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ALASKA DEPARTMENT OF FISH AND GAME  
SUMMARY OF THE 1995 MANDATORY SHELLFISH  
OBSERVER PROGRAM DATABASE



Regional Information Report No. 4K96-47

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

October 1996



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SUMMARY OF THE 1995 MANDATORY SHELLFISH  
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By

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## INTRODUCTION

During the spring of 1988, the Alaska Board of Fisheries (BOF) mandated at-sea observer coverage for all vessels commercially processing king and *Chionoecetes bairdi* (Tanner) crab in Alaskan waters. Since then, the BOF has amended state shellfish regulations to include observer coverage in the Bering Sea *C. opilio* fishery. Regulations requiring observers on all vessels fishing king crab in the Aleutian Islands were passed in the spring of 1995. In addition, board members granted authority to the Alaska Department of Fish & Game (ADF&G) to place observers on commercial vessels participating in other Alaskan shellfisheries when such action would facilitate the only means to collect biological and fishery management data. In recent years that has included all vessels participating in the Bering Sea/Aleutian Islands Korean hair crab fishery and all vessels targeting *C. tanneri* and *C. angulatus*.

Although observers devote a considerable amount of effort toward monitoring and documenting commercial vessel fishing activities for regulatory compliance, they also collect a significant amount of biological data. These data have been useful for many applications, such as developing models for estimating relative stock abundance, defining male and female crab size/age distributions on an annual basis, chronicling species' reproductive cycles, and quantifying levels of incidental bycatch. Ultimately, the shellfish observer biological database provides a source of information to aid in comprehensive management of Alaska's shellfish resources.

The databases of biological and regulatory compliance information collected by observers is maintained by Westward Region ADF&G staff members. Archived information includes a variety of commercial fishing and shellfish biology statistics ranging from pot locations, gear types and soak duration, to species composition of catches, biological and legal crab carapace size distributions, and the reproductive status of female crabs.

In this report, compiled data were collected during fisheries primarily occurring within the 1995 calendar year. Due to the substantial volume of available statistics, the scope of data presented has been narrowed to include only size composition and molt stages of commercially retained crabs, the documented incidence of illegally retained crabs, and the general results of random pot sampling. New to the 1995 report is analysis of harvest data generating estimates of catch per pot and estimated total catch for selected fisheries.

Topical statistics from the 1991, 1992, 1993, and 1994 seasons are occasionally included for comparative purposes. Any inconsistencies between findings presented in this document and previously published reports regarding the shellfish observer database are the result of updated summaries and interpretation of historical data.

Size distributions of retained crabs presented often include those collected in a number of fisheries by ADF&G personnel at shoreside processing locations. Additional information, including Bering Sea/Aleutian Islands fishery catch statistics, has been provided by Morrison et al., 1996.

## METHODS

Comprehensive shellfish observer sampling methodologies are outlined in the most recent publishing of the ADF&G Shellfish Observer Field Manual (ADF&G 1993).

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

*Carapace Length (CL)* - the straight line distance across the carapace from the posterior margin of the right eye orbit to the medial-posterior margin of the carapace; the biological size measurement of hair crabs, all species of *Paralomis* crabs, and all king crab species.

*Carapace Width (CW)* - the straight line distance across the carapace at a right angle to a line midway between the eyes to the medial-posterior margin of the carapace, not including the spines; the biological size measurement of *C. bairdi*, *C. opilio*, *C. tanneri*, and *C. angulatus*.

*Legal Size* - the straight line distance across the carapace of male crabs at a right angle to a line midway between the eyes to the medial-posterior margin, including the spines.

*Mature* - male and female crabs that have at least attained a biological size at which 50 percent or more of a random sample of individuals are physiologically capable of mating.

*Immature* - male and female crabs that have not attained a biological size at which 50 percent or more of a random sample of individuals are physiologically capable of mating.

*Soft shell* - crabs that have molted within the previous two months.

*New shell* - crabs that have molted between the preceding two to twelve months.

*Old shell* - crabs that have molted between the preceding twelve to twenty-four months.

*Very old shell* - crabs that have not molted within the preceding twenty-four months.

*Eyed Eggs* - embryoid eggs.

*Uneyed Eggs* - non-embryoid eggs.

*Mated/Barren* - female crabs not carrying eggs but showing signs of previously mating (based on evidence of egg clutch extrusion).

*Non-mated/Barren* - female crabs not carrying eggs and not exhibiting signs of prior mating activity (including immature crabs).

*Recruit* - male crabs at an age/size within one growth cycle beyond the minimum legal size established for the species.

*Post-recruit* - male crabs at an age/size greater than one growth cycle beyond the minimum legal size established for the species, which also includes old shelled crabs at or above the legal size.

During the 1995 Bering Sea/Aleutian Islands shellfisheries, observers were deployed on catcher-processor, floater-processor, and catcher vessels. Observers on board floater-processors have access only to pre-sorted and retained catches, while those placed on catcher-processor and catcher vessels are able to examine total pot contents prior to catch sorting.

### ***Floater-Processors***

Catch deliveries to floater-processors are monitored by observers for commercial fishing regulations compliance with regard to retention of legal crab species, sex, and size. Sampling procedures consist of surveying 600 crab taken from individual vessel catches to ascertain a percentage, if any, of illegally retained animals. This sample type is referred to as a 'Legal Tally'.

Biological data collected by observers on board floater-processors includes the measurement of 100 randomly selected crabs from each catch delivery to determine carapace size distribution and shell age condition. The mean weight of harvested crabs is also calculated from a vessel's catch.

Normally, observers on floater-processors are directed to monitor all catch deliveries to their vessel. On limited occasions, this convention necessitates a work schedule in excess of 24-hour intervals.

### ***Catcher-Processors***

In addition to collecting the carapace size distribution, Legal Tally, and average catch weight samples from retained crabs, observers deployed on catcher-processors routinely examine randomly selected pots for species composition. This exercise is referred to as 'Bycatch Sampling'. Methodology includes enumerating all species in a pot, recording the carapace size frequency of all commercially important crabs observed, determining shell age composition, and evaluating the reproductive condition of female crabs.

There are occasions when other vessels will deliver crab to a catcher-processor. When this occurs, the observer on the catcher-processor will sample the crab delivered as they would if on a floating-processor.

### *Catcher Vessels*

Routine data collection objectives for observers on board catcher vessels are similar to those assigned to personnel deployed on catcher-processors, except that pot contents assessment is usually the primary at-sea sampling activity. Retained catches are formally inspected for regulations compliance (consisting of a Legal Tally sample) only on occasions when the vessel delivers to a processing facility. When a vessel transfers harvested crabs to an at-sea processor, Legal Tally and biological carapace measurements are collected concurrently by observers deployed on each vessel.

Daily observer sampling goals on catcher-processors and catcher vessels (regarding quantity of fished pots examined, crabs measured, etc.) are dependent on a number of variables, such as whether an individual has been assigned any special data collection projects, the anticipated duration of the fishery in which the observer is deployed, and the data collection priorities established by ADF&G. Fishery-specific sampling goals will be discussed in subsequent sections when appropriate.

Special shellfish research assignments carried out by observers on board catcher-processors and catcher vessels have ranged from collecting specimens of brown, blue, and red king crabs for Genetic Stock Inventory (GSI) sampling, to collecting morphometric measurements from male and female *C. tanneri*, and Korean hair crabs, for size-at-maturity estimation. Investigation of these data have not been included in this report.

### *Estimation of Catch Per Unit Effort (CPUE) and Total Fishery Catch*

Estimates for CPUE and their standard errors were generated using weighted variance formulas for stratified sampling (Cochran 1977; Appendix 1). With this technique each vessel is considered a separate stratum. The weights reflect the relative importance of a vessel's daily sampling compared to all the days on which sampling occurred -- the more pots sampled on a given day, the greater the weight for that day. Variances were calculated for each vessel-day and then summed over all vessels and all days for the entire fishery. Weighted estimates are presented in figures displaying CPUE estimates for 1995 fisheries.

As can be seen in the tables displaying the standard error estimates, there are several ways to calculate CPUE. Multiple estimates are included not to confuse the reader, but rather to provide a range of information and a basis for comparison. The 'sample' CPUE is generated from observer

data, and is based solely on the sampled bycatch pots. This is the estimate which has been reported in past observer reports (Tracy 1994, 1995a,b). It is calculated as total catch from sampled pots divided by total pots sampled. The 'weighted' CPUE uses the Cochran stratified technique as described above and in Appendix 1. Weighted estimates and standard errors were calculated with Cochran's method for those crab species with a 'sample' CPUE greater than one. (Estimates for selected fish species were calculated using the 'sample' method. No standard errors were calculated.) The 'actual total fishery' CPUE is based on fish ticket information as reported in the Regional Information Reports for commercial crab fisheries in the Bering Sea and Aleutian Island Management Areas (Morrison et al. 1996; Gish et al. 1996). The final CPUE is generated from confidential interviews, which are performed by onboard observers or dockside samplers. The 'actual total fishery' and confidential interview CPUE's are generated for retained legal crabs only. Both provide information on total catch of retained crab, total pots pulled, and fishing locations. Information from confidential interviews is recorded on a daily basis (fish tickets reflect an entire trip between deliveries) and is generally considered more accurate than information obtained from fish tickets.

Estimated catch totals are derived by multiplying the CPUE estimates by the total number of pots pulled in the fishery. For those fisheries with 100 percent observer coverage, the total pots pulled information is taken from confidential interviews. Otherwise, the total pots pulled data is taken from fish ticket summaries.

When viewing CPUE and total catch estimates for both the directed catch and bycatch, the reader should note the precision and accuracy of the estimates as indicated by the standard errors and by the comparability of the estimates for legal retained crabs obtained from observer data with those obtained from confidential interviews and fish tickets. The reader should also 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 or by observers deployed on catcher-processor vessels. 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 vessel component of the fleet.

## **RESULTS AND DISCUSSION**

### ***Bering Sea Chionoecetes opilio***

In recent years, the *C. opilio* fishery has become the principal revenue source of the commercial crabbing fleet. The largest annual harvests of this stock on record have occurred since at-sea observer coverage was authorized by BOF in the spring of 1990. The immense harvests and extended seasons in previous years have generated some of the larger data sets amassed by observers since the program's inception.

In the 1995 fishery, observers were deployed on a total of 19 catcher-processor and 15 floater-processor vessels. The bycatch pot sampling goal for observers on catcher-processor vessels was four pots per day fished. The animals were sorted by species, sex, and legal size and counted for all sampled pots. However, measurements were collected from animals in only one of the four sampled pots due to the large number of crab per pot taken in this fishery. Also, this method reduces crab mortality while observers are sampling during the extreme weather that occurs during this fishery.

Samples of retained crabs taken from catcher-processors, floater-processors, and shoreside locations revealed a mean carapace width of 108.6 millimeters (mm) (Table 1). More than 105,000 retained crabs were examined throughout the course of the season; the majority of measurements were collected by observers on board catcher-processors. The overall size distribution of retained *C. opilio* has varied slightly over the past seasons; nearly 40 percent of all crabs examined since 1992 have ranged between 106 mm and 115 mm CW (Table 2). The mean carapace width of harvested crabs has also remained relatively constant during the same period, varying by less than 2.5 mm between seasons.

The carapace width distribution of all male *C. opilio* measured by observers showed an apparent increase in the proportion of recruit-sized crabs in comparison to the 1994 data (Figure 1). The mean size of all observed *C. opilio* males decreased 7 mm from the prior season, from 105 mm to 98 mm CW. Juvenile crabs below 65 mm CW are not commonly documented in fished pots, which may account in part for the somewhat static annual nature of these data.

Observations of female *C. opilio* were relatively rare in pots sampled during the 1995 fishery. From a total of 1,530 pots examined for contents, only 2,309 females were enumerated and 539 were measured. Histograms depicting the size distribution of *C. opilio* females measured over four seasons reveal a progressive predominance of large, mature, old shelled crabs (Figure 2). Since the 1992 fishery, the mean CW of captured females has not fallen below 65 mm. The occurrence of females observed in sampled pots during the 1995 season was comparable to data summarized in 1994, although, in terms of mean catch per pot, the abundance of female *C. opilio* has decreased by greater than 50 percent over the past four years.

Retention of illegal crabs appeared insignificant during the 1995 season. Random tallies of 600 crabs harvested daily by catcher-processors, combined with legal measurements collected from catches delivered to floating-processors, produced a total sample of more than 510,000 retained animals examined for legal size, sex, and species (Table 3). Approximately 0.8 percent of the sample was comprised of unlawfully retained catch, most of which were pre-recruit sized *C. bairdi* males.

Legal *C. opilio* males dominated the catches in sampled pots at a mean of 175 individuals (Table 4). Catches of incidental species were minor compared to the abundance of legal crabs. Sub-legal sized *C. bairdi* constituted the largest portion of incidentally caught crab. Estimates of the total catches of selected crab species during the fishery are also presented.

Other commercially valuable species observed included small numbers of blue king crab, pacific cod, and halibut. A comparison of pot sampling conducted over several seasons indicates a 37 percent decrease in the CPUE of legal retained males since 1993. The abundance of legal non-retained males has increased 16 fold since 1992, although the CPUE has remained constant for the last two years (Figure 3).

Shell age classifications of all male *C. opilio* sampled remained consistent with findings from prior seasons (Table 5). Eighty-seven percent of all males examined were classified as new shell, the balance consisting almost exclusively of old shelled crabs. Very old shelled crabs (those failing to molt for two or more consecutive growth cycles) have been nearly absent from samples.

Comparison of female *C. opilio* shell condition assessment to data collected in previous seasons seems to represent an increase in the numbers of new shelled (primiparous) crabs (Table 5). During the 1995 season the numbers of new shelled crabs constituted nearly 14 percent of the total sample. The percent of new shell females decreased from nearly 17 percent in 1992 to less than 5 percent in 1994. These findings may indicate an increase in the abundance of immature females in the areas commercially fished.

At the time of the 1995 fishery, 80 percent of the *C. opilio* females inspected for signs of mating activity possessed clutches of eyed eggs (Table 6). A small percentage (12.5) carried uneyed eggs. All other females were devoid of eggs, and less than one percent were described as non-mated. Summarized results of *C. opilio* reproductive condition assessments during the last several seasons are also given in Table 6.

The locations of bycatch pots sampled in the 1995 Bering Sea *C. opilio* fishery are indicated on the map in Appendix B-1.

### ***Bering Sea Chionoecetes bairdi (Tanner Crab)***

Data compiled from the 1992 Bering Sea *C. bairdi* fishery is presented in this report using two chronological parameters. Pot composition statistics have been limited to statistics obtained prior to the onset of the *C. opilio* season, due to the overlap in directed harvest of both species that year. Since most vessels retained both *C. bairdi* and *C. opilio* during the concurrent 1992 seasons, it is difficult to identify pot content samples collected while a vessel exclusively directed effort on *C. bairdi*. *C. bairdi* size distributions, shell age, and reproductive condition assessments have been summarized from data collected throughout the course of both fisheries.

Also, BOF amendments to shellfish regulations in 1993 resulted in the *C. bairdi* fishery opening on November 1, concurrent with the Bristol Bay red king crab season. Ten days following the Bristol Bay fishery closure on November 10, 1993 (Morrison et al. 1994), the *C. bairdi* season reopened. Because no directed Tanner effort was documented by observers on board catcher-processors during the period in which both species were legally retained, catch composition information for 1993 only includes data collected after the closure of the red king crab fishery.

The Bristol Bay red king crab fishery remained closed in 1994 and 1995 due to a low estimated abundance of female red king crabs. However, the *C. bairdi* fishery opened as scheduled by regulation on November 1 (Morrison et al. 1996), and all observer data collected during those seasons has been included.

The bycatch pot sampling goal for observers on catcher-processor vessels during the 1995 season was four pots per day fished. The animals were sorted by species, sex, and legal size and counted for all sampled pots. Measurements were collected from animals in two of the four sampled pots. Eleven catcher-processors and one floating processor participated in the 1995 season.

More than 27,000 retained *C. bairdi* measurements were obtained from a combination of observer sampling effort on catcher-processors and ADF&G personnel stationed at shoreside locations. Combined measurements from all sample locations produced a mean width of 149.3 mm (Table 7). The size distribution of *C. bairdi* harvested during the 1995 season is essentially the same as for the 1994 season. In the 1992 through 1995 seasons, approximately 50 to 70 percent of measured crabs ranged between 141 mm and 155 mm CW (Table 8).

Carapace width measurements of all *C. bairdi* males (legal and sublegal crabs) derived from pot sampling revealed a mean size of 132 mm (Figure 4). The data seem to indicate limited recruitment into the stock, which correlates to size distribution histograms depicting the previous years' data (Figure 4). In 1995, shellfish observers collected 5,184 size frequencies from *C. bairdi* males, in comparison to sample sizes of 40,000 to 54,000 crabs in 1992 and 1993, respectively. The decrease in the number of crabs sampled is the result of decreased season lengths in 1994 and 1995.

The size distribution of *C. bairdi* females observed in sampled pots was also consistent with data summarized from the 1992, 1993, and 1994 seasons. Histograms from each respective year are provided in Figure 5. The average female crab size measured in 1995 was 93 mm, within the 92 mm to 96 mm CW range of previous seasons.

Less than one percent of the 58,130 retained *C. bairdi* examined during Legal Tally sampling were documented as illegal harvest (Table 9). Undersized *C. bairdi* males comprised almost 100 percent of unlawfully retained crabs. The cumulative number of crabs inspected represented approximately 32 percent of the catcher-processor harvest and approximately four percent of the harvest delivered to floating processors.

A total of 421 pot samples were collected during the 1995 season. Females and undersized *C. bairdi* males were the most prevalent in the sampled catch, averaging nearly 22 and 20 individuals per pot, respectively (Table 10). The mean catch of legal sized males was eight per pot. The estimated total catch of female and sublegal male *C. bairdi* exceeded the catch of legal males by a 5 to 1 ratio (Table 10). No red king crab and only one blue king crab were documented in the 421 sampled pots.

Results of pot sampling during the 1995 season appear to reflect a reduction in the overall abundance of male *C. bairdi* in the areas commercially fished. Between 1992 and 1995, the

average catch of legal males declined by 84 percent; the abundance of undersized males decreased by 76 percent in the same period (Figure 6). Selected bycatch of other species is listed in Table 10.

Shell age classification of *C. bairdi* males indicated a substantial change in composition as compared to sampling results from the three previous years. Only 31 percent of 5,590 crab sampled in 1995 were described as new shelled, while data collected in 1992, 1993, and 1994 indicated that at least 84 percent of sampled males were new shell (Table 11). Old shelled *C. bairdi* males comprised the majority of crabs observed in sampled pots. Like the size-frequency data (Figure 4), the preponderance of old-shelled males is indicative of poor recruitment into the fishery. However, female *C. bairdi* shell age classification indicated a slight increase in the percentage of new shell crab compared to the previous years.

Gravid *C. bairdi* females have typically comprised the majority of those examined for reproductive condition during the last several seasons. In 1995, nearly 93 percent of the females surveyed possessed egg clutches (Table 12). Females carrying uneyed eggs outnumbered those carrying eyed eggs by nearly 16 to 1. The vast majority of clutches examined during the 1992 and 1994 seasons contained uneyed eggs, while a majority of eyed egg clutches were observed in the 1993 season. The disparity between respective years may be attributable to the shift in timing and duration of the fishery in 1993 and the additional reduction in geographic area open to commercial fishing effort. The small numbers of barren females observed in 1994 (just over 4 percent of the total sample) were divided evenly between previously mated individuals and those exhibiting no signs of annual reproductive activity.

The locations of bycatch pots sampled in the 1995 Bering Sea *C. bairdi* fishery are indicated on the map in Appendix B-2.

### *St. Matthew District Blue King Crab*

Shellfish observers were deployed on one catcher-processor and one catcher vessel during the 1995 season. Catch data from these vessels is confidential. Four floating processors were in the area to take deliveries from both the St. Matthew and Pribilof district fisheries. The observer on the catcher processor was assigned a special priority project to collect abdominal sections from blue king crab that were processed at-sea as part of a comprehensive Passive Integrated Transmitting (PIT) tag study.

A sample of nearly 7,290 retained male blue king crab (measured at all processing locations) revealed a mean carapace length of 135 mm (Table 13). Over 62 percent of sampled crabs ranged between 126 mm and 140 mm CL (Table 14). The size distribution of harvested males has remained virtually constant since 1992. Accordingly, the mean size of sampled crabs during this period has fluctuated by less than 3 mm CL.

A histogram representing approximately 770 legal and sub-legal male blue king crab measurements derived from observer pot sample data is depicted in Figure 7. An increase in the

mean carapace length by 9 mm, in comparison to data collected in the 1994 season, could indicate a slight shift in the overall age composition of males.

Blue king crab females constituted the largest incidental catch in the 1995 St. Matthew fishery. A mean carapace length of 93 mm was generated from measurements of more than 1,000 crabs observed in sampled pots. The size dispersion of captured females ranged between 59 mm and 121 mm CL. Histograms of blue king crab female size and shell age composition from the 1992, 1993, 1994, and 1995 seasons are provided in Figure 8 for comparative purposes.

Over the past four seasons, summaries of observer pot content sampling have shown that female blue king crab constituted the largest portion of the animals caught in the St. Matthew fishery followed by undersized blue king males (Figure 9).

The shell age composition of male and female blue king crabs during the commercial harvest period have been well-documented in observer data sets over the past four years (Table 16). In respective seasons, over 90 percent of all males examined have been categorized as new shells, the remainder almost exclusively being described as single year skip molts (old shell). Shell age classification of blue king females has varied to a somewhat greater degree over the same interval. Numbers of those recorded as new shelled have comprised approximately 40 to 80 percent of the total sample (Table 16).

Several years of summarized pot sample results have consistently shown that ovigerous female blue king crabs are nearly absent from the geographic area targeted in the St. Matthew fishery (Table 17). Three gravid female crabs, two carrying clutches of eyed eggs, were documented in data collected during the 1995 season. Five of every six barren females examined by onboard observers exhibited evidence of prior mating activity and comprised 83 percent of the aggregate sample.

Approximately six percent of the 1995 blue king crab harvest (totaling 27,580 crabs) was monitored for illegally retained catch (Table 18). Prohibited animals documented during Legal Tally sampling consisted solely of females and undersized males. No illegal crabs were observed on the catcher processor. Nearly all unlawfully retained crabs were encountered by observers sampling deliveries to floating processors. Illegal crab comprised less than one percent of the aggregate sample for the entire fishery. Extrapolation of this percentage to the entire catch in 1995 indicated that a total of approximately 3,803 undersized male and female crabs were harvested (Table 18).

### ***Pribilof District Red and Blue King Crab***

In 1995 the Pribilof district was open concurrently for both red and blue king crab. The blue king crab fishery had been closed in the Pribilof district since 1987, and the red king crab fishery had opened in 1993 (Morrison et al., 1996). Total observer deployment during the season was limited to one catcher-processor vessel; consequently the catch data is confidential.

Shell age assessments of retained red king males were characterized by large numbers of new shell crabs; retained males described as old shelled constituted less than 10 percent of the sample (Table 20). The corresponding sample size of all retained males averaged 162.5 mm CL, which was similar to data collected in the 1994 season (Table 21).

Legal Tally samples collected in the Pribilof district red king crab fishery indicated that illegal crabs comprised less than one percent of the sampled harvest (Table 22). A total of 1,731 crabs were examined (12.3 percent of the total harvest) and an estimated 99 illegal crab were retained.

Shell age assessments of retained blue king males were approximately 89 percent new shell; males described as old shelled constituted approximately 10 percent of the sample (Table 23). The corresponding sample of retained males averaged 153.3 mm CL. Over 99 percent of the crabs measured in 1995 ranged between 136 mm and 175 mm CL (Table 24).

Legal Tally samples collected in the Pribilof district blue king crab fishery indicated that one percent of the 6,227 sampled crabs were illegal (Table 25). Approximately 13 percent of the total harvest was sampled and the majority of prohibited animals consisted of under-sized males.

### ***Bristol Bay Area Red King Crab***

In accordance with federal fisheries regulations, the Bristol Bay fishery remained closed in 1995 due to a critically low estimated abundance of female red king crabs. The fishery has been closed since the 1993 season. Published historical summaries of shellfish observer data collected in this fishery are available from the Alaska Department of Fish and Game.

### ***Adak Area Brown King Crab***

Shellfish observers on board catcher-processors in the Adak fishery had traditionally been the primary means for ADF&G to collect descriptive biological information on king crab stocks inhabiting the Western Aleutians. Data compiled in this report encompasses a nine and a half month regulatory period the fishery occurred, beginning November 1, 1994 and concluding on August 15, 1995. The goal for sampling of pot contents was sorting contents and collecting species measurements from 15 pots per day fished. At the conclusion of the 1994-95 season, observers had been deployed on two catcher-processors, two catcher vessels, and two floating-processors. Observers were voluntarily carried on the two catcher vessels for part of the fishery. Data was collected from the contents of 1,430 sampled pots.

The combination of data gathered by ADF&G personnel at shoreside facilities and measurements collected by observers on the at-sea processors produced an aggregate sample of approximately 34,000 crabs retained males with a mean CL of 148 mm (Table 26). Over the last several seasons, the mean length of retained crab is unchanged and a constant size distribution of harvested crabs has ranged between 126 mm and 175 mm (Table 27).

Juvenile crabs as small as 60 mm CL routinely occurred as bycatch in sampled pots; mature crabs exceeding 180 mm CL were also documented. The mean carapace length of all males (129 mm) was very similar to the average calculated from observer data collected in the 1992, 1993, and 1994 seasons (Figure 10). The size dispersion of female brown king crabs measured during the same four-year period has fluctuated moderately between 118 mm and 122 mm (Figure 11).

Numbers of unlawfully retained crabs consisted entirely of brown king crab females and undersized males. Over 23 percent of the total estimated harvest of brown king crab was sampled for illegally retained crab (Table 28).

The species composition of pots sampled annually in the Adak fishery include a wide variety of invertebrate and fish species. However, brown king crab females and sub-legal males constitute the predominant incidental catch. In 1994-95, the mean catch of 7 legal males per pot was similar to the 1993-94 season, and considerably less than the overall average number of legal crabs landed in the 1992-93 season (Figure 12). Catches of female and undersized male brown king crabs respectively averaged 9 and 7 animals per pot in 1994-95. Catch per pot of selected species from the sampled pots is presented in Table 29.

Classification of male and female brown king crab shell condition produced nearly identical results between sexes and between the prior several years' data. During the 1994-95 season, 97 percent of male crabs examined were characterized as new shelled; 95 percent of the females inspected were also similarly described (Table 30). Observers have annually reported the periodic occurrence of very old, large brown king males described as having discolored, highly abraded shells with a soft, "leathery" texture. These crabs comprise an insignificant portion of shell age samples.

Ovigerous crabs accounted for 54 percent of the 12,337 brown king females assessed for signs of reproductive activity (Table 31). Approximately one of every three females was observed as barren with no evidence of prior mating.

The locations of bycatch pots sampled in the 1994-95 Adak brown king crab fishery are indicated on the map in Appendix B-5.

### ***Adak Area Red King Crab***

Descriptive biological characteristics of red king crabs landed in the Adak fishery has historically been collected by observers deployed on board catcher-processors that alternately target brown king crabs. As a result, available information is derived from data sets that are relatively small in comparison to those collected in other fisheries. Also, discussion of species composition prior to 1993 has been eliminated in reference to pot samples collected because of the difficulty in separating pots directed at red king crabs from those targeting brown king crabs.

New regulations adopted by the Alaska Board of Fisheries (BOF) during the spring of 1995 required observer coverage on all vessels participating in Aleutian Islands king crab fisheries.

Shellfish observers were deployed on one catcher-processor and five catcher vessels during this fishery and 263 pots targeted on red king crab were examined for contents. The pot sampling goal for observers was a minimum of eight pots per day. Biological data was collected from all sampled pots.

Data in this report describes the 1995-96 season which began November 1. Though the season was open through February 15, 1996, no landings occurred after January 12 (Morrison et al., 1996). Poor landings of legal sized red king crab males prompted the emergency closure of the fishery. Summarized catch statistics collected by observers corroborate this evidence of depressed stocks in the area.

Retained red king crab males averaged 153 mm CL (Table 32). The sample consisted of 942 individuals harvested by catcher-processors or delivered to shoreside processing locations. Seventy-six percent of these crabs were identified as having new shells. Landed males surveyed in 1995 predominantly fit into a size distribution of 141 mm to 170 mm CL, similar to the 1994 and 1993 seasons; these differ from the 1992 fishery data where the majority of retained males ranged between 136 mm to 165 mm CL (Table 33).

The mean size (133 mm CL) of all male red king crab observed in pot content samples, and representative of both harvested and discarded crabs, may indicate recruitment into the stock prior to the 1995-96 fishery. Length frequency histograms of similar data collected the three previous seasons yielded evidence of recruitment failure (Figure 13). However, it should be noted that variables potentially affecting sampling results, including the sample size and capture location of sampled crabs, were discounted during data summary.

An aggregate of 1,073 female red king crabs examined by observers in 1995 revealed a mean size of 84 mm CL (Figure 14). The overall length distribution of females ranged between 64 mm and 149 mm CL.

Less than one percent of the crabs monitored by observers on catcher vessels were illegal (Table 34).

Summarized catch statistics from the pots sampled in 1995 indicated a reduced abundance of legal crabs in comparison to the data collected in 1993 and 1994; numbers of harvestable males averaged 21, 3, and 2 per pot during respective years (Figure 15). A summary of the pot contents of selected species in the 1995-96 fishery is presented in Table 35. Female red king crab predominated the catch in the sample pots with a mean catch of 6 per pot. The estimated total catch of selected crab species for the entire fishery is also shown in Table 35.

Nearly all of the 1,073 female red king crab assessed for shell condition (99.5 percent) were characterized as new shelled (Table 36). Male red king crab were observed to be approximately two-thirds new shell, with old shell males comprising the remaining one-third of the sampled crabs.

Of the 1,073 females observed in sampled pots, 861 were bearing uneyed eggs and 63 carried eyed eggs (Table 37). Barren crabs comprised 14 percent of the total sample, the majority of which exhibited no sign of prior mating activity.

The locations of bycatch pots sampled in the 1994-95 Adak red king crab fishery are indicated on the map in Appendix B-6.

### *Dutch Harbor Area Brown King Crab*

New regulations adopted by the Alaska Board of Fisheries (BOF) during the spring of 1995 required observer coverage on all vessels participating in Aleutian Islands king crab fisheries. The absence of catcher-processor participation in the Dutch Harbor fishery in 1993 and 1994 seriously curtailed the amount of biological information obtained on brown king crabs inhabiting commercially fished areas. In 1995, shellfish observers were deployed on one catcher-processor and 16 catcher vessels during this fishery. The pot sampling goal for observers was eight pots per day. Biological data was collected from all 2,512 sampled pots.

A total of 5,886 retained males measured at all processing locations revealed a mean size of 150 mm CL, with new shell crabs constituting 95 percent of the sample (Table 38). The size distributions of landed crabs over the last four seasons has remained virtually constant with approximately 70 percent ranging between 136 mm and 155 mm CL (Table 39). Accordingly, the mean size of retained males has fluctuated by only 2 mm.

The contents of the pots sampled by observers was comprised chiefly of brown king crab, with both female and sub-legal brown king crab catch rates greater than legal brown king crab (Table 40). A ratio of two females were caught for each legal male. Estimates of the total fishery catch for selected crab species are also presented. Comparison of 1992 and 1995 data reveals that catch rates of sub-legal and female brown king crab in 1995 were down by 25-40 percent compared to those of the 1992 season (Figure 16). Catch rates of legal males remained constant over the same period.

One-third of the 25,530 females examined from the sampled pots carried egg clutches. Fifty-eight percent of these gravid females had clutches of eyed eggs. Nearly 55 percent of all females examined were described as non-mated (Table 41).

The mean size of all male brown king crab examined in observer sampled pots was 127 mm CL, seven millimeters larger than 1992 data (Figure 17). Male sizes ranged from 22 mm to 197 mm CL. Mean size of female brown king crab was 115 mm CL, similar to 1992 (Figure 18). The numbers of male and female crab sampled were much larger than the 1992 sample sizes.

Assessment of shell aging of all males examined in the sampled pots revealed that over 96 percent were new shell while over 93 percent of females were similarly classified. These results are similar to observations made in 1992 (Table 42).

Illegally retained crab comprised 1.3 percent of the crab observers encountered during Legal Tally sampling (Table 43). The illegal crab were nearly all sublegal males. Overall, six percent of the total harvest was examined for illegal crab.

The locations of bycatch pots sampled in the 1995 Dutch Harbor Area brown king crab fishery are indicated on the map in Appendix B-7.

