Fishery Data Series No. 08-17

Alaska Department of Fish and Game Summary of the 2006/2007 Mandatory Shellfish Observer Program Database for the Rationalized Crab Fisheries

by

David R. Barnard

and

Ryan Burt

April 2008

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

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 the 2006/2007 rationalized BSAI crab fisheries by shellfish observers deployed on catcher-processor vessels, floater-processor vessels, and catcher-only vessels and provides historical data for comparison. The data summaries include catch rates of targeted species by soak time and depth, 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 the 2006/2007 rationalized fisheries, commercially harvested crab species included golden king crab *Lithodes aequispinus* from the Aleutian Islands, and red king crab *Paralithodes camtschaticus,* snow crab *Chionoecetes opilio* and Tanner crab *C. bairdi* from the Bering Sea.

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

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). 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 can be found in Bowers et al. 2008.

In March 2005 new federal regulations were issued to establish the BSAI Crab Rationalization Program according to the provisions adopted by the North Pacific Fishery Management Council (NPFMC) in Amendments 18 and 19 to the Fishery Management Plan for the commercial king and Tanner crab fisheries in the BSAI (NPFMC/NMFS 2006). The Crab Rationalization Program established a quota system for allocating the entire harvest in each of the Bristol Bay red king crab, St. Matthew blue king crab, Pribilof red and blue king crab, Bering Sea snow crab *Chionoecetes opilio*, Bering Sea Tanner crab *C. bairdi*, Eastern Aleutian Islands golden king crab, Western Aleutian Islands golden king crab, and Western Aleutian Islands red king crab fisheries. With implementation of the Crab Rationalization Program, ADF&G now establishes a total allowable catch (TAC) for each fishery according to state regulations and the National Marine Fisheries Service (NMFS) distributes the TAC as quota shares (QS), with 10% of the TAC allocated to the community development quota (CDQ) and the remaining 90% of the TAC allocated to qualifying vessels as individual fishing quotas. The Department of Fish and Game no longer manages the rationalized fisheries inseason; harvesters may harvest their QS at any time within the fishery seasons established in state regulations. The 2006/2007 commercial fishery season was the second to be prosecuted under the new Crab Rationalization Program.

Observers collect biological data from the contents of sampled pot lifts and from samples of retained or delivered catch. They also document vessel catch, bycatch, and effort, and monitor

vessel activities for regulatory compliance. 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. Those data are used in management and research applications to develop stock-assessment models, to estimate the magnitude and composition of bycatch, to chronicle female reproductive cycles, and as an aid in preseason and inseason projections of fishery performance. The database provides a source of information crucial to the comprehensive management of Alaska's shellfish resources in the Bering Sea and Aleutian Islands.

This report summarizes data collected by onboard observers during the commercial crab fisheries that began after the implementation of the BSAI Crab Rationalization Program in August of 2006. Those fisheries were: the 2006/2007 Bering Sea snow crab fishery; the 2006/2007 Bering Sea Tanner crab fishery east and west of 166° W longitude; the 2006/2007 Bristol Bay red king crab fishery, and the 2006/2007 Aleutian Islands golden king crab fisheries east and west of 174° W longitude. Under the rationalization program, observer vessel coverage was increased for the Bering Sea snow and Tanner crab fisheries and the Bristol Bay red king crab fishery. Observer coverage was reduced for Aleutian Islands golden king crab fisheries.

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 sizes and shell conditions 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. As in previous seasons, observers were deployed on all catcher-processor and floating-processor vessels that participated in each of the reported fisheries. Observers were also deployed on randomly selected catcher-only vessels that participated in the Bering Sea snow crab fishery, Bering Sea Tanner crab fishery, and the Bristol Bay red king crab fishery. Observers were deployed on approximately 30% of catcher-only vessels participating in the Bering Sea snow crab and Tanner crab fisheries, and 20% of the catcher-only vessels participating in the Bristol Bay red king crab fishery. In the Aleutian Islands golden king crab fisheries, all catcher-only vessels were required to carry an observer for at least 50% of their assigned quota caught and landed in each three-month trimester of the nine month season.

TERMS

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

Pot-lift sample – A randomly selected pot lift from which crabs of all species captured are identified and enumerated, and, from a subset of the selected pot lifts, measurements and assessments of ancillary characteristics are recorded from crabs of selected species.

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 all species of king crabs and hair crabs *Erimacrus isenbeckii* 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 all species of *Chionoecetes* 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, including the spines, at a right angle to a line midway between the eyes to the medial-posterior margin.

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

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.

Shell condition (or age) is recorded to provide an estimate of the time since a crab's last molt (ADF&G 2003; Jadamec et al. 1999; Donaldson and Byersdorfer 2005). Observers scored the shell condition of sampled crabs as either "soft", "new pliable", "new", "old", or "very old" on the basis of the presence and amount of abrasions, discoloration, and wear on the ventral surfaces, the presence and amount of epibionts on the dorsal surface, the color of the dorsal surface, and the degree of wear on spines and dactyls.

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 estimated to be 8 weeks to 12 months old (8 weeks to 18 months for golden king crabs).
Old-shell –	Exoskeleton estimated to be more than 12 months and up to 24 months old (up to 36 months for golden king crabs).
Very old-shell –	Exoskeleton estimated to be more than 24 months old (more than 36 months old for golden king crabs).

SAMPLING DUTIES

During the 2006/2007 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 previously-sorted, retained catches, whereas 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 a legal tally.

Catcher-Processors

Sampling duties for observers deployed on catcher-processors included size frequency sampling, legal tally sampling from the retained catch, pot-lift sampling, 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 pot-lift sampling, which was 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 pot-lift 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.

For ease of reading, 2006/2007 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

Estimates of CPUE and their standard errors were generated using weighted mean and variance formulas for stratified sampling (Cochran 1977; Appendices A1 and A2). With this technique, each vessel-day was considered a separate stratum 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, vessels were stratified by vessel type (catcher-only versus catcher-processor) to account for differences in observer coverage levels (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 (e.g., 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 ratio of a standard error estimate to its CPUE estimate expressed as a percent. 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

During the 2006/2007 fishing season, observers were deployed on 4 catcher-processor vessels, 2 floating-processor vessels, and 23 of 65 catcher-only vessels participating in the fishery. The pot-lift sampling goal for observers on catcher-processors was 4 pot lifts during each day of fishing activity. The pot-lift sampling goal for observers on catcher-only vessels was 6 pot lifts during each day of fishing activity. The season opened 15 October 2006, fishing began in November and continued until May 2007. Most of the effort took place from January through April 2007. A

total of 1,118 pot lifts selected for sampling accounted for 1.3% of the 89,419 pot lifts reported by vessel operators (Bowers et al. 2008). The locations of pot lifts sampled by observers during the 2006/2007 Bering Sea snow crab fishery are displayed in Appendix B1.

Measurements of CW for size frequency samples were taken from 34,415 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 109.1 mm.

Measurements of CW from pot-lift samples were taken from 169,775 male snow crabs throughout the season by onboard observers. The mean CW for male snow crabs from sampled pot lifts was 103.3 mm. The size frequency distribution revealed a prominent mode between 101 and 110 mm, a decrease from the previous season (Figure 1). The percentage of male snow crabs sampled that were categorized as old shell and very-old shell condition was 10.8%. Measurements of CW were taken from 57 female snow crabs during pot-lift sampling and the mean CW was 70.2 mm with 73.7% being categorized as old and very-old shell condition.

The stratified CPUE estimate of 336.8 legal retained snow crabs per pot lift (Table 2) was a 64.2% increase from the 2005/2006 estimate and a 31.8% increase over the 2005 pre-rationalization fishery CPUE estimate (Figure 2). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 3.2% of the estimated mean. The 95% confidence interval for the CPUE of legal retained crabs estimated from sampled pot lifts was 315.5 to 358.1 crabs per pot lift. This interval included the ATF CPUE of 331, indicating that the sampled pot lifts were representative of the total fishery. Approximately 37% of the total catch of snow crabs were legal-sized male crabs < 102 mm (4 inches) CW that were discarded as bycatch. Although the minimum legal size for snow crabs was 79 mm (3.1 inches) CW, processing plants generally do not accept crabs < 4 inches CW. Sublegal male and female snow crabs together made up 1% of the total catch and 3% of the bycatch.

Total catches of all animals identified in sampled pot lifts during the 2006/2007 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 pot-lift samples (Appendix C4).

Legal tallies conducted on catcher-processor vessels and catcher-only vessels delivering snow crab to processors totaled 86,697 crabs, which accounted for 0.3% of the cumulative reported harvest (Appendix D1). Of all sampled crabs, 0.1% were illegal, either due to size, sex, or species.

BERING SEA TANNER CRAB

The Bering Sea Tanner crab fishery was closed following the 1996 season due to poor fishery performance and low estimated abundances of legal male Tanner crabs. The fishery was allowed to proceed in 2005/2006 west of 166° W longitude after minimum stock thresholds were met. Further improvements in the stock east of 166° W longitude allowed a fishery to open there during the 2006/2007 season as well.

West of 166° W Longitude

During the 2006/2007 fishery west of 166° W longitude, observers were deployed on 3 catcher-only vessels registered to take directed catch in the Bering Sea Tanner crab fishery. The Tanner crab fishery was conducted concurrently with the Bering Sea snow crab fishery and regulations permit properly licensed vessels fishing for snow crab to retain legal male Tanner crabs as

incidental catch. The pot-lift sampling goal for observers on catcher-processors was 4 pot lifts during each day of fishing activity. The pot-lift sampling goal for observers on catcher-only vessels was 6 pot lifts during each day of fishing activity. The season opened 15 October 2006, fishing began in November and continued until the season closed on 31 March 2007. A total of 141 pot lifts selected for pot-lift sampling accounted for 5.4% of the estimated 2,619 pot lifts reported by vessel operators in the directed fishery (Bowers et al. 2008). The locations of pot lifts sampled by observers during the 2006/2007 Bering Sea Tanner crab fisheries are displayed in Appendix B2.

Size frequency sample measurements of CW were taken from 581 retained male Tanner crabs throughout the directed-catch season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 3). The mean CW of retained male Tanner crabs was 145.6 mm.

Pot-lift sample measurements of CW were taken throughout the season by onboard observers from 11,538 male Tanner crabs captured in the directed Bering Sea Tanner crab fishery (Figure 3). The mean CW for male Tanner crabs from sampled pot lifts was 130.3 mm; 42% of the measured male Tanner crabs were categorized as old-shell or very-old-shell condition. Pot-lift sample measurements of CW were taken throughout the season by onboard observers from 2,859 female Tanner crabs from the Bering Sea Tanner crab fishery (Figure 4). The mean CW for female Tanner crabs from sampled pot lifts was 90.3 mm; 71% were categorized as being of old-shell or very-old-shell condition.

The stratified CPUE estimate in the directed Tanner crab fishery was 41.8 legal retained Tanner crabs per pot lift (Table 4). The precision of the stratified CPUE estimate for all legal retained crabs was fair; the standard error was 9.7% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 33.9 to 49.7 crabs per pot lift. This interval included the ATF CPUE for the directed fishery of 42. Approximately 47% of the total catch of Tanner crabs was landed by vessels fishing in the directed fishery. An estimated 54% of all Tanner crabs captured during the 2006/2007 directed fishery were sublegal male crabs and were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2006/2007 Tanner crab directed fishery are provided in Appendix C5. Summaries of CPUE by soak time and depth for Tanner crabs caught during the directed 2006/2007 Bering Sea Tanner fishery west of 166° W longitude can be found in Appendices C6 and C7, respectively, and the reproductive condition of female Tanner crabs from the sampled pot lifts are listed in Appendix C8.

Legal tallies conducted on catcher-only vessels delivering to processors totaled 6,511 crabs by the end of the 2006/2007 season and comprised 2.2% of the cumulative reported harvest (Appendix D1). From all sampled crabs, 1.0% were illegal, either due to size, sex, or species.

East of 166° W Longitude

During the 2006/2007 fishery season, observers were deployed on 1 catcher-processor vessel and 10 catcher-only vessels registered to take directed catch in the Bering Sea Tanner crab fishery east of 166° W longitude. The Tanner crab fishery was conducted concurrently with the Bristol Bay red king crab fishery and regulations permit properly licensed vessels fishing for red king crab to retain legal male Tanner crabs as incidental catch. The pot-lift sampling goal for observers on catcher-processors was 4 pot lifts during each day of fishing activity. The pot-lift sampling goal for observers on catcher-only vessels was 6 pot lifts during each day of fishing activity. The season opened 15 October 2006, fishing began in October and continued until the

season closed 31 March 2007. A total of 280 pot lifts selected for pot-lift sampling accounted for 1.8% of the estimated 15,331 pot lifts reported by vessel operators in the directed fishery (Bowers et al. 2008). The locations of pot lifts sampled by observers during the 2006/2007 Bering Sea Tanner crab fisheries are displayed in Appendix B2.

Size frequency sample measurements of CW were taken from 2,359 retained male Tanner crabs throughout the directed-catch season by onboard observers and ADF&G staff stationed at shore-side processing locations (Table 5). The mean CW of retained male Tanner crabs was 151.1 mm.

Pot-lift sample measurements of CW were taken throughout the season by onboard observers from 12,706 male Tanner crabs captured in the directed Bering Sea Tanner crab fishery east of 166° W longitude (Figure 5). The mean CW for male Tanner crabs from pot lifts sampled was 133.5 mm and 37% were categorized as old-shell or very-old-shell condition. Pot-lift sample measurements of CW were taken throughout the season by onboard observers from 1,573 female Tanner crabs from the Bering Sea Tanner crab fishery (Figure 6). The mean CW for female Tanner crabs from sampled pot lifts was 97.3 mm and 47% were classed old-shell or very-old-shell condition.

The stratified CPUE estimate in the directed Tanner crab fishery east of 166° W longitude was 42.0 legal retained Tanner crabs per pot lift (Table 6). The precision of the stratified CPUE estimate for all legal retained crabs was fair; the standard error was 10.7% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 33.2 to 50.8 crabs per pot lift. This interval included the ATF CPUE of 37. Approximately 99.6% of the total catch of Tanner crabs were landed by vessels fishing in the directed fishery. An estimated 53% of all Tanner crabs captured during the 2006/2007 directed fishery were sublegal male crabs and were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2006/2007 Tanner crab directed fishery are provided in Appendix C9. Summaries of CPUE by soak time and depth for Tanner crabs caught incidentally during the directed 2006/2007 Bering Sea Tanner crab fishery can be found in Appendices C10 and C11, respectively. The reproductive condition of female Tanner crabs from the sampled pot lifts are listed in Appendix C12.

Legal tallies conducted on catcher-only vessels delivering to processors totaled 5,741 crabs by the end of the 2006/2007 season and comprised 1.1% of the cumulative reported harvest (Appendix D1). From all sampled crabs in this fishery, 0.7% were illegal, either due to size, sex, or species.

BRISTOL BAY RED KING CRAB

Observers were deployed on 4 catcher-processor vessels, 3 floating-processor vessels, and 18 of 78 catcher-only vessels during the 2006/2007 rationalized fishery. The 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 2006 and continued until late November 2006. A total of 1,215 pot lifts selected for sampling accounted for 1.7% of the 71,740 pot lifts reported by vessel operators (Bowers et al. 2008). Locations of pot lifts sampled by observers during the 2006/2007 Bristol Bay red king crab fishery are displayed in Appendix B3.

Size frequency sample measurements of CL were taken from 18,027 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 150.9 mm.

Pot-lift sample measurements of CL were taken from 65,712 male red king crabs throughout the season by onboard observers. The mean CL for all male red king crabs from sampled pot lifts was 138.0 mm. The size frequency distribution of these measurements reveals a prominent mode between 141 mm and 150 mm (Figure 7). The percentage of old-shell and very-old-shell condition male red king crabs in pot-lift samples was 5.3%. Measurements of CL were taken from 3,607 female red king crabs (Figure 8). The mean CL for all female red king crabs from sampled pot lifts was 100.7 mm and 0.6% were categorized as being old-shell or very-old-shell condition.

The stratified CPUE estimate of 33.4 legal retained red king crabs per pot lift (Table 8) was a 40% increase from the 2005/2006 fishery estimate (Figure 9). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 5.7% 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 37.1 crabs per pot lift. This interval included the ATF CPUE of 34, indicating the sampled pot lifts were representative of the total fishery. An estimated 41% of all male red king crabs captured during the 2006/2007 fishery were discarded due to minimum size regulations. An estimated 2% of legal male red king crabs were discarded during the fishery.

Total catches of all animals identified in sampled pot lifts during the 2006/2007 season are provided in Appendix C13. Additional appendices contain CPUE by soak time (Appendix C14), depth (Appendix C15), and the reproductive condition of female red king crabs from pot-lift samples (Appendix C16).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors totaled 24,862 crabs by the end of the 2006/2007 season and comprised 1.1% of the cumulative reported harvest (Appendix D1). Approximately 0.3% were illegal due to size, sex, or species regulations.

