2004 and continued until 3 January, 2005. A total of 2,619 pot lifts selected for bycatch sampling accounted for 4.6% of the 56,769 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude are displayed in Appendix B7.

Size frequency sample measurements of CL were taken from 12,948 retained male golden king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 13). The mean CL of retained male golden king crabs was 146.4 mm.

Bycatch sample measurements of CL were taken from 35,530 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot

lifts was 134.9 mm. The general size and shell age distributions and proportions of sublegal and legal male golden king crabs are similar to the 2003/2004 fishery (Figure 11). Bycatch sample measurements of CL were taken from 12,985 female golden king crabs throughout the season by onboard observers. The mean CL for all female golden king crabs from sampled pot lifts was 124.2 mm. The general size and shell age distributions and proportions of female golden king crabs are similar to the previous season (Figure 12).

The stratified CPUE estimate of 10.8 legal retained golden king crabs per pot lift (Table 14) was a 11.3% increase from the 2003/2004 fishery estimate (Figure 13). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 5.9% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 9.5 to 12.0 crabs per pot lift. This interval includes the ATF CPUE of 12, indicating the sampled pot lifts were representative of the total fishery. An estimated 65% of all golden king crabs captured during the 2004/2005 fishery were discarded bycatch.

Total catches of all animals identified in sampled pot lifts during the 2004/2005 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 C24).

BERING SEA GOLDEN KING CRAB

2001 marked the first year that observers were deployed during the Bering Sea golden king crab fishery. During the 2004 fishery, observers were deployed on 5 catcher-only vessels. The bycatch-sampling goal for observers on catcher-only vessels was 10 pot lifts during each day of fishing activity. The fishery opened by commissioner's permit on 1 January and was closed on 12 March. A total of 552 pot lifts selected for bycatch sampling accounted for 23.9% of the 2,312 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Bering Sea golden king crab fishery are displayed in Appendix B8.

Size frequency sample measurements of CL were taken from 552 retained male golden king crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 15). The mean CL of retained male golden king crabs was 142.8 mm.

Bycatch sample measurements of CL were taken from 11,055 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot lifts was 134.3 mm. The general size and shell age distributions and proportions of sublegal and legal male golden king crabs are similar to the 2003 fishery (Figure 14). Bycatch sample measurements of CL were taken from 1,185 female golden king crabs throughout the season by onboard observers (Figure 15). The mean CL for all female golden king crabs from sampled pot lifts was 107.9 mm.

Total catches of all animals identified in sampled pot lifts during the 2004 season are provided in Appendix C28. Additional appendices contain CPUE by soak time (Appendix C29) and depth (Appendix C30), and the reproductive condition of female golden king crabs from the bycatch (Appendix C31).

Legal tallies conducted on catcher-only vessels delivering to processors totaled **CONFIDENTIAL** crabs by the end of the 2004 season and comprised **CONFIDENTIAL** of the cumulative reported harvest (Appendix C36). From all sampled crabs, 0.16% were deemed illegal, either due to size, sex or species; 0.44% less than the 2003 season.

BERING SEA GROOVED TANNER CRAB

During the 2004 Bering Sea grooved Tanner crab fishery, observers were deployed on 2 catcher-only vessels. The bycatch-sampling goal for observers on catcher-only vessels was 10 pot lifts during each day of fishing activity. The fishery opened by commissioner's permit on 1 January and fishing took place from 24 March to 18 June. In addition to grooved Tanner crabs, legal triangle Tanner crabs and legal scarlet king crabs were also retained during this fishery.

A total of 567 pot lifts selected for bycatch sampling accounted for 7.1% of the 7,934 pot lifts reported by vessel operators (Bowers et al. 2005). The locations of pot lifts sampled by observers during the 2004 Bering Sea grooved Tanner crab fishery are displayed in Appendix B9.

Size frequency sample measurements of CW were taken from 730 retained male grooved Tanner crabs throughout the season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 17). The mean CW of retained male grooved Tanner crabs was 143.6 mm.

Measurements of CL were also taken from 277 retained male scarlet king crabs and the mean CL was 132.6 mm (Table 18). Measurements of CW were also taken from 200 retained male triangle Tanner crabs and the mean CW was 123.4 mm.

Bycatch sample measurements of CW were taken from 5,725 male grooved Tanner crabs throughout the season by onboard observers (Figure 17). The mean CW for all male grooved Tanner crabs from sampled pot lifts was 140.1 mm. Bycatch sample measurements of CW were taken from 2,937 female grooved Tanner crabs throughout the season by onboard observers (Figure 18). The mean CW for all female grooved Tanner crabs from sampled pot lifts was 103.3 mm.

Total catches of all animals identified in sampled pot lifts during the 2004 season are provided in Appendix C32. Additional appendices contain CPUE by soak time (Appendix C33) and depth (Appendix C34), and the reproductive condition of female golden king crabs from the bycatch (Appendix C35).

Legal tallies conducted on catcher-only vessels delivering to processors totaled **CONFIDENTIAL** crabs by the end of the 2004 season and comprised **CONFIDENTIAL** of the cumulative reported harvest (Appendix C36). From all sampled crabs, 0.28% were deemed illegal, either due to size, sex or species.

Accuracy and Precision of CPUE Estimates

In using CPUE estimates based on observer data it was important to have some assessment of their reliability for observed vessels and, especially, for all vessels participating in a fishery. Although the observer data were the only source of information on bycatch CPUEs for the fisheries presented in this report, fish tickets also provided 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 provided an independent estimate of the total fishery CPUE of retained legal crabs. This was particularly useful for fisheries in which observers were required on catcher-processor vessels and only a fraction of the catcher-only vessels.

With the exception of two fisheries, CPUE estimates for retained legal crabs computed from observer bycatch samples were within 5% of the ATF CPUE for all fisheries in which crab observers were deployed (Table 20). Additionally, all ATF CPUEs were contained within the 95% confidence intervals for CPUEs derived from observer data. 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 Bristol Bay red king crab CDQ fishery and the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude.

CPUE estimates computed from observer data for retained legal crabs in the 2004 Bristol bay red king crab CDQ fishery (Table 8) differed from the ATF CPUE by 8.7% or 2.8 crabs per pot lift. The other fishery with less reliable estimates was the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude (Table 14). The 10.7% difference between observer and ATF CPUE estimates represented just 1.2 crabs per pot lift.

Comparing stratified CPUE estimates for retained legal crabs with the ATF CPUE in all other fisheries with partial observer coverage indicated the coverage provided adequate data for estimation of total fishery CPUE. The Bering Sea golden king crab, general snow crab and general Bristol Bay red king crab fisheries discussed in this report realized the best agreement between estimates. For the general snow crab and red king crab fisheries, the close agreement can likely 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 was different from the “sample” observer-based CPUE estimate used in Mandatory Shellfish Observer Database Summaries prior to 1996 (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 was 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. A general measure of statistical precision was the ratio of the standard error of an estimate to the estimate itself; they are expressed here as a percent (ratio $\times$ 100). Ratios that are less than 10% are considered to be acceptable for the estimates made using data collected by observers; 5% or less are desirable. Generally, the stratified CPUE estimates appeared to be precise, as all ratios of standard errors to CPUE estimates were less than 10%. They ranged from a low of 4.9% for the Bering Sea snow crab CDQ fishery to 9.4% for the Bering Sea golden king crab fishery. We also computed 95% confidence intervals for the CPUE estimates even though the sample size within each stratum (vessel-day) was not large enough to assume an asymptotic normal distribution. However, 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).

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TABLES AND FIGURES

Table 1.-Carapace width (CW, mm) frequency distributions by shell age from biological measurements of retained male snow crabs sampled during the 2004 Bering Sea snow crab general fishery.

Width (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
< 76	< 0.1	0	0	< 0.1
76-80	< 0.1	< 0.1	0	0.1
81-85	< 0.1	< 0.1	< 0.1	0.1
86-90	0.2	< 0.1	< 0.1	0.2
91-95	0.8	0.2	< 0.1	1.1
96-100	5.0	1.2	0.1	6.2
101-105	15.7	2.9	0.1	18.8
106-110	22.3	3.2	0.2	25.7
111-115	20.4	2.6	0.2	23.2
116-120	13.6	1.9	0.1	15.6
121-125	5.8	0.8	< 0.1	6.7
126-130	1.6	0.3	< 0.1	2.0
131-135	0.3	< 0.1	0	0.3
> 135	0.1	0	0	0.1
Total Crab	18,973	2,911	184	22,068
Total Percent	86.0	13.2	0.8	100.0

[a] Average CW = 110.4 mm.

Table 2.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2004 Bering Sea snow crab general fishery. The estimates are from 817 pot lifts.

	Sampled Fleet Estimates		
Species / Sex class	CPUE	SE	Estimated Total Catch[a]
Snow Crab			
Legal males - retained	149.6[b]	12.92	16,469,000[c]
Legal males - not retained	36.8	5.76	4,051,000
Sublegal males	2.1	0.37	232,000
Females	0.1	0.03	9,000
Tanner x Snow Hybrid			
Legal males - retained	5.1[b]	2.33	562,000[c]
Legal males - not retained	1.2	0.45	134,000
Sublegal males	0.4	0.14	43,000
Females	< 0.1	< 0.01	1,000

[a] Estimated catch is the product of the CPUE estimate and 110,087, the total number of pot lifts for the 2004 Bering Sea snow crab general fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 157 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 17,331,514 (Bowers et al. 2005).

Table 3.-Carapace width (CW, mm) frequency distributions by shell age from biological measurements of retained male snow crabs sampled during the 2004 Bering Sea snow crab CDQ fishery.

Width (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
< 76	0	< 0.1	0	< 0.1
76-80	0	0	0	0
81-85	0	0	0	0
86-90	< 0.1	< 0.1	< 0.1	0.1
91-95	0.2	0.1	0	0.4
96-100	2.5	0.8	< 0.1	3.3
101-105	12.4	2.0	0.1	14.4
106-110	22.7	2.7	< 0.1	25.5
111-115	23.5	2.5	0.2	26.2
116-120	17.9	1.8	0.1	19.8
121-125	7.5	0.7	< 0.1	8.2
126-130	1.7	0.1	0	1.8
131-135	0.3	0.1	0	0.3
> 135	< 0.1	0	0	< 0.1
Total Crab	4,936	605	25	5,566
Total Percent	88.7	10.9	0.4	100.0

[a] Average CW = 111.8 mm.

Table 4.-Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2004 Bering Sea snow crab CDQ fishery. The estimates are from 780 pot lifts.

	Sampled Fleet Estimates		
Species / Sex class	CPUE	SE	Estimated Total Catch[a]
Snow Crab			
Legal males - retained	94.6[b]	4.71	1,289,000[c]
Legal males - not retained	33.1	3.24	450,000
Sublegal males	1.2	0.16	16,000
Females	< 0.1	0.05	500
Tanner x Snow Hybrid			
Legal males - retained	1.3[b]	0.2	18,000[c]
Legal males - not retained	0.5	0.22	7,000
Sublegal males	0.2	0.06	3,000
Females	0.2	0.32	2,000

[a] Estimated catch is the product of the CPUE estimate and 13,622, the total number of pot lifts for the 2004 Bering Sea snow crab CDQ fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 98 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 1,338,077 (Bowers et al. 2005).

Table 5.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male red king crabs sampled during the 2004 Bristol Bay red king crab general fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
106-110	< 0.1	0	0	< 0.1
111-115	0	0	0	0
116-120	< 0.1	0	0	< 0.1
121-125	0	0	0	0
126-130	< 0.1	< 0.1	< 0.1	0.1
131-135	1.2	0.2	0.1	1.4
136-140	5.4	1.1	0.3	6.9
141-145	10.8	2.0	0.7	13.6
146-150	14.7	2.8	0.9	18.5
151-155	15.2	2.5	1.0	18.6
156-160	12.9	2.4	0.9	16.3
161-165	9.4	1.9	0.9	12.1
166-170	5.7	1.2	0.6	7.5
171-175	2.5	0.7	0.4	3.5
176-180	0.7	0.2	0.1	1.0
181-185	0.3	0.1	0.1	0.4
186-190	< 0.1	< 0.1	< 0.1	0.1
191-195	< 0.1	0	0	< 0.1
Total Crab	15,795	3,046	1,197	20,038
Total Percent	78.8	15.2	6.0	100.0

[a] Average CL = 153.7 mm.

Table 6.-Estimated catch per pot (CPUE) of red king crabs from 536 pot lifts sampled by observers deployed during the 2004 Bristol Bay red king crab general fishery.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch[a]
	CPUE	SE	
Red King Crab			
Legal males - retained	23.1[b]	1.51	2,098,000[c]
Legal males - not retained	< 0.1	0.02	4,000
Sublegal males	14.2	2.55	1,288,000
Females	9.6	6.22	877,000

[a] Estimated catch is the product of the CPUE estimate and 90,972, the total number of pot lifts for the 2004 Bristol Bay red king crab general fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 23 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 2,075,622 (Bowers et al. 2005).

Table 7.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male red king crabs sampled during the 2004 Bristol Bay red king crab CDQ fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
131-135	0.5	0	0	0.5
136-140	5.6	0.2	0	5.8
141-145	11.2	1.3	< 0.1	12.6
146-150	15.0	2.6	< 0.1	17.7
151-155	16.7	2.7	0.1	19.4
156-160	14.6	2.2	0.1	16.9
161-165	9.9	2.0	0.1	12.0
166-170	6.8	1.5	0.1	8.4
171-175	3.4	0.7	0.1	4.2
176-180	1.3	0.2	< 0.1	1.6
181-185	0.4	0.1	0	0.5
Total Crab	2,084	329	14	2,427
Total Percent	85.9	13.6	0.6	100.0

[a] Average CL = 154.5 mm.

Table 8.-Estimated catch per pot (CPUE) of red king crabs from 226 pot lifts sampled by observers deployed during the 2004 Bristol Bay red king crab CDQ fishery.