### ***Bering Sea Korean Hair Crab***

Prior to the onset of the 1992 Bering Sea fishery, the general lack of established life history and other biological knowledge of the hair crab species, and concerns over possible excessive red king crab and *C. bairdi* bycatch, prompted ADF&G to include observer coverage as a permit requirement for all participants. In 1995 observers were deployed on 21 catcher vessels. Catcher-processor and floater-processor vessels did not participate in the fishery.

Vessels targeting hair crabs typically deploy large numbers of pots on a daily basis. In order to obtain representative catch composition statistics from the 1995 fishery, individual observers were directed to examine a total of 30 pots for contents within each 24-hour interval of fishing activity on board their respective vessels. Size and other biological data was collected from the animals in 10 of the sampled pots; the remaining 20 pots were sampled for species composition, sex, and legal status. The resulting archive contained more than 10,100 bycatch samples.

Observers were also assigned a special project to collect morphometric measurements from hair crab less than 3.25 inches CW. This data was to be used to determine the size of sexual maturity. However, male and female crab of these sizes were not commonly encountered during the fishery, resulting in an incomplete database.

A combined total of nearly 7,500 carapace length measurements from retained male hair crabs were taken over the season by observers and ADF&G personnel and had a mean size of 91 mm (Table 44). Crabs landed in the 1992, 1993, and 1994 seasons were somewhat smaller than those surveyed in 1995; mean sizes ranged from 84 mm to 93 mm CL between the respective seasons (Table 45). A legal size of 3.25 inches CW was established in 1993; there were no male hair crab size restrictions during the 1992 season.

The length dispersion of more than 13,500 measured male hair crabs observed in pot samples showed little variation from the size distribution of the retained catch. Landed crabs averaged 89 mm CL, similar to the mean calculated from 1993 and 1994 sampling results (Figure 19). Male crabs larger than 110 mm CL have been rare in all years.

Approximately 700 female hair crabs were measured during the 1995 fishery. Carapace length distribution varied between 44 mm and 144 mm, although size frequencies predominantly ranged within a 58 mm to 76 mm interval (Figure 20). Females averaged 66 mm CL in 1995; identical to the median sized crab observed in 1994.

Summary of the data indicated that legal hair crabs were landed more frequently (at about four per pot) than all other crab species (Table 46). Female *C. bairdi*, red and blue king crab, respectively, comprised the next largest segments of the catch in sampled pots. The estimated catch of hair crab and king crab is presented in Table 46. Mean pot catches of male hair crab for the 1993, 1994, and 1995 seasons became nearly static after size restrictions were established following the 1992 season (Figure 21).

Classification of male and female hair crab shell condition was similar to 1994 which indicated that soft shelled crabs were virtually absent in the sampled catch (Table 47). Of the hair crab sampled, 87 and 91 percent of the males and females, respectively, were characterized as having molted in the preceding year.

Of the 692 female hair crab examined for reproductive state, 16 percent were ovigerous at the time of the fishery. Of those, 94 carried clutches of eyed eggs while the remaining 18 gravid females had uneyed eggs (Table 48). Females described as non-mated comprised 62 percent of the total sample.

Results of observer Legal Tally sampling on catcher vessels indicated a relatively small number of under-sized male hair crabs were harvested. Just over 42,500 crabs were inspected, which amounted to three percent of total processed catch in 1995 (Table 49). Prohibited animals comprised less than one percent of the crabs sampled, the majority of which were sub-legal male hair crabs.

The locations of bycatch pots sampled in the 1995 Bering Sea Korean Hair crab fishery are indicated on the map in Appendix B-8.

### *Bering Sea Chionoecetes tanneri*

Over the last two years, significant commercial interest in marketing *C. tanneri* (commonly referred to as “grooved Tanner crab” or “deep sea Tanner crab”) has resulted in directed fishing effort in the Bering Sea, Aleutian Islands, South Peninsula, Kodiak, and Yakutat registration areas. Little is known with regard to the life history and population dynamics of these previously unexploited stocks. In order to establish a baseline archive of biological descriptive characteristics, and initiate research activities aimed at enhancing fisheries management, ADF&G mandated observer coverage on all vessels targeting *C. tanneri* in Alaskan waters prior to the 1994 fisheries. This coverage was again mandatory for the 1995 fishery. All the *C. tanneri* fisheries have been conducted as permit fisheries with a season from January 1 through December 31 each calendar year.

The legal size established for *C. tanneri* in all registration areas is 5.0 inches CW. The legal size determination of other crab species encountered by observers during sampling were: *C. angulatus* = 4.5 inches CW and *Lithodes couesi* = 5.5 inches CW.

Observers in all areas were assigned the special project of collecting morphometric measurements whenever they encountered *C. tanneri* males less than 90 mm CW and females less than 80 mm CW; also, the same data was to be collected from all sizes of *C. angulatus*. This data was to be used to determine the size of sexual maturity. However, *C. tanneri* of these sizes were seldom present in retrieved pots.

The commercial harvest of *C. tanneri* in the Bering Sea occurred from March through December (Morrison et al. 1996). In 1995, shellfish observers were deployed on eight catcher vessels during this period. Observers were instructed to collect biological data from all animals in the eight pots they sampled each day the vessel fished.

The biological carapace widths of 4,997 retained males measured by ADF&G personnel at shoreside processing locations and by observers averaged 144.8 mm CW (Table 50). The total sample was comprised of crabs ranging approximately between 121 mm and 170 mm CW; sizes dispersed in 5 mm intervals revealed the highest frequency at 136 mm-140 mm CW (Table 51).

The size distribution of all male *C. tanneri* observed in sampled pots also extended over a broad range, between 47 mm and 188 mm CW (Figure 22). At 142 mm, the mean width of all landed males was slightly less than that of harvested crabs. Female *C. tanneri* width frequencies were moderately dispersed in comparison to male crabs, only varying between 59 mm and 129 mm (Figure 23). Mean size of the 8,832 females measured during the Bering Sea fishery was 102 mm CW.

Shell age assessments of *C. tanneri* proved difficult for observers, mostly due to little evidence of integument abrasion and decay that is commonly observed in other crab species. A small proportion of sampled males were ultimately identified as soft shelled and the remainder, slightly less than 90 percent, were judged to have completed a molt cycle within the preceding 12 months (Table 52). Assessing the shell condition of females was also somewhat troublesome for observers, although 63 percent of the 8,802 crabs inspected were characterized as new shell (Table 52).

A small number of unlawfully retained crabs were documented in observer Legal Tally sampling. Three percent of the fishery harvest was monitored, in which only 92 under-sized male *C. tanneri* were observed (Table 53).

In addition to landings of *C. tanneri*, several other species of commercially significant crabs appeared in sampled pots. These included *C. angulatus*, *Lithodes couesi*, and brown king crabs (Table 54). Still, legal size *C. tanneri* constituted the predominant catch, averaging 8 crabs per pot. Estimates of the total catch generated for *C. tanneri* and other crab species are presented in Table 54.

Over 92 percent of the female *C. tanneri* caught in sampled pots were gravid, and nearly all were comprised of uneyed egg clutches (Table 55). Of the 676 barren females observed, 551 exhibited no evidence of prior reproduction.

The locations of bycatch pots sampled in the 1995 Bering Sea *C. tanneri* fishery are indicated on the map in Appendix B-9.

### *Eastern Aleutian Area Chionoecetes tanneri*

In the 1995 Eastern Aleutian registration area fishery, vessel effort targeted on *C. tanneri* continued at varying levels from March through December (Gish et al. 1996). By the conclusion of the season, observers had been deployed on seven catcher vessels that participated in the fishery. Bycatch pot sampling goals for observers was eight pots per day fished and the contents of 4,216 pots were examined.

Results of 5,138 retained crab measurements collected by observers on catcher vessels and ADF&G personnel sampling at shoreside processing locations revealed a mean size of 139 mm CW (Table 56). Legal sized males landed in the Eastern Aleutian fishery appeared to be slightly smaller in size than those harvested in the Bering Sea (Table 51).

The combined size disbursement of both retained and discarded *C. tanneri* males ranged between 68 mm and 192 mm CW. The grouping of width frequencies in a 5 mm interval histogram (Figure 22) revealed a notable number of crabs measuring less than 135 mm. The overall mean size calculated from these data equaled 129 mm CW.

The carapace width distribution of *C. tanneri* females observed was similar to size frequencies of female crabs collected in the Bering Sea fishery (Figure 23). Median sizes also showed close association, at 100 mm and 102 mm CW respectively.

Summarized Legal Tally data indicated that illegal crabs comprised less than 1 percent of the 1995 harvest (Table 57). A total of 156 under-sized male and six female *C. tanneri* were detected among the 19,776 crab sampled by observers during deliveries of their assigned vessels.

A total of 4,216 pots were sampled for contents. Legal *C. tanneri* males dominated catches, averaging 7 landed per pot (Table 58). Female and sub-legal *C. tanneri* were the next most prevalent animals caught averaging 4 and 5 per pot, respectively. Brown king crab *Lithodes couesi* and *C. angulatus* were also encountered in sampled pots. Table 58 presents the estimated total catch of commercially significant crab species during the 1995 fishery. A comparison of mean pot sample catches from all 1995 *C. tanneri* fisheries, provided in Figure 24, indicates that the catch rate of legal males was lowest and almost identical in the Eastern Aleutian and Western Aleutian areas.

Shell age assessments of all male *C. tanneri* indicated that 74 percent of sampled crabs were classified as new shell (Table 52). Female *C. tanneri* examined in the Eastern Aleutian area were characterized as 64 percent old shell and 32 percent new shell. This varies significantly from the age distribution in the other *C. tanneri* fisheries (Table 52). This may be attributed to the difficulty in assessing shell ages of this species discussed previously. No soft shelled female crabs were observed during the season and only 10 soft shelled males were observed.

The majority of inspected female *C. tanneri* carried eggs, 93 percent of which were uneyed (Table 55). Of the 254 females identified as barren, 154 displayed evidence of prior mating.

The locations of bycatch pots sampled in the 1995 Eastern Aleutians *C. tanneri* fishery are indicated on the map in Appendix B-10.

### *Western Aleutian Area Chionoecetes tanneri*

Directed effort for *C. tanneri* crab in the Western Aleutian registration area during 1995 occurred from March through June, and briefly in December. Fishing effort was spread out over the Western Aleutian District from Amukta Pass to the Petrel Banks (Gish et al. 1996). By the conclusion of the season, observers had been deployed on five catcher vessels which had directed effort for *C. tanneri*. Processing vessels did not participate in the 1995 season. The bycatch sampling goal of observers in this fishery was 15 pots per day. Biological data was collected from the animals in all 1,096 pots sampled.

Legal sized males landed in the Western Aleutian fishery had a mean carapace width of 139 mm (Table 59). A total of 1,325 retained crab measurements were recorded by observers and by ADF&G personnel sampling at shoreside processing locations. Most retained crab ranged from 136 mm to 140 mm CW (Table 51).

The combined size disbursement of both retained and discarded *C. tanneri* males ranged between 43 mm and 176 mm CW. The grouping of width frequencies in a 5 mm interval histogram (depicted in Figure 22) reveals an overall mean size of 137 mm CW. The mean width frequency of female *C. tanneri* was 105 mm CW, the largest females of all fisheries sampled (Figure 23).

Summarized Legal Tally data indicated that illegal crabs comprised less than one percent of the 1995 harvest (Table 60). A total of 5,868 crab were inspected and only 35 under-sized males were detected. Over 70 percent of the reported harvest was examined during Legal Tally sampling.

A total of 1,096 pots were sampled for contents. The majority of the catch was legal *C. tanneri* males, averaging 7 landed per pot while females of that species had the second highest catch rate at 6 per pot (Table 61). A comparison of mean pot sample catches from all 1995 *C. tanneri* fisheries, provided in Figure 24, indicates that legal males were caught at about the same rate in both the Western Aleutian and the Eastern Aleutian areas.

Shell age assessments of all male *C. tanneri* from bycatch sampled pots were comprised of 87 percent new shell (Table 52). There were eight male crab that observers classified as soft shell. Eighty percent of female *C. tanneri* examined in the Western Aleutian area were characterized as new shell. No soft shelled female crabs were observed during the season.

The majority of inspected female *C. tanneri* carried eggs, 91 percent of which were uneyed (Table 55). Of the 318 females identified as barren, 239 displayed evidence of prior mating.

The locations of bycatch pots sampled in the 1995 Western Aleutians *C. tanneri* fishery are indicated on the map in Appendix B-11.

### *South Peninsula Area Chionoecetes tanneri*

The interest in the 1995 South Peninsula district fishery increased over 1994. Participating vessels consisted of one catcher-processor and seven catcher vessels. Some fishing activity occurred in all months except May and September (Jackson 1996). Bycatch sampling goals for this fishery were 10 pots per day for observers assigned to catcher vessels and eight pots per day for catcher-processor vessels. Observers sampled 925 pots during the fishery.

A total of 7,409 retained *C. tanneri* CW measurements were obtained by observers, and a summary of these data produced a mean width of 132 mm (Table 62). Crabs harvested from the South Peninsula Area were generally smaller in size than those landed in other *C. tanneri* fisheries, with approximately 27 percent of sampled males measuring less than 126 mm CW (Table 51).

All male *C. tanneri* observed in sampled pots were also smaller (averaging 126 mm CW) than those landed in the Bering Sea, Eastern Aleutian, and Western Aleutian fisheries. Comparative illustrations of these data are given in Figure 22.

The general size distribution of female *C. tanneri* ranged between 75 mm and 125 mm CW, and averaged 95 mm (Figure 23). Females landed in the South Peninsula fishery were also smaller than females observed in the Bering Sea, Eastern Aleutian, and Western Aleutian areas.

Approximately eight percent of harvested *C. tanneri* were surveyed during Legal Tally sampling. Retention rates of prohibited animals were minimal, at less than one percent of crabs landed; under-sized males accounted for 280 of the 288 illegal crabs detected (Table 63).

The composition of pot catches were dominated by *C. tanneri* males. An average of 85 legal crabs were landed in the 927 sampled pots; sub-legal males averaged 53 per pot (Table 64). Other commercially significant species observed included small numbers of *Lithodes couesi*, brown king crabs, and sablefish, although none were recorded in large quantities. The estimated catches of selected crab species during the 1995 season are presented in Table 64. The estimated CPUE of legal *C. tanneri* in the South Peninsula Area was at least 10 times that for any other area with directed *tanneri* effort (Figure 24). The higher CPUE in the South Peninsula can be attributed in part to differences in gear fished. Only single pot fishing was allowed in the South Peninsula while long-lined pots were used in other areas.

Approximately 75 percent of all male *C. tanneri* inspected during the season were categorized as new shelled while 71 percent of females were similarly categorized (Table 52). Only 35 male crabs were identified as soft shell from the 66,714 males sampled.

Over 98 percent of all female *C. tanneri* assessed for reproductive condition during the fishery were ovigerous with the largest portion of these carrying uneyed eggs (Table 55). Less than one percent of females examined were identified as non-mated.

The locations of bycatch pots sampled in the 1995 South Peninsula *C. tanneri* fishery are indicated on the map in Appendix B-12.

#### *Yakutat Area Chionoecetes tanneri*

Less than three vessels fished for *C. tanneri* in the Yakutat area. Consequently all catch data from this fishery are confidential and were not included in the descriptive tables and graphs of the other *C. tanneri* fisheries.

A sample of 202 retained male *C. tanneri* ranged from 122 mm and 167 mm CW, with a mean width of 142 mm (Table 65).

#### *Eastern Aleutian Area Chionoecetes angulatus*

While all vessels targeting *C. tanneri* had also encountered some *C. angulatus*, these catches were incidental to the overall harvest, as illustrated in Figure 24. Directed effort for *C. angulatus* in the Eastern Aleutian area during 1995 was undertaken by less than three vessels. All catch data are confidential. The legal size for male *C. angulatus* was 4.5 inches CW.

The mean width of retained *C. angulatus* was 120 mm (Table 67). Nearly 72 percent of the retained crab were between 111 mm and 125 mm CW (Table 68).

Data collected from all male *C. angulatus* examined in the fishery yielded a mean size of 117 mm CW (Figure 25). The mean size of the small number of female *C. angulatus* caught was 72 mm CW. Identification of new shell condition for the respective males and females examined was 94 percent and 93 percent (Table 70). Ovigerous females comprised 94 of the 123 females examined for reproductive condition, only one of which had eyed eggs (Table 71). Twenty-two of 29 barren females were identified as non-mated.

#### *Eastern Aleutian Area Octopus*

The concerns over possible excessive crab bycatch prompted ADF&G to require observers on all vessels fishing modified crab pots that were targeting octopus. Three catcher vessels obtained shellfish observers and fished octopus during October. The sample goal for observers was 15 pots per day. A total of 316 pots were sampled.

Deliveries of octopus from the three vessels totaled 1,541 pounds with an average weight of 23 pounds; 7,580 pots were pulled for a catch rate of less than one octopus per pot (Gish et al.

1996). The total catch of approximately 1,200 snails comprised the most numerous animal in the sampled pots. Other commercial exploited species recorded from the bycatch samples included 240 Pacific cod, 100 *C. bairdi* of mixed sizes and sex, seven halibut, and two Korean hair crab.

### *Accuracy and Precision of CPUE Estimates*

In using CPUE estimates based on observer data, it is important to have some assessment of their reliability in estimating the catch rates for observed vessels and, especially, for all vessels participating in a fishery. Although the observer data is the only source of information on bycatch rates in the fisheries presented in this report, confidential interviews with the operators of observed vessels and fish tickets provide data for independent estimates of the CPUE of retained legal crabs. We can gain some understanding of the reliability of the CPUE estimates computed from observer data by comparing the retained legal CPUE estimates computed from observer data with those computed from confidential interview and fish ticket data.

The confidential interview data provides estimates of retained legal CPUE for the observed vessels participating in a fishery. Accordingly, in this discussion we will refer to the retained legal CPUE estimated from confidential interview data as the "Actual Observed Fleet CPUE". Note that in those fisheries for which 100% observer coverage was required (i.e., the Bering Sea Korean hair crab fishery, all *C. tanneri* fisheries, all *C. angulatus* fisheries, the Adak Area red king crab fishery, and the Dutch Harbor Area brown king crab fishery), the Observed Fleet CPUE also provides an independent retained legal CPUE estimate for the entire fishery. Fish ticket data from all landings of all vessels participating in a fishery provide an independent estimate of the total fishery CPUE of retained legal crabs for a fishery in which observers were required only on catcher-processor vessels. We will refer to the CPUE of retained legal crabs estimated from the fish ticket data for all fishery landings as the "Actual Total Fishery CPUE".

CPUE estimates computed from observer data for retained legal crabs are within 8% or less of the Actual Observed Fleet CPUE for the Bering Sea *C. opilio*, Bering Sea *C. bairdi*, Adak Area brown king crab, Dutch Harbor Area brown king crab, Bering Sea Korean hair crab, Bering Sea *C. tanneri*, Eastern Aleutians Area *C. tanneri*, Western Aleutians Area *C. tanneri*, South Peninsula Area *C. tanneri*, and the Eastern Aleutians Area *C. angulatus* fisheries (Table 72). The close agreement between the observer-based and Actual Observed Fleet CPUE estimates for retained legal crab in each of those nine fisheries indicates that observer data provides highly reliable estimates of CPUE for the observed portion of the fleet in each of those fisheries. The close agreement between those two CPUE estimates also indicates that observer data provides reliable CPUE estimates for the entire fishery in the Dutch Harbor Area brown king crab, Bering Sea Korean hair crab, Bering Sea *C. tanneri*, Eastern Aleutians Area *C. tanneri*, Western Aleutians Area *C. tanneri*, South Peninsula Area *C. tanneri*, and Eastern Aleutians Area *C. angulatus* fisheries, because observer coverage was 100% in each of those fisheries.

CPUE estimates computed from observer data for retained legal crabs in each of the St. Matthew District blue king crab, the Pribilofs District king crab, the Adak Area red king crab, and the Yakutat Area *C. tanneri* fisheries differed from the Actual Observed Fleet CPUE by 20% or more, indicating lower reliability of observer data in providing catch rate estimates for the observed fleets in those fisheries (Table 72). Those five fisheries were distinguished by having the lowest numbers of pots sampled, ranging from only 16 sampled pots for the Yakutat Area *C. tanneri* fishery to 263 for the Adak Area red king crab fishery. Since the observer data for the Adak Area red king crab fishery was based on 100% observer coverage, that comparison also reflects on the ability of the observer coverage in that fishery to provide reliable estimates for the entire fishery. It should be noted, however, that some large relative difference between the CPUE estimates may be associated with only small absolute differences between the estimates; for example, although the CPUE estimate based on observer data for retained legal crabs in the Adak Area red king crab fishery is 26% less than the estimate based on confidential interviews, in absolute numbers the two estimates differ by less than one legal crab per pot (Table 35).

Comparison of CPUE estimates based on observer data for retained legal crabs with the Actual Total Fishery CPUE in fisheries with partial observer coverage (Table 72) indicates that partial observer coverage provided adequate data for estimation of CPUE for the entire fishery in the Bering Sea *C. opilio* and Bering Sea *C. bairdi* fisheries. It is noteworthy that observers deployed only on catcher-processors in those two fisheries provided adequate data to accurately (within 6%) estimate the retained legal CPUE for the entire fishery. On the other hand, the low participation of observers in the St. Matthew District and Pribilofs District fisheries during the 1995 season reduced the ability of observer coverage to adequately characterize those two fisheries. In fact, observer coverage in the Pribilofs District king crab fishery did not provide any information on the catch rates of one of the two species of king crabs harvested during that fishery. Observer coverage in the St. Matthew District and Pribilofs District king crab fisheries was distinguished by having low numbers of observed vessels (two in St. Matthew District and one in the Pribilofs District), as well as low numbers of pots sampled. The most interesting fishery in this comparison is the Adak Area brown king crab fishery, in which the observer-based CPUE estimate differed from the Actual Total Fishery CPUE by 37%. Although observer data apparently was adequate to characterize the CPUE for the observed portion of the fleet in the Adak Area brown king crab fishery, the partial observer coverage in that fishery was not adequate to reliably characterize catch rates for the entire fishery. The percentage of vessels with observer coverage during the Adak Area brown king crab fishery was actually higher (12%) than that for either of the Bering Sea *C. opilio* (8%) and *C. bairdi* (6%) fisheries. The poor performance of partial observer coverage in the Adak Area brown king crab fishery most likely reflects the inability of partial observer coverage to adequately sample a fishery prosecuted over a vast area during a season lasting nine-and-one-half months.

The “weighted” CPUE estimator used in this report is different from the “sample” CPUE estimate used in past Mandatory Shellfish Observer Database Summaries (e.g., Tracy 1994, 1995a,b). Although the “weighted” estimation method can provide more accurate and precise estimates, the “weighted” and “sample” CPUE estimates are generally very close to each other. Therefore, the “weighted” estimates presented here are comparable to those CPUE estimates

included in previous observer data summaries. The value of using the “weighted” CPUE estimates is that the estimation method allows for computation of the standard errors of the estimates.

The standard errors of estimates provided in this report give a measure of the precision or repeatability of the CPUE estimates. Generally, the CPUE estimates appear to be precise, as reflected in the relatively small standard errors. There are problems in using the standard errors to directly compute confidence intervals, however. Although the statistical distribution of the CPUE estimates has not been determined for each fishery, the number of pots sampled within each vessel-day strata are probably not adequate to assume an asymptotic normal distribution. A *t*-distribution with approximate degrees of freedom can be used to provide approximate confidence intervals in such cases (Cochran 1977). We have not computed confidence intervals using the *t*-distribution approximation. However, for all but the St. Matthew District blue king crab, Pribilofs District king crab, and Yakutat Area *C. tanneri* fisheries, numbers of pots sampled by observers are large enough that the CPUE estimate plus-or-minus three standard errors should provide extremely conservative 95% confidence intervals. In that regard it is worth noting that the CPUE estimates based on observer data for retained legal crabs in the Bering Sea *C. opilio*, Bering Sea Korean hair crab, Bering Sea *C. tanneri*, and Eastern Aleutians Area *C. tanneri* fisheries differ from the Actual Observed Fleet CPUE by more than three standard errors. That situation may indicate that the true standard errors of the CPUE estimates are themselves underestimated or that some slight biases exist in the estimates of CPUE provided by either or both of the observer data or the confidential interviews.

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Table 1. Retained *C. opilio* carapace width frequency statistics by processor type from 1995 Bering Sea fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Processor	46,810	108.0mm	-	90.9	8.5	0.5
Floating Processor	43,162	109.0mm	-	86.4	13.1	0.5
Shoreside Processor	15,707	110.0mm	-	94.3	5.6	0.1
Totals	105,679	108.6mm	-	89.5	10.0	0.5

Table 2. Bering Sea retained *C. opilio* carapace width distributions, 1992, 1993, 1994, and 1995.

Width (mm)	1992		1993		1994		1995	
	Num. Crab	Percent						
86 - 90	860	0.5	752	0.3	1,590	0.9	1,655	1.6
91 - 95	2,095	1.7	1,194	0.8	4,333	2.5	4,713	4.5
96 - 100	8,895	5.3	5,196	2.1	13,435	7.8	11,784	11.1
101 - 105	21,925	13.0	14,474	5.8	29,095	16.8	20,050	18.9
106 - 110	33,285	19.8	33,958	13.6	37,902	21.9	21,442	20.2
111 - 115	37,814	22.5	51,358	20.5	37,157	21.5	18,824	17.8
116 - 120	31,869	18.9	59,911	23.9	27,721	16.0	13,817	13.0
121 - 125	19,315	11.5	47,999	19.2	14,512	8.4	8,006	7.5
126 - 130	8,131	4.8	24,657	9.8	5,127	3.0	3,062	2.9
131 - 135	2,343	1.4	7,952	3.2	1,080	0.6	756	0.7
Totals	166,532	99.4	247,451	99.2	171,952	99.4	104,109	98.5
	Mean width = 112.2 mm		Mean width = 111.6 mm		Mean width = 110.4 mm		Mean width = 110.0 mm	

Table 3. Illegally retained crabs observed during the 1995 Bering Sea *C. opilio* fishery.

Sample Location	Sample Size	Male		Female		Other Crabs <sup>a</sup>	Total Percent Illegal	Number Crabs Harvested <sup>b</sup>	Estimated Number Illegal Crabs <sup>c</sup>	Percent Harvest Sampled
		Number	Percent	Number	Percent					
Catcher Processor	266,254	832	0.31	42	<0.10	1,351	0.84	7,048,548	59,208	3.78
Floating Processor	247,593	509	0.21	79	<0.10	1,176	0.71	30,769,047	218,460	0.80
Totals	513,847	1,341	0.26	121	<0.10	2,527	0.78	37,817,595	277,668	1.36

<sup>a</sup> Other illegal crabs primarily male *C. bairdi*.

<sup>b</sup> Morrison et. al. 1996.

<sup>c</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 4. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers deployed on catcher-processors during the 1995 Bering Sea *Chionoecetes opilio* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 1,530 potlifts sampled from all 19 catcher-processors which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>C. opilio</i></u>			
retained males	171,306	110.00 (1.91) <sup>b</sup>	55,748,000 <sup>c</sup>
legal males	264,394	175.20 (2.61)	88,792,000
sublegal males	35,420	26.25 (0.77)	13,304,000
females	2,039	1.25 (0.23)	634,000
<u><i>C. bairdi</i></u>			
legal males	441	0.29 <sup>d</sup>	146,000
sublegal males	10,149	7.01 (0.32)	3,553,000
females	3,885	2.82 (0.55)	1,429,000
<u><i>opilio x bairdi</i> hybrid</u>			
legal males	1,217	0.80 <sup>d</sup>	403,000
sublegal males	550	0.36 <sup>d</sup>	182,000
females	111	0.07 <sup>d</sup>	36,800
<u><i>P. platypus</i></u>			
legal males	2	< 0.01 <sup>d</sup>	660
sublegal males	31	0.02 <sup>d</sup>	10,300
females	0	--	--
<u><i>L. aequispina</i></u>			
legal males	1	< 0.01 <sup>d</sup>	330
sublegal males	0	--	--
females	0	--	--
Pacific cod	1,386	0.90 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 506,802 total pot lifts (Morrison et al., 1996) during fishery.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 118.49 (CPUE from confidential interviews was 115.13 for days when bycatch sampling occurred); actual total fishery CPUE of retained legal crabs was 117 (Morrison et al., 1996).

<sup>c</sup> Actual catch of retained legal crabs for the fishery was 60,611,411 (Morrison et al., 1996).

<sup>d</sup> CPUE computed as total pot sample catch divided by 1,530 pots sampled; standard errors of estimates were not computed.

Table 5. Shell age distributions of all *C. opilio* males and females observed in the 1992, 1993, 1994, and 1995 Bering Sea fishery.

Fishery Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	121,432	115,095	94.8	5,613	4.6	724	0.6
Females	1,367	231	16.9	873	63.9	263	19.2
<b>1993</b>							
Males	135,989	121,809	89.6	13,227	9.7	953	0.7
Females	1,919	199	10.4	1,123	58.5	597	31.1
<b>1994</b>							
Males	167,443	156,555	93.7	9,942	5.7	946	0.6
Females	1,273	62	4.9	929	73.0	282	22.2
<b>1995</b>							
Males	54,165	47,021	86.8	6,597	12.2	547	1.0
Females	539	74	13.7	328	60.9	137	25.4

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 6. Summary of the reproductive status of female *C. opilio* examined by observers during the 1992, 1993, 1994, and 1995 Bering Sea fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren Non-mated	Percent Total
1992	827	64.0	150	11.6	215	16.8	100	7.7
1993	979	51.0	172	9.0	455	23.7	312	16.3
1994	800	64.1	60	4.8	116	9.3	273	21.9
1995	340	80.4	53	12.5	26	6.2	4	0.9
Totals	2946	60.3	435	8.8	812	16.6	689	14.1

Table 7. Retained *C. bairdi* carapace width frequency statistics by processor type from the 1995 Bering Sea season.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Processor	11,411	149.0mm	-	38.7	57.7	3.6
Floater Processor	736	148.8mm	-	91.7	8.0	0.3
Shoreside Processor	7,129	149.8mm	0.1	87.0	12.8	0.1
Totals	19,276	149.3mm	0.1	58.5	39.2	2.2

Table 8. Bering Sea retained *C. bairdi* carapace width distributions from the 1992, 1993, 1994, and 1995 fishery.

Width (mm)	1992		1993		1994		1995	
	Num. Crab	Percent						
130-135	577	0.5	306	0.1	115	0.4	64	0.3
136-140	16,787	13.5	7,270	0.4	3,073	11.1	2601	13.5
141-145	35,110	28.0	15,047	10.2	6,173	22.3	4531	23.5
146-150	30,799	24.6	15,507	21.0	6,202	22.4	4279	22.2
151-155	21,999	17.6	13,838	21.7	5,284	19.1	3555	18.4
156-160	12,063	9.6	10,156	19.3	3,678	13.3	2349	12.2
161-165	5,001	4.0	5,717	14.2	2,125	7.7	1259	6.5
166-170	1,662	1.3	2,467	8.0	761	2.8	454	2.4
171-175	510	0.4	1,010	3.4	185	0.7	134	0.7
176-180	166	0.1	196	1.4	30	0.1	28	0.2
Totals	124,674	99.6	71,514	99.7	27,626	99.5	19,254	99.9
	Mean width = 148.0mm		Mean width = 150.7mm		Mean width = 150.0mm		Mean width = 149.3mm	

Table 9. Illegally retained crabs observed during the 1995 Bering Sea *C. bairdi* fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Total Other Crabs	Total Percent Illegal	Number crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor	50,607	404	0.80	26	<0.10	3	0.86	160,169	1,370	31.6
Floating Processor	7,523	129	1.71	0	-	0	1.76	204,030	3,499	3.7
Totals	58,130	533	0.92	26	<0.10	3	0.97	364,199	4,849	19.4

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 10. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers deployed on catcher-processors during the 1995 Bering Sea *Chionoecetes bairdi* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 421 potlifts sampled from all 11 catcher-processors which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>C. bairdi</i></u>			
legal males	3,347	7.92 (0.55) <sup>b</sup>	1,963,000 <sup>c</sup>
sublegal males	9,077	21.49 (1.03)	5,326,000
females	8,248	20.34 (1.86)	5,041,000
<u><i>C. opilio</i></u>			
legal males	1,514	3.58 (0.56)	887,000
sublegal males	565	1.43 (0.35)	354,000
females	364	0.86 <sup>d</sup>	214,000
<u><i>opilio x bairdi</i> hybrid</u>			
legal males	16	0.04 <sup>d</sup>	9,400
sublegal males	202	0.48 <sup>d</sup>	119,000
females	37	0.09 <sup>d</sup>	22,000
<u><i>P. platypus</i></u>			
legal males	0	--	--
sublegal males	1	< 0.01 <sup>d</sup>	590
females	0	--	--
<u><i>E. isenbeckii</i></u>			
legal males	17	0.04 <sup>d</sup>	10,000
sublegal males	37	0.09 <sup>d</sup>	22,000
females	1	< 0.01 <sup>d</sup>	590
Pacific cod	504	1.20 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 247,853 total pot lifts (Morrison et al., 1996) during fishery.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 7.66; actual total fishery CPUE of retained legal crabs was 7.57 (Morrison et al., 1996).

