4K95-14

ALASKA DEPARTMENT OF FISH AND GAME BIOLOGICAL SUMMARY OF THE 1993 MANDATORY SHELLFISH OBSERVER PROGRAM DATABASE

By

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Regional Information Report[1] No. 4K95-14

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Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, Alaska 99615

March 1995

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ACKNOWLEDGEMENTS

Much gratitude is expressed to the many shellfish observers deployed during the 1993 Bering Sea/Aleutian fisheries. Their ability to endure the inimical conditions of working and living at sea for extended periods has produced the raw data summarized in this report.

Alaska Department of Fish and Game staff assisting in the compilation of this summary include the entire Dutch Harbor Area Office staff. In particular, Shellfish Observer Program Coordinator Mike Ward, and staff biologists Ben Kirkpatrick and Larry Boyle, who are responsible for administering observer deployments and controlling data collection objectives. Area Biologist Rance Morrison and his staff have lent continuous assistance and support in attending observer candidate qualifying exams and ensuring timely editing and electronic entry of collected data. Regional Shellfish Biologist Bill Nippes has been responsible for directing and administering departmental policy which has had a positive affect on the evolution of the program since 1988. Kodiak Biometrician Doug Pengilly has repeatedly contributed his professional knowledge and skills to the observer program, thus augmenting the integrity of the information presented here. ADF&G biologist Jim Blackburn has been invaluable in lending his expertise for shellfish observer database design and computer programming for data entry and summary.

Acknowledgement is also given to the Pacific Fisheries Information Network (PacFIN) for recognizing the importance of annual funding in support of Bering Sea shellfish research.

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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 Tanner *C. bairdi* crab in Alaskan waters. Since that time, the BOF has amended observer deployment regulations to include the Bering Sea *C. opilio* fisheries. In addition, board members granted authority to the Alaska Department of Fish and Game (ADF&G) to place observers on commercial vessels participating in other Alaskan shellfisheries, when such action would facilitate the only means to collect valuable biological and fishery management data.

Historically, the primary purpose of deploying observers on crabbing vessels has been to provide an enforcement monitoring tool to promote the long term health of the fisheries. Although observers do spend a considerable amount of effort monitoring and documenting the fishing activities of commercial vessels, they also collect a wealth of biological data. These data are useful for establishing patterns in population dynamics with regard to stock age composition, reproductive patterns and the effects of commercial exploitation. Ultimately, the shellfish observer biological database provides a valuable source of information to facilitate more 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 periods, to species composition of catches, biological and legal crab size frequencies, and the reproductive status of female crabs.

During the 1993 Bering Sea/Aleutian Islands shellfisheries, observers were deployed on catcher processor, floating processor, and catcher only vessels. Observers onboard floating processors have access only to pre-sorted and retained catches which limited certain types of data collection. Observers placed on catcher processor and catcher vessels were able to examine pot contents prior to any catch sorting.

In this report, compiled data was collected during fisheries primarily occurring in the 1993 calendar year. Due to the substantial volume of available information, the scope of data presented has been narrowed to include only size frequency and molt stages of commercially retained crabs, the documented incidence of illegally retained crabs, and the results of random pot sampling. Topical statistics from the 1990, 1991, and 1992 seasons have also been include for comparative purposes. Any inconsistencies between findings presented in this document and previously published reports regarding the shellfish observer databases are the result of updated summaries and interpretation of historical data.

Size frequency measurements of retained crabs presented in this report include those collected in a number of fisheries at shoreside processing locations by ADF&G "dockside" samplers. Additional information, regarding Bering Sea/Aleutian Islands fishery management and the shellfish observer program, has been provided by Griffin and Ward (1993), and Morrison et al. (1994).

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 the 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 Korean hair 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* and *C. opilio* crabs.

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 of the carapace including the spines.

Mature - crabs (both male and female) that have attained a biological size at which 50 percent or more of a given sample at that size are physiologically capable of mating.

Immature - crabs (both male and female) that have not attained a biological size at which 50 percent or more of a given sample at that size are physiologically are 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 (Skip molt) - crabs that have molted between the preceding twelve to twenty-four months.

Very old shell (2nd skip) - 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 mating (based on evidence of egg clutch extrusion) in the previous year.

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

Floating Processors

Observers onboard floating processors monitor catcher vessel deliveries 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 the "Legal Tally".

Biological data collected from the catcher vessel deliveries includes random selection of 100 crabs to determine carapace size distributions and shell age condition, and a determination of an average catch weight of sampled crabs.

Catcher Processors

Observers deployed on catcher processors have the opportunity to conduct a more comprehensive survey of vessel fishing activities and catch statistics than those placed on floating processors. In addition to collecting the carapace size distribution, Legal Tally and average catch weight samples from retained crabs, each observer routinely examines randomly selected pots for species composition. This sample type is sometimes referred to as the "Bycatch" sample. Methodology includes enumerating all species in a pot, assessing the size frequencies of all commercially important crabs observed, determining their shell age composition, and evaluating the reproductive condition of any captured female crabs.

Daily sampling objectives on catcher processors (in terms of the quantity of fished pots examined, crabs measured, etc.) are dependent on a number of variables. Specifically, factors such as whether an individual has been assigned any special data collection projects, the projected duration of the fishery in which the observer is deployed, and the data collection priorities established by ADF&G staff for separate fisheries all affect the volume and variety of information collected. Fishery specific sampling goals will be discussed in subsequent sections when appropriate.

RESULTS AND DISCUSSION

Bering Sea C. opilio

In recent years, the *C. opilio* fishery has become the economic mainstay of the Bering Sea/Aleutian Islands commercial crab fleet. The largest harvests on record of these stocks have occurred since at sea observer coverage was authorized by the Alaska Board of Fisheries in the spring of 1990. These immense catches coupled with relatively lengthy seasons have generated some of the larger data sets amassed by observers since the program's inception.

In the 1993 fishery a total of fifty observers were placed on catcher processor and floating processor vessels, less than half the total personnel deployed in 1992 (Ward et al. 1993). By the conclusion of the season on March 15, nearly 1.7 million male and female *C. opilio* had been examined by observers for biological/legal descriptive characteristics.

In 1993 the average carapace width (CW) of a retained male *C. opilio* showed slight variation between processing types. Sampling results from catcher processors, floating processors, and shoreside locations are depicted in Table 1. The mean size of retained males observed during the previous four seasons has also remained relatively constant at between 109 mm and 112 mm (Table 2). The carapace width distributions of crabs harvested between 1990 and 1993 indicates that there has been virtually no change in the overall size composition (Figure 1). Historical carapace width distributions of harvested *C. opilio* prior to 1990 are not available from the Bering Sea fishery.

The CW distributions of all male *C. opilio* (both those retained and released) observed in pot samples displayed little change from the 1992 fishery (Figure 2). The mean size of male crabs (108 mm) still remained significantly larger than that of the 1991 season (102 mm), but there appeared to be little evidence of prospects for recruitment since the 1992 fishery. It should be noted that the age classes of juvenile male crabs below 65 mm CW are not typically seen in fished pots and any assumption of poor recruitment could only be based on evidence of slight change in the size distribution of the larger male crabs.

The CW frequencies of female *C. opilio* observed in pot samples over the last several years are depicted in Figure 3. There appeared to be fewer crabs examined during the 1993 fishery (in comparison to the previous year) in the mature size range. The size at maturity for female *C. opilio* is generally thought to be at 50 mm however, continuing studies may indicate there is significant variability in this index based on geographic differences in suitable habitat (R. Otto, National Marine Fisheries Service, Kodiak, pers. communication). Overall, there was little variance in the mean CW of females between the 1992 and 1993 seasons. The difficulty in objectively assessing the shell age of these crabs may explain the presence of non-molting individuals in the immature size classes and the evidence of molt activity in the larger (mature) size classes.

Retention of illegal crabs appeared to be relatively insignificant during the *C. opilio* season as shown in Tables 3 and 4. Examination of nearly 1.2 million crabs for legal size, sex and species revealed just under 7,000 unlawfully harvested individuals; the vast majority of which were undersize *C. bairdi*. The cumulative percentage of illegally retained crabs was identical to that of the prior year's fishery at 0.5% (Tracy, 1994).

Average catches per pot of retained male *C. opilio* derived from 1,151 observer pot samples were substantially higher than those reported on commercial fish tickets in 1993; a mean of 235 crabs per sampled pot (Figure 4) compared to the 187 crab CPUE reported to ADF&G management biologists by catcher processors (Morrison et al. 1994). Also, the average pot sample catch of retained crabs during the 1993 fishery was 12 percent higher than results from 1992. Estimated total fishery catches of retained crabs and incidental animals showed that relative to the targeted male *C. opilio*, unintentional capture of other crabs and fish was nominal (Table 5). Tanner

hybrids composed the largest bycatch occurrence at an estimated 9.5 million animals during the fishery.

Shell age classifications of male *C. opilio* in the 1993 season remained consistent with findings from prior seasons (Table 6). Ninety percent of all males examined were classified as new shell; the balance consisting almost exclusively of first year skip molts (old shell). Male crabs failing to molt for two or more consecutive years have been nearly absent from samples during each of the past four seasons.

In comparison to previous fisheries, the results of female *C. opilio* shell age assessment revealed that greater numbers of individuals were described as having very old shells (Table 6). Conversely, the numbers of new shell females decreased from 32% of the total sample size in 1991 to just over 10% in 1993. The proportion of skip molt crabs remained relatively constant with findings from preceding years.

The numbers of *C. opilio* females carrying eggs at the time of the 1993 harvest was also relatively similar with the outcome of sampling from the 1992 fishery (Figure 5). Summary of available data showed that females with clutches of eyed and uneyed eggs comprised 60% of the total sample. In 1992, the ratio of ovigerous *C. opilio* was slightly higher at 75% of all crabs observed. The decrease in abundance of females carrying egg clutches in 1993 (and the according increase of those described as barren) may signify a shift in population dynamics towards the presence of a larger proportion of aged and non-fertile crabs however, this disparity is possibly within a statistical margin of error in observer assessment of female reproductive condition.

Compared to catches of male *C. opilio*, females have not been common in pot samples; less than 2,000 of these crabs were examined by observers in both the 1992 and 1993 fisheries (Table 7). Although nearly 8,500 female *C. opilio* appeared in the summary of data from numbers of pots inspected in 1991, at minimum an analysis of variance in catch locations would be necessary in order to conclude there was a general increase in abundance during that season.

Bering Sea C. bairdi (Tanner Crab)

Information summarized from the 1990, 1991, and 1992 Bering Sea fisheries is presented in this report using two separate chronological parameters to define the data sets. Some pot sample statistics have been limited to the portion of data obtained prior to the overlap of the *C. bairdi* season with the *C. opilio* fishery. Since most vessels retain both *C. bairdi* and *C. opilio* during the concurrent seasons, it is difficult to identify a pot sample derived from exclusively directed *C. bairdi* effort. All sampling figures with regard to species composition and catches per pot, have been derived only from data sets generated in the fishery prior to January 1st of each respective year. Data statistics such as size frequencies, shell ages and reproductive condition of females have been taken from *C. bairdi* sampled throughout the entire course of both fisheries.

In 1993 shellfish regulations were amended resulting in the initial allowable harvest period for *C. bairdi* opening concurrent to the Bristol Bay red king crab fishery on November 1st. No directed Tanner effort was observed during this interval. The *C. bairdi* fishery re-opened on November 20; 10 days following the Bristol Bay closure (Morrison et al. 1994). Summarized catch composition information contains only data collected between the latter November opening and the ultimate conclusion of the season on January 1, 1994.

Most retained *C. bairdi* CW samples were obtained from observer sampling on catcher processors. Combined measurements from all processing locations produced and average width of 151 mm (Table 8). Forty-six percent of the sample consisted of post-recruit sized crabs (Table 9). Although a smaller number of retained males were examined in 1993 than in the preceding two years, the overall CW distributions from all three seasons are very similar (Figure 6).

The age/width structure of *C. bairdi* males (retained and released crabs) taken from pot samples showed little indication of upcoming recruitment into the population (Figure 7). However, due to regulation changes in the portions of the Bering Sea where Tanner crab harvest was allowed in 1993, the summarized measurements are not representative of the entire area fished in previous seasons. The average CW of *C. bairdi* females (95 mm) remained identical to the mean of crabs measured during the 1992 season (Figure 8). Crabs below 65 mm CW were conspicuously absent from sampled pots but this observation is consistent with findings from the 1990, 1991, and 1992 seasons.

Illegal crabs appeared to be more prevalent during the *C. bairdi* opening than in any other fishery subject to observer coverage in 1993. One percent of all retained males surveyed were under legal retention size (Table 10). Applying this percentage to the total reported catch resulted in approximately 35,000 sub-legal males harvested during the season.

Catches of legal and undersized males (17.7 and 30.8 per sampled pot, respectively) were low in 1993 compared to preceding years (Figure 9). The decline in abundance of *C. opilio* catches continued; from 41.5 crabs per pot in 1991 to an average of less than 4 in 1993 samples. Bycatch of red king crabs was also reduced by 85%, but still consisted of an approximated 225,000 individuals (of both sexes) caught and released over the course of the season (Table 11).

New shell males and old shell females comprised the majority of *C. bairdi* assessed for shell age (Table 12). Only 12.5% of the male crabs were characterized as skip molts. Nine of every 10 females examined were also described as old shell.
Gravid *C. bairdi* females typically have made up the bulk of those examined for reproductive characteristics during the last several seasons. In 1993, 96.2% of the females surveyed carried egg clutches (Table 13). Clutches containing eyed eggs outnumbered those comprised of uneyed eggs by a ratio of 3 to 1. During the 1991 and 1992 fisheries the vast majority of clutches examined contained uneyed eggs (Figure 10). The disparity between respective years may be attributable to the change of seasons in 1993 and the additional reduction in geographic area where fishing effort was allowed. The very small numbers of barren females observed in 1993 were more or less evenly split between previously mated individuals and those exhibiting no signs of recent mating activity.

St. Matthew Blue King Crab

During the 1993 Board of Fisheries shellfish session the annual season opening for the St. Matthew blue king crab fishery was changed from September 1 to September 15. The Board's intent was to schedule the fishery concurrent with the opening for Pribilof district red king crab in order to divide vessel effort between the two areas. In recent years the harvestable surplus of blue king crab in the St. Matthew fishery has declined relative to historic levels. Conversely, fishing pressure has increased; in 1992, 174 vessels registered for the 60 hour opening (Griffin et al. 1993).

As a result of the season change mandated by the BOF, only 92 vessels participated in the 6 day opening (Morrison et al. 1994). At the conclusion of the fishery on September 21, shellfish observers deployed on three catcher processors and four floating processors had examined more than 475,000 blue king males and females in the course of their sampling activities (Ward et al. 1994).

Just under 12,000 CL measurements of retained blue king crabs revealed an average size (135 mm) very similar to data results from the preceding three years (Figure 11). The average size of retained crabs sampled at each processing location during the 1993 fishery were relatively consistent with a mean of 134 mm at shoreside locations and 137 mm on catcher processors (Table 14). The overall size composition of retained crabs during the past four seasons also showed little variation with 70 percent of harvested crabs at or below 140 mm CL (Table 15).

The CL distribution of all male blue king crabs appears to correlate well with the 1992 data set in relation to potential recruitment into the population. The significant frequency of crabs in the juvenile size class (60 mm - 90 mm CL) from that year emerged in the 75 mm - 105 mm CL range during the last season (Figure 12). The median CL (112 mm) of blue king males in 1993 was slightly higher than the mean CL of 110 mm recorded in 1992; this nominal increase is possibly attributable to the slight decline in abundance of recruit and post recruit males between the two years.

To some degree, changes in female blue king CL composition between seasons were not as evident as those of the male population. A sample of 2,722 crabs in 1993 revealed an increase in average CL of 6 mm in comparison to the previous year and, a concurrent rise in the numbers of females characterized as old shells (Figure 13). The numbers of immature female crabs documented in pot catches has remained relatively unchanged since the 1991 fishery.

As in previous years, the incidence of illegal crabs retained in 1993 constituted less than 0.5% of the total harvest (Table 16). Observers deployed on catcher processors and floating processors surveyed approximately 13% of the year's catch and subsequently found less than 200 undersized male blue kings in their samples. Based on these findings, as well as the numbers of female blue king crabs and other illegal species that were documented in samples, an estimated 1,900 illegal animals were retained by the fleet during the fishery.

Over the past four seasons, summaries of pot content sampling have shown that non-target catches of crabs and fish in the St. Matthew fishery have been in large part limited to undersized

blue king males and females (Figure 14). The mean catch of blue king females has fluctuated between a low of 8.4 crabs per pot in 1990 up to as many as 60.4 crabs in 1992. The average catch of 33.3 females during the 1993 season extrapolates to nearly 2 million individuals caught and released (Table 17). The mean catch of legal males remained comparable to the 1992 opening at nearly 14 crabs per pot but showed a significant decline from the CPUE of 19.5 crabs in the 1991 fishery. The only other commercially important crab species documented in bycatch pots was *C. opilio*, of which there were 199 individuals of both sexes in a survey of 84 pots (Table 17).

Shell age statistics of male and female blue king crabs at the time of the fishery have been well documented in observer data sets over the past four years. In each season roughly 90% of all males examined have been categorized as new shells; the remainder almost exclusively being described as 1st year skip molts (Table 18). Shell classification of blue king females has varied somewhat with numbers of those recorded as new shell differing by as much as 30% of the total sample size between 1990 and 1993. Accordingly, old shell females comprised just under 20% of those sampled in 1992 and greater than 35% of the crabs observed in 1993.

In prior years, gravid female blue kings have consistently been absent from sampled pots. This was again the case in 1993 when all of the 2,720 crabs examined were devoid of egg clutches (Table 19). Compared to the past several year's data, a higher percentage of the barren females inspected in 1993 showed signs of earlier mating activity. As Figure 15 illustrates, there appears to be a pattern of this nature developing that dates back to 1991. The concurrent decrease in numbers of non-mated females between 1992 and 1993 correlates to the rise in average female CL and increased percentage of old shell crabs in consecutive years.

Pribilof Red King Crab

There are no historic records available of a directed domestic harvest of red king crabs in the Pribilof Island section of the Bering Sea (R. Morrison, Alaska Department of Fish and Game, Dutch Harbor, personal communication). During the 1970s and early to mid 1980s, significant numbers of blue king crabs were removed from the area and a small amount of red king crab was taken as incidental catch. In 1993 an estimated 3.4 million pound harvestable surplus of red king males (NMFS 1993) allowed the opening of a directed fishery on September 15. Of the total observers onboard vessels during the season, two were deployed on catcher processors and two monitored catcher vessel deliveries to floating processors (Ward et al. 1994).

More than 6,700 retained red king males were measured for carapace length by observers on both at sea processing vessel types and also, by ADF&G "dockside" samplers at shoreside locations (Table 20). The mean retained crab CL of 154 mm is comparable to the average size of red king crabs harvested in the Bristol Bay area over the last several years (Figure 16). Slightly over 50% of the retained male sample consisted of crabs between 140 mm and 155 mm CL (Table 21).

The CL distribution of red king males observed in pot samples showed a noticeable "spike" of crabs in the pre-recruit (100 mm -120 mm) age class (Figure 17). Nevertheless, the overall mean size (138 mm) was still above the generally accepted threshold (135 mm) for recruit red king

males in the Bering Sea. Only 53 red king females were seen in pot samples and all were reported as being new shell crabs (Figure 18).

More than half of the harvest reported by catcher processors was monitored by observers for compliance with legal retention size and composition regulations; 16.5% of the catch delivered to floating processors was also surveyed (Table 22). Undersized male red kings comprised the majority of the illegal catch which was 0.2% of the total sample.

An average catch of 7.6 legal red king crabs was derived from 55 pot samples collected during the season (Table 23). This number was considerably less than the calculated mean of 11.6 crabs per pot obtained from commercial fish tickets (Morrison et al. 1994). Bycatch samples also included 107 incidental blue king crabs of both sexes. In general, *C. bairdi* and *C. opilio* were the most commonly observed species at 19.3 and 13.4 animals per pot, respectively (Figure 19).

As mentioned previously, all of the female red king crabs examined by observers were classified as new shell (Table 24). Most of the 693 males evaluated had also completed a molt cycle within the preceding year. Only 130 old and very old shell male crabs were seen in the 55 sampled pots.

Barren females displaying no evidence of mating in the twelve month period prior to their capture in the fishery accounted for nearly 75% of the 53-crab sample (Table 25). Fourteen red king females possessed clutches of eyed eggs; none carried uneyed eggs or were reported as barren but having mated within the previous year. These data are illustrated in Figure 20.

Bristol Bay Red King Crab

Shortly following the inception of the shellfish observer program in 1988, initial deployments began in the Bristol Bay red king crab fishery. During that year, 20 observers were placed onboard catcher processors and 5 on floating processors (Quimby 1990). In part, the original Board of Fisheries mandate for observer coverage was based upon a substantial disparity in reported catch rates between the un-regulated catcher processors and the remainder of the fleet, which was subject to legal harvest monitoring by ADF&G "dockside" samplers. Schimdt et al. (1990) concluded that indeed the presence of observers on the catcher processors had a positive effect on equalizing relative fishing performance amongst all vessels. Since that time, the biological and fishing statistics collected by observers in the Bristol Bay fishery have been utilized to modify regulations with regard to the retention of incidental *C. bairdi* during the season, and the restriction of commercial effort following the closure in areas with high bycatch rates of red king crabs.

Over the course of the 1993 opening, 17 observers monitored fishing activities and gathered data on catcher processors; another seven sampled catcher vessel deliveries to floating processors (Ward et al. 1994).

Over the past several seasons, the average size of retained red king males has remained constant at roughly 152 mm CL (Figure 21). The nearly 33,000 crabs measured at three different processing locations in 1993 showed variation of less than 2 mm in average carapace size (Table

26). The majority of sampled crabs (55% - 60%) combined from all processor types ranged between 146 mm and 165 mm CL (Table 27). Based on these findings, a similar proportion of the 1993 catch could be considered "post-recruit aged" individuals, i.e., crabs which have attained legal size at least a year prior to commercial harvest.

A comparison of the size distribution of both retained and released red king males measured during the last three seasons appeared to show signs of legal crab recruitment in 1993. As Figure 22 illustrates, there was a noticeable increase in relative abundance of pre-recruit sized crabs (110 mm - 134 mm) between the 1991 and 1992 seasons. The change in mean CL from 139 mm to 125 mm during the respective years supports these findings. In 1993 the average CL of male crabs increased to 133 mm, accompanied by an upward shift in overall size frequency to the 125 mm - 140 mm range. The CL dispersion of red king crab females also indicated an increase in larger individuals from 1991 to 1993 as evidenced by a corresponding 14 mm change in mean carapace size (Figure 23). Samples of females were quite small in the earlier seasons; 376 crabs in 1991 compared to 5,946 in the latest fishery. There is little annual change in the locale of directed effort in Bristol Bay but the successive annual increase in numbers of pots sampled by observers probably contributed to the higher occurrence of females in the data.

The retention rate of illegal crabs in Bristol Bay appeared to be modestly higher than in other fisheries discussed previously. A sample of over 107,500 crabs examined for legal size, sex and species revealed a ratio of 1 illegal animal out of every 124 crabs tallied (Table 28). Undersized red king males made up 90% of the documented illegal catch.

Pot sample catches of red king males and females have fluctuated significantly since the 1990 season. The average catch of 8.3 legal males (Table 29) in 1993 was very similar to the 9 crab CPUE derived from commercial fish tickets (Morrison et al. 1994), and was substantially higher than the pot sample average catch of 5.2 crabs obtained from 1992 observer data (Figure 24). Undersized red king male and female catches per pot remained consistent with 1992 levels at 10.5 and 11.1, respectively. The most prevalent incidental species was *C. bairdi*; an estimated 3.9 million individuals of both sexes were caught during the 10 day opening. It should be noted that *C. bairdi* males equal to or greater than 5.5 inches CW could be legally retained during the 1993 Bristol Bay season.

Almost all Bristol Bay female red king crabs sampled by observers since 1990 have been characterized as new shells; less than 1% have been described as skip molts (Table 30). During the same time period the shell age composition of red king males has also remained constant. Eighty-five to ninety percent have been classified as new shell, and only 1 to 2 percent described as very old shell. Of interest may be the fact that over the past several years the apparent dynamic nature of the male stock (referred to previously) has not affected the overall shell age stratification.

Ninety-five percent of the red king females observed at the time of the 1993 fishery carried egg clutches (Table 31). These findings are analogous to results of data collected in 1992, although a greater number of clutches assessed during that fishery were comprised of eyed eggs (Figure 25). This disparity could possibly be attributable to sampling error (with regard to the difficulty in visually detecting the presence or absence of embryonic eyes), but the reproductive condition of females is generally obvious in all king crab species.

Adak Brown King Crab

Shellfish observers onboard catcher processors in the Adak area fishery have traditionally been the primary means for ADF&G to collect much needed descriptive biological information on brown king stocks inhabiting the Western Aleutians. Due to the expansiveness and remote nature of the region, and the limited amount of vessel effort, few other sources of comprehensive data are available to shellfish biologists.

Data compiled from this fishery encompasses the 9 month period beginning on November 1 and concluding in mid-August the following year. By the end of the 1992/93 season, 14 observers had completed trips on five catcher processors (Ward et al. 1994).

The combination of data summarized from ADF&G sampling at shoreside locations and measurements of retained males collected by observers on the catcher processors revealed an aggregate sample size of 33,644 crabs and a median CL of 147 mm (Table 32). The mean CL and size frequency distribution of harvested brown king crabs has changed very little over the past 4 years; 75% or more of all crabs measured during respective seasons have fallen in the range from 136 mm to 155 mm (Figure 26 and Table 33).

Little variation is detectable in the annual length distribution of brown king males surveyed in pot samples. Juvenile crabs as small as 60 mm CL routinely occur as bycatch but the abundance of these and other age classes of crabs has remained relatively constant since 1990. The annual CL disbursement of brown king males is illustrated in Figure 27. The size/age dispersion of female brown king crabs appears to demonstrate a more progressive trend of some recruitment over the past four years, although the mean CL has varied only slightly between 120 mm and 122 mm (Figure 28).

The numbers of unlawfully retained crabs documented by the observers on catcher processors consisted entirely of brown king females and undersized males. Over 46% (127,497 crabs) of the CP harvest was monitored and from this sample a total of 1,020 females and small males were detected (Table 34). Similar to the Bristol Bay red king crab fishery, an average of 1 illegal animal was discovered for every 124 crabs tallied during sampling.

During every Adak fishery where observer coverage on catcher processors has been conditional, fairly large numbers of bycatch samples are collected. The species composition of these pots includes a wide variety of invertebrate and fish species; though predominately male and female brown king crabs. In 1993 the catch per pot of legal males (11.4) was higher than the pot sample CPUE in the prior three seasons (Figure 29). The average catch of females and undersized males was 27.1 and 24.8 animals per pot, respectively. By the fishery closure, an estimated 8 million of these crabs (Table 35) were captured and released concurrent to the 4.9 million pound reported harvest of legal males.

The shell age composition of male and female brown king crabs was identical in the 1993 fishery and compares favorably with the past several year's data. Ninety-seven percent of all crabs examined were classified as new shell, and the remainder as skip molts (Table 36). Observers occasionally reported the occurrence of 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 brown king females constituted more than 50% of specimens examined in 1993 and the ratio of barren/mated to non-mated females was approximately 3:1 (Table 37). These data are consistent with findings from previous Adak fisheries (Figure 30), and support studies conducted on Canadian fjord dwelling brown king crab stocks that indicate aseasonal spawning by segments of the population at various times of the year characterizes the reproductive cycle of the species (Sloan 1984, 1985).

Adak Red King Crab

Observer generated data from the Adak red king crab fishery has historically been collected during deployments onboard catcher processors that alternately target brown king crabs. Consequently, the available information is derived from data sets that are relatively small in comparison to those from other fisheries. Because of the difficulty in separating pots directed at red king crabs from those fished for brown kings, discussion of species composition sampling has been eliminated in this section. The pot number statistics included with data pertaining to reproductive state of red king females reflect the incidence of females observed rather than the compliment of fishing gear targeted on red king crabs.

More than 4,000 retained red king males were measured at processing locations in 1993 revealing an average CL of 155 mm (Table 38). Crabs sampled in 1992 were generally in the size range between 136 mm and 155 mm CL while most of those measured in the last season were between 151 mm and 170 mm CL (Table 39). Retained crab length frequencies were available for summary from the Adak fishery in 1990 but not 1991. The ratios of recruits to post-recruits in 1990, 1992 and 1993 was 2.4, 2.4 and .6, respectively. Fifty-two percent of males measured in 1992 were below the median, compared to 35.6% in 1993 (Figure 31).

The mean CL of red king males (including those not retained) was a little less then 6 mm below the harvested crab average. It was however, nearly 20 mm larger than the mean size (129 mm) of all males measured in 1990 (Figure 32). Red king females were also significantly larger in 1993 compared to prior seasons. The representation of CL frequencies given in Figure 33 indicates that some recruitment may have occurred between the 1991 and 1992 fisheries. Nevertheless, female crabs below 100 mm CL were virtually absent in the 1993 data.

A substantial portion of the 1993 red king crab harvest (37.5%) taken by catcher processors was monitored for illegally retained animals (Table 40). The proportion of undersized males detected amounted to 1 out of every 183 legal crabs; or an average of 15 sub-legals per vessel throughout the season. The only other prohibited animals documented consisted of 4 red king crab females. Essentially all red king females assessed for signs of molting activity in 1993 were categorized as new shells. Ninety percent of the male red king crabs examined were also characterized accordingly. Only 42 old shell males were observed from a 485 crab sample. Shell age information from the preceding four years records are similar to findings in the 1993 fishery (Table 47).

Slightly less than 98% of the total 1993 sample of Adak red king females were gravid (Table 42). Three of every four clutches examined contained uneyed eggs. Data collected in 1990, 1991 and 1992 do not reflect these finding and in fact, reproductive statistics compiled from any of the respective seasons do not correlate well (Figure 34). Most of the barren females that occurred in sampled pots during the 1993 fishery showed evidence of mating within the prior twelve month period.

Dutch Harbor Brown King Crab

Crab processing vessels did not participate in the 1993 Dutch Harbor area brown king crab fishery. The consequent absence of observer deployments excludes any discussion of fishing and biological statistics from the 1993 season in this report.

Bristol Bay Korean Hair Crab

Renewed commercial interest in Korean hair crab during 1991 and 1992 has focused Bering Sea fishing effort in the shoal areas surrounding the Pribilof Islands. In addition to the recommended guideline harvest level for the latter year's Pribilof season, results of the 1992 NMFS trawl survey indicated a potential 1 million pound harvestable surplus of hair crabs in the Bristol Bay area of the Bering Sea (NMFS 1992).

Based on this information, ADF&G opened the Bristol Bay fishery in the spring of 1993 (Morrison et al. 1994). The general lack of life history and other biological information relative to the hair crab species, as well as concerns over possible excessive red king crab and *C. bairdi* bycatch prompted the department to include observer coverage as a permit requirement for all fishery participants. Subsequently, seven shellfish observers were deployed on catcher vessels during the relatively brief directed effort for hair crab in this area (Ward et al. 1994).

A total of 1,504 retained hair male hair crabs were measured by observers and ADF&G "dockside" samplers throughout the course of the Bristol Bay season. The calculated mean carapace length (CL) of these crabs was 84 mm; nearly identical to the average size of hair crabs harvested in the Pribilof area opening the following autumn (Table 43). A representative size distribution of all sampled and retained hair crabs (grouped in 5 mm intervals) reveals that the harvest was comprised of very few individuals larger than 100 mm CL (Table 44, Figure 35).

The CL distribution of male hair crabs observed in pot samples had a relatively narrow range; the average size of 82 mm was scarcely lower than the mean of retained crabs (Figure 36). The average CL of female hair crabs was considerably smaller than the males at 74 mm (Figure 37). Sample sizes for both males and females were extremely small; 22 and 6 respectively.

Vessel effort in the Bristol Bay fishery lasted just over 3 weeks due to the lack of significant catches of marketable crabs. During this brief period observers surveyed 249 pots for contents and species composition. The results of this sampling revealed that the relative abundance of all crab and fish species was very low. Only 30 hair crabs were observed; 11 of which were marketable males (Table 45). Catches of other animals included small numbers of *C. bairdi*, *C.*

opilio, and red king crab. Average catch per pot statistics for selected crab species are provided in Figure 38.

Nearly all of the 28 male and female hair crabs assessed for shell age during the fishery were classified as new (Table 46). Information compiled from verbal communication with observers seems to indicate that the evidence of shell age commonly seen on other crab species (such as ventral shell discoloration and evidence of abrasion on dactyls due contact with the substrate) is largely absent on hair crabs.