Species / Sex class	Sampled Fleet Estimates CPUE	SE	Estimated Total Catch[a]
Red King Crab			
Legal males - retained	33.8[b]	2.10	181,000[c]
Legal males - not retained	3.5	0.49	19,000
Sublegal males	42.5	3.94	228,000
Females	10.3	1.32	55,000

[a] Estimated catch is the product of the CPUE estimate and 5,359, the total number of pot lifts for the 2004 Bristol Bay red king crab CDQ fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 31 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 166,829 (Bowers et al. 2005).

Table 9.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male golden king crabs sampled during the 2004 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	4.7	0	0	4.7
136-140	15.6	0.1	< 0.1	15.6
141-145	22.4	0.6	0	22.9
146-150	19.5	0.6	0	20.1
151-155	14.6	0.5	0	15.1
156-160	10.0	0.6	< 0.1	10.6
161-165	5.5	0.3	0.1	5.9
166-170	3.1	0.2	< 0.1	3.4
171-175	1.1	0.1	< 0.1	1.3
176-180	0.1	0	0	0.1
181-185	< 0.1	0	0	< 0.1
186-190	0	0	0	0
191-195	< 0.1	0	0	< 0.1
Total Crab	3,135	98	7	3,240
Total Percent	96.8	3.0	0.2	100.0

[a] Average CL = 148.4 mm.

Table 10.-Estimated catch per pot (CPUE) of golden king crabs from 2,136 pot lifts sampled by observers deployed during the 2004 Aleutian Islands golden king crab fishery east of 174° W longitude.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch[a]
	CPUE	SE	
Golden King Crab			
Legal males - retained	17.3[b]	1.10	605,000[c]
Legal males - not retained	0.1	0.09	4,000
Sublegal males	12.0	1.35	418,000
Females	9.0	1.55	313,000

[a] Estimated catch is the product of the CPUE estimate and 34,925, the total number of pot lifts for the 2004 eastern Aleutian Islands golden king crab fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 18 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 634,390 (Bowers et al. 2005).

Table 11.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male golden king crabs sampled during the 2003/2004 Aleutian Islands golden king crab fishery west of 174° W longitude.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
126-130	0.2	0	0	0.2
131-135	4.6	< 0.1	< 0.1	4.6
136-140	20.4	0.2	0.1	20.6
141-145	26.8	0.4	0.1	27.3
146-150	20.9	0.4	0.1	21.5
151-155	12.7	0.3	0.1	13.2
156-160	6.3	0.3	0.1	6.6
161-165	3.3	0.2	0.1	3.5
166-170	1.5	0.1	< 0.1	1.6
171-175	0.5	< 0.1	< 0.1	0.6
176-180	0.2	< 0.1	< 0.1	0.2
181-185	< 0.1	0	< 0.1	0.1
186-190	< 0.1	0	0	< 0.1
Total Crab	11,999	247	85	12,331
Total Percent	97.3	2.0	0.7	100.0

[a] Average CL = 146.4 mm.

Table 12.-Estimated catch per pot (CPUE) of golden king crabs from 3,323 pot lifts sampled by observers deployed during the 2003/2004 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch[a]
	CPUE	SE	
Golden King Crab			
Legal males - retained	9.7[b]	0.49	644,000[c]
Legal males - not retained	0.1	0.04	4,000
Sublegal males	8.5	0.71	562,000
Females	8.1	0.83	536,000

[a] Estimated catch is the product of the CPUE estimate and 66,255, the total number of pot lifts for the 2003/2004 western Aleutian Islands golden king crab fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 10 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 676,633 (Bowers et al. 2005).

Table 13.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male golden king crabs sampled during the 2004/2005 Aleutian Islands golden king crab fishery west 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	4.6	0.1	0	4.7
136-140	20.2	0.4	0	20.6
141-145	27.5	0.5	< 0.1	27.9
146-150	20.4	0.4	< 0.1	20.8
151-155	12.0	0.4	< 0.1	12.3
156-160	6.6	0.2	< 0.1	6.9
161-165	3.5	0.1	< 0.1	3.7
166-170	1.7	0.1	0	1.8
171-175	0.7	< 0.1	0	0.8
176-180	0.2	< 0.1	0	0.2
181-185	0.1	0	0	0.1
186-190	< 0.1	< 0.1	0	< 0.1
Total Crab	12,655	287	5	12,948
Total Percent	97.7	2.2	< 0.1	100.0

[a] Average CL = 146.4 mm.

Table 14.-Estimated catch per pot (CPUE) of golden king crabs from 2,612 pot lifts sampled by observers deployed during the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species / Sex class	Sampled Fleet Estimates		Estimated Total Catch[a]
	CPUE	SE	
Golden King Crab			
Legal males - retained	10.8[b]	0.64	613,000[c]
Legal males - not retained	0.3	0.06	16,000
Sublegal males	10.1	0.98	575,000
Females	9.4	1.09	532,000

[a] Estimated catch is the product of the CPUE estimate and 56,769, the total number of pot lifts for the 2004/2005 western Aleutian Islands golden king crab fishery (Bowers et al. 2005).

[b] Actual total fishery CPUE of retained legal crabs was 12 for all vessels (Bowers et al. 2005).

[c] Actual catch of retained legal crabs for the fishery was 684,611 (Bowers et al. 2005).

Table 15.-Carapace length (CL, mm) frequency distributions by shell age from biological measurements of retained male golden king crabs sampled during the 2004 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	4.9	0	0	4.9
126-130	9.8	0	0	9.8
131-135	15.8	0.2	0	15.9
136-140	12.0	0.4	0	12.3
141-145	16.5	0.7	0	17.2
146-150	14.3	0.4	0	14.7
151-155	10.0	0.2	0	10.1
156-160	6.9	0.5	0	7.4
161-165	3.6	0.2	0	3.8
166-170	2.0	0	0	2.0
171-175	1.1	0	0	1.1
176-180	0	0.2	0	0.2
181-185	0.2	0	0	0.2
Total Crab	537	15	0	552
Total Percent	97.3	2.7	0	100.0

[a] Average CL = 142.8 mm.

Table 16.-Estimated catch per pot (CPUE) of golden king crabs from 552 pot lifts sampled by observers deployed during the 2004 Bering Sea golden king crab fishery.

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Table 17.-Carapace width (CW, mm) frequency distributions by shell age from biological measurements of retained male grooved Tannner crab sampled during the 2004 Bering Sea grooved Tanner crab fishery.

Length (mm)[a]	New Percent	Old Percent	Very old Percent	All Percent
116-120	0.1	0	0	0.1
121-125	1.4	0	0	1.4
126-130	5.6	0.3	0	5.9
131-135	11.8	1.4	0	13.2
136-140	17.3	1.5	0	18.8
141-145	19.0	2.1	0.3	21.4
146-150	15.2	2.3	0.1	17.7
151-155	7.9	1.0	0	8.9
156-160	5.1	1.2	0	6.3
161-165	3.2	1.4	0.1	4.7
166-170	1.0	0.4	0	1.4
171-175	0.3	0.1	0	0.4
Total Crab	641	85	4	730
Total Percent	87.7	11.6	0.5	100.0

[a] Average CW = 143.6 mm.

Table 18.-Carapace measurements and frequency distributions by shell age from biological measurements of retained male scarlet king crab (CL, mm) and retained male triangle Tanner crab (CW, mm) sampled during the 2004 Bering Sea grooved Tanner crab fishery.

Measurement	Scarlet king crab (CL[a])		Triangle Tanner crab (CW[b])	
(mm)	New Percent	Old Percent	New Percent	Old Percent
106-110	--	--	2.5	0
111-115	1.4	0	9.5	1.0
116-120	5.1	0	21.5	1.0
121-125	11.2	0.4	20.5	2.5
126-130	22.0	0	21.0	2.0
131-135	26.7	0.4	14.0	0.5
136-140	16.6	0.4	4.0	0
141-145	6.5	0	--	--
146-150	8.3	0	--	--
151-155	1.1	0	--	--
Total Crab	274	3	186	14
Total Percent	98.9	1.1	93.0	7.0

[a] Average CL = 132.6 mm.

[b] Average CW = 123.4 mm.

Table 19.-Estimated catch per pot (CPUE) of selected crab species from 567 pot lifts sampled by observers deployed during the 2004 Bering Sea grooved Tanner crab fishery.

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Table 20.-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 2004 crab fisheries with mandatory observers.

	Vessels		Pot Lifts		Percent difference of the weighted CPUE estimate from ATF CPUE[a]
Fishery	Observed	Total Fishery	Observed	Total Fishery	
Bering Sea snow crab general (with legal hybrids)	24	190	817	110,087	-1.7[b]
Bering Sea snow crab CDQ (with legal hybrids)	10	10	780	13,622	-2.1[b]
Bristol Bay red king crab general	28	251	536	90,972	+1.3[b]
Bristol Bay red king crab CDQ	8	12	226	5,359	+8.7[b]
2004 Aleutian Islands golden king crab east of 174° W	19	19	2,206	34,925	+4.9[b]
2003/04 Aleutian Islands golden king crab west of 174° W	6	6	3,324	66,255	-4.9[b]
2004/05 Aleutian Islands golden king crab west of 174° W	6	6	2,617	56,769	-10.7[b]
Bering Sea golden king crab	5	5	[c]	[c]	+0.7[b]
Bering Sea grooved Tanner crab	2	2	[c]	[c]	+4.1[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.

[c] Confidential

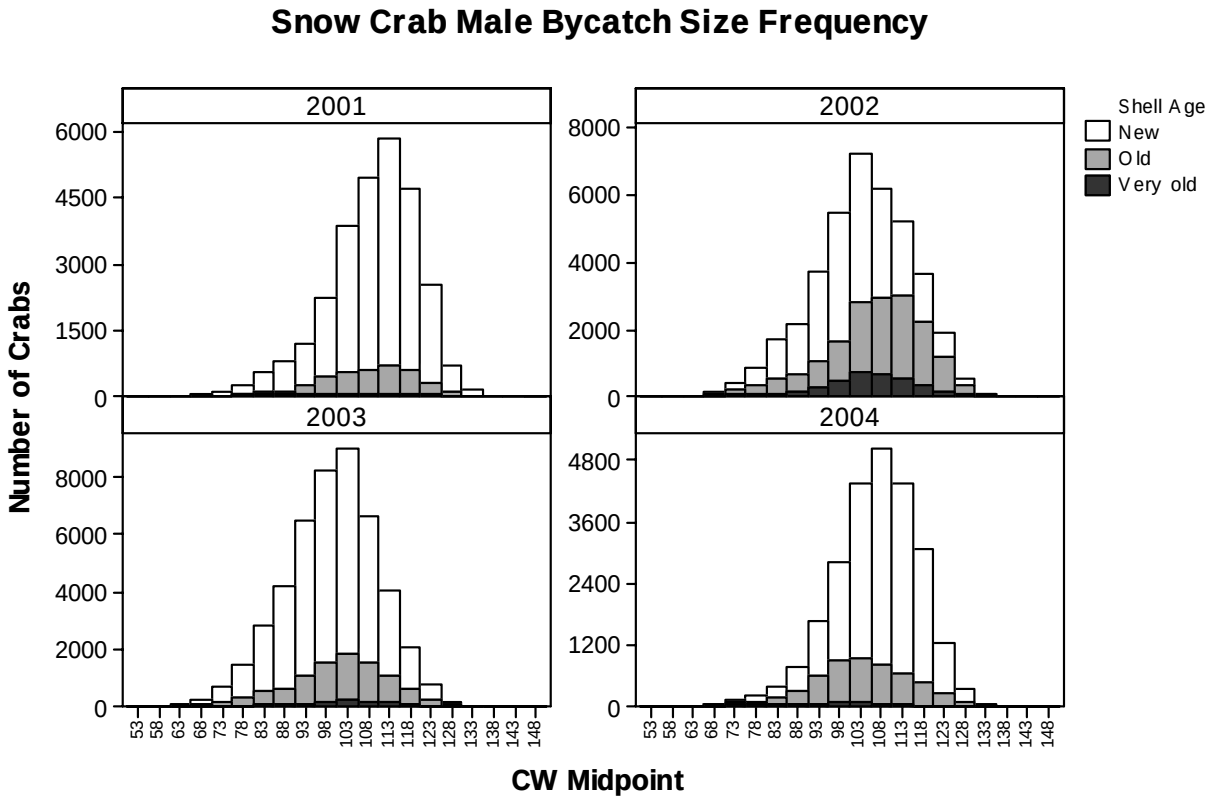

Figure 1.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for male snow crabs from pot lifts sampled during the 2001-2004 Bering Sea snow crab general fisheries.

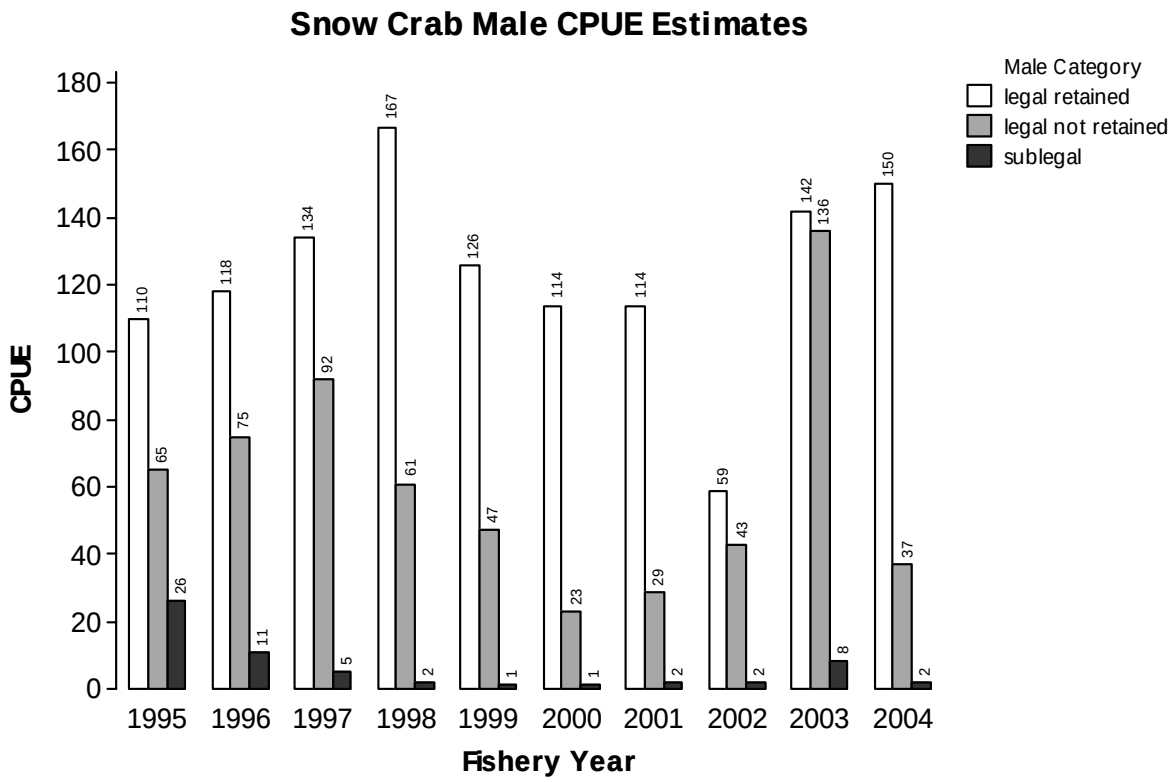

Figure 2.-Estimated CPUE of male snow crabs from pot lifts sampled during the 1995-2004 Bering Sea snow crab general fisheries.