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 ADF&G 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. 2008). Results from the 2006/2007 fishery east of 174° W longitude and the 2006/2007 fishery west of 174° W longitude are reported here.

East of 174° W Longitude

During the 2005/2006 Aleutian Islands golden king crab fishery east of 174° W longitude, observers were deployed on 1 catcher-processor vessel and 5 catcher-only vessels. The sampling goal for observers on catcher-only vessels was 14 pot lifts per fishing day and for observers on the catcher-processor the goal was 9 pot lifts per fishing day. The season opened 15 August 2006 and fishing continued until January 2007. A total of 1,097 pot lifts selected for sampling accounted for 4.2% of the 26,195 pot lifts reported by vessel operators (Bowers et al. 2008). The locations of pot lifts sampled by observers during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude are displayed in Appendix B4.

Size frequency sample measurements of CL were taken from 1,685 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 151.5 mm.

Pot-lift sample measurements of CL were taken from 9,665 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot lifts was 145.3 mm. The size and shell condition frequency distributions of sublegal and legal male golden king crabs show a mode between 141 mm and 150 mm, similar to the previous season (Figure 10). From pot-lift samples, measurements of CL were taken from 2,330 female golden king crabs throughout the season by onboard observers. The mean CL for all female golden king crabs from sampled pot lifts was 127.5 mm (Figure 11).

The stratified CPUE estimate of 24.2 legal retained golden king crabs per pot lift (Table 10) was an 11% decrease from the 2005/2006 fishery estimate (Figure 12). The precision of the stratified CPUE estimate was good for all legal retained crabs; the standard error was 6.6% of the estimated mean. The 95% confidence interval for the CPUE for legal retained crabs estimated from the sampled pot lifts was 21.1 to 27.4 crabs per pot lift. This interval included the ATF CPUE of 25, indicating the sampled pot lifts were representative of the total fishery. An estimated 41% of all golden king crabs captured during the 2006/2007 fishery were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2006/2007 season are provided in Appendix C17. Additional appendices contain CPUE by soak time (Appendix C18) and depth (Appendix C19), and the reproductive condition of female golden king crabs from sampled pot lifts (Appendix C20).

West of 174° W Longitude

During the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude, observers were deployed on 1 catcher-processor vessel and 3 catcher-only vessels. The sampling goal for observers on catcher-only vessels was 10 pot lifts and for the observer on the catcher-processor vessel was 5 pot lifts during each day of fishing activity. The fishery opened 15 August 2006 and continued until May 2007. A total of 1,183 pot lifts selected for sampling accounted for 4.4% of the 26,870 pot lifts reported by vessel operators (Bowers et al. 2008). The locations of pot lifts sampled by observers during the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude are displayed in Appendix B5.

Size frequency sample measurements of CL were taken from 12,618 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 150.0 mm.

Pot-lift sample measurements of CL were taken from 27,074 male golden king crabs throughout the season by onboard observers. The mean CL for all male golden king crabs from sampled pot lifts was 142.9 mm. The size and shell condition frequency distributions of sublegal and legal male golden king crabs were similar to the 2005/2006 season (Figure 13). Pot-lift sample measurements of CL were taken from 7,153 female golden king crabs throughout the season by onboard observers. The mean CL for all female golden king crabs from sampled pot lifts was 132.4 mm. The general size and shell condition distributions and proportions of female golden king crabs show a mode between 131 mm and 135 mm (Figure 14).

The stratified CPUE estimate of 21.8 legal retained golden king crabs per pot lift (Table 12) was a 8% increase from the 2005/2006 fishery estimate (Figure 15). 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 19.1 to 24.5 crabs per pot lift. This interval included the ATF CPUE of 21, indicating the

sampled pot lifts were representative of the total fishery. An estimated 48% of all golden king crabs captured during the 2006/2007 fishery were discarded as bycatch.

Total catches of all animals identified in sampled pot lifts during the 2005/2006 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 sampled pot lifts (Appendix C24).

Legal tallies conducted on catcher-processors and catcher-only vessels delivering to processors from both east and west of 174° W longitude totaled 56,102 crabs by the end of the 2006/2007 season and comprised 4.7% of the cumulative reported harvest (Appendix D1). From all sampled crabs, 0.5% were 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 CPUE 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 CPUE estimated 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.

CPUE estimates for retained legal crabs computed from observer pot-lift samples were within 5% of the ATF CPUE for all but one of the reported fisheries (Table 13). The exception was the Bering Sea Tanner crab fishery east of 166° W longitude. Additionally, all ATF CPUEs were contained within the 95% confidence intervals for CPUEs derived from observer data. The close agreement between the observer-based estimates and the ATF CPUE for retained legal crab in those BSAI crab fisheries indicated that observer pot-lift sample data provide reliable estimates of CPUE for the entire fleet.

ATF CPUE estimates computed from fish ticket data for retained legal crabs in the 2006/2007 Bering Sea Tanner crab fisheries west and east of 166° W longitude were calculated differently than previous seasons (Table 4, Table 6). Only fish ticket data associated with directed Tanner crab deliveries (i.e. – no coincident deliveries of other targeted species) were used to estimate total effort. The directed Tanner crab fishery west of 166° W longitude landed 49.3% of the total catch, the remaining 50.7% were landed in the Bering Sea snow crab fishery as incidental catch where the estimated legal male CPUE was 1.4 crabs per pot lift (Table 2). The directed Tanner crab fishery east of 166° W longitude landed 99.6% of the total catch, the remaining 0.4% were landed in the Bristol Bay red king crab fishery as incidental catch where the estimated legal male CPUE was 0.04 crabs per pot lift (Table 8). The directed ATF CPUEs were calculated from the estimated total catch divided by the estimated total number of pot lifts in each fishery.

Comparing observer-based CPUE estimates for retained legal crabs with the ATF CPUE in all fisheries in this report indicated that the coverage provided adequate data for estimation of total fishery CPUE.

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 × 100%). Ratios that are less than 10% are considered to be acceptable for the estimates made using data collected by observers; ratios of 5% or less are desirable. Generally, the stratified CPUE estimates appeared to be precise for the 2006/2007 Bering Sea snow crab fishery, the Bristol Bay red king crab fishery, and the Aleutian Islands golden king crab fisheries east and west of 174° W longitude, as all ratios of standard errors to CPUE estimates were less than 10%. They ranged from a low of 3.2% for the Bering Sea snow crab fishery to 6.6% for the Aleutian Islands golden king crab fishery east of 174° W longitude. The precision of the 2006/2007 Bering Sea Tanner crab CPUE estimates were less acceptable with a ratios of 9.7% west of 166° W longitude and 10.6% east of 166° W longitude. However, these estimates come from limited data (141 pot lifts from 3 vessels and 280 pot lifts from 4 vessels, respectively). 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 were 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 frequency distributions by shell condition from biological measurements of retained snow crabs sampled during the 2006/2007 Bering Sea snow crab fishery.

Carapace Width (mm)[a]	New shell (percent)	Old shell (percent)	Very Old shell (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	0.2
91-95	0.6	< 0.1	< 0.1	0.7
96-100	5.4	0.2	< 0.1	5.7
101-105	24.1	0.9	0.1	25.1
106-110	31.5	1.8	0.1	33.4
111-115	18.0	2.2	0.2	20.3
116-120	5.5	2.3	0.2	8.1
121-125	1.7	2.0	0.1	3.8
126-130	0.8	0.9	0.1	1.7
131-135	0.2	0.3	< 0.1	0.5
> 135	0.2	0.2	< 0.1	0.4
Total Crab	30,419	3,710	286	34,415
Total Percent	88.4	10.8	0.8	100

[a] Average CW = 109.1 mm.

Table 2.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 Bering Sea snow crab fishery. The estimates are from 1,110 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Snow crab			
Legal males - retained	336.8[b]	10.88	30,112,857[c]
Legal males - not retained	198.8	12.96	17,777,807
Sublegal males	5.7	1.02	507,809
Females	0.1	0.02	10,272
Tanner/Snow hybrid			
Legal males - retained	0.9	0.16	77,346
Legal males - not retained	0.4	0.09	39,589
Sublegal males	0.3	0.06	25,246
Females	< 0.1	< 0.01	576
Tanner crab			
Legal males – retained [d]	1.4	0.40	125,602
Legal males - not retained	0.8	0.21	72,430
Sublegal males	19.8	2.84	1,768,407
Females	2.3	0.55	203,009

[a] Estimated catch is the product of the CPUE estimate and 89,419, the total number of pots pulled for the 2006/2007 Bering Sea snow crab fishery (Bowers et al. 2008).

[b] Actual total fishery CPUE of retained legal snow crabs was 331 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal snow crabs for the fishery was 29,620,689 (Bowers et al. 2008).

[d] Legal male Tanner crabs were retained by qualified vessels as incidental catch in the 2006/2007 Bering Sea snow crab fishery which was prosecuted concurrently with the 2006/2007 Bering Sea Tanner crab fishery.

Table 3.–Carapace width frequency distributions by shell condition from biological measurements of retained Tanner crabs sampled during the 2006/2007 Bering Sea Tanner crab fishery west of 166° W longitude.

Carapace Width (mm)[a]	New shell (percent)	Old shell (percent)	Very Old shell (percent)	All (percent)
136-140	5.7	12.0	0	17.7
141-145	15.5	22.0	0.2	37.7
146-150	9.8	16.5	0.2	26.5
151-155	6.7	5.5	0	12.2
156-160	2.4	1.9	0.3	4.6
161-165	0.5	0	0	0.5
166-170	0.3	0.3	0	0.7
Total Crab	238	339	4	581
Total Percent	41.0	58.3	0.7	100

[a] Average CW = 145.6 mm.

Table 4.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 directed Bering Sea Tanner crab fishery west of 166° W longitude. The estimates are from 135 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Tanner crab			
Legal males - retained	41.8[b]	4.04	109,408[c]
Legal males - not retained	2.8	2.00	7,343
Sublegal males	144.4	12.386	378,135
Females	77.5	16.63	203,073
Tanner/Snow hybrid			
Legal males - retained	0	0	0
Legal males - not retained	< 0.1	0.03	40
Sublegal males	0.7	0.16	1,721
Females	< 0.1	0.03	53
Snow crab			
Legal males – retained[d]	0	0	0
Legal males - not retained	7.2	1.39	18,885
Sublegal males	0.1	0.05	208
Females	0	0	0

[a] Estimated catch is the product of the CPUE estimate and 2,619, the estimated total number of pots pulled for the 2006/2007 directed Bering Tanner crab fishery west of 166 W longitude (Bowers et al. 2008).

[b] Actual directed fishery CPUE of retained legal Tanner crabs was 42 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal Tanner crabs for the fishery was 340,622 (Bowers et al. 2008).

[d] Legal male snow crabs were retained by qualified vessels as incidental catch in the 2005/2006 Bering Sea Tanner crab fishery which was prosecuted concurrently with the 2005/2006 Bering Sea snow crab fishery.

Table 5.–Carapace width frequency distributions by shell condition from biological measurements of retained Tanner crabs sampled during the 2006/2007 Bering Sea Tanner crab fishery east of 166° W longitude.

Carapace Width (mm)[a]	New shell (percent)	Old shell (percent)	Very Old shell (percent)	All (percent)
126-130	0	< 0.1	0	< 0.1
131-135	0.1	0.2	0	0.3
136-140	1.8	4.2	0.4	6.4
141-145	8.4	11.4	0.8	20.5
146-150	8.8	13.4	1.4	23.7
151-155	6.6	13.0	1.6	21.2
156-160	4.9	9.2	1.1	15.3
161-165	3.0	4.7	1.1	8.7
166-170	0.8	1.9	0.5	3.2
171-175	0.3	0.3	0.1	0.6
176-180	< 0.1	0.1	0	0.2
Total Crab	815	1,378	166	2,359
Total Percent	34.6	58.4	7.0	100

[a] Average CW = 151.1 mm

Table 6.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 directed Bering Sea Tanner crab fishery east of 166° W longitude. The estimates are from 276 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Tanner crab			
Legal males - retained	42.0[b]	4.49	643,424[c]
Legal males - not retained	1.0	0.87	14,882
Sublegal males	63.3	4.72	970,742
Females	12.3	1.84	189,163
Tanner/Snow hybrid			
Legal males - retained	< 0.1	< 0.01	15
Legal males - not retained	0.1	0.04	2,019
Sublegal males	0.2	0.08	2,983
Females	< 0.1	0.01	45
Red King crab			
Legal males – retained[d]	< 0.1	0.01	129
Legal males - not retained	< 0.1	0.03	296
Sublegal males	0.1	0.03	1,485
Females	0.1	0.07	938

[a] Estimated catch is the product of the CPUE estimate and 15,331, the estimated total number of pots pulled for the 2006/2007 directed Bering Tanner snow crab fishery east of 166 W longitude (Bowers et al. 2008).

[b] Actual directed fishery CPUE of retained legal Tanner crabs was 37 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal Tanner crabs for the fishery was 585,479 (Bowers et al. 2008)

Table 7.– Carapace length frequency distributions by shell condition from biological measurements of retained red king crabs sampled during the 2006/2007 Bristol Bay red king crab fishery.

Carapace Length (mm)[a]	New shell (percent)	Old shell (percent)	Very old shell (percent)	All (percent)
116-120	< 0.1	0	0	< 0.1
121-125	< 0.1	0	0	< 0.1
126-130	0.1	< 0.1	0	0.1
131-135	1.4	0.3	< 0.1	1.7
136-140	8.6	1.2	0.1	9.9
141-145	17.0	3.0	0.3	20.3
146-150	18.2	3.3	0.3	21.8
151-155	14.6	3.1	0.4	18.1
156-160	9.6	2.6	0.3	12.5
161-165	6.0	1.7	0.2	7.9
166-170	3.5	1.0	0.1	4.6
171-175	1.5	0.5	0.1	2.1
176-180	0.6	0.2	< 0.1	0.8
181-185	0.2	0.1	< 0.1	0.2
186-190	< 0.1	< 0.1	0	< 0.1
191-195	< 0.1	< 0.1	0	< 0.1
196-200	0	< 0.1	0	< 0.1
Total Crab	14,646	3,035	346	18,027
Total Percent	81.2	16.8	1.9	100

[a] Average CL = 150.9 mm.

Table 8.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 Bristol Bay red king crab fishery. The estimates are from 1,153 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Red king crab			
Legal males - retained	33.4[b]	1.90	2,396,309[c]
Legal males - not retained	1.3	0.24	94,905
Sublegal males	25.8	3.66	1,853,035
Females	3.1	0.96	221,506
Tanner crab			
Legal males - retained	< 0.1	0.02	2,609
Legal males - not retained	0.1	0.02	5,769
Sublegal males	0.4	0.05	27,489
Females	< 0.1	0.01	3,285

[a] Estimated catch is the product of the CPUE estimate and 71,740, the total number of pot lifts for the 2006/2007 Bristol Bay red king crab fishery (Bowers et al. 2008).

[b] Actual total fishery CPUE of retained legal crabs was 34 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal crabs for the fishery was 2,429,660 (Bowers et al. 2008).

Table 9.–Carapace length frequency distributions by shell condition from biological measurements of retained golden king crabs sampled during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude.

Carapace Length (mm)[a]	New shell (percent)	Old shell (percent)	Very old shell (percent)	All (percent)
131-135	1.4	0	0	1.4
136-140	10.3	0.3	0	10.6
141-145	18.1	0.7	0	18.8
146-150	20.2	0.6	0	20.8
151-155	17.6	0.8	0	18.4
156-160	10.3	0.5	0	10.8
161-165	8.6	0.8	0	9.4
166-170	5.1	0.5	0	5.6
171-175	2.3	0.2	0	2.6
176-180	0.8	0.2	0	1.0
181-185	0.4	0	0	0.4
186-190	0.1	0	0	0.1
191-195	0.1	0	0	0.1
Total Crab	1,607	78	0	1,685
Total Percent	95.4	4.6	0	100

[a] Average CL = 151.5 mm.

Table 10.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude. The estimates are from 1,090 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Golden king crab			
Legal males - retained	24.2[b]	1.60	635,086[c]
Legal males - not retained	0.7	0.15	19,210
Sublegal males	8.4	1.21	219,463
Females	7.7	1.71	202,924

[a] Estimated catch is the product of the CPUE estimate and 26,195, the total number of pot lifts for the 2006/2007 eastern Aleutian Islands golden king crab fishery (Bowers et al. 2008).

[b] Actual total fishery CPUE of retained legal crabs was 25 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal crabs for the fishery was 643,077 (Bowers et al. 2008).

Table 11.–Carapace length frequency distributions by shell condition from biological measurements of retained golden king crabs sampled during the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude.