Five of the six female hair crabs that were observed in sampled pots were characterized as barren with no signs of recent mating activity (Table 47). One crab was described as barren with matted setae indicating maturity and probable egg extrusion within the previous year.

Bering Sea Korean Hair Crab

The 1993 season was the second year of relatively intensified commercial effort in the Korean hair crab fishery, occurring in the area surrounding St. Paul Island. Vessels targeting hair crabs are allowed to utilize an unlimited compliment of gear which is typically fished in a longline configuration of up to 200 small conical pots per string. In order to continue gathering elemental biological information on the species and assess the inadvertent bycatch of other commercially important shellfish (in particular, red and blue king crabs), 100% observer coverage was required on all vessels participating in this fishery.

Summarized data was collected by 23 different observers deployed on 13 catcher vessels throughout the season (Ward et al. 1994), which ultimately closed on April 15th, 1994 (Morrison et al. 1994).

A combined total of nearly 14,500 retained hair crab CL measurements were taken over the course of the season by observers and ADF&G personnel. A strong correlation between the data from both sampling sources (shown in Table 48) suggests that CL and shell age statistics are representative of the harvest. Retained crabs from the 1993 fishery were significantly larger than those measured in the 1992 season; average CL's were 88 mm and 83.1 mm, respectively (Figure 39). Over 33% of crabs assessed in 1993 were 91 mm - 100 mm in carapace length compared to 12.9% in the same size class from the preceding year's sample (Table 49). However, only 800 retained crabs were measured in 1992 and, a legal hair crab retention size limit of 3.25 inches, based on industry preference, was a permit requirement during the 1993 season.

The CL disbursement of the more than 52,000 male hair crabs measured during pot sampling by observers showed variation from the size distribution of the retained harvest. In contrast to 1992 data where the average CL of all males was virtually the same as that of harvested crabs, significant numbers of males below the market size were observed, bringing the median CL down to 79 mm (Figure 40). The length frequency distribution of female hair crabs displayed little change between the two seasons, although only 21 were measured in 1992 compared to a sample of 4,420 crabs in 1993 (Figure 41).

The numbers of retained hair crab males below legal retention size constituted 0.7% of the aggregate Legal Tally sample (Table 51). The 66,414 crabs inspected amounted to nearly 3.5% of the year's reported harvest. Of these, only 41 were female hair crabs or another species of commercially important shellfish.

Because of the large number of pots reportedly fished/pulled by vessels on a daily basis, observer bycatch sampling objectives were set at up to 20 pots (per 24 hour period) for the 1993 season. The subsequent data generated from their efforts comprises the largest database of species composition statistics available in any fishery subject to observer coverage since the program's inception. The 12,226 pot survey equaled greater than 2% of the total pot pulls reported on commercial fish tickets (Morrison et al., 1994).

Catch statistics from the observer data set revealed retained hair crabs occurred more frequently at 3.7 individuals per pot than non-retained crabs, females, or any other species (Table 52). Just 790 legal sized *C. bairdi* were caught in contrast to the 10,621 female *C. bairdi* that were also captured and released. Several thousand red and blue king crabs were observed in pot samples and these consisted primarily of females. A comparison of average pot catches between the 1992 and 1993 seasons is provided in Figure 42.
Close to 5% of the hair crab males assessed for shell age in 1993 had very recently molted (Table 53). The vast majority of these soft and new-soft shell crabs were seen near the fishery closure in mid-April. Most female hair crabs (92.6%) were characterized as new shell and only 21 individuals in soft shell condition showed up in the data. Skip molt crabs of both sexes appeared in small numbers, but the difficulty observers encountered in the Bristol Bay hair crab fishery in classifying old shell hair crabs was also a problem during the Pribilof season.

A very small number of sampled hair crab females carried egg clutches at the time of the fishery. Five of every six ovigerous crabs examined possessed uneyed eggs. Of those females described as barren, nearly 80% displayed no signs of annual mating activity (Figure 43).

Adak Korean Hair Crab

The commercial harvest of Korean hair crabs has traditionally been incidental to that of species targeted in several other Adak area fisheries. For the most part, small catches have been reported by vessels during the brown and red king crab seasons (Morrison et al. 1994).

In 1993, the eight vessels registered for Adak hair crab included one catcher processor carrying an onboard observer (Ward et al. 1994). The data generated from this single deployment were collected over a three week period in April.

A mean CL of 94 mm was calculated from a sample of 561 retained hair crab males (Table 54). More than 56% of the length frequencies occurred between 91 mm and 105 mm (Table 55). Figure 44 shows that the size distribution of retained Adak hair crabs encompassed a much broader range than those sampled from the Bering Sea fisheries.

The overall CL frequency of male hair crabs measured in pot samples was very similar to the size distribution of retained crabs (Figure 45). Only 10 female hair crabs were observed; all were dispersed between the 62 mm and 82 mm CL (Figure 46).

A total of 80 pot samples from directed hair crab effort contained a wide variety of invertebrates. The most abundant incidental catch recorded was brown king crabs at roughly three individuals per pot (Figure 47). Other crab species included several *C. bairdi* and one specimen of *Lithodes cousei* (deep sea king crab). Approximately one hair crab (of either sex) was observed for every four pots sampled (Table 56).

One hundred percent of both the male and female hair crabs examined in pot samples were categorized as new shells (Table 57). Also, of the 10 female crabs surveyed, all were barren and showed no signs of annual mating activity (Table 58, Figure 48).

Bering Sea Snails

Historically, the commercial harvest of snails in the eastern Bering Sea has been limited to directed effort by Japanese vessels. Records maintained by NMFS indicate that annual catches of over 1 million pounds were not uncommon during the early to mid - 1970s (MacIntosh 1980). Domestic interest in the snail resource began in the spring of 1993 when four vessels applied to ADF&G for pot fishing permits with the intent of exploring the feasibility of catching and marketing several snail species commonly found in the area.

In order to collect catch statistics and biological information on the composition of both the directed and incidental harvest, observer deployment was conditional on all vessels taking part in the fishery. By the conclusion of the season, five observers had spent over 150 days deployed on four vessels (Ward et al. 1994).

Sampling objectives during the snail fishery were centered around pot content samples to document the species composition of harvested snails and incidental bycatch of crabs and fish. Shell height frequencies of targeted snails were also collected by observers for age/maturity structure analysis. Currently, size limits for retention of various snail species are not specified in Alaska shellfish regulations and pot sample results indicate nearly all sizes of animals are acceptable for commercial purchase.

Taxonomic identification of snails proved somewhat difficult for observers and although over 12 different species were ultimately documented in the 1,353 pots examined during the course of the fishery, greater than 95% of the retained harvest was comprised of two genera; *Neptunea* and *Buccinum*. *Neptunea pribilofensis* were the most abundant species observed at just under 13 individuals per pot (Figure 49); several species of *Buccinum* also accounted for approximately 107,000 of all snails harvested (Table 59). Incidental bycatch of crabs was nominal and probably attributable to the large tunnel opening required by ADF&G for commercial snail pots. Based on pot sample results, an estimated 110,000 *C. bairdi* and *C. opilio* Tanner crabs were captured and released throughout the course of the season (Table 59). Both red and blue king crabs were scarce; observers recorded only 25 of these animals in sampled pots.

Shell height frequencies from more than 14,000 snails of the species *Neptunea pribilofensis* and *Neptunea lyrata* were collected during the fishery. According to literature available from the National Marine Fisheries Service (MacIntosh 1980), shell height (measured from the shell base to tip) can be used as an index of age and sexual maturity. For *N. pribilofensis* and *N. lyrata*, maturity occurs within the shell height range of 90 mm - 110 mm (MacIntosh and Paul 1977).

From a sample size of over 13,600 *N. pribilofensis* measurements, the mean shell height was 91 mm (Figure 50). The average size of measured *N. lyrata* specimens was also 91 mm indicating that a large portion of harvested snails probably attained sexual maturity prior to their removal from the population.

At this time, a small amount of directed effort continues for harvesting snails from the Bering Sea. Observer coverage is no longer a permit condition for this fishery and although observer data presented in this report is general in nature, a more comprehensive discussion of summarized data from the 1993 season will be available in the future.

CONCLUSION

The collection of management information and perceptive biological data by shellfish observers has been, and continues to be an integral component in establishing an extensive database for monitoring the short and long term dynamics of the Bering Sea/Aleutian Islands crab populations. Facts and figures pertinent to potential recruitment, incidental bycatch of other species, and fishing operations have been utilized extensively by fishery managers in the period since the inception of the program.

Although the established sampling methodologies used by observers are largely based on the principles of inferential analysis, summarized data presented in this report are generalized descriptive biological statistics and should be only be regarded within that context. Because of the considerable volume of information contained in the databases, a standard summary format was utilized for each fishery. There are countless variables such as pot soak times, gear types, fishing depths and locations, and the chronology of data collection that can affect the outcome of sampling, none of which were considered during assembly of this report. The application of mathematical evaluation or multiple perspectives in examining the shellfish observer databases might lead the investigator to results different than those presented.

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Table 1. Bering Sea commercially retained *C. opilio* width frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Width	Shell Age Percentages		
			New	Old	Very old
Catcher processor	122,582	110.4 mm	90.3	9.2	0.5
Floater processor	106,411	112.9 mm	96.2	3.5	0.2
Shoreside processor	21,599	112.3 mm	87.2	12.4	0.5
Totals	250,592	111.6 mm	92.5	7.1	0.4

Table 2. Bering Sea commercially retained *C. opilio* width frequencies from the 1990, 1991, 1992, and 1993 fisheries.

Width (mm)	1990		1991		1992		1993	
	Num. of crab	Percent	Num. of crab	Percent	Num. of crab	Percent	Num. of crab	Percent
86- 90	281	1.0	146	0.4	860	0.5	752	0.3
91- 95	1,084	3.4	784	1.9	2,905	1.7	1,194	0.8
96-100	3,529	11.0	3,179	7.9	8,895	5.3	5,196	2.1
101-105	6,791	21.2	7,619	18.9	21,925	13.0	14,474	5.8
106-110	6,790	21.2	9,895	24.5	33,285	19.8	33,958	13.6
111-115	5,527	17.2	8,671	21.5	37,814	22.5	51,358	20.5
116-120	4,269	13.3	5,928	14.7	31,869	18.9	59,911	23.9
121-125	2,537	7.9	3,028	7.5	19,315	11.5	47,999	19.2
126-130	876	2.7	904	2.2	8,131	4.8	24,657	9.8
131-135	196	0.6	148	0.4	2,343	1.4	7,952	3.2
Totals	31,880[a]	99.5[b]	40,302	99.9	167,342	99.4	247,451	99.2
	mean size = 109.1 mm		mean size = 111.0 mm		mean size = 112.2 mm		mean size = 111.6 mm	

[a] Total sample numbers do not include width frequencies outside the listed ranges.

[b] Percentages do not include width frequencies outside the listed range.

Table 3. Illegally retained crabs observed in the 1993 Bering Sea *C. opilio* fishery including undersized males, and females.

Sample Type	Sample Size[a]	Undersized Males		Females		Total Percent Illegals	Total Crabs Harvested	Est. Total[b] Illegals	% Harvest Sampled
		Number	Percent	Number	Percent				
Catcher Processor[c]	703,463	354	<.1	334	<.1	<.1	23,741,672	23,219	3.0
Floater Processor[d]	593,042	392	<.1	274	<.1	.1	91,723,897	103,008	.6
Totals	1,296,505	746	<.1	608	<.1	.1	115,465,569	120,586	1.1

[a]Includes all species and sexes of crab recorded in *C. opilio* catch samples.

[b]Estimates derived from percentages of illegal crab X total numbers of crab harvested during the fishery.

[c]Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[d]Floater processor figures based upon legal measurements of 600 retained crab per each catcher vessel delivery.

Table 4. Illegally retained *C. bairdi* observed during the 1993 Bering Sea *C. opilio* fishery including undersized and out-of-season males, and females.

Sample Type	Sample Size	Males		Females		Total Percent Illegals	Total Crabs Harvested[b]	Est. Total Illegals[c]	% Harvest Sampled
		Number	Percent	Number	Percent				
Catcher Processor[d]	703,463	2,880	.4	164	<.1	.4	23,741,672	102,734	3.0
Floater Processor[e]	593,042	2,254	.4	92	<.1	.4	91,723,897	362,848	.6
Totals	1,296,505	5,424	.4	204	<.1	.4	115,465,569	501,225	1.1

[a] Includes all species and sexes of crab recorded in *C. opilio* catch samples.

[b] 1993 Bering Sea *C. opilio* harvest.

[c] Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[d] Catcher processor figures based upon legal measurements of 600 retained crab on vessels per fishing day.

[e] Floater processor figures based upon legal measurements of 600 retained crab per catcher vessel delivery.

Table 5. Catch per pot of selected species from the 1993 Bering Sea *C. opilio* fishery.

Species	Total Pot Sample Catch[a]	Catch Per Unit Effort	Estimated Total Fishery Catch[b]
C. opilio			
Legal male	270,783	235.3	228,487,123
Sub-legal male	2,568	2.2	2,136,301
Female	2,927	2.5	2,427,615
C. bairdi			
Legal male	876	.8	776,836
Sub-legal male	6,029	5.2	5,049,439
Female	1,049	.9	873,941
Hybrid Tanner Crab			
Mixed size/sex	11,451	9.9	9,613,355
Red King Crab			
Legal male	11	<.1	9,820
Sub-legal male	6	<.1	5,061
Female	12	<.1	10,124
Blue King Crab			
Legal male	1	<.1	843
Sub-legal male	33	<.1	27,841
Female	7	<.1	5,906
Pacific Cod[c]	1,292	1.1	1,068,150
Halibut	8	<.1	6,749

[a] Total pot contents derived from 1,151 random samples taken on catcher processors during the fishery.

[b] Estimated catch derived from pot sample CPUE x 971,046 total reported pot pulls during the fishery.

[c] All fish species mixed size and sex.

Table 6. Shell age distributions of *C. opilio* males and females observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

Fishery Year	Sample Size[a]	Shell Age					
		New	Percent	Old	Percent	Very old	Percent
1990							
Males	494	471	95.3	22	4.5	1	0.2
Females	0	-	-	-	-	-	-
1991							
Males	116,430	106,107	91.1	8,845	7.6	1,478	1.3
Females	8,565	2,739	32.0	4,981	58.2	845	9.8
1992							
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
1993							
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

[a] Derived from random pot contents samples taken on catcher processors during the fisheries.

Table 7. Reproductive state of female *C. opilio* observed in the 1991, 1992, and Bering Sea fisheries.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	0	-	0	-	0	-	0	-
1991	687	8.1	6,119	72.4	806	9.5	837	9.9
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
Totals	2,493	21.4	6,441	55.2	1,476	12.7	1,249	10.7

Table 8. Bering Sea commercially retained *C. bairdi* width frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Width	Shell Age Percentages		
			New	Old	Very old
Catcher Processor	36,110	150.3 mm	92.7	6.7	0.6
Floater Processor	16,933	152.3 mm	94.8	5.1	0.1
Shoreside Processor	18,579	149.8 mm	95.4	4.6	<.1
Totals	71,622	150.7 mm	93.9	5.8	0.3

Table 9. Bering Sea commercially retained *C. bairdi* width frequencies from the 1991, 1992, and 1993 fisheries.

Width (mm)	1991 Num. of crab	1991 Percent	1992 Num. of Crab	1992 Percent	1993 Num. of Crab	1993 Percent
131 - 135	723	0.6	577	0.5	306	0.1
136 - 140	13,281	10.6	16,787	13.5	7,270	0.4
141 - 145	29,846	23.9	35,110	28.0	15,047	10.2
146 - 150	26,226	21.0	30,799	24.6	15,507	21.0
151 - 155	20,401	16.3	21,999	17.6	13,838	21.7
156 - 160	14,997	12.0	12,063	9.6	10,156	19.3
161 - 165	9,775	7.8	5,001	4.0	5,717	14.2
166 - 170	5,520	4.4	1,662	1.3	2,467	8.0
171 - 175	2,522	2.0	510	0.4	1,010	3.4
176 - 180	804	0.6	166	0.1	196	1.4
Totals	124,095[a] mean size = 150.4 mm	99.2[b]	124,774 mean size = 148.0 mm	99.6	71,622 mean size = 150.7 mm	99.7

[a] Total sample numbers do not include width frequencies outside the listed ranges.

[b] Percentages do not include width frequencies outside the listed range.

Table 10. Illegally retained crabs recorded during the 1993 Bering Sea *C. bairdi* fishery including undersized males, and females.

Sample Type	Sample Size	Undersized Males		Females		Number of Other Crab	Total % Illegals	Total Crabs Harvested	Est. Total Illegals[a]	% Harvest Sampled
		Number	Percent	Num.	Percent					
Catcher Processor[b]	85,625	917	1.1	38	<.1	23	1.1	902,330	10,306	9.4
Floater Processor[c]	56,249	440	.8	41	<.1	14	.9	2,525,293	22,223	2.2
Totals	141,874	1,357	1.0	79	<.1	37	1.2	3,427,623	35,587	4.1

[a] Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b] Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[c] Floater processor figures based upon legal measurements of 600 retained crab per each catcher vessel delivery.

Table 11. Catch per pot of selected species from the 1993 Bering Sea *C. bairdi* fishery, between November 1 - December 31, 1993.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
C. bairdi			
Legal male	17,426	17.2	7,209,948
Sub-legal male	31,135	30.9	12,952,755
Female	12,497	12.4	5,197,869
C. opilio			
Legal male	3,388	3.4	1,425,222
Sub-legal male	105	.1	41,918
Female	45	<.1	18,695
Hybrid Tanner Crab			
Mixed size/sex	680	.7	293,428
Red King Crab			
Legal male	57	<.1	23,680
Sub-legal male	176	.2	83,837
Female	311	.3	125,755
Blue King Crab			
Legal male	0	-	-
Sub-legal male	99	<.1	48,129
Female	123	.1	41,918
Korean Hair Crab	70	<.1	29,081
Halibut	41	<.1	17,033
Pacific Cod	1,728	1.7	712,611

a Total pot contents derived from 1,009 random samples taken on catcher processors during the fishery.

b Estimated catch derived from pot sample CPUE x 419,183 total reported pot pulls between the dates of Nov. 21 and Dec. 31, 1993.

Table 12. Shell age distributions of *C. bairdi* males and females observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

Fishery Year	Sample Size[a]	Shell Age					
		New	Percent	Old	Percent	Very Old	Percent
1990							
Males	41,265	34,536	83.7	6,070	14.7	654	1.6
Females	4,436	1,658	37.4	2,263	51.0	515	11.6
1991							
Males	31,253	27,818	89.0	3,162	10.1	273	.9
Females	5,639	2,515	44.6	2,507	44.5	617	10.9
1992							
Males	36,943	30,991	83.8	5,411	14.6	491	1.3
Females	5,162	475	9.2	3,643	70.6	1,044	20.2
1993							
Males	40,385	34,019	84.2	5,837	17.2	529	1.3
Females	10,471	1,248	11.9	7,054	67.4	2,169	20.7

[a] Derived from random pot contents samples taken on catcher processors during the fisheries.

Table 13. Reproductive state of *C. bairdi* females observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

Fishery Year	Eyed Eggs		Uneyed Eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	2,297	53.3	1,936	45.0	47	1.1	26	.1
1991	1,274	22.6	4,205	74.5	118	2.1	47	.8
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
Totals	11,607	45.4	12,983	50.8	558	2.2	415	1.6

Table 14. St. Matthew commercially retained blue king crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Width	Shell Age Percentages		
			New	Old	Very old
Catcher processor	1,397	137.2 mm	86.2	13.8	0.0
Floater processor	8,734	135.3 mm	93.9	5.7	0.4
Shoreside processor	1,818	134.2 mm	97.7	2.2	0.1
Totals	11,949	135.4 mm	93.6	6.1	0.3

Table 15. St. Matthew commercially retained blue king crab length frequencies from the 1990, 1991, 1992, and 1993 fisheries.

Length (mm)	1990 Num. of crab	1990 Percent	1991 Num. of crab	1991 Percent	1992 Num. of crab	1992 Percent	1993 Num. of crab	1993 Percent
111-115	2	0.1	13	0.1	22	0.5	13	0.1
116-120	96	2.4	387	2.7	429	1.7	201	1.7
121-125	452	11.4	1,663	11.5	2,112	5.3	1,193	10.0
126-130	962	24.3	2,749	19.0	3,120	13.0	2,168	18.1
131-135	978	24.7	3,571	24.6	3,247	19.8	2,666	22.3
136-140	649	16.4	3,111	21.5	2,683	22.5	2,478	20.7
141-145	309	7.8	1,740	12.0	1,576	18.9	1,842	15.4
146-150	218	5.5	860	5.9	746	11.5	976	8.2
151-155	215	5.4	310	2.1	202	4.8	333	2.8
156-160	56	1.4	72	0.5	57	1.4	74	.6
Totals	3,935[a] mean size = 134.3 mm	99.4[b]	14,476 mean size = 134.1 mm	99.9	14,194 mean size = 133.2 mm	99.9	11,944 mean size = 135.4 mm	99.9

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 16. Illegally retained crabs observed in the 1993 St. Matthew blue king crab fishery including undersized males, and females.

Sample Type	Sample Size	Undersized Males Number	Undersized Males Percent	Females Num.	Females Percent	Number of Other Crab	Total % Illegals	Total crabs Harvested	Est. Total[a] Illegals	% Harvest Sampled
Catcher[b] Processor	9,470	49	.5	6	<.1	4	.6	35,135	219	26.9
Floater[c] Processor	49,801	144	.3	32	<.1	9	.4	424,328	1,576	11.7
Totals	59,271	193	.3	38	<.1	13	.4	459,463	1,891	12.9

[a] Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b] Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[c] Floater processor figures based upon legal measurements of 600 retained crab per each catcher vessel delivery.

Table 17. Catch per pot of selected species from the 1993 St. Matthew blue king crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Blue King			
legal male	1,118	13.3	780,005
sub-legal male	1,739	20.7	1,213,993
female	2,794	33.3	1,952,945
C. opilio			
legal male	136	1.6	93,835
sub-legal male	60	.7	41,053
female	5	<.1	3,460
Red King			
male	0	-	-
female	0	-	-
Pacific Cod[c]	211	2.5	146,618
Yellowfin Sole	145	1.7	99,700

[a] Total pot contents derived from 84 random samples taken on catcher processors during the fishery.

[b] Estimated catch derived from pot sample CPUE x 58,647 total reported pot pulls during the fishery.

[c] All fish species mixed size and sex.

Table 18. Shell age distributions of blue king crab males and females observed in the 1990, 1991, 1992, and 1993 St. Matthew fisheries.

Fishery Year	Sample Size[a]	Shell Age					
		New	Percent	Old	Percent	Very Old	Percent
1990							
Males	156	128	82.1	28	17.9	0	-
Females	27	14	51.8	13	48.2	0	-
1991							
Males	3,960	3,539	89.4	364	9.2	14	.4
Females	2,037	1,505	73.9	481	23.6	9	.4
1992							
Males	2,099	1,906	90.8	179	8.5	14	.7
Females	3,083	2,928	80.3	603	19.6	3	.1
1993							
Males	2,797	2,555	91.3	239	8.5	3	.1
Females	2,721	1,734	63.7	968	35.6	19	.7

[a] Derived from 84 random pot contents samples taken on catcher processors during the fisheries.

Table 19. Reproductive state of female blue king crabs observed in the 1990, 1991, 1992, and 1993 St. Matthews fisheries.

Fishery Year	Eyed Eggs		Uneyed Eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	0	-	0	-	13	48.1	14	51.9
1991	1	<.1	7	.3	821	38.9	1,281	60.7
1992	4	.1	6	.2	1,642	53.6	1,409	46.1
1993	0	-	0	-	1,957	71.9	763	28.1
Totals	5	.1	13	.2	4,443	55.6	3,467	43.8

Table 20. Pribilof area commercially retained red king crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell Age Percentages			
			Soft	New	Old	Very old
Catcher processor	1,147	154.4 mm	0.0	76.9	21.9	1.1
Floater processor	4,001	154.7	0.0	76.6	20.2	3.1
Shoreside processor	1,648	154.0 mm	0.0	81.9	17.9	0.2
Totals	6,796	154.4 mm	0.0	78.0	20.0	2.0

Table 21. Pribilof area commercially retained red king crab length frequencies from the 1993 fishery.

Length (mm)	1993 Number of Crab	1993 Percent of Sample
131 - 135	24	0.4
136 - 140	242	3.6
141 - 145	713	10.5
146 - 150	1,336	19.7
151 - 155	1,548	22.7
156 - 160	1,365	20.1
161 - 165	899	13.2
166 - 170	427	6.3
171 - 175	158	2.3
176 - 180	60	0.9
181 - 185	16	0.2
Totals	6,788[a]	99.9[b]
	mean size = 154.4 mm	

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 22. Illegally retained crabs observed in the 1993 Pribilof red king crab fishery including undersized males, and females.

Sample Type	Sample Size	Undersized Males Number	Undersized Males Percent	Females Num.	Females Percent	Number of Other Crab	Total % Illegals	Total Crabs Harvested	Est. Total[a] Illegals	% Harvest Sampled
Catcher[b] Processor	3,874	9	.2	0	0.0	9	.5	6,637	31	58.4
Floater[c] Processor	21,212	36	.2	2	<.1	29	.3	121,786	385	16.5
Totals	25,086	45	.2	2	<.1	38	.3	128,423	435	19.5

[a] Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b] Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[c] Floater processor figures based upon legal measurements of 600 retained crab per each catcher vessel delivery.

Table 23. Catch per pot of selected species from the 1993 Pribilof red king crab fishery.

Species	Total Pot Sample Catch	Catch Per Unit Effort	Estimated Total Fishery Catch
Red King Crab			
legal male	417	7.6	273,387
sub-legal male	276	5.0	179,860
female	53	.9	32,375
Blue King Crab			
legal male	9	.2	7,194
sub-legal male	41	.7	25,180
female	57	1.0	35,972
C. bairdi			
legal male	131	2.4	86,333
sub-legal male	279	5.1	183,457
female	653	11.9	428,067
C. opilio			
legal male	714	13.0	467,636
sub-legal male	7	.1	3,597
female	15	.3	10,791
Yellowfin Sole	33	.6	21,583

[a] Total pot contents derived from 55 random samples taken on catcher processors during the fishery.

[b] Estimated catch derived from pot sample CPUE x 35,972 total reported pot pulls during the fishery.

Table 24. Shell age distribution of red king crab males and females observed in the 1993 Pribilof fishery.

Fishery Year	Sample Size[a]	Shell Age					
		New	Percent	Old	Percent	Very Old	Percent
Males	693	563	81.2	124	17.9	6	.9
Females	53	53	100.0	0	-	0	-

[a] Derived from 55 random pot contents samples taken on catcher processors during the fishery.

Table 25. Reproductive state of female red king crabs observed in the 1993 Pribilof fishery.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1993	14	26.5	0	-	0	-	39	73.5

Table 26. Bristol Bay commercially retained red king crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell Age Percentages		
			New	Old	Very old
Catcher processor	10,692	150.9 mm	83.9	13.6	2.5
Floater processor	11,937	152.5 mm	81.3	17.8	0.9
Shoreside processor	10,148	152.1 mm	84.9	13.9	1.3
Totals	32,777	151.9 mm	83.2	15.2	1.5

Table 27. Bristol Bay commercially retained red king crab length frequencies from the 1990, 1991, 1992, and 1993 fisheries.

Length (mm)	1990		1991		1992		1993	
	Num. of crab	Percent	Num. of crab	Percent	Num. of crab	Percent	Num. of crab	Percent
131-135	925	2.3	813	2.3	602	2.6	775	2.4
136-140	4,350	10.9	3,818	10.8	2,172	9.2	3,861	11.8
141-145	6,813	17.1	6,054	17.0	3,605	15.3	6,028	18.4
146-150	7,178	18.0	6,468	18.2	3,949	16.8	5,593	17.1
151-155	6,673	16.7	5,178	16.5	4,126	17.5	5,016	15.3
156-160	5,644	14.2	4,941	13.9	3,435	14.5	4,211	12.9
161-165	4,313	10.8	3,747	10.6	2,633	11.3	3,293	10.1
166-170	2,523	6.3	2,230	6.3	1,707	7.3	2,129	6.5
171-175	1,013	2.5	1,109	3.1	863	3.7	1,198	3.7
176-180	295	1.0	343	1.0	316	1.3	475	1.5
Totals	39,772[a]	99.8[b]	34,701	99.7	23,408	99.5	32,579	99.7
	mean size = 151.8 mm		mean size = 151.9 mm		mean size = 152.8 mm		mean size = 151.9 mm	

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 28. Illegally retained crab observed during the 1993 Bristol Bay red king crab fishery including undersized males, females and *C. bairdi*.

Sample Type	Sample Size	Undersize Males Number	Undersize Males Percent	Females Num.	Females Percent	*C. bairdi* Male/Female		Total % Illegals	Total crabs Harvested	Est. total[a] Illegals	% Harvest Sampled
Catcher[b] Processor	35,410	362	1.0	15	<.1	0	0	1.1	196,920	2,096	18.0
Floater[c] Processor	72,108	409	.6	78	.1	0	1	.7	1,029,069	6,964	7.0
Totals	107,518	771	.7	93	<.1	0	1	.8	1,225,989	9,863	8.7

[a]Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b]Catcher processor figures based upon 600 legal measurements per vessel for each day of the fishery.

[c]Floater processor figures based upon 600 legal measurements for each vessel delivery.

Table 29. Catch per pot of selected species from the 1993 Bristol Bay red king crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Red King Crab			
legal male	4,446	8.0	2,022,165
sub-legal male	5,910	10.6	2,688,033
female	6,188	11.1	2,814,475
C. bairdi			
legal male	4,772	8.6	2,170,439
sub-legal male	2,707	4.9	1,231,219
female	1,246	2.2	566,716
C. opilio			
legal male	34	.1	15,464
sub-legal male	6	<.1	2,729
female	4	<.1	1,819
Pacific Cod[c]	404	.7	183,750
Yellowfin Sole	442	.8	201,034
Halibut	7	<.1	3,184

[a] Total pot contents derived from 558 random samples taken on catcher processors during the fishery.

[b] Estimated catch derived from pot sample CPUE x 253,794 total reported pot pulls during the fishery.

[c] All fish species mixed size and sex.

Table 30. Shell age distributions of red king crab males and females observed in the 1990, 1991, 1992, and 1993 fisheries.

Fishery Year	Sample[a] Size	Shell Size					
		New	Percent	Old	Percent	Very old	Percent
1990							
Males	2,484	2,106	84.8	329	13.2	49	2.0
Females	696	692	99.5	4	.5	-	-
1991							
Males	4,690	4,196	89.5	443	9.4	51	1.1
Females	376	375	99.9	1	<.1	-	-
1992							
Males	4,747	4,077	85.9	582	12.3	88	1.8
Females	2,381	2,369	99.5	12	.5	-	-
1993							
Males	10,173	9,087	89.3	935	9.2	151	1.5
Females	5,946	5,938	99.9	7	.1	1	<.1

[a] Derived from random pot contents samples taken on catcher processors during the fisheries.

Table 31. Reproductive state of female red king crabs observed in the 1990, 1991, 1992, and 1993 Bristol Bay fisheries.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	284	40.8	376	54.0	4	.6	32	4.6
1991	25	6.8	218	59.6	1	.3	122	33.3
1992	386	16.3	1,619	68.0	46	1.9	327	13.8
1993	2,410	40.5	3,267	54.9	49	.8	223	3.8
Totals	3,105	33.1	5,480	58.4	100	1.1	704	7.5

Table 32. Adak commercially retained brown king crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell age percentages		
			New	Old	Very old
Catcher processor	37,320	147.0 mm	93.4	5.3	.5
Floater[a] processor	0	-	-	-	-
Shoreside processor	1,324	146.3 mm	93.9	5.8	.3
Totals	38,644	147.0 mm	93.5	5.3	.5

[a] Floating processors did not participate in the 1993 fishery.

Table 33. Adak commercially retained brown king crab length frequencies from the 1990, 1991, 1992, and 1993 fisheries.

Length (mm)	1990 Num. of crab	1990 Percent	1991 Num. of crab	1991 Percent	1992 Num. of crab	1992 Percent	1993 Num. of crab	1993 Percent
126-130	111	0.7	65	0.4	174	0.3	146	0.4
131-135	1,231	7.2	1,626	9.3	3,571	6.2	2,069	5.4
136-140	3,202	18.6	4,740	27.1	11,185	19.4	7,836	20.3
141-145	3,711	21.6	4,409	25.2	13,102	22.7	9,346	24.2
146-150	2,885	16.8	2,958	16.9	11,436	19.8	7,717	20.0
151-155	2,101	12.2	1,728	9.9	8,121	14.1	5,201	13.5
156-160	1,409	8.2	1,017	5.8	4,677	8.1	3,054	7.9
161-165	955	5.5	556	3.2	2,712	4.7	1,655	4.3
166-170	804	4.7	261	1.5	1,443	2.5	856	2.2
171-175	377	2.2	99	0.6	746	1.3	434	1.1
Totals	16,786[a]	97.7[b]	17,459	99.9	57,167	99.1	38,314	99.3
	mean size = 148.8 mm		mean size = 144.7 mm		mean size = 147.2 mm		mean size = 147.0 mm	

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 34. Illegally retained crabs observed during the 1993 Adak brown king crab fishery including undersized males, and females.