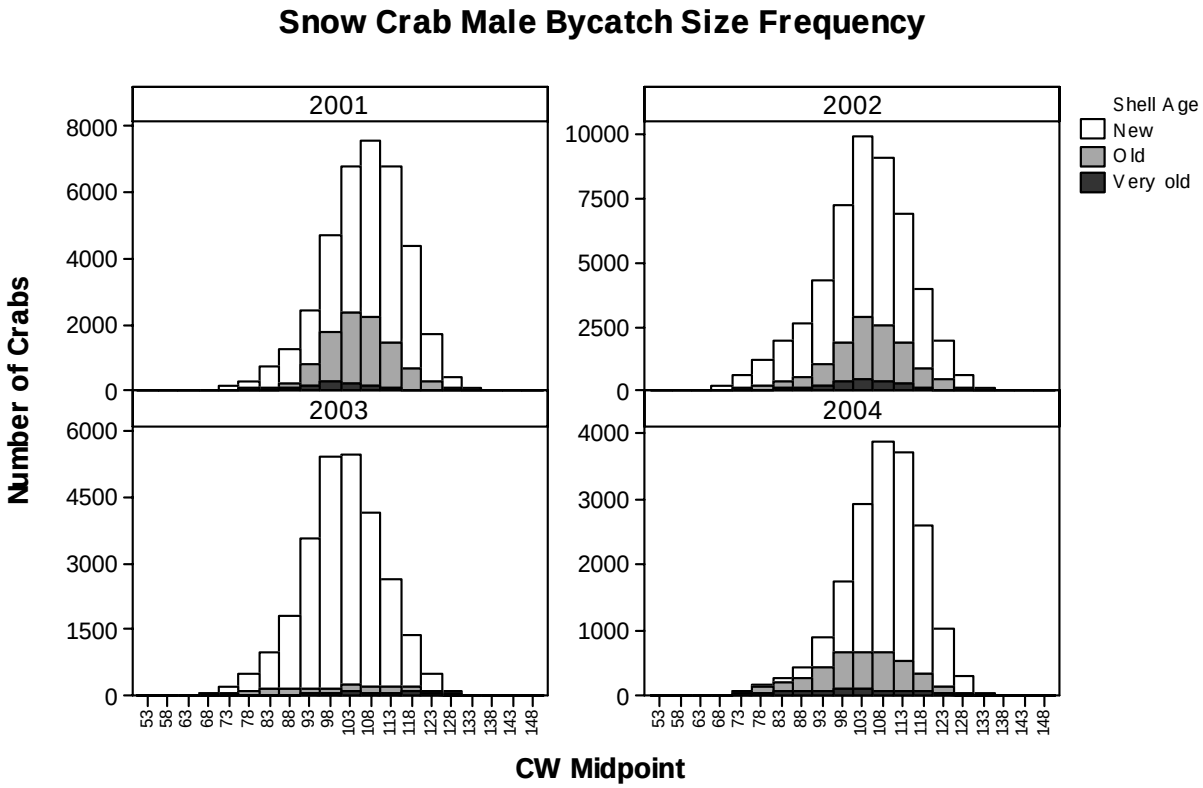

Figure 3.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for male snow crabs from pot lifts sampled during the 2001-2004 Bering Sea snow crab CDQ fisheries.

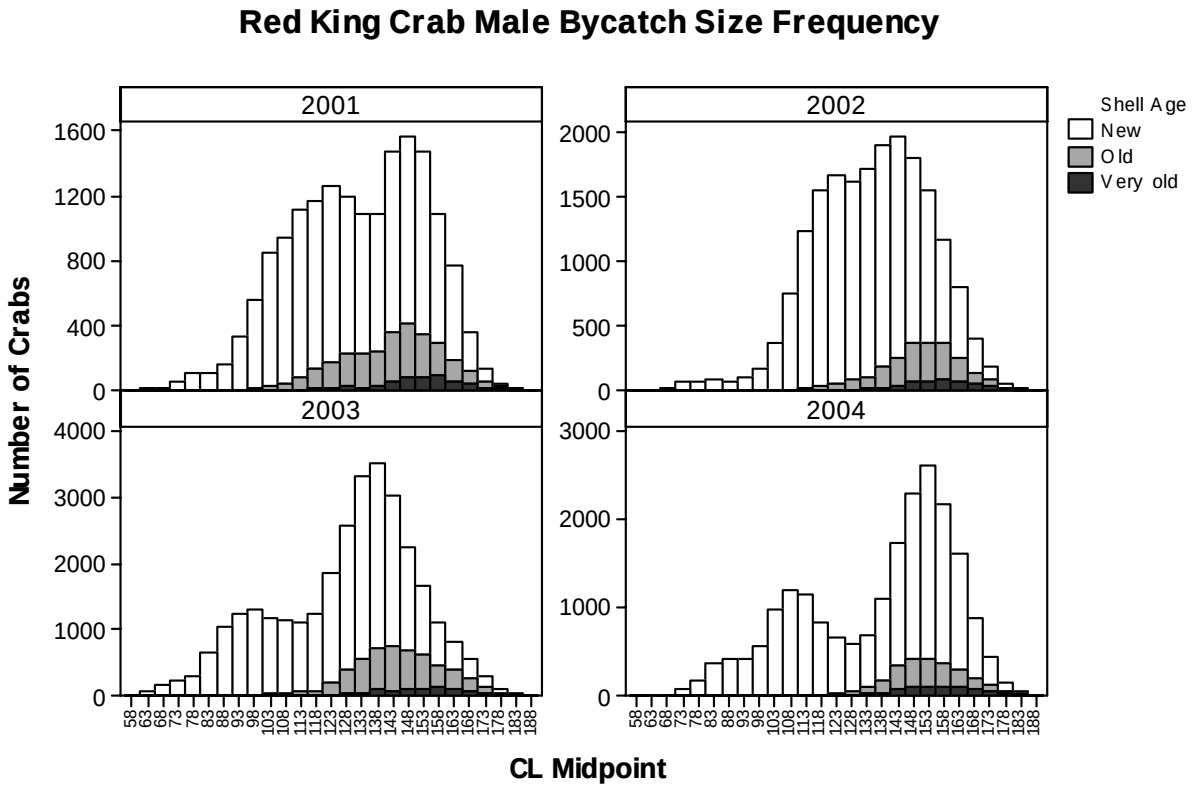

Figure 4.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male red king crabs from pot lifts sampled during the 2001-2004 Bristol Bay red king crab general fisheries.

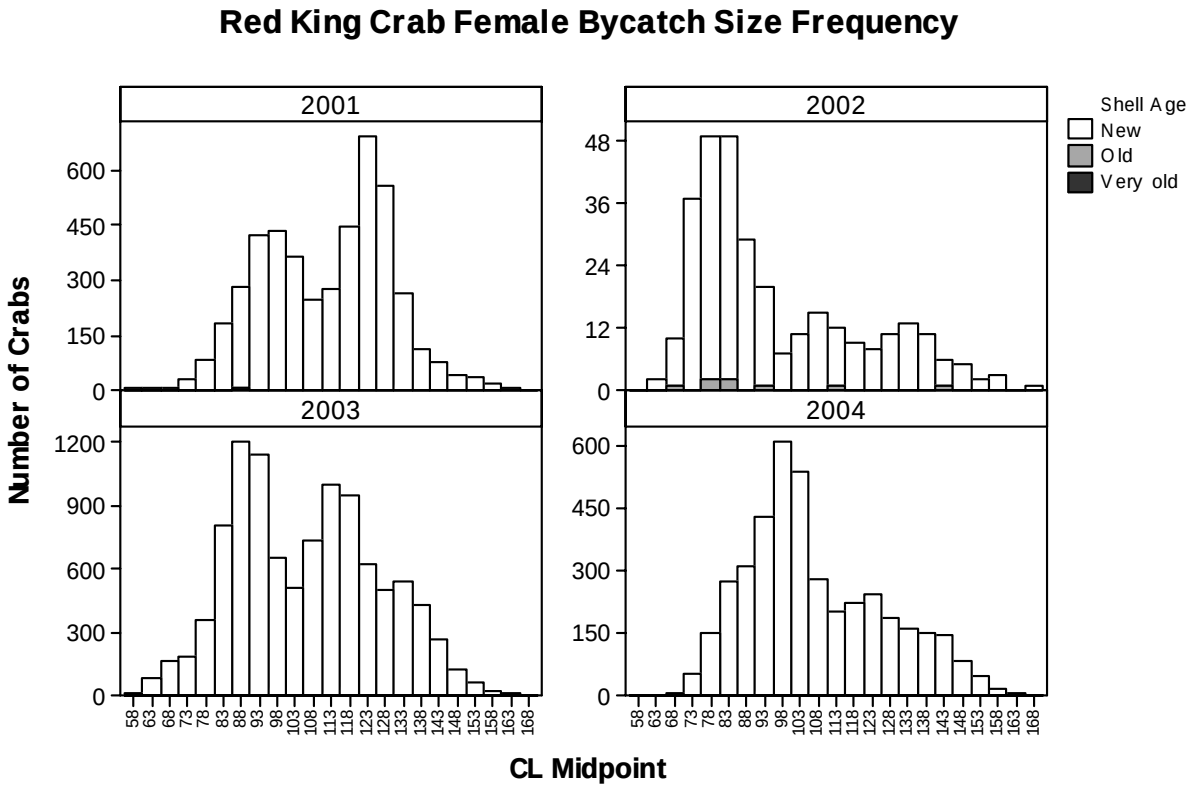

Figure 5.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female red king crabs from pot lifts sampled during the 2001-2004 Bristol Bay red king crab general fisheries.

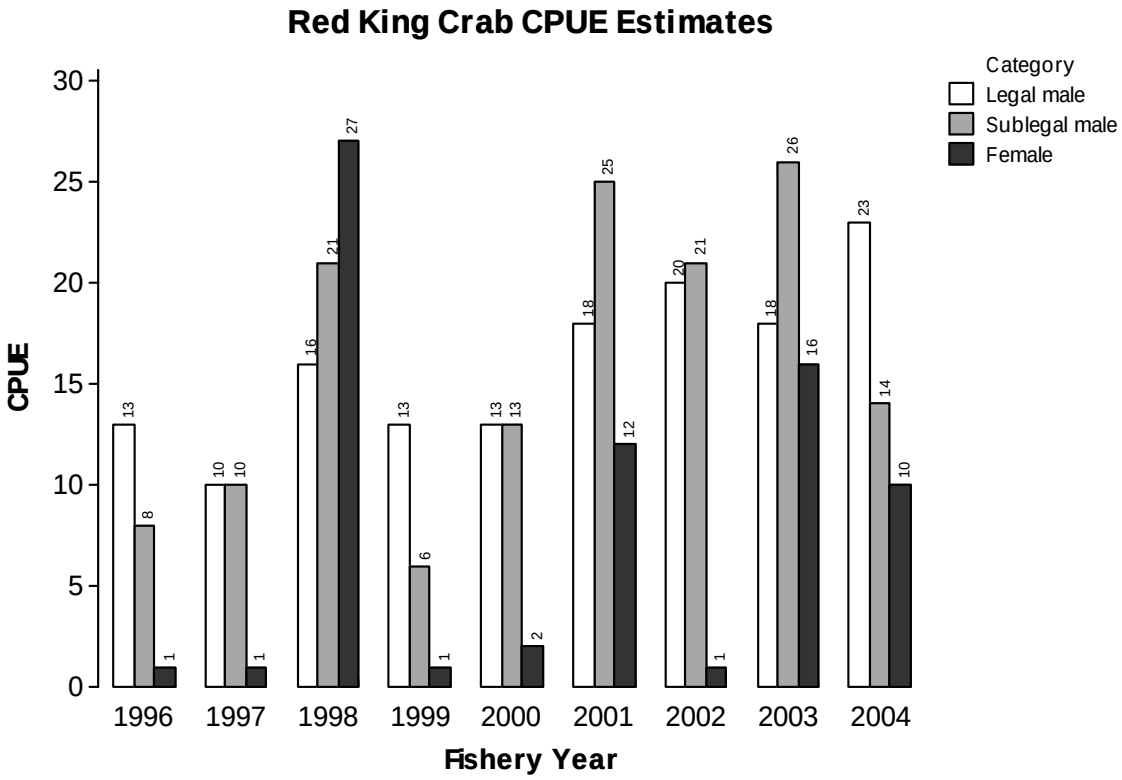

Figure 6.-Estimated CPUE of red king crabs from pot lifts sampled during the 1996-2004 Bristol Bay red king crab general fisheries.