Carapace Length (mm)[a]	New shell (percent)	Old shell (percent)	Very old shell (percent)	All (percent)
126-130	< 0.1	0	0	< 0.1
131-135	2.5	0.1	0	2.6
136-140	13.0	0.2	< 0.1	13.2
141-145	22.0	0.4	0.1	22.5
146-150	18.9	0.5	< 0.1	19.4
151-155	15.7	0.4	0.1	16.2
156-160	10.0	0.5	0.1	10.5
161-165	7.2	0.3	< 0.1	7.5
166-170	4.1	0.2	< 0.1	4.3
171-175	2.2	0.1	< 0.1	2.4
176-180	0.8	< 0.1	< 0.1	0.8
181-185	0.3	< 0.1	< 0.1	0.3
186-190	0.1	0	0.	0.1
191-195	< 0.1	0	0	< 0.1
Total Crab	12,212	347	59	12,618
Total Percent	96.8	2.7	0.5	100

[a] Average CL = 150.0 mm.

Table 12.–Estimated catch per pot (CPUE) of selected crab species from pot lifts sampled by observers deployed during the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude. The estimates are from 1,183 pot lifts.

Species / Sex Class	Sampled Fleet Estimates		Estimated Total Catch [a]
	CPUE	SE	
Golden king crab			
Legal males - retained	21.8[b]	1.36	586,690[c]
Legal males - not retained	0.2	0.12	6,012
Sublegal males	9.5	1.02	256,059
Females	10.5	1.95	281,018

[a] Estimated catch is the product of the CPUE estimate and 26,870, the total number of pot lifts for the 2006/2007 western Aleutian Islands golden king crab fishery (Bowers et al. 2008).

[b] Actual total fishery CPUE of retained legal crabs was 21 for all vessels (Bowers et al. 2008).

[c] Actual catch of retained legal crabs for the fishery was 552,521 (Bowers et al. 2008).

Table 13.–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.

Fishery	Vessels		Pot Lifts		Percent difference of the weighted CPUE estimate from ATF CPUE[a]
	Observed	Total Fishery	Observed	Total Fishery	
2006/07 Bering Sea snow crab (with legal hybrids)	27	69	1,118	89,419	+1.7
2006/07 Bering Sea Tanner crab west of 166° W	3	38[c]	141	2,619[d]	-1.4
2006/07 Bering Sea Tanner crab east of 166° W	11	37[c]	280	15,331[d]	+14.8
2006/07 Bristol Bay red king crab	22	81	1,215	71,740	-1.5
2006/07 Aleutian Islands golden king crab east of 174° W	6	6	1,097	26,195	-1.2
2006/07 Aleutian Islands golden king crab west of 174° W	4	4	1,183	26,870	+5.8

[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] Registered to retain Tanner crabs either as directed or incidental catch.

[d] Estimated number of pot lifts for the directed Tanner crab fishery only

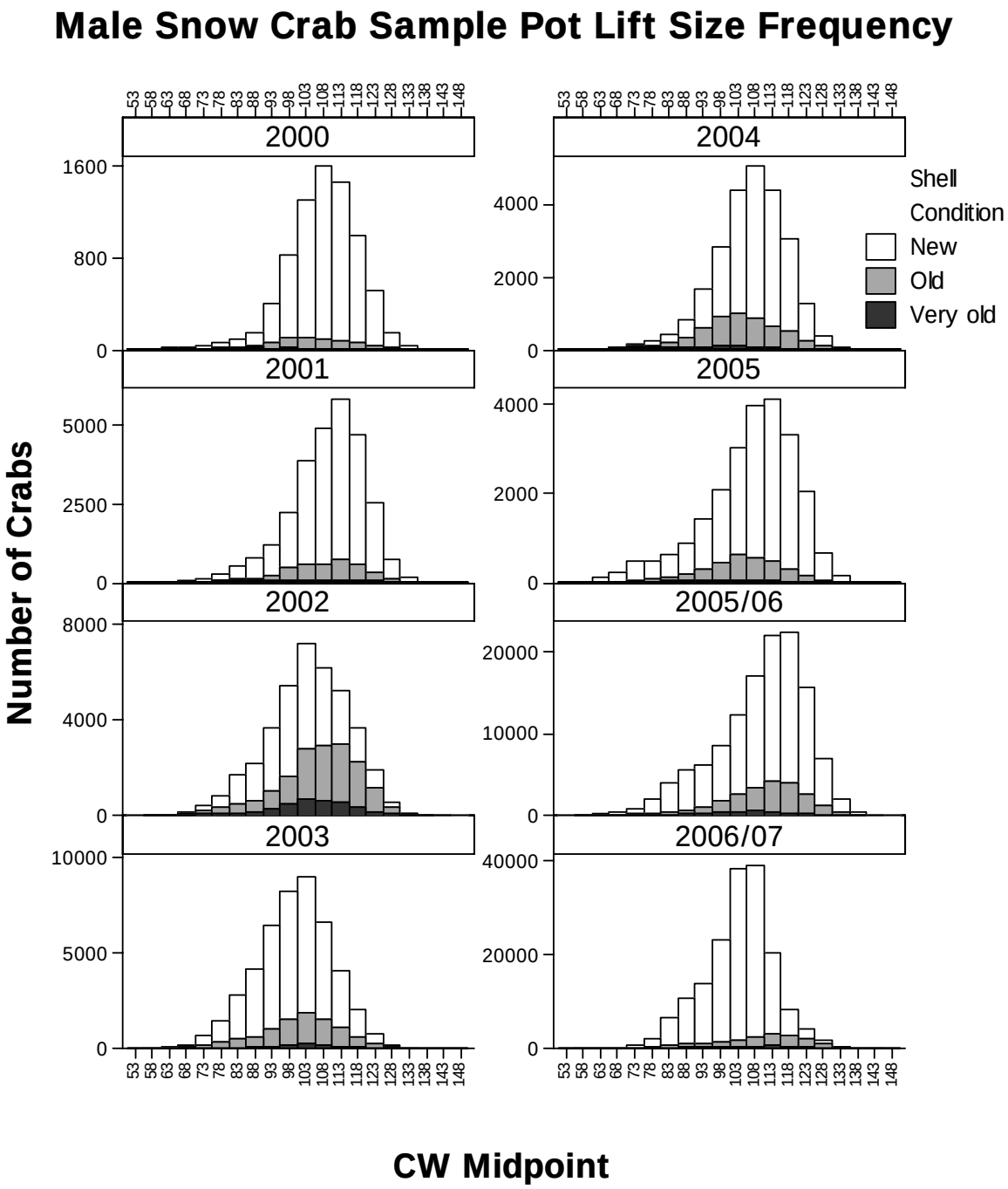


Figure 1.–Carapace width (CW, mm) frequency distributions with corresponding shell condition for male snow crabs from sampled pot lifts taken during the 2000-2006/2007 Bering Sea snow crab fisheries.

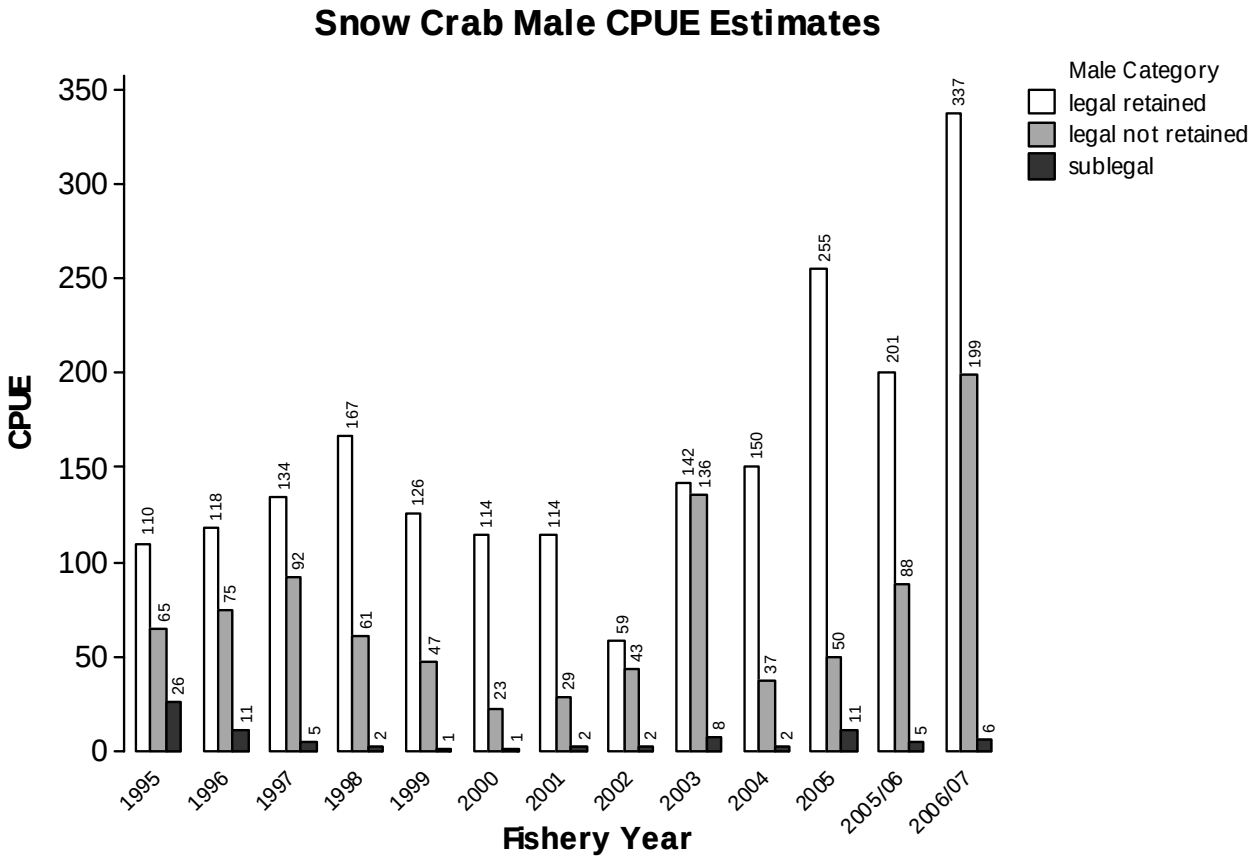


Figure 2.–Estimated CPUE of male snow crab from pot-lift samples taken during the 1995-2006/2007 Bering Sea snow crab fisheries.

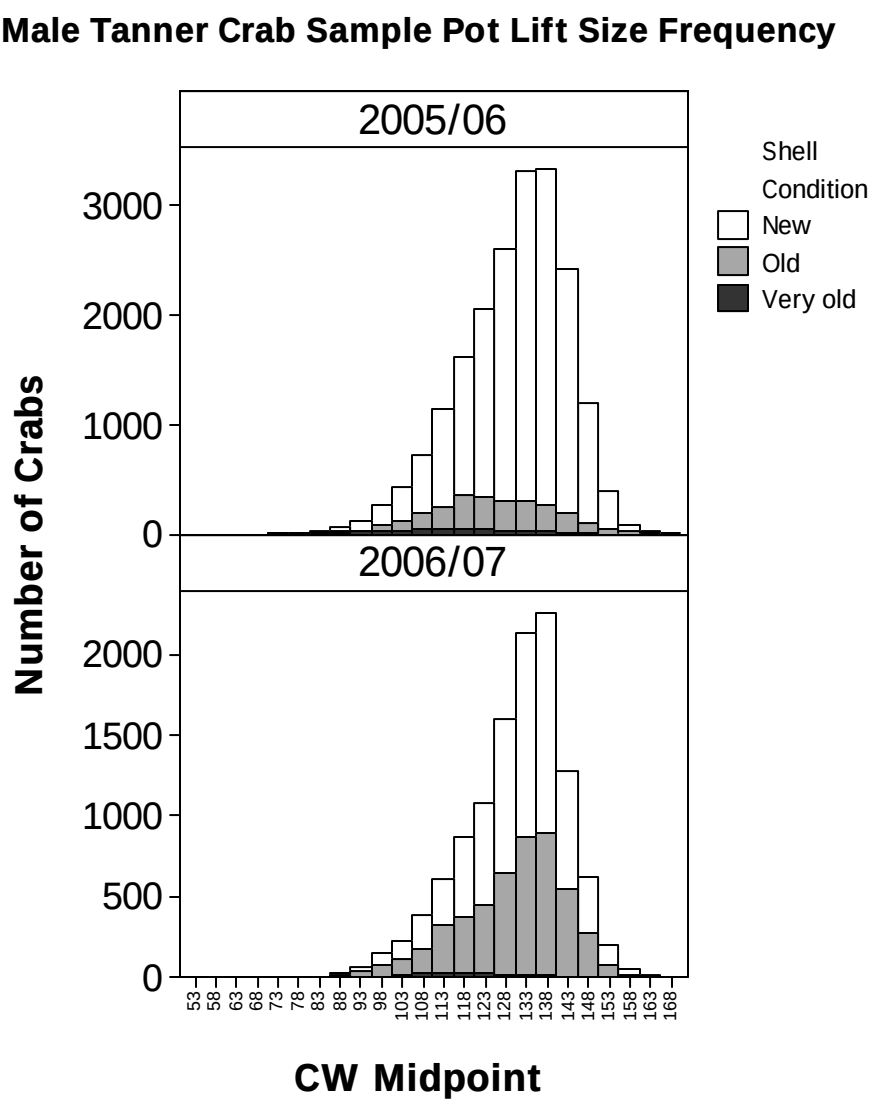


Figure 3.–Carapace width (CW, mm) frequency distributions with corresponding shell condition for male Tanner crabs from pot-lift samples taken during the 2005/2006 and 2006/2007 Bering Sea Tanner crab fisheries west of 166° W longitude.

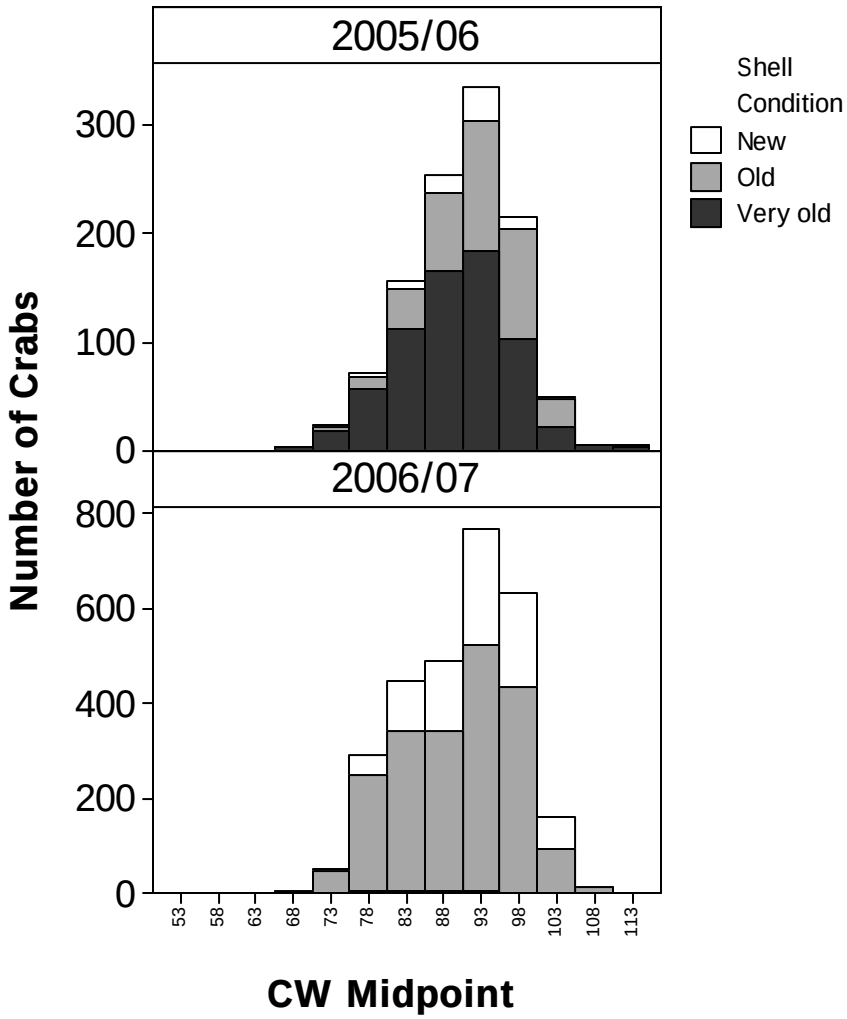


Figure 4.–Carapace width (CW, mm) frequency distributions with corresponding shell condition for female Tanner crabs from pot lifts sampled during the 2005/2006 and 2006/2007 Bering Sea Tanner crab fisheries west of 166° W longitude.