Sample Type	Sample Size	Undersized Males Number	Undersized Males Percent	Females[a] Num.	Females[a] Percent	Number of Other Crab	Total % Illegals	Total Crabs Harvested	Est. Total Illegals	% Harvest Sampled
Catcher[b] Processor	127,497	860	.7	160	.1	0	.8	276,847	2,212	46.1
Floater[c] Processor	----------	----------	----------	----------	----------	N/A	----------	----------	----------	----------
Totals	127,497	860	.7	160	.1	0	.8	276,847	2,212	46.1

[a]Estimate derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b]Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[c]Floating processors did not participate in the 1992/1993 fishery.

Table 35. Catch per pot of selected species from the 1993 Adak brown king crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Brown King Crab			
legal male	7,708	11.4	1,886,361
sub-legal male	13,526	21.7	3,591,415
female	16,840	27.1	4,488,036
Red King Crab			
legal male	768	1.2	204,680
sub-legal male	210	.3	55,967
female	806	1.3	214,807
C. bairdi			
legal male	0	-	-
sub-legal male	6	<.1	1,599
female	0	-	-
L. couesi	226	.4	60,231
Pacific Cod[c]	280	.5	74,623
Halibut	7	<.1	3,184

[a] Total pot contents derived from 621 random samples taken on catcher processors during the fishery.

[b] Estimated catch derived from pot sample CPUE x 165,503 total reported pot pulls during the fishery.

[c] All fish species mixed size and sex.

Table 36. Shell age distributions of brown king crab males and females observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

Fishery Year	Sample[a] Size	Shell Size					
		New	Percent	Old	Percent	Very old	Percent
1990							
Males	34,706	30,113	86.8	3,736	10.8	153	.4
Females	19,165	16,962	88.5	1,796	9.3	93	.5
1991							
Males	7,469	7,057	94.5	288	3.9	37	.5
Females	5,061	4,834	95.5	212	4.2	4	.1
1992							
Males	16,731	15,675	93.7	933	5.5	90	.5
Females	8,001	7,491	93.5	499	6.2	15	.2
1993							
Males	19,944	19,350	97.0	574	2.9	20	.1
Females	15,000	14,484	96.6	510	3.4	6	<.1

[a] Derived from random pot contents samples taken on catcher processors during the fisheries. Total sample sizes for each year and sex contain small numbers of recorded soft shell crab.

Table 37. Reproductive state of female brown king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	4,356	23.2	6,122	32.6	1,835	9.8	6,443	34.4
1991	1,309	26.6	1,219	24.8	571	11.6	1,814	36.9
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
Totals	10,811	23.3	14,733	31.8	5,140	11.1	15,657	33.8

Table 38. Adak commercially retained red king crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell age percentages			
			Soft	New	Old	Very old
Catcher processor	3,712	154.3 mm	0.08	71.4	26.0	2.5
Floater processor	100	159.9 mm	0.0	52.0	43.0	5.0
Shoreside processor	614	155.2 mm	1.3	90.4	8.3	0.0
Totals	4,426	154.6 mm	0.2	73.6	23.9	2.2

Table 39. Adak commercially retained red king crab length frequencies from the 1990, 1992 and 1993 fisheries.

Length (mm)	1990 Num. of crab	1990 Percent	1992 Num. of crab	1992 Percent	1993 Num. of crab	1993 Percent
131 - 135	256	2.9	39	3.8	1	<.1
136 - 140	1,299	14.5	170	16.7	31	.7
141 - 145	1,765	19.8	183	18.0	186	4.2
146 - 150	1,615	18.1	163	16.1	545	12.3
151 - 155	1,362	15.3	166	16.4	813	18.4
156 - 160	1,099	12.3	109	10.7	889	20.1
161 - 165	753	8.5	95	9.4	811	18.3
166 - 170	431	4.8	48	4.7	590	13.3
171 - 175	225	2.5	25	2.5	339	7.7
176 - 180	106	1.2	16	1.6	146	3.3
Totals	8,911[a]	99.9[b]	1,014	99.9	4,426	98.3
	mean size = 151.9 mm		mean size = 151.3 mm		mean size = 154.6 mm	

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 40. Illegally retained crab observed during the 1993 Adak red king crab fishery including red king undersized males, and females.

Sample Type	Sample Size	Undersized Males Number	Undersized Males Percent	Females[a] Num.	Females[a] Percent	Number of Other crab	Total % Illegals	Total Crabs Harvested	Est. Total Illegals	% Harvest Sampled
Catcher[b] Processor	14,108	77	.5	4	<.1	0	.6	37,591	215	37.5
Floater[c] Processor	----------	----------	----------	----------	----------	N/A	----------	----------	----------	----------
Totals	14,108	77	.5	4	<.1	0	.6	37,591	215	37.5

[a] Estimate derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b] Catcher processor figures based upon legal measurements of 600 retained crab on each vessel per fishing day.

[c] Floating processors did not participate in the 1993 fishery.

Table 41. Shell age distributions of red king crab males and females observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

Fishery Year	Sample[a] Size	Shell Size					
		New	Percent	Old	Percent	Very old	Percent
1990							
Males	2,240	2,024	90.4	212	9.5	4	.1
Females	501	497	99.2	4	.8	0	-
1991							
Males	2,602	2,315	89.0	266	10.2	21	.8
Females	685	665	97.1	20	3.9	0	-
1992							
Males	2,411	2,086	89.3	235	10.1	90	.6
Females	1,377	1,371	99.6	6	.4	0	-
1993							
Males	485	435	89.7	42	8.7	8	1.6
Females	260	259	99.6	1	.4	0	-

[a] Derived from random pot contents samples taken on catcher processors during the fisheries. Total sample sizes for each year and sex contain small numbers of recorded soft shell crab.

Table 42. Reproductive state of female red king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1990	284	40.8	376	54.0	4	.6	32	4.6
1991	25	6.8	218	59.6	1	.3	122	33.3
1992	386	16.3	1,619	68.0	46	1.9	327	13.8
1993	2,410	40.5	3,267	54.9	49	.8	223	3.8
Totals	3,105	33.1	5,480	58.4	100	1.1	704	7.5

Table 43. Bristol Bay area commercially retained Korean hair crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell Age Percentages			
			Soft	New	Old	Very old
Catcher processor	656	82.7 mm	4.6	87.2	6.1	2.1
Floater[a] processor	0	-	-	-	-	-
Shoreside processor	861	84.4 mm	0.1	97.6	2.3	0.0
Totals	1,517	83.6 mm	2.0	93.1	4.0	.9

[a] Floating processors did not participate in the 1993 fishery.

Table 44. Bristol Bay commercially retained Korean hair crab length frequencies from the 1993 fishery.

Length (mm)	1993 Number of crab	1993 Percent of sample
61 - 65	3	0.2
66 - 70	19	1.3
71 - 75	141	9.3
76 - 80	339	22.4
81 - 85	425	28.0
86 - 90	339	22.4
91 - 95	153	10.1
96 - 100	43	2.8
101 - 105	24	1.6
106 - 110	16	1.1
Totals	1,502[a]	99.2[b]
	mean size = 83.6 mm	

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 45. Catch per pot of selected species from the 1993 Bristol Bay Korean hair crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Korean hair crab			
retained male[c]	11	<.1	413
non-retained male	14	<.1	525
female	5	<.1	188
C. bairdi			
legal male	33	.1	1,238
sub-legal male	164	.7	6,154
female	23	<.1	863
Red King Crab			
legal male	3	<.1	113
sub-legal male	30	.1	1,125
female	33	.1	1,238
C. opilio			
legal male	12	<.1	450
sub-legal male	20	<.1	750
female	1	<.1	38
Yellowfin Sole	200	.8	7,506
Pacific Cod	44	.2	1,651

[a] Total pot contents derived from 249 random samples taken on fishing vessels during the fishery.

[b] Estimated catch derived from pot sample CPUE x 9,345 total reported pot pulls during the fishery.

[c] At the time of the fishery, no size limit had been established in regulation for this species.

Table 46. Shell age distributions of Korean hair crab males and females observed in the 1993 Bristol Bay fishery.

Fishery Year	Sample Size[a]	Shell Age					
		New	Percent	Old	Percent	Very old	Percent
1993							
Males	22	21	95.5	1	.5	0	-
Females	6	6	100.0	0	-	0	-

[a] Derived from 249 random pot contents samples taken on catcher vessels during the fishery.

Table 47. Reproductive state of female Korean hair crabs observed in the 1993 Bristol Bay fishery.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1993	0	-	0	-	1	16.6	5	83.4

Table 48. Bering Sea commercially retained Korean hair crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell Age Percentages			
			Soft	New	Old	Very old
Catcher vessel	10,202	88.4 mm	0.4	87.4	11.4	.7
Floater[a] processor	0	-	-	-	-	-
Shoreside processor	4,266	87.4 mm	0.6	91.6	7.8	.1
Totals	14,468	88.0 mm	0.5	88.7	10.3	.5

[a] Floating processors did not participate in the 1993 fishery.

Table 49. Bering Sea commercially retained Korean hair crab length frequencies from the 1992 and 1993 fisheries.

Width (mm)	1992 Num. of crab	1992 Percent	1993 Num. of crab	1993 Percent
61 - 65	3	0.2	0	0.0
66 - 70	19	1.3	8	0.1
71 - 75	141	9.3	126	0.9
76 - 80	339	22.4	1,337	9.2
81 - 85	425	28.0	3,263	22.5
86 - 90	339	22.4	4,760	32.9
91 - 95	153	10.1	3,563	24.6
96 - 100	43	2.8	1,237	8.6
101 - 105	24	1.6	161	1.1
106 - 110	16	1.1	12	0.1
Totals	1,502[a] mean size =	99.2[b] 83.6 mm	14,468 mean size =	100.0 88.0 mm

[a] Total sample numbers do not include length frequencies outside the listed ranges.

[b] Percentages do not include length frequencies outside the listed range.

Table 50. Illegally retained crabs observed during the 1993 Bering Sea Korean hair crab fishery including undersized males, and females.

Sample Type	Sample Size	Undersized Males Number	Undersized Males Percent	Females[a] Num.	Females[a] Percent	Number of Other Crab	Total % Illegals	Total Crabs Harvested	Est. Total Illegals	% Harvest Sampled
Catcher Vessel	66,414	443	.7	29	<.1	12	.7	1,936,912	14,115	3.4
Catcher[b] Processor	----------	----------	----------	----------	----------	N/A	----------	----------	----------	----------
Floater[c] Processor	----------	----------	----------	----------	----------	N/A	----------	----------	----------	----------
Totals	66,414	443	.7	29	<.1	12	.7	1,936,912	14,115	3.4

[a] Estimates derived from percentage of illegal crab X total numbers of crab harvested during the fishery.

[b] Catcher processors did not participate in the 1993 fishery.

[c] Floating processors did not participate in the 1993 fishery.

Table 51. Catch per pot of selected species from the 1993 Bering Sea Korean hair crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Korean Hair Crab			
retained male	45,597	3.7	2,168,322
non-retained male	9,931	.8	468,826
female	4,372	.4	234,413
C. bairdi			
legal male	790	<.1	37,713
sub-legal male	8,020	.7	410,223
female	10,621	.9	527,429
Red King Crab			
legal male	135	<.1	6,445
sub-legal male	409	<.1	19,524
female	1,947	.2	117,207
Blue King Crab			
legal male	245	<.1	11,696
sub-legal male	1,598	.1	58,603
female	1,159	.1	58,603
C. opilio (legal males only)	1,015	<.1	48,454
Pacific Cod	683	<.1	32,605

[a] Total pot contents derived from 12,276 random samples taken on fishing vessels during the fishery.

[b] Estimated catch derived from pot sample CPUE x 586,033 total reported pot pulls during the fishery.

Table 52. Shell age distributions of Korean hair crab males and females observed in the 1992 and 1993 Bering Sea fisheries.

Fishery Year	Sample[a] Size	Shell Age							
		Soft	Percent	New	Percent	Old	Percent	Very old	Percent
1992									
Males	1,815	0	-	1,681	92.6	133	7.3	1	<.1
Females	21	0	-	10	47.6	10	47.6	1	4.8
1993									
Males	55,552	2,659	4.8	43,394	78.1	8,020	14.4	1,479	2.7
Females	4,418	21	.5	4,089	92.6	278	6.3	30	.7

[a] Derived from 115 and 12,276 random pot content samples collected on catcher vessels during the 1992 and 1993 fisheries respectively.

Table 53. Reproductive state of female Korean hair crabs observed in the 1992 and 1993 Bering Sea fisheries.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1992	1	5.3	3	15.8	1	5.3	14	73.7
1993	117	2.7	24	.5	842	19.1	3,414	77.6
Totals	118	2.7	27	.6	843	19.1	3,428	77.6

Table 54. Adak area commercially retained Korean hair crab length frequency statistics from the 1993 fishery by processor type.

Sample Type	Sample Size	Avg. Length	Shell age percentages			
			Soft	New	Old	Very old
Catcher processor	561	94.1 mm	0.0	97.3	2.7	0.0
Floater[a] processor	0	-	-	-	-	-
Shoreside[b] processor	0	-	-	-	-	-
Totals	561	94.1 mm	0.0	97.3	2.7	0.0

[a] Floating processors did not participate in the 1993 fishery.

[b] Vessel deliveries to shoreside processors were not sampled by ADF&G personnel in 1993.

Table 55. Adak commercially retained Korean hair crab length frequencies from the 1993 fishery.

Length (mm)	1993 Number of crab	1993 Percent of sample
71 - 75	6	1.1
76 - 80	26	4.6
81 - 85	68	12.1
86 - 90	96	17.1
91 - 95	114	20.3
96 - 100	103	18.4
101 - 105	100	17.8
106 - 110	42	7.5
111 - 115	6	1.1
116 - 120	0	-
Totals	561	100.0
	mean size = 94.1 mm	

Table 56. Catch per pot of selected species from the 1993 Adak area Korean hair crab fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Korean Hair Crab			
legal male	11	.1	839
sub-legal male	3	<.1	229
female	10	.1	763
C. bairdi			
legal male	0	-	-
sub-legal male	1	<.1	76
female	4	<.1	305
Brown King Crab			
legal male	54	.7	4,273
sub-legal male	71	.9	5,494
female	105	1.3	7,935
L. couesi			
legal male	1	<.1	76
sub-legal male	0	-	-
female	0	-	-
Octopus	1	<.1	76
Pacific Cod	4	<.1	305

[a] Total pot contents derived from 80 random samples taken on fishing vessels during the fishery.

[b] Estimated catch derived from pot sample CPUE x 6,104 total reported pot pulls during the fishery.

Table 57. Shell age distributions of males and females observed in the 1993 Adak Korean hair crab fishery.

Fishery Year	Sample[a] Size	Shell Age					
		New	Percent	Old	Percent	Very old	Percent
Males	13	13	100.0	0	-	0	-
Females	10	10	100.0	0	-	0	-

[a] Derived from 80 random pot contents samples taken on catcher processors during the fishery.

Table 58. Reproductive state of female Korean hair crabs observed in the 1993 Adak fishery.

Fishery Year	Eyed eggs		Uneyed eggs		Mated/Barren		Non-mated	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1993	0	-	0	-	0	-	10	100.0

Table 59. Catch per pot of selected species from the 1993 Bering Sea snail fishery.

Species	Total Pot[a] Sample Catch	Catch Per Unit Effort	Estimated Total[b] Fishery Catch
Blue King Crab			
legal male	0	-	-
sub-legal male	15	<.1	495
female	9	<.1	297
Red King Crab			
legal male	1	<.1	33
sub-legal male	0	-	-
female	0	-	-
C. opilio			
male	968	.7	31,280
female	1,235	.9	40,217
C. bairdi			
legal male	11	<.1	363
sub-legal male	78	<.1	2,576
female	1,120	.8	35,749
N. pribilofensis	17,472	12.9	576,449
N. lyrata	2,045	1.5	67,029
Buccinum spp.	3,220	2.4	107,246

[a] Total pot contents derived from 1,353 random samples taken on catcher vessels during the fishery.

[b] Estimated catch derived from pot sample CPUE x 44,686 total reported pot pulls during the fishery.

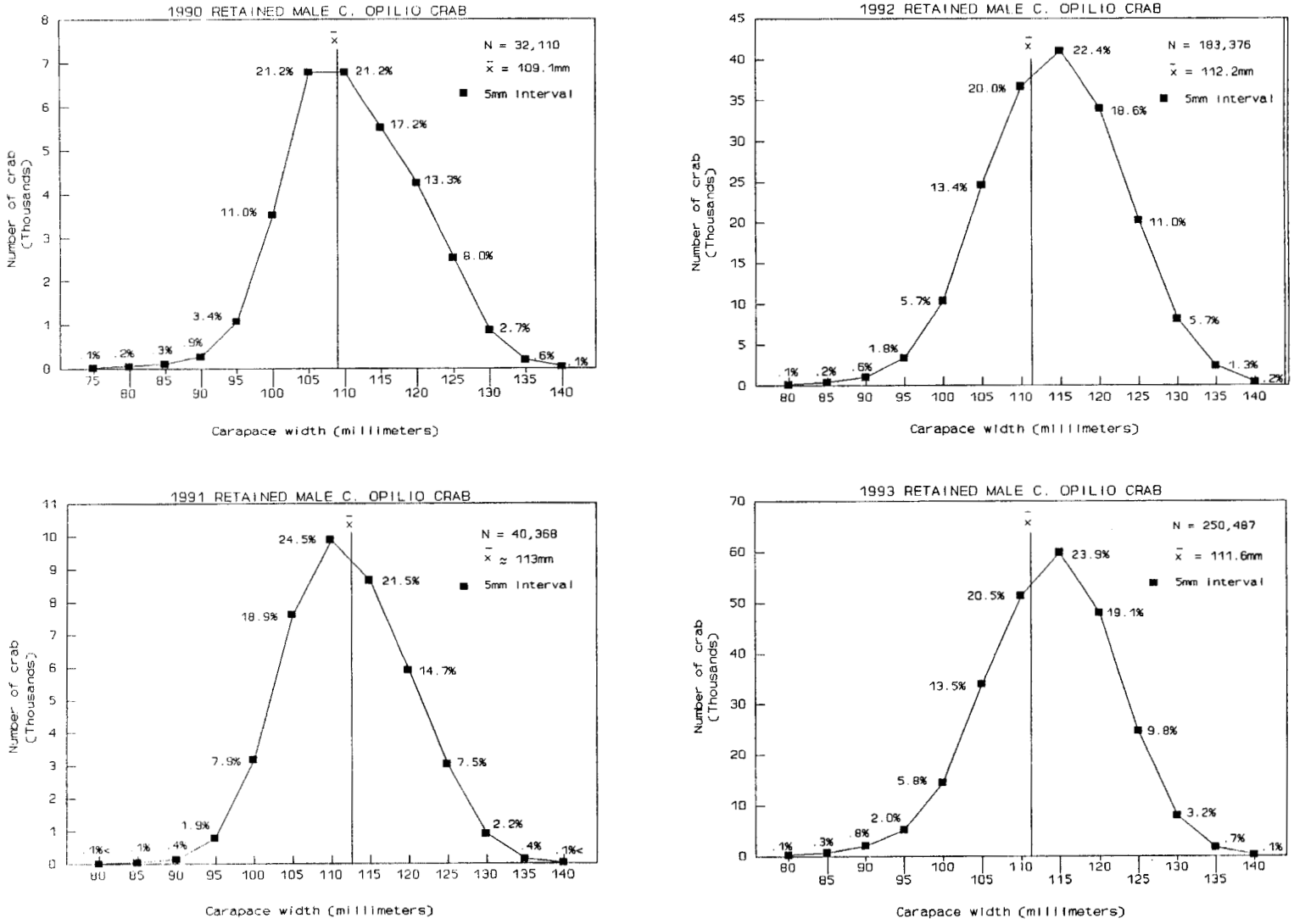

Figure 1. Commercially retained *C. opilio* width frequency statistics from the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

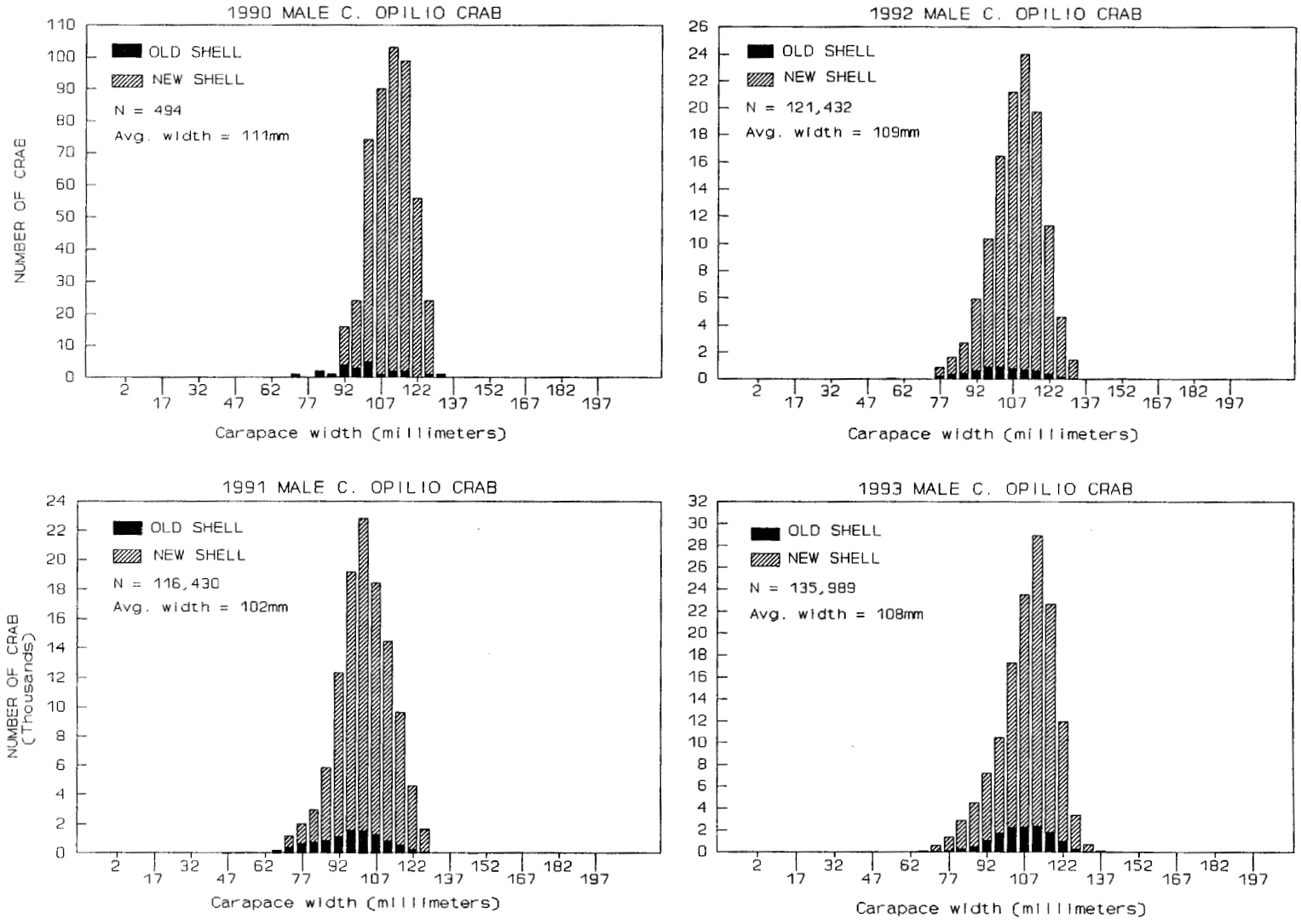

Figure 2. Carapace width distributions of all *C. opilio* males observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

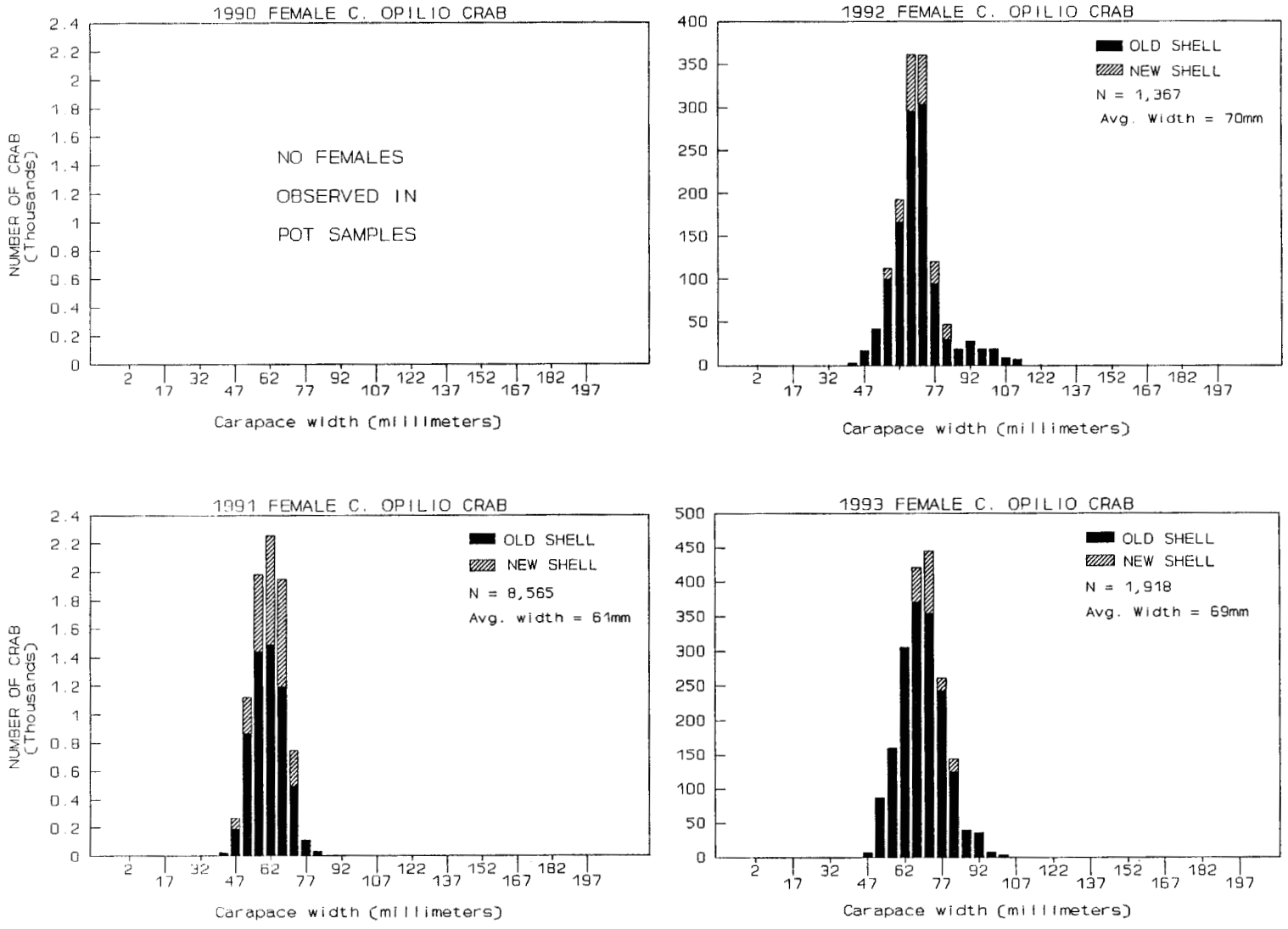

Figure 3. Carapace width distributions of *C. opilio* females observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

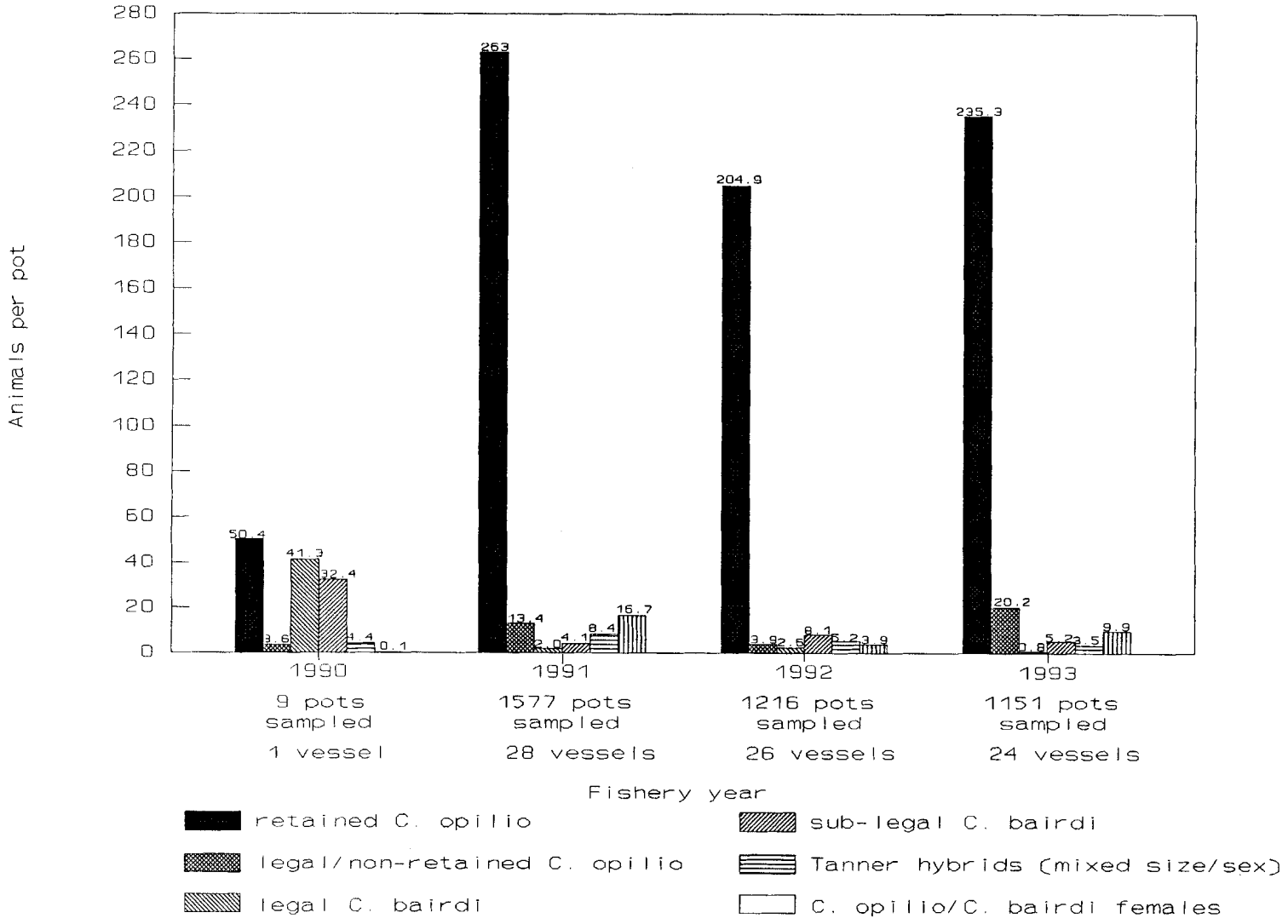

Figure 4. Catch per pot of selected species from the 1990, 1991, 1992, and 1993 Bering Sea *C. opilio* fisheries.