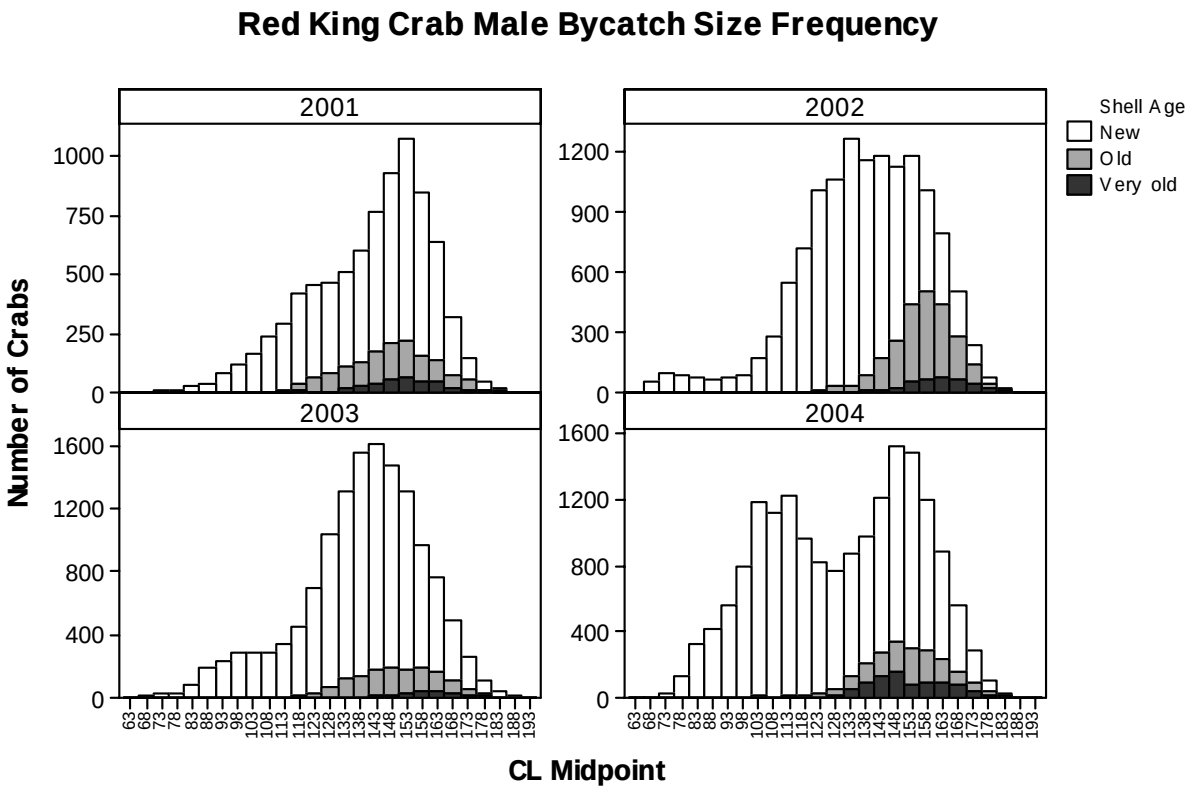

Figure 7.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male red king crabs from pot lifts sampled during the 2001-2004 Bristol Bay red king crab CDQ fisheries.

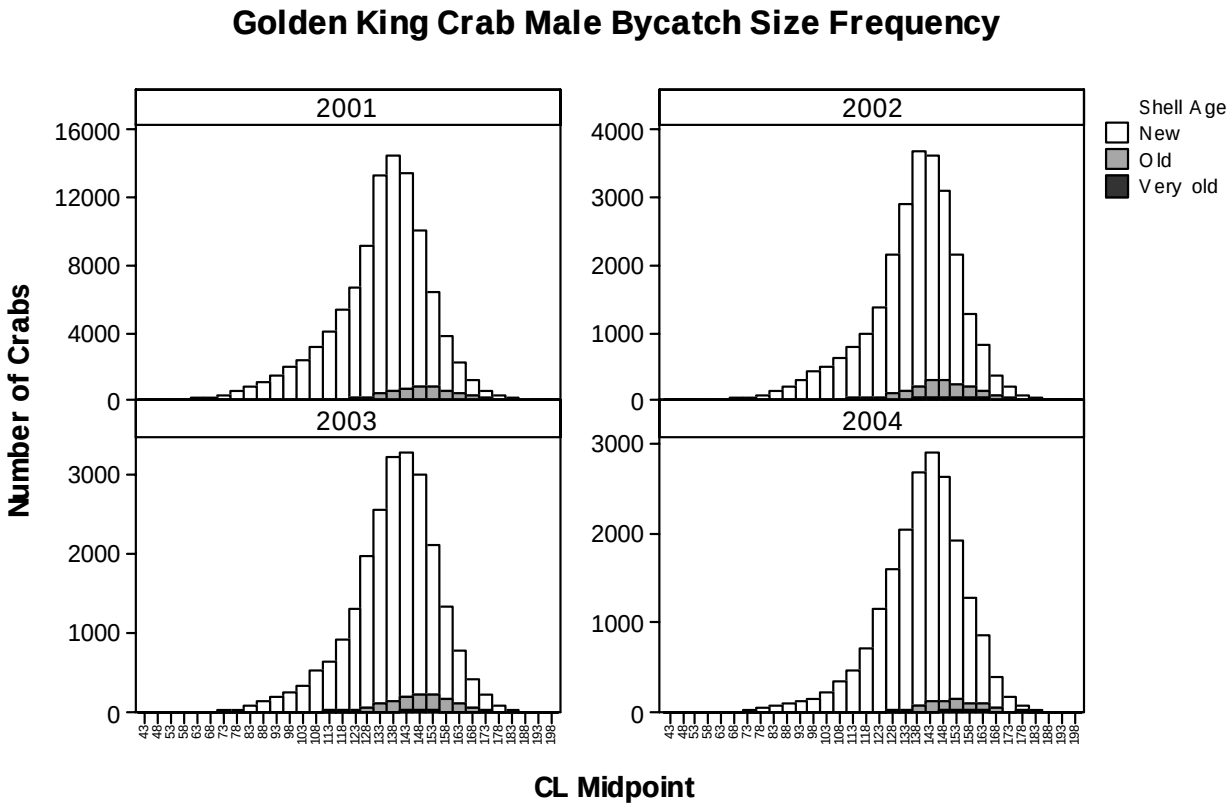

Figure 8.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 2001-2004 Aleutian Islands golden king crab fisheries east of 174° W longitude.

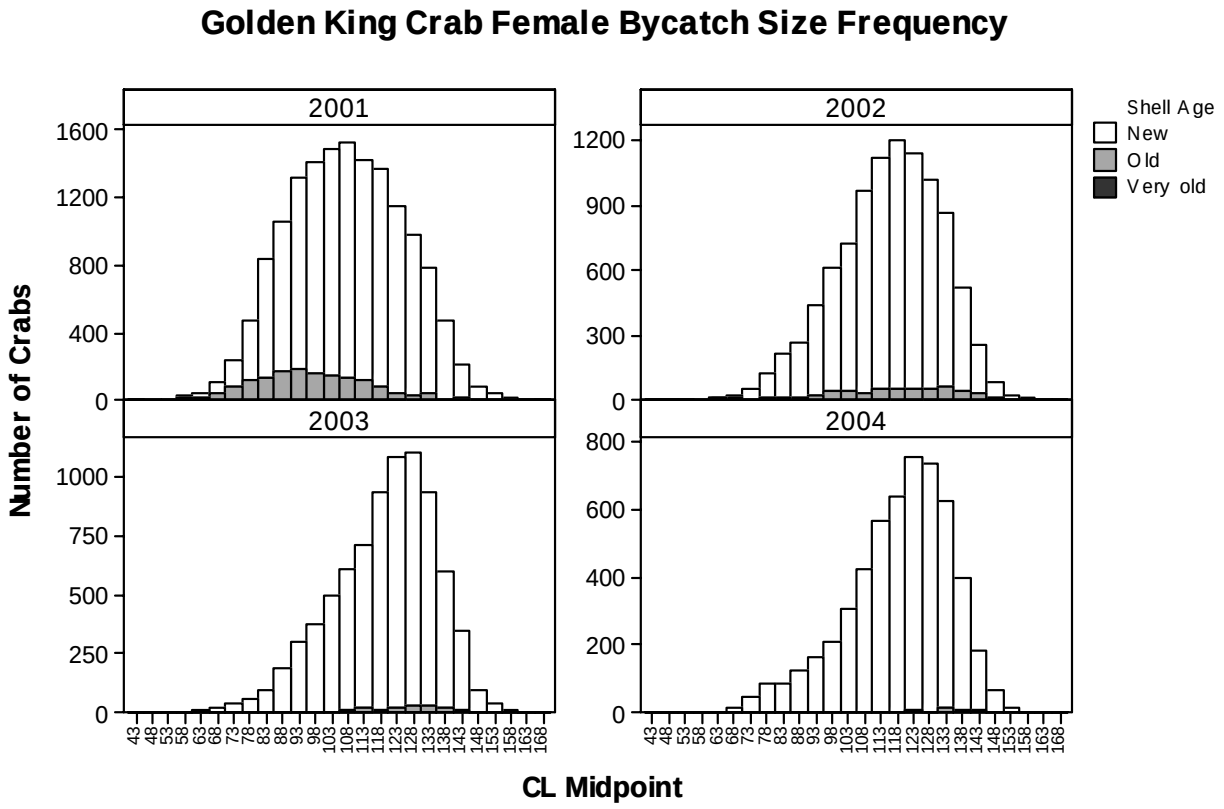

Figure 9.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 2001-2004 Aleutian Islands golden king crab fisheries east of 174° W longitude.

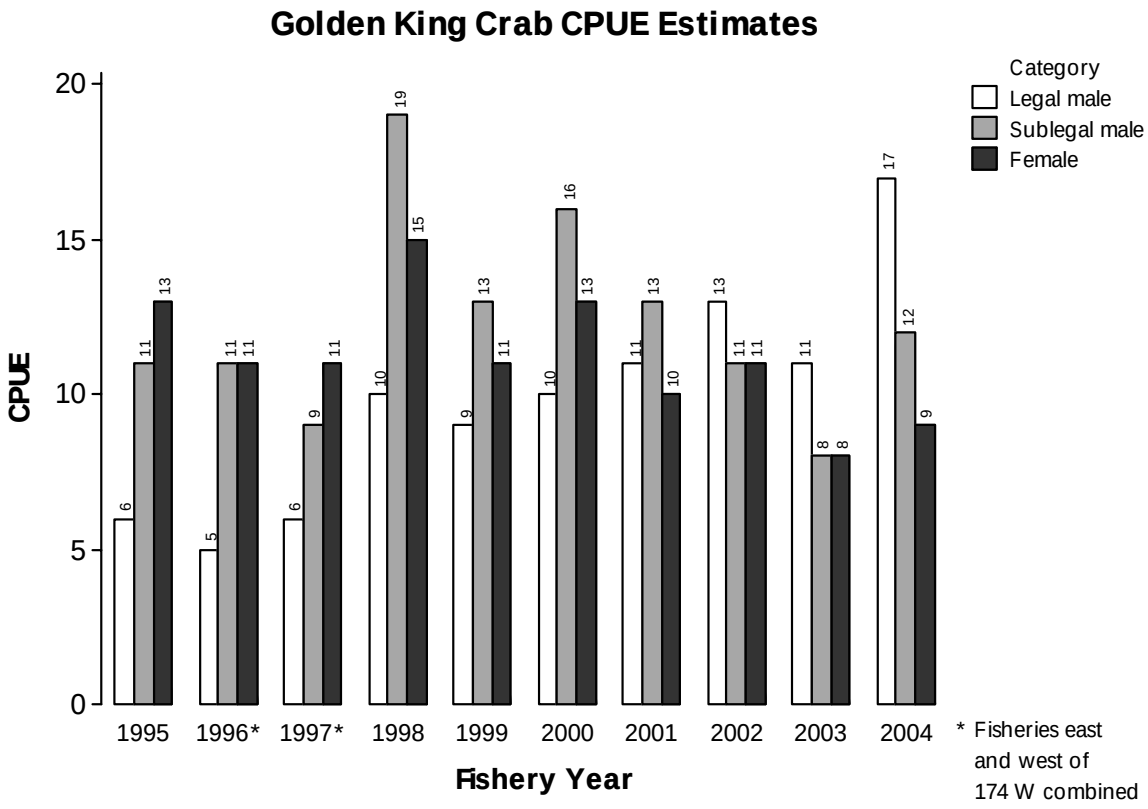

Figure 10.-Estimated CPUE of golden king crabs from pot lifts sampled during the 1995-2004 Aleutian Islands golden king crab fisheries east of 174° W longitude.

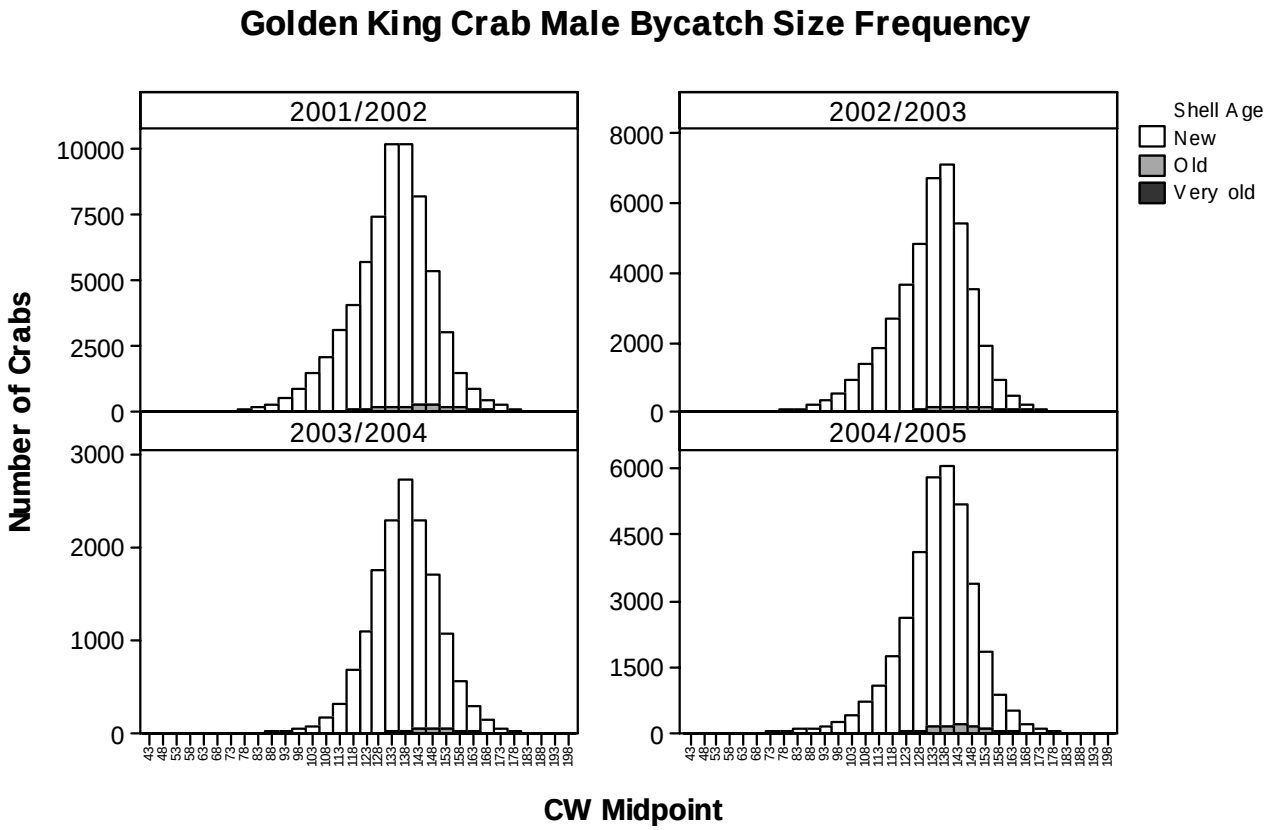

Figure 11.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 2001/2002-2004/2005 Aleutian Islands golden king crab fisheries west of 174° W longitude.