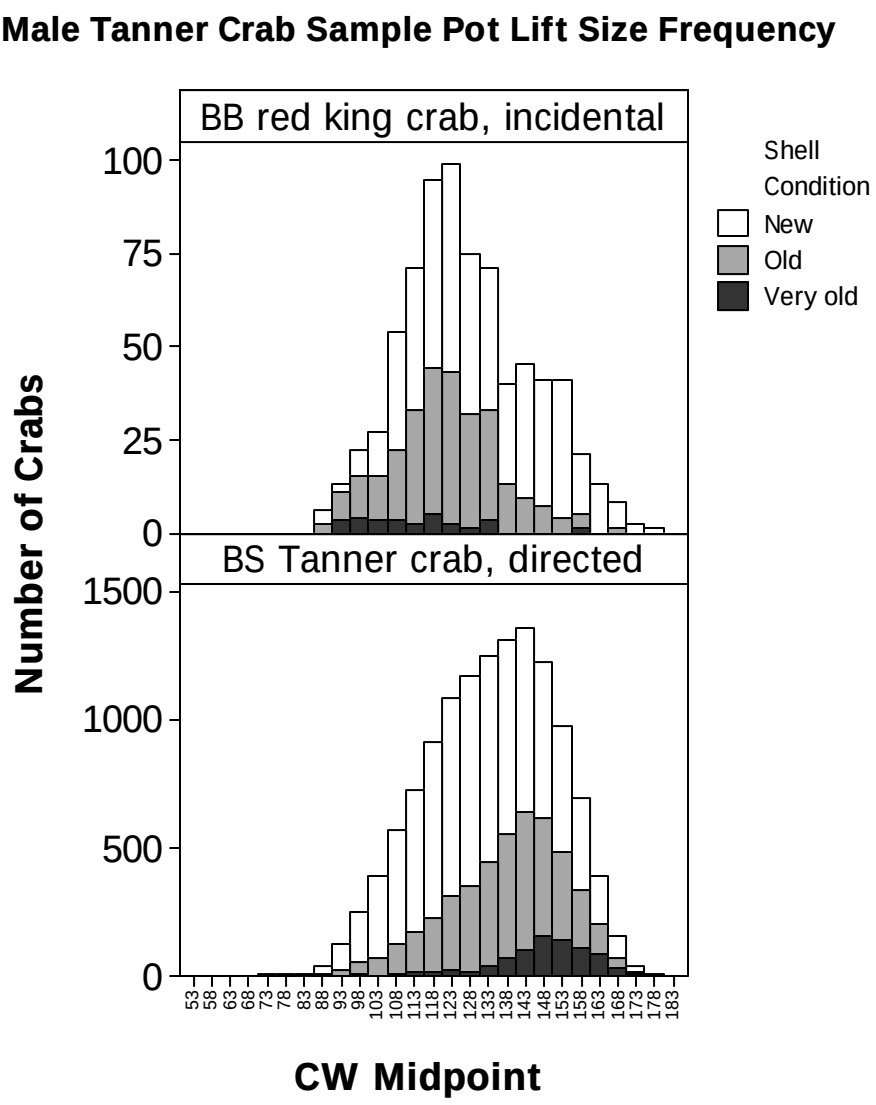


Figure 5.–Carapace width (CW, mm) frequency distributions with corresponding shell condition for male Tanner crabs from pot-lift samples taken during the 2006/2007 Bristol Bay red king crab (incidental) and Bering Sea Tanner crab (directed) fisheries east of 166° W longitude.

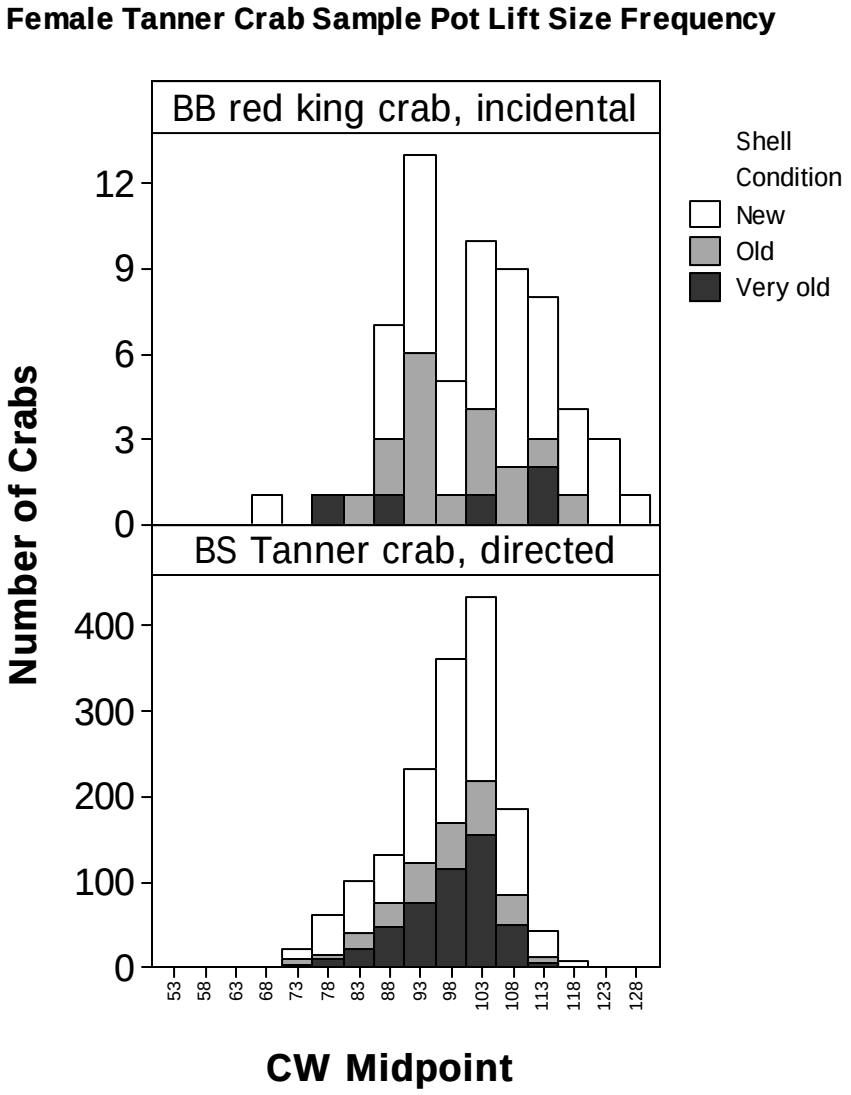


Figure 6.–Carapace width (CW, mm) frequency distributions with corresponding shell condition for female Tanner crabs from pot lifts sampled during the 2006/2007 Bristol Bay red king crab (incidental) and Bering Sea Tanner crab (directed) fisheries east of 166° W longitude.

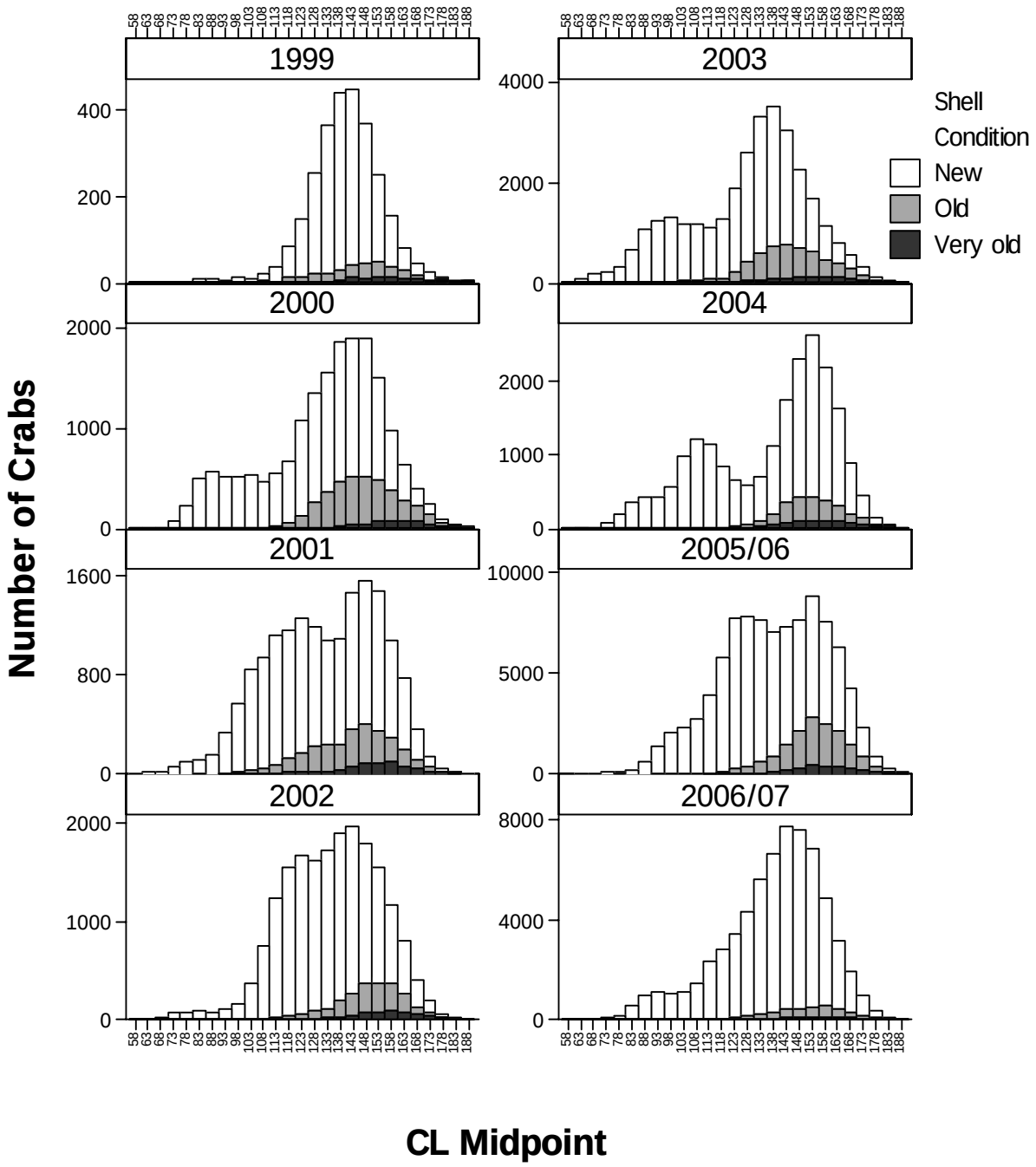


Figure 7.–Carapace length (CL, mm) frequency distributions with corresponding shell conditions for male red king crabs from pot lifts sampled during the 1999-2006/2007 Bristol Bay red king crab fisheries.

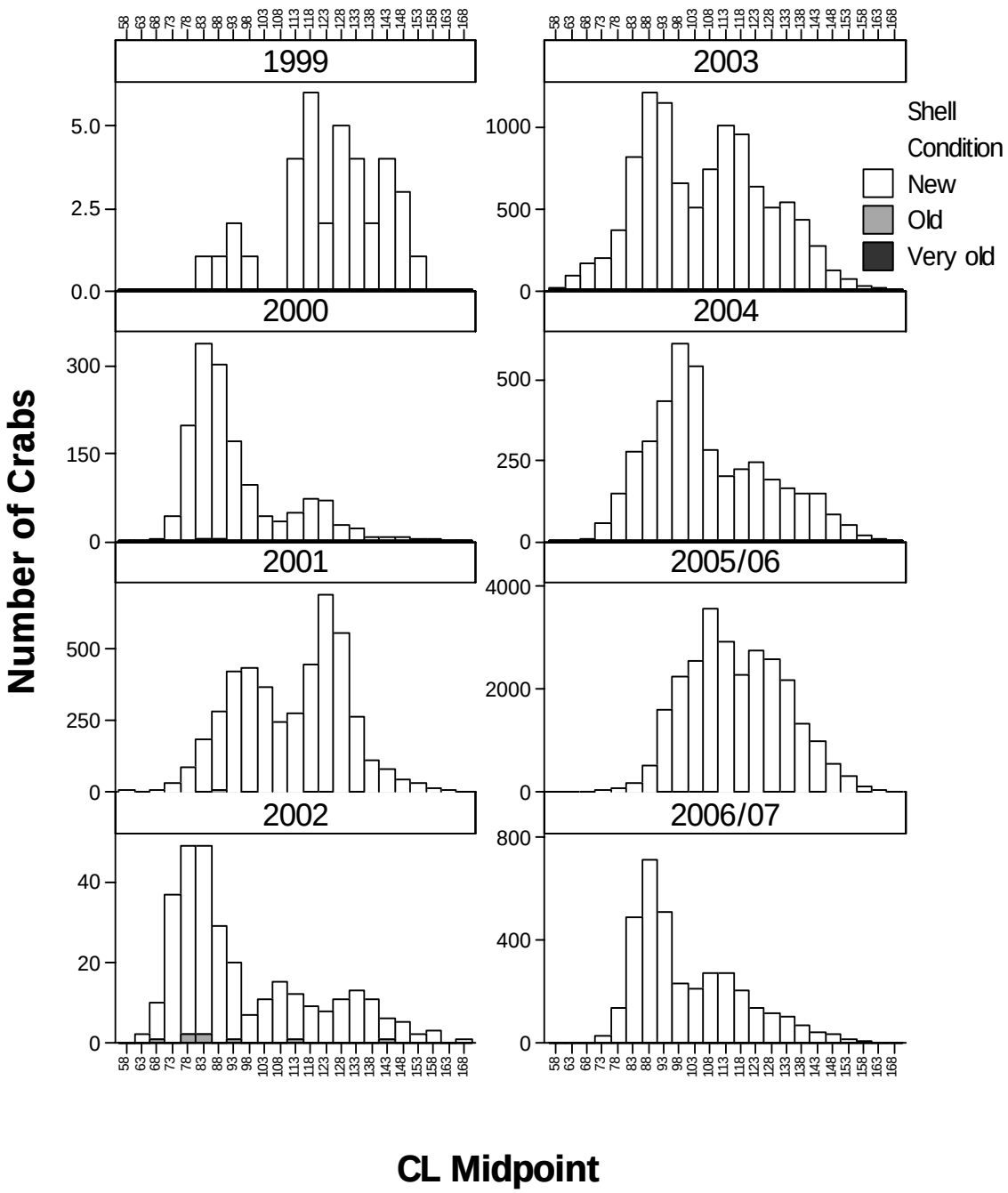


Figure 8.–Carapace length (CL, mm) frequency distributions with corresponding shell condition for female red king crabs from pot lifts sampled during the 1999-2006/2007 Bristol Bay red king crab fisheries.

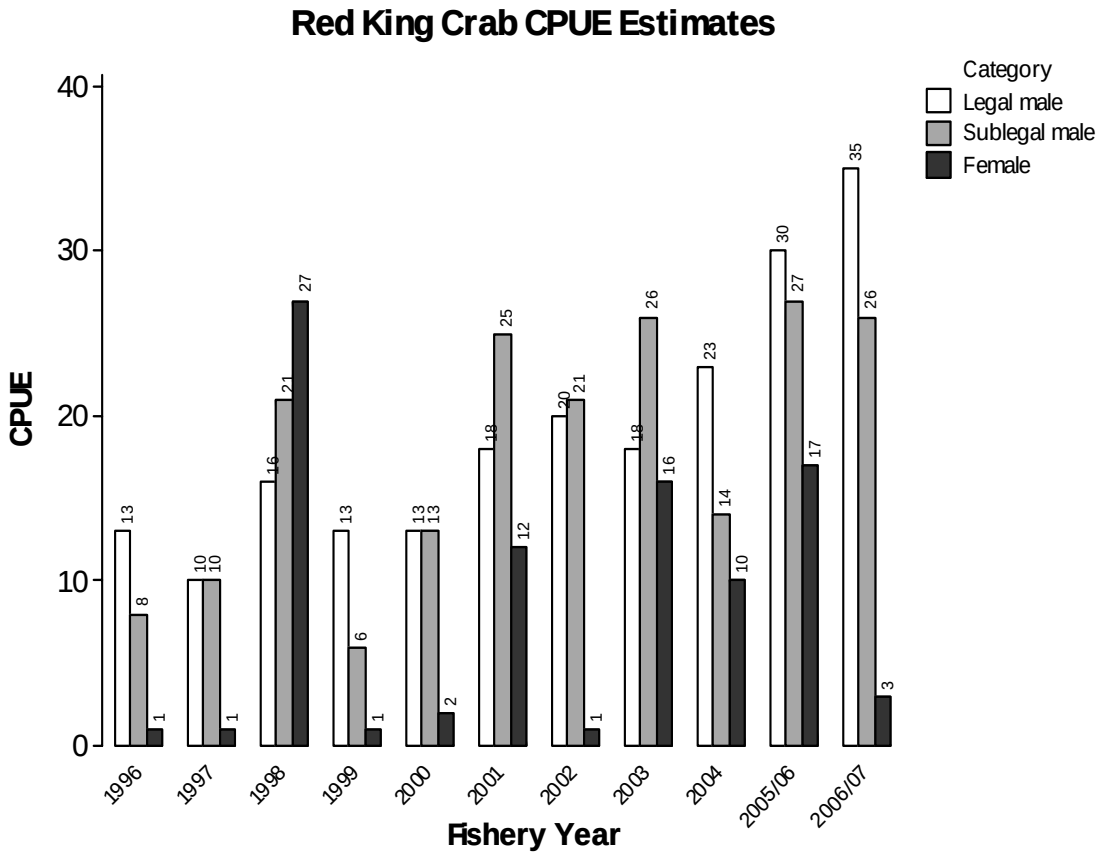


Figure 9.–Estimated CPUE of red king crabs from pot lifts sampled during the 1996-2006/2007 Bristol Bay red king crab fisheries.