<sup>c</sup> Actual catch of retained legal crabs for the fishery was 1,877,303 (Morrison et al., 1996).

<sup>d</sup> CPUE computed as total pot sample catch divided by 421 pots sampled; standard errors of estimates were not computed.

Table 11. Shell age distributions of all *C. bairdi* males and females observed in the 1992, 1993, 1994, and 1995 Bering Sea fishery.

Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	36,943	30,991	83.9	5,411	14.6	491	1.3
Females	5,162	475	9.2	3,643	70.6	1,044	20.2
<b>1993</b>							
Males	40,385	34,019	84.2	5,837	14.5	529	1.3
Females	10,471	1,248	11.9	7,054	67.4	2,169	20.7
<b>1994</b>							
Males	5,791	4,948	85.4	777	13.4	66	1.1
Females	2,132	218	10.2	1,720	80.7	194	9.1
<b>1995</b>							
Males	5,590	1,752	31.3	3,432	61.4	406	7.3
Females	3,208	464	14.5	1,089	33.9	1,655	51.6

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 12. Summary of the reproductive state of female *C. bairdi* examined by observers during the 1992, 1993, 1994, and 1995 Bering Sea fishery.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	440	8.6	4,447	86.5	196	3.8	56	1.1
1993	7,596	72.5	2,395	22.9	197	1.9	286	2.7
1994	423	20.0	1,602	75.8	51	2.4	38	1.8
1995	176	5.5	2,796	87.2	117	3.6	117	3.6
Totals	8,635	41.2	11,240	53.7	561	2.7	497	2.4

Table 13. Retained blue king crab carapace length frequency statistics by processor type for the 1995 St. Matthew District season.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Processor	519	134.3mm	-	100.0	-	-
Floater Processor	4,392	134.8mm	0.5	84.5	13.8	1.1
Shoreside Processor	2,378	135.1mm	-	92.5	6.9	<0.1
Totals	7,289	134.8mm	0.3	88.4	10.6	0.7

Table 14. St. Matthew District retained blue king crab carapace length distributions from the 1992, 1993, 1994, and 1995 fishery.

Length (mm)	1992		1993		1994		1995	
	Num. Crab	Percent						
111-115	22	0.2	13	0.1	15	0.1	10	0.1
116-120	429	3.0	201	1.7	315	2.8	161	2.2
121-125	2,112	14.9	1,193	9.9	1,445	12.9	762	10.4
126-130	3,120	22.0	2,168	18.1	2,505	22.4	1,315	18.0
131-135	3,247	22.8	2,666	22.2	2,735	24.4	1,681	23.0
136-140	2,683	18.9	2,478	20.6	2,209	19.7	1,540	21.1
141-145	1,576	11.1	1,842	15.4	1,228	10.9	1,074	14.7
146-150	746	5.3	976	8.1	533	4.8	543	7.4
151-155	202	1.4	333	2.8	147	1.3	154	2.1
156-160	57	0.4	74	0.6	48	0.4	49	0.7
Totals	14,194	100.0	11,994	99.4	11,180	99.7	7,289	99.7
	Mean length = 133.2mm		Mean length = 135.4mm		Mean length = 133.3mm		Mean length = 134.8mm	

Table 16. Shell age distributions of blue king crab males and females observed in the 1992, 1993, 1994, and 1995 St. Matthew District fishery.

Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	2,099	1,906	90.8	179	8.5	14	0.7
Females	3,534	2,928	80.3	603	19.6	3	0.1
<b>1993</b>							
Males	2,797	2,555	91.3	239	8.5	3	0.1
Females	2,721	1,734	63.7	968	35.6	19	0.7
<b>1994</b>							
Males	6,054	5,960	98.5	90	1.5	0	-
Females	5,107	4,285	83.9	818	16.0	4	0.1
<b>1995</b>							
Males	773	715	92.5	58	7.5	0	-
Females	1,013	387	38.2	615	60.7	11	1.1

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 17. Summary of the reproductive status of female blue king crabs examined by observers during the 1992, 1993, 1994, and 1995 St. Matthew District fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	4	0.1	6	0.2	1,642	53.6	1,409	46.1
1993	0	-	0	-	1,957	71.9	763	28.1
1994	0	-	2	<0.1	3,443	67.0	1,661	32.6
1995	2	-	1	<0.1	849	83.1	161	15.9
Totals	6	<0.1	9	<0.1	7,891	66.3	3,994	33.6

Table 18. Illegally retained crabs observed during the 1995 St. Matthew District blue king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor	CONFIDENTIAL									
Floating Processor	24,650	128	0.52	84	0.34	0	0.86	440,156	3,786	5.6
Catcher Vessel	CONFIDENTIAL									
Totals	27,580	129	0.5	85	0.3	0	0.77	456,259	3,803	6.0

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 20. Retained red king crab carapace length frequency statistics by processor type for the 1995 Pribilof District season.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Processor	0	-	-	-	-	-
Floater Processor	405	164.3mm	1.0	73.3	25.0	0.7
Shoreside Processor	2,764	162.1mm	-	92.1	7.5	0.4
Totals	3,169	162.5mm	0.1	89.7	9.7	0.5

Table 21. Pribilof District retained red king crab carapace length distributions from the 1994 and 1995 fisheries.

Length (mm)	1994		1995	
	Number crab	Percent	Number crab	Percent
131 - 135	28	1.0	34	1.1
136 - 140	83	2.8	161	5.1
141 - 145	143	4.9	242	7.6
146 - 150	264	9.1	292	9.2
151 - 155	362	12.4	307	9.7
156 - 160	408	14.0	295	9.3
161 - 165	416	14.3	374	11.8
166 - 170	484	16.6	428	13.5
171 - 175	360	12.4	448	14.1
176 - 180	241	8.3	334	10.5
181 - 185	92	3.2	160	5.0
Totals	2,881	99.0	3,075	96.9
	Mean length = 161.8mm		Mean length = 162.5mm	

Table 22. Illegally retained crabs observed during the 1995 Pribilof District red king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor							<b>CONFIDENTIAL</b>			
Floating Processor							<b>CONFIDENTIAL</b>			
Totals	1,731	11	0.6	1	<0.1	1	0.75	14,108	99	12.3

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 23. Retained blue king crab carapace length frequency statistics by processor type for the 1995 Pribilof District fishery.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Processor	643	152.1mm	-	78.0	21.2	0.8
Floater Processor	461	154.0mm	-	83.3	14.3	2.4
Shoreside Processor	2,592	153.6mm	-	92.4	7.2	0.4
Totals	3,696	153.3mm	-	88.8	10.5	0.7

Table 24. Pribilof District retained blue king crab carapace length distributions from the 1995 fishery.

Length (mm)	Num. crab	Percent
131 - 135	11	0.3
136 - 140	177	4.8
141 - 145	525	14.2
146 - 150	732	19.8
151 - 155	777	21.0
156 - 160	710	19.2
161 - 165	494	13.6
166 - 170	211	5.7
171 - 175	47	1.3
176 - 180	9	0.2
Totals	3,693	99.9
	Mean length = 153.3mm	

Table 25. Illegally retained crabs observed during the 1995 Pribilof District blue king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor		CONFIDENTIAL								
Floating Processor		CONFIDENTIAL								
Totals	6,227	50	0.8	13	0.2	1	1.03	48,592	772	12.8

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 26. Retained brown king crab carapace length frequency statistics by processor type for the 1994-95 Adak Area season.

Sample Type	Sample Size	Average Length	-----Shell Age (%)-----			
			Soft	New	Old	Very Old
Catcher processor	23,661	148.3	0.8	93.9	5.1	0.2
Floater processor	5,105	147.0	0.4	96.4	2.3	0.9
Shoreside processor	5,091	146.6	-	96.3	3.6	<0.1
Fishing Vessel	200	145.0	-	98.5	1.5	-
Totals	34,057	147.8	0.6	94.7	4.4	0.3

Table 27. Adak Area retained brown king crab carapace length distributions from the 1992, 1993, 1994, and 1995 fisheries.

Length (mm)	1992		1993		1994		1995	
	Num. crab	Percent	Num. crab	Percent	Num. crab	Percent	Num. crab	Percent
126-130	174	0.3	146	0.4	35	0.2	74	0.2
131-135	3,571	6.2	2,069	5.5	793	3.9	1,513	4.4
136-140	11,185	19.4	7,836	20.3	3,456	16.9	6,276	18.4
141-145	13,102	22.7	9,346	24.2	5,006	24.5	7,895	23.2
146-150	11,436	19.8	7,717	20.0	4,471	21.9	6,967	20.5
151-155	8,121	14.1	5,201	13.5	3,048	14.9	4,679	13.7
156-160	4,677	8.1	3,054	7.9	1,691	8.3	3,001	8.8
161-165	2,712	4.7	1,655	4.3	1,038	5.1	1,829	5.4
166-170	1,443	2.5	856	2.2	539	2.6	1,004	2.9
171-175	746	1.3	434	1.1	224	1.1	533	1.6
Totals	57,167 Mean length = 147.2 mm	99.1	38,314 Mean length = 147.0 mm	99.4	20,301 Mean length = 147.8 mm	99.4	33,771 Mean length = 147.8mm	99.1

Table 28. Illegally retained crabs observed during the 1994-95 Adak Area brown king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor										
							<b>CONFIDENTIAL</b>			
Floating Processor										
							<b>CONFIDENTIAL</b>			
Catcher Vessel										
							<b>CONFIDENTIAL</b>			
Totals	114,606	452	0.4	39	<0.1	0	0.4	490,474	2,406	23.4

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 29. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1994-95 Adak brown king crab *Lithodes aequispina* fishery. Standard errors of the CPUE estimates are included in parentheses. Data is from 1,430 potlifts sampled from the two catcher-processors which participated in the fishery and two catcher vessels.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>L. aequispina</i></u>			
legal males	9,465	6.62 (0.23) <sup>b</sup>	2,112,000 <sup>c</sup>
sublegal males	16,725	8.81 (0.44)	2,810,000
females	12,288	7.04 (0.62)	2,246,000
<u><i>L. couesi</i></u>			
legal males	226	0.16 <sup>d</sup>	51,000
sublegal males	30	0.02 <sup>d</sup>	6,380
females	32	0.02 <sup>d</sup>	6,380
<u><i>C. tanneri</i></u>			
legal males	12	< 0.01 <sup>d</sup>	2,680
sublegal males	6	< 0.01 <sup>d</sup>	1,340
females	4	< 0.01 <sup>d</sup>	890
<u><i>E. isenbeckii</i></u>			
legal males	14	< 0.01 <sup>d</sup>	3,120
sublegal males	9	< 0.01 <sup>d</sup>	2,000
females	0	--	--

<sup>a</sup> Estimated CPUE multiplied by 319,006 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 4.83.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 1,539,866.

<sup>d</sup> CPUE computed as total pot sample catch divided by 1,430 pots sampled; standard errors of estimates were not computed.

Table 30. Shell age distributions of all brown king crab males and females observed in the 1992, 1993, 1994, and 1995 Adak Area fishery.

Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	16,698	15,675	93.7	933	5.5	90	0.5
Females	8,005	7,491	93.5	499	6.2	15	0.2
<b>1993</b>							
Males	19,944	19,350	97.0	574	2.9	20	0.1
Females	15,000	14,484	96.6	510	3.4	6	<0.1
<b>1994</b>							
Males	5,578	5,424	97.2	154	2.8	0	-
Females	3,462	3,429	99.0	32	0.9	1	<0.1
<b>1995</b>							
Males	26,193	25,314	96.6	853	3.3	26	0.1
Females	12,294	11,656	94.8	626	5.1	12	0.1

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 31. Summary of the reproductive status of female brown king crabs examined by observers during the 1992, 1993, 1994, and 1995 Adak Area fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	1,690	25.1	2,710	34.8	1,060	13.6	2,336	30.0
1993	3,456	23.2	4,684	31.5	1,674	11.3	5,064	34.0
1994	507	14.6	1,075	31.1	757	21.9	1,122	32.4
1995	3,779	30.6	2,928	23.7	1,661	13.5	3,969	32.2
Totals	9,432	24.5	11,397	29.6	5,152	13.4	12,491	32.5

Table 32. Retained red king crab carapace length frequency statistics by processor type from the 1995 Adak Area fishery.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	65	154.3mm	-	56.9	3.8	12.3
Catcher Processor	776	153.8mm	-	76.9	21.0	2.1
Shoreside Processor	101	144.3mm	-	66.3	33.7	-
Totals	942	152.8mm	-	75.6	22.4	2.0

Table 33. Adak Area retained red king crab carapace length distributions from the 1992, 1993, 1994, and 1995 fisheries.

Length (mm)	1992		1993		1994		1995	
	Num. Crab	Percent	Num. Crab	Percent	Num. Crab	Percent	Num. Crab	Percent
131-135	39	3.8	1	<0.1	16	1.5	27	2.8
136-140	170	16.7	31	0.7	66	6.7	112	11.9
141-145	183	18.0	186	4.2	99	9.6	157	16.7
146-150	163	16.1	545	12.3	146	14.1	145	15.4
151-155	166	16.4	813	18.4	145	14.0	124	13.2
156-160	109	10.7	889	20.1	153	14.8	118	12.5
161-165	95	9.4	811	18.3	146	14.1	97	10.3
166-170	48	4.7	590	13.3	119	11.5	96	10.2
171-175	25	2.5	339	7.7	65	6.3	49	5.2
176-180	16	1.6	146	3.3	39	3.8	11	1.2
181-185	0	-	0	-	23	2.2	3	0.3
186-190	0	-	0	-	14	1.4	2	0.2
Totals	1,014	99.1 Mean length = 151.3 mm	4,351	98.3 Mean length = 154.6 mm	1,031	100.0 Mean length = 157.5 mm	941	99.9 Mean length = 152.8mm

Table 34. Illegally retained crabs observed during the 1995 Adak Area red king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Total Other Crabs	Total Percent Illegal	Number crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor						<b>CONFIDENTIAL</b>				
Catcher Vessel						<b>CONFIDENTIAL</b>				
Totals	1,821	4	0.22	0	0.00	0	0.22	6,843	24	26.6

<sup>a</sup> Gish et. al., 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 35. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Adak Area red king crab *Paralithodes camtschaticus* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 263 potlifts sampled from the single catcher-processor and 5 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>P. camtschaticus</i></u>			
legal males	640	2.19 (0.37) <sup>b</sup>	4,960 <sup>c</sup>
sublegal males	587	3.02 (1.26)	6,840
females	1,073	5.76 (2.56)	13,050
<u><i>L. aequispina</i></u>			
legal males	86	0.33 <sup>d</sup>	740
sublegal males	6	0.02 <sup>d</sup>	50
females	19	0.07 <sup>d</sup>	160
<u><i>E. isenbeckii</i></u>			
legal males	35	0.13 <sup>d</sup>	300
sublegal males	16	0.06 <sup>d</sup>	140
females	5	0.02 <sup>d</sup>	40
<u><i>C. bairdi</i></u>			
legal males	5	0.02 <sup>d</sup>	40
sublegal males	92	0.35 <sup>d</sup>	790
females	27	0.10 <sup>d</sup>	230
Pacific cod	321	1.20 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 2,265 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 2.97.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 6,733.

<sup>d</sup> CPUE computed as total pot sample catch divided by 263 pots sampled; standard errors of estimates were not computed.

Table 36. Shell age distributions of all red king crab males and females observed in the 1992, 1993, 1994, and 1995 Adak Area fisheries.

Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	2,411	2,086	86.5	235	9.7	90	0.4
Females	1,377	1,371	99.6	6	0.4	0	-
<b>1993</b>							
Males	485	435	89.7	42	8.7	8	1.6
Females	260	259	99.6	1	0.4	0	-
<b>1994</b>							
Males	484	339	70.0	122	25.2	23	4.8
Females	88	86	97.7	2	0.3	0	-
<b>1995</b>							
Males	1,227	802	65.4	378	30.8	43	3.5
Females	1,073	1,068	99.5	5	0.5	0	-

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 37. Summary of the reproductive status of female red king crabs examined by observers during the 1992, 1993, 1994, and 1995 Adak Area fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	1,141	82.8	212	15.4	6	0.4	19	1.4
1993	58	22.2	198	73.8	5	1.9	1	0.4
1994	26	29.5	54	61.4	3	3.4	5	5.7
1995	63	5.9	861	80.2	1	<0.1	148	13.8
Totals	1,288	45.9	1,325	43.7	15	0.5	173	6.2

Table 38. Retained brown king crab carapace length frequency statistics by processor type from the 1995 Dutch Harbor Area fishery.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	2,882	150.1mm	-	93.7	6.2	<0.1
Catcher Processor	1,572	148.6mm	-	94.5	5.3	0.2
Shorside Processor	1,432	149.3mm	-	96.9	3.1	0
Totals	5,886	149.6mm	-	94.7	5.2	0.1

Table 39. Dutch Harbor Area retained brown king crab carapace length distributions from the 1992, 1993, 1994, and 1995 fisheries.

Length (mm)	1992		1993 <sup>a</sup>		1994 <sup>a</sup>		1995	
	Num. Crab	Percent	Num. Crab	Percent	Num. Crab	Percent	Num. Crab	Percent
126-130	69	0.5	5	1.0	12	0.7	11	0.2
131-135	1,105	7.5	36	6.7	97	5.8	252	4.3
136-140	2,467	16.6	82	15.2	298	17.7	871	14.9
141-145	3,182	21.5	104	19.3	348	20.7	1,185	20.2
146-150	2,786	18.8	96	17.8	386	23.0	1,134	19.4
151-155	2,118	14.3	69	12.8	222	13.2	901	15.4
156-160	1,498	10.1	51	9.5	138	8.2	649	11.1
161-165	872	5.8	51	9.5	88	5.2	418	7.1
166-170	459	3.1	29	5.4	44	2.6	258	4.4
171-175	182	1.2	9	1.7	34	2.0	119	2.0
176-180	58	0.4	3	0.6	8	0.5	53	0.9
Totals	14,796	99.1	535	98.3	1,675	100.0	5,851	99.9
	Mean length = 147.8 mm		Mean length = 149.1 mm		Mean length = 147.6 mm		Mean length = 149.6mm	

<sup>a</sup> All samples collected by ADF&G personnel at shoreside processing plants.

Table 40. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Dutch Harbor Area brown king crab *Lithodes aequispina* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 2,512 potlifts sampled from the single catcher-processor and all 16 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>L. aequispina</i></u>			
legal males	13,246	6.26 (0.17) <sup>b</sup>	411,000 <sup>c</sup>
sublegal males	22,714	11.40 (0.41)	749,000
females	26,393	12.69 (0.53)	834,000
<u><i>P. camtschaticus</i></u>			
legal males	0	--	--
sublegal males	0	--	--
females	1	< 0.01 <sup>d</sup>	25
<u><i>L. couesi</i></u>			
legal males	2	< 0.01 <sup>d</sup>	50
sublegal males	24	< 0.01 <sup>d</sup>	630
females	21	< 0.01 <sup>d</sup>	550
<u><i>C. tanneri</i></u>			
legal males	20	< 0.01 <sup>d</sup>	520
sublegal males	12	< 0.01 <sup>d</sup>	310
females	0	--	--
<u><i>E. isenbeckii</i></u>			
legal males	0	--	--
sublegal males	1	< 0.01 <sup>d</sup>	25
females	0	--	--
Pacific cod	873	0.35 <sup>d</sup>	--
halibut	470	0.19 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 65,732 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 6.18.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 405,915.

<sup>d</sup> CPUE computed as total pot sample catch divided by 2,512 pots sampled; standard errors of estimates were not computed.

Table 41. Summary of the reproductive status of female brown king crab examined by observers during the 1992 and 1995 Dutch Harbor Area fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	617	19.4	838	26.4	273	8.6	1,451	45.6
1993	No data							
1994	No data							
1995	3,573	14.0	4,996	19.6	3,000	11.8	13,961	54.6
Totals	4,190	14.6	5,834	20.3	3,273	11.4	15,412	53.7

Table 42. Shell age distributions of all brown king crab males and females observed in sampled pots during the 1992 and 1995 Dutch Harbor Area fisheries.

Fishery Year	Sample Size <sup>a</sup>	Shell Age Classes					
		New	% Total	Old	% Total	Very Old	% Total
<b>1992</b>							
Males	3,087	2,994	97.0	86	2.8	7	0.2
Females	3,179	2,928	92.1	239	7.5	12	0.4
<b>1993</b>							
	No Data						
<b>1994</b>							
	No Data						
<b>1995</b>							
Males	34,922	33,566	96.1	1,317	3.8	39	<0.1
Females	25,568	23,861	93.3	1,658	6.5	49	0.2

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 43. Illegally retained crabs observed during the 1995 Dutch Harbor Area brown king crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor							<b>CONFIDENTIAL</b>			
Catcher Vessel							<b>CONFIDENTIAL</b>			
Totals	26,050	314	1.21	20	0.08	3	1.29	431,867	4,945	6.0

<sup>a</sup> Gish et. al., 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 44. Retained Korean hair crab carapace length frequency statistics by sample location from the 1995 Bering Sea fishery.

Sample Type	Sample Size	Mean Length	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	7,278	91.5 mm	<0.1	93.1	6.6	0.2
Shoreside Processor	205	89.6 mm	-	96.6	3.4	-
Totals	7,483	91.3 mm	<0.1	93.2	6.5	0.2

Table 45. Bering Sea retained Korean hair crab carapace length distributions, 1992, 1993, 1994, and 1995.

Width (mm)	1992		1993		1994		1995	
	Num. Crab	Percent						
61 - 65	3	0.2	0	-	0	-	1	<0.1
66 - 70	19	1.3	8	0.1	0	-	0	-
71 - 75	141	9.3	126	0.9	19	0.3	40	0.5
76 - 80	339	22.4	1,337	9.2	321	5.0	450	6.1
81 - 85	425	28.0	3,263	22.5	945	14.7	968	12.9
86 - 90	339	22.4	4,760	32.9	1,603	25.0	1,721	23.0
91 - 95	153	10.1	3,563	24.6	1,913	29.8	2,166	28.9
96 - 100	43	2.8	1,237	8.6	1,191	18.6	1,515	20.2
101 - 105	24	1.6	161	1.1	392	6.1	530	7.1
106 - 110	16	1.1	12	0.1	31	0.5	86	1.1
Totals	1,502	99.2	14,467	100.0	6,415	100.0	7,477	99.9
	Mean length = 83.6 mm		Mean length = 88.0 mm		Mean length = 91.0 mm		Mean length = 91.3 mm	

Table 46. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Bering Sea Korean horsehair crab *Erimacrus isenbeckii* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 10,117 potlifts sampled from all 21 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>E. isenbeckii</i></u>			
legal males	34,100	3.50 (0.03) <sup>b</sup>	1,566,400 <sup>c</sup>
sublegal males	2,721	0.27 <sup>d</sup>	120,400
females	1,974	0.20 <sup>d</sup>	87,300
<u><i>P. camtschaticus</i></u>			
legal males	26	< 0.01 <sup>d</sup>	1,150
sublegal males	344	0.03 <sup>d</sup>	13,400
females	5,242	0.52 <sup>d</sup>	232,700
<u><i>P. platypus</i></u>			
legal males	160	0.02 <sup>d</sup>	8,900
sublegal males	1,480	0.15 <sup>d</sup>	67,100
females	4,432	0.44 <sup>d</sup>	196,900
<u><i>C. opilio</i></u>			
legal males	3,320	0.33 <sup>d</sup>	147,700
sublegal males	3,248	0.32 <sup>d</sup>	143,200
females	139	0.01 <sup>d</sup>	6,100
<u><i>C. bairdi</i></u>			
legal males	91	< 0.01 <sup>d</sup>	4,000
sublegal males	2,094	0.21 <sup>d</sup>	94,000
females	6,890	0.68 <sup>d</sup>	304,300

<sup>a</sup> Estimated CPUE multiplied by 447,555 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 3.25.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 1,455,303.

<sup>d</sup> CPUE computed as total pot sample catch divided by 10,117 pots sampled; standard errors of estimates were not computed.

Table 47. Shell age distributions of all Korean hair crab males and females observed in the 1992, 1993, 1994, and 1995 Bering Sea fisheries.

Fishery Year	Sample Size <sup>a</sup>	Shell Age Classes					
		Soft	% Total	New	% Total	Old	% Total
<b>1992</b>							
Males	1,815	-	-	1,681	92.6	134	7.4
Females	21	-	-	10	47.6	11	52.4
<b>1993</b>							
Males	55,552	2,659	4.8	43,394	78.1	9,499	17.1
Females	4,418	21	0.5	4,089	92.6	308	7.0
<b>1994</b>							
Males	4,088	1	<0.1	3,437	84.1	650	15.9
Females	91	0	-	86	94.5	5	0.6
<b>1995</b>							
Males	13,587	2	<0.1	11,755	86.5	1,830	13.5
Females	706	0	-	644	91.2	62	8.8

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 48. Summary of the reproductive status of female Korean hair crabs examined by observers during the 1992, 1993, 1994, and 1995 Bering Sea fisheries.

Year	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
1992	1	5.3	3	15.8	1	5.3	14	73.7
1993	117	2.7	24	0.5	842	19.1	3,414	77.6
1994	2	2.3	14	16.3	1	1.2	69	80.2
1995	94	13.6	18	2.6	148	21.4	432	62.4
Totals	214	4.1	59	1.1	992	19.1	3,929	75.7

Table 49. Illegally retained crabs observed during the 1995 Bering Sea Korean hair crab fishery.

Sample Location	Sample Size	Male		Female		Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
		Number	Percent	Number	Percent					
Catcher Vessel	42,572	161	0.38	25	0.06	60	0.58	1,433,478	8,283	3.0
Totals	42,572	161	0.38	25	0.06	60	0.58	1,433,478	8,283	3.0

<sup>a</sup> Morrison et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 50. Retained *C. tanneri* crab carapace width frequency statistics by processor type from the 1995 Bering Sea fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	4,792	144.8mm	0.2	86.7	12.4	0.7
Shoreside Processor	205	147.1mm	-	98.5	1.5	-
Totals	4,997	144.8mm	0.2	87.2	11.9	0.7

Table 51. Retained *C. tanneri* crab carapace width distributions from the 1995 Bering Sea, Eastern Aleutian, Western Aleutian, and South Peninsula Area fisheries.

Width (mm)	Bering Sea		Eastern Aleutian		Western Aleutian		South Peninsula	
	Num. Crab	Percent	Num. Crab	Percent.	Num. Crab	Percent	Num. Crab	Percent
121-125	200	4.0	495	9.6	44	3.3	1,990	26.9
126-130	457	9.1	614	11.9	173	13.1	1,704	23.6
131-135	652	13.1	874	17.0	286	21.6	1,172	15.8
136-140	681	13.6	992	17.9	296	22.3	1,149	15.5
141-145	653	13.1	733	14.3	247	18.6	799	10.8
146-150	598	12.0	532	10.4	150	11.3	318	4.3
151-155	573	11.5	370	7.2	75	5.6	71	0.9
156-160	537	10.8	245	4.8	30	2.3	18	0.2
161-165	380	7.6	135	2.6	14	1.0	0	-
166-170	189	3.8	65	1.3	2	0.2	0	-
Totals	4,920	98.6	5,055	97.0	1,317	99.3	7,221	97.4
	Mean width = 144.8 mm		Mean width = 139.1 mm		Mean width = 138.6 mm		Mean. width = 131.6	

Table 52. Shell age distributions of all *C. tanneri* male and female crab observed in the 1995 Bering Sea, Eastern Aleutian, Western Aleutian, and South Peninsula Area fisheries.

Fishery	Sample Size <sup>a</sup>	Shell Age Classes							
		Soft	% Total	New	% Total	Old	% Total	Very Old	% Total
<b>Bering Sea</b>									
Males	39,398	63	0.2	34,653	87.9	4,442	11.3	240	0.6
Females	8,802	1	<0.1	5,552	63.1	2,738	31.0	511	5.8
<b>Eastern Aleutian</b>									
Males	41,339	10	<0.1	30,446	73.6	10,584	25.6	299	0.7
Females	15,923	0	-	5,159	32.4	10,133	63.5	651	4.1
<b>Western Aleutian</b>									
Males	8,665	8	<0.1	7,544	87.0	1,084	12.5	29	0.3
Females	5,922	0	-	4,730	79.9	1,188	20.0	4	<0.1
<b>South Peninsula</b>									
Males	66,714	35	<0.1	49,747	74.6	14,411	21.6	2,521	3.8
Females	14,374	0	-	10,142	70.6	3,962	27.5	270	1.9

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 53. Illegally retained crabs observed during the 1995 Bering Sea *C. tanneri* crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Vessel	19,803	92	0.46	0	0	0	0.46	437,877	2,034	3.0
Totals	19,803	92	0.46	0	0	0	0.46	433,877	2,034	3.0

<sup>a</sup> Morrison et. al., 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 54. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Bering Sea *Chionoecetes tanneri* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 4,407 potlifts sampled from the 8 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<i>C. tanneri</i>			
legal males	34,612	8.19 (0.09) <sup>b</sup>	492,000 <sup>c</sup>
sublegal males	4,935	1.17 (0.04)	70,300
females	8,835	2.13 (0.12)	127,900
<i>C. angulatus</i>			
legal males	6,700	1.63 (0.05)	97,900
sublegal males	5,832	1.36 (0.04)	81,700
females	99	0.02 <sup>d</sup>	1,200
<i>C. bairdi</i>			
legal males	0	--	--
sublegal males	2	< 0.01 <sup>d</sup>	30
females	0	--	--
<i>C. opilio</i>			
legal males	0	--	--
sublegal males	0	--	--
females	3	< 0.01 <sup>d</sup>	40
<i>P. couesi</i>			
legal males	1,692	0.38 <sup>d</sup>	22,800
sublegal males	2,478	0.56 <sup>d</sup>	33,600
females	2,160	0.49 <sup>d</sup>	29,400
<i>L. aequispina</i>			
legal males	317	0.07 <sup>d</sup>	4,200
sublegal males	810	0.18 <sup>d</sup>	10,800
females	155	0.04 <sup>d</sup>	2,400

<sup>a</sup> Estimated CPUE multiplied by 60,069 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 7.59.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 456,174.

<sup>d</sup> CPUE computed as total pot sample catch divided by 4,407 pots sampled; standard errors of estimates were not computed.

Table 55. Summary of the reproductive status of female *C. tanneri* examined by observers during the 1995 Bering Sea, Eastern Aleutian, Western Aleutian, and South Peninsula Area fisheries.

Fishery	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren, Non-mated	Percent Total
Bering Sea	270	3.1	7,854	89.2	125	1.4	551	6.3
Eastern Aleutians	790	5.0	14,868	93.4	154	1.0	100	0.6
Western Aleutians	221	3.7	5,389	91.0	239	4.0	79	1.3
Alaska Peninsula	1,052	7.4	13,038	91.2	110	0.8	94	0.6
Totals	2,333	5.2	41,149	91.6	628	1.4	824	1.8

Table 56. Retained *C. tanneri* crab carapace width frequency statistics by processor type from the 1995 Eastern Aleutian Area fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	4,591	139.1mm	-	84.9	14.4	0.7
Shoreside Processor	547	137.5mm	-	98.4	1.6	-
Totals	5,138	139.1mm	-	86.3	13.0	0.7

Table 57. Illegally retained crabs observed during the 1995 Eastern Aleutian Area *C. tanneri* crab fishery.

Sample Location	Sample Size	Male		Female		Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
		Number	Percent	Number	Percent					
Catcher Vessel	19,776	156	0.79	6	0.03	0	0.82	494,908	4,054	4.0
Totals	19,776	156	0.79	6	0.03	0	0.82	494,908	4,054	4.0

<sup>a</sup> Gish et. al. 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 58. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Eastern Aleutian Area *Chionoecetes tanneri* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 4,216 potlifts sampled from the 7 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>C. tanneri</i></u>			
legal males	27,058	6.73 (0.10) <sup>b</sup>	484,000 <sup>c</sup>
sublegal males	14,281	3.75 (0.08)	270,000
females	16,013	4.52 (0.42)	325,000
<u><i>C. angulatus</i></u>			
legal males	5,546	1.31 (0.03)	94,200
sublegal males	4,346	0.95 (0.05)	68,300
females	304	0.07 <sup>d</sup>	5,000
<u><i>P. couesi</i></u>			
legal males	1,686	0.40 <sup>d</sup>	28,800
sublegal males	1,703	0.40 <sup>d</sup>	28,800
females	3,460	0.82 <sup>d</sup>	59,000
<u><i>L. aequispina</i></u>			
legal males	22	0.01 <sup>d</sup>	720
sublegal males	230	0.05 <sup>d</sup>	3,600
females	220	0.05 <sup>d</sup>	3,600
Sablefish	152	0.04 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 71,931 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 7.10.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 510,993.