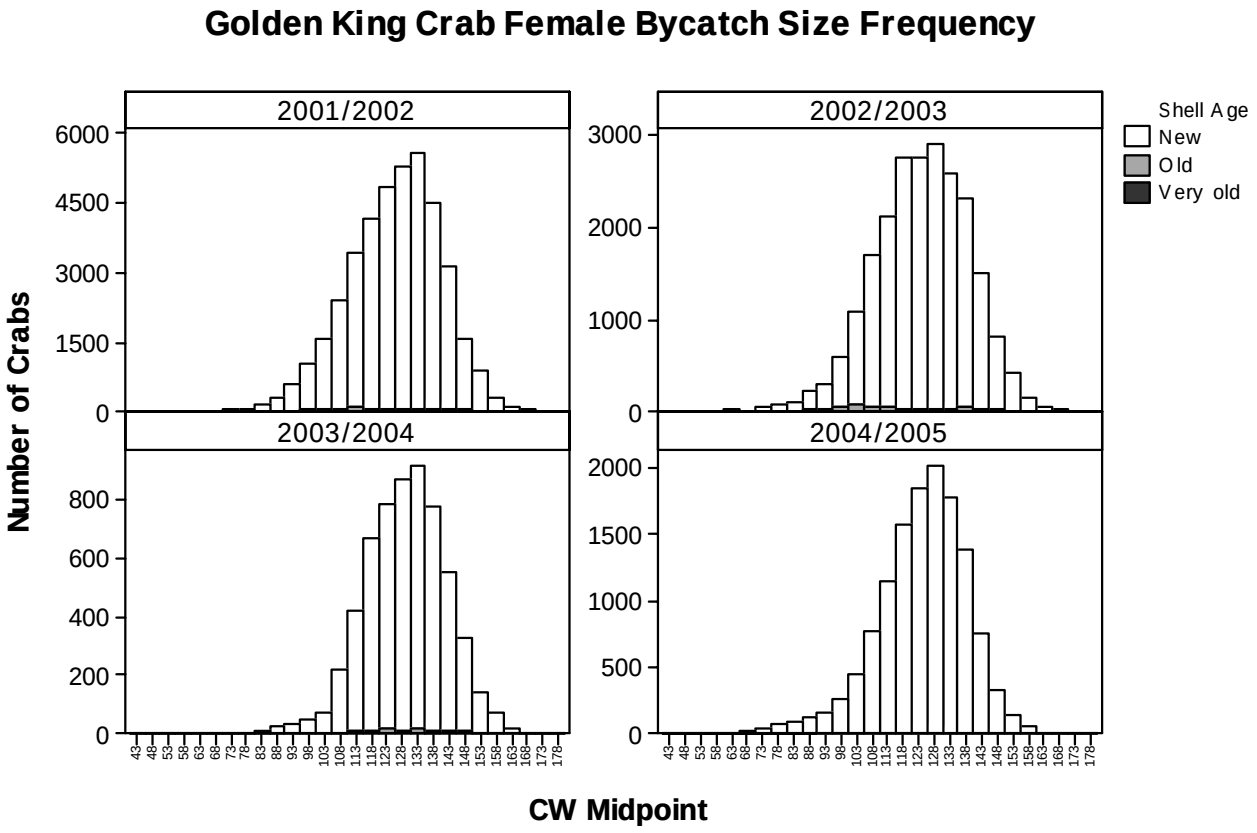

Figure 12.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 2001/2002-2004/2005 Aleutian Islands golden king crab fisheries west of 174° W longitude.

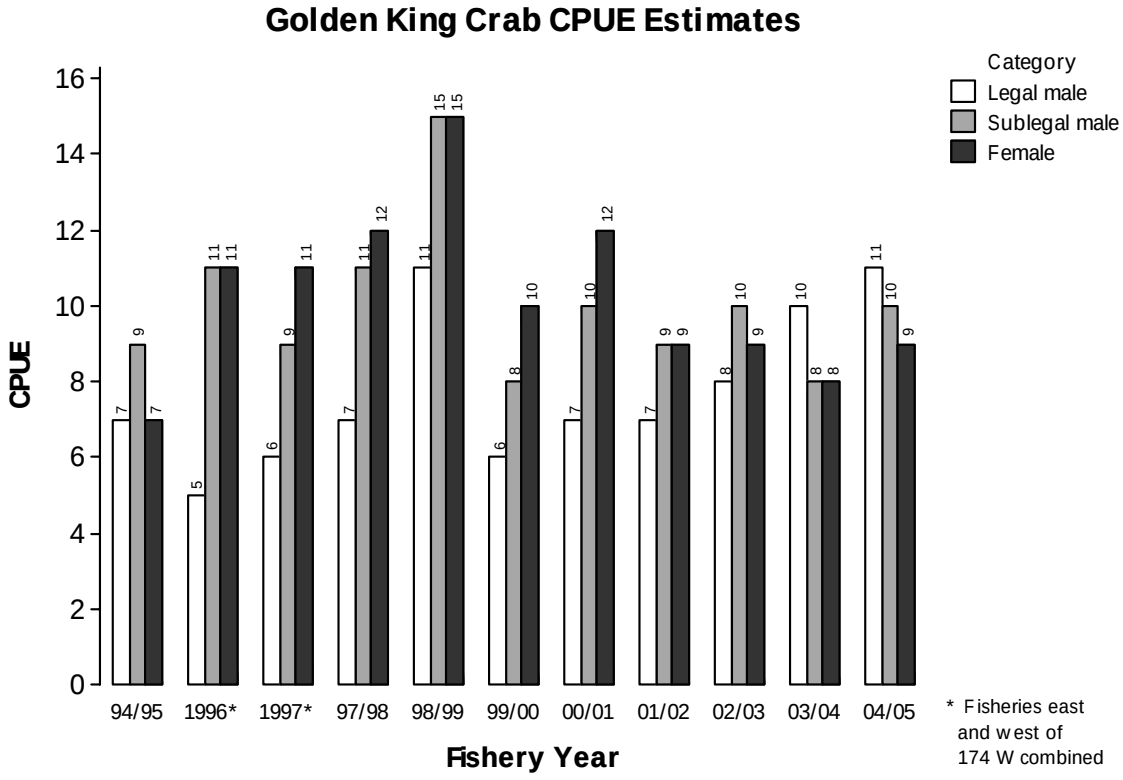

Figure 13.-Estimated CPUE of golden king crabs from pot lifts sampled during the 1994/1995-2004/2005 Aleutian Islands golden king crab fisheries west of 174° W longitude.

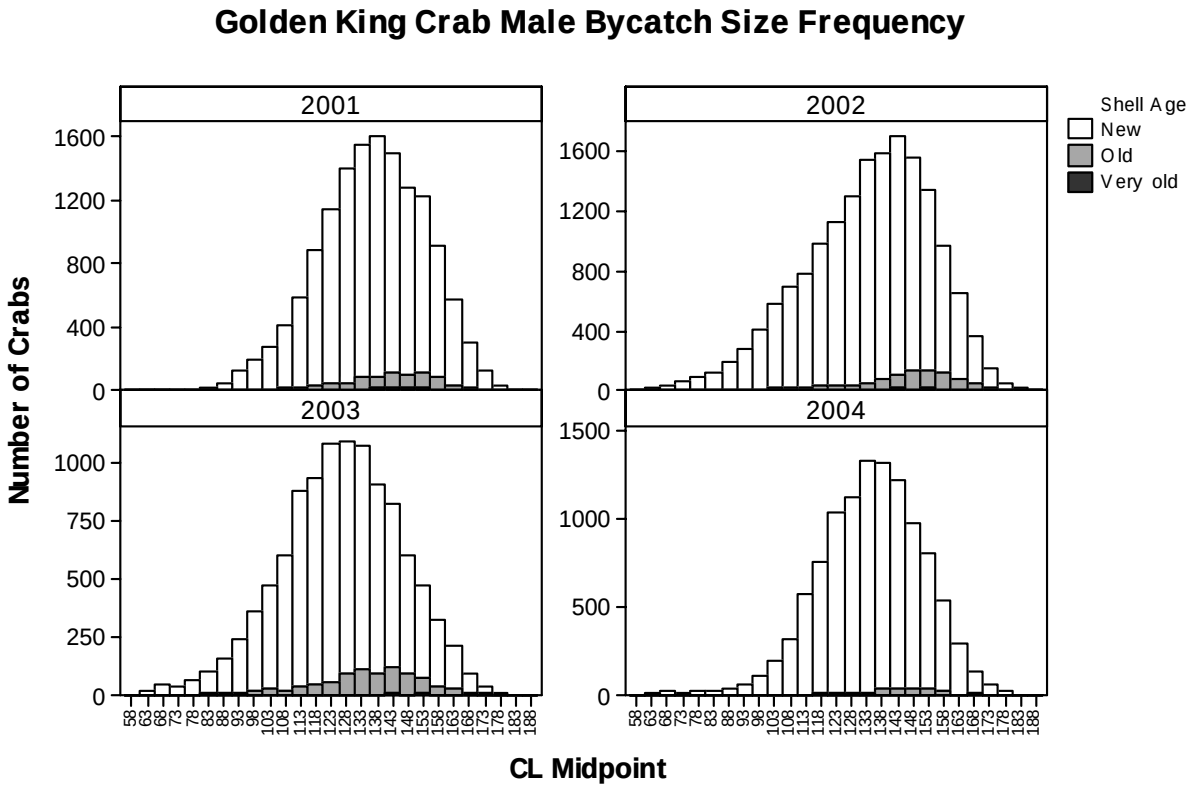

Figure 14.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for male golden king crabs from pot lifts sampled during the 2001-2004 Bering Sea golden king crab fisheries.

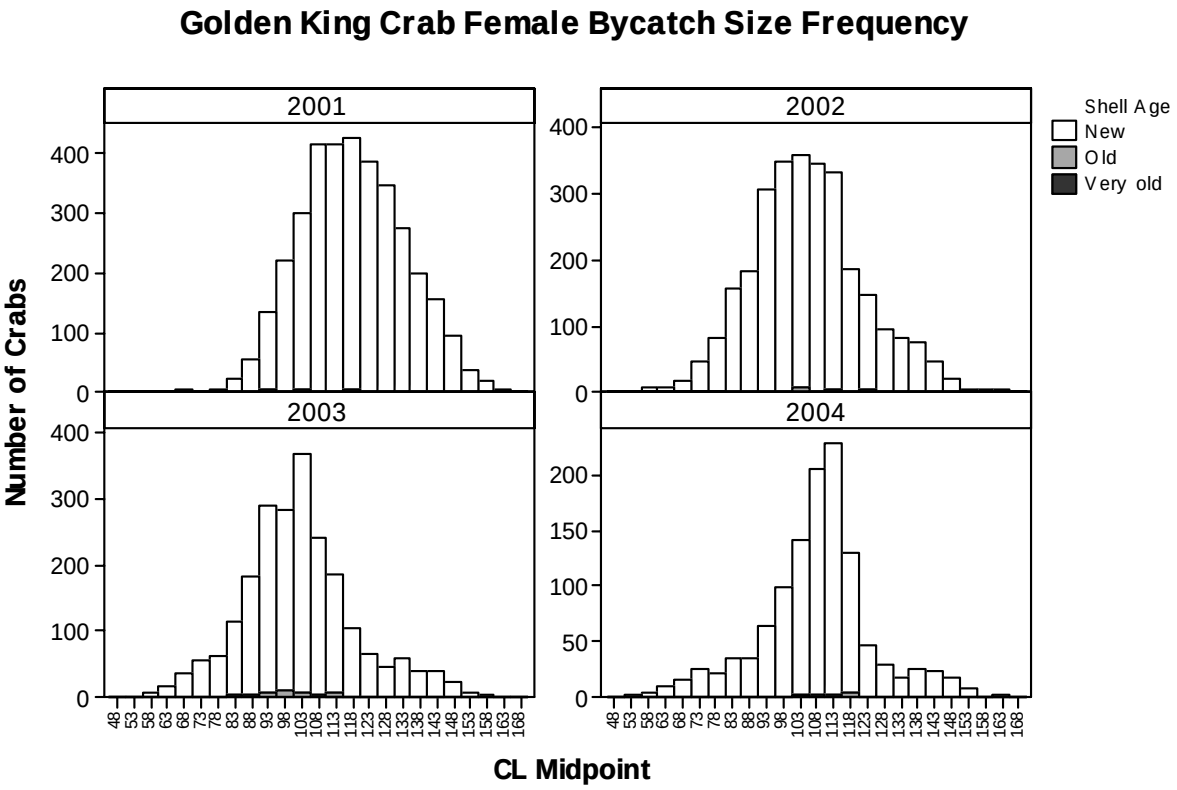

Figure 15.-Carapace length (CL, mm) frequency distributions with corresponding shell ages for female golden king crabs from pot lifts sampled during the 2001-2004 Bering Sea golden king crab fisheries.