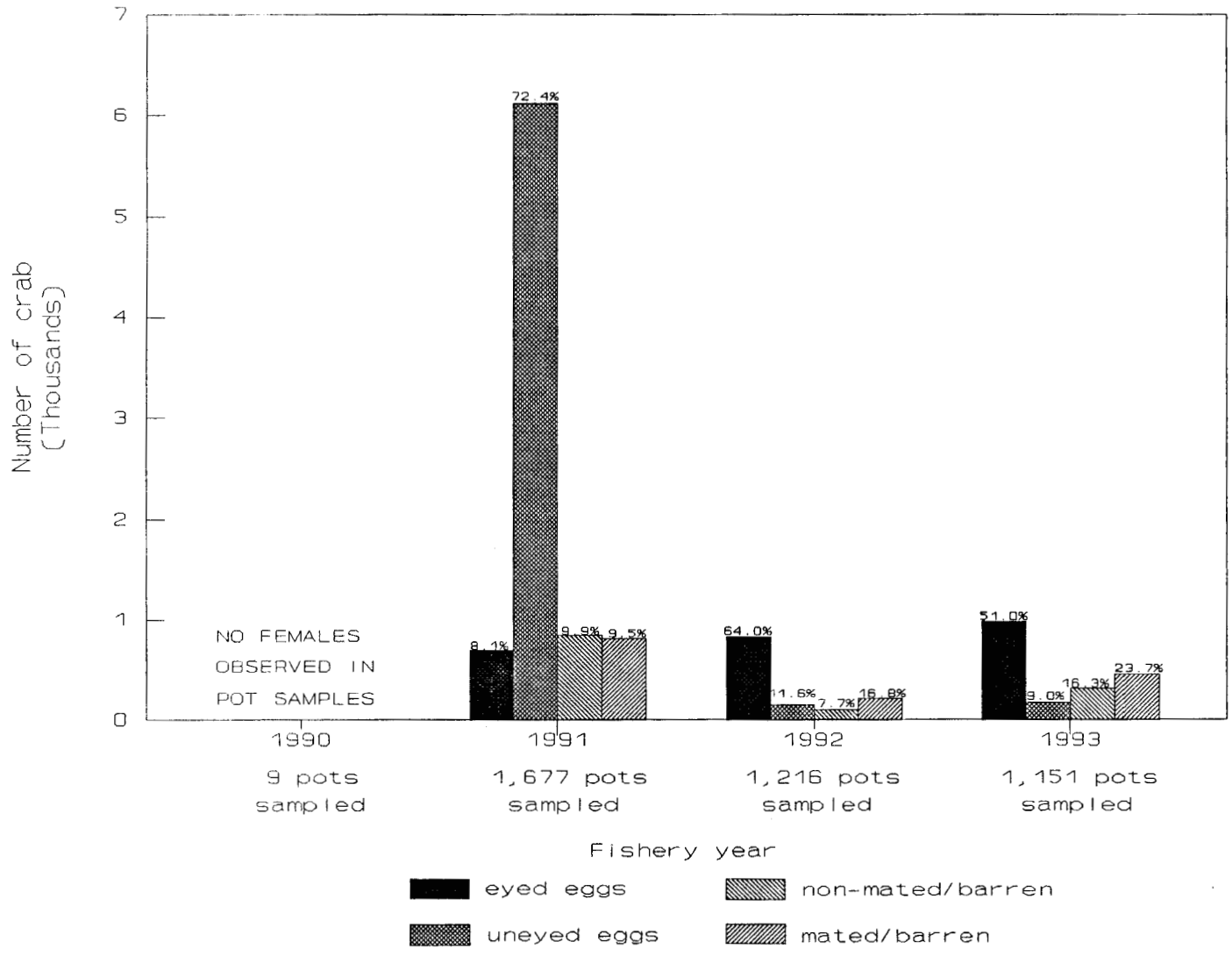

Figure 5. Reproductive state of female *C. opilio* observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

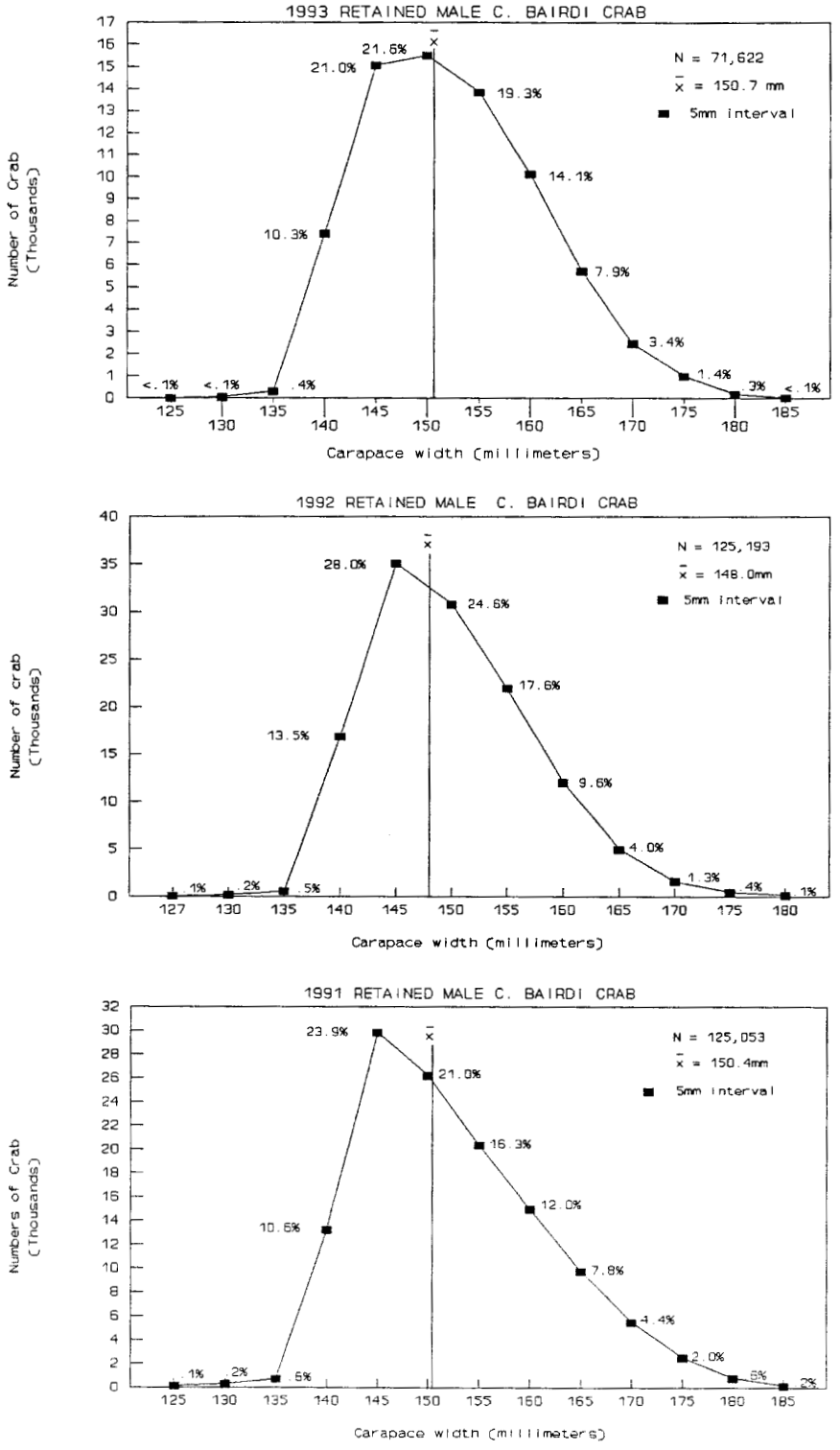

Figure 6. Commercially retained *C. bairdi* width frequency statistics from the 1991, 1992, and 1993 Bering Sea fisheries.

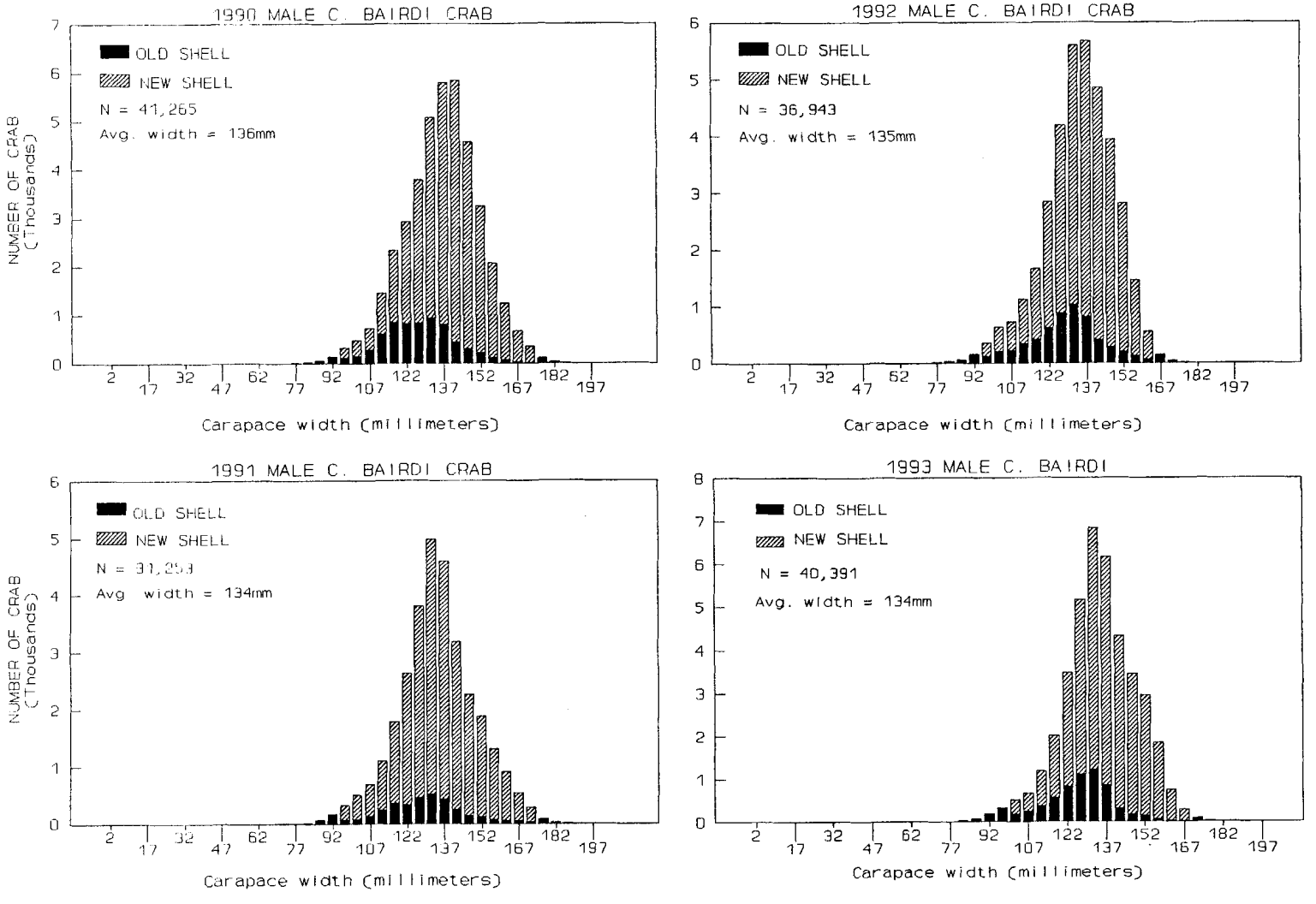

Figure 7. Carapace width distributions of all *C. bairdi* males observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

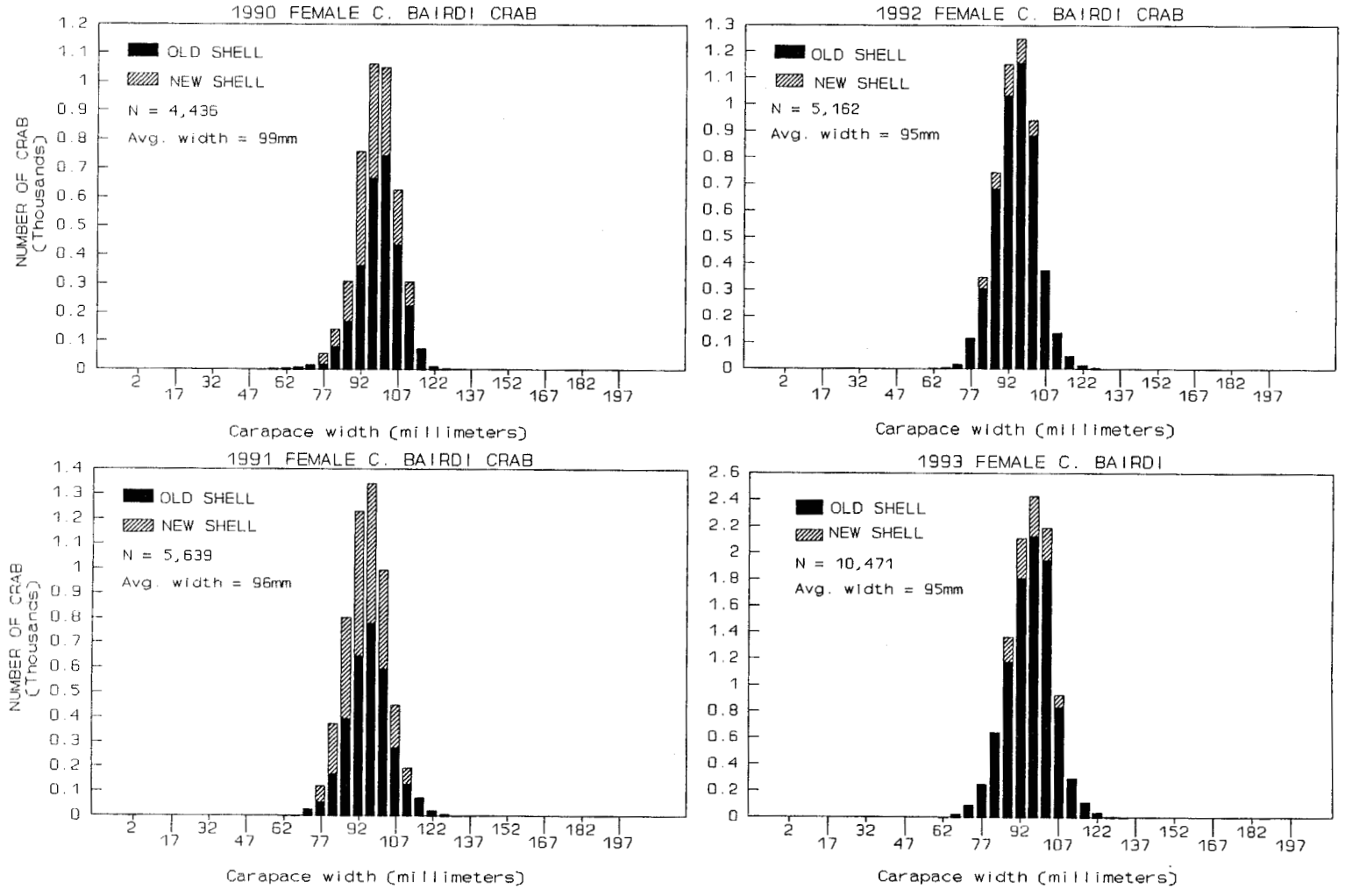

Figure 8. Carapace width distributions of female *C. bairdi* observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

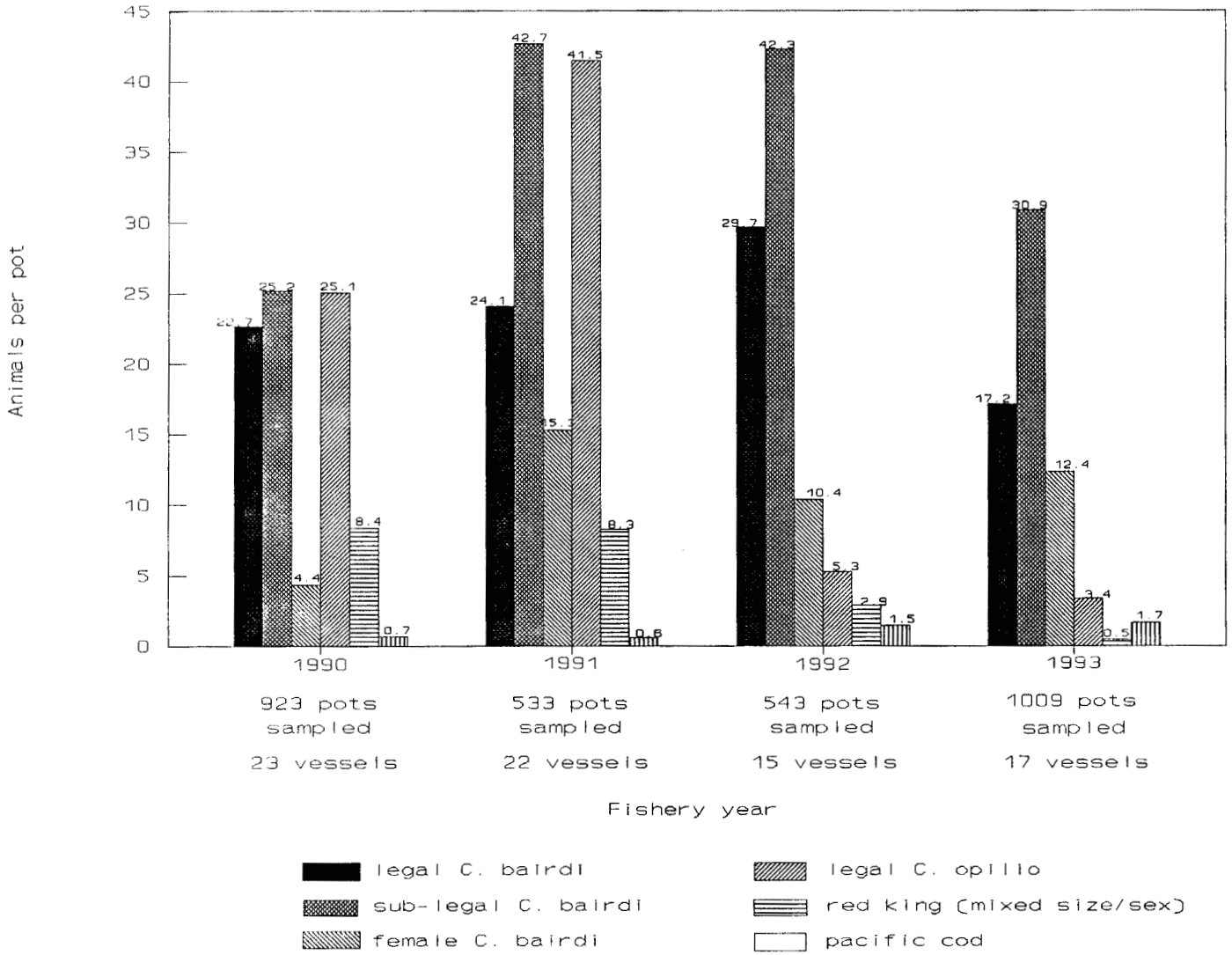

Figure 9. Catch per pot of selected species from the 1990, 1991, 1992, and 1993 Bering Sea *C. bairdi* fisheries.

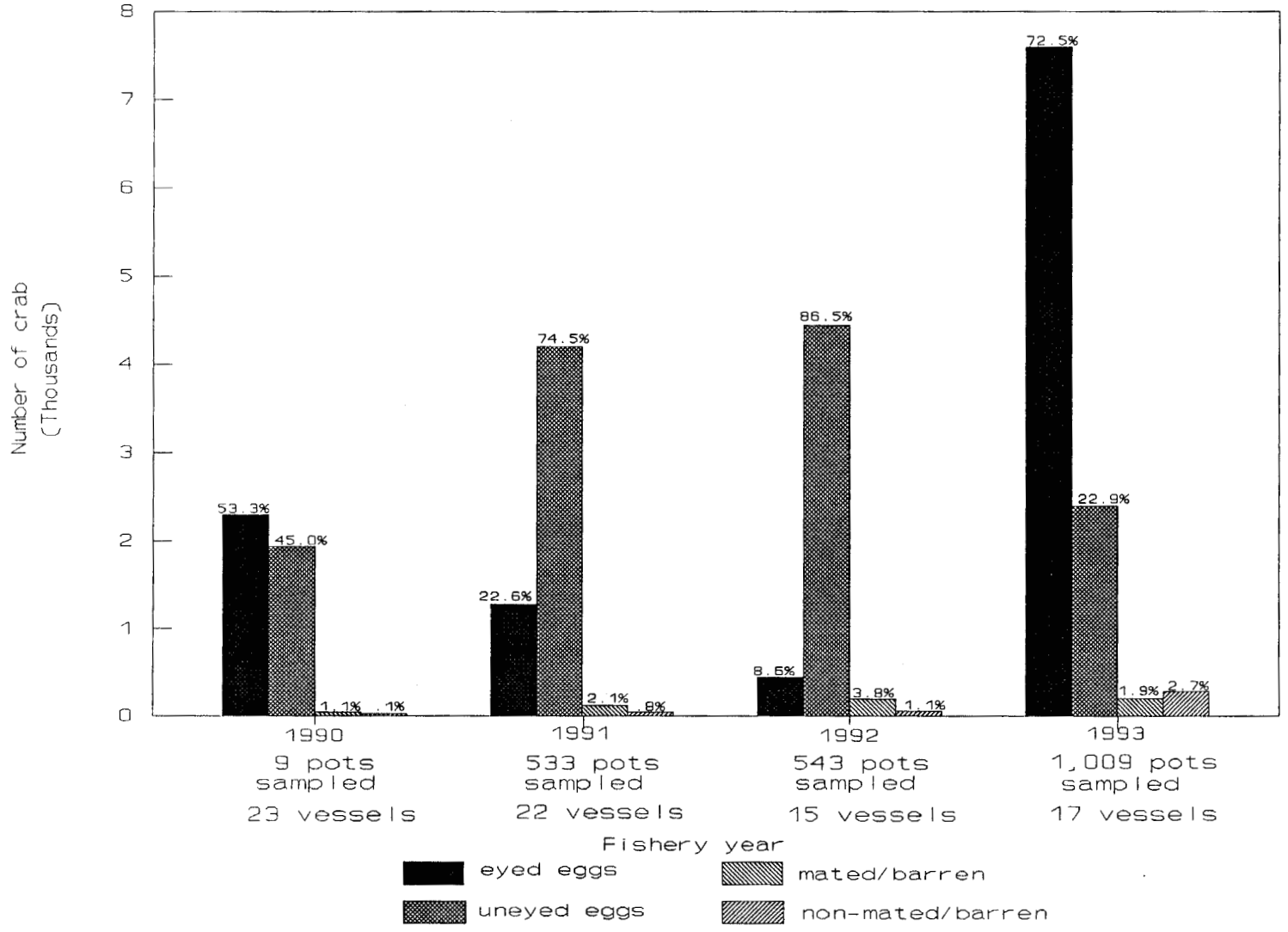

Figure 10. Reproductive state of female *C. bairdi* observed in the 1990, 1991, 1992, and 1993 Bering Sea fisheries.

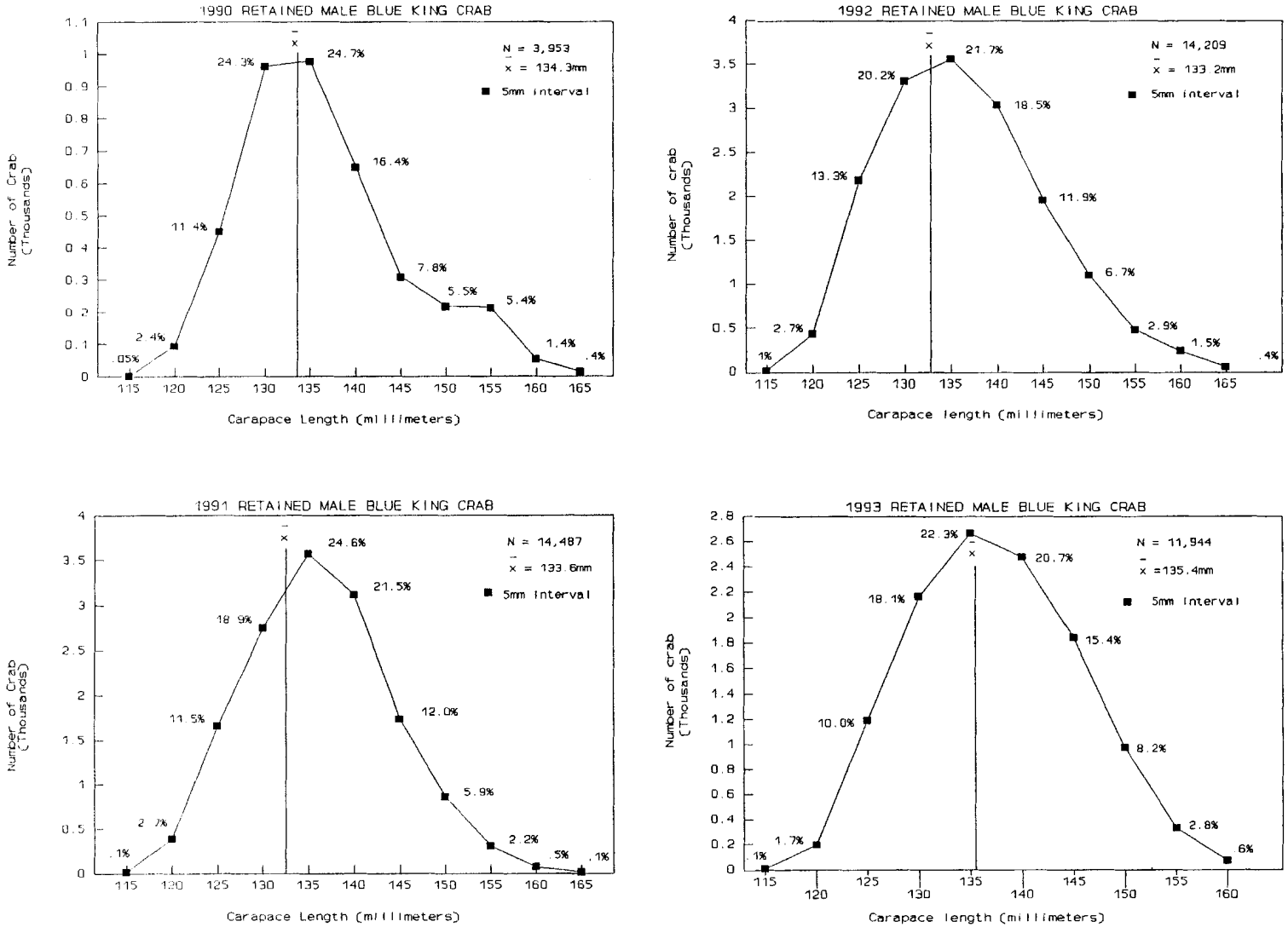

Figure 11. Commercially retained blue king crab length frequency statistics from the 1990, 1991, 1992, and 1993 St. Matthew fisheries.

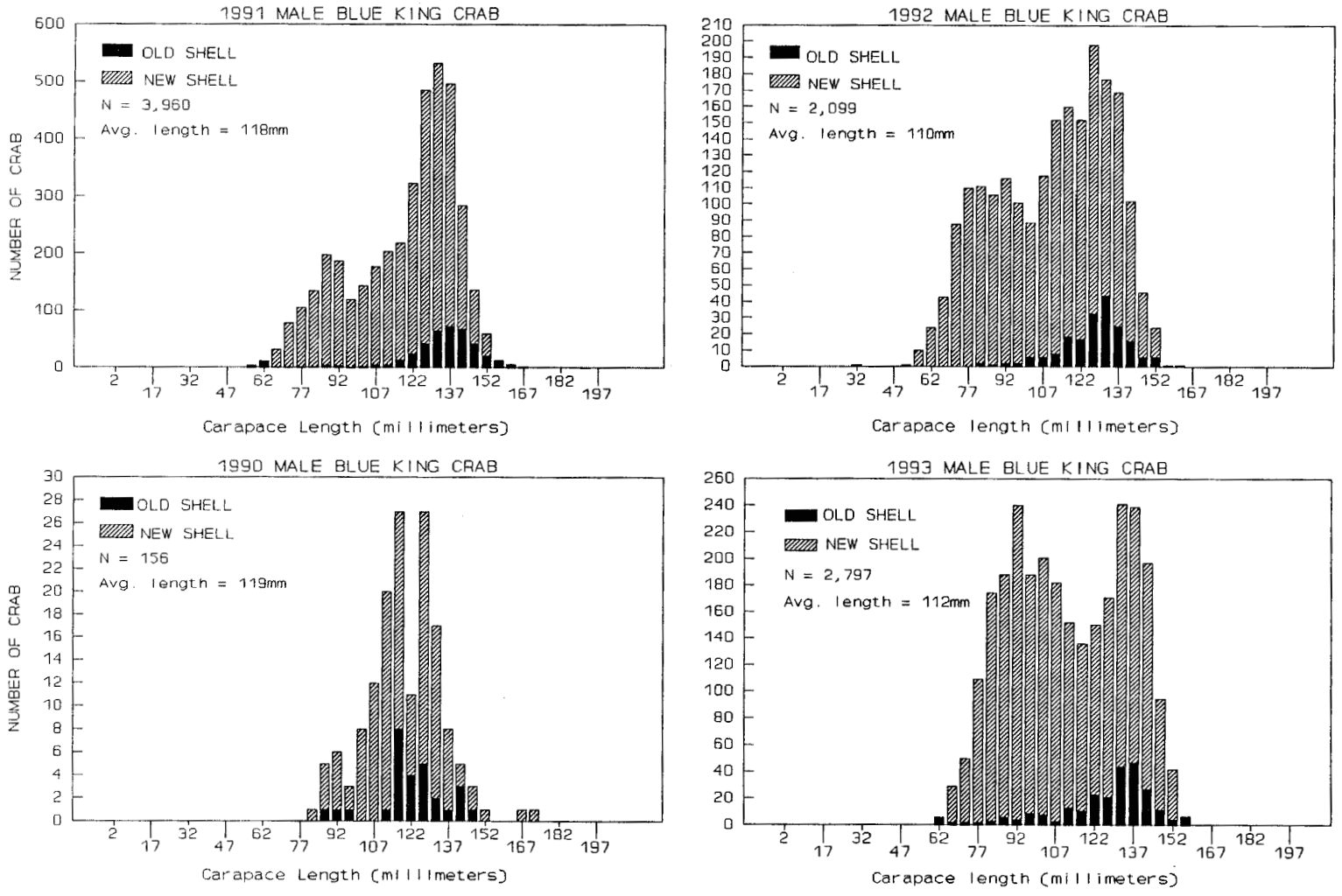

Figure 12. Carapace length distributions of all blue king crab males observed in the 1990, 1991, 1992, and 1993 St. Matthew fisheries.

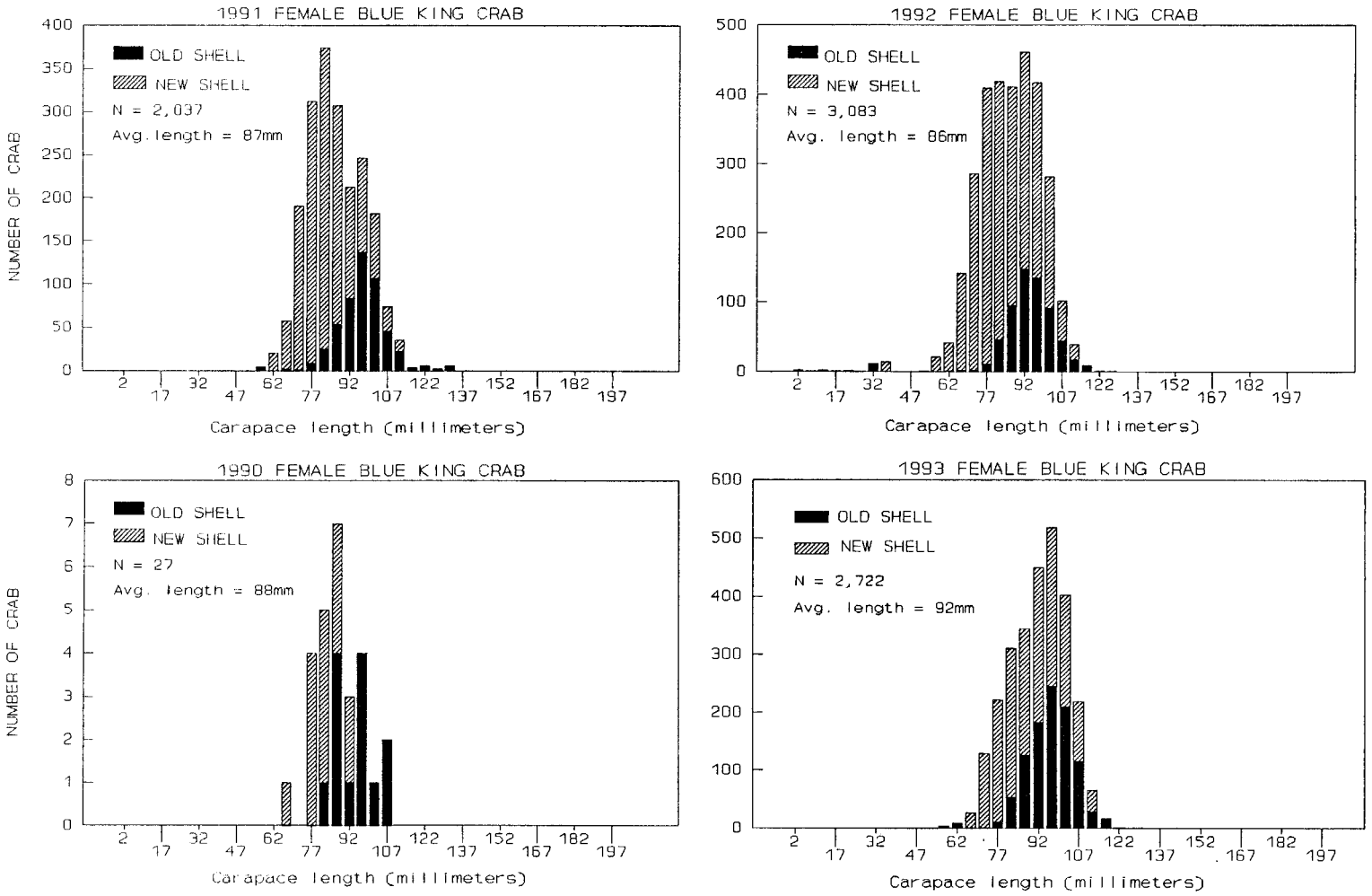

Figure 13. Carapace length distributions of female blue king crabs observed in the 1990, 1991, 1992, and 1993 St. Matthew fisheries.