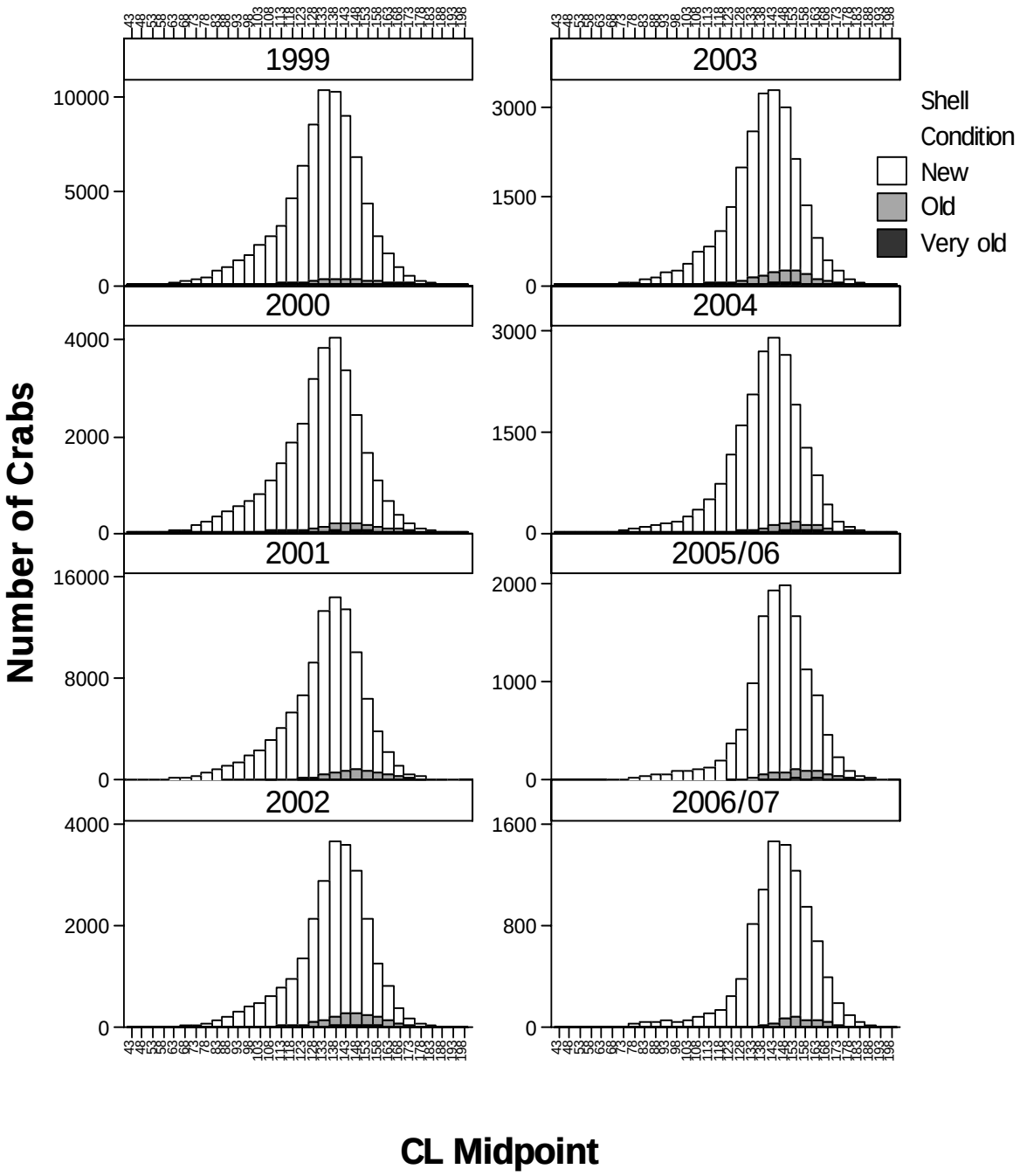


Figure 10.–Carapace length (CL, mm) frequency distributions with corresponding shell condition for male golden king crabs from pot lifts sampled during the 1999-2006/2007 Aleutian Islands golden king crab fisheries east of 174° W longitude.

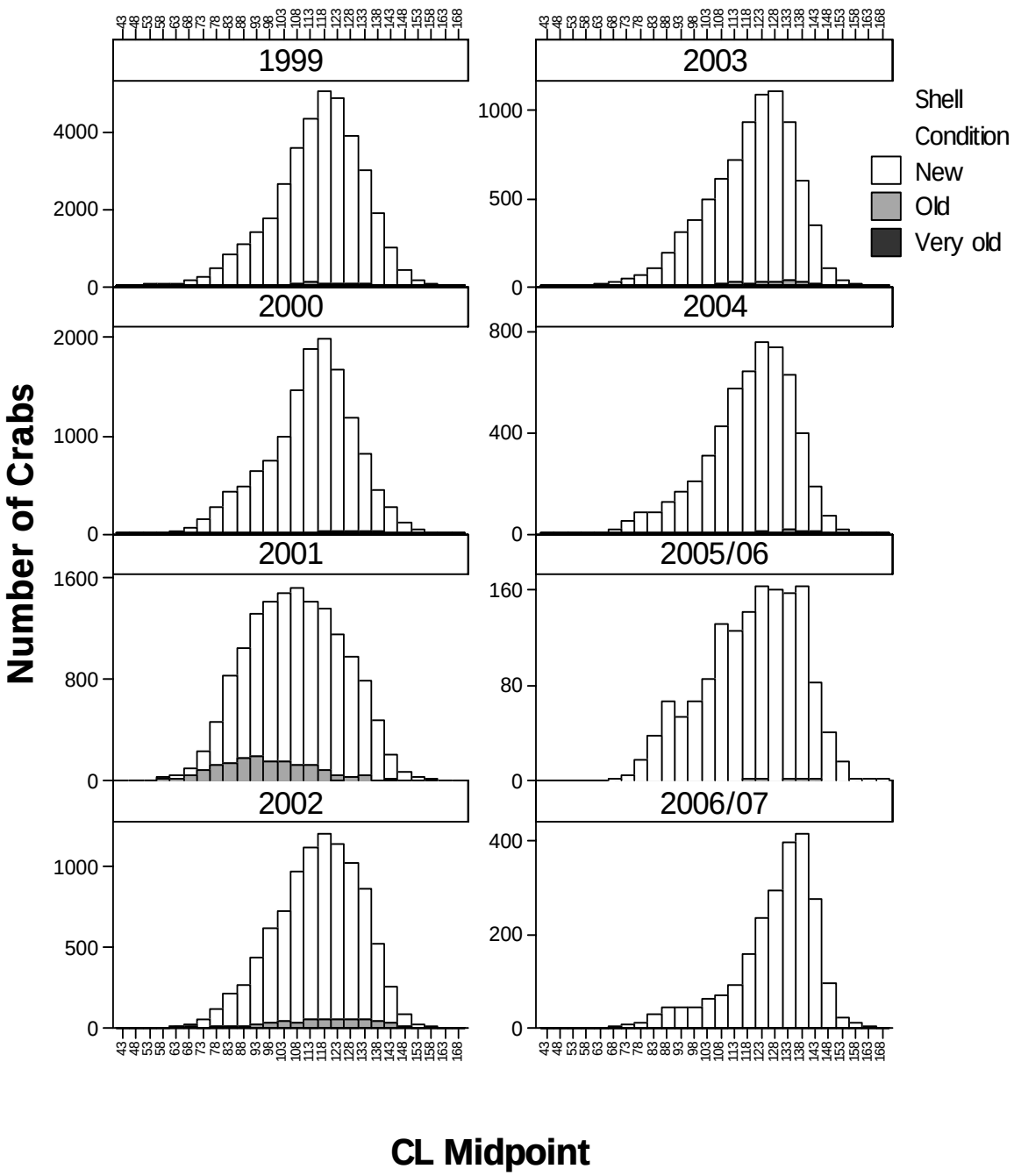


Figure 11.–Carapace length (CL, mm) frequency distributions with corresponding shell condition for female golden king crabs from pot lifts sampled during the 1999-2006/2007 Aleutian Islands golden king crab fisheries east of 174° W longitude.

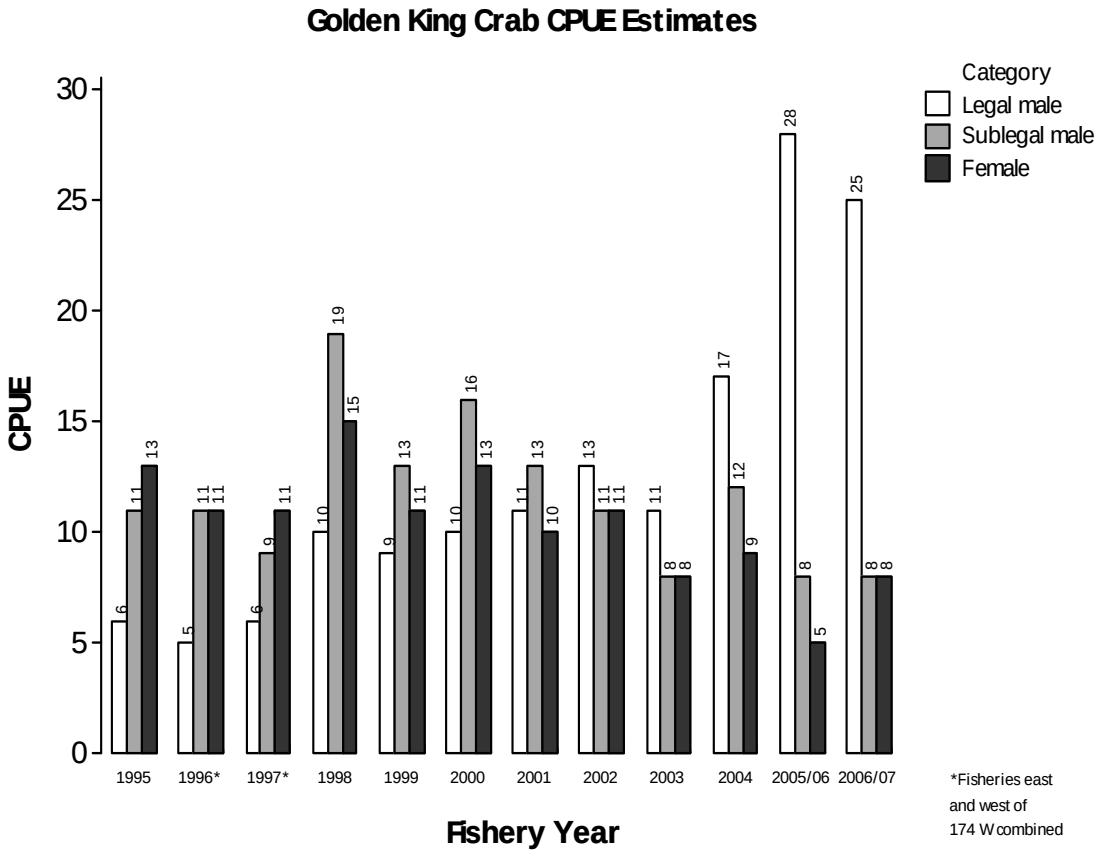


Figure 12.–Estimated CPUE of male golden king crabs from pot lifts sampled during the 1995-2006/2007 Aleutian Islands golden king crab fisheries east of 174° W longitude.

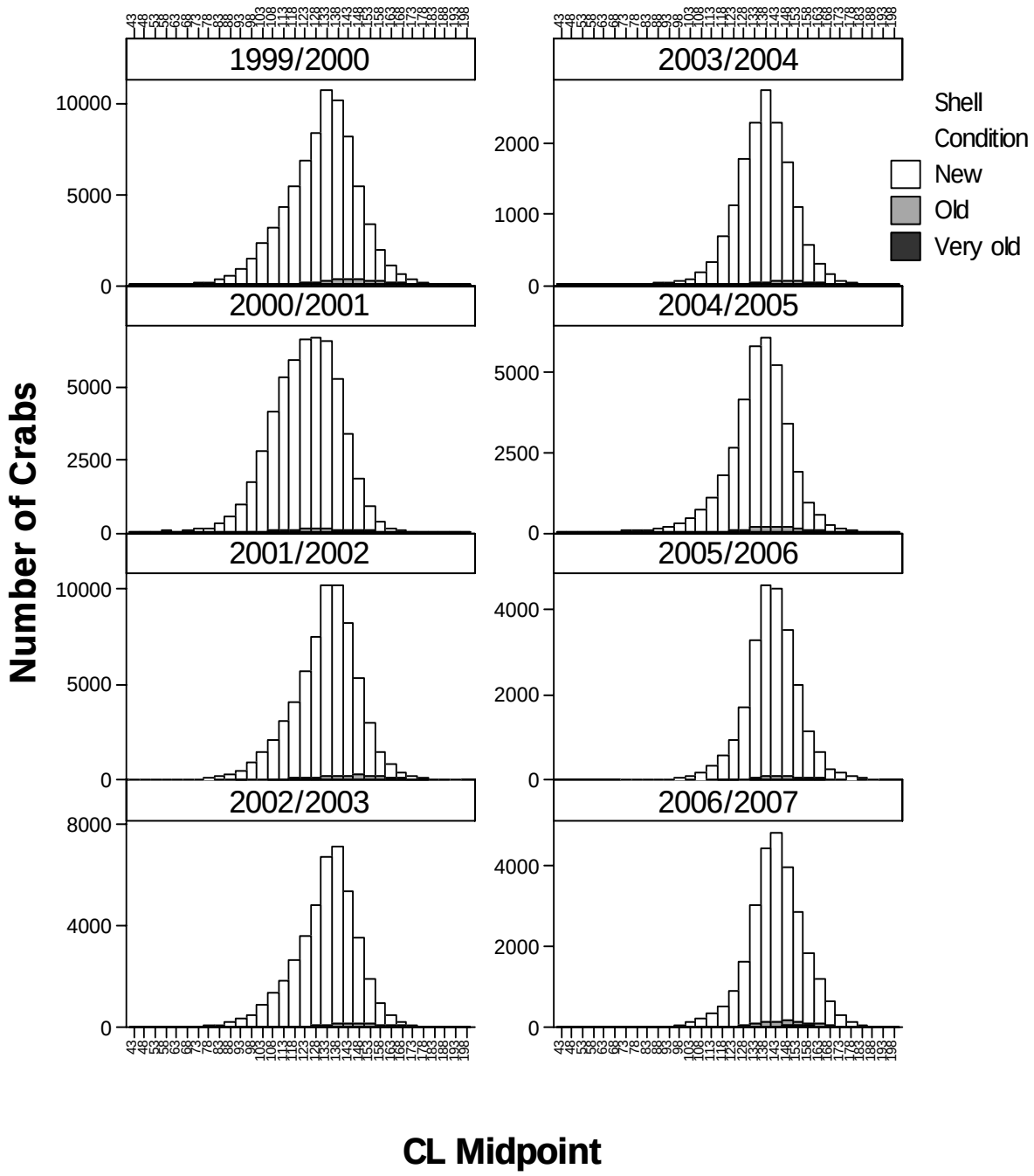


Figure 13.–Carapace length (CL, mm) frequency distributions with corresponding shell condition for male golden king crabs from pot lifts sampled during the1999/2000-2006/2007 Aleutian Islands golden king crab fisheries west of 174° W longitude.