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Figure 16.-Estimated CPUE of golden king crabs from pot lifts sampled during the 2001-2004 Bering Sea golden king crab fisheries.

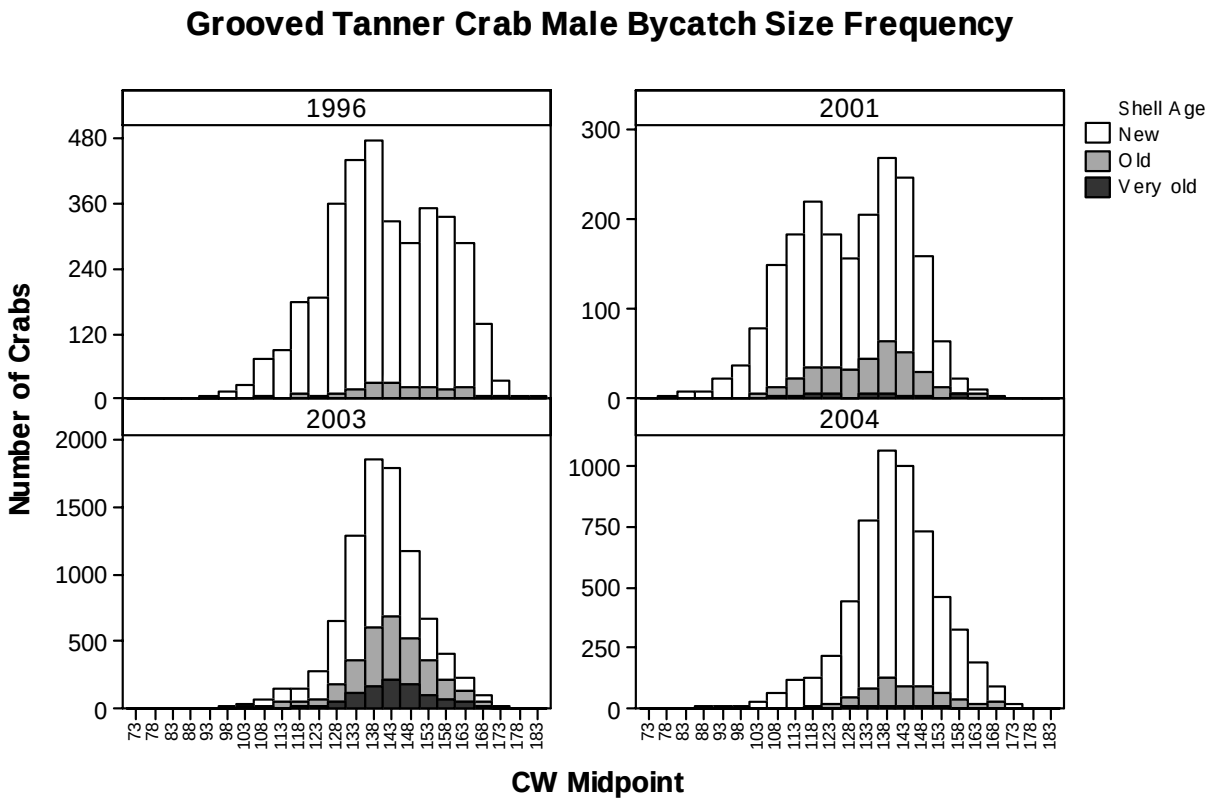

Figure 17.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for male grooved Tanner crabs from pot lifts sampled during the 1996, 2001, 2003 and 2004 Bering Sea grooved Tanner crab fisheries.

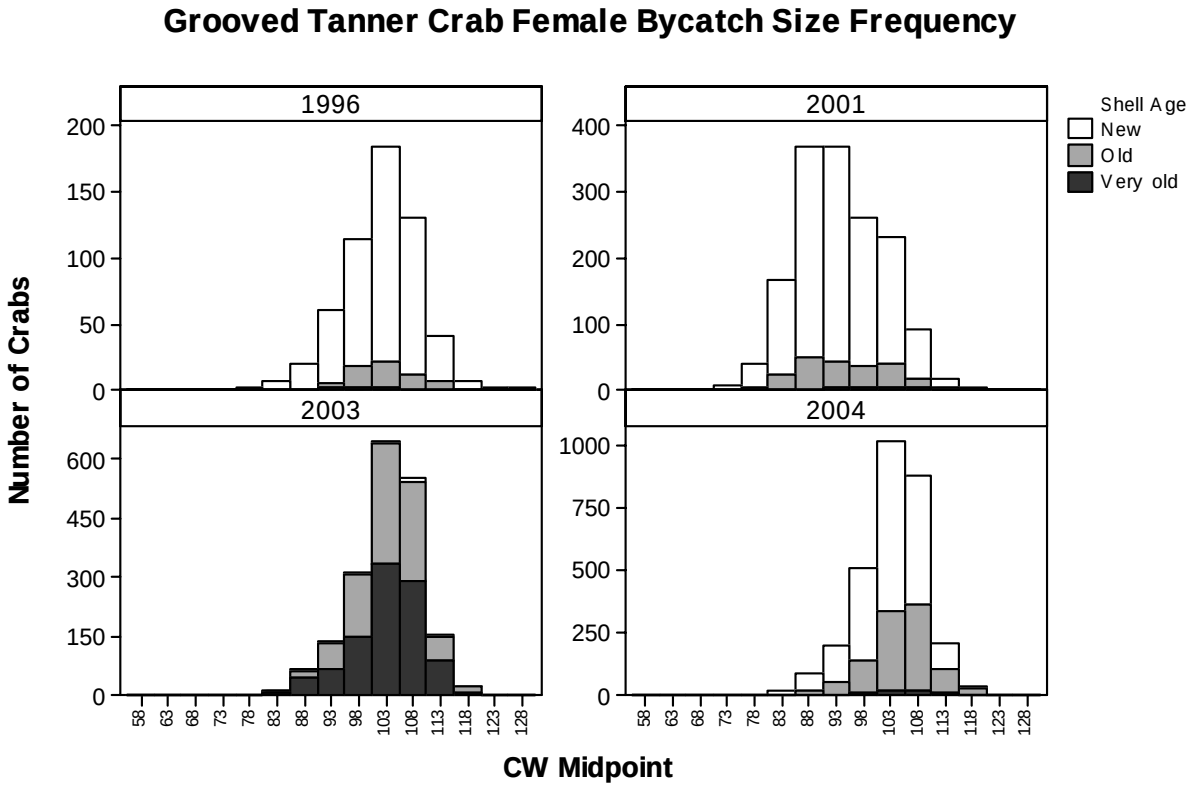

Figure 18.-Carapace width (CW, mm) frequency distributions with corresponding shell ages for female grooved Tanner crabs from pot lifts sampled during the 1996, 2001, 2003 and 2004 Bering Sea grooved Tanner crab fisheries.

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Figure 19.-Estimated CPUE of grooved Tanner crabs from pot lifts sampled during the 1995, 1996, 2001, 2003 and 2004 Bering Sea grooved Tanner 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

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-

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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.

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.

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

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

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

-Continued-

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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

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

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

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

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 2004 Bering Sea snow crab general fishery.

CONFIDENTIAL

Appendix B2.-Locations of pot lifts sampled by observers during the 2004 Bering Sea snow crab CDQ fishery.

CONFIDENTIAL

Appendix B3.-Locations of pot lifts sampled by observers during the 2004 Bristol Bay red king crab general fishery.

CONFIDENTIAL

Appendix B4.-Locations of pot lifts sampled by observers during the 2004 Bristol Bay red king crab CDQ fishery.

CONFIDENTIAL

Appendix B5.-Locations of pot lifts sampled by observers during the 2004 Aleutian Islands golden king crab fishery east of 174° W longitude.

CONFIDENTIAL

Appendix B6.-Locations of pot lifts sampled by observers during the 2003/2004 Aleutian Islands golden king crab fishery west of 174° W longitude.

CONFIDENTIAL

Appendix B7.-Locations of pot lifts sampled by observers during the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude.

CONFIDENTIAL

Appendix B8.-Locations of pot lifts sampled by observers during the 2004 Bering Sea golden king crab fishery.

CONFIDENTIAL

Appendix B9.-Locations of pot lifts sampled by observers during the 2004 Bering Sea grooved Tanner crab fishery.

APPENDIX C: ADDITIONAL CATCH AND BIOLOGICAL INFORMATION

Appendix C1.-Total catches of all animals from 817 pot lifts sampled during the 2004 Bering Sea snow crab general fishery.

Species	Total Catch
Snow Crab	
Legal males	157,540
Sublegal males	1,550
Females	63
Tanner x Snow Crab Hybrid	
Legal males	3,785
Sublegal males	244
Females	4
Tanner Crab	
Legal males	74
Sublegal males	1,104
Females	320
Other Species	
Snail (unidentified)	661
Pacific cod	418
Sea jelly (unidentified)	42
Hermit crab (unidentified)	41
Octopus	37
Sea star (unidentified)	24
Basket star (unidentified)	14
Pacific halibut	13
Brittle star (unidentified)	13
Sea anemone (unidentified)	7
Sculpin (unidentified)	5
Walleye pollock	5
Arrowtooth flounder	3
Lyre crab	2
Skate (unidentified)	2
Snailfish (unidentified)	2
Crinoid (unidentified)	1
Flatfish (unidentified)	1
Ladder whelk	1
Lyre whelk	1
Oregon triton	1
Searcher	1
Yellow fin sole	1
Yellow Irish lord	1
Scaleworm (unidentified)	1
Tunicate (unidentified)	1

Appendix C2.-CPUE by soak times for 816 pot lifts sampled during the 2004 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	133.0	31.0	0	0	164.0
7-12	5.3	131.0	39.2	1.9	0.1	172.2
13-18	27.5	132.8	34.1	1.7	0.1	168.6
19-24	49.4	147.7	42.0	2.1	0.1	191.9
25-30	12.4	159.5	35.9	1.8	< 0.1	197.2
31-36	2.6	132.9	31.5	0.7	0	165.1
37-42	1.5	178.3	41.7	0.7	0	220.8
43-48	0.7	179.7	30.2	0.5	0	210.3
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55-60	0.4	401.0	89.7	6.7	0	497.3
61-66	0.1	9.0	0	0	0	9.0
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109-114	0.1	27.0	0	0	0	27.0

[a] Mean soak time = 21.1 hours.

Appendix C3.-CPUE by depth for 816 pot lifts sampled during the 2004 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
56-60	4.9	162.4	62.7	4.4	0.1	229.6
61-65	39.8	147.0	59.8	3.0	0.1	209.9
66-70	27.2	145.0	18.9	1.0	0.1	164.9
71-75	8.1	122.7	21.2	1.3	< 0.1	145.3
76-80	5.0	132.6	19.1	0.6	0	152.3
81-85	1.6	111.5	14.5	0.7	0.	126.8
86-90	5.8	161.6	13.0	0.1	< 0.1	174.7
91-95	2.0	206.6	13.0	0.2	0	219.8
96-100	0.1	230.0	4.0	0.0	0	234.0
101-105	0.2	189.0	3.5	4.0	0	196.5
106-110	1.8	177.7	110.8	3.1	0.5	292.1
111-115	1.5	144.3	19.6	0.1	0	163.9
116-120	1.0	63.0	15.5	0.0	0	78.5
121-125	0.4	59.7	5.0	0.0	0	64.7
126-130	0.5	86.5	34.3	1.5	0	122.3
131-135	0.1	0	0	0	0	0

[a] Mean depth = 70.9 fathoms.

Appendix C4.-Reproductive condition of female snow crabs from pot lifts sampled during the 1995-2004 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
2004	10	10.0	30.0	0	60.0

Appendix C5.-Total catches of all animals from 780 pot lifts sampled during the 2004 Bering Sea snow crab CDQ fishery.

Species	Total Catch
Snow Crab	
Legal males	103,162
Sublegal males	759
Females	27
Tanner x Snow Crab Hybrid	
Legal males	1,519
Sublegal males	155
Females	91
Tanner Crab	
Legal males	50
Sublegal males	2,232
Females	275
Golden King Crab	
Legal males	0
Sublegal males	1
Females	0
Other Species	
Snail (unidentified)	2,222
Pacific cod	1,130
Hermit crab (unidentified)	1,105
Brittle star (unidentified)	650
Pribilof whelk	144
Sea star (unidentified)	84
Basket star (unidentified)	63
Octopus	58
Sea anemone (unidentified)	22
Oregon triton	21
Walleye pollock	19
Sea jelly (unidentified)	18
Lyre crab	16
Sculpin (unidentified)	12
Skate (unidentified)	9
Pacific halibut	6
Yellow Irish lord	6
Flathead sole	4
Great sculpin	2
Sea urchin (unidentified)	2
Sponge (unidentified)	2
Yellowfin sole	2
Dover sole	1
Butter sole	1
Cockle (unidentified)	1
Sinuous whelk	1

Appendix C6.-CPUE by soak times for 780 pot lifts sampled during the 2004 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	1.2	16.7	6.3	0.2	0	23.2
13-24	14.5	100.6	23.4	0.4	0.1	124.5
25-36	36.5	91.2	29.9	1.1	0	122.3
37-48	20.8	114.0	31.6	1.1	0	146.7
49-60	7.2	117.4	37.5	1.1	0	156.0
61-72	7.7	116.1	36.7	1.5	0.1	154.4
73-84	5.3	98.7	28.5	0.8	0	128.1
85-96	1.9	98.2	62.3	1.5	0.1	162.0
97-108	1.7	73.6	32.5	1.2	0	107.2
109-120	0.5	12.5	13.5	0.3	0	26.3
121-132	0.5	26.5	4.5	0.3	0	31.3
133-144	0.1	136.0	40.0	0	0	176.0
145-156	0.1	265.0	17.0	0	0	282.0
157-168	0.8	258.5	10.8	0.2	0	269.5
169-180	0.1	35.0	6.0	0	0	41.0
181-192	0.3	374.0	20.5	0	0	394.5
193-204	0.1	320.0	21.0	0	0	341.0
205-216	0.1	344.0	9.0	0	0	353.0
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277-288	0.6	22.8	7.0	0.2	0	30.0

[a] Mean soak time = 45.7 hours.