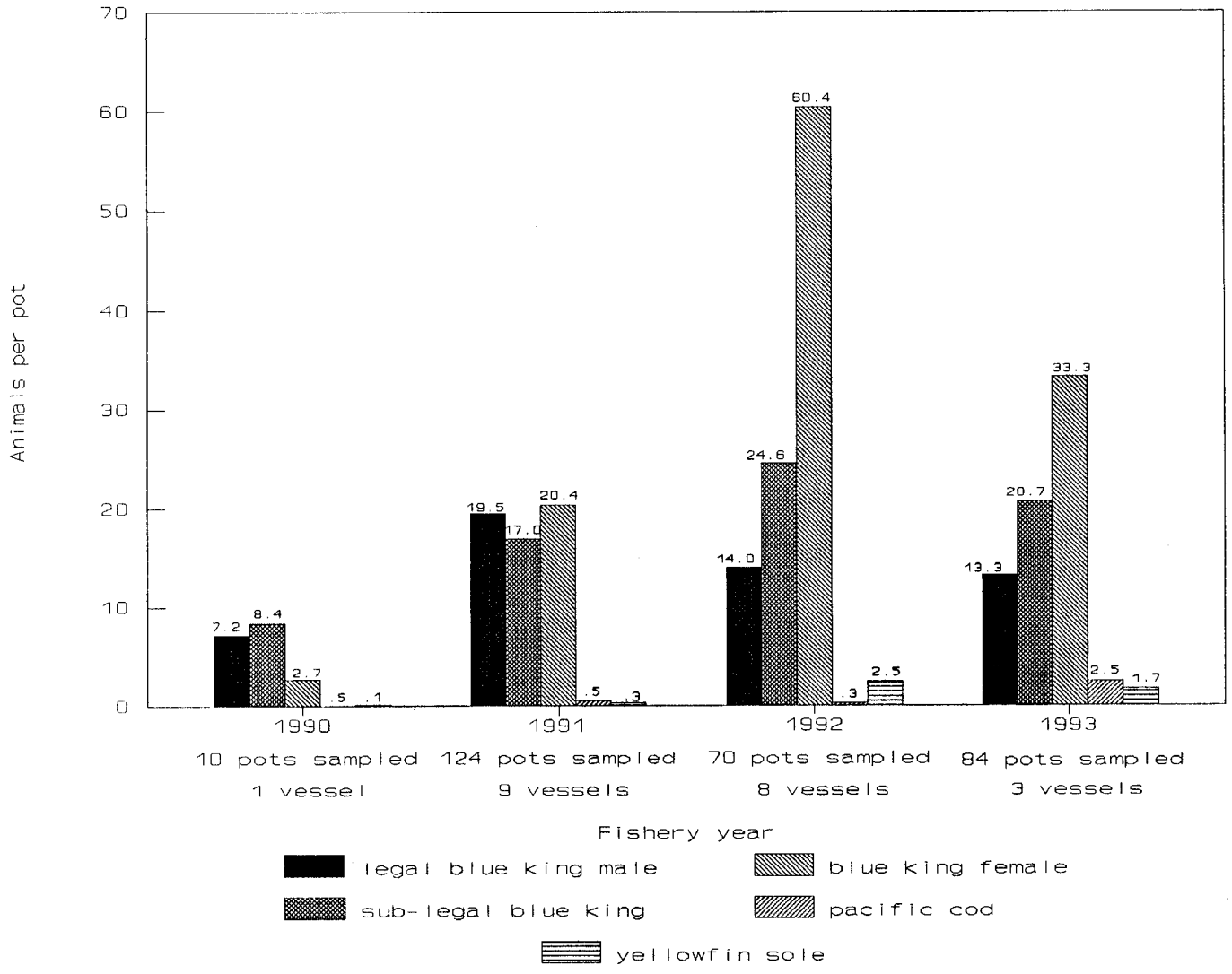

Figure 14. Catch per pot of selected species from the 1990, 1991, 1992, and 1993 St. Matthew blue king crab fisheries.

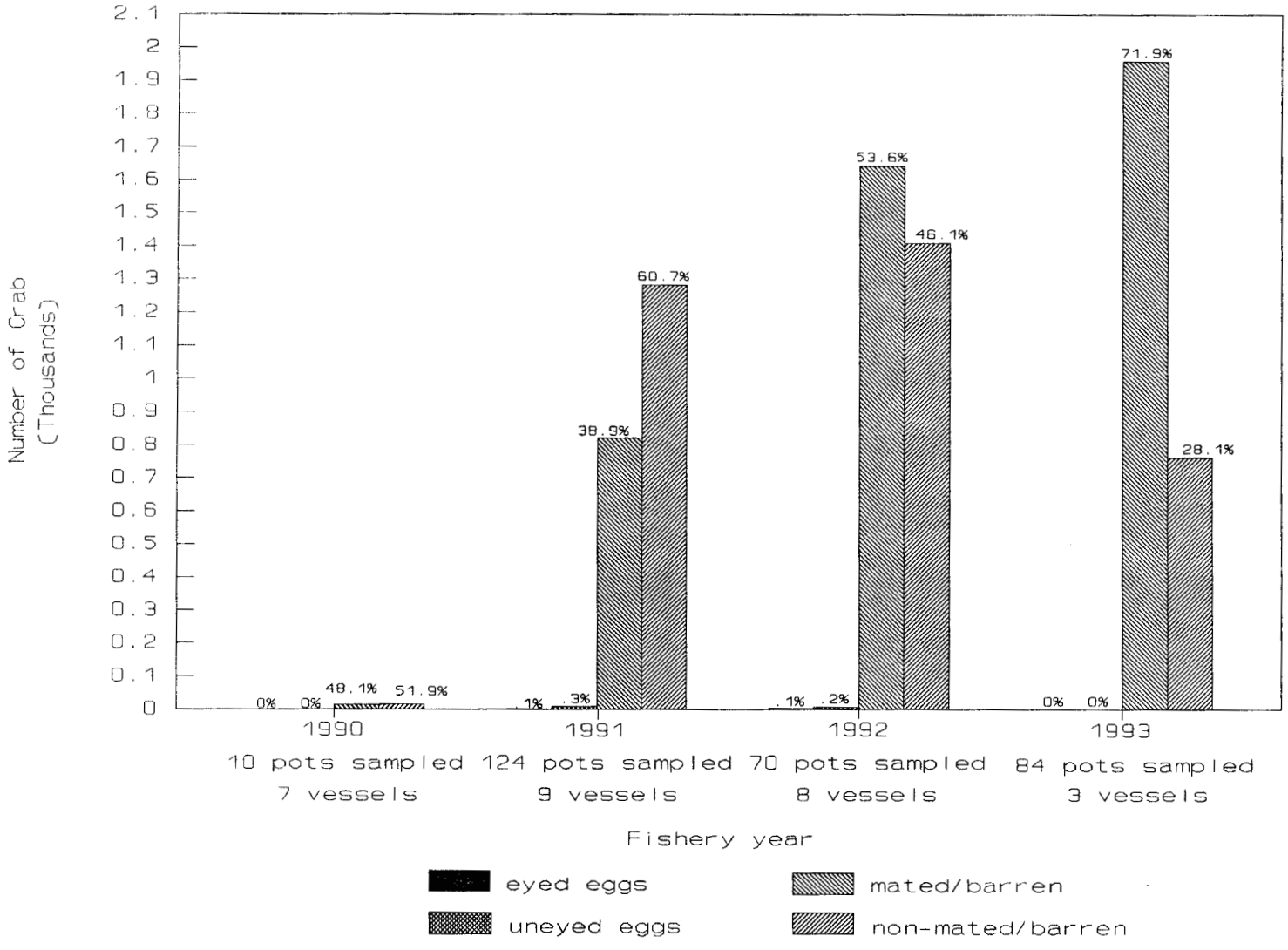

Figure 15. Reproductive state of female blue king crabs observed in the 1990, 1991, 1992, and 1993 St Matthew fisheries.

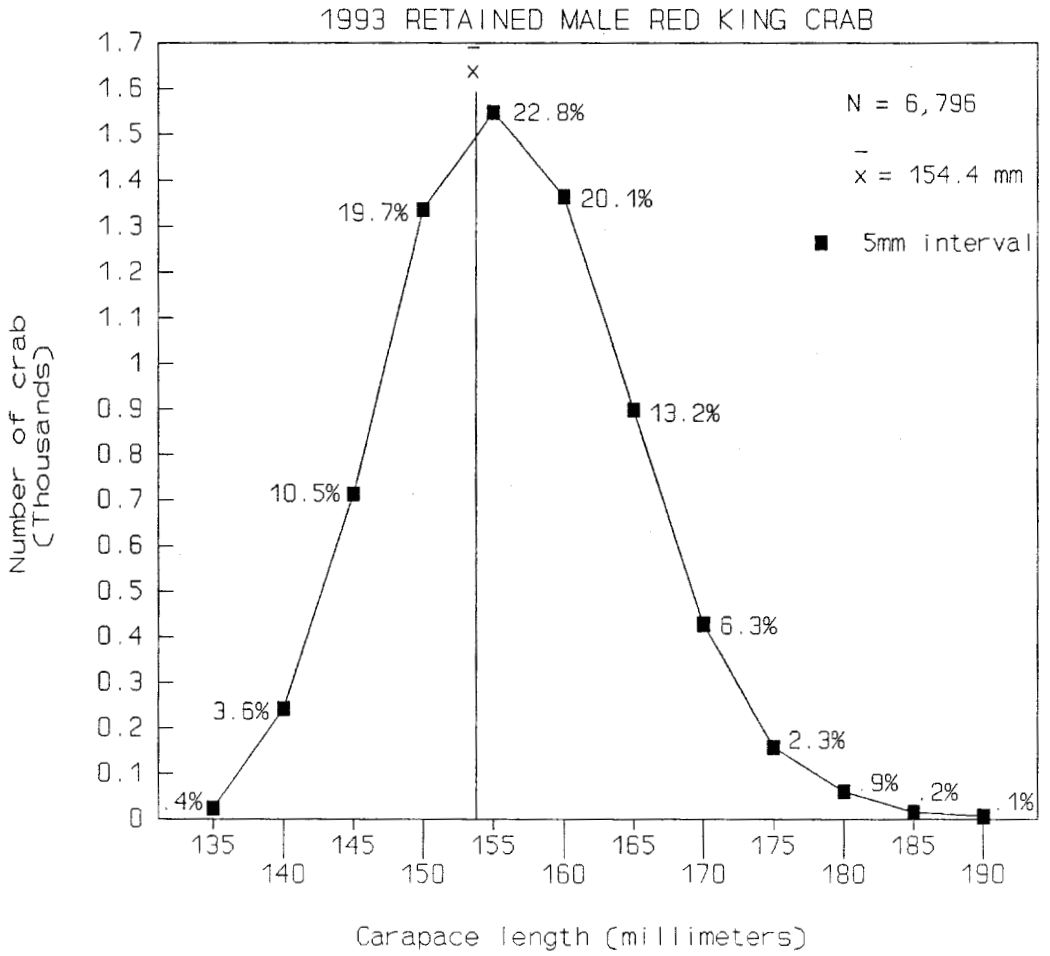

Figure 16. Commercially retained red king crab length frequency statistics from the 1993 Pribilof fishery.

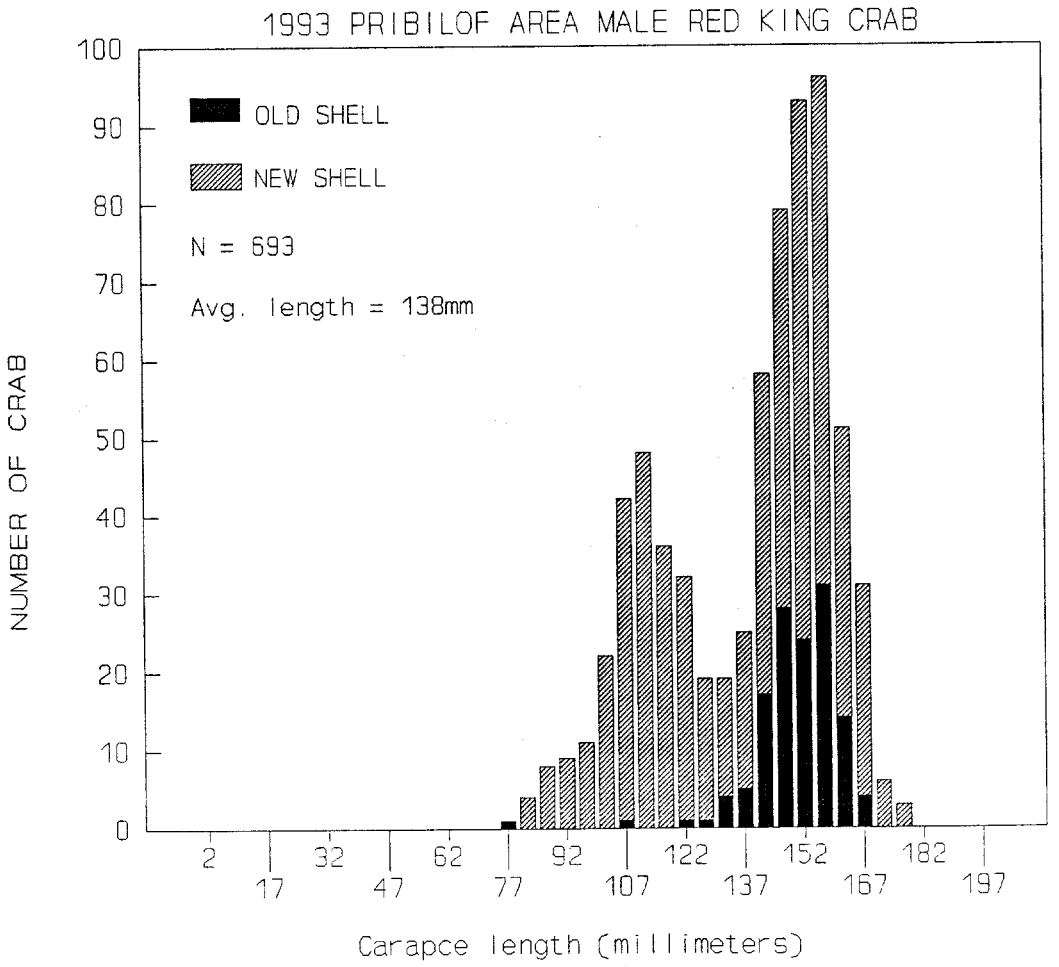

Figure 17. Carapace length distribution of all red king males observed in the 1993 Pribilof fishery.

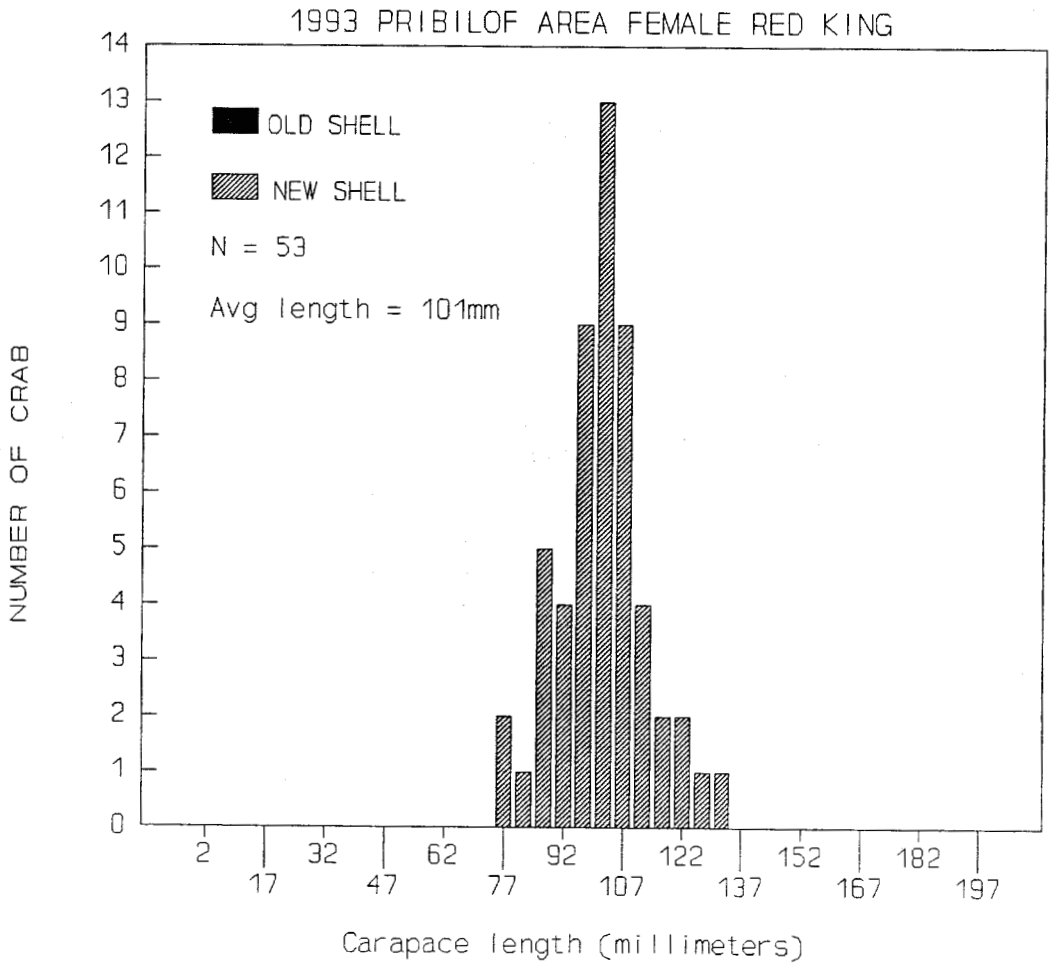

Figure 18. Carapace length distribution of female red king crabs observed in the 1993 Pribilof fishery.

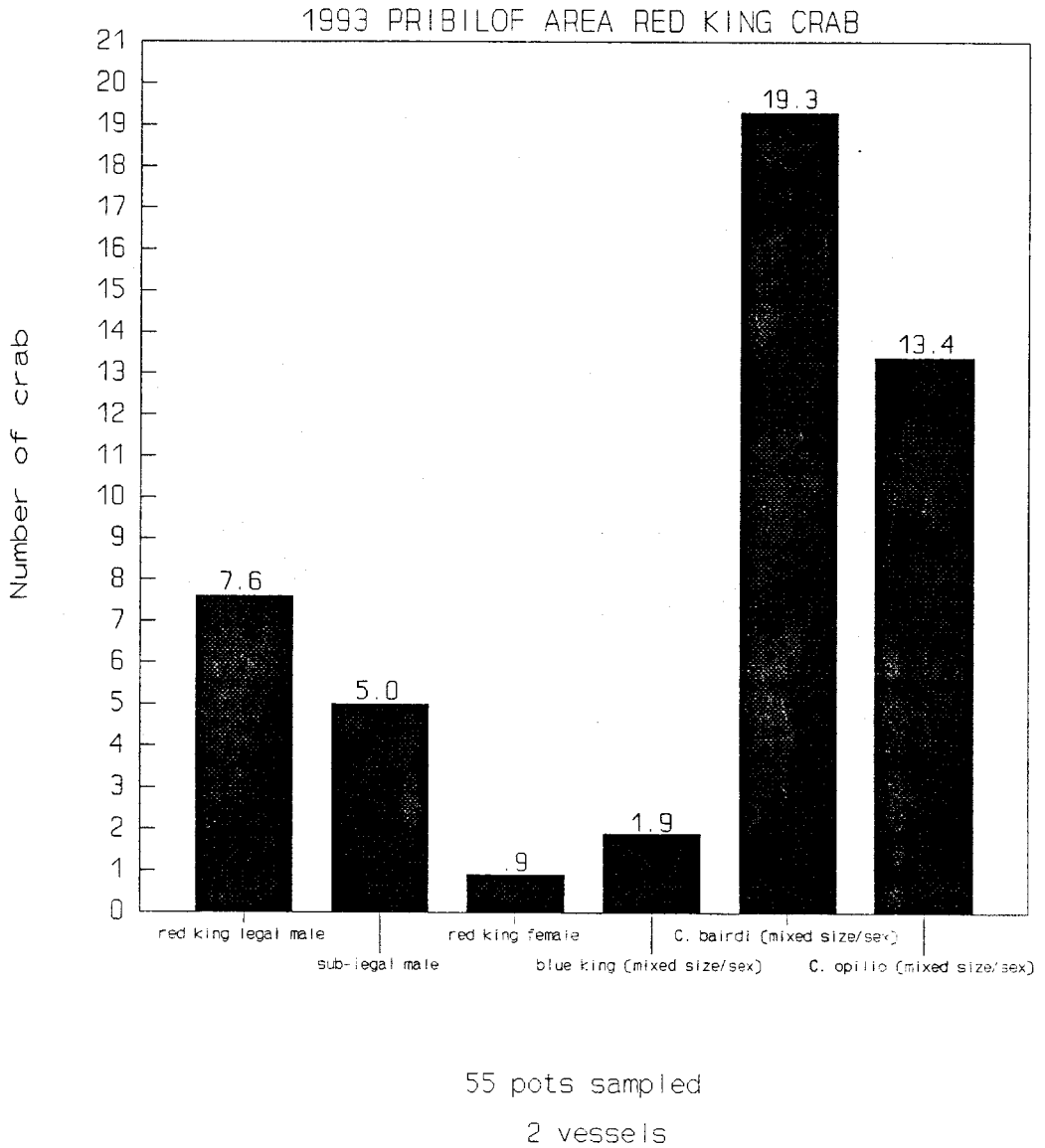

Figure 19. Catch per pot of selected species from the 1993 Pribilof red king crab fishery.

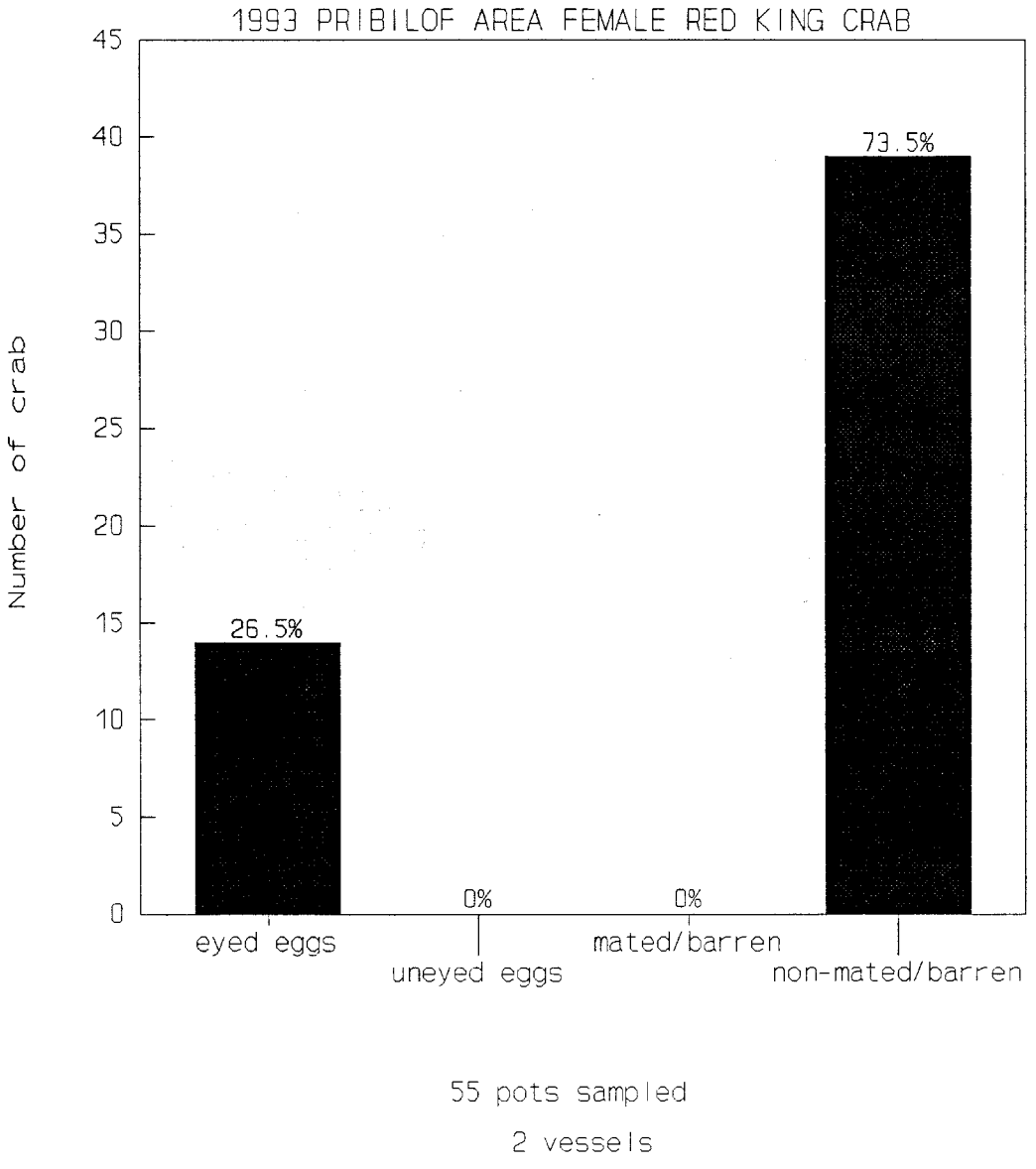

Figure 20. Reproductive state of female red king crabs observed in the 1993 Pribilof fishery.

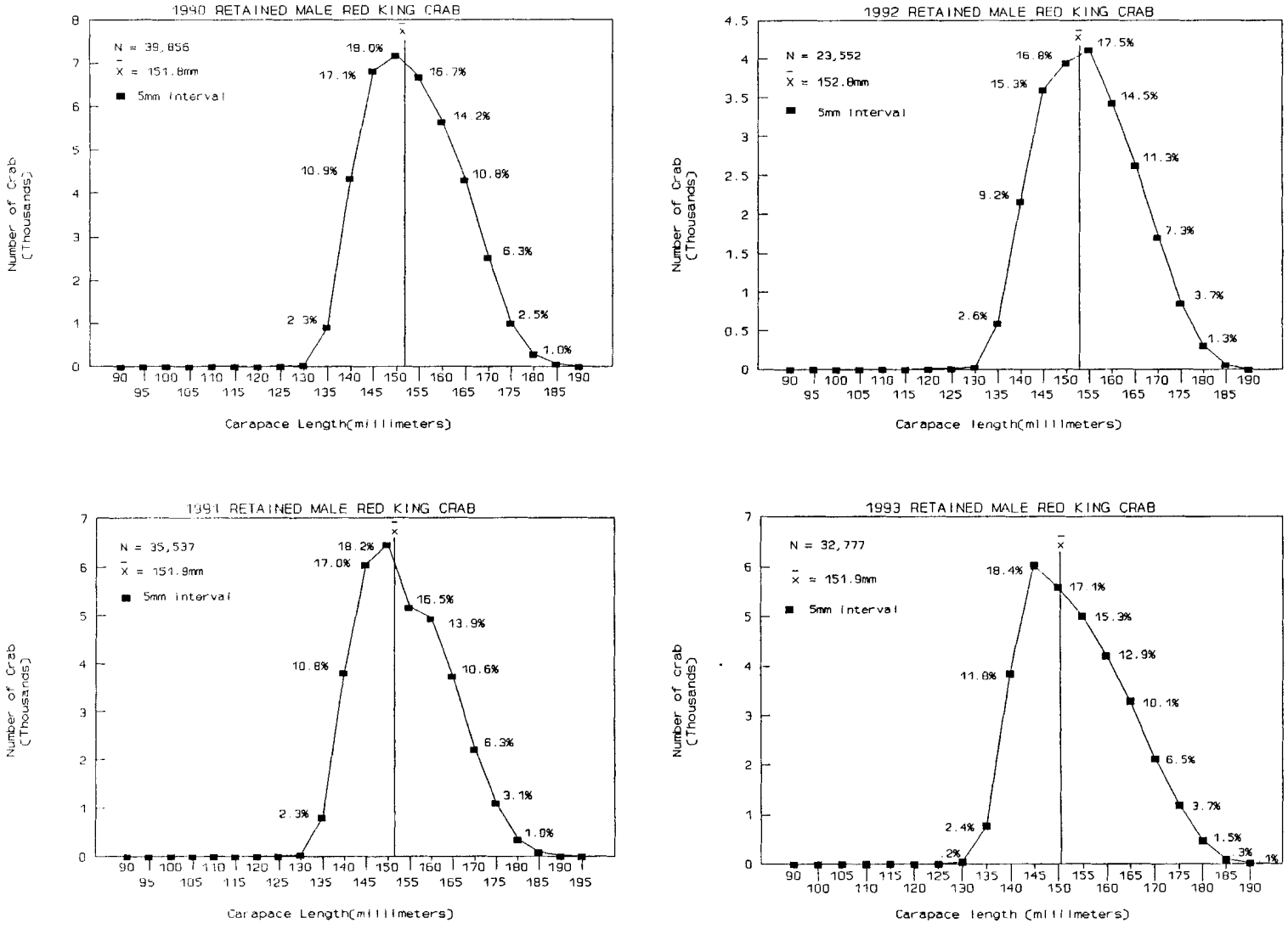

Figure 21. Commercially retained red king crab length frequency statistics from the 1990, 1991, 1992, and 1993 Bristol Bay fisheries.

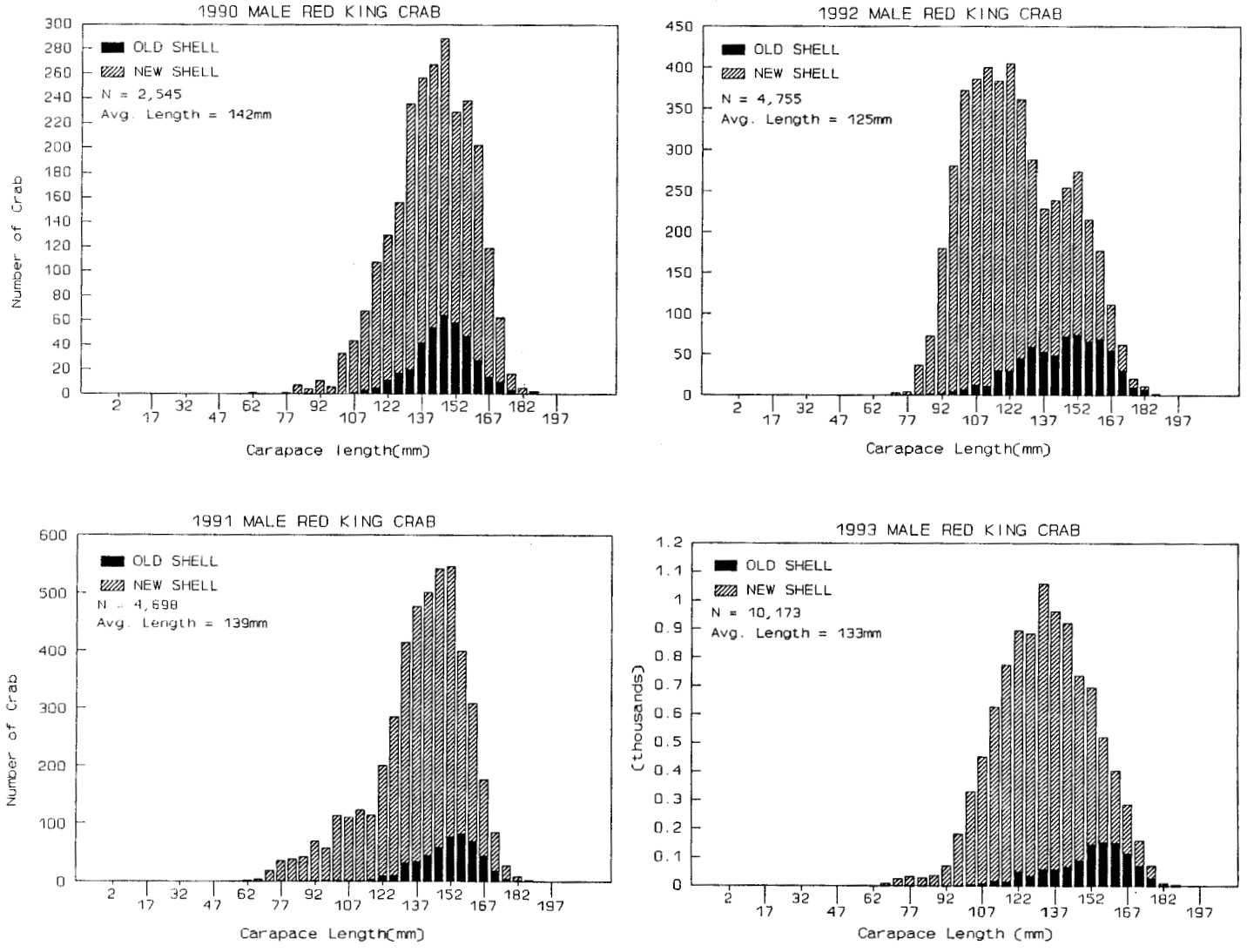

Figure 22. Carapace length distributions of all red king crab males observed in the 1990, 1991, 1992, and 1993 Bristol Bay fisheries.