<sup>d</sup> CPUE computed as total pot sample catch divided by 4,216 pots sampled; standard errors of estimates were not computed.

Table 59. Retained *C. tanneri* carapace width frequency statistics by processor type from the 1995 Western Aleutian Area fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	826	138.1mm	-	93.0	7.0	-
Floating Processor	799	139.6mm	-	100	-	-
Totals	1,325	138.6mm	-	95.6	4.4	-

Table 60. Illegally retained crabs observed during the 1995 Western Aleutian Area *C. tanneri* crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Vessel	5,868	35	0.60	0	0.00	0	0.60	8,328	50	70.5
Totals	5,868	35	0.60	0	0.00	0	0.60	8,328	50	70.5

<sup>a</sup> Gish et. al., 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 61. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 Western Aleutian Area *Chionoecetes tanneri* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 1,096 potlifts sampled from the 5 catcher vessels which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE For Sampled Fleet	Estimated Total Fishery Catch <sup>a</sup>
<u><i>C. tanneri</i></u>			
legal males	7,486	6.79 (0.20) <sup>b</sup>	76,900 <sup>c</sup>
sublegal males	1,227	1.14 (0.06)	12,900
females	5,967	5.71 (0.42)	64,700
<u><i>L. couesi</i></u>			
legal males	1,139	1.25 (0.05)	14,200
sublegal males	667	0.61 <sup>d</sup>	8,700
females	1,725	1.69 (0.10)	19,100
<u><i>L. aequispina</i></u>			
legal males	144	0.13 <sup>d</sup>	1,500
sublegal males	1,740	1.59 (0.20)	18,000
females	2,042	1.86 (0.23)	21,100
<u><i>C. angulatus</i></u>			
legal males	7	< 0.01 <sup>d</sup>	70
sublegal males	16	0.02 <sup>d</sup>	170
females	1	< 0.01 <sup>d</sup>	10
Sablefish	14	0.01 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 11,324 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 6.62

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 74,970.

<sup>d</sup> CPUE computed as total pot sample catch divided by 1,096 pots sampled; standard errors of estimates were not computed.

Table 62. Retained *C. tanneri* crab carapace width frequency statistics by processor type from the 1995 Alaska Peninsula Area fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	239	134.1mm	-	72.8	25.2	1.7
Catcher Processor	7,170	131.6mm	0.1	80.5	17.0	2.4
Totals	7,409	131.6mm	0.1	80.2	17.4	2.3

Table 63. Illegally retained crabs observed during the 1995 Alaska Peninsula Area *C. tanneri* crab fishery.

Sample Location	Sample Size	Male Number	Male Percent	Female Number	Female Percent	Other Crabs	Total Percent Illegal	Number Crabs Harvested <sup>a</sup>	Estimated Number Illegal Crabs <sup>b</sup>	Percent Harvest Sampled
Catcher Processor							<b>CONFIDENTIAL</b>			
Catcher Vessel							<b>CONFIDENTIAL</b>			
Totals	49,566	280	0.56	8	0.02	0	0.58	600,984	3,564	8.2

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<sup>a</sup> Jackson, 1996.

<sup>b</sup> Estimates derived from percentage of illegal crabs from sample locations multiplied by number of crabs harvested in the fishery.

Table 64. Estimated catch per pot (CPUE) of selected crab species from potlifts sampled by observers during the 1995 South Peninsula Area *Chionoecetes tanneri* fishery. Standard errors of the CPUE estimates are included in parentheses. Data are from 925 potlifts sampled from the 7 catcher vessels and single catcher-processor which participated in the fishery.

Species / Sex Class	Total Pot Sample Catch	Estimated CPUE for Fishery	Estimated Fishery Catch <sup>a</sup>
<u><i>C. tanneri</i></u>			
legal males	71,412	85.15 (1.87) <sup>b</sup>	617,200 <sup>c</sup>
sublegal males	41,924	53.43 (2.21)	387,300
females	49,496	74.91 (7.06)	543,000
<u><i>L. couesi</i></u>			
legal males	313	0.34 <sup>d</sup>	2,500
sublegal males	140	0.15 <sup>d</sup>	1,100
females	610	0.66 <sup>d</sup>	4,800
<u><i>L. aequispina</i></u>			
legal males	11	0.01 <sup>d</sup>	90
sublegal males	10	0.01 <sup>d</sup>	80
females	8	< 0.01 <sup>d</sup>	60
Arrowtooth flounder	1,130	1.22 <sup>d</sup>	--
Sablefish	789	0.85 <sup>d</sup>	--

<sup>a</sup> Estimated CPUE multiplied by 7,248 total pot lifts during fishery as reported on confidential interview forms.

<sup>b</sup> Actual CPUE for retained legal crabs for the fishery as reported on confidential interview forms was 84.37.

<sup>c</sup> Actual catch of retained legal crabs for the fishery as reported on confidential interview forms was 609,575.

<sup>d</sup> CPUE computed as total pot sample catch divided by 925 pots sampled; standard errors of estimates were not computed.

Table 65. Retained *C. tanneri* crab carapace width distributions from the 1995 Yakutat area fishery.

Width (mm)	Num. crab	Percent
121-125	13	6.4
126-130	29	14.4
131-135	39	19.3
136-140	25	12.4
141-145	15	7.4
146-150	18	8.9
151-155	26	12.9
156-160	22	10.9
161-165	13	6.4
166-170	2	1.0
Total	202	100.0
	Mean width = 141.8 mm	

Table 67. Retained *C. angulatus* carapace width frequency statistics by processor type from 1995 Eastern Aleutian area fishery.

Sample Type	Sample Size	Mean Width	Shell Age (%)			
			Soft	New	Old	Very Old
Catcher Vessel	1,468	120.5mm	-	92.4	6.4	1.2
Shoreside Processor	205	117.5mm	-	100.0	-	-
Totals	1,673	120.3mm	-	93.4	5.6	1.0

Table 68. Retained *C. angulatus* crab carapace width distributions from the 1995 Eastern Aleutian area fishery.

Width (mm)	Num. Crab	Percent
101-105	3	0.2
106-110	93	5.6
111-115	369	22.0
116-120	392	23.4
121-125	443	26.5
126-130	277	16.6
131-135	78	4.7
136-140	16	1.0
141-145	2	0.1
Total	1,673	100.0
	Mean width = 120.3mm	

Table 70. Shell age distributions of all *C. angulatus* males and females observed in the 1995 Eastern Aleutian Area fishery.

Sex	Sample Size <sup>a</sup>	Shell Age Classes							
		Soft	% Total	New	% Total	Old	% Total	Very Old	% Total
Males	12,792	36	0.3	12,041	94.1	714	5.6	1	<0.1
Females	123	1	0.8	114	92.7	8	6.5	0	-

<sup>a</sup> Summary of crab measured from random pots sampled by observers, including soft shelled crabs.

Table 71. Summary of the reproductive status of female *C. angulatus* examined by observers during the 1995 Eastern Aleutian Area fishery.

	Eyed Eggs	Percent Total	Uneyed Eggs	Percent Total	Barren, Mated	Percent Total	Barren Non-mated	Percent Total
	1	0.8	93	75.6	7	5.7	22	17.9
Totals	1	0.8	93	75.6	7	5.7	22	17.9

Table 72. Observer coverage, pot sampling effort by observers, and relative difference of observer-based CPUE estimates for retained legal crabs from the Actual Observed Fleet CPUE and from the Actual Total Fishery CPUE. Data is from crab fisheries with mandatory observer and seasons ending in 1995.

Fishery (Table in report referenced)	Vessels		Pot lifts		Percent difference of observer-based CPUE estimate from:	
	Observed	Total Fishery	Sampled	Total Fishery	Actual Observed Fleet CPUE <sup>a</sup>	Actual Total Fishery CPUE <sup>b</sup>
Bering Sea <u>C. opilio</u> (Table 4)	19	253 <sup>c</sup>	1,530	506,802	-7.2%	-6.0%
Bering Sea <u>C. bairdi</u> (Table 10)	11	196 <sup>c</sup>	421	247,853	3.4%	4.6%
St. Matthew District blue king crab (Table 15)	2	90 <sup>c</sup>	47	48,560	-20.2%	
Pribilofs District king crab (Table 19)	1	119 <sup>c</sup>	34	34,721	32.8%	
Adak Area brown king crab (Table 29)	4	32 <sup>d</sup>	1,430	319,006	-3.1%	37.1%
Adak Area red king crab (Table 35)	6	6	263	2,265	-26.3%	- <sup>e</sup>
Dutch Harbor Area brown king crab (Table 40)	17	17	2,512	65,732	1.3%	- <sup>e</sup>
Bering Sea Korean hair crab (Table 46)	21	21	10,117	447,555	7.7%	- <sup>e</sup>
Bering Sea <u>C. tanneri</u> (Table 54)	8	8	4,407	60,069	7.9%	- <sup>e</sup>
Eastern Aleutians Area <u>C. tanneri</u> (Table 58)	7	7	4,216	71,931	-5.2%	- <sup>e</sup>
Western Aleutians Area <u>C. tanneri</u> (Table 61)	5	5	1,096	11,324	2.6%	- <sup>e</sup>
South Peninsula Area <u>C. tanneri</u> (Table 64)	7	7	925	7,248	0.9%	- <sup>e</sup>
Yakutat Area <u>C. tanneri</u> (Table 66)	1	1			48.8%	- <sup>e</sup>
Eastern Aleutians Area <u>C. angulatus</u> (Table 69)	1	1			1.3%	- <sup>e</sup>

<sup>a</sup> Actual Observed Fleet CPUE is based on confidential interviews with the operators of observed vessels. Percent difference is computed as:  $\{[(\text{Observer-based CPUE}) - (\text{Confidential Interview CPUE})] / (\text{Confidential Interview CPUE}) - 1\} \times 100\%$ .

<sup>b</sup> Actual Total Fishery CPUE is based on fish ticket data on all landings in the fishery. Percent difference is computed as:  $\{[(\text{Observer-based CPUE}) - (\text{Fish Ticket CPUE})] / (\text{Fish Ticket CPUE}) - 1\} \times 100\%$ . Computed only for fisheries with partial observer coverage.

<sup>c</sup> Morrison et al., 1996.

<sup>d</sup> Gish et al. 1996.

<sup>e</sup> Fishery with 100% observer coverage. Comparison with observed fleet CPUE provides comparison with total fishery CPUE.

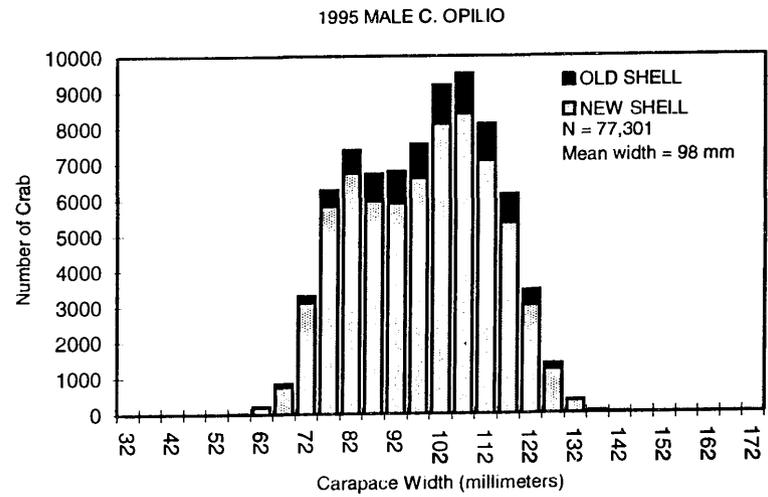
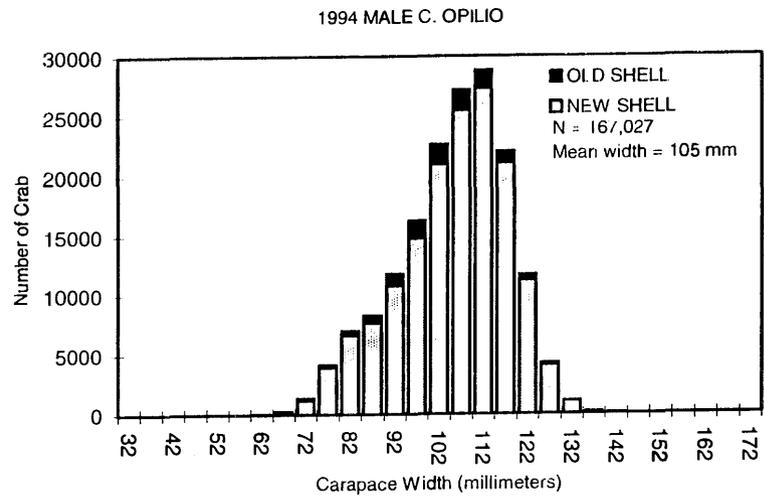
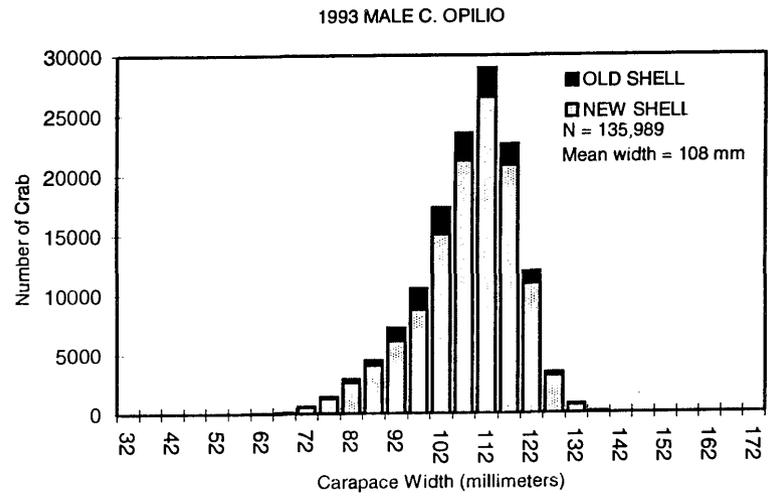
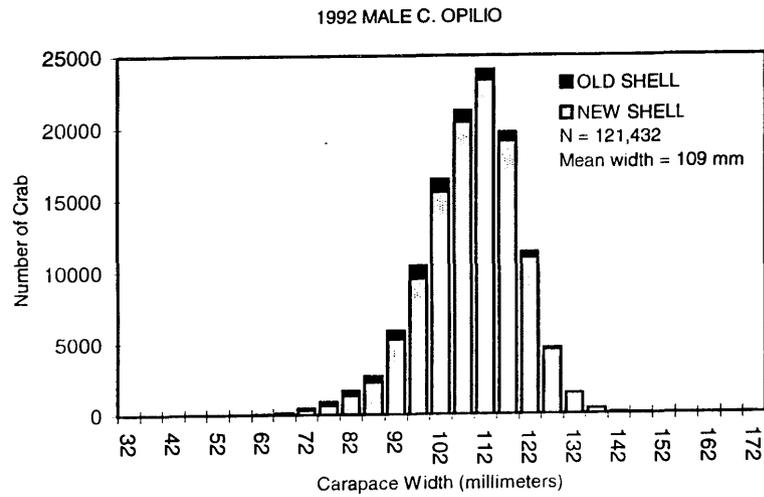


Figure 1. Carapace width distribution histograms of all *C. opilio* males observed in the Bering Sea fishery, 1992-1995.

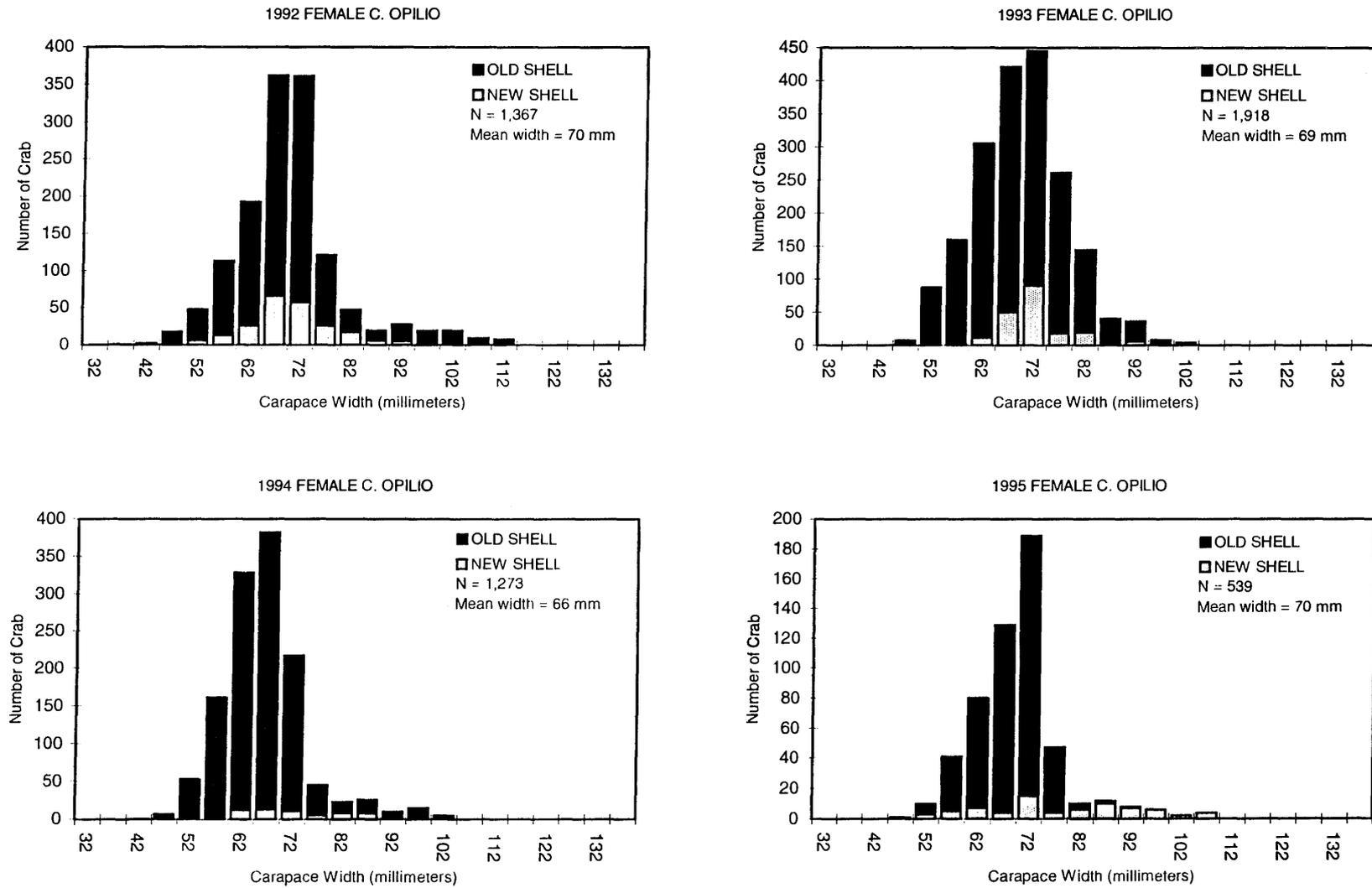


Figure 2. Carapace width distribution histograms of all *C. opilio* females observed in the Bering Sea fishery, 1992-1995.

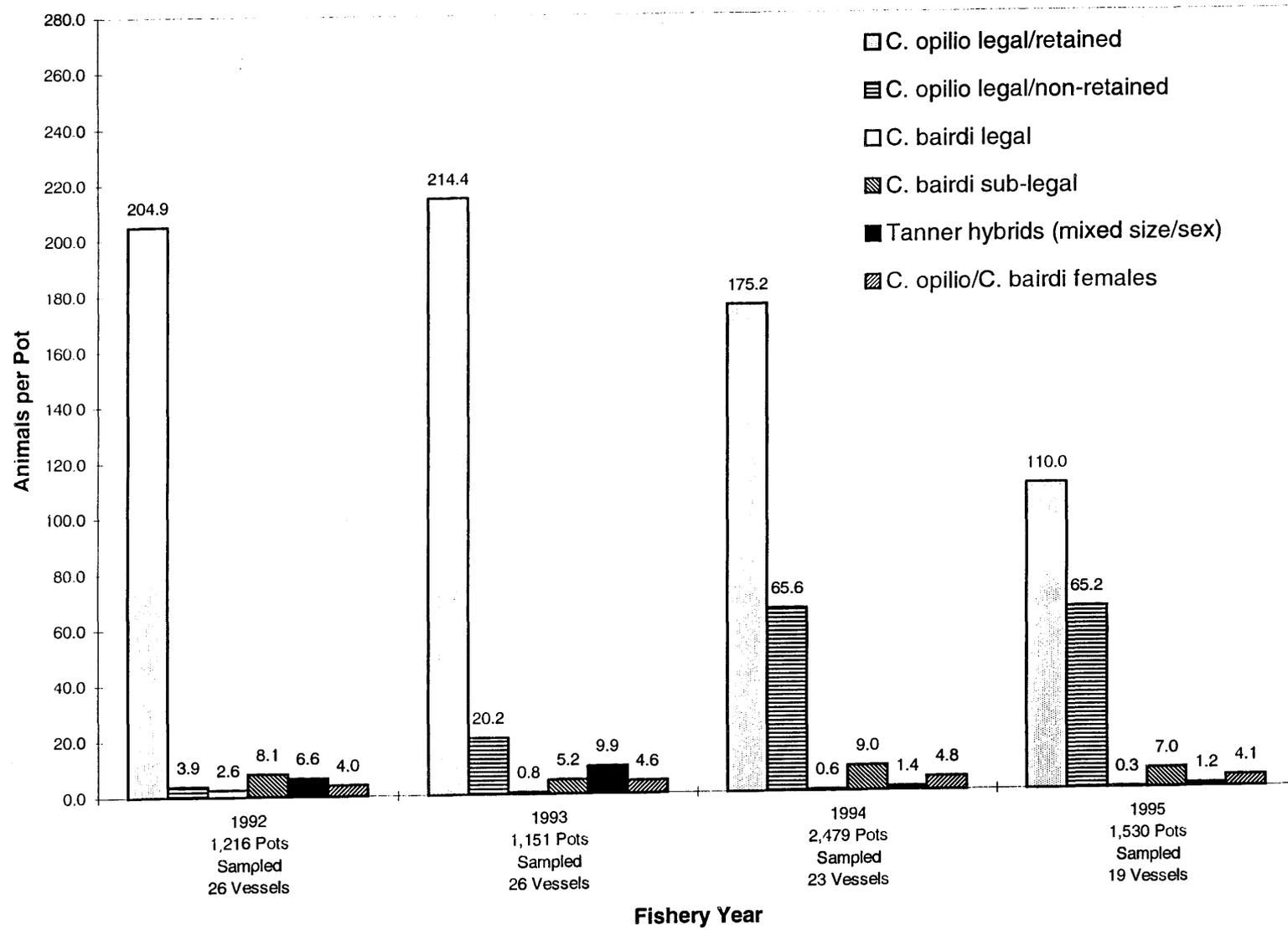


Figure 3. Catch per pot of selected species from the Bering Sea *C. opilio* fishery, 1992-1995.

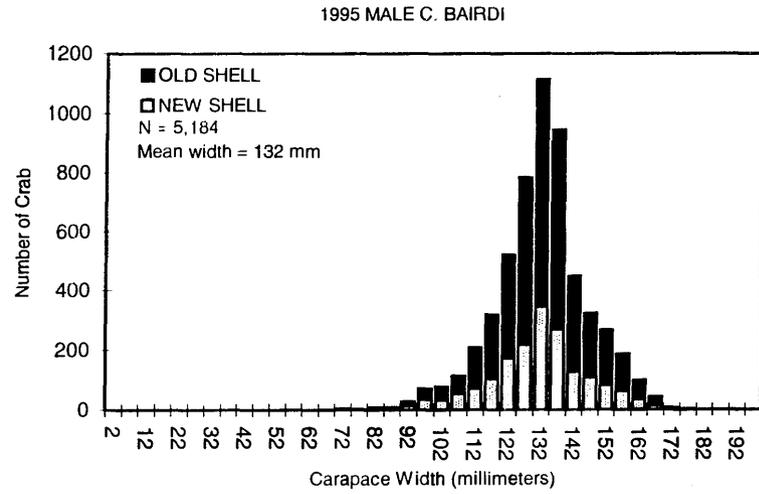
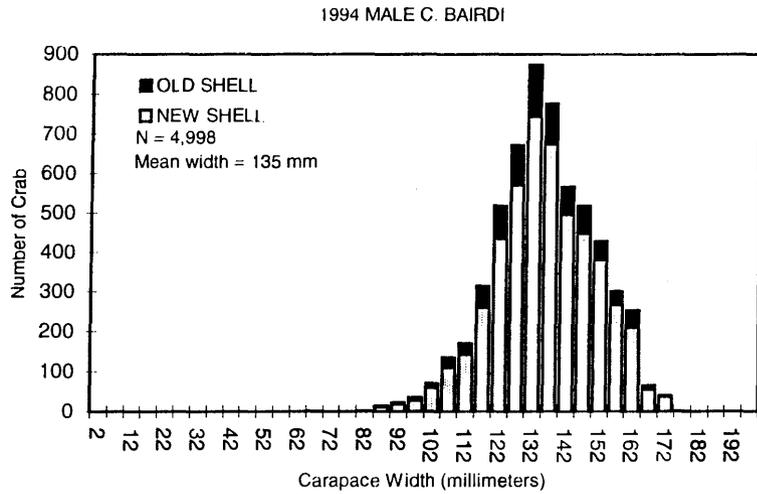
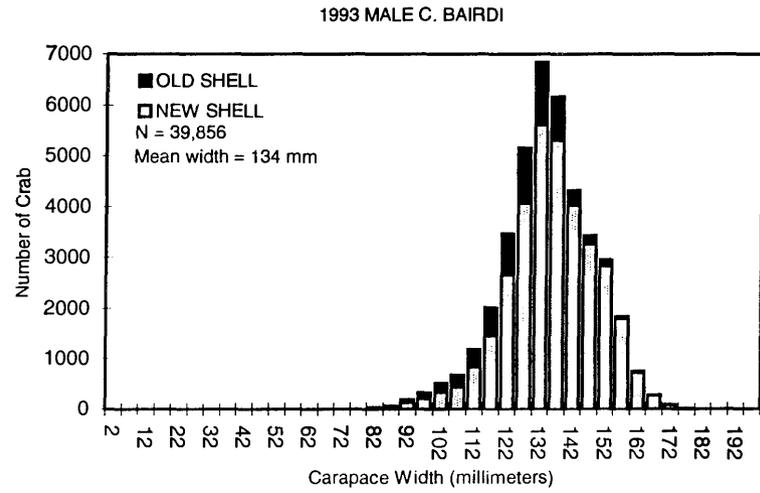
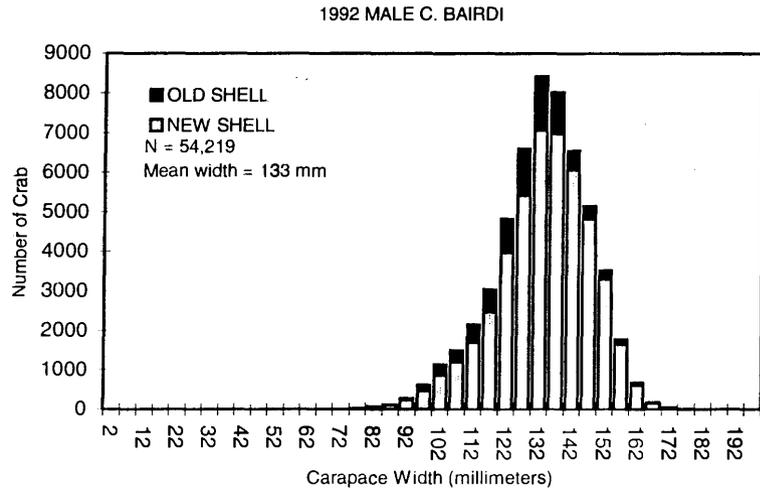


Figure 4. Carapace width distribution histograms of all *C. bairdi* males observed in the Bering Sea fishery, 1992-1995.

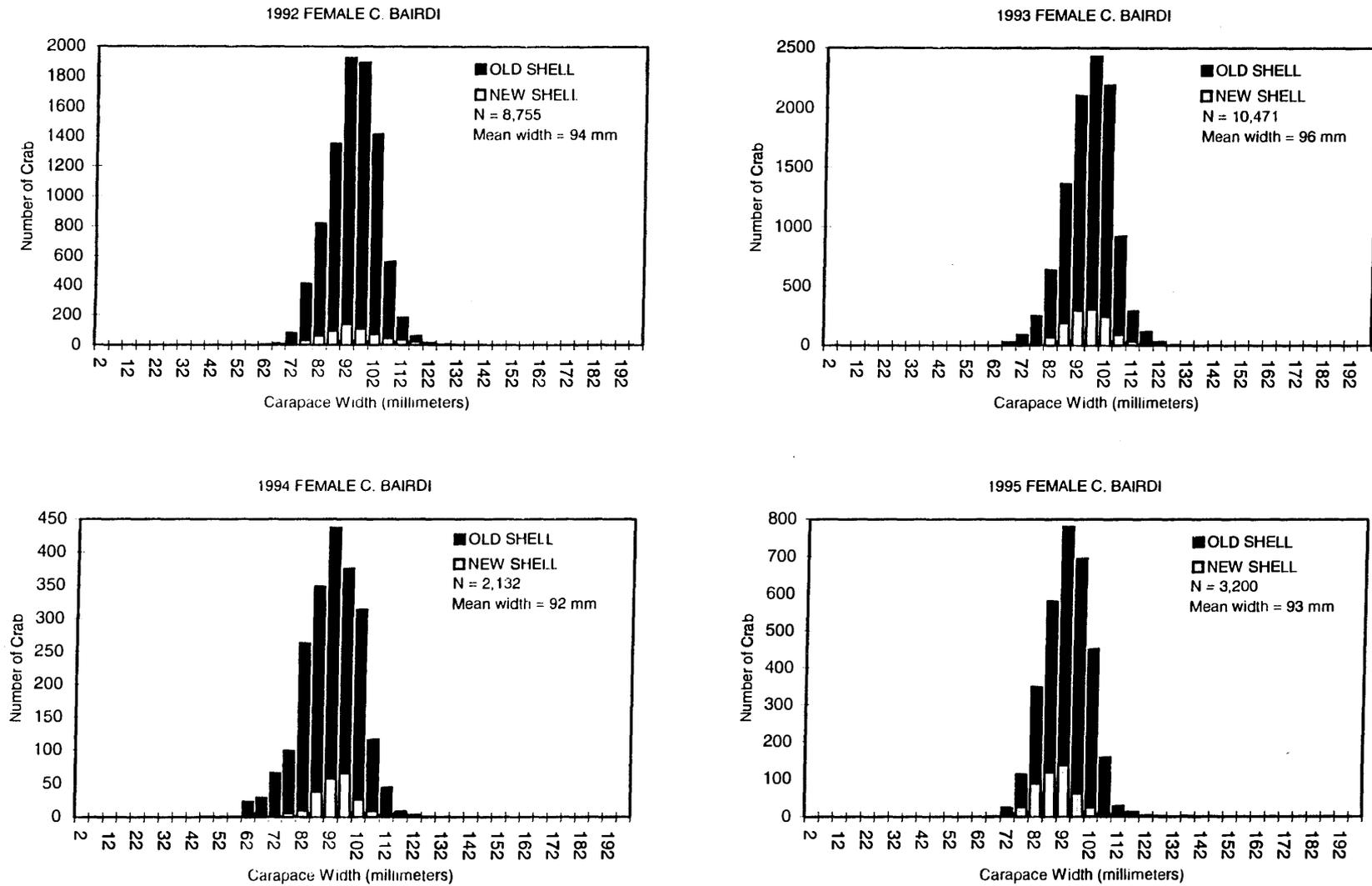


Figure 5. Carapace width distribution histograms of all *C. bairdi* females observed in the Bering Sea fishery, 1992-1995.