Appendix C7.-CPUE by depth for 780 pot lifts sampled during the 2004 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
21-25	0.1	18.0	3.0	0	0	21.0
31-35	0.5	103.3	14.3	1.5	0	119.0
--	--	--	--	--	--	--
51-55	0.3	75.5	14.0	0	0	89.5
56-60	9.9	104.1	47.6	1.2	< 0.1	152.9
61-65	53.1	85.7	35.2	1.5	0.1	122.5
66-70	17.2	74.8	19.9	0.2	< 0.1	94.9
71-75	3.3	48.0	20.3	0.2	< 0.1	68.6
76-80	1.3	36.5	15.6	0	0	52.1
81-85	2.3	61.1	6.2	0	0	67.2
86-90	1.7	132.4	7.1	0	0	139.5
91-95	1.9	213.2	10.5	0.1	0	223.9
96-100	2.7	260.9	14.7	0.1	0	275.6
101-105	0.3	479.5	25.5	0.0	0	505.0
106-110	2.3	292.2	11.1	0.1	0	303.3
111-115	0.9	337.3	16.7	0.1	0	354.1
116-120	0.6	90.6	4.6	0.0	0	95.2
121-125	0.5	279.8	159.5	0.5	0	439.8
--	--	--	--	--	--	--
131-135	0.3	261.5	13.0	0.5	0	275.0
136-140	0.4	329.0	10.7	0	0	339.7
141-145	0.3	27.5	1.5	0	0	29.0
146-150	0.1	262.0	18.0	0	0	280.0
151-155	0.1	498.0	17.0	0	0	515.0

[a] Mean depth = 69.4 fathoms.

Appendix C8.-Reproductive condition of female snow crabs from pot lifts sampled during the 1999-2004 Bering Sea snow crab CDQ fisheries.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2004	12	83.3	0	0	16.7

Appendix C9.-Total catches of all animals from 536 pot lifts sampled during the 2004 Bristol Bay red king crab general fishery.

Species	Total Catch
Red King Crab	
Legal male	12,993
Sublegal male	8,250
Female	4,114
Tanner Crab	
Legal male	83
Sublegal male	342
Female	40
Snow Crab	
Legal male	93
Sublegal male	149
Female	0
Tanner x Snow Crab Hybrid	
Legal male	17
Sublegal male	8
Female	0
Hair Crab	
Legal male	0
Sublegal male	2
Female	0
Blue King Crab	
Legal male	0
Sublegal male	2
Female	0
Other Species	
Yellowfin sole	460
Snail (unidentified)	388
Pacific cod	243
Sea jelly (unidentified)	35
Sculpin (unidentified)	28
Sea star (unidentified)	27
Hermit crab (unidentified)	18
Yellow Irish lord	16
Lyre whelk	14
Pacific halibut	11
Great sculpin	9
Crinoid (unidentified)	7
Basket star (unidentified)	4
Lyre crab	2
Brittle star (unidentified)	2
Octopus (unidentified)	2
Skate (unidentified)	2
Coral (unidentified)	1
Flathead sole	1
Soft coral (unidentified)	1
Sponge (unidentified)	1

Appendix C10.-CPUE by soak times for 536 pot lifts sampled during the 2004 Bristol Bay red king crab general fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
7-12	1.9	12.5	3.2	3.6	19.3
13-18	12.9	17.7	17.8	5.6	41.1
19-24	18.7	22.9	15.1	9.4	47.4
25-30	28.0	26.4	15.9	7.9	50.2
31-36	20.9	23.4	15.6	8.3	47.3
37-42	12.3	28.7	15.7	8.6	52.9
43-48	4.1	31.1	8.1	1.6	40.9
49-54	0.7	8.5	1.0	0.0	9.5
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67-72	0.6	54.0	44.3	9.0	107.3

[a] Mean soak time = 28.5 hours.

Appendix C11.-CPUE by depth for 536 pot lifts sampled during the 2004 Bristol Bay red king crab general fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
21-25	0.4	1.0	2.5	2.5	6.0
--	--	--	--	--	--
31-35	2.8	31.1	25.9	4.1	61.1
36-40	28.4	29.7	17.4	7.1	54.3
41-45	40.1	24.4	14.7	11.0	50.1
46-50	27.1	18.7	14.0	4.1	36.7
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56-60	0.9	1.4	2.4	0.2	4.0
--	--	--	--	--	--
71-75	0.4	24.5	4.5	4.0	33.0

[a] Mean depth = 42.7 fathoms.

Appendix C12.-Reproductive condition of female red king crabs from pot lifts sampled during the 1996-2004 Bristol Bay red king crab general fisheries.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2004	4,111	21.4	48.4	0.6	29.6

Appendix C13.-Total catches of all animals from 226 pot lifts sampled during the 2004 Bristol Bay red king crab CDQ fishery.

Species	Total Catch
Red King Crab	
Legal male	8,193
Sublegal male	9,347
Female	2,553
Tanner Crab	
Legal male	20
Sublegal male	55
Female	3
Snow Crab	
Legal male	12
Sublegal male	0
Female	0
Tanner x Snow Crab Hybrid	
Legal male	1
Sublegal male	1
Female	0
Other Species	
Sea star (unidentified)	31
Sculpin (unidentified)	20
Yellowfin sole	20
Hermit crab (unidentified)	13
Sea jelly (unidentified)	11
Pacific halibut	9
Great sculpin	9
Sponge (unidentified)	6
Brittle star (unidentified)	5
Sea raspberry	1
Tunicate (unidentified)	1

Appendix C14.-CPUE by soak times for 226 pot lifts sampled during the 2004 Bristol Bay red king crab CDQ fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
7-12	0.4	4.0	4.0	0	8.0
13-18	0.4	11.0	20.0	1.0	32.0
19-24	1.8	10.5	3.0	0.5	14.0
25-30	6.2	18.3	28.5	7.9	54.7
31-36	5.3	22.8	44.8	19.3	86.8
37-42	17.7	27.2	33.3	12.3	72.8
43-48	20.4	41.5	58.4	15.7	115.6
49-54	14.6	31.0	38.2	8.8	78.1
55-60	8.4	37.9	58.3	16.6	112.9
61-66	1.8	46.8	54.0	7.0	107.8
67-72	4.4	56.8	46.4	8.5	111.7
79-84	2.7	44.0	26.2	3.5	73.7
85-90	1.3	42.3	43.7	13.0	99.0
91-96	3.1	63.6	53.9	9.1	126.6
97-102	2.2	67.6	48.2	17.4	133.2
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127-132	0.9	53.0	4.0	8.0	65.0
--	--	--	--	--	--
139-144	2.7	43.5	22.2	4.2	69.8
--	--	--	--	--	--
157-162	1.3	38.3	18.7	2.3	59.3
--	--	--	--	--	--
187-192	0.4	63.0	48.0	7.0	118.0
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349-354	4.0	43.2	17.0	1.1	61.3

[a] Mean soak time = 66.8 hours.

Appendix C15.-CPUE by depth for 225 pot lifts sampled during the 2004 Bristol Bay red king crab CDQ fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch Per Sampled Pot			
		Legal	Sublegal	Female	Total
33-34	4.4	34.1	23.9	14.2	72.2
35-36	9.3	30.3	34.1	6.3	70.7
37-38	21.8	32.2	50.2	12.5	94.9
39-40	35.6	36.8	46.4	13.8	97.1
41-42	12.0	40.7	51.7	15.6	108.0
43-44	6.2	57.6	30.1	6.4	94.1
45-46	8.0	30.5	16.7	2.0	49.2
47-48	2.2	33.4	9.2	0.4	43.0
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71-72	0.4	44.0	39.0	10.0	93.0

[a] Mean depth = 39.7 fathoms.

Appendix C16.-Reproductive condition of female red king crabs from pot lifts sampled during the 1999-2004 Bristol Bay red king crab CDQ fisheries.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2004	2,553	24.2	44.2	0.2	31.3

Appendix C17.-Total catches of all animals from 2,206 pot lifts sampled during the 2004 Aleutian Islands golden king crab fishery east of 174° W longitude.

Species	Total Catch
Golden King Crab	
Legal male	41,644
Sublegal male	23,962
Female	17,975
Scarlet King Crab	
Legal male	1
Sublegal male	4
Female	0
Grooved Tanner Crab	
Legal male	24
Sublegal male	5
Female	1
Paralomis multispina	
Legal male	0
Sublegal male	0
Female	8
Triangle Tanner Crab	
Legal male	1
Sublegal male	2
Female	0
Other Species	
Brittle star (unidentified)	170
Basket star (unidentified)	410
Sponge (unidentified)	309
Stylaster spp.	197
Snail (unidentified)	130
Sea star (unidentified)	123
Primnoa Group I	100
Pacific halibut	75
Sea urchin (unidentified)	47
Cyclohelia spp.	54
Pacific cod	27
Paragorgia spp.	24
Skate (unidentified)	23
Anthomastus spp.	21
Distichopora spp.	12
Fanellia spp.	15
Arrowtooth flounder	14
Lyre crab	12

Species	Total Catch
Other Species (Con't)	
Scallop (unidentified)	12
Arthrogorgia spp.	11
Greenland turbot	11
Rockfish (unidentified)	10
Crypthelia spp.	10
Primnoidae (unidentified)	9
Soft coral (unidentified)	8
Atka mackerel	7
Plexauridae (unidentified)	7
Primnoa spp.	7
Calcigorgia spp.	5
Errinopora spp.	5
Grenadier (unidentified)	5
Leech (unidentified)	5
Cup coral (unidentified)	4
Octopus	4
Mussel (unidentified)	4
Sculpin (unidentified)	4
Oregon triton	3
Pacific ocean perch	3
Crinoid (unidentified)	3
Flatfish (unidentified)	3
Walleye pollock	3
Yellow Irish lord	3
Clavularia spp.	2
Bryozoan (unidentified)	2
Tunicate (unidentified)	2
Sea jelly (unidentified)	2
Lillipathes spp.	1
Barnacle (unidentified)	1
Bivalve (unidentified)	1
Circumboreal toad crab	1
Hydrocoral (unidentified)	1
Tubeworm (unidentified)	1
Sablefish	1
Sea anemone (unidentified)	1
Hydroid (unidentified)	1
Shortspine thornyhead	1
Sea raspberry	1
Sea spider (unidentified)	1
Hydroid (unidentified)	1

Appendix C18.-CPUE by soak times for 2,206 pot lifts sampled during the 2004 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
25-36	0.8	6.4	1.4	1.4	9.1
37-48	7.8	6.6	5.8	3.1	15.5
49-60	5.2	8.3	7.4	5.6	21.3
61-72	18.3	18.0	9.5	9.9	37.3
73-84	23.3	18.9	13.7	9.4	42.0
85-96	17.1	19.2	11.0	9.2	39.4
97-108	7.9	36.8	15.9	9.7	62.3
109-120	8.5	19.2	13.0	7.0	39.2
121-132	2.3	20.9	12.0	9.4	42.4
133-144	2.3	20.4	9.8	4.2	34.4
145-156	1.7	27.3	8.9	2.5	38.7
157-168	2.0	20.5	4.9	5.7	31.1
169-180	1.7	17.8	2.8	9.3	29.9
181-192	0.8	22.8	3.2	4.9	30.8
193-204	0.1	1.0	0.5	1.0	2.5
205-216	0.1	11.0	5.0	3.0	19.0
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253-264	0.1	35.0	3.0	0	38.0

[a] Mean soak time = 88.2 hours.

Appendix C19.-CPUE by depth for 2,204 pot lifts sampled during the 2004 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
26-50	0.3	8.5	9.0	0.5	18.0
51-75	0.4	8.8	5.3	1.4	15.6
76-100	8.6	37.7	14.6	2.6	55.0
101-125	13.7	21.9	12.2	5.3	39.3
126-150	15.2	14.9	7.4	8.0	30.4
151-175	14.4	16.9	8.3	7.2	32.4
176-200	12.0	16.6	8.7	7.6	32.8
201-225	9.9	17.1	10.0	9.0	36.1
226-250	8.8	15.4	12.5	8.1	35.9
251-275	7.2	18.6	13.1	19.7	51.4
276-300	4.1	17.4	11.7	8.8	38.0
301-325	3.4	17.4	14.5	6.2	38.2
326-350	1.4	11.4	24.8	23.7	60.0
351-375	0.4	6.6	16.9	13.2	36.7
376-400	0.2	10.6	29.2	19.2	59.0
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426-450	< 0.1	3.0	1.0	0.0	4.0

[a] Mean depth = 180.8 fathoms.