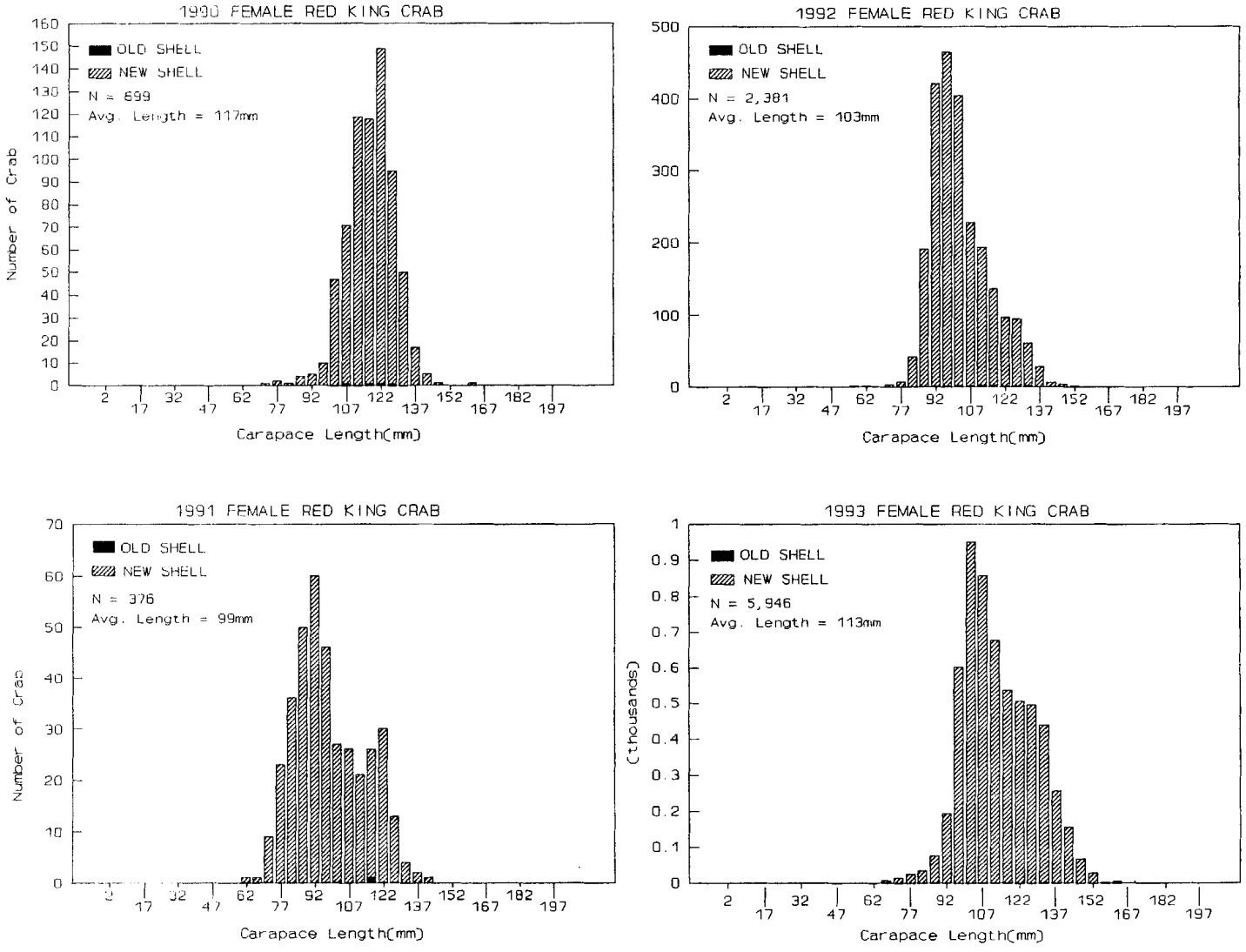

Figure 23. Carapace length distributions of female red king crabs observed in the 1990, 1991, 1992, and 1993 Bristol Bay fisheries.

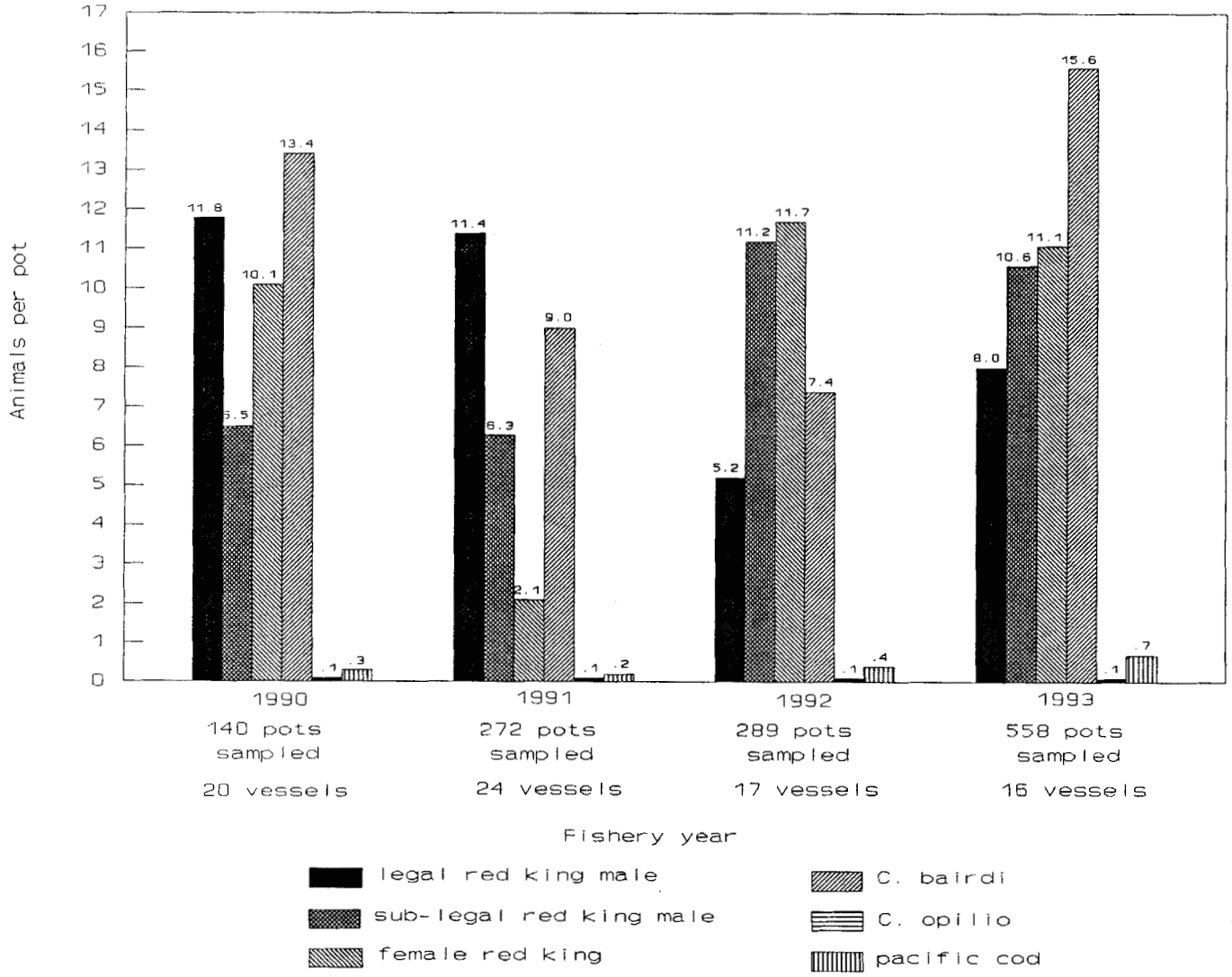

Figure 24. Catch per pot of selected species from the 1990, 1991, 1992, and 1993 Bristol Bay red king crab fisheries.

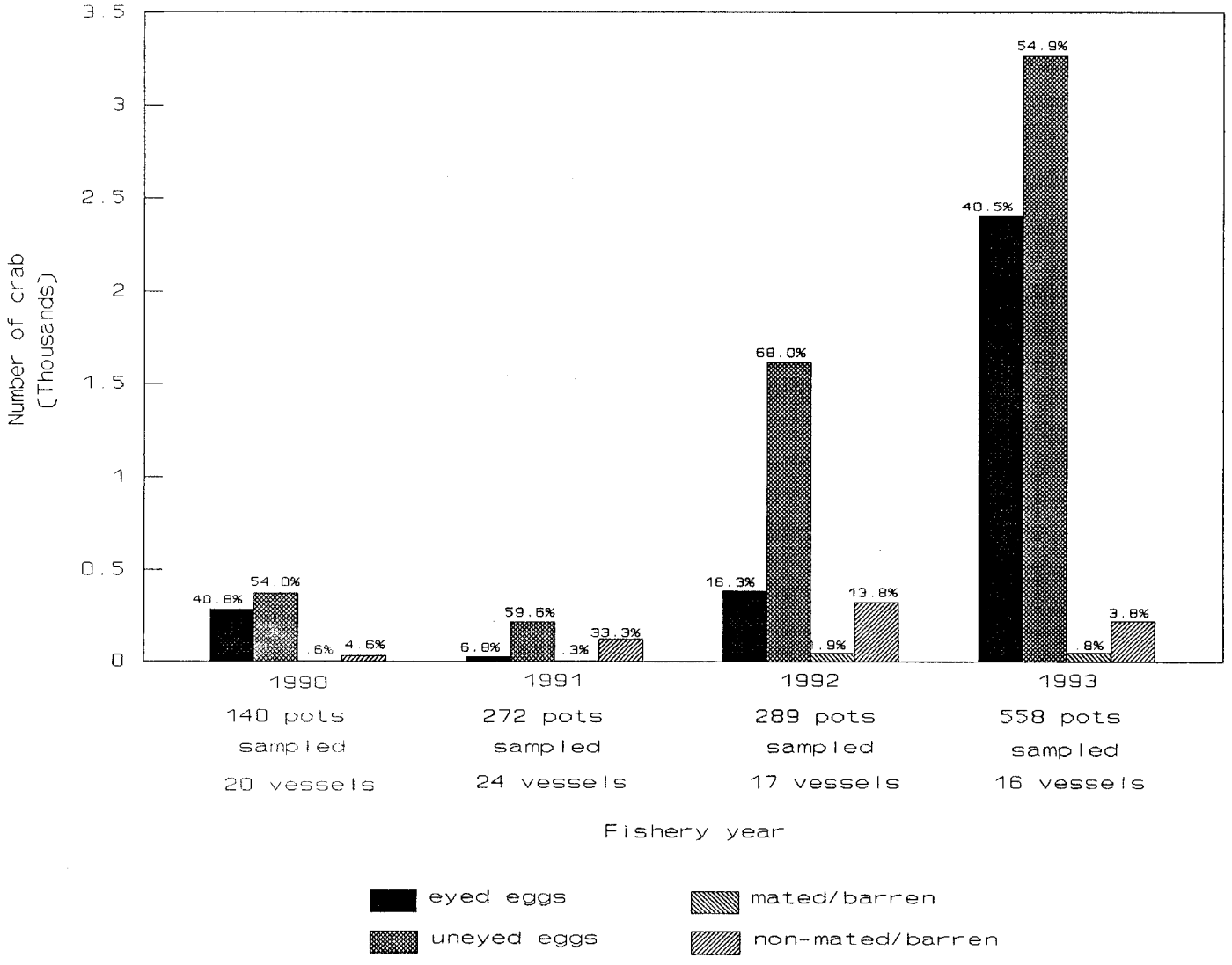

Figure 25. Reproductive state of female red king crabs observed in the 1990, 1991, 1992, and 1993 Bristol Bay fisheries.

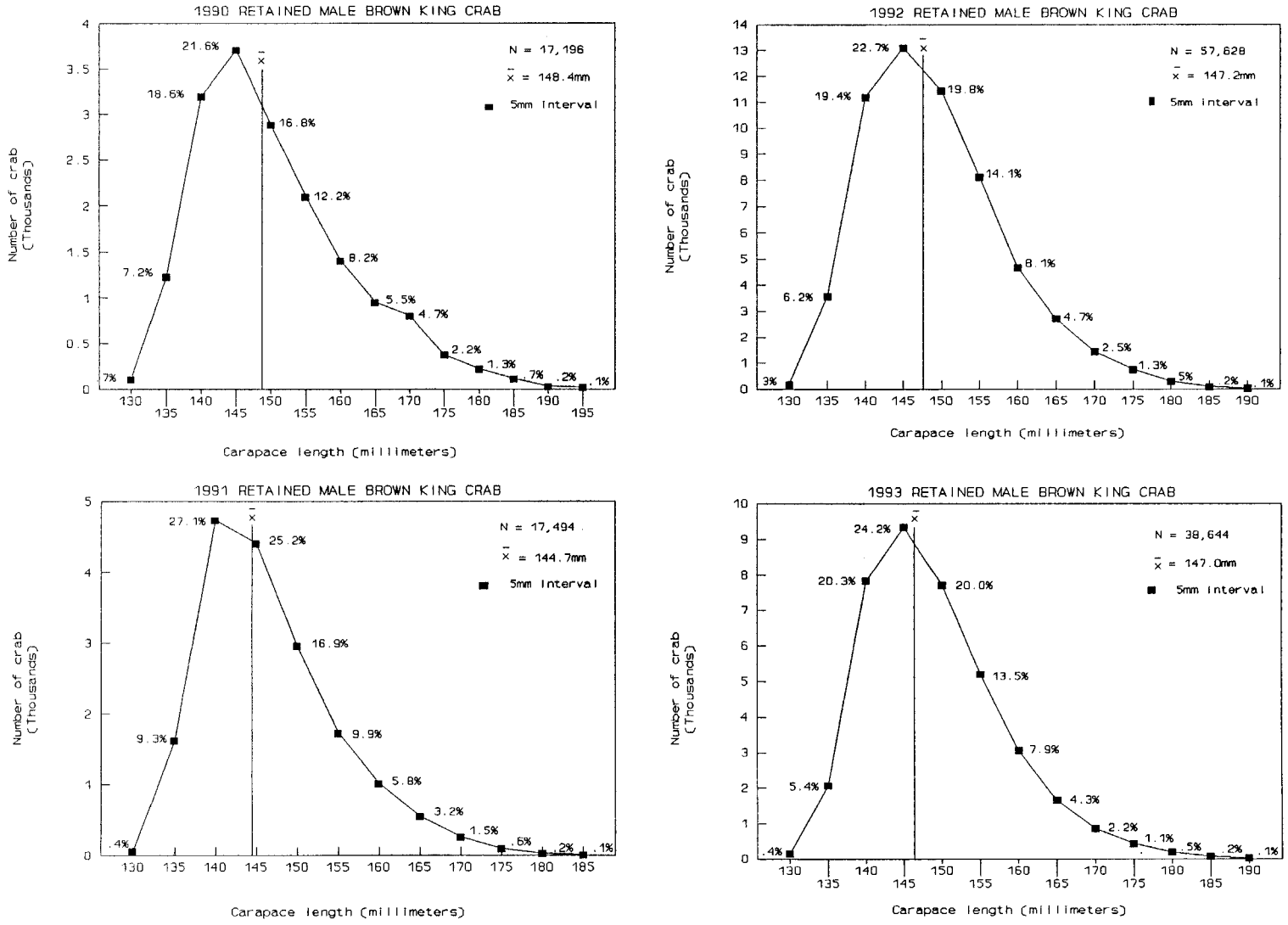

Figure 26. Commercially retained brown king crab length frequency statistics from the 1990, 1991, 1992, and 1993 Adak fisheries.

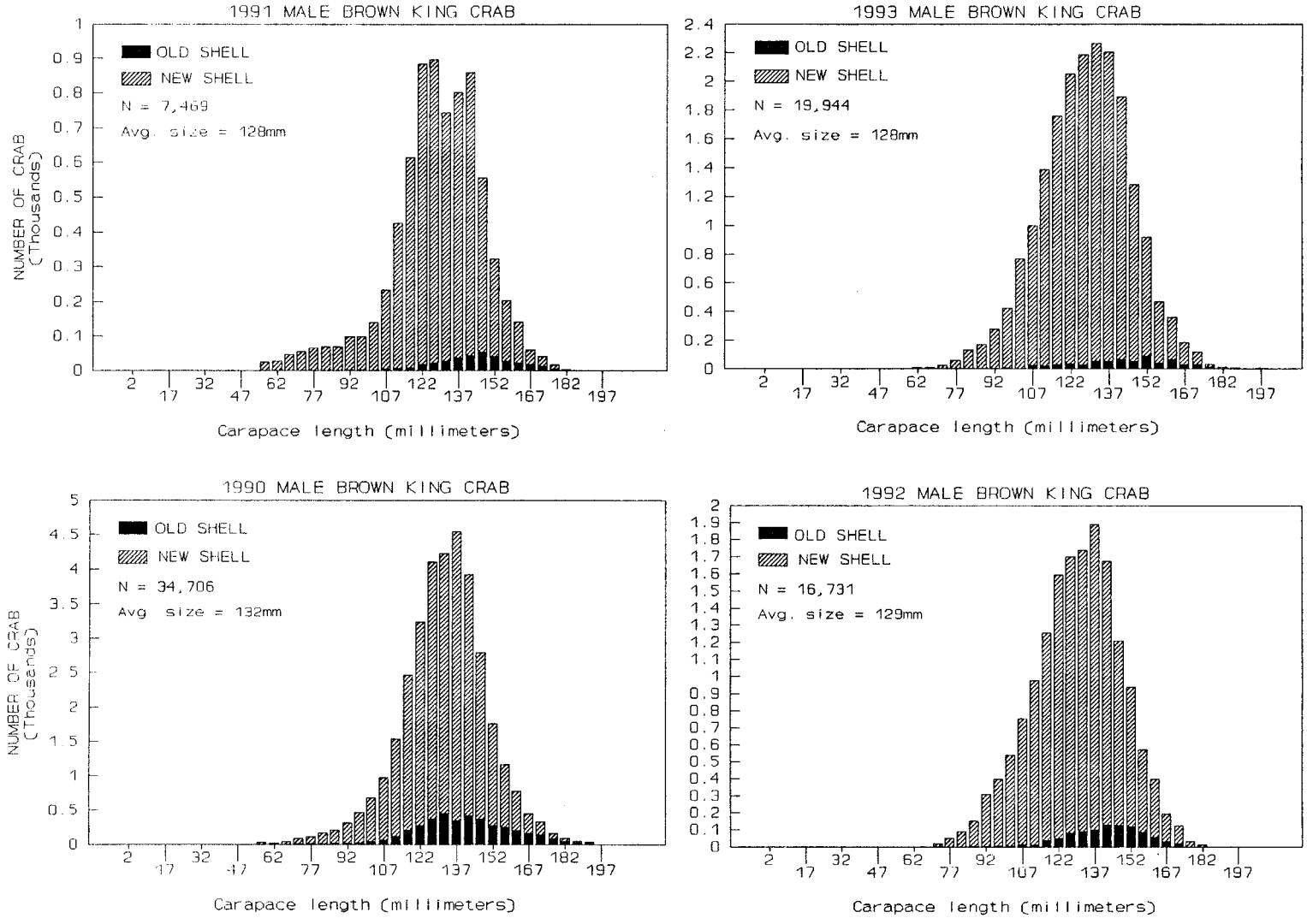

Figure 27. Carapace length distributions of all brown king crab males observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

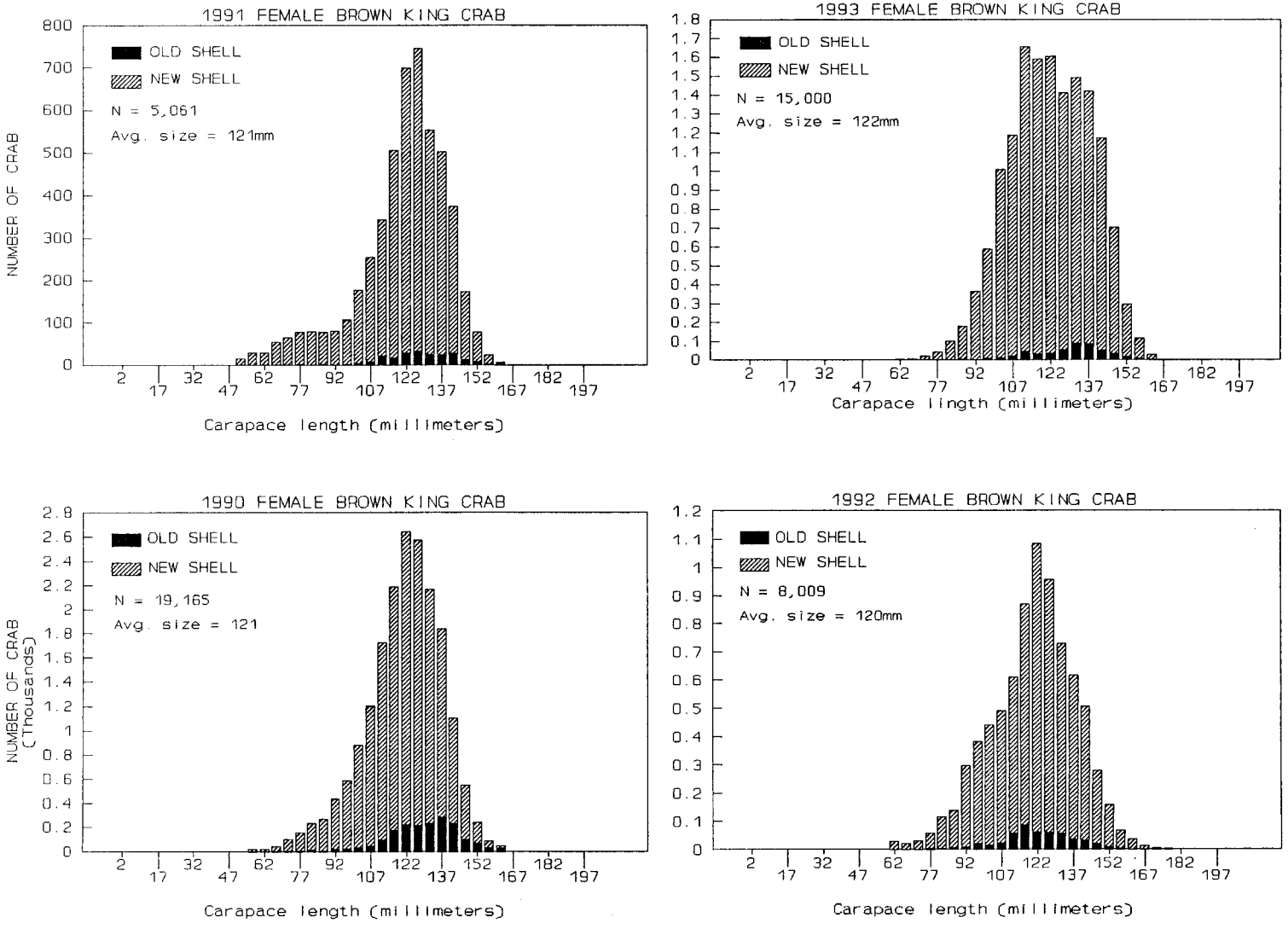

Figure 28. Carapace length distributions of female brown king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

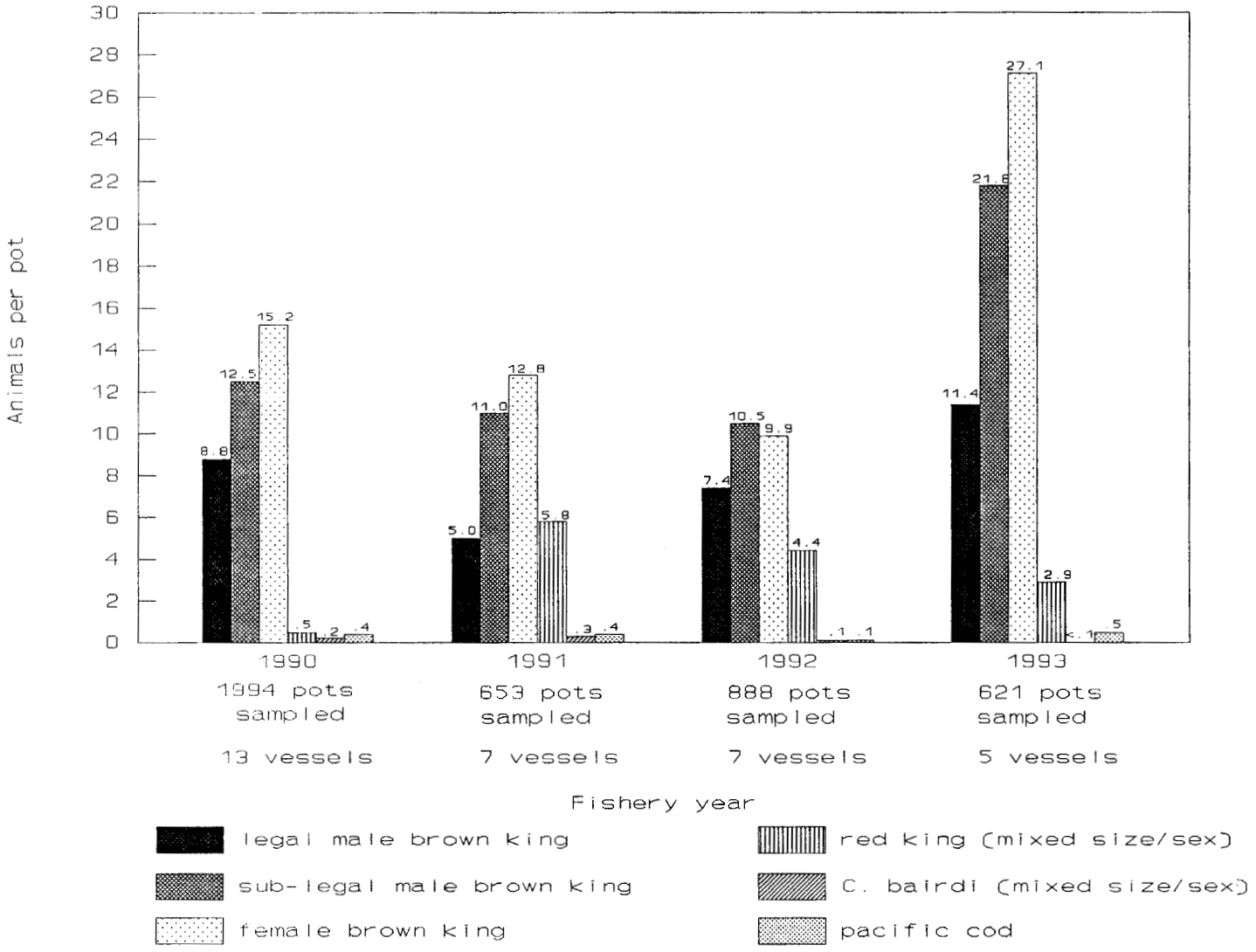

Figure 29. Catch per pot of selected species from the 1990, 1991, 1992, and 1993 Adak brown king crab fisheries.

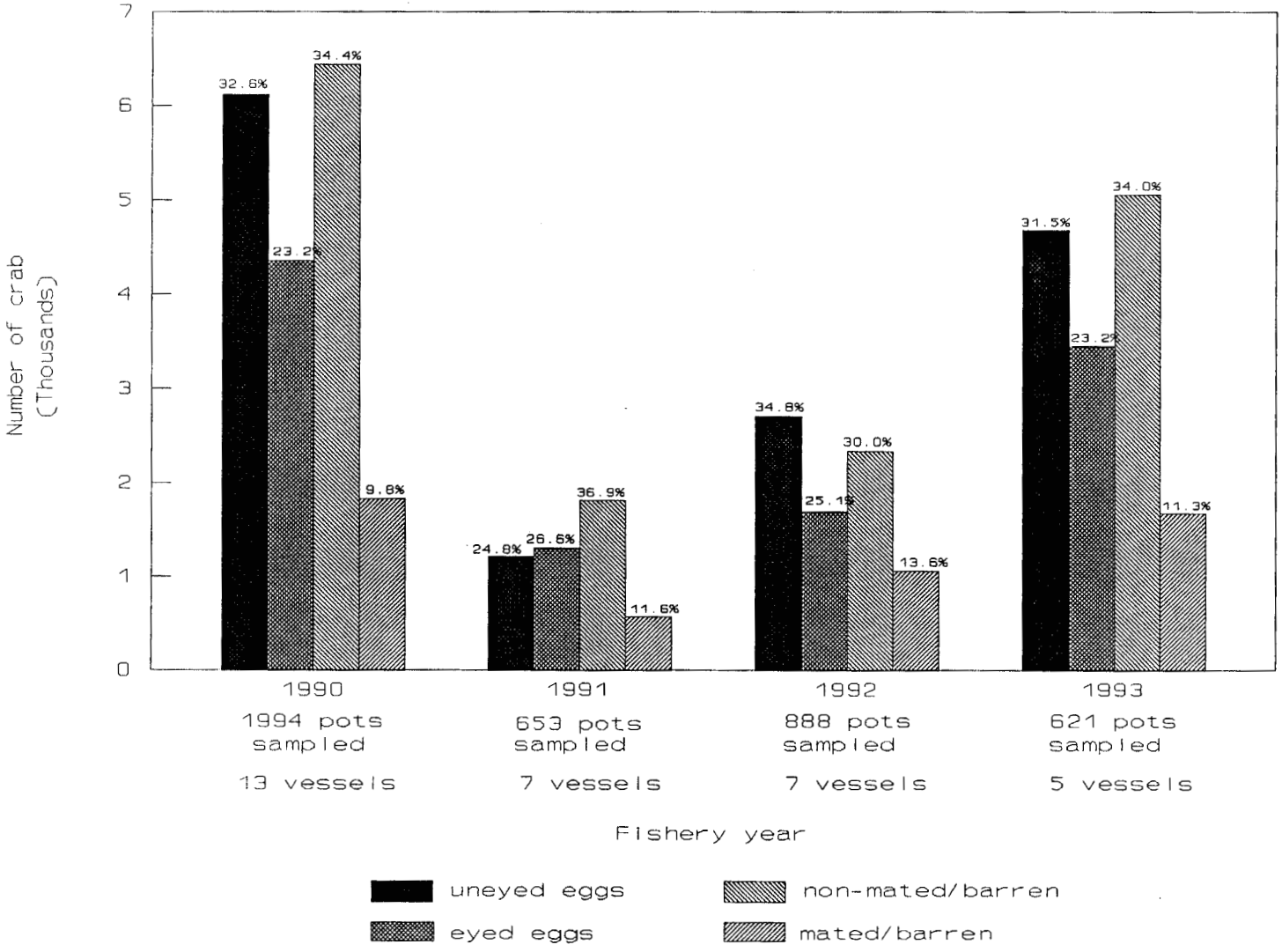

Figure 30. Reproductive state of female brown king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

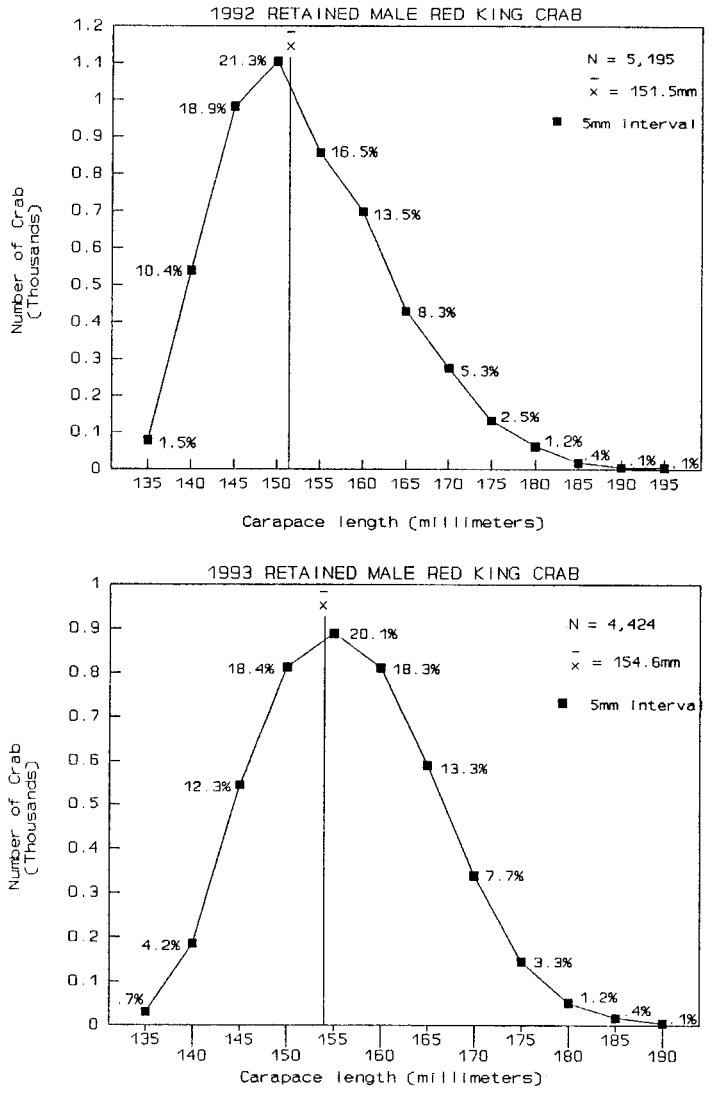

Figure 31. Commercially retained red king crab length frequency statistics from the 1992 and 1993 Adak fisheries.