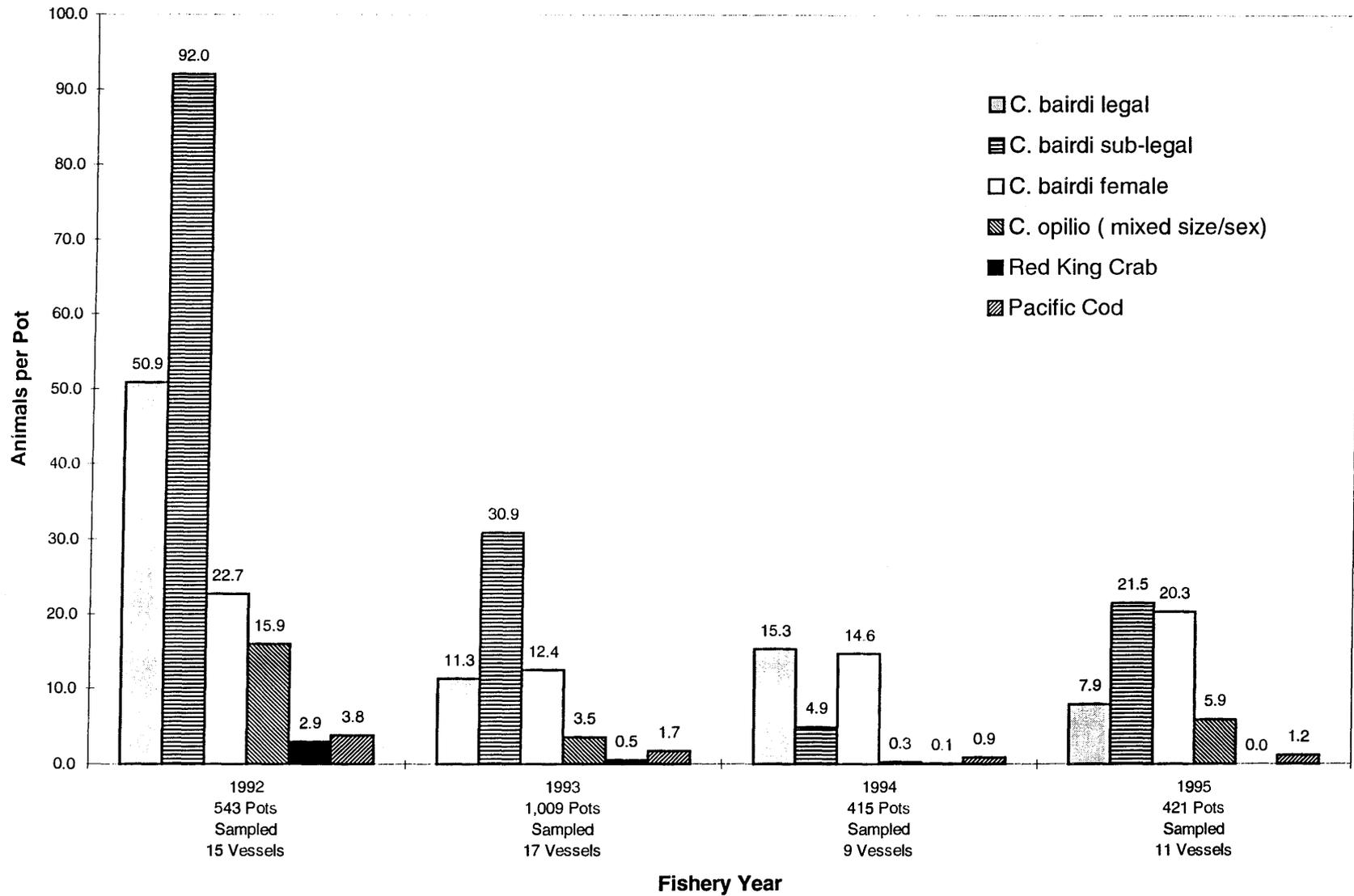


Figure 6. Catch per pot of selected species from the Bering Sea *C. bairdi* fishery, 1992-1995.

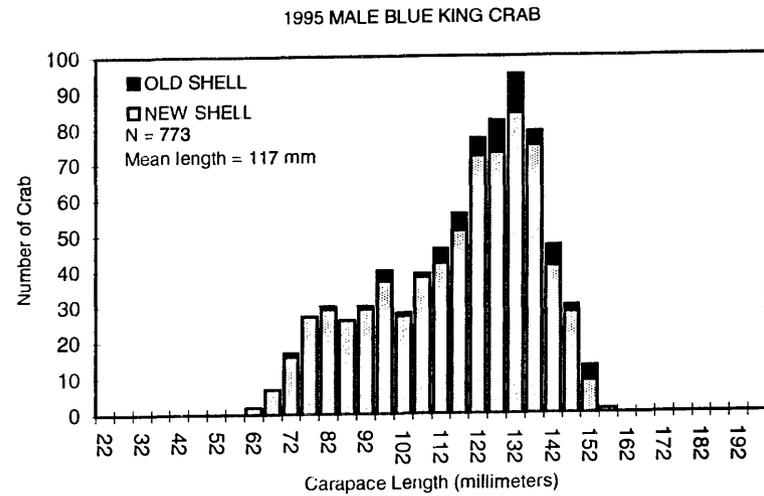
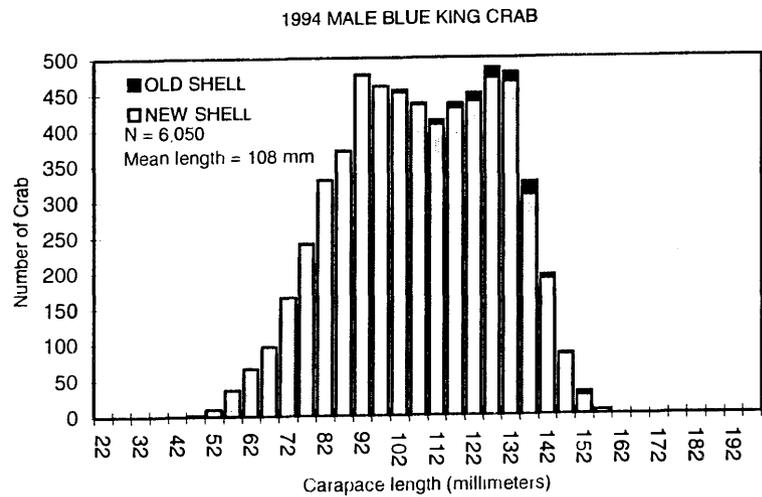
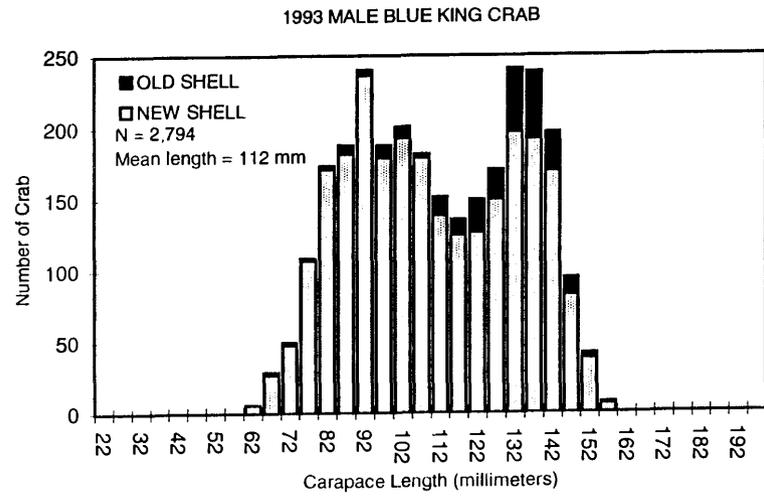
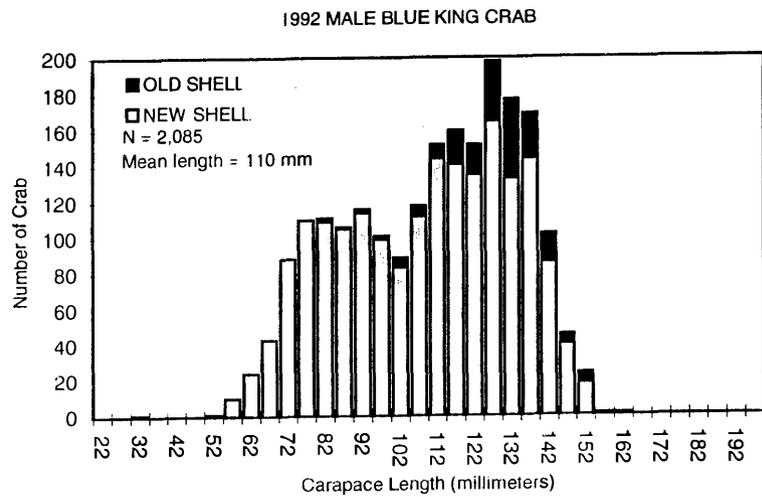


Figure 7. Carapace length distribution histograms of all blue king crab males observed in the St. Matthew District fishery, 1992-1995.

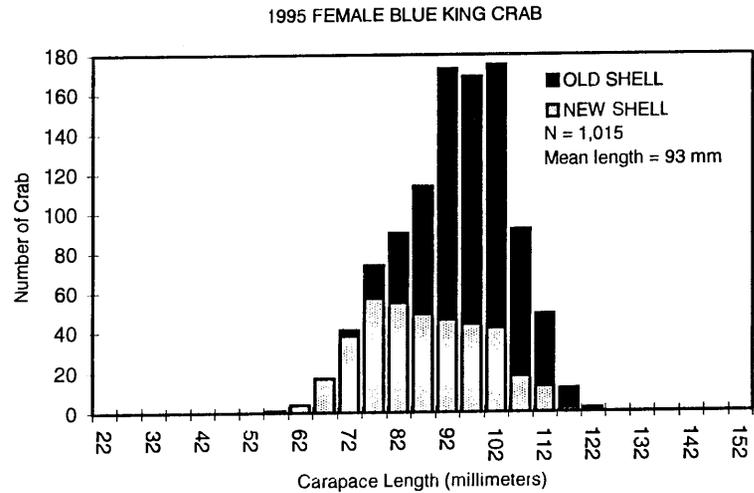
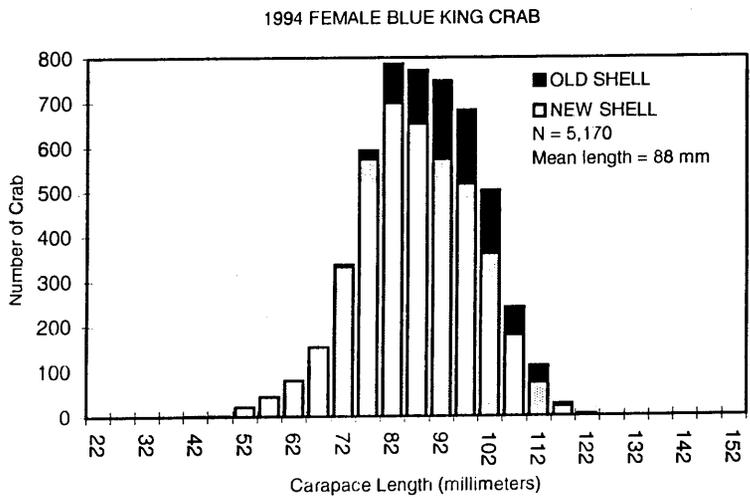
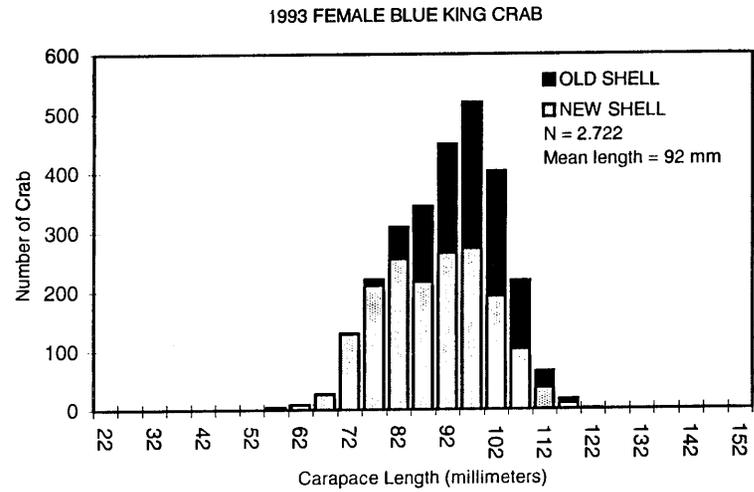
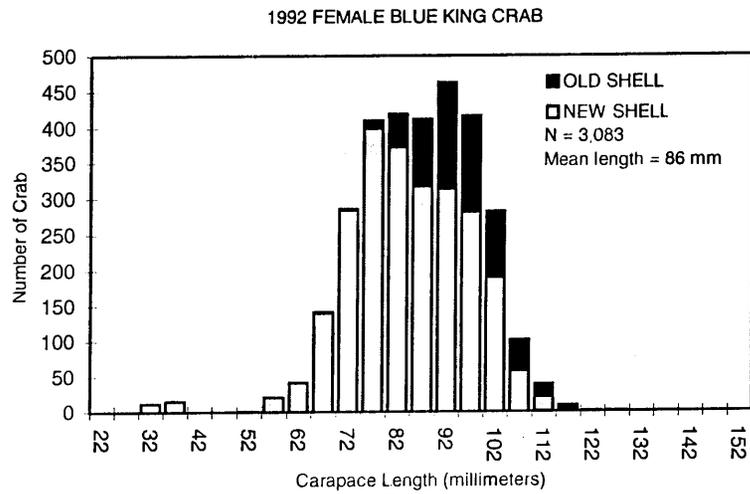
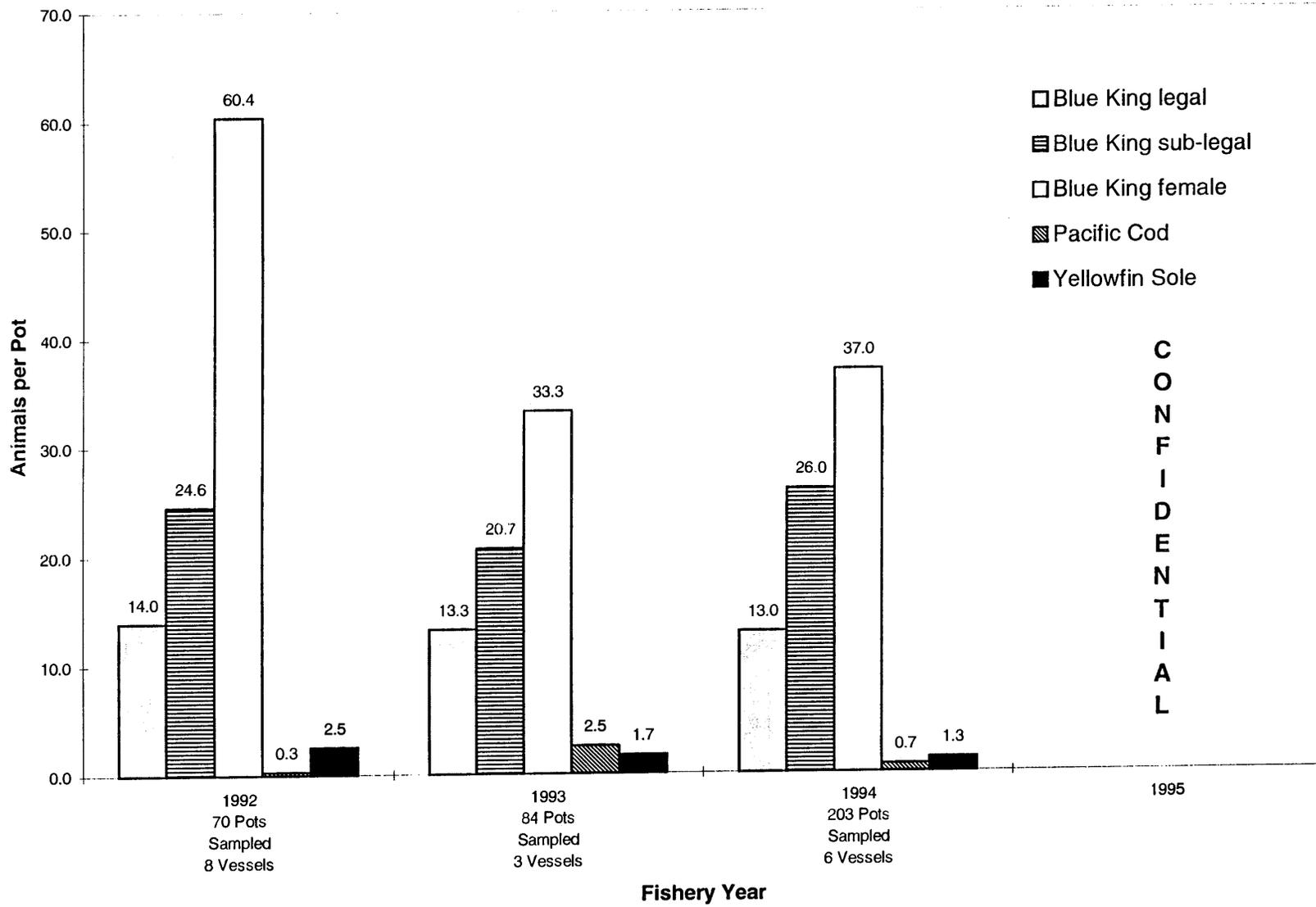


Figure 8. Carapace length distribution histograms of all blue king crab females observed in the St. Matthew District fishery, 1992-1995.



C O N F I D E N T I A L

Figure 9. Catch per pot of selected species from the St. Matthew District blue king crab fishery, 1992-1995.

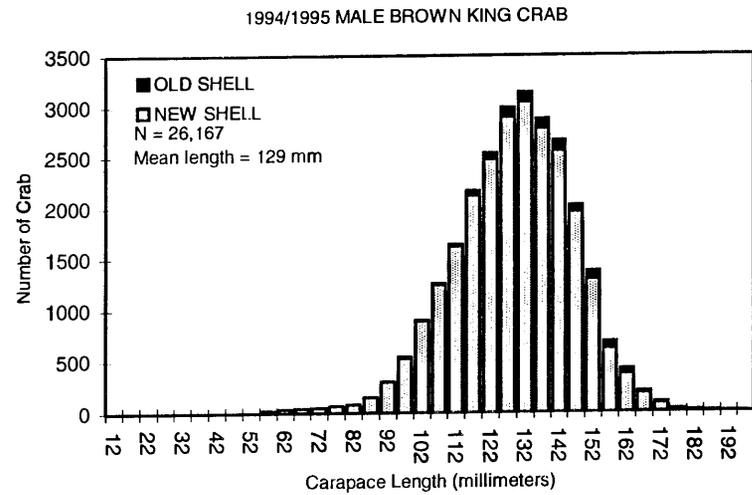
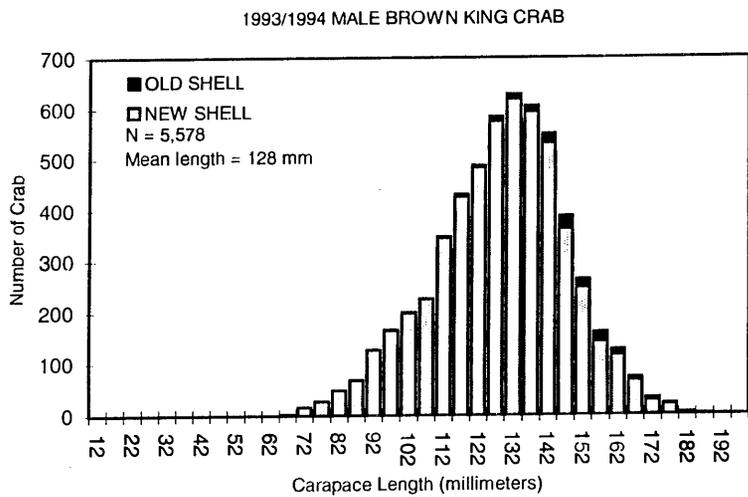
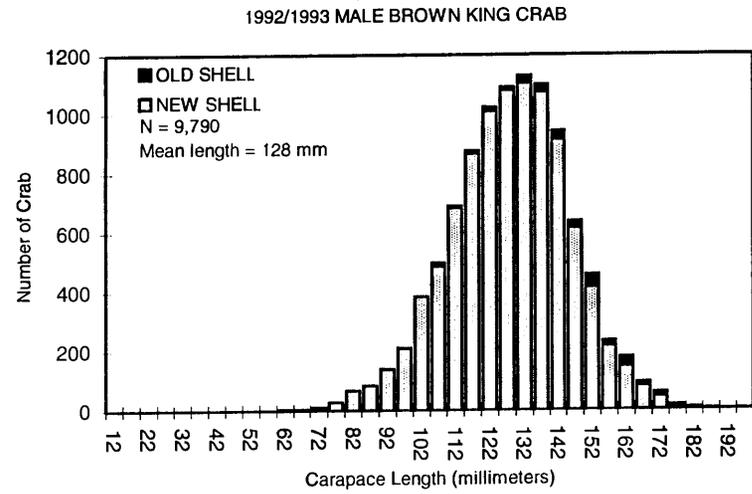
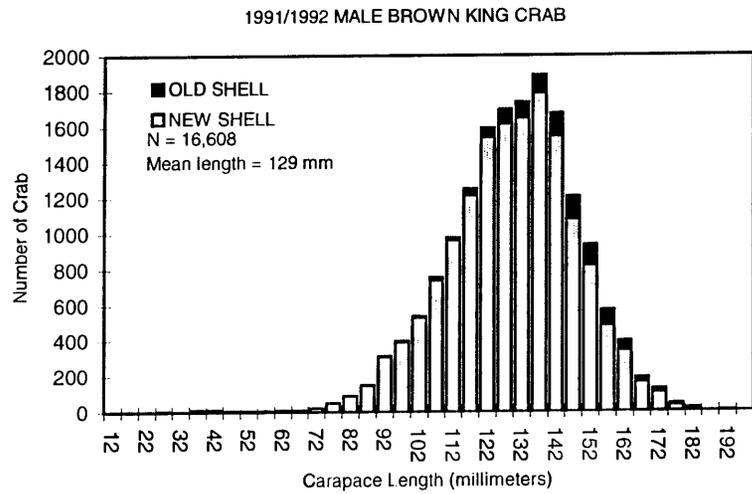


Figure 10. Carapace length distribution histograms of all brown king crab males observed in the Adak Area fishery, 1992-1995.

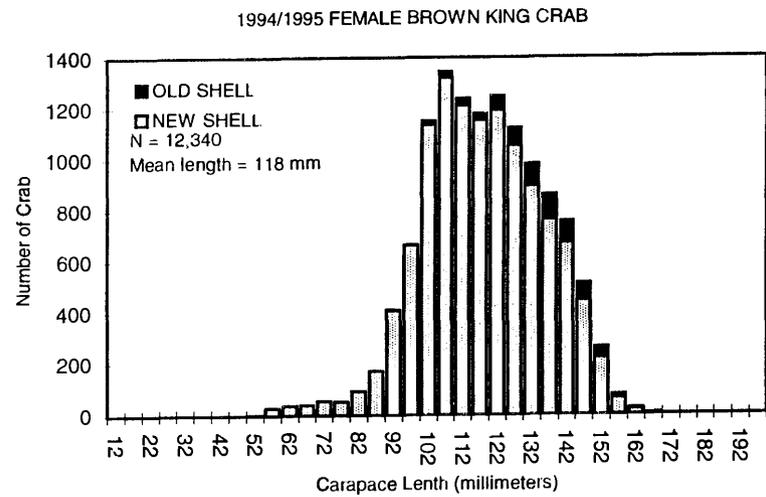
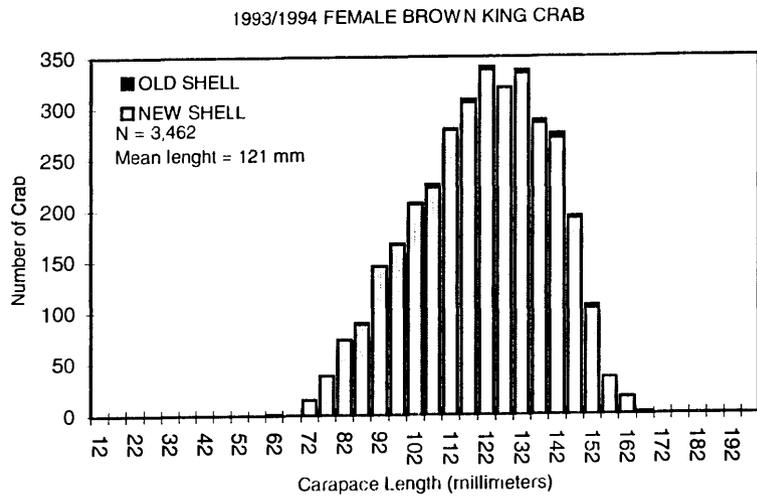
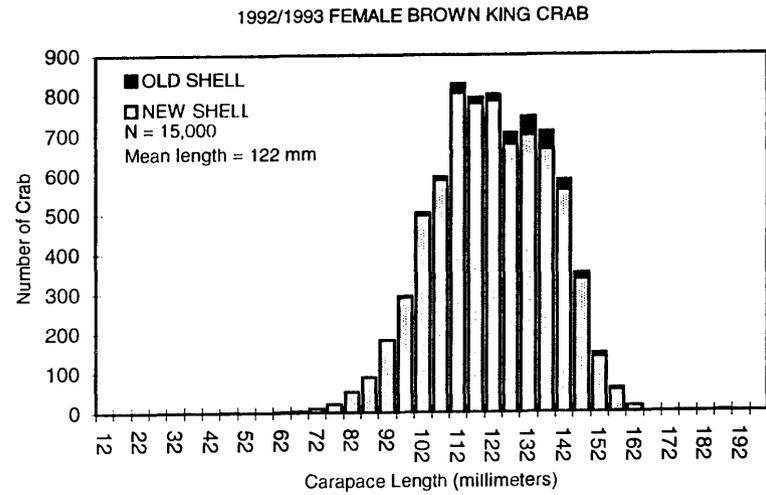
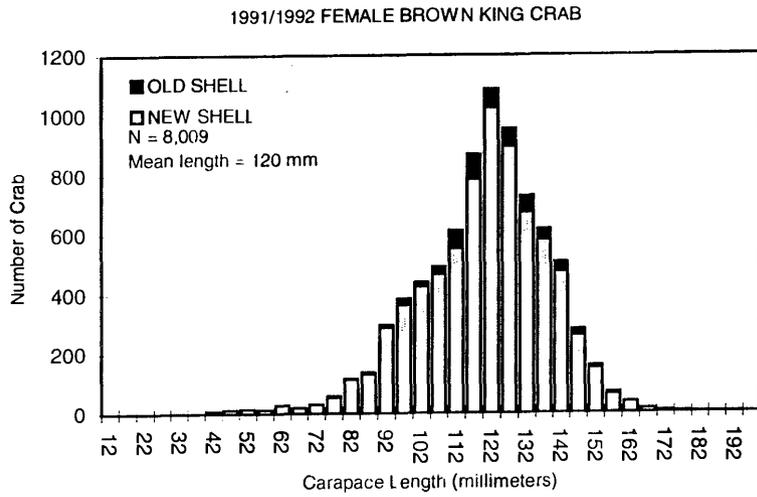


Figure 11. Carapace length distribution histograms of all brown king crab females observed in the Adak Area fishery, 1992-1995.

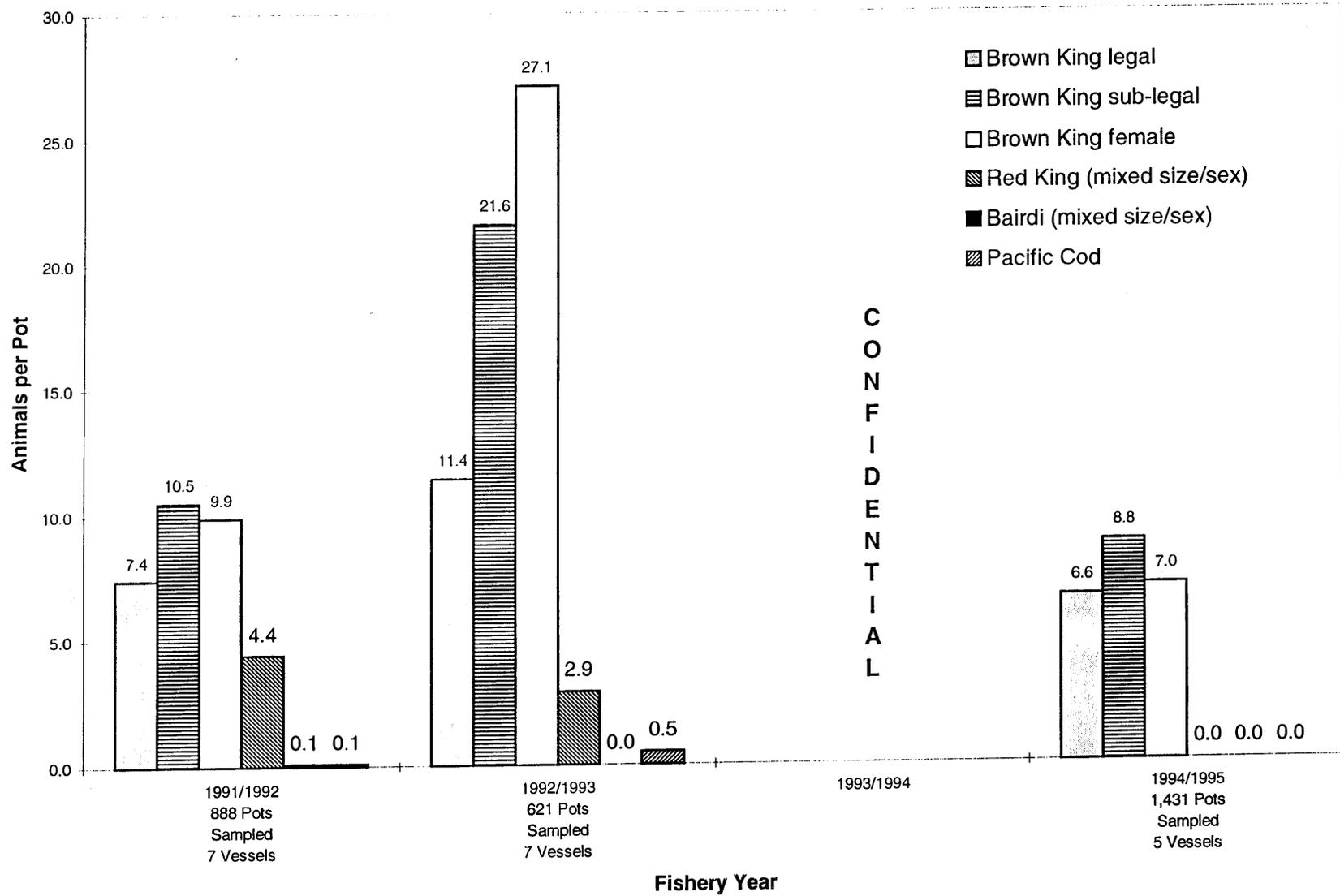


Figure 12. Catch per pot of selected species from the Adak Area brown king crab fishery, 1992-1995.