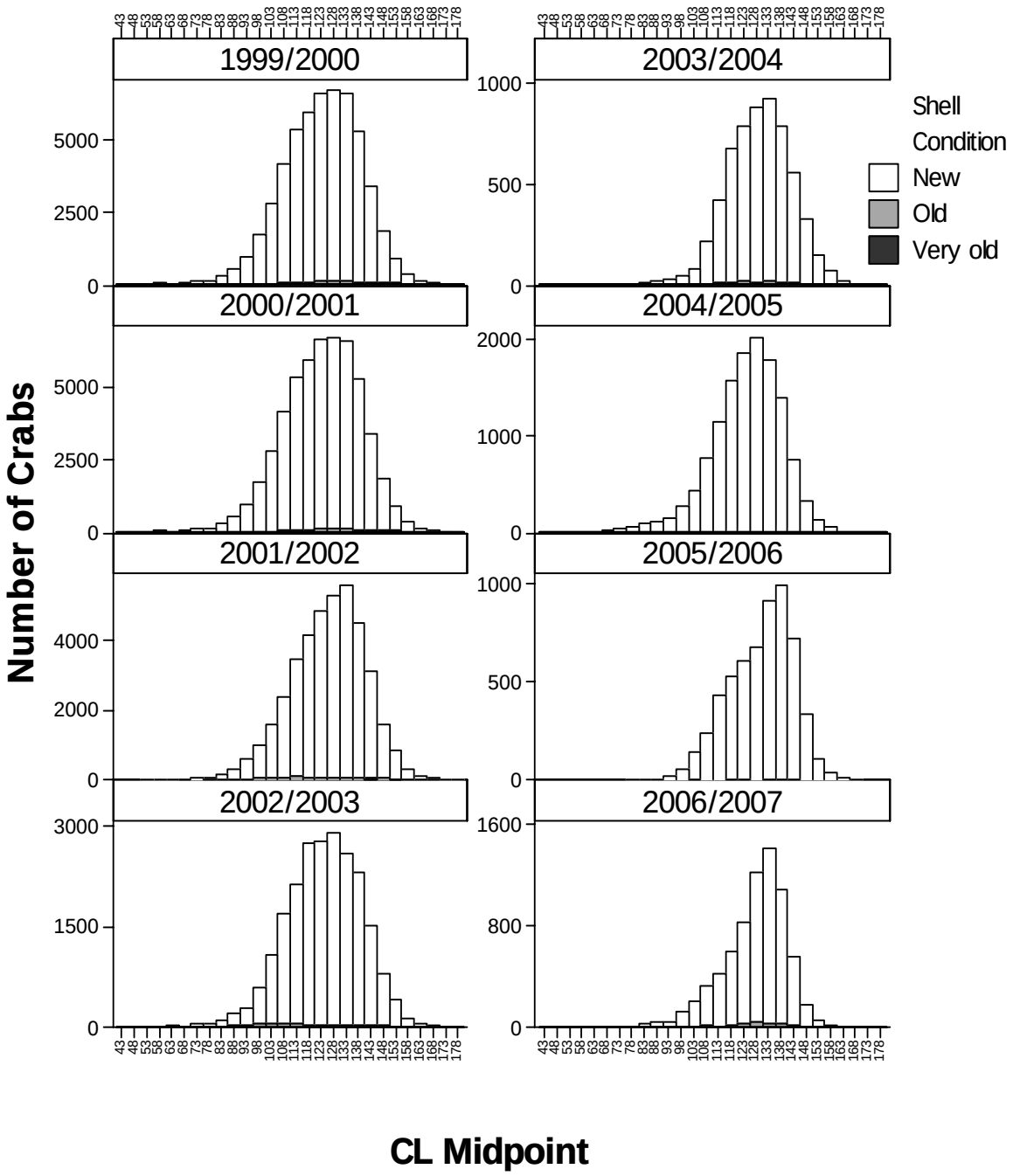


Figure 14.–Carapace length (CL, mm) frequency distributions with corresponding shell condition for female golden king crabs from pot lifts sampled during the 1999/2000-2006/2007 Aleutian Islands golden king crab fisheries west of 174° W longitude.

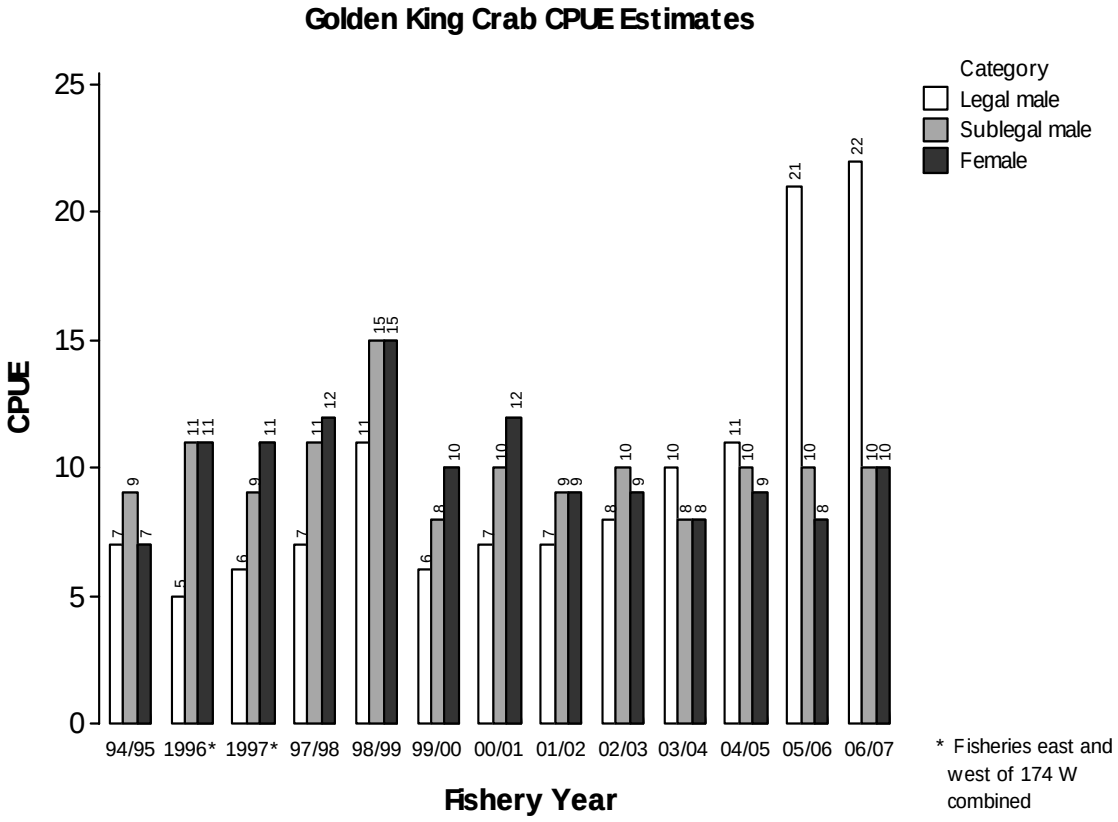


Figure 15.–Estimated CPUE of golden king crabs from pot lifts sampled during the 1994/1995-2006/2007 Aleutian Islands golden king crab fisheries west of 174° W longitude.

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 pot lifts 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-

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

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

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 of type *i*

M_i = number of vessels of type *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

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

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

-continued-

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 of type *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 of type *i*. No weighting was used at this stage as it was assumed that all vessels within a type 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

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

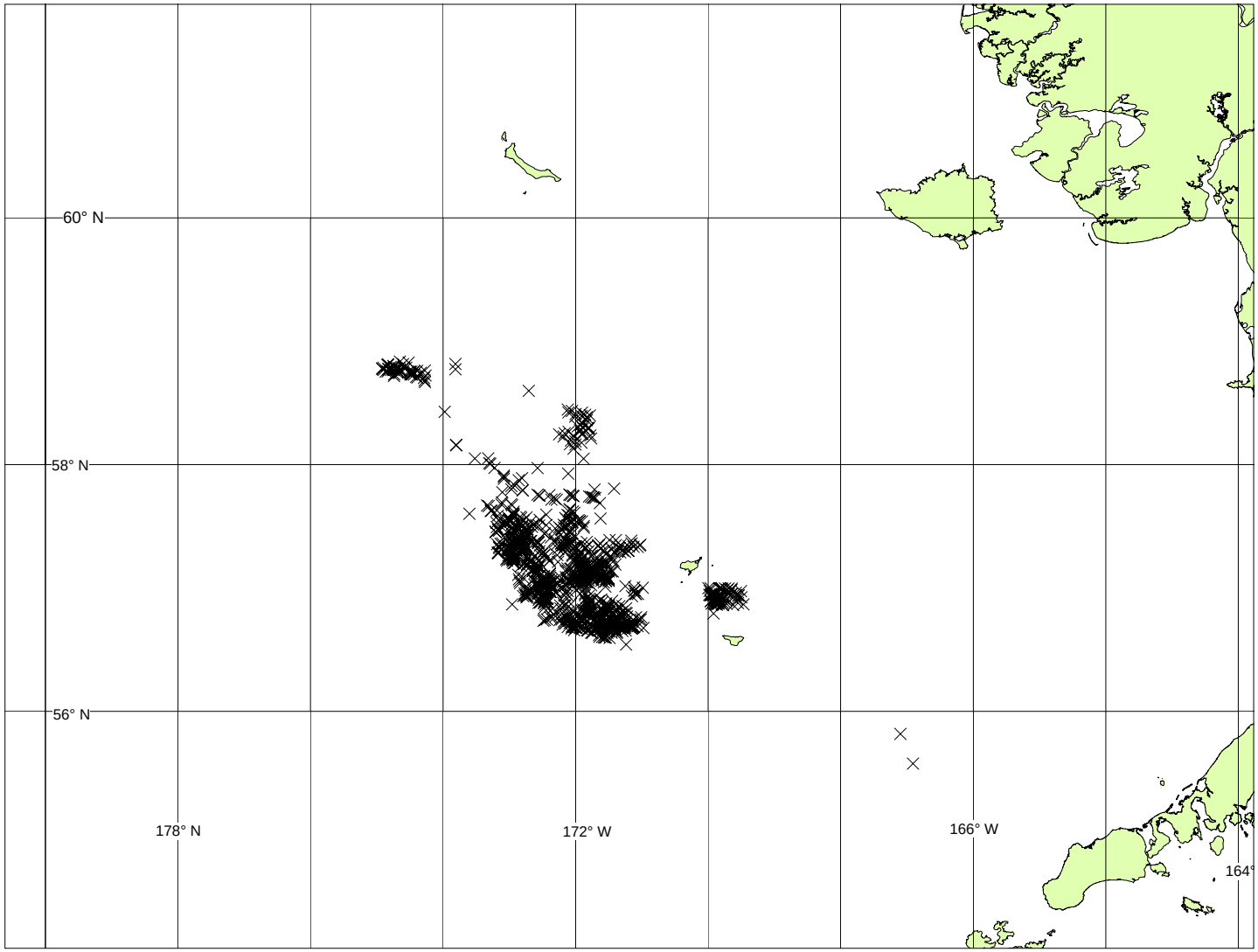
$$= \sum_i \frac{M_i^2}{M_.^2} \left[\left(\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right) + \frac{1}{M_i m_i} \sum_j \left(\sum_k \left[\hat{v}(\bar{c}_{ijk.}) \times \left(\frac{N_{ijk}}{N_{ij.}} \right)^2 \right] \right)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

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

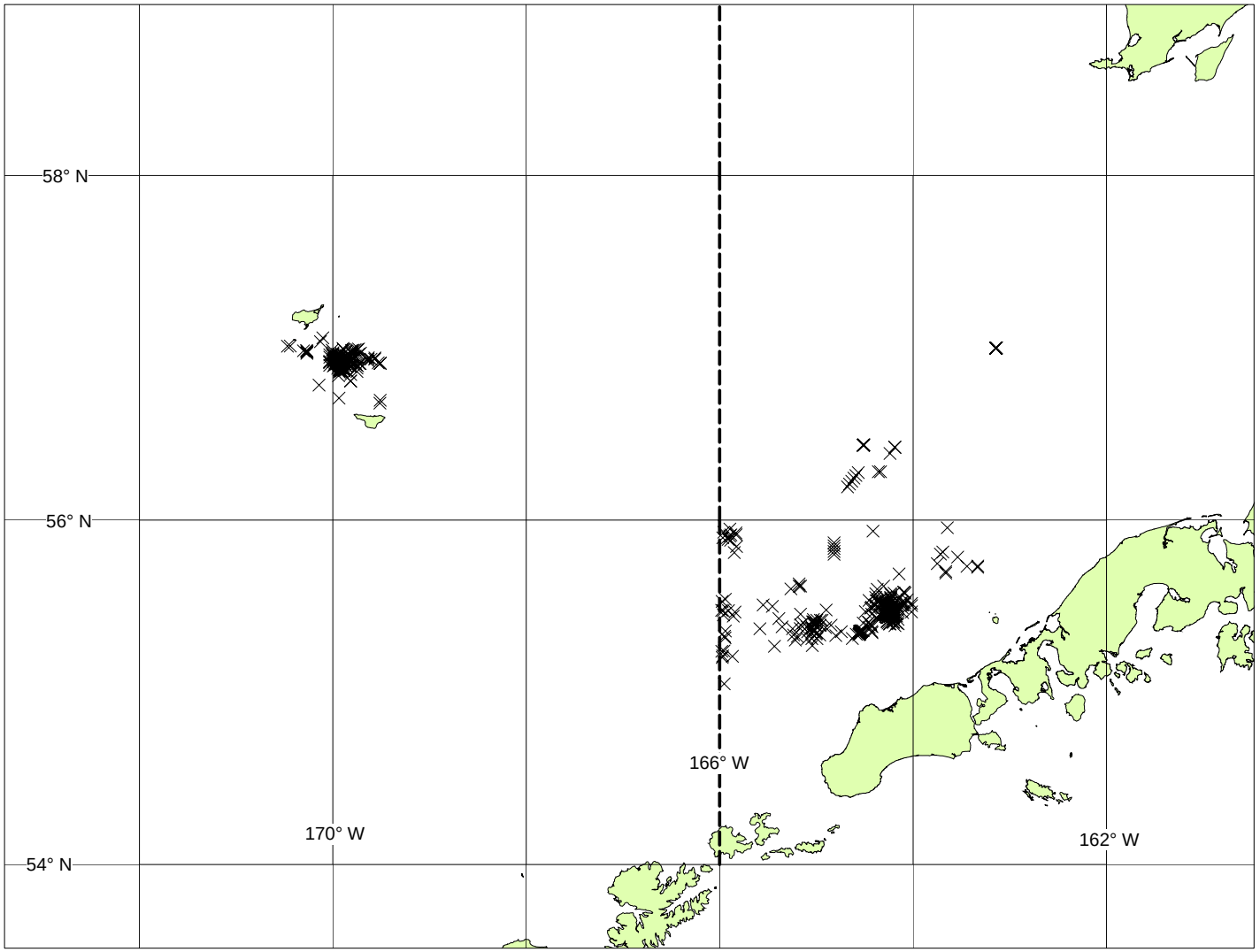
Let $\hat{v}(\bar{a}_i) = \left(\frac{M_i - m_i}{M_i} \times \frac{1}{m_i} \left(\frac{\sum_j (\bar{c}_{ij..} - \bar{c}_{i...})^2}{(m_i - 1)} \right) \right)$ and $\hat{v}(\bar{b}_i) = \left(\frac{1}{M_i m_i} \sum_j \left(\frac{1}{N_{ij.}^2} \sum_k \left[\hat{v}(\bar{c}_{ijk.}) \right] \times N_{ijk}^2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

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)**

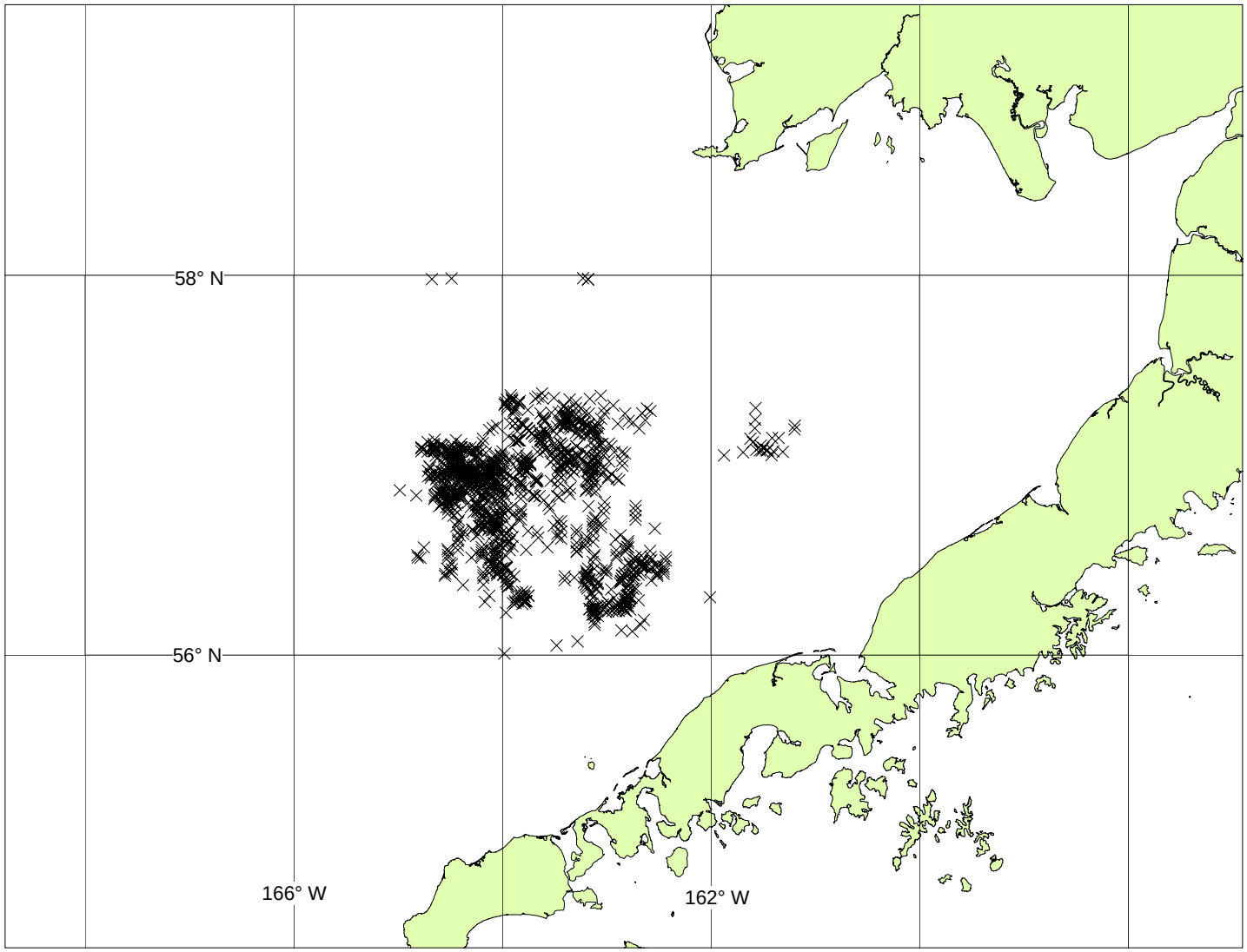
APPENDIX B: LOCATIONS OF SAMPLED POT LIFTS