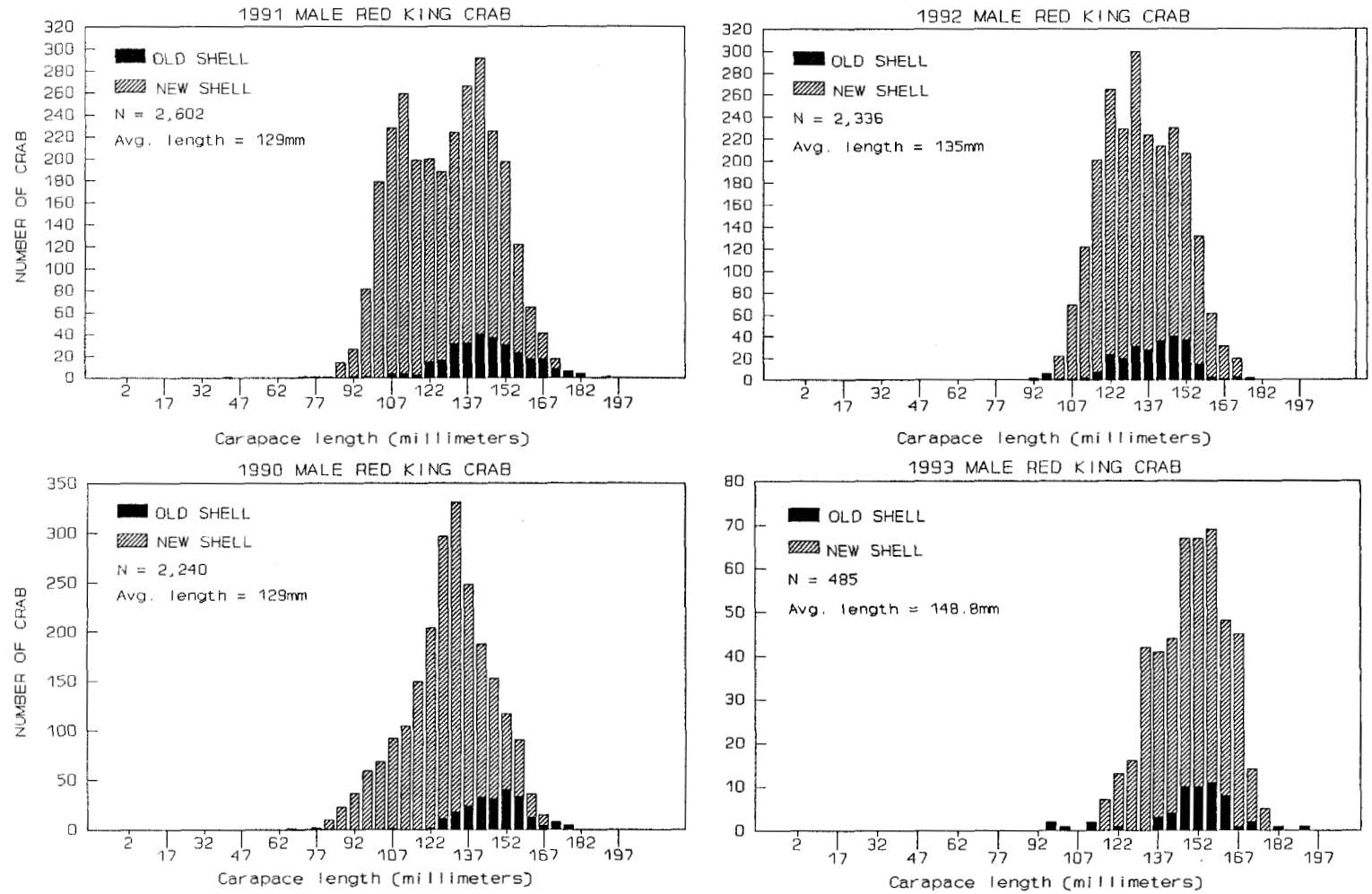

Figure 32. Carapace length distributions of all red king crab males observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

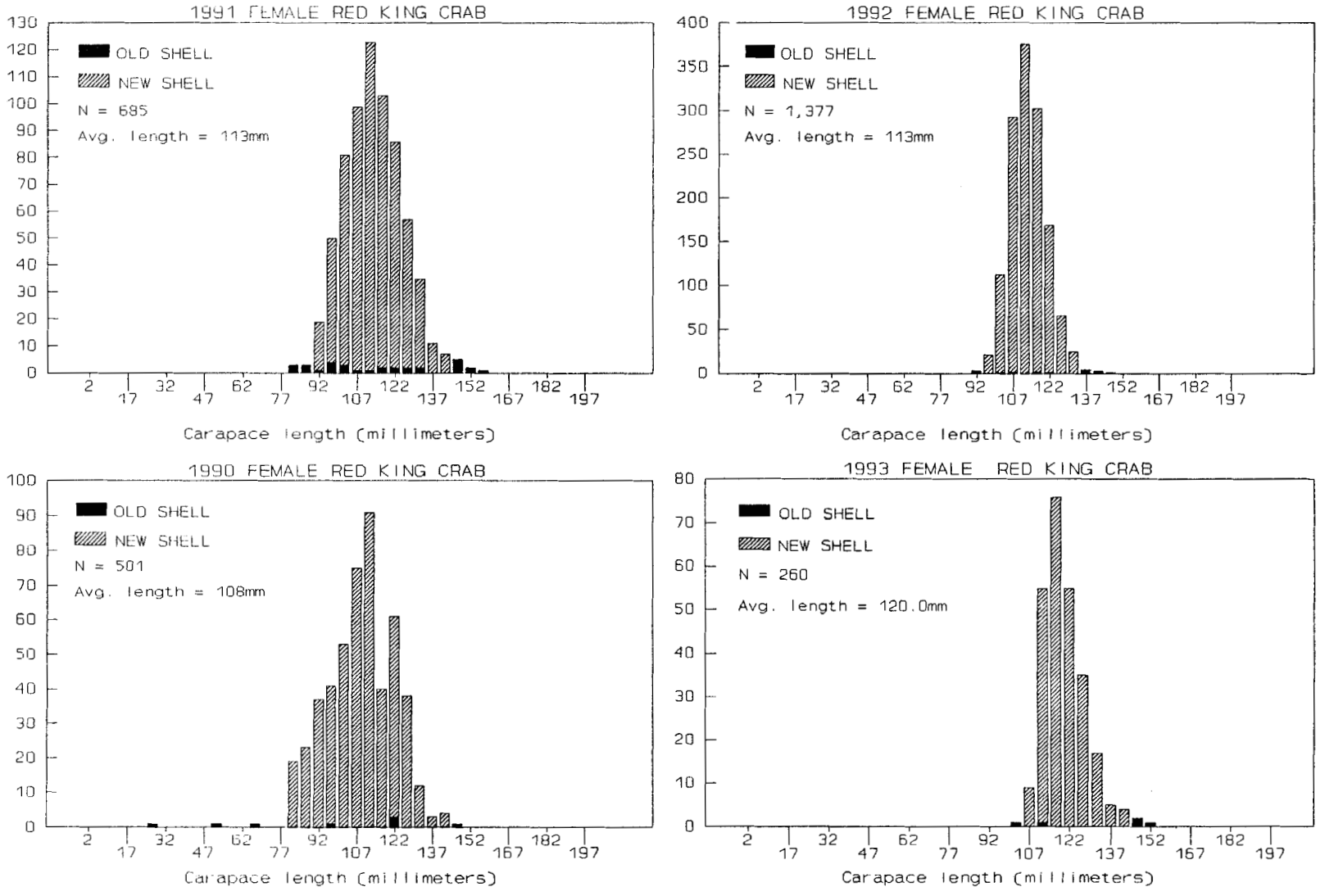

Figure 33. Carapace length distributions of female red king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

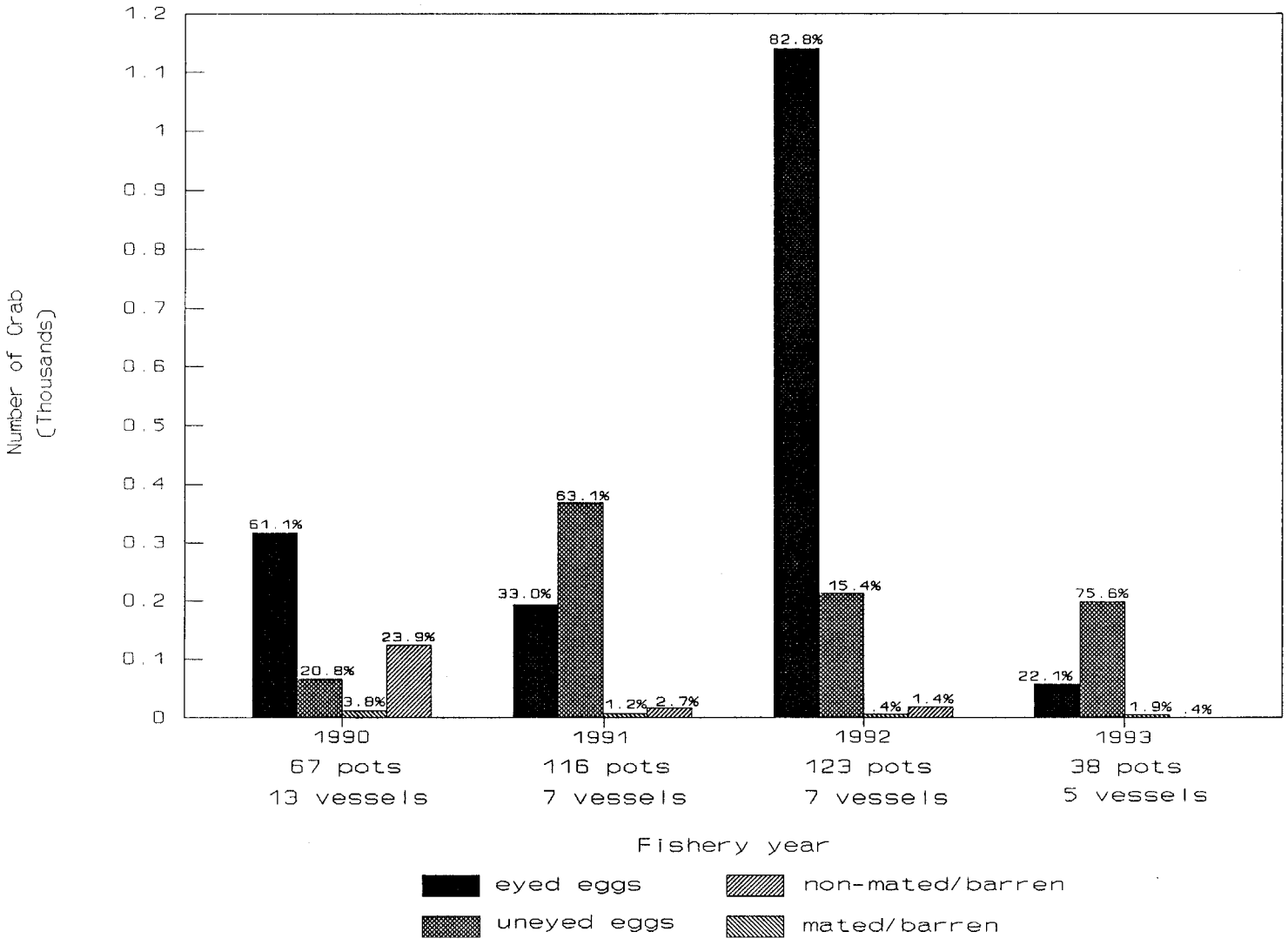

Figure 34. Reproductive state of female red king crabs observed in the 1990, 1991, 1992, and 1993 Adak fisheries.

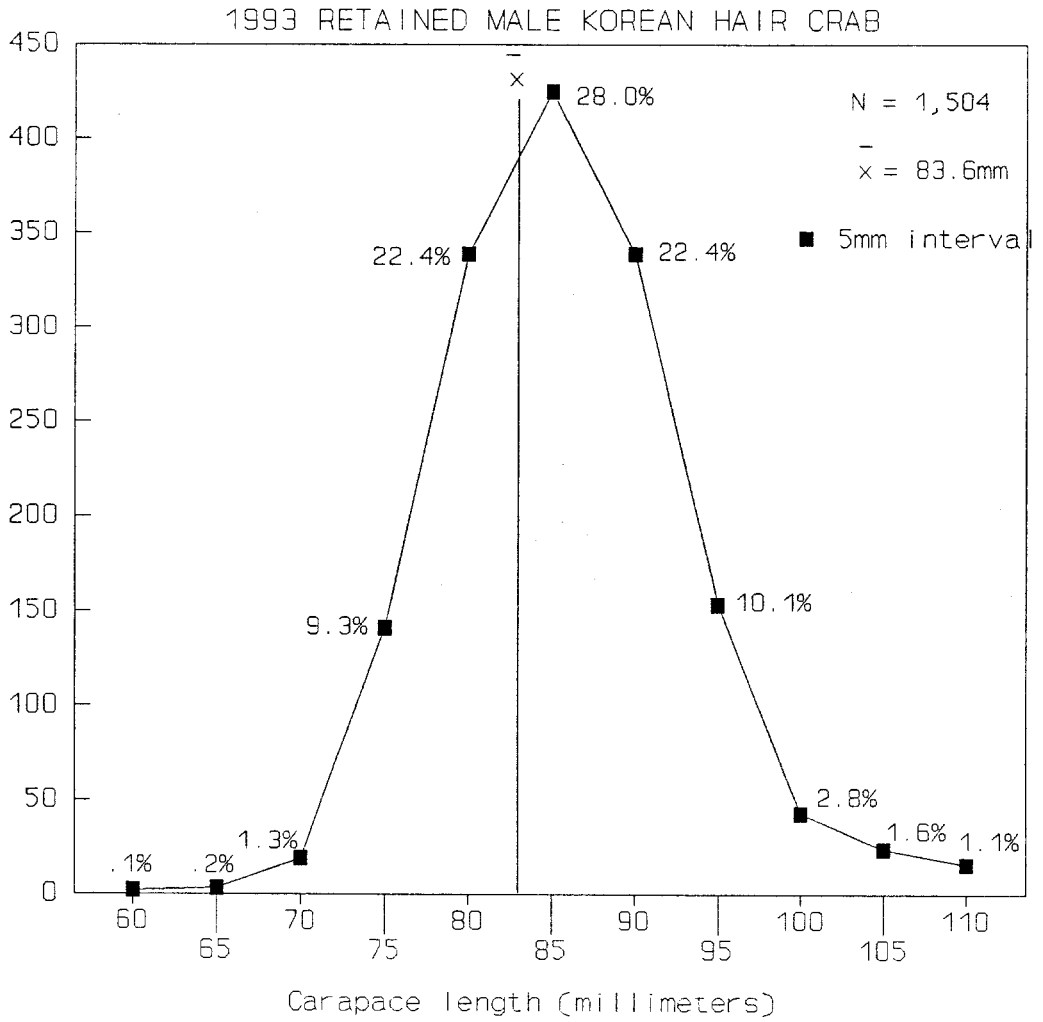

Figure 35. Commercially retained Korean hair crab length frequency statistics from the 1993 Bristol Bay fishery.

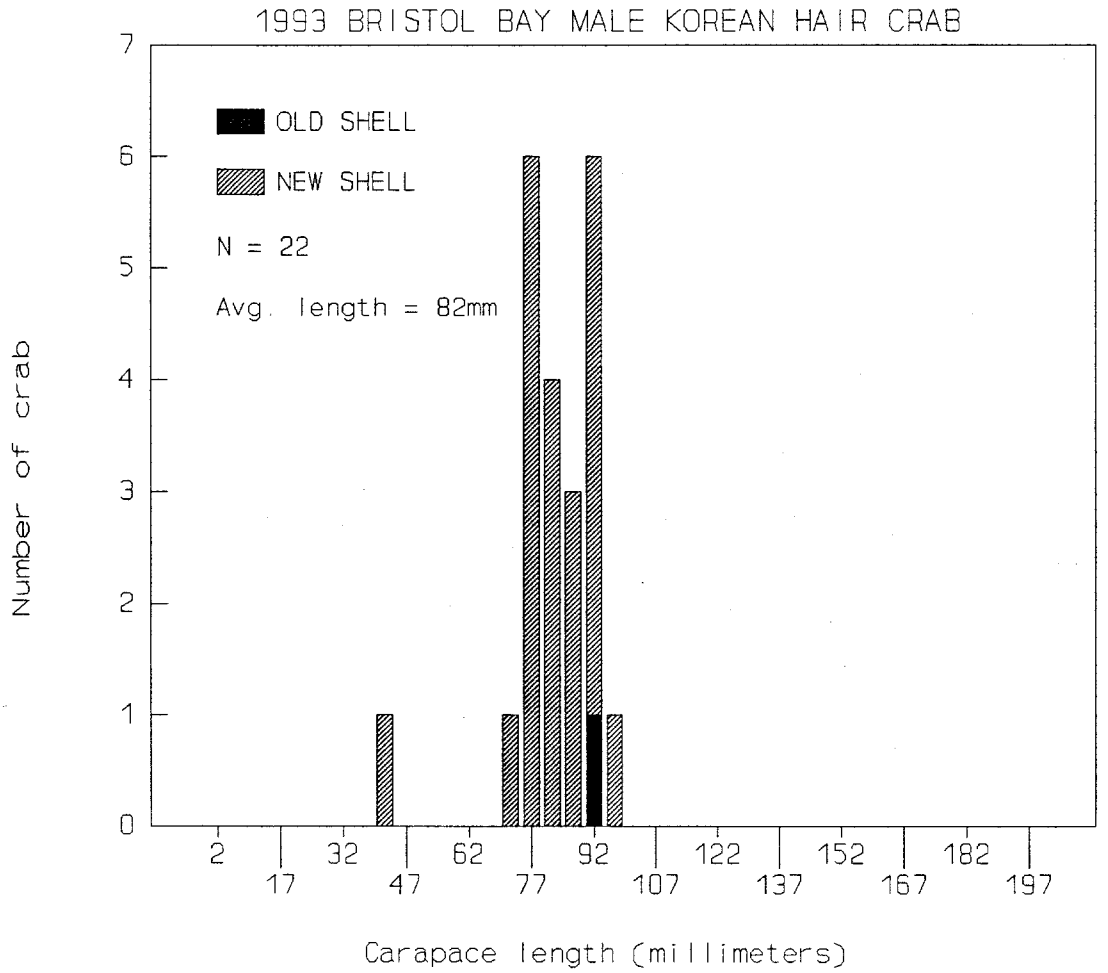

Figure 36. Carapace length distribution of all Korean hair crab males observed in the 1993 Bristol Bay fishery.

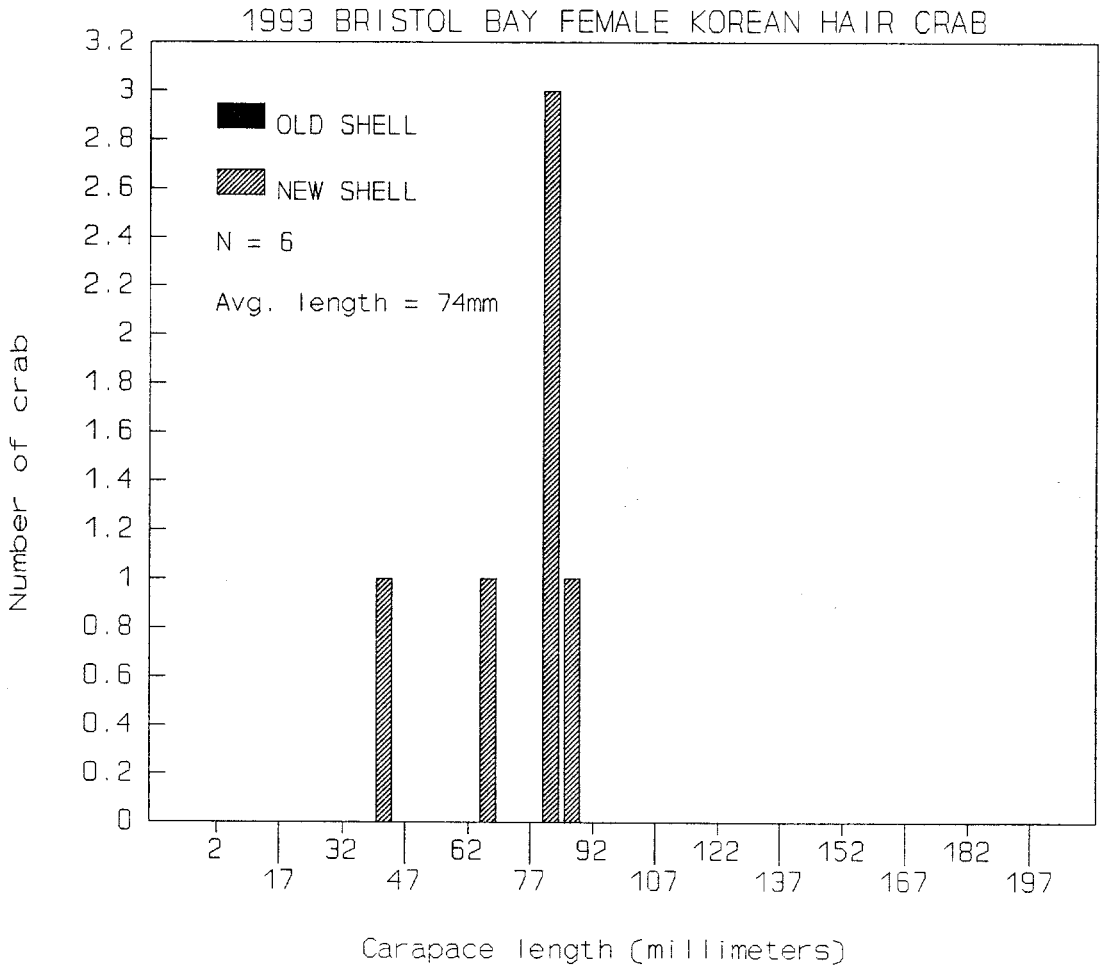

Figure 37. Carapace length distribution of female Korean hair crabs observed in the 1993 Bristol Bay fishery.

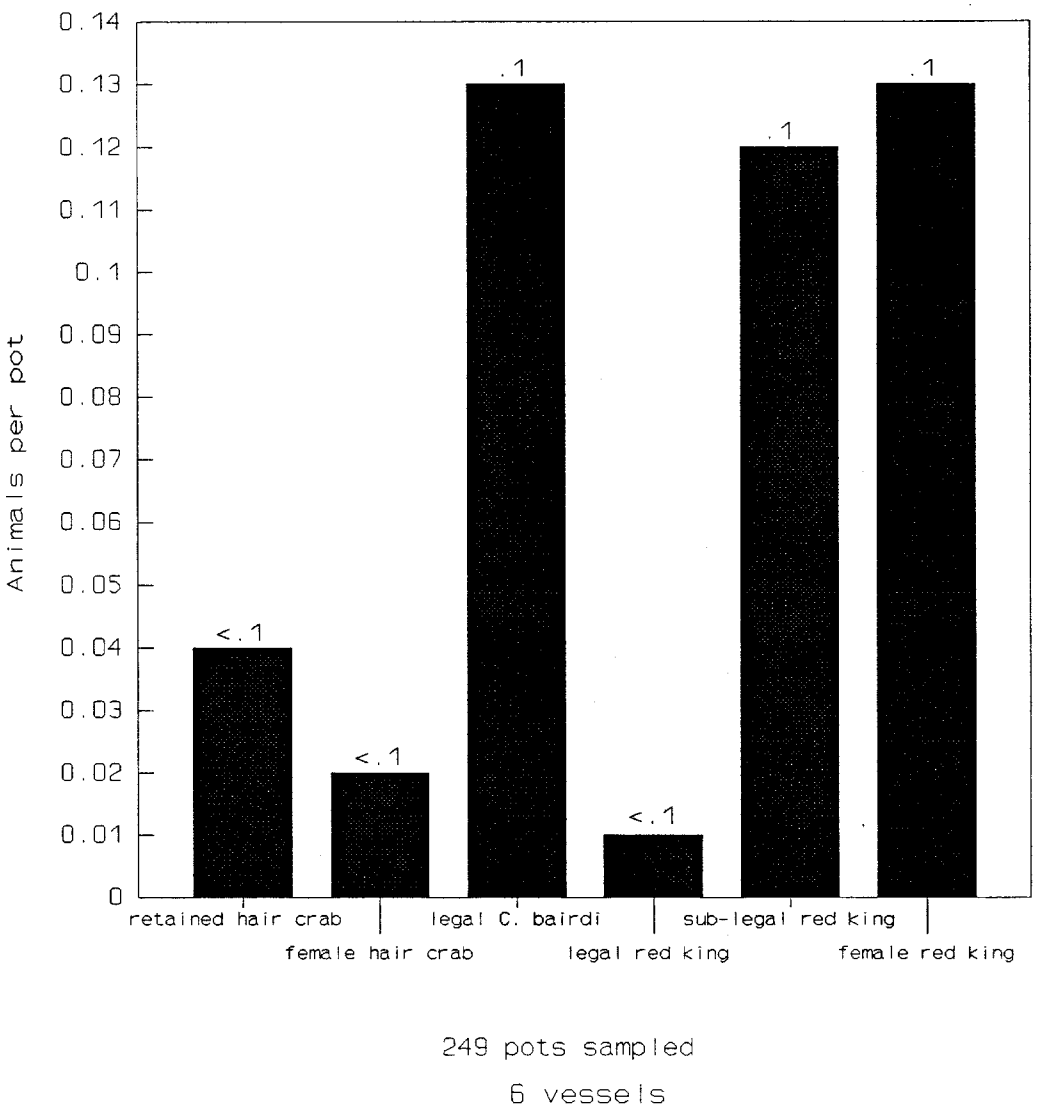

Figure 38. Catch per pot of selected species from the 1993 Bristol Bay Korean hair crab fishery.

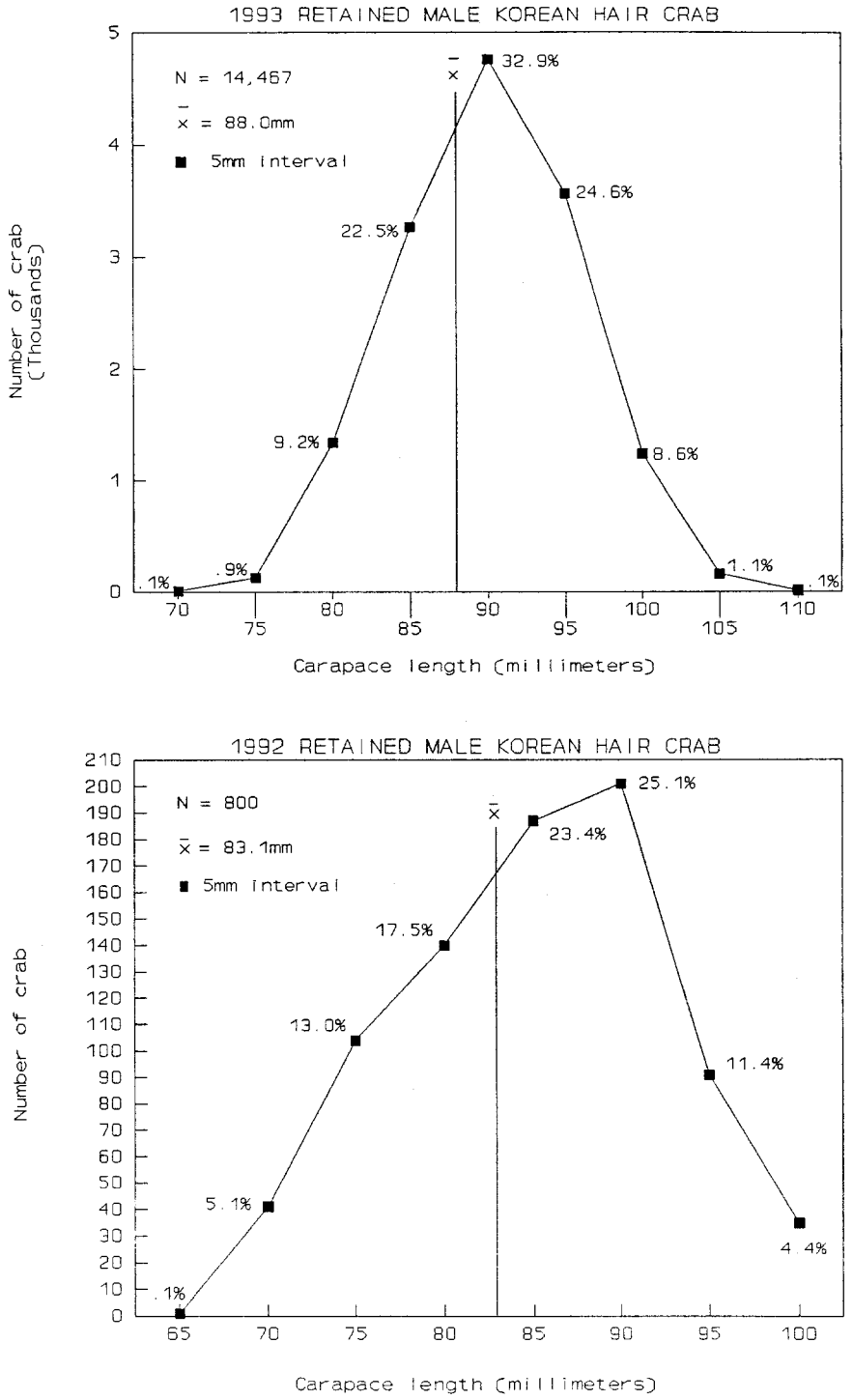

Figure 39. Commercially retained Korean hair crab length frequency statistics from the 1992 and 1993 Bering Sea fisheries.