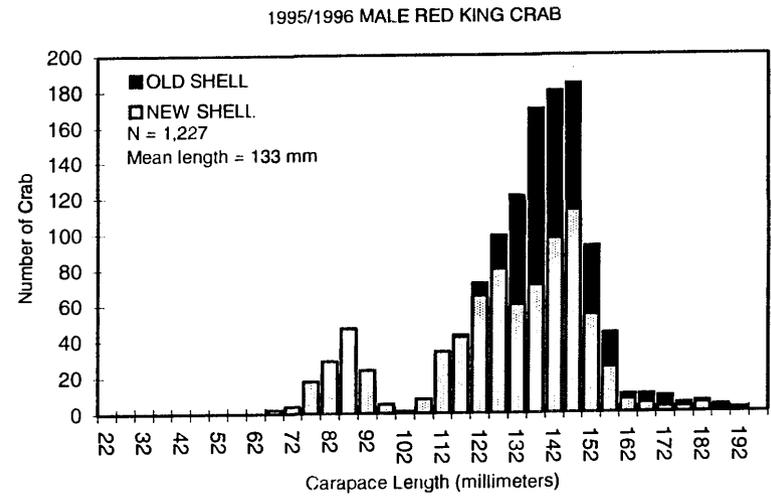
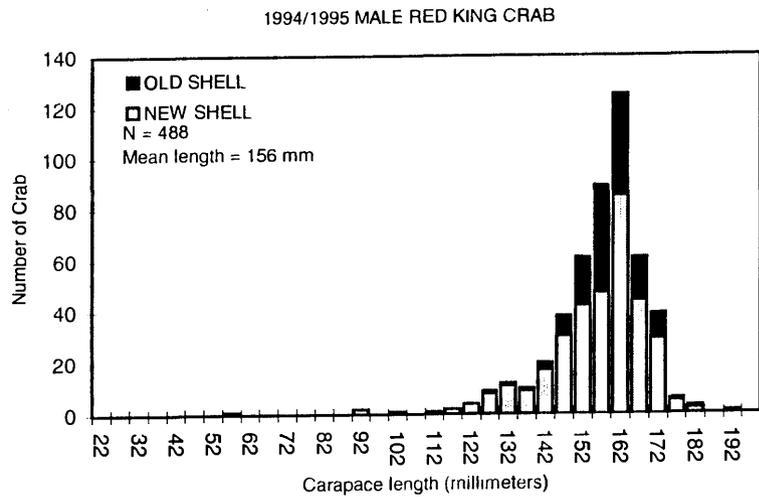
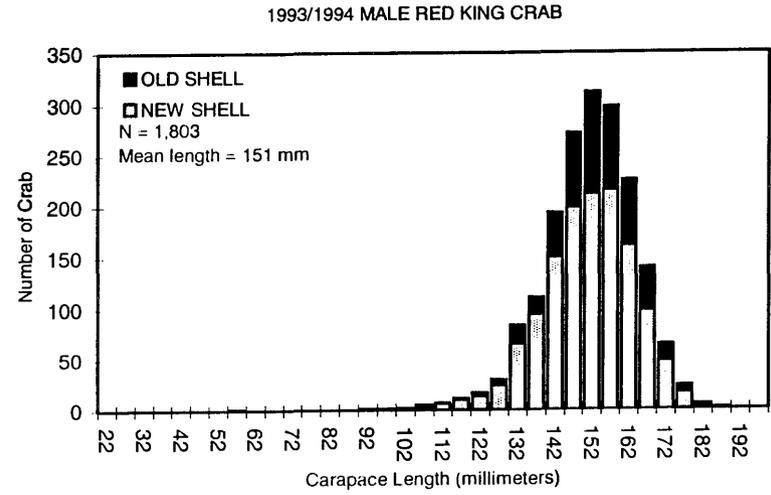
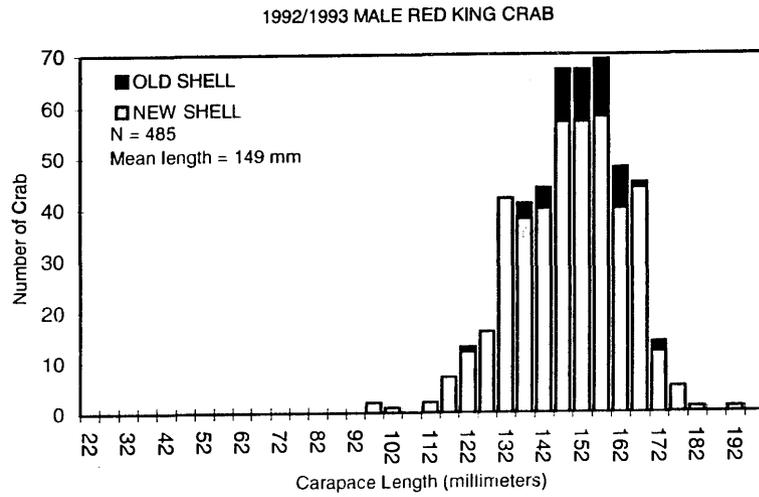


Figure 13. Carapace length distribution histograms of all red king crab males observed in the Adak Area fishery, 1992-1995.

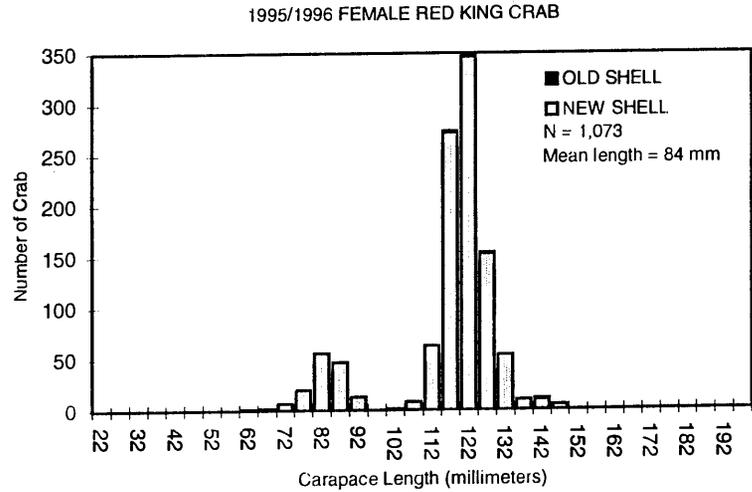
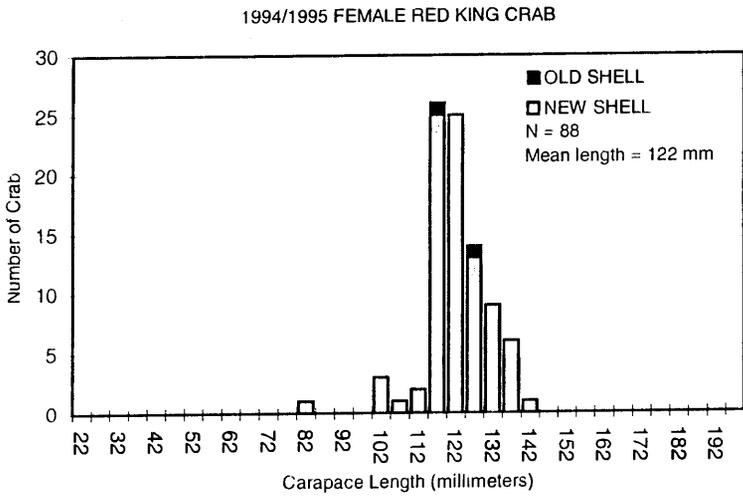
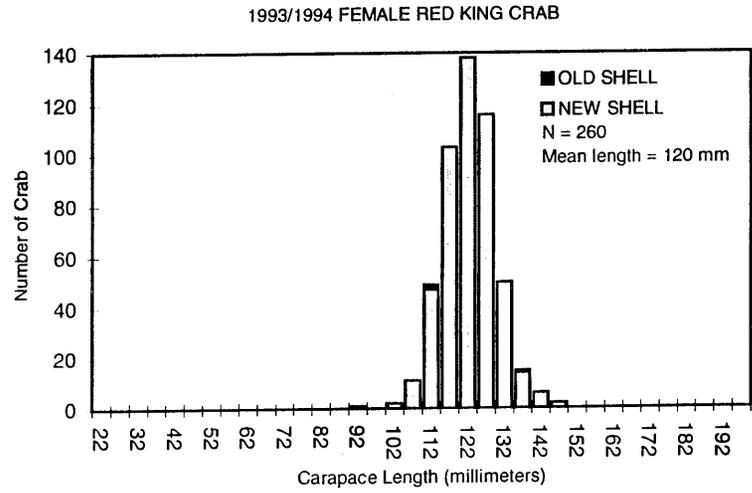
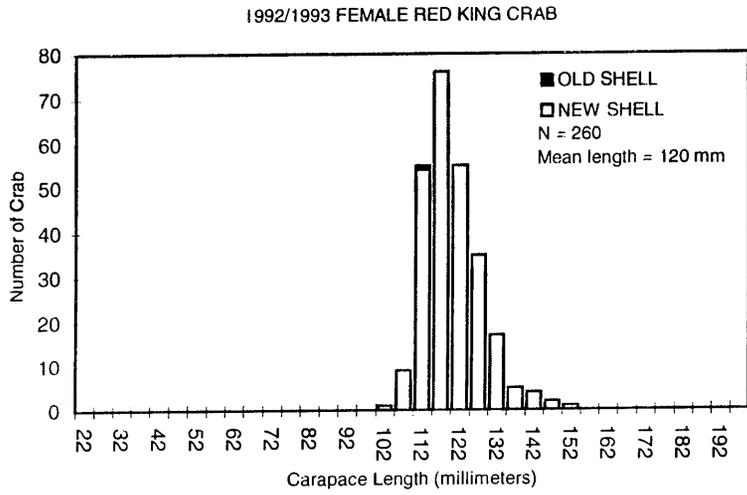


Figure 14. Carapace length distribution histograms of all red king crab females observed in the Adak Area fishery, 1992-1995.

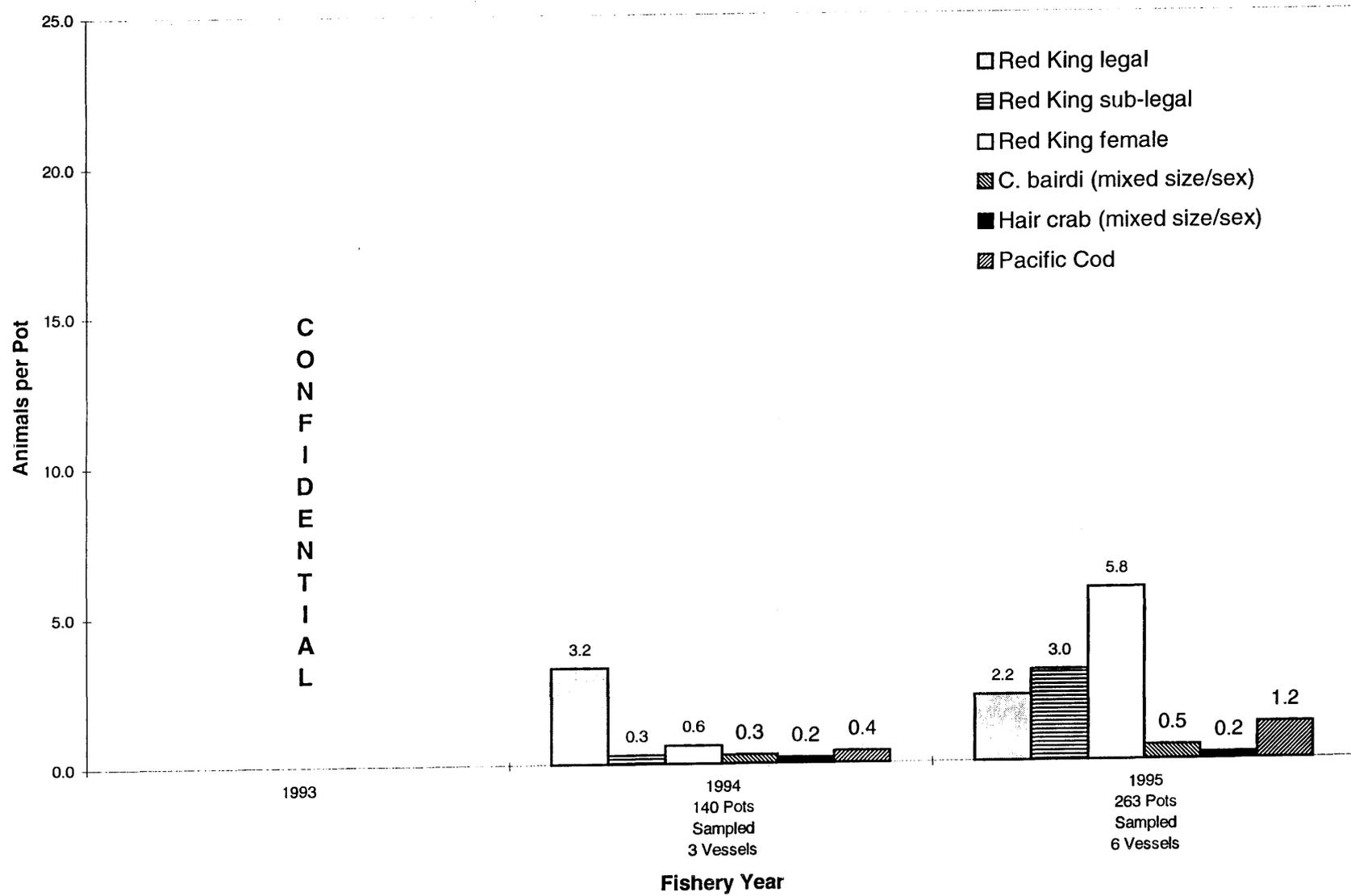


Figure 15. Catch per pot of selected species from the Adak Area red king crab fishery, 1993-1995.

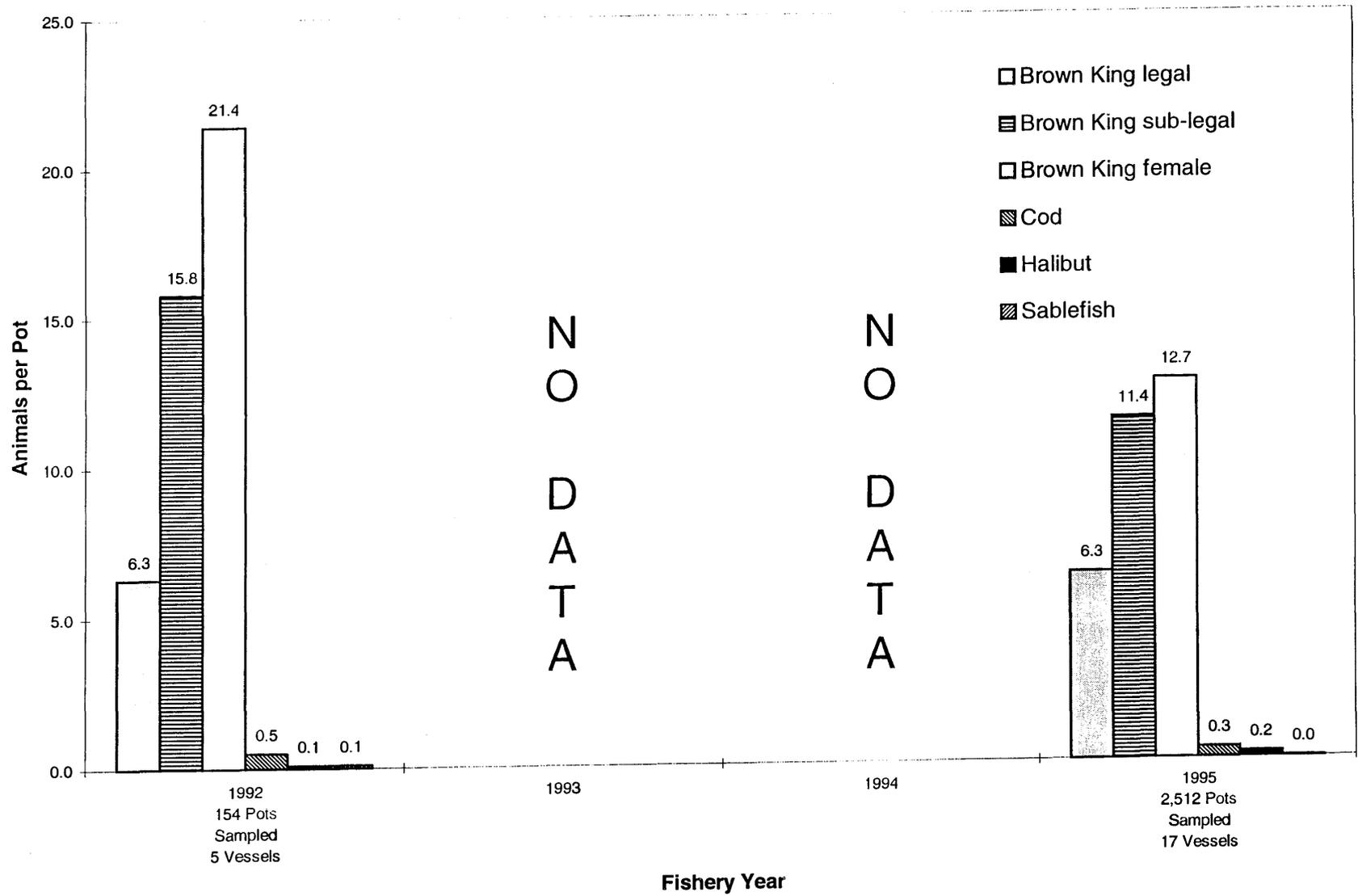


Figure 16. Catch per pot of selected species from the Dutch Harbor Area brown king crab fishery, 1992-1995.

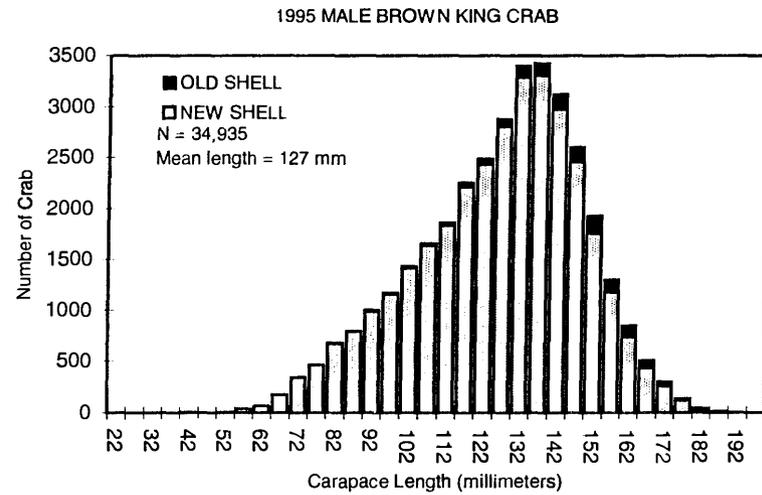
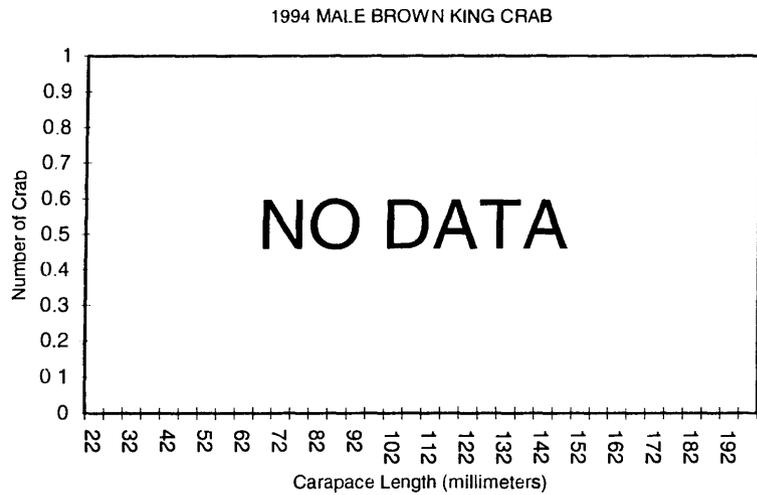
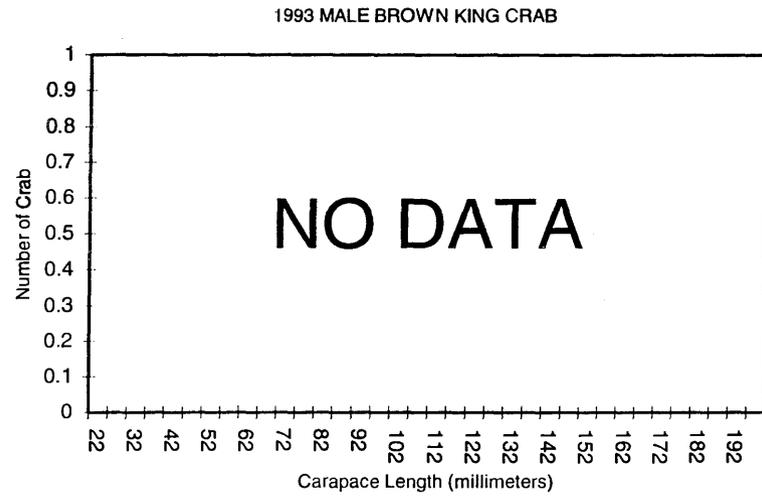
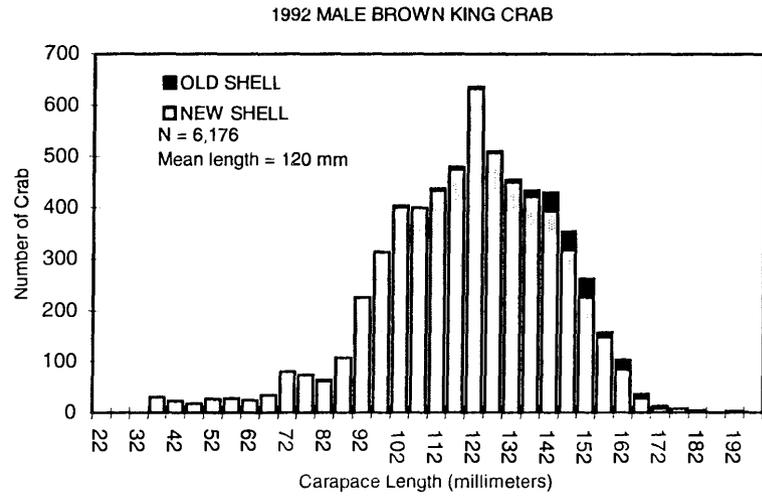


Figure 17. Carapace length distribution histograms of all brown king crab males observed in the Dutch Harbor Area fishery, 1992-1995.

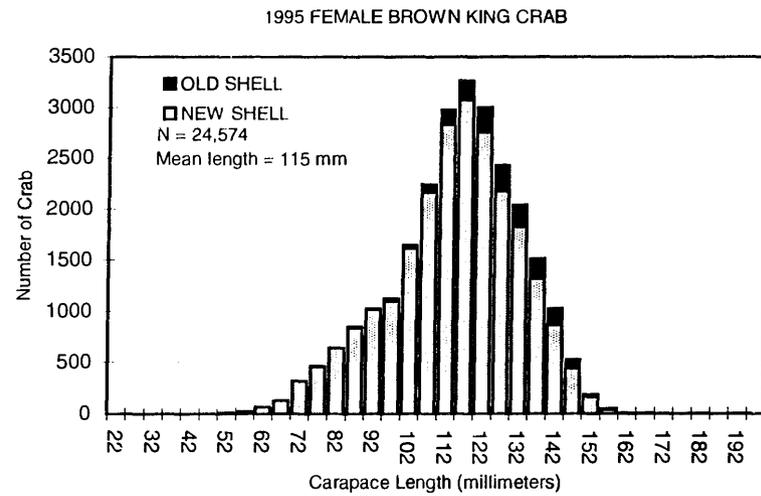
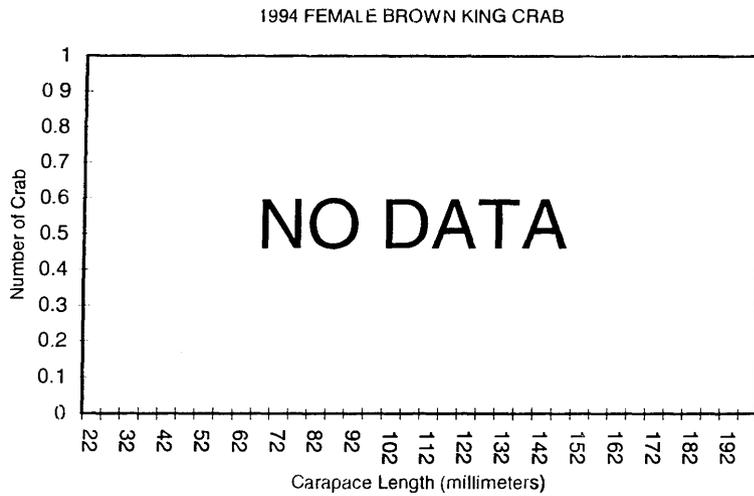
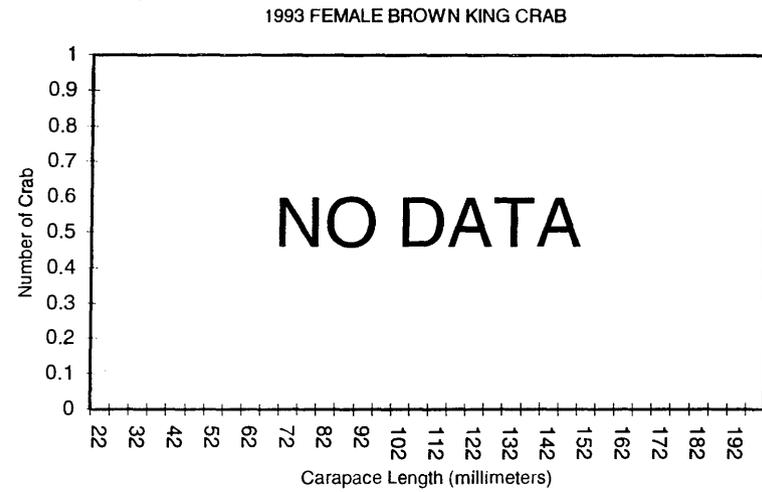
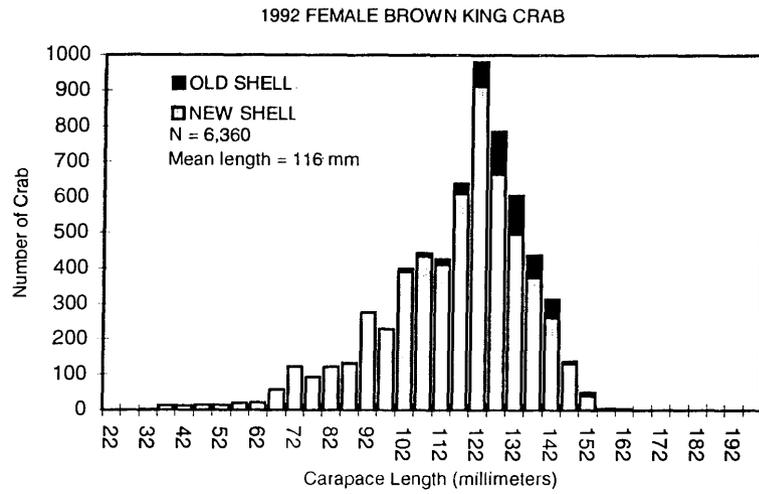


Figure 18. Carapace length distribution histograms of all brown king crab females observed in the Dutch Harbor Area fishery, 1992-1995.

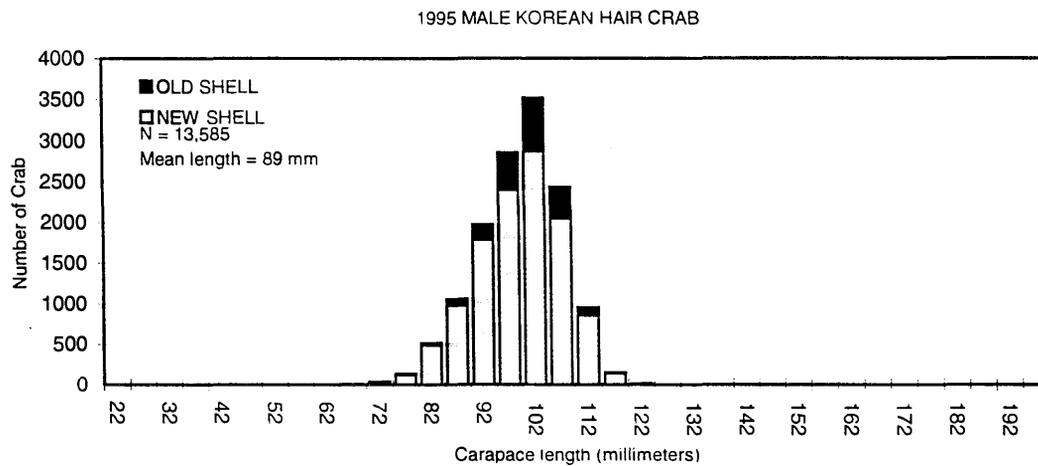
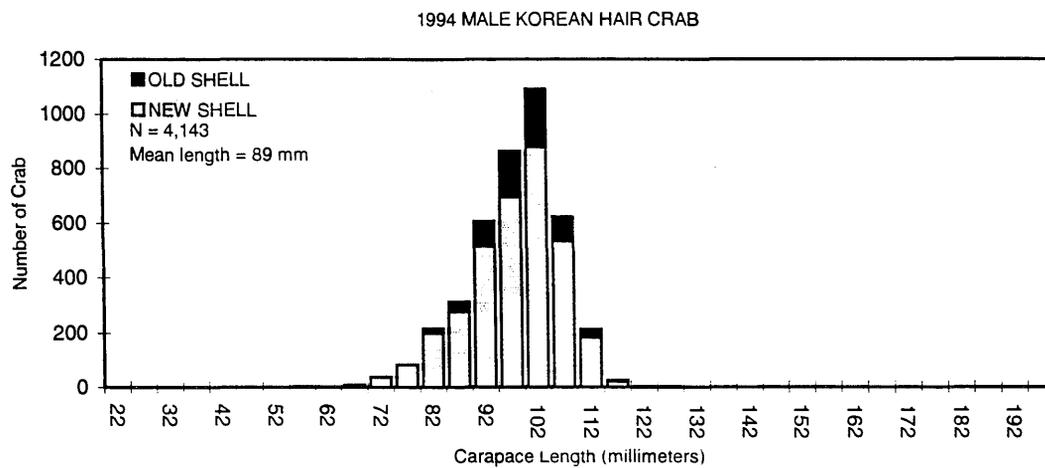
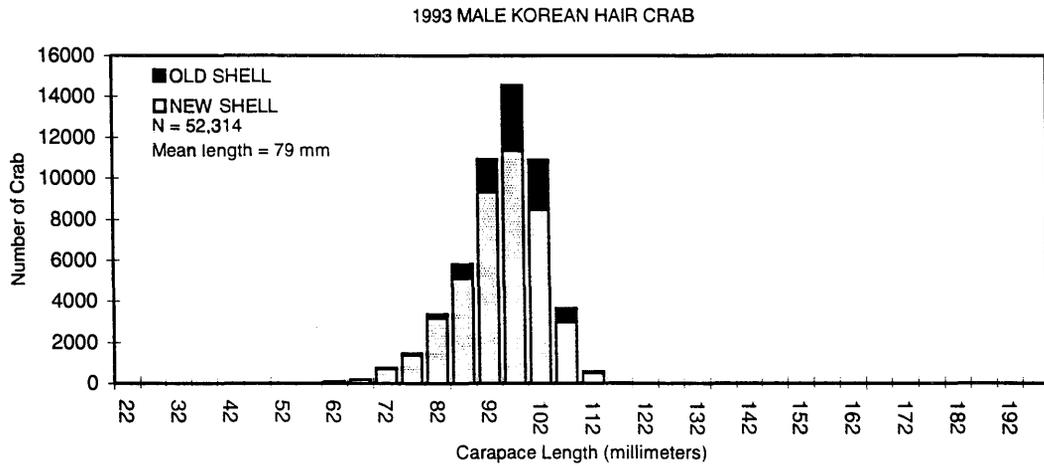


Figure 19. Carapace length distribution histograms of all Korean hair crab males observed in the Bering Sea fishery, 1993-1995.