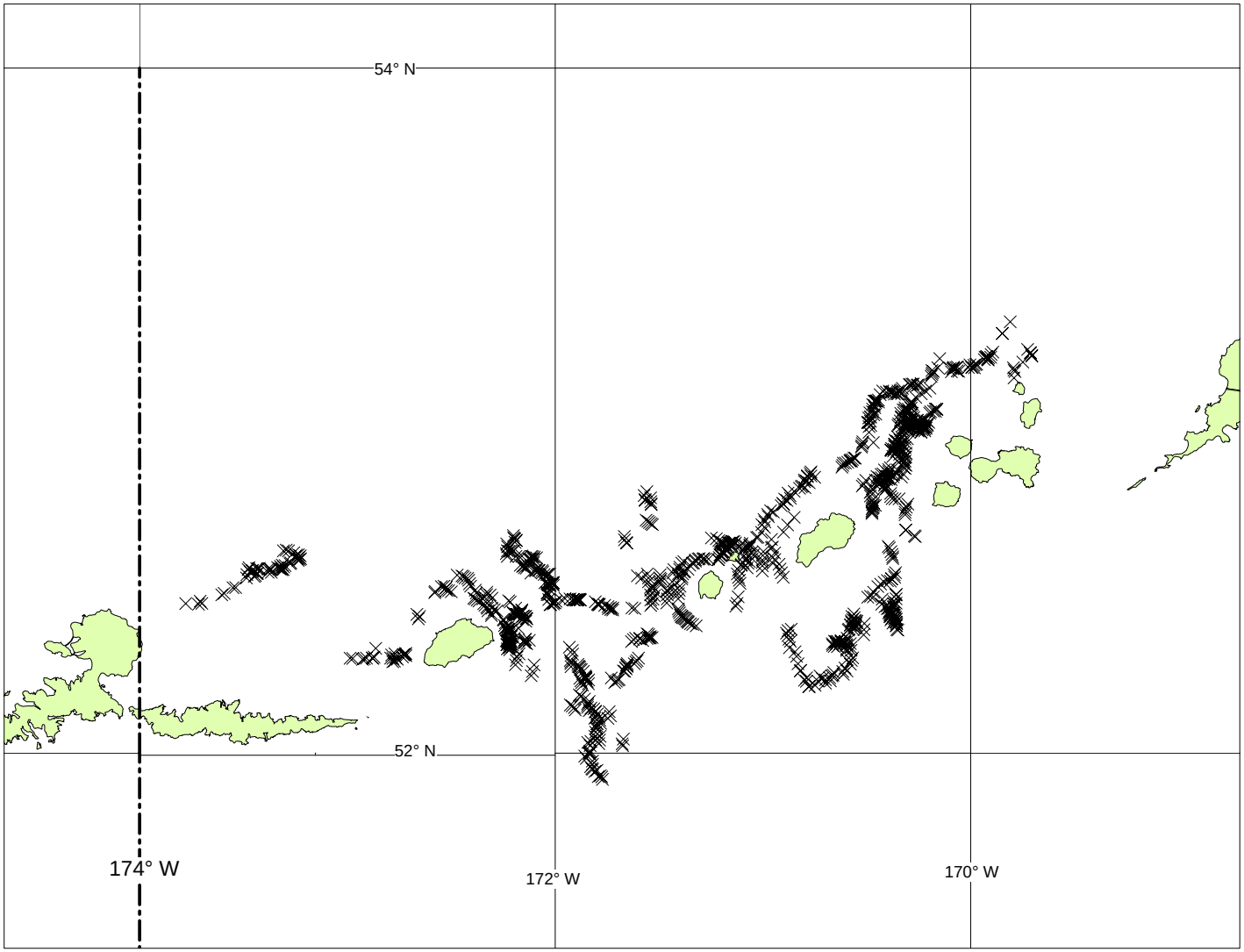
Appendix B1.–Locations of pot lifts sampled by observers during the 2006/2007 Bering Sea snow crab fishery.



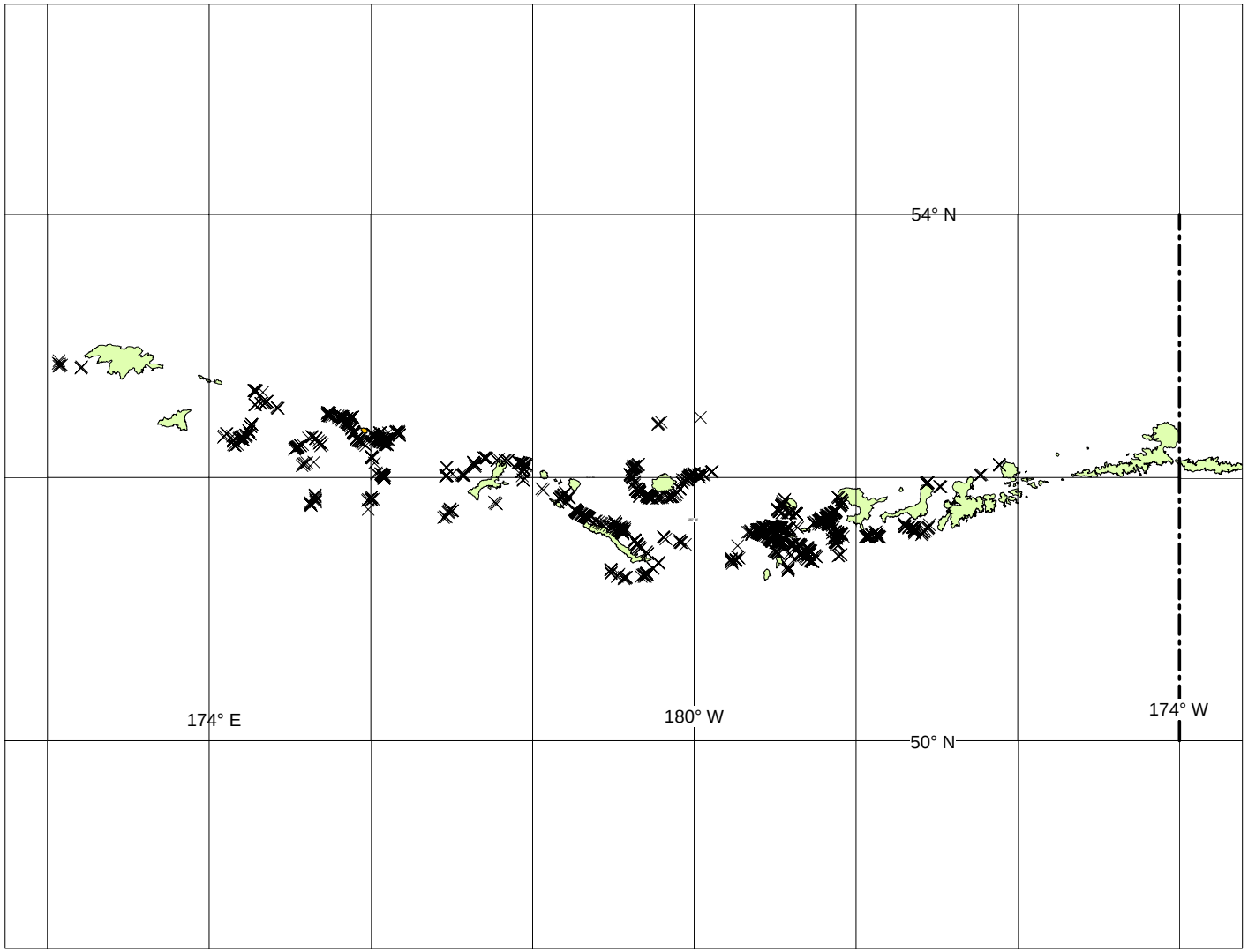
Appendix B2.–Locations of pot lifts sampled by observers during the 2006/2007 Bering Sea Tanner crab fishery east and west of 166° W longitude.



Appendix B3.–Locations of pot lifts sampled by observers during the 2006/2007 Bristol Bay red king crab fishery.



Appendix B4.–Locations of pot lifts sampled by observers during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude.



Appendix B5.–Locations of pot lifts sampled by observers during the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude.

APPENDIX C: ADDITIONAL CATCH AND BIOLOGICAL SUMMARIES

Appendix C1.–Total contents of 1,118 sampled pot lifts taken during the 2006/2007 Bering Sea snow crab fishery.

Species	Total Catch	Species	Total Catch
Snow crab			
Legal males	913,598	Leech (unidentified)	119
Sublegal males	7,185	Hermit crab (unidentified)	53
Females	137	Yellow Irish lord	37
		Basket star (unidentified)	28
Tanner/Snow crab hybrid		Sea anemone (unidentified)	22
Legal males	1,706	Pacific Lyre crab	15
Sublegal males	228	Dover sole	7
Females	10	Flathead sole	6
		Octopus	6
Tanner crab		Pacific halibut	6
Legal males	6,992	Arrowtooth flounder	3
Sublegal males	30,792	Sea jelly (unidentified)	3
Females	5,559	Walleye pollock	3
		Butter sole	2
Hair crab		Flatfish (unidentified)	2
Legal males	1	Great sculpin	2
Sublegal males	1	Sea cucumber (unidentified)	2
Females	0	Skate (unidentified)	2
		Alaska plaice	1
Snail (unidentified)	5,854	Mussel (unidentified)	1
Pacific cod	488	Prow fish	1
Sea star (unidentified)	225	Sea urchin (unidentified)	1
Sculpin (unidentified)	181	Starry flounder	1
Yellow fin sole	142		

Appendix C2.–Mean snow crab CPUE by soak times for 1,116 sampled pot lifts taken during the 2006/2007 Bering Sea snow crab fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
1-12	0.5	101.8	91.2	2.8	0.2	196.0
13-24	6.7	294.5	164.2	3.8	0.1	462.6
25-36	25.4	282.8	150.2	3.7	0.1	436.8
37-48	28.9	315.4	182.9	5.8	0.1	504.2
49-60	10.8	328.4	191.1	3.8	0.2	523.4
61-72	5.0	329.9	171.4	7.8	0.1	509.3
73-84	4.3	323.8	155.9	5.8	< 0.1	485.6
85-96	2.8	424.5	213.8	6.0	0.1	644.3
97-108	3.3	338.1	221.3	5.3	0	564.8
109-120	2.8	351.8	222.3	2.4	< 0.1	576.6
121-132	0.6	495.3	223.1	6.3	0	724.7
133-144	0.8	361.7	260.7	8.4	2.6	633.3
145-156	1.1	470.5	241.6	3.3	0.1	715.5
157-168	1.1	404.3	276.7	3.4	0.2	684.5
169-180	0.7	394.5	184.1	2.1	0	580.8
181-192	1.2	376.2	192.1	3.3	0	571.6
193-204	0.6	348.4	224.1	4.4	0	577.0
205-216	0.5	373.7	218.3	2.3	0.5	594.8
217-228	0.7	387.6	154.4	4.9	0	546.9
229-240	0.9	348.3	169.2	2.1	0.3	519.9
241-252	0.1	397.0	220.0	4.0	0	621.0
253-264	0.1	306.0	253.0	0.0	0	559.0
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337-348	0.4	404.3	104.3	6.3	0	514.8
349-360	0.4	395.8	115.0	1.8	0	512.5
361-372	--	--	--	--	--	--
373-384	0.2	356.5	162.0	2.5	0	521.0
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409-420	0.2	291.0	236.0	0	0	527.0

[a] Mean soak time = 63.6 hours

Appendix C3.–Mean snow crab CPUE by depth for 1,112 sampled pot lifts taken during the 2006/2007 Bering Sea snow crab fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
31-35	1.8	15.8	23.3	0.2	0	39.2
36-40	4.8	8.3	21.2	0.9	0	30.4
41-45	0.1	0	0	0	0	0.0
46-50	0.9	306.9	105.6	1.2	0	413.7
51-55	3.9	375.0	259.0	10.2	1.0	645.1
56-60	18.7	406.7	218.7	5.2	0.1	630.7
61-65	43.3	320.0	168.5	3.8	0.1	492.5
66-70	20.2	313.7	177.3	7.2	0.1	498.2
71-75	3.4	372.9	241.6	3.2	0	617.7
76-80	1.5	379.3	287.2	4.5	0	670.9
81-85	1.2	442.6	218.3	0.5	0	661.4
86-90	0.1	307.0	236.0	3.0	0	546.0
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111-115	0.1	288.0	496.0	27.0	1.0	812.0

[a] Mean depth = 61.9 fathoms

Appendix C4.–Reproductive condition of female snow crabs from pot lifts sampled during the 1995-2006/2007 Bering Sea snow crab fisheries.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (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
2005[a]	9	88.9	11.1	0	0
2005/06	129	6.2	89.2	2.3	2.3
2006/07	57	84.2	14.0	0	1.8

[a] Pre-rationalized

Appendix C5.–Total pot lift contents for 141 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery west of 166° W longitude.

Species	Total Catch	Species	Total Catch
Tanner crab		Hair crab	
Legal male	12,130	Legal male	2
Sublegal male	20,222	Sublegal male	1
Female	10,768	Female	0
Snow crab			
Legal male	889	Sea star (unidentified)	317
Sublegal male	13	Yellowfin sole	123
Female	0	Yellow Irish lord	96
		Sculpin (unidentified)	60
Tanner x snow crab hybrid		Pacific cod	31
Legal male	2	Pacific Lyre crab	23
Sublegal male	94	Snail (unidentified)	23
Female	3	Brittle star (unidentified)	5
		Hermit crab (unidentified)	3
		Flathead sole	2
Red king crab		Hydroid (unidentified)	2
Legal male	3	Rock sole (unidentified)	2
Sublegal male	1	Sea cucumber (unidentified)	2
Female	9	Graceful decorator crab	1
		Pacific halibut	1
Blue king crab		Snailfish (unidentified)	1
Legal male	0		
Sublegal male	0		
Female	1		

Appendix C6.–Mean Tanner crab CPUE by soak times for 141 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery west of 166° W longitude.

Soak Hours[a]	Percent of Sampled Pots	Catch per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
1-12	1.4	9.0	2.0	29.5	55.0	95.5
13-24	21.3	29.9	2.5	111.0	141.2	284.5
25-36	22.7	42.2	2.9	149.5	106.3	300.9
37-48	21.3	41.9	5.8	146.7	60.3	254.6
49-60	4.3	19.5	0.0	108.3	9.8	137.7
61-72	7.1	52.1	1.2	173.6	34.2	261.1
73-84	5.0	57.1	0.7	174.0	25.9	257.7
85-96	3.5	54.0	0.2	168.0	45.2	267.4
97-108	2.1	51.7	0.0	170.7	15.3	237.7
109-120	2.1	61.7	0.3	242.3	0.7	305.0
121-132	3.5	52.8	1.0	184.8	15.2	253.8
133-144	--	--	--	--	--	--
145-156	0.7	15.0	1.0	65.0	3.0	84.0
157-168	3.5	56.0	5.0	141.6	24.0	226.6
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205-216	1.4	68.5	3.5	134.0	78.0	284.0

[a] Mean soak time = 54.0 hours.

Appendix C7.–Mean Tanner crab CPUE by depth for 141 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery west of 166° W longitude.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch per Sampled Pot				
		Legal Retained	Legal Not Retained	Sublegal	Female	Total
021-025	0.7	36.0	1.0	93.0	0.0	130.0
031-035	15.6	37.6	7.5	101.9	8.5	155.5
036-040	80.1	44.3	2.1	158.0	93.6	298.0
041-045	3.5	0.0	0.0	6.4	0.2	6.6

[a] Mean depth = 37.1 fathoms

Appendix C8.–Reproductive condition of female Tanner crabs from pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery west of 166° W longitude.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (percent)
2005/06	1,101	21.9	75.8	0.6	1.6
2006/07	2,859	25.9	73.5	0.5	< 0.1

Appendix C9.–Total pot lift contents for 280 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery east of 166° W longitude.