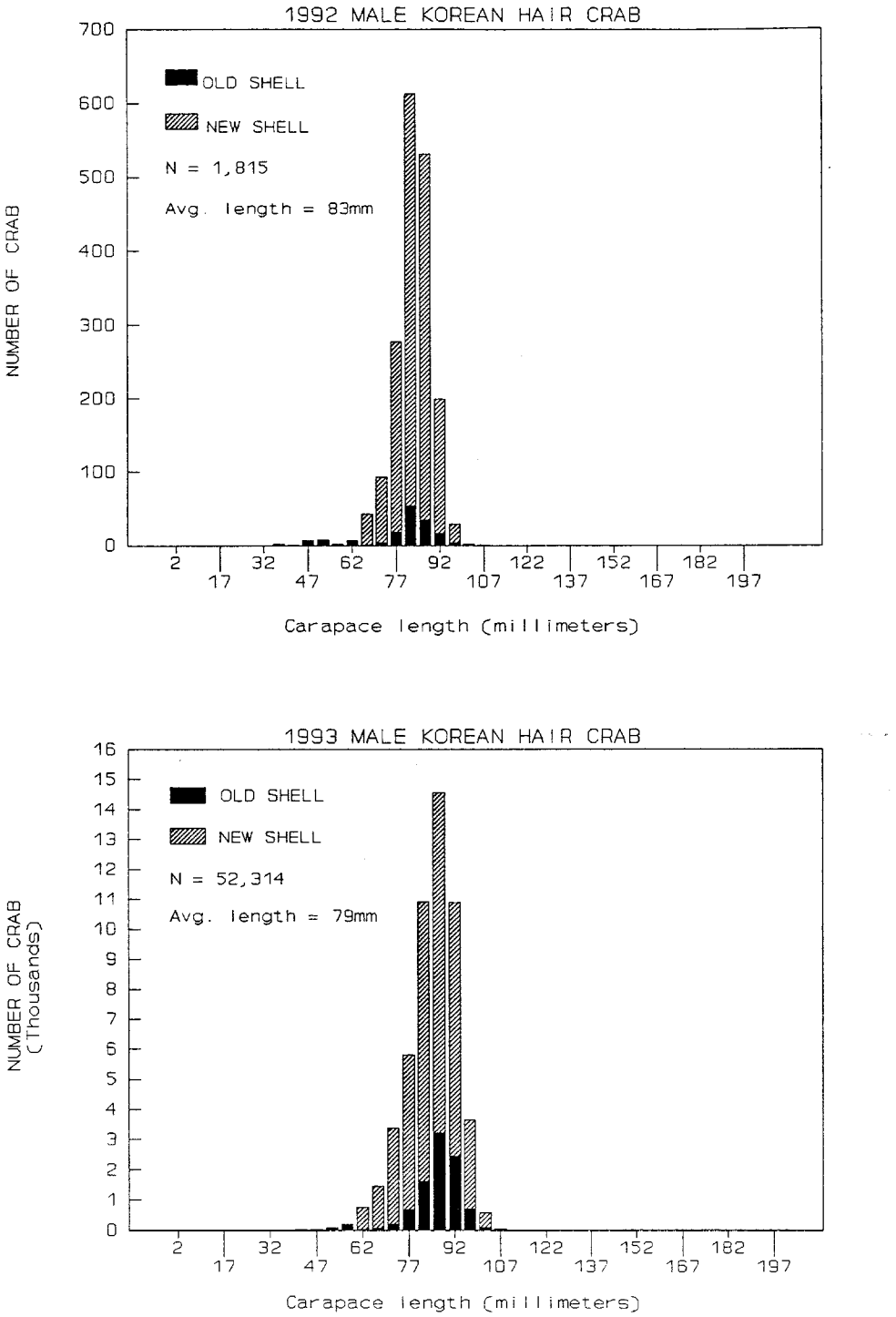

Figure 40. Carapace length distributions of all Korean hair crab males observed in the 1992 and 1993 Bering Sea fisheries.

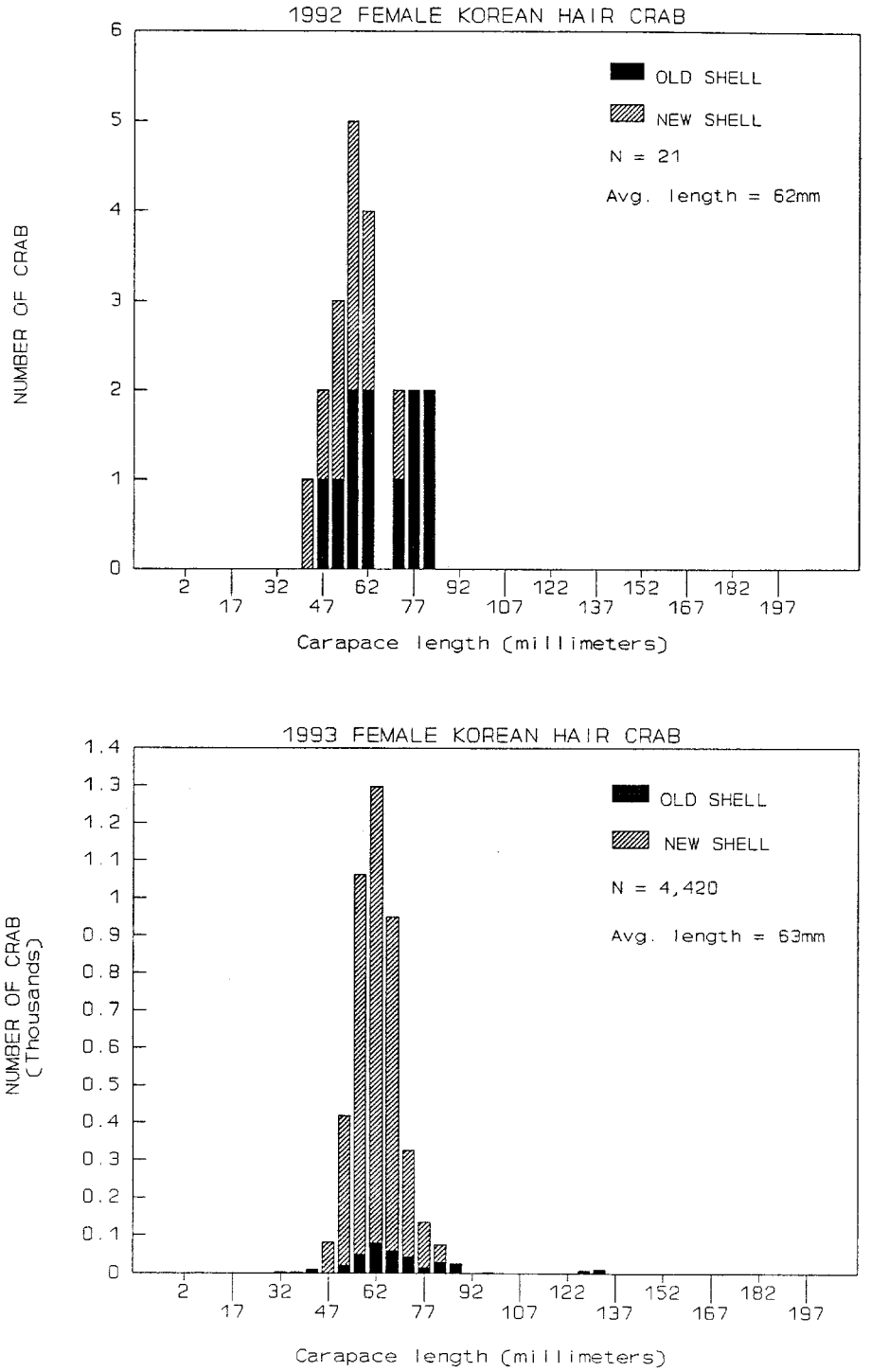

Figure 41. Carapace length distributions of female Korean hair crabs observed in the 1992 and 1993 Bering Sea fisheries.

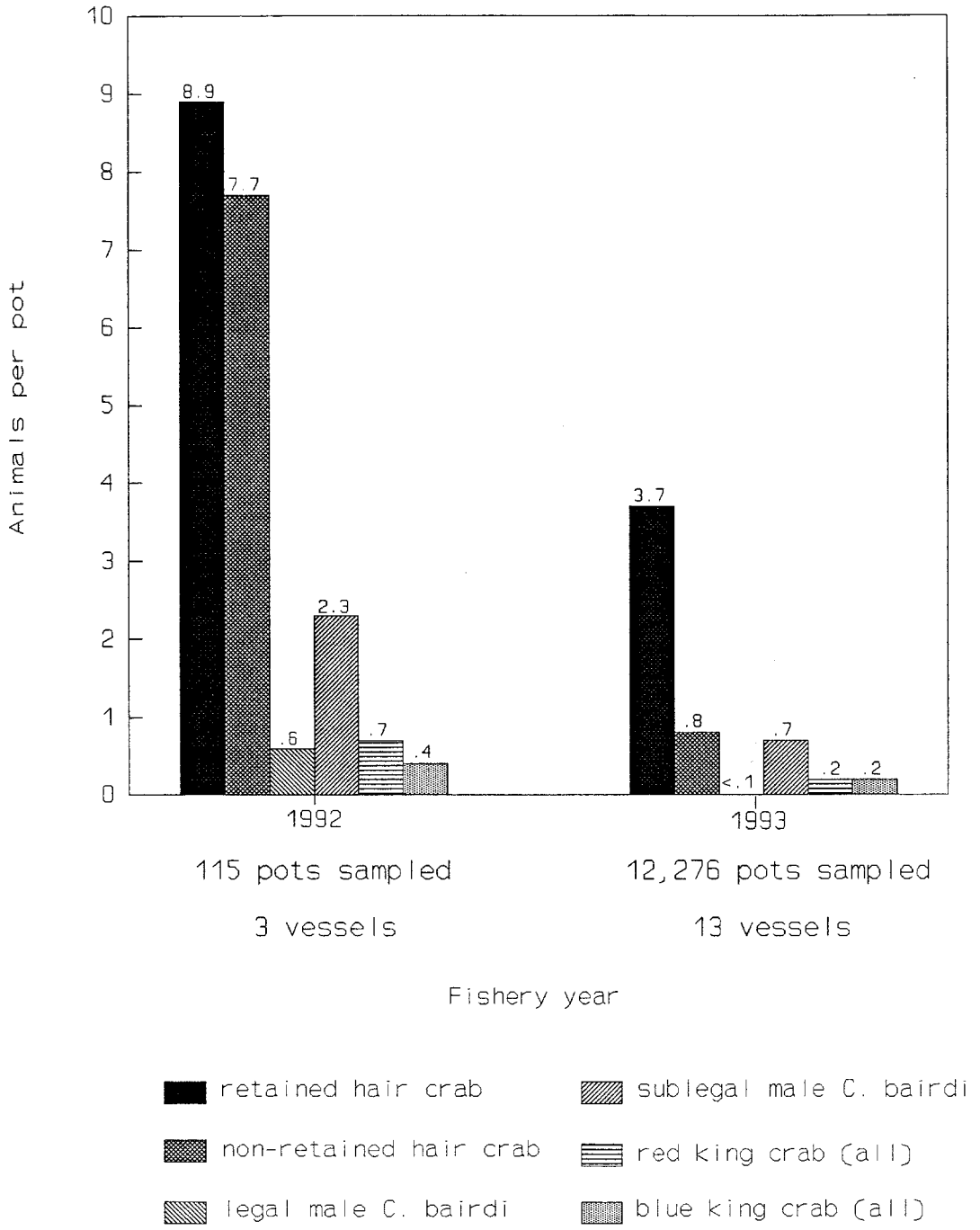

Figure 42. Catch per pot of selected species from the 1992 and 1993 Bering Sea Korean hair crab fisheries.

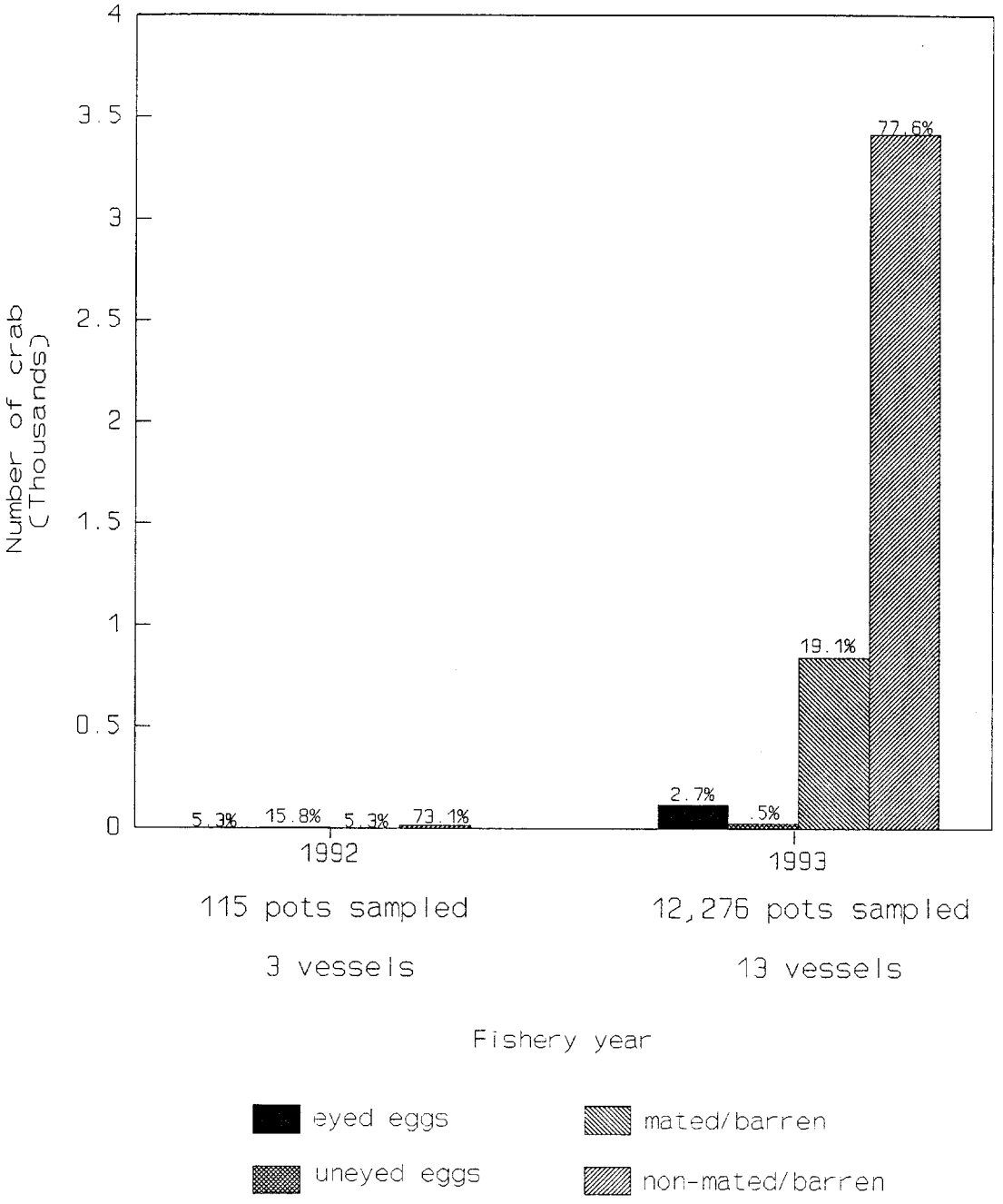

Figure 43. Reproductive state of female Korean hair crabs observed in the 1992 and 1993 Bering Sea fisheries.

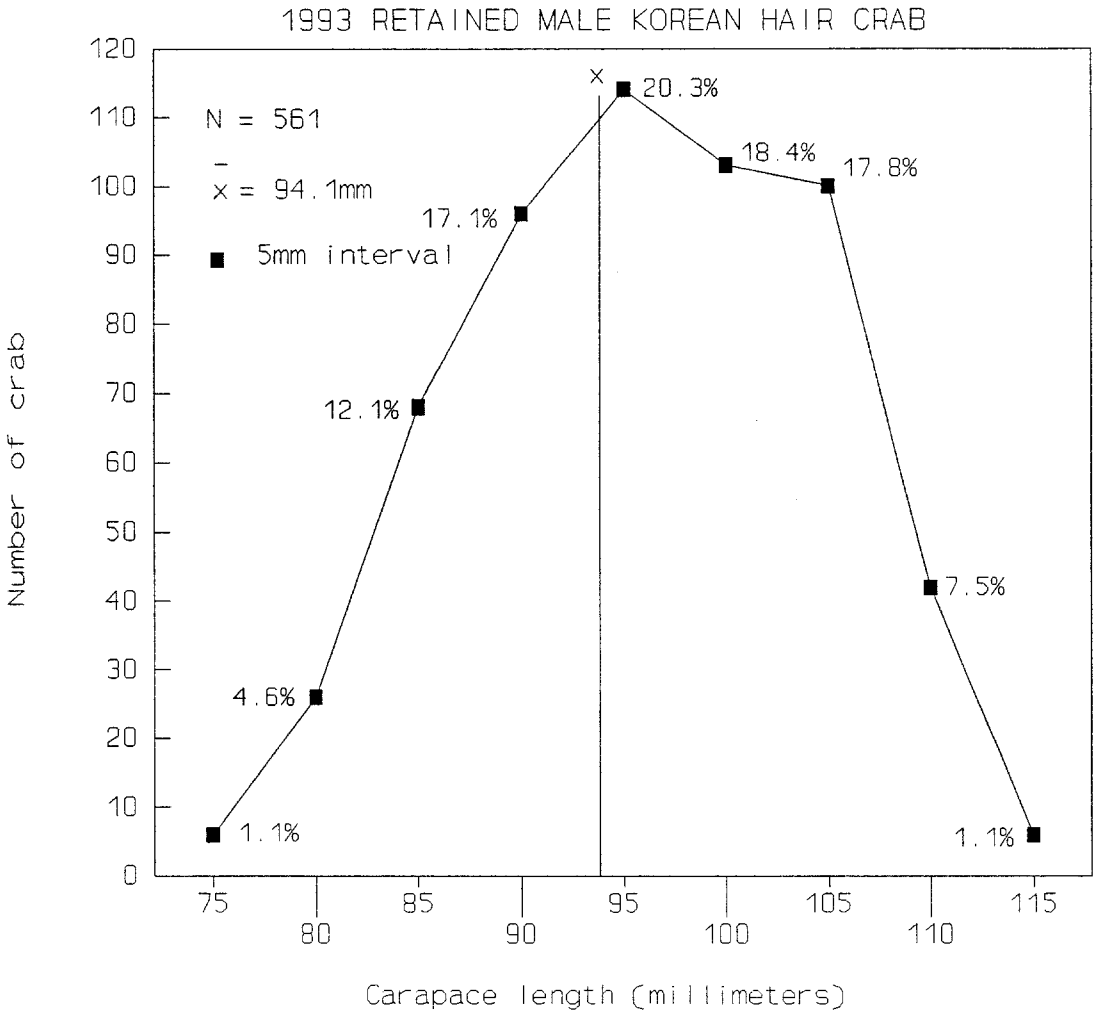

Figure 44. Commercially retained Korean hair crab length frequency statistics from the 1993 Adak fishery.

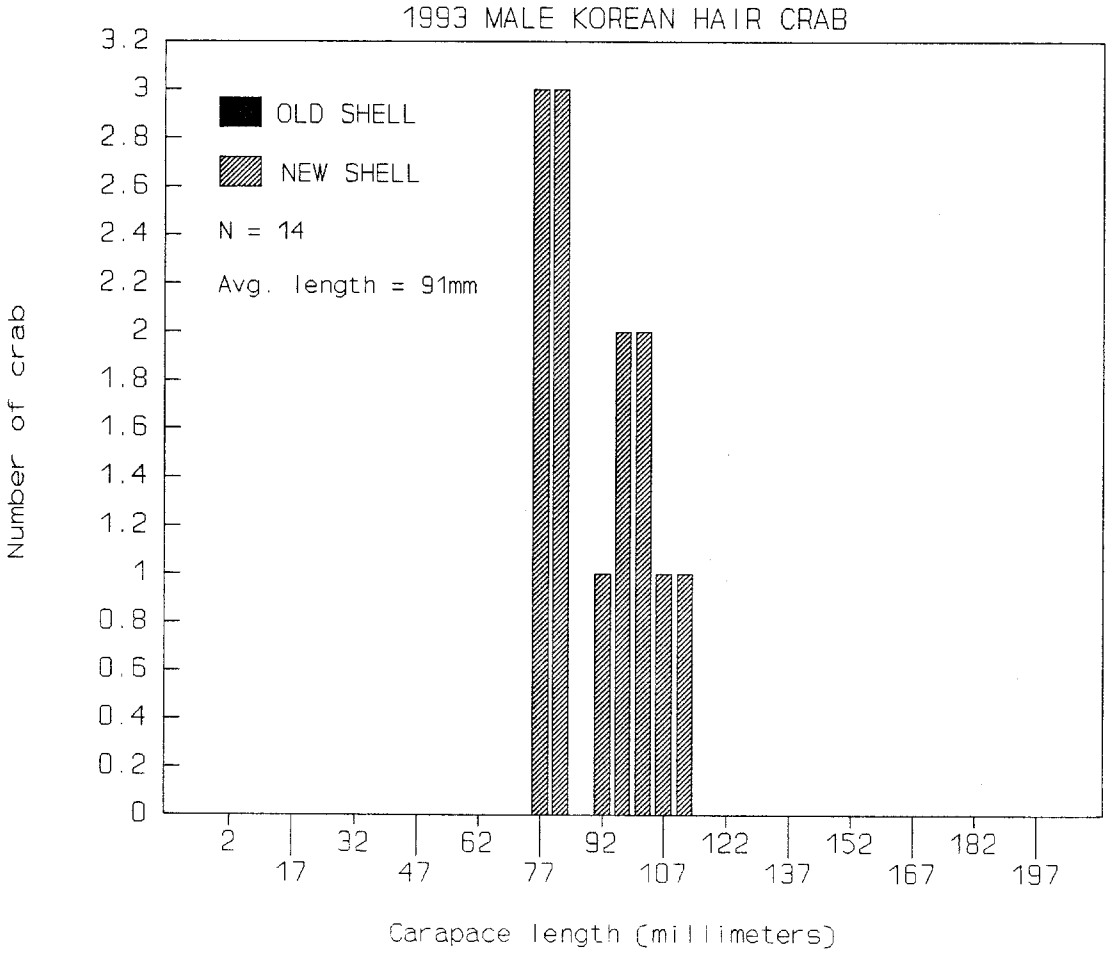

Figure 45. Carapace length distribution of all Korean hair crab males observed in the 1993 fishery.

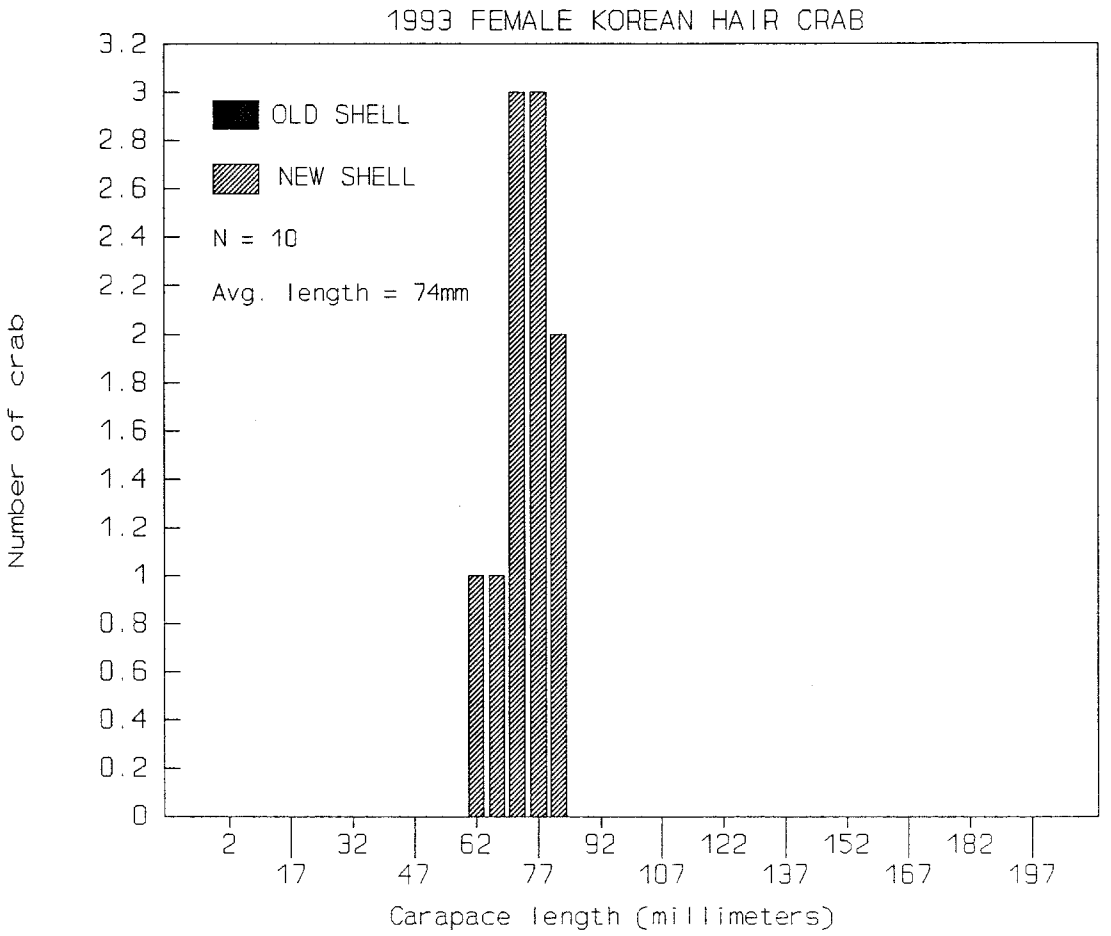

Figure 46. Carapace length distribution of female Korean hair crabs observed in the 1993 Adak fishery.

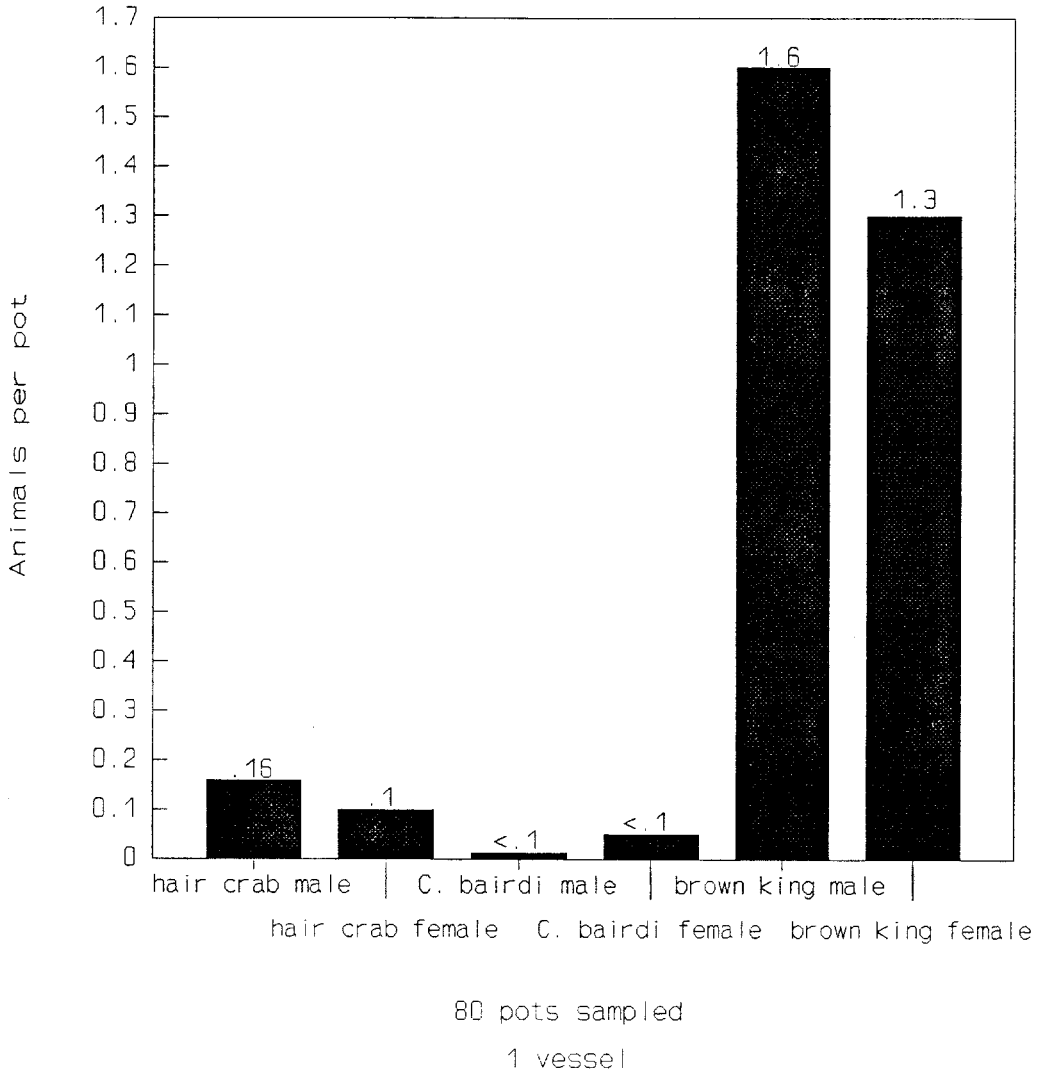

Figure 47. Catch per pot of selected species from the 1993 Adak Korean hair crab fishery.

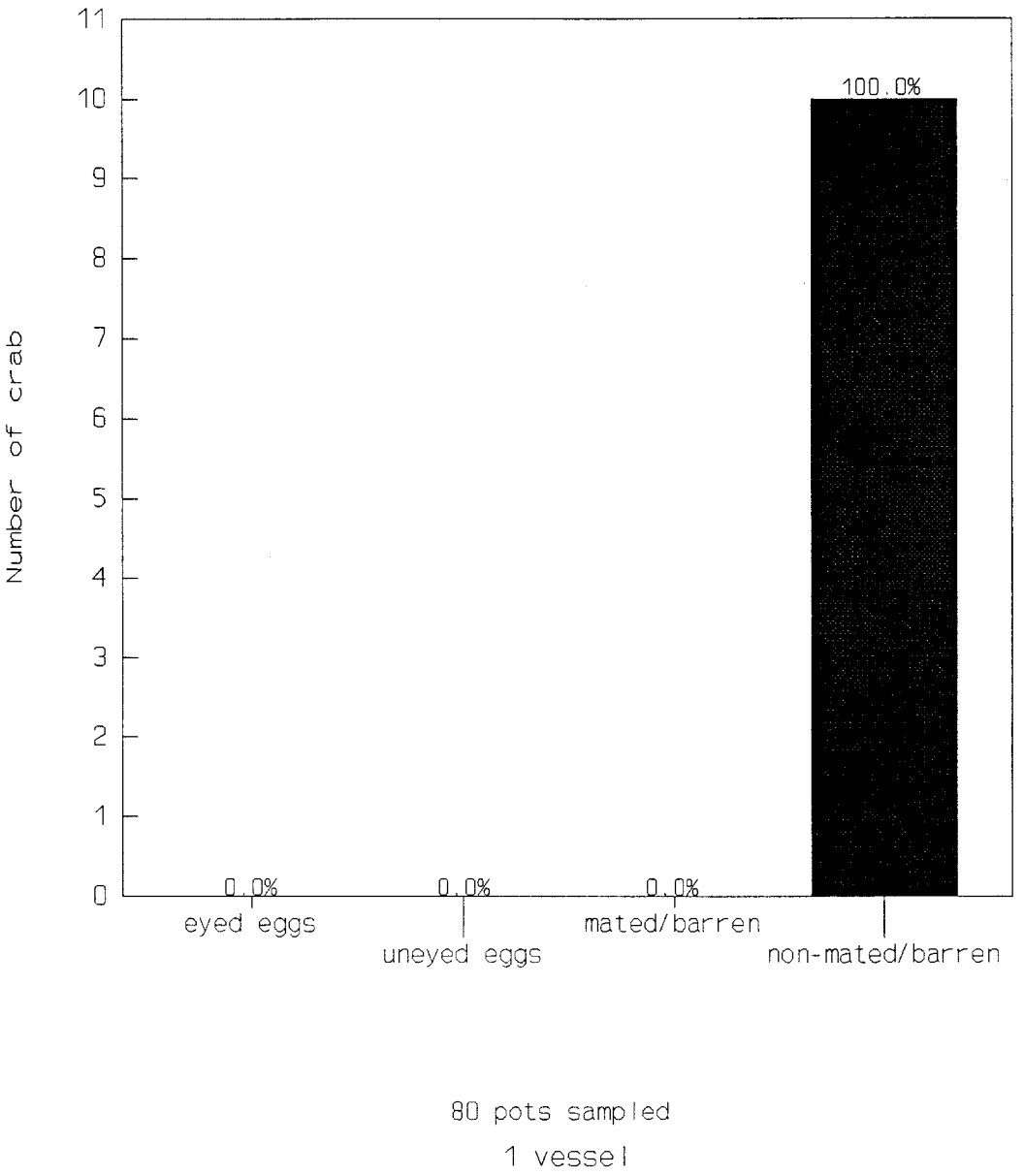

Figure 48. Reproductive state of female Korean hair crabs observed in the 1993 Adak fishery.