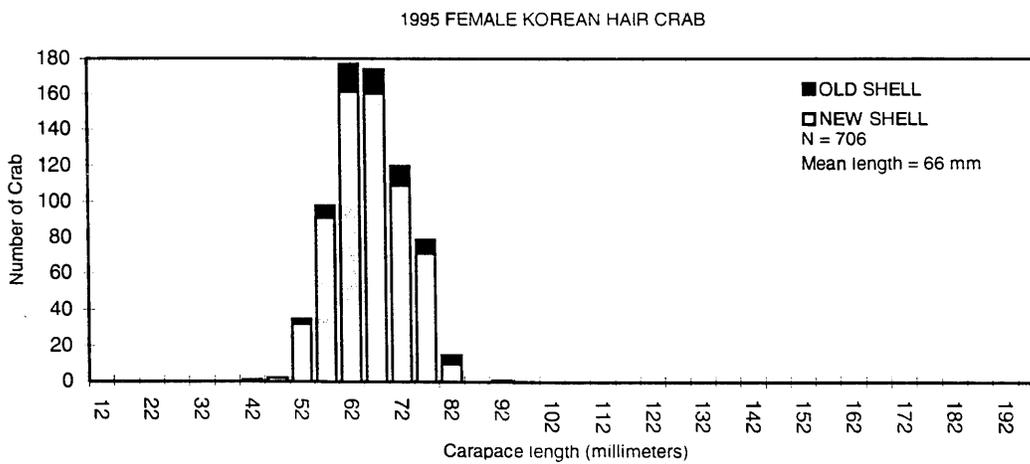
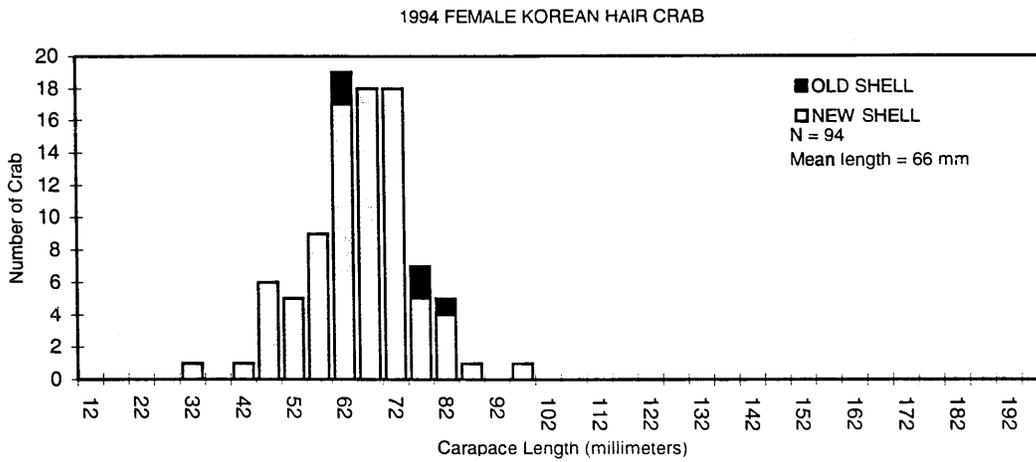
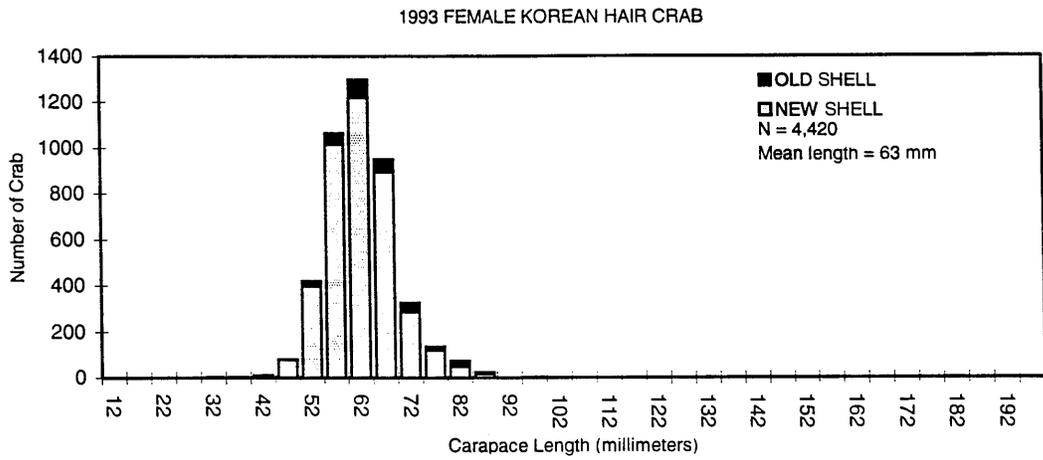


Figure 20. Carapace length distribution histograms of all Korean hair crab females observed in the Bering Sea fishery, 1993-1995.

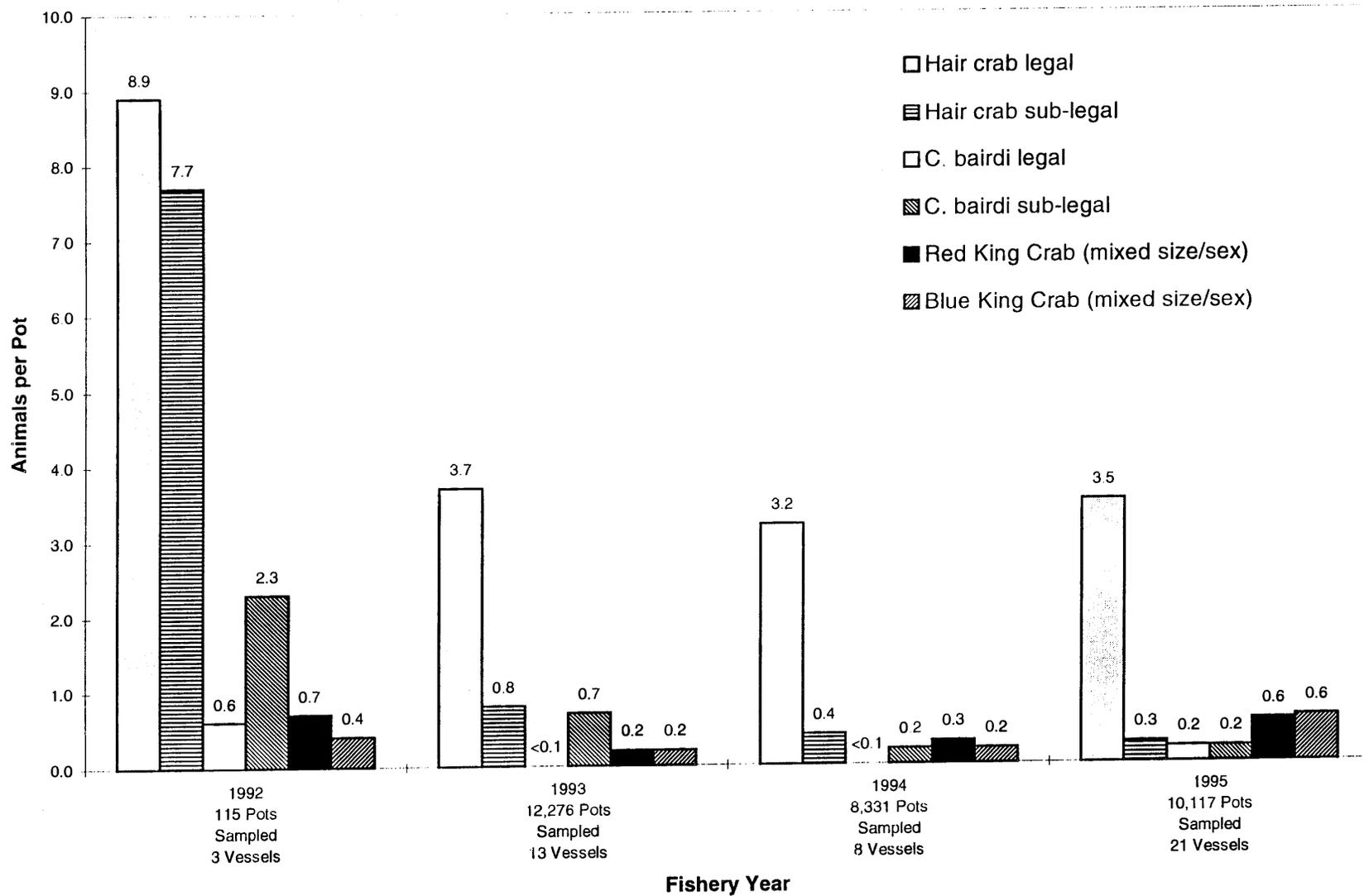


Figure 21. Catch per pot of selected species from the Bering Sea Korean hair crab fishery, 1992-1995. Estimates for 1992 are for retained crab; there was no legal size requirement in place in 1992.

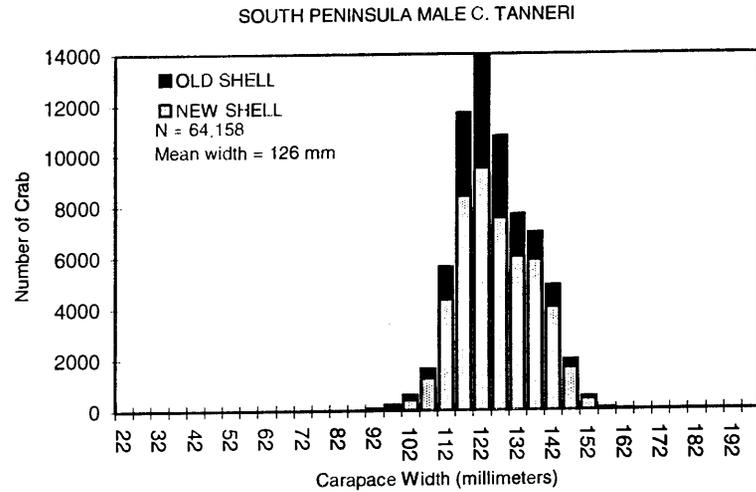
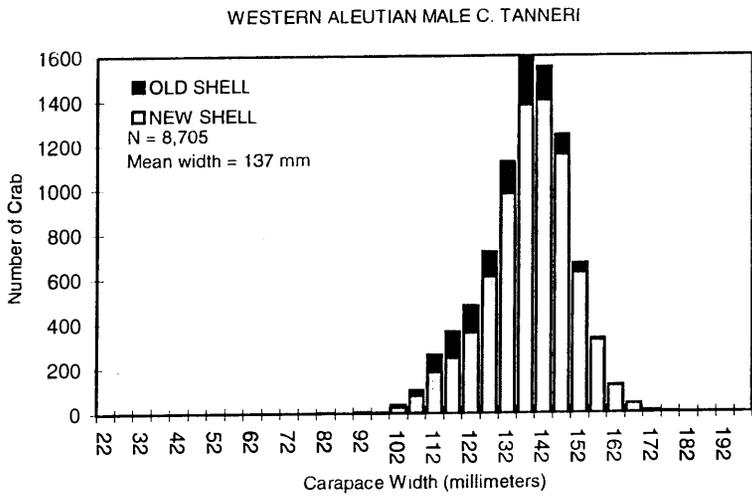
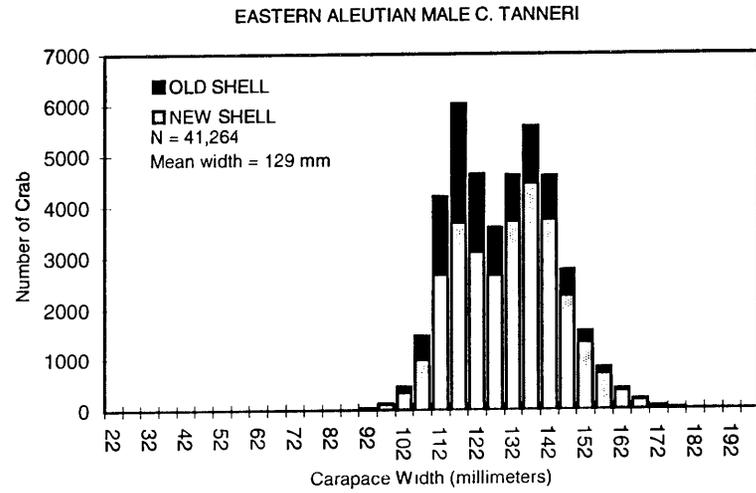
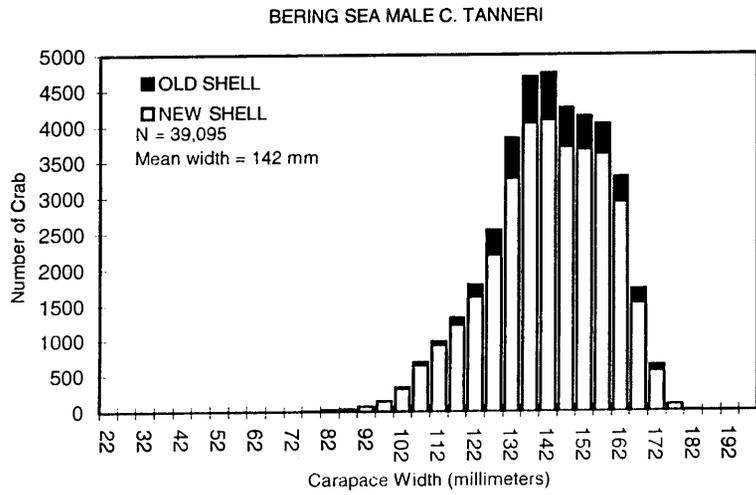


Figure 22. Carapace width distribution histograms of all *C. tanneri* males observed in the Bering Sea, Western Aleutian, Eastern Aleutian, and South Peninsula fisheries, 1995.

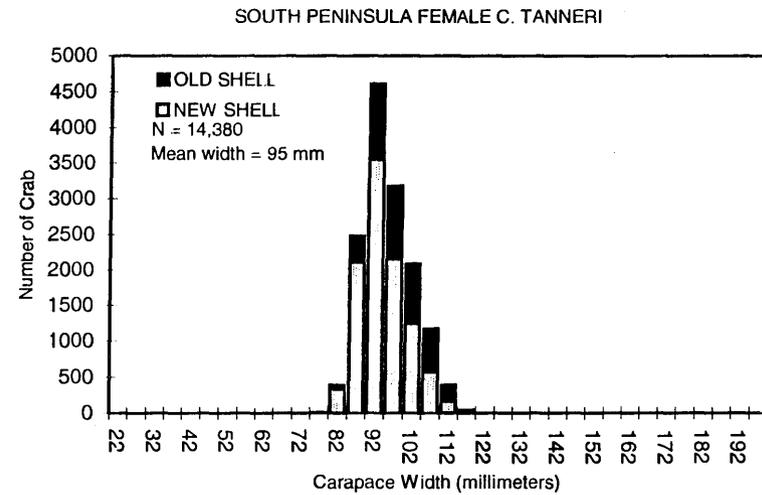
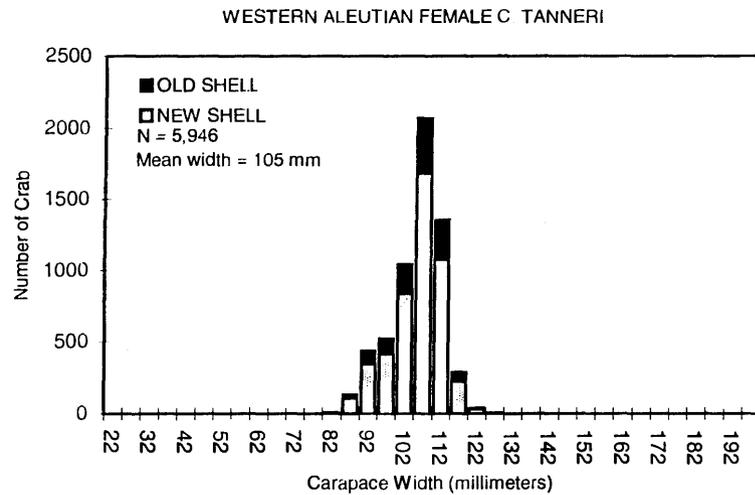
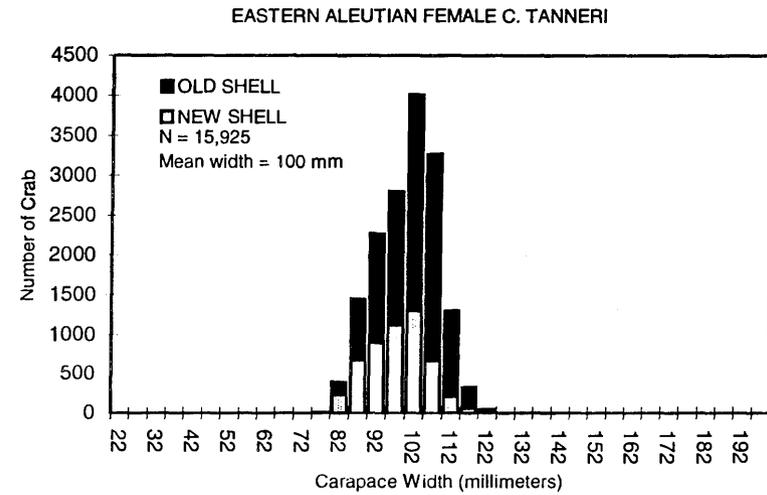
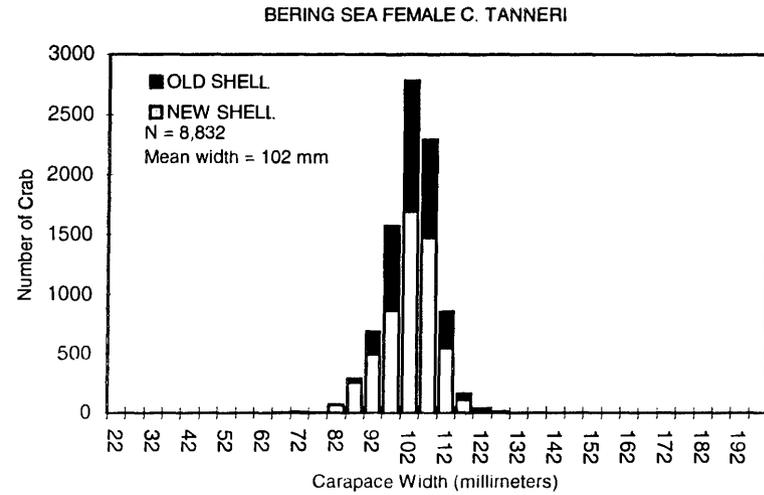


Figure 23. Carapace width distribution histograms of all *C. tanneri* females observed in the Bering Sea, Western Aleutian, Eastern Aleutian, and South Peninsula fisheries, 1995.

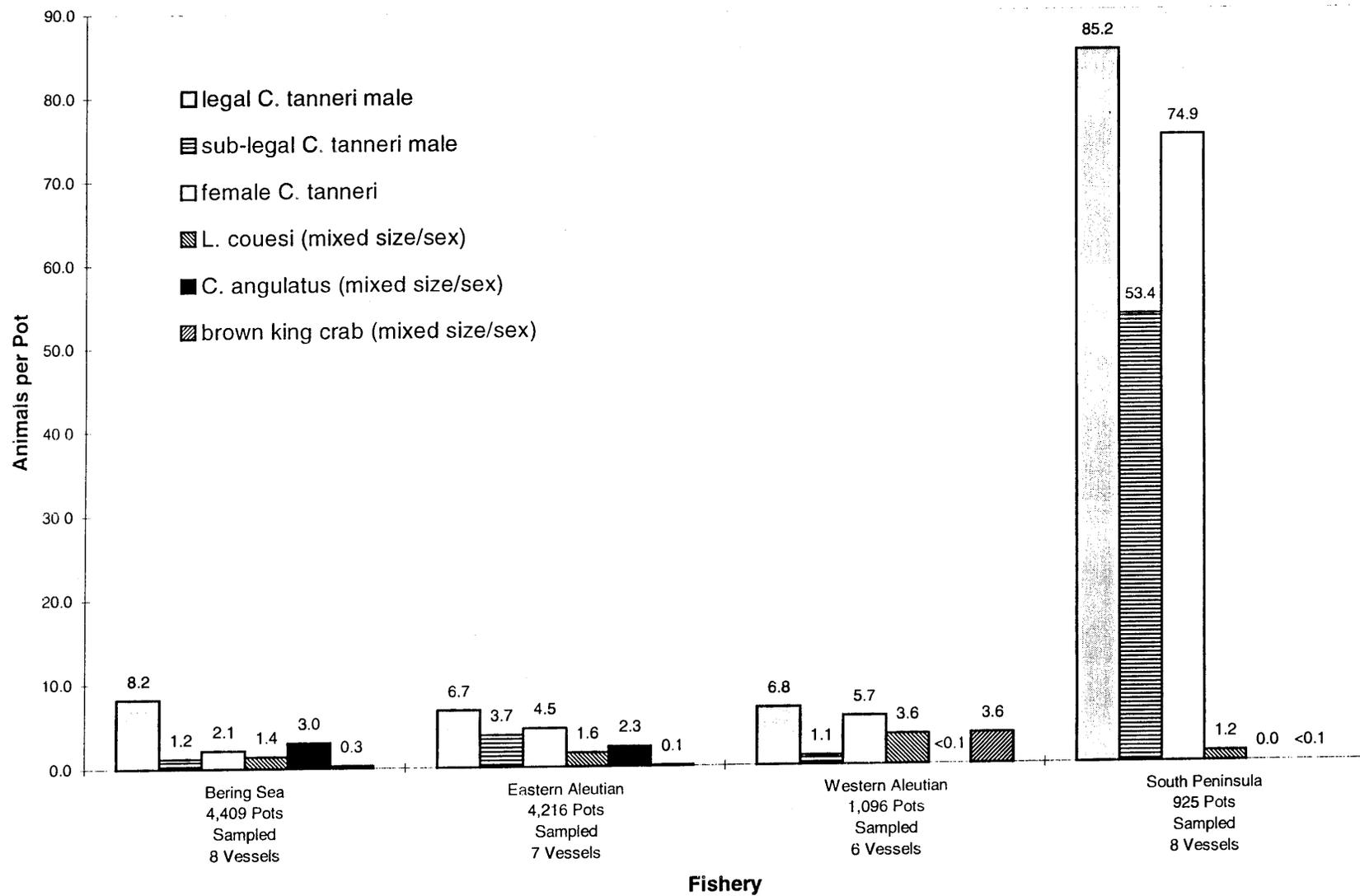


Figure 24. Catch per pot of selected species from the Bering Sea, Western Aleutian, Eastern Aleutian, and South Peninsula *C. tanneri* fisheries, 1995.

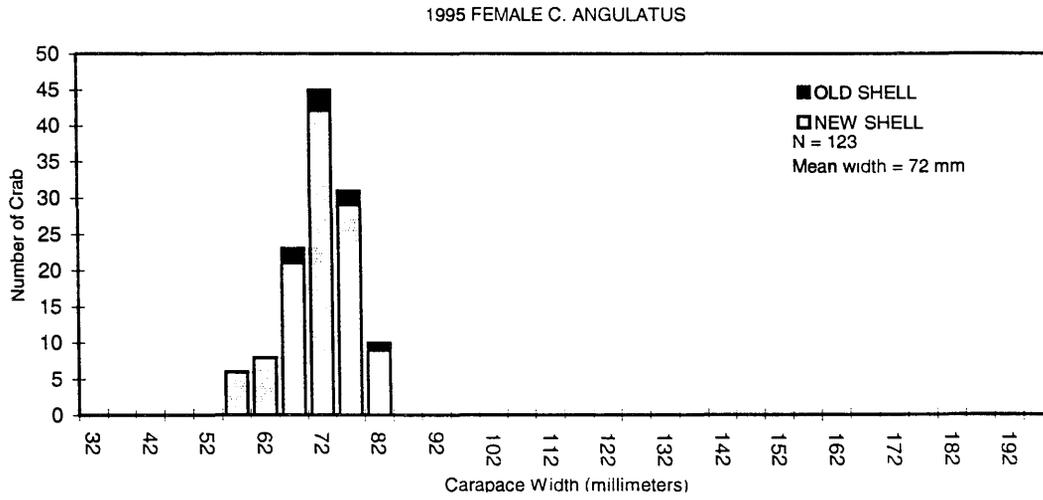
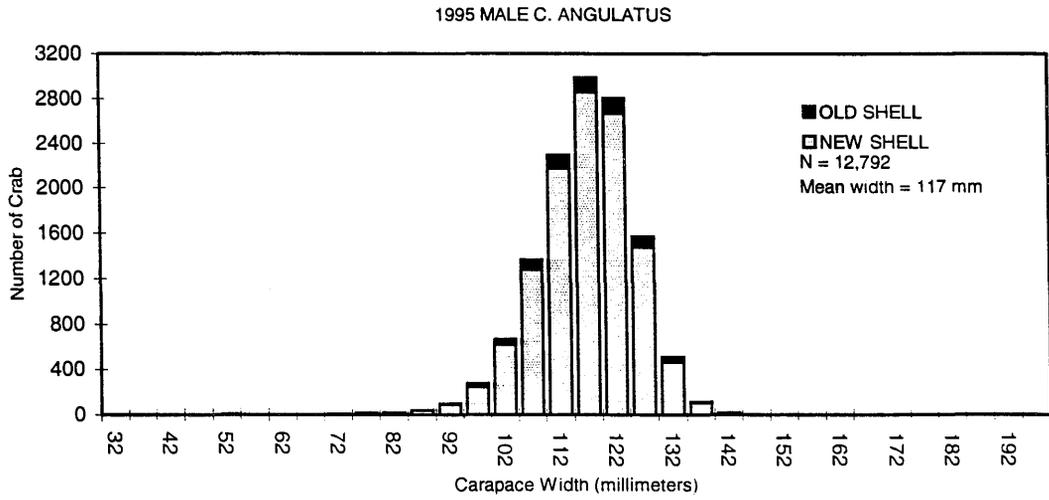


Figure 25. Carapace width distribution histograms of all *C. angulatus* males and females observed in the Eastern Aleutian fishery, 1995.

**APPENDIX**

Appendix A-1. Formulas used to calculate mean and variance estimates for CPUE.

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

The mean cpue for vessel  $i$  on day  $j$  is

$$\bar{x}_{ij.} = 1/n_{ij} \sum_k x_{ijk}$$

and the variance for this estimator is

$$\hat{\text{var}}(\bar{x}_{ij.}) = (\sum_k (x_{ijk} - \bar{x}_{ij.})^2 / (n_{ij} - 1)) / n_{ij}$$

where  $x$  = number of crab in pot sample

$i$  = vessel

$j$  = day

$k$  = pot sampled

$n$  = number of pots sampled.

It follows that

$$(\bar{x}_{ij.}) (N_{ij}) = \text{estimated total catch by vessel } i \text{ on day } j$$

$$\sum_j (\bar{x}_{ij.} N_{ij}) = \text{estimated total catch by vessel } i \text{ over the fishery}$$

$$(1/N_{i.}) \sum_j (\bar{x}_{ij.} N_{ij}) = \text{estimated weighted mean catch per pot lift by vessel } i \text{ over the fishery}$$

$$= \sum_j (\bar{x}_{ij.}) (w_{ij})$$

$$= (\bar{x}_{i..})$$

and

$$\hat{\text{var}}(\bar{x}_{i..}) = \sum_j \hat{\text{var}}(\bar{x}_{ij.}) w_{ij}^2$$

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

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-Continued-

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

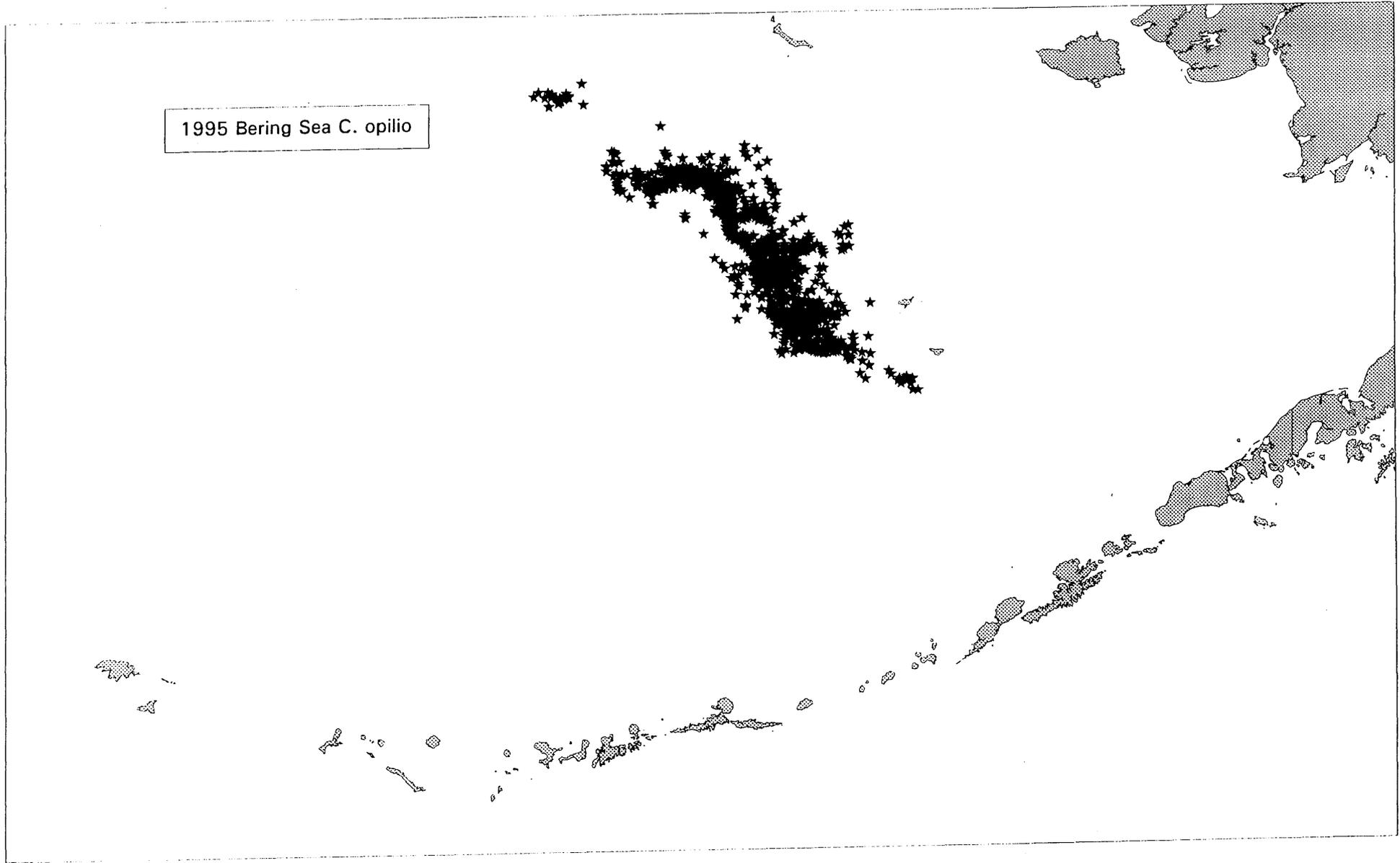
$$\begin{aligned}\bar{x} \dots &= (1/N_{..}) \sum_i (\bar{x}_{i..}) N_i \\ &= \sum_i (\bar{x}_{i..}) w_i \\ &= (1 / N_{..}) \sum_i \sum_j (\bar{x}_{ij} \cdot N_{ij})\end{aligned}$$

and the variance of this estimator is

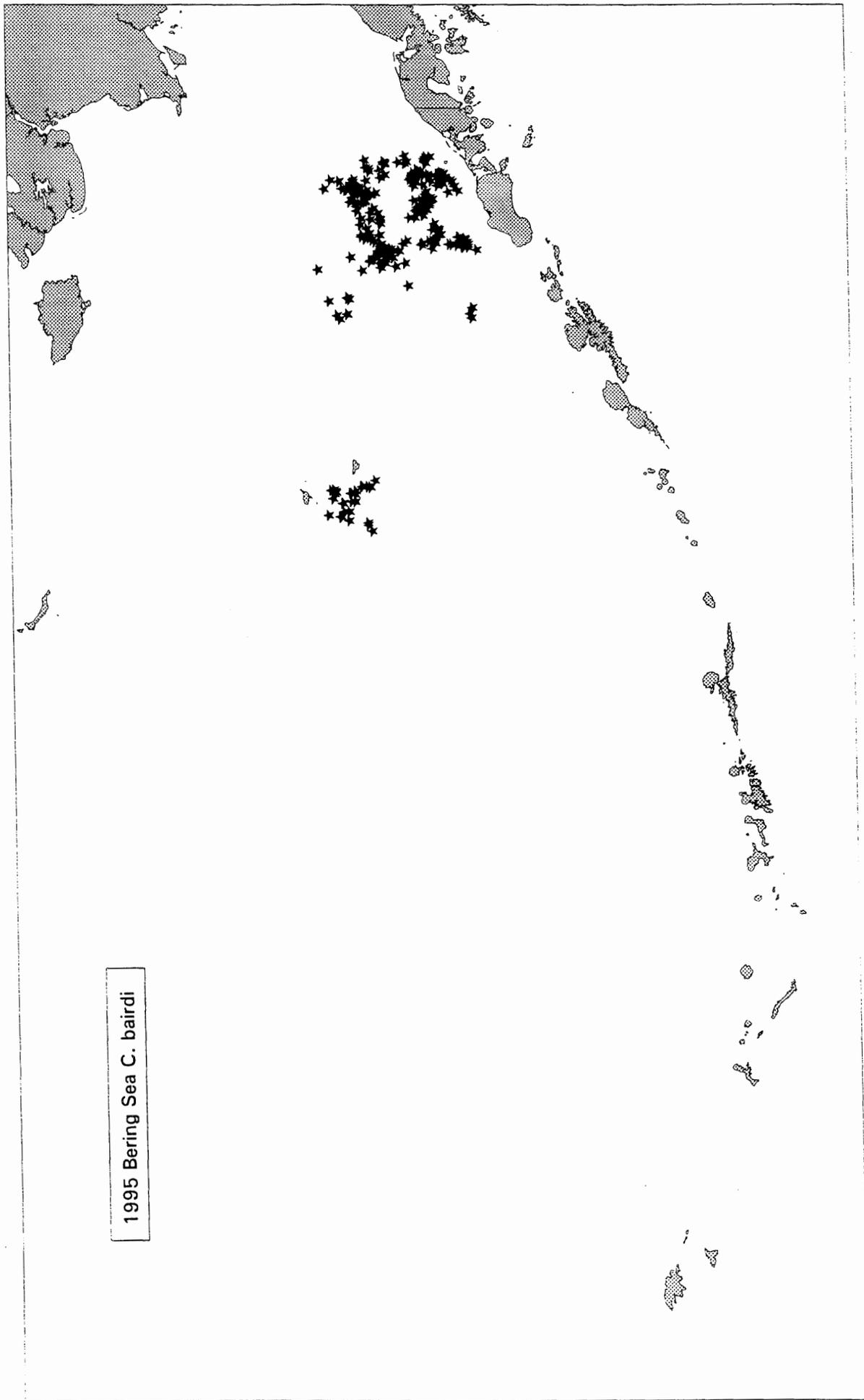
$$\begin{aligned}\hat{\text{var}} (\bar{x} \dots) &= \sum_i \hat{\text{var}} (\bar{x}_{i..}) w_i^2 \\ &= \sum_i \sum_j \hat{\text{var}} (\bar{x}_{ij}) (w_{ij}^2 w_i^2) \\ &= \sum_i \sum_j \hat{\text{var}} (\bar{x}_{ij}) (N_{ij} / N_i) (N_i / N_{..}) \\ &= \sum_i \sum_j \hat{\text{var}} (\bar{x}_{ij}) (N_{ij} / N_{..})^2 \\ &= (1/N_{..})^2 \sum_i \sum_j \hat{\text{var}} (\bar{x}_{ij}) (N_{ij}^2)\end{aligned}$$