Species	Total Catch	Species	Total Catch
Tanner crab		Pacific cod	100
Legal male	22,763	Sea anemone (unidentified)	92
Sublegal male	16,079	Hermit crab (unidentified)	85
Female	3,437	Sponge (unidentified)	63
		Pribilof Neptune	39
Snow crab		Hairy triton	22
Legal male	2,204	Sea jelly (unidentified)	12
Sublegal male	137	Pacific halibut	8
Female	1	Walleye pollock	8
		Flatfish (unidentified)	6
Red king crab		Sea pen (unidentified)	6
Legal male	55	Angled buccinum	5
Sublegal male	95	Great sculpin	4
Female	18	Weathervane scallop	4
		Invertebrate (unidentified)	3
Tanner x snow crab hybrid		Basket star (unidentified)	2
Legal male	38	Giant octopus	2
Sublegal male	51	Sea star (unidentified)	2
Female	2	Brittle star (unidentified)	1
		Bryozoan (unidentified)	1
		Flathead sole	1
Snail (unidentified)	1,903	Lyre whelk	1
Yellowfin sole	308	Rockfish (unidentified)	1
Pacific Lyre crab	132	Worm (unidentified)	1

Appendix C10.–Mean CPUE by soak times for 280 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery east of 166° W longitude.

Soak Hours[a]	Percent of Sampled Pots	Catch per Sampled Pot			
		Legal	Sublegal	Female	Total
1-12	0.4	0	2.0	1.0	3.0
13-24	31.4	39.4	80.8	19.2	139.4
25-36	33.9	47.6	47.1	10.9	105.5
37-48	16.1	36.9	37.8	12.0	86.7
49-60	3.9	12.6	35.5	3.5	51.7
61-72	1.1	43.0	67.7	7.0	117.7
73-84	1.4	33.0	55.3	1.8	90.0
85-96	0.4	4.0	0	0	4.0
97-108	0.7	10.5	2.5	0	13.0
109-120	1.8	7.2	14.6	0	21.8
121-132	1.8	67.6	261.0	2.0	330.6
133-144	1.4	37.0	26.0	4.5	67.5
145-156	0.7	3.0	8.0	0.0	11.0
157-168	4.3	43.8	24.0	4.7	72.5
169-180	0.4	196.0	92.0	6.0	294.0
181-192	0.4	172.0	86.0	16.0	274.0

[a] Mean soak time = 44.3 hours.

Appendix C11.–Mean CPUE by depth for 279 pot lifts sampled during the 2006/2007 Bering Sea Tanner crab fishery east of 166° W longitude.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch per Sampled Pot			
		Legal	Sublegal	Female	Total
31-35	2.5	0.4	3.6	0.4	4.4
46-50	6.5	9.3	7.6	5.5	22.3
51-55	61.3	49.1	36.3	15.2	100.6
56-60	15.8	29.1	61.2	4.7	95.0
61-65	8.6	53.3	162.7	10.5	226.5
66-70	4.7	23.2	218.0	18.7	259.9
71-75	0.7	21.5	125.5	19.0	166.0

[a] Mean depth = 55.0 fathoms.

Appendix C12.–Reproductive condition of female Tanner crabs from pot lifts sampled during the 2005/2006 Bering Sea Tanner crab fishery east of 166° W longitude.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (percent)
2006/07	1,573	95.6	2.9	0.8	0.6

Appendix C13.–Total contents of 1,215 pot lifts sampled during the 2006/2007 Bristol Bay red king crab fishery.

Species	Total Catch	Species	Total Catch
Red king crab		Yellowfin sole	1,323
Legal male	74,448	Snail (unidentified)	1,067
Sublegal male	28,504	Pacific cod	412
Female	3,646	Sea star (unidentified)	284
		Hermit crab (unidentified)	191
Tanner crab		Sculpin (unidentified)	98
Legal male	243	Brittle star (unidentified)	54
Sublegal male	574	Great sculpin	52
Female	72	Tunicate (unidentified)	40
		Pacific halibut	29
Snow crab		Sea jelly (unidentified)	20
Legal male	169	Bigmouth sculpin	15
Sublegal male	8	Basket star (unidentified)	11
Female	1	Flatfish (unidentified)	11
		Pacific Lyre crab	8
Tanner x snow crab hybrid		Black rockfish	7
Legal male	22	Leech (unidentified)	6
Sublegal male	9	Shrimp (unidentified)	3
Female	1	Arrowtooth flounder	2
		Hairy triton	2
Hair crab		Rockfish (unidentified)	2
Legal male	0	Skate (unidentified)	2
Sublegal male	1	Sponge (unidentified)	2
Female	1	Walleye pollock	2
		Bivalve (unidentified)	1
Blue king crab		Flathead sole	1
Legal male	1	Humpy shrimp	1
Sublegal male	2	Invertebrate (unidentified)	1
Female	0	Sand sole	1
		Scale worm (unidentified)	1
		Sea cucumber (unidentified)	1
		Starry flounder	1

Appendix C14.–Mean CPUE by soak times for 1,208 pot lifts sampled during the 2006/2007 Bristol Bay red king crab fishery.

Soak Hours[a]	Percent of Sampled Pots	Catch per Sampled Pot			
		Legal	Sublegal	Female	Total
1-12	0.8	3.5	2.6	0.1	6.2
13-24	13.2	19.9	35.1	7.5	62.5
25-36	24.6	26.6	24.0	3.0	53.6
37-48	31.3	31.8	18.6	3.0	53.4
49-60	14.7	35.2	18.8	1.0	55.1
61-72	2.1	45.1	46.6	3.6	95.3
73-84	0.7	32.8	15.6	0.4	48.8
85-96	1.9	34.3	23.9	0.3	58.5
97-108	2.1	41.5	32.8	0.8	75.2
109-120	1.5	56.3	26.2	2.1	84.6
121-132	1.2	42.9	27.4	1.0	71.3
133-144	1.5	50.1	23.5	0.4	74.1
145-156	1.3	47.5	19.1	0.9	67.6
157-168	0.7	52.7	23.1	0.1	75.9
169-180	0.6	39.6	41.6	0.9	82.0
181-192	0.7	47.1	25.9	0.7	73.7
193-204	0.7	45.0	25.1	0.9	71.0
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289-300	0.1	54.0	31.0	0	85.0
301-312	0.1	70.0	13.0	1.0	84.0
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349-360	0.2	72.3	18.7	1.3	92.3

[a] Mean soak time =51.1 hours.

Appendix C15.–Mean CPUE by depth for 1,207 pot lifts sampled during the 2006/2007 Bristol Bay red king crab fishery.

Depth[a] (fathoms)	Percent of Sampled Pots	Catch per Sampled Pot			
		Legal	Sublegal	Female	Total
21-25	0.3	4.0	0.5	0	4.5
26-30	4.6	33.6	34.3	8.4	76.2
31-35	21.2	38.0	24.7	3.9	66.5
36-40	50.5	32.1	21.0	1.5	54.6
41-45	19.4	23.1	28.7	5.4	57.3
46-50	4.0	24.1	13.8	0.2	38.1

[a] Mean depth = 37.5 fathoms.

Appendix C16.–Reproductive condition of female red king crabs from pot lifts sampled during the 1996-2006/2007 Bristol Bay red king crab fisheries.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (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
2005/06	26,753	41.3	45.0	0.2	13.4
2006/07	3,586	16.5	32.5	1.4	49.5

Appendix C17.–Total pot lift contents for 1,097 pot lifts sampled during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude.

Species	Total Catch	Species	Total Catch
Golden king crab		*Errinopora* spp	10
Legal male	27,264	Plexauridae (unidentified)	9
Sublegal male	8,993	Tunicate (unidentified)	9
Female	8,398	*Calcigorgia* spp.	7
		Scale worm (unidentified)	7
Scarlet king crab		Sea anemone (unidentified	6
Legal male	11	Feather star (unidentified)	6
Sublegal male	0	Arrowtooth flounder	5
Female	0	*Clavularia* spp.	5
		Sculpin (unidentified)	5
		Atka mackerel	4
Basket star (unidentified)	385	Sea jelly (unidentified)	4
Sponge (unidentified)	337	Red tree coral	4
Hydroid (unidentified)	170	Cup coral (unidentified)	2
Stylaster spp.	153	Great sculpin	2
Sea star (unidentified)	138	Pacific ocean perch	2
Brittle star (unidentified)	113	Red banded rockfish	2
Skate (unidentified)	77	Rockfish (unidentified)	2
Sea urchin (unidentified)	62	Sea pen (unidentified)	2
Primnoa Group I	38	Sea spider (unidentified)	2
Cyclohelia spp.	36	Bigmouth sculpin	1
Snail (unidentified)	33	*Caryophyllia* sp.	1
Primnoidae (unidentified)	32	Chiton (unidentified)	1
Fanellia spp.	28	Grenadier (unidentified)	1
Distichopora spp.	27	*Javania* sp.	1
Bryozoan (unidentified)	23	Neptune snail (unidentified)	1
Pacific cod	23	Lyre crab	1
Paragorgia spp.	20	Shortspine thornyhead	1
Anthomastus spp.	17	Shrimp (unidentified)	1
Crypthelia spp.	13	Soft coral (unidentified)	1
Arthrogorgia spp.	11	Worm (unidentified)	1
Pacific halibut	11	Yellow Irish lord	1

Appendix C18.–Mean CPUE by soak times for 1,097 pot lifts sampled during the 2006/2007 Aleutian Islands golden king crab fishery east of 174° W longitude.

Soak Hours[a]	Percent of Sampled Pots	Catch per Sampled Pot			
		Legal	Sublegal	Female	Total
1-48	0.3	3.0	3.0	7.0	13.0
49-96	2.2	13.6	5.9	5.2	24.7
97-144	5.2	17.1	6.4	9.4	32.9
145-192	12.6	19.6	10.1	7.2	36.9
193-240	22.5	27.1	8.2	11.7	46.9
241-288	20.7	27.0	9.0	7.8	43.8
289-336	11.0	24.6	8.7	5.0	38.2
337-384	12.9	26.3	7.1	4.4	37.8
385-432	5.6	24.5	7.6	9.8	41.8
433-480	3.7	29.3	6.7	2.3	38.3
481-528	0.5	29.2	7.5	10.8	47.5
529-576	1.5	33.9	7.4	4.3	45.6
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673-720	0.5	9.8	1.2	0	11.0
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913-960	0.7	28.8	9.6	2.8	41.1

[a] Mean soak time = 277.0 hours.

Appendix C19.–Mean CPUE by depth for 1,097 pot lifts sampled during the 2006/2007 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
76-100	4.4	21.1	6.4	3.2	30.8
101-125	18.6	27.5	7.8	5.9	41.2
126-150	12.5	23.7	5.7	7.1	36.5
151-175	12.5	25.0	7.2	8.3	40.5
176-200	11.1	23.7	8.0	10.3	42.1
201-225	10.8	23.2	8.5	8.0	39.7
226-250	10.5	21.9	7.8	8.7	38.3
251-275	11.3	25.0	10.8	6.2	42.0
276-300	6.6	28.5	13.5	12.0	53.9
301-325	1.3	31.1	7.6	2.2	40.9
326-350	0.4	38.8	2.3	13.8	54.8
351-375	0.1	29.0	1.0	4.0	34.0

[a] Mean depth = 185.5 fathoms.

Appendix C20.–Reproductive condition of female golden king crabs from pot lifts sampled during the 1996-2005/2006 Aleutian Islands golden king crab fisheries east of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (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
2005/06	1,489	25.8	25.2	18.3	30.7
2006/07	2,328	29.6	35.7	9.1	25.6

Appendix C21.–Total pot lift contents for 1,812 pot lifts sampled during the 2006/2007 Aleutian Islands golden king crab fishery west of 174° W longitude.

Species	Total Catch	Species	Total Catch
Golden king crab			
Legal male	25,3321	Buccinum snail (unidentified)	15
Sublegal male	1,383	Sculpin (unidentified)	14
Female	13,107	*Crypthelia* spp.	13
		Barnacle (unidentified)	10
Red king crab		*Clavularia* spp.	10
Legal male	1	Rockfish (unidentified)	8
Sublegal male	33	Sablefish	8
Female	20	Feather star (unidentified)	8
		Octopus	7
Scarlet king crab		*Paragorgia* spp.	7
Legal male	17	Pacific cod	7
Sublegal male	4	Primnoidae (unidentified)	6
Female	0	Coral (unidentified)	5
		Sea anemone (unidentified)	5
Hair crab		Sea spider (unidentified)	5
Legal male	1	Invertebrate (unidentified)	4
Sublegal male	1	Sea pen (unidentified)	4
Female	0	Skate (unidentified)	4
		Atka mackerel	3
		Hydrocoral (unidentified)	3
Sponge (unidentified)	353	Scallop (unidentified)	3
Brittle star (unidentified)	231	Sea cucumber (unidentified)	3
Stylaster spp.	182	Arrowtooth flounder	2
Basket star (unidentified)	165	*Caryophyllia* spp.	2
Hydroid (unidentified)	141	Cup coral (unidentified)	2
Primnoa Group I	110	*Lillipathes* sp.	2
Sea urchin (unidentified)	101	Pacific halibut	2
Sea star (unidentified)	69	Bivalve (unidentified)	1
Snail (unidentified)	44	*Errinopora* sp.	1
Fanellia spp.	37	Graceful decorator crab	1
Anthomastus spp.	32	Grenadier (unidentified)	1
Oregon triton	32	Hermit crab (unidentified)	1
Distichopora spp.	31	Sea jelly (unidentified)	1
Arthrogorgia spp.	29	Pacific lyre crab	1
Bryozoan (unidentified)	26	Prickle back (unidentified)	1
Plexauridae (unidentified)	25	Sea raspberry	1
Cyclohelia spp.	21	Shrimp (unidentified)	1
Calcigorgia spp.	20	Snailfish (unidentified)	1
Tunicate (unidentified)	18	Soft coral (unidentified)	1
Red tree coral	16	Worm (unidentified)	1

Appendix C22.–Mean CPUE by soak times for 1,182 pot lifts sampled during the 2006/2007 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
97-144	4.9	7.8	6.8	4.6	19.2
145-192	7.7	13.2	9.3	8.7	31.2
193-240	10.7	13.8	13.8	17.2	44.8
241-288	3.6	15.2	7.1	4.6	26.9
289-336	9.2	19.1	11.0	14.1	44.2
337-384	13.4	19.8	12.0	15.2	47.1
385-432	12.4	24.9	10.4	15.1	50.4
433-480	1.7	19.7	9.7	14.4	43.8
481-528	7.7	30.3	8.6	8.4	47.3
529-576	3.0	22.0	6.1	2.4	30.4
577-624	0.3	57.0	6.7	6.7	70.3
625-672	0.4	45.6	15.6	0.6	61.8
673-720	2.5	29.9	5.4	12.0	47.3
721-768	0.8	28.8	3.1	26.6	58.5
769-816	11.1	29.9	9.2	7.1	46.2
817-864	6.3	25.7	8.4	6.9	41.1
865-912	2.8	16.4	2.3	1.2	19.9
913-960	0.6	27.4	2.9	28.9	59.1
961-1008	0.3	70.3	13.8	16.8	100.8
1009-1056	0.2	3.0	0.5	0	3.5
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1249-1296	0.5	1.5	0	0.2	1.7

[a] Mean soak time = 455.9 hours.

Appendix C23.–Mean CPUE by depth for 1,182 pot lifts sampled during the 2006/2007 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
76-100	1.0	27.4	15.1	3.6	46.1
101-125	6.6	23.4	10.2	8.1	41.6
126-150	23.3	24.1	8.0	9.2	41.3
151-175	23.3	21.0	9.1	9.8	39.9
176-200	19.7	19.3	10.3	10.4	40.0
201-225	14.0	19.4	12.5	18.6	50.5
226-250	8.2	21.8	9.3	13.7	44.9
251-275	3.1	20.6	6.8	8.3	35.6
276-300	0.6	10.6	5.0	5.4	21.0
301-325	0.1	17.0	1.0	9.0	27.0
326-350	--	--	--	--	--
351-375	0.1	2.0	0	0	2.0

[a] Mean depth = 175.7 fathoms.

Appendix C24.–Reproductive condition of female golden king crabs from pot lifts sampled during the 1996/1997-2005/2006 Aleutian Islands golden king crab fisheries west of 174° W longitude.

Year	Crabs Sampled	Eyed Eggs (percent)	Uneyed Eggs (percent)	Barren, Mated (percent)	Barren, Non-mated (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
2005/2006	5,798	35.2	33.5	21.7	9.6
2006/2007	7,136	31.6	36.0	19.3	13.0

APPENDIX D: RESULTS OF LEGAL TALLY SAMPLES

Appendix D1.–Results of legal tally samples taken during the 2006/2007 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	86,697	0.02	0.00	0.09	0.11	32,116
Bering Sea Tanner crab west of 166° W	6,511	0.97	0.00	0.00	0.97	3,296
Bering Sea Tanner crab east of 166° W	5,741	0.70	0.00	0.00	0.70	4,079
Bristol Bay red king crab	24,862	0.30	0.02	0.01	0.32	7,818
Aleutian Islands golden king crab	56,102	0.49	0.02	0.00	0.51	6,074

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