Appendix C20.-Reproductive condition of female golden king crabs from pot lifts sampled during the 1996-2004 Aleutian Islands golden king crab fisheries east of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2004	5,430	24.9	24.7	24.9	25.5

Appendix C21.-Total catches of all animals from 3,324 pot lifts sampled during the 2003/2004 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species	Total Catch
Golden King Crab	
Legal male	31,130
Sublegal male	28,287
Female	29,676
Red King Crab	
Legal male	60
Sublegal male	102
Female	119
Scarlet King Crab	
Legal male	50
Sublegal male	2
Female	3
Grooved Tanner Crab	
Legal male	5
Sublegal male	2
Female	0
Hair Crab	
Legal male	2
Sublegal male	4
Female	0
Other Species	
Sponge (unidentified)	412
Basket star (unidentified)	361
Brittle star (unidentified)	317
Stylaster spp.	278
Sea urchin (unidentified)	159
Primnoa Group I	149
Snail (unidentified)	106
Bryozoan (unidentified)	79
Fanellia spp.	63
Sea star (unidentified)	64
Oregon triton	55
Rockfish (unidentified)	54
Worm (unidentified)	50
Hydroid (unidentified)	37
Octopus	38
Clavularia spp.	31
Skate (unidentified)	27
Arthrogorgia spp.	26
Paragorgia spp.	26
Primnoidae (unidentified)	26
Carophyllia spp.	25
Sculpin (unidentified)	14
Pacific halibut	14
Sablefish	13
Tubeworm (unidentified)	13

Species	Total Catch
Other Species (Con't)	
Sea anemone (unidentified)	12
Plexauridae (unidentified)	11
Lepidisis spp.	10
Anthomastus spp.	9
Coral (unidentified)	9
Cup coral (unidentified)	9
Arrowtooth flounder	9
Primnoa spp.	8
Rougheye rockfish	8
Black coral (unidentified)	7
Errinopora spp.	7
Snailfish (unidentified)	7
Tunicate (unidentified)	7
Sea jelly (unidentified)	6
Atka mackerel	5
Distichopora spp.	6
Pacific ocean perch	5
Grenadier (unidentified)	5
Sea cucumber (unidentified)	6
Crypthelia spp.	4
Cyclohelia spp.	4
Hydrocoral (unidentified)	4
Scale worm (unidentified)	4
Soft coral (unidentified)	4
Turbot (unidentified)	4
Calcigorgia spp.	3
Ideogorgia spp.	3
Javiania spp.	3
Bigmouth sculpin	3
Hermit crab (unidentified)	3
Invertebrate (unidentified)	3
Shortspine thornyhead	5
Fungiacyanthus spp.	2
Greenland turbot	2
Pribilof whelk	2
Stylantheca spp.	3
Barnacle (unidentified)	3
Flatfish (unidentified)	2
Leech (unidentified)	2
Scaled crab	2
Anthoptilum spp.	1
Dover sole	1
Bamboo coral (unidentified)	1
Lampshell (unidentified)	1
Nudibranch (unidentified)	1
Prowfish	1
Scallop (unidentified)	1
Sea spider (unidentified)	1
Shrimp (unidentified)	1
Yellow Irish lord	1

Appendix C22.-CPUE by soak times for 3,316 pot lifts sampled during the 2003/2004 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	0.2	2.8	1.4	5.9	10.0
49-96	2.9	3.8	3.5	9.6	17.0
97-144	4.7	7.9	9.0	11.9	28.8
145-192	5.9	6.8	9.8	9.4	26.0
193-240	12.3	8.0	9.3	10.3	27.6
241-288	25.7	9.7	10.3	10.8	30.9
289-336	24.6	11.4	8.8	8.8	29.1
337-384	5.9	8.4	6.6	6.8	21.8
385-432	3.6	8.5	6.5	4.3	19.3
433-480	2.2	8.5	7.9	5.6	22.0
481-528	0.5	5.0	1.4	2.6	9.0
529-576	1.8	10.2	8.2	5.6	24.1
577-624	2.1	10.1	6.1	8.8	25.0
625-672	1.2	10.6	3.8	2.7	17.2
673-720	3.2	12.3	6.0	5.3	23.6
721-768	0.6	9.4	4.5	9.2	23.1
769-816	1.0	8.2	3.8	3.6	15.5
817-864	0.6	5.3	2.5	4.6	12.3
865-912	0.5	7.0	4.6	1.1	12.7
913-960	0.4	8.1	2.1	1.9	12.2
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1057-1104	< 0.1	7.0	0	0	7.0
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1153-1200	0.1	2.5	0	0.5	3.0

[a] Mean soak time = 321.7 hours.

Appendix C23.-CPUE by depth for 3,316 pot lifts sampled during the 2003/2004 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
51-75	0.5	7.9	0.7	1.4	10.0
76-100	2.1	7.7	3.7	1.8	13.2
101-125	5.4	8.9	7.3	6.2	22.4
126-150	21.6	12.0	9.1	6.4	27.5
151-175	18.2	10.4	8.7	8.0	27.1
176-200	20.5	9.2	9.7	10.8	29.6
201-225	13.7	8.1	9.4	14.0	31.5
226-250	9.9	7.5	7.1	10.4	24.9
251-275	4.8	6.2	6.1	9.2	21.4
276-300	2.3	5.3	7.7	3.9	16.8
301-325	0.9	6.2	3.7	3.1	13.0
326-350	0.1	7.3	3.5	10.3	21.0
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401-425	< 0.1	1.0	1.0	0	2.0

[a] Mean depth = 182.5 fathoms.

Appendix C24.-Reproductive condition of female golden king crabs from pot lifts sampled during the 1996/1997-2004/2005 Aleutian Islands golden king crab fisheries west of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2003/2004	5,946	32.8	26.8	19.2	21.2
2004/2005	12,970	26.1	31.7	21.6	20.6

Appendix C25.-Total pot lift contents for 2,617 pot lifts sampled during the 2004/2005 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species	Total Catch
Golden King Crab	
Legal male	28,980
Sublegal male	29,294
Female	25,397
Red King Crab	
Legal male	16
Sublegal male	3
Female	0
Scarlet King Crab	
Legal male	49
Sublegal male	6
Female	2
Grooved Tanner Crab	
Legal male	2
Sublegal male	0
Female	0
Hair Crab	
Legal male	1
Sublegal male	1
Female	0
Other Species	
Brittle star (unidentified)	5,481
Hydroid (unidentified)	1,885
Sponge (unidentified)	565
Basket star (unidentified)	280
Primnoa Group I	240
Stylaster spp.	210
Snail (unidentified)	130
Crangon spp.	100
Sea urchin (unidentified)	94
Sea star (unidentified)	86
Fanellia spp.	82
Arthrogorgia spp.	74
Coral (unidentified)	61
Rougheye rockfish	53
Calcigorgia spp.	50
Oregon triton	45
Octopus	43
Paragorgia spp.	41
Distichopora spp.	36
Primnoa spp.	30
Anthomastus spp.	25

Species	Total Catch
Other Species (Con't)	
Invertebrate (unidentified)	23
Worm (unidentified)	20
Skate (unidentified)	18
Plexauridae (unidentified)	16
Rockfish (unidentified)	16
Crypthelia spp.	15
Crinoid (unidentified)	15
Primnoidae (unidentified)	14
Bryozoan (unidentified)	14
Arrowtooth flounder	13
Scale worm (unidentified)	11
Sculpin (unidentified)	10
Tubeworm (unidentified)	10
Cyclohelia spp.	9
Sea cucumber (unidentified)	9
Tunicate (unidentified)	9
Atka mackerel	7
Stony coral (unidentified)	7
Clavularia spp.	6
Errinopora spp.	6
Sea spider (unidentified)	6
Shortspine thornyhead	6
Pacific cod	5
Soft coral (unidentified)	5
Pacific halibut	4
Sea jelly (unidentified)	4
Cup coral (unidentified)	3
Bigmouth sculpin	3
Grenadier (unidentified)	3
Hydrocoral (unidentified)	3
Sablefish	3
Chiton (unidentified)	2
Hermit crab (unidentified)	2
Slender sea whip	2
Sea anemone (unidentified)	1
Snailfish (unidentified)	1
Carophyllia spp.	1
Flatfish (unidentified)	1
Scaled crab	1
Yellow Irish lord	1
Cladopathes spp.	1
Neptunea spp.	1
Pacific lyre crab	1
Sea pen or whip (unidentified)	1
Sea raspberry	1

Appendix C26.-CPUE by soak times for 2,617 pot lifts sampled during the 2004/2005 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	0.2	5.3	2.0	0	7.3
49-96	4.4	6.3	8.7	12.7	27.7
97-144	3.7	5.3	8.1	10.7	24.1
145-192	12.2	9.7	12.0	8.4	30.1
193-240	13.6	11.2	15.4	12.4	39.0
241-288	23.5	10.4	14.3	10.3	34.9
289-336	21.3	13.1	8.8	10.4	32.4
337-384	12.8	13.4	9.0	7.3	29.7
385-432	2.1	11.5	11.6	4.3	27.4
433-480	3.6	12.8	5.9	4.5	23.1
481-528	0.5	13.2	10.5	16.5	40.2
529-576	1.1	11.6	3.4	7.7	22.7
577-624	0.2	3.8	0.5	2.5	6.8
625-672	0.4	2.4	0.4	3.4	6.1
673-720	0.1	1.0	0	0	1.0
721-768	< 0.1	0	0	0	0

[a] Mean soak time = 279.0 hours.

Appendix C27.-CPUE by depth for 2,617 pot lifts sampled during the 2004/2005 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
51-75	0.3	4.5	1.0	0.4	5.9
76-100	1.2	4.1	1.9	1.1	7.1
101-125	5.1	12.1	11.7	5.2	29.0
126-150	25.5	14.3	11.8	6.2	32.3
151-175	23.0	11.0	12.3	10.2	33.5
176-200	21.5	9.3	10.3	9.4	29.0
201-225	13.3	9.5	10.6	16.0	36.0
226-250	6.5	9.5	10.8	14.9	35.2
251-275	2.1	10.3	15.6	14.3	40.2
276-300	0.8	6.7	5.6	7.0	19.3
301-325	0.4	6.8	5.5	10.5	22.7
326-350	0.2	18.8	7.8	4.4	31.0
451-475	< 0.1	13.0	2.0	0	15.0
476-500	< 0.1	0	0	0	0

[a] Mean depth = 174.8 fathoms.

Appendix C28.-Total pot lift contents for 552 pot lifts sampled during the 2004 Bering Sea golden king crab fishery.

Species	Total Catch
Golden King Crab	
Legal male	8,479
Sublegal male	2,576
Female	1,185
Grooved Tanner Crab	
Legal male	106
Sublegal male	27
Female	6
Tanner Crab	
Legal male	0
Sublegal male	66
Female	3
Scarlet King Crab	
Legal male	11
Sublegal male	1
Female	17
Triangle Tanner Crab	
Legal male	3
Sublegal male	2
Female	0
Tanner x Snow Crab Hybrid	
Legal male	0
Sublegal male	2
Female	0
Hair Crab	
Legal male	0
Sublegal male	0
Female	1

Species	Total Catch
Other Species	
Arrowtooth flounder	152
Pacific halibut	129
Pacific cod	98
Basket star (unidentified)	57
Tube worm (unidentified)	57
Bryozoan (unidentified)	45
Lampshell (unidentified)	25
Snail (unidentified)	21
Limpet (unidentified)	19
Hermit crab (unidentified)	14
Sculpin (unidentified)	11
Brittle star (unidentified)	10
Rockfish (unidentified)	8
Sea cucumber (unidentified)	8
Greenland turbot	6
Snailfish (unidentified)	6
Sea star (unidentified)	6
Primnoa Group I	5
Sea anemone (unidentified)	5
Sponge (unidentified)	5
Octopus	4
Flatfish (unidentified)	3
Cup coral (unidentified)	2
Flathead sole	2
Rougheye rockfish	2
Sea urchin (unidentified)	2
Clavularia spp.	1
Primnoa spp.	1
Skate (unidentified)	1
Northern rockfish	1
Walleye pollock	1
Yellow Irish lord	1

Appendix C29.-CPUE by soak times for 552 pot lifts sampled during the 2004 Bering Sea golden king crab fishery.

CONFIDENTIAL

Appendix C30.-CPUE by depth for for 552 pot lifts sampled during the 2004 Bering Sea golden king crab fishery.

CONFIDENTIAL

Appendix C31.-Reproductive condition of female golden king crabs from pot lifts sampled during the 2001 - 2004 Bering Sea golden king crab fisheries.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	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
2004	1,185	11.1	36.1	4.1	48.7

Appendix C32.-Total pot lift contents for 567 pot lifts sampled during the 2004 Bering Sea grooved Tanner crab fishery.

Species	Total Catch
Grooved Tanner Crab	
Legal male	5,349
Sublegal male	442
Female	3,046
Triangle Tanner Crab	
Legal male	763
Sublegal male	351
Female	13
Scarlet King Crab	
Legal male	199
Sublegal male	282
Female	104
Paralomis multispina	
Legal male	47
Sublegal male	20
Female	144
Golden King Crab	
Legal male	48
Sublegal male	32
Female	5
P. verilli	
Legal male	6
Sublegal male	26
Female	28
Other Species	
Brittle star (unidentified)	7,079
Invertebrate (unidentified)	318
Snail (unidentified)	297
Sea star (unidentified)	49
Sea cucumber (unidentified)	15
Hermit crab (unidentified)	3
Hydrocoral (unidentified)	3
Sponge (unidentified)	3
Octopus	2
Sea jelly (unidentified)	2
Soft coral (unidentified)	2
Pacific halibut	1
Flatfish (unidentified)	1
Sablefish	1
Salmon shark	1
Shortspine thornyhead	1

Appendix C33.-CPUE by soak times for 567 pot lifts sampled during the 2004 Bering Sea grooved Tanner crab fishery.

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Appendix C34.-CPUE by depth for 567 pot lifts sampled during the 2004 Bering Sea grooved Tanner crab fishery.

CONFIDENTIAL

Appendix C35.-Reproductive condition of female grooved Tanner crabs from pot lifts sampled during the 1995, 1996, 2001, 2003, and 2004 Bering Sea grooved Tanner crab fisheries.

Year	Crabs Sampled	Eyed Eggs	Uneyed Eggs	Barren, Matted	Barren, Non-matted
		Percent	Percent	Percent	Percent
1995	8,800	3.1	89.2	1.4	6.3
1996	569	43.3	40.1	5.3	11.4
2001	1,513	80.7	6.9	2.2	10.9
2003	1,904	26.5	69.8	1.8	1.8
2004	2,937	39.6	56.9	0.2	3.3

Appendix C36.-Results of legal tally samples taken during the 2004 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	69,995	0.04	<0.01	0.20	0.24	41,846
Bering Sea snow crab CDQ	33,100	0.01	<0.01	0.10	0.12	1,577
Bristol Bay red king crab	36,303	0.45	0.03	0.01	0.49	10,234
Bristol Bay red king crab CDQ	12,567	0.48	0.06	<0.01	0.54	903
Aleutian Islands golden king crab[b]	78,760	0.41	0.03	<0.01	0.44	5,761
Bering Sea golden king crab	[c]	0.08	0.08	<0.01	0.16	[c]
Bering Sea grooved Tanner crab	[c]	0.28	<0.01	<0.01	0.28	[c]

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

[b] Fisheries east and west of 174° W longitude combined.

[c] Confidential