where  $w_i = N_i / N_{..}$

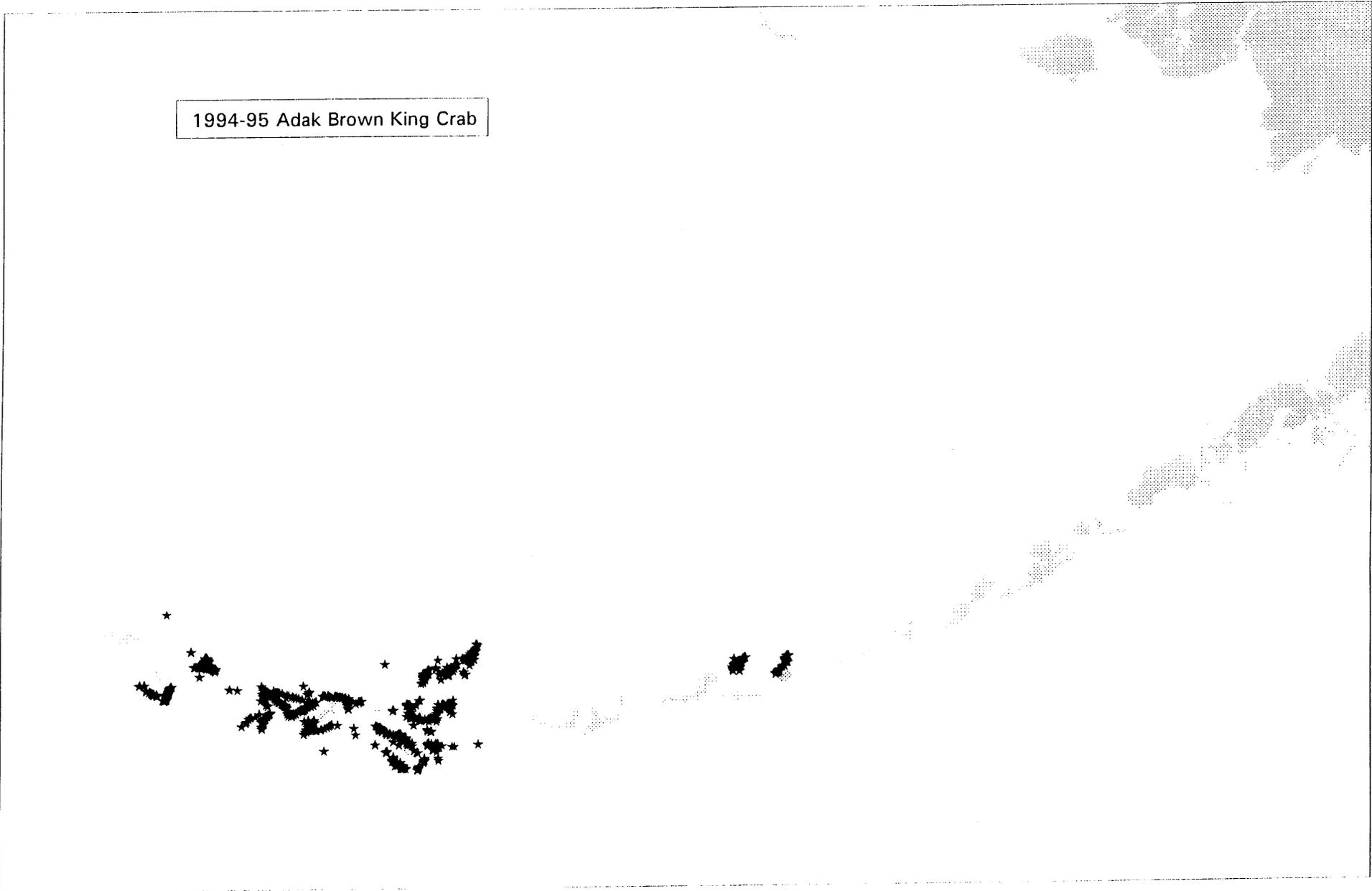
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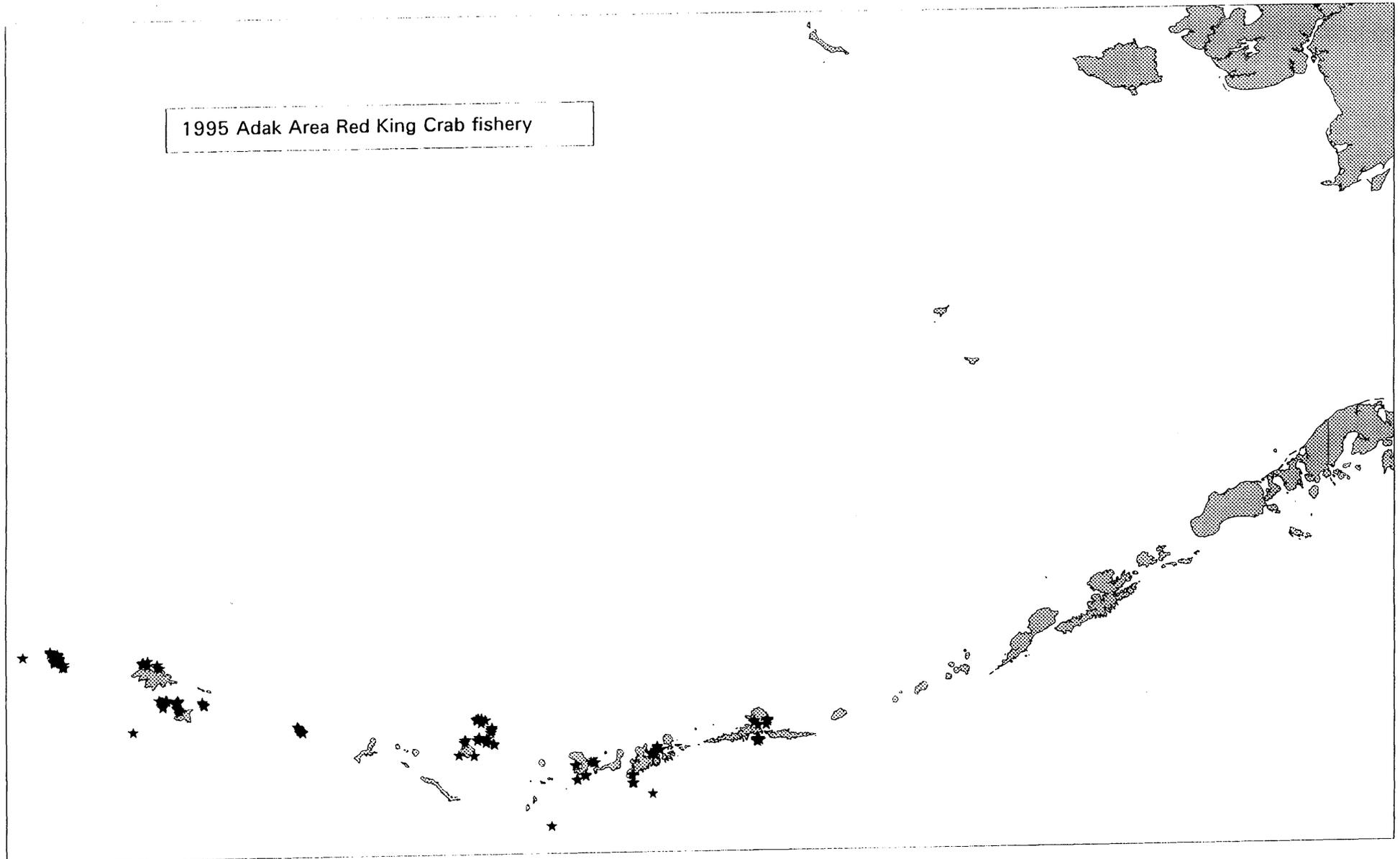
Appendix B-1. Location of pots sampled by observers in the 1995 Bering Sea *C. opilio* fishery.



Appendix B-2. Location of pots sampled by observers in the 1995 Bering Sea *C. bairdi* fishery.

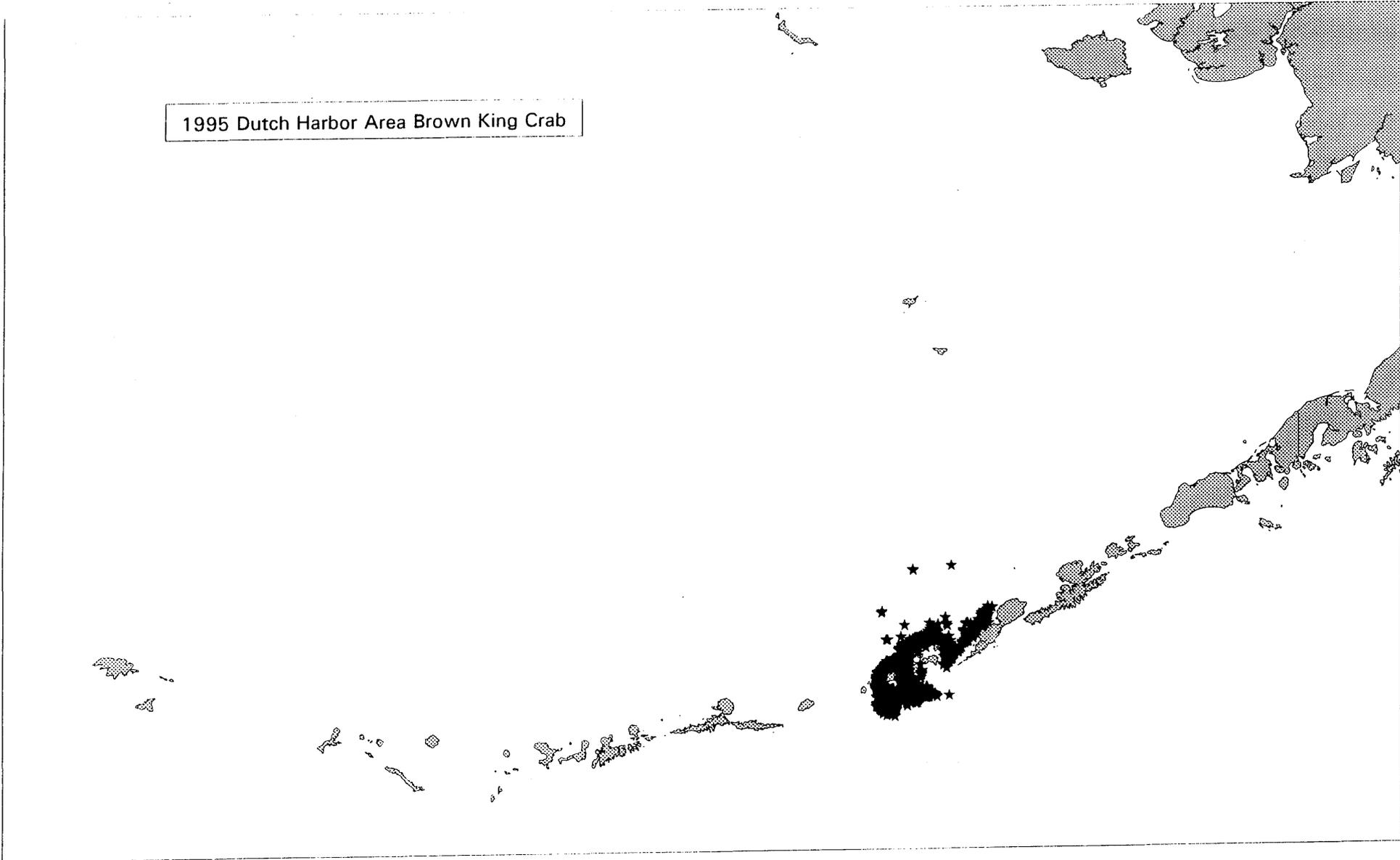


Appendix B-5. Location of pots sampled by observers in the 1994-95 Adak Brown King Crab fishery.

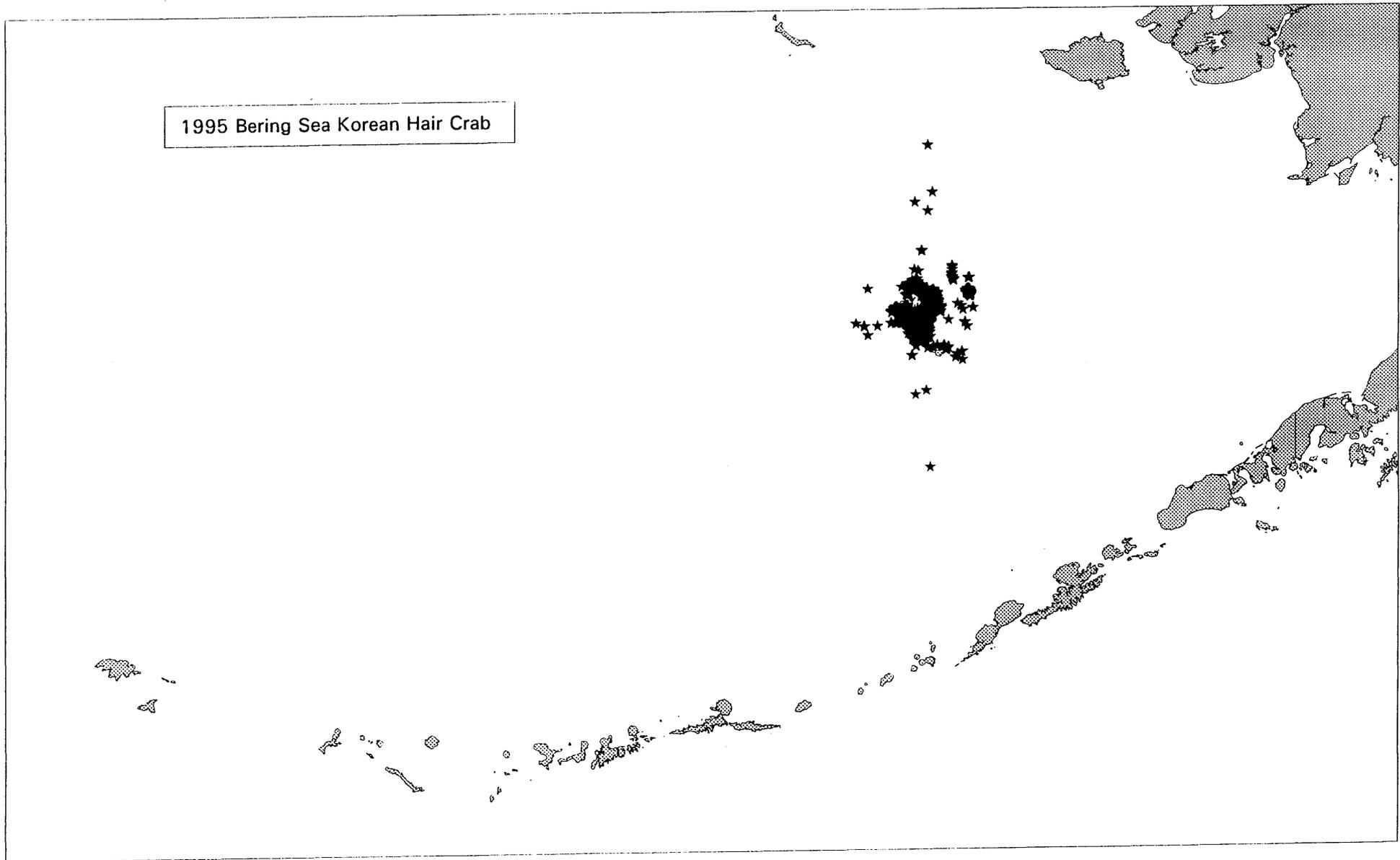


Appendix B-6. Location of pots sampled by observers in the 1995 Adak Area Red King Crab fishery.

1995 Dutch Harbor Area Brown King Crab

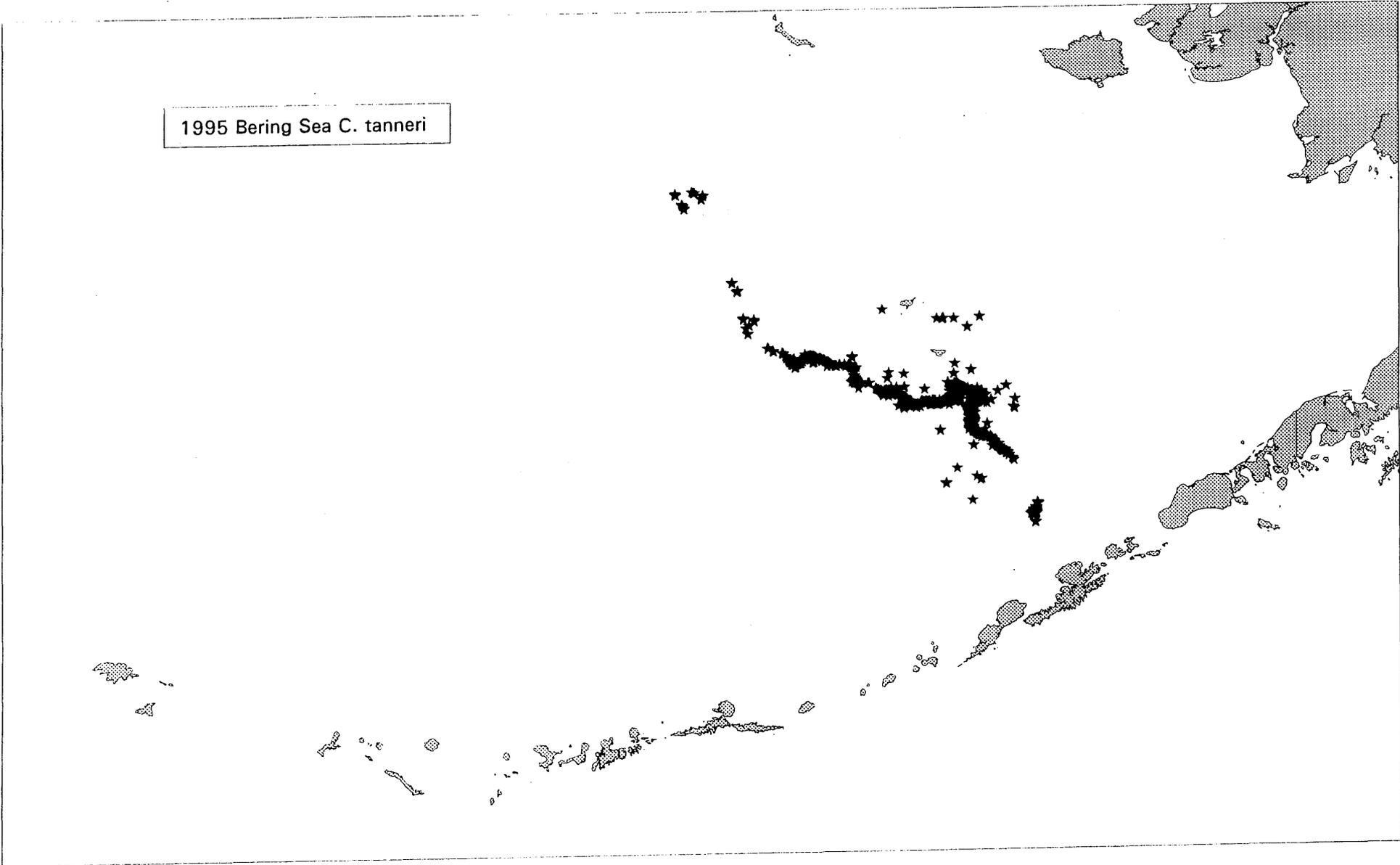


Appendix B-7. Location of pots sampled by observers in the 1995 Dutch Harbor Area Brown King Crab fishery.

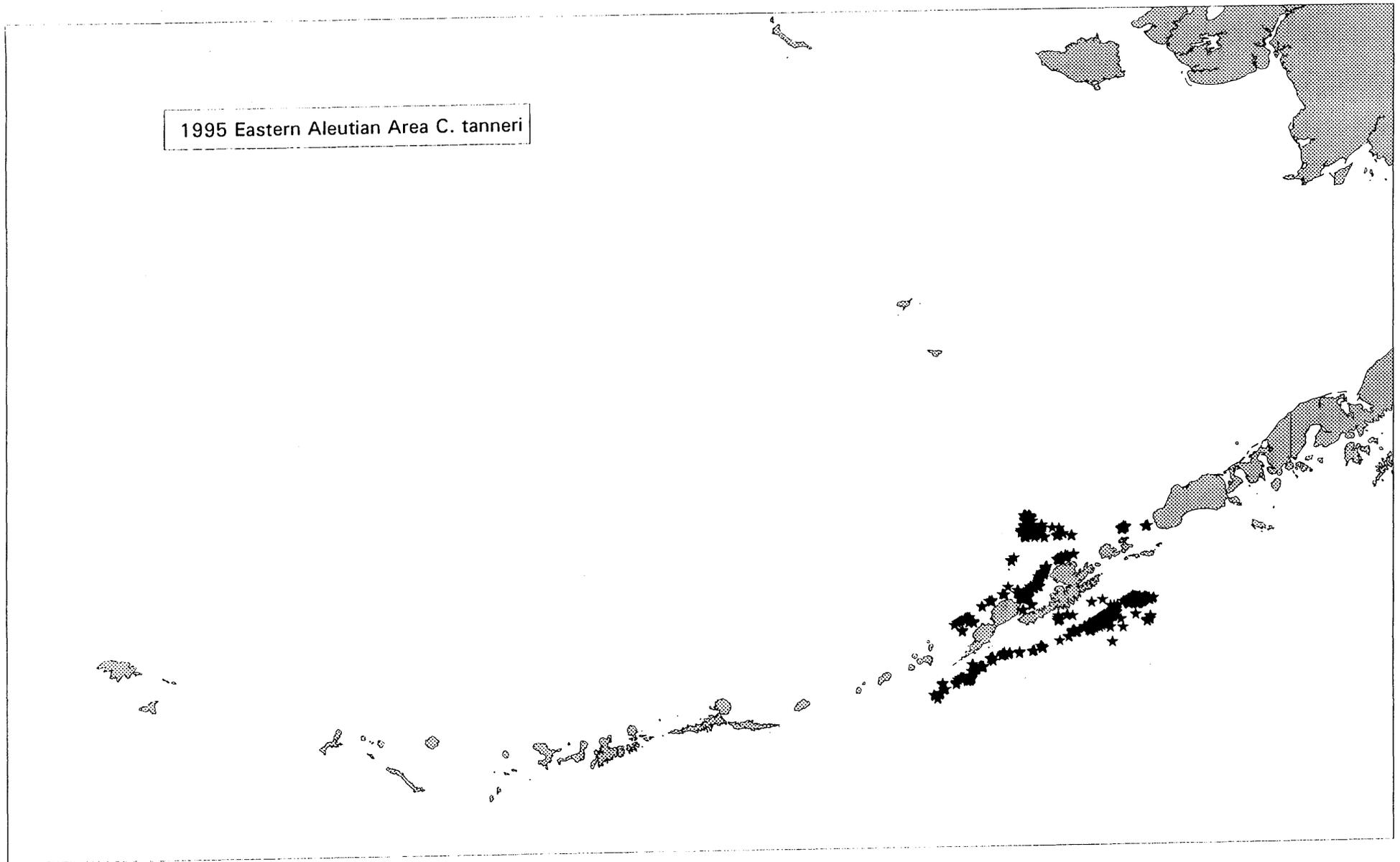


Appendix B-8. Location of pots sampled by observers in the 1995 Bering Sea Korean Hair Crab fishery.

1995 Bering Sea *C. tanneri*

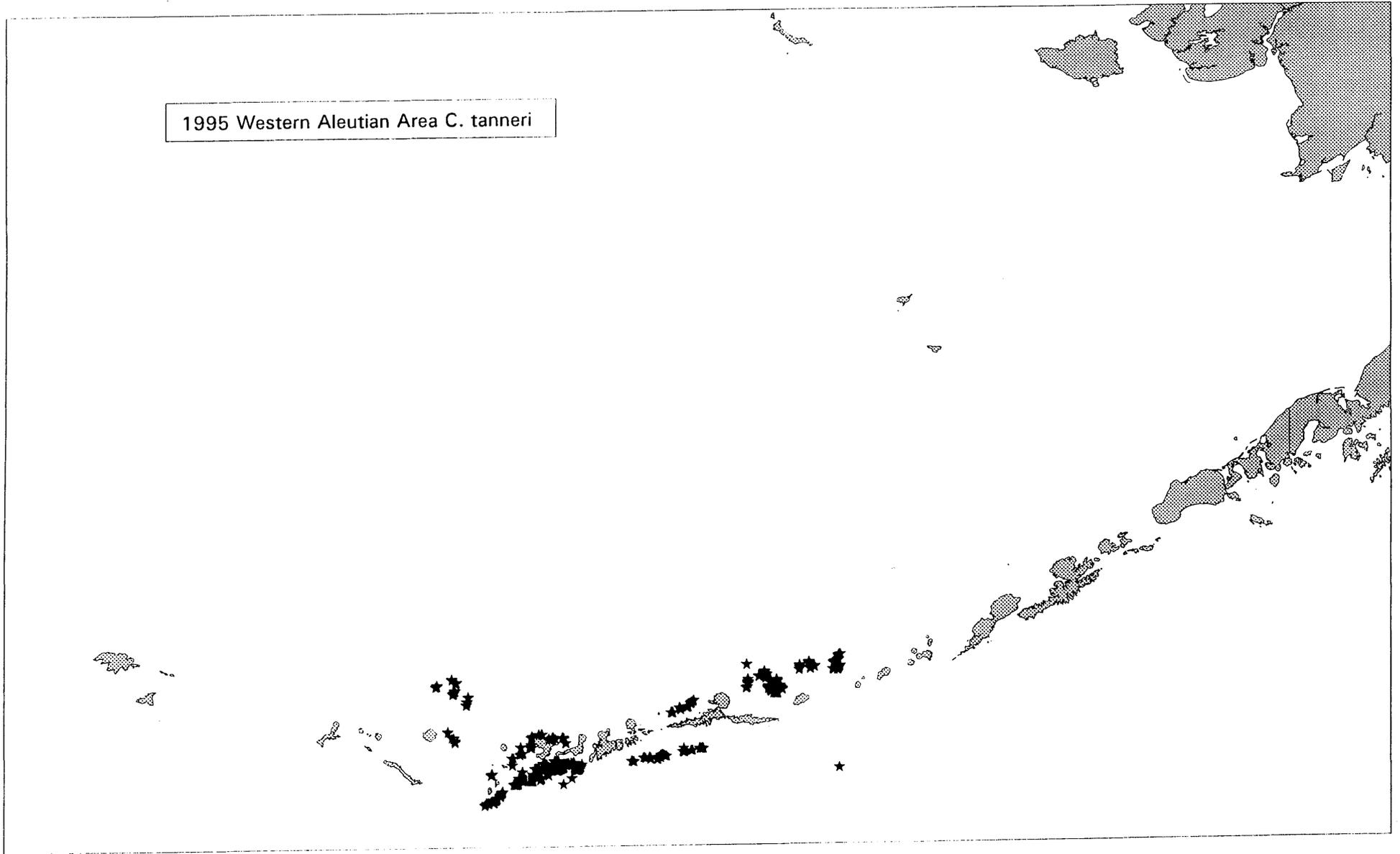


Appendix B-9. Location of pots sampled by observers in the 1995 Bering Sea *C. tanneri* fishery.

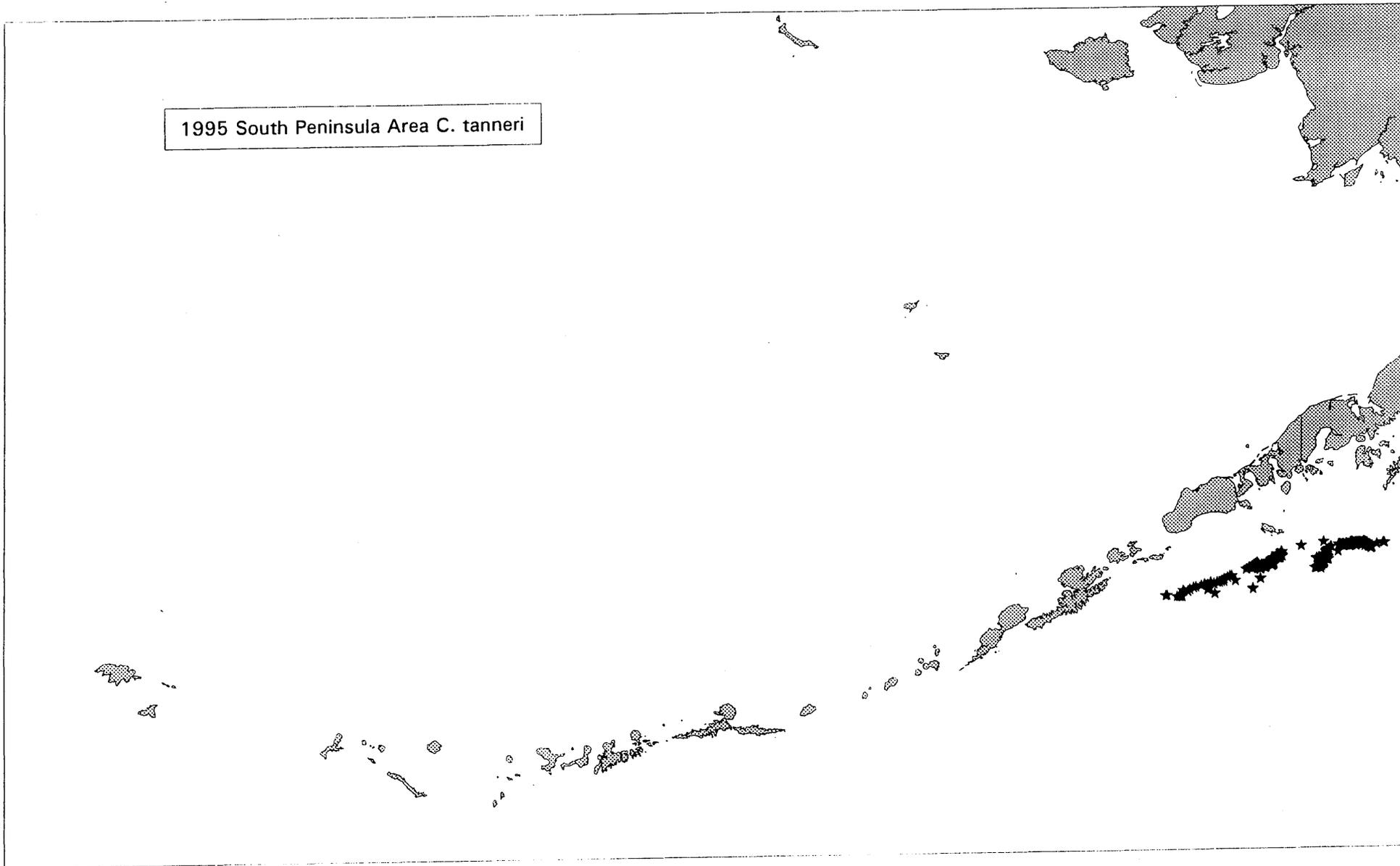


Appendix B-10. Locations of pots sampled by observers in the 1995 Eastern Aleutian Area *C. tanneri* fishery.

1995 Western Aleutian Area *C. tanneri*



Appendix B-11. Location of pots sampled by observers in the 1995 Western Aleutian Area *C. tanneri* fishery.



Appendix B-12. Location of pots sampled by observers in the 1995 South Peninsula Area C. tanneri fishery.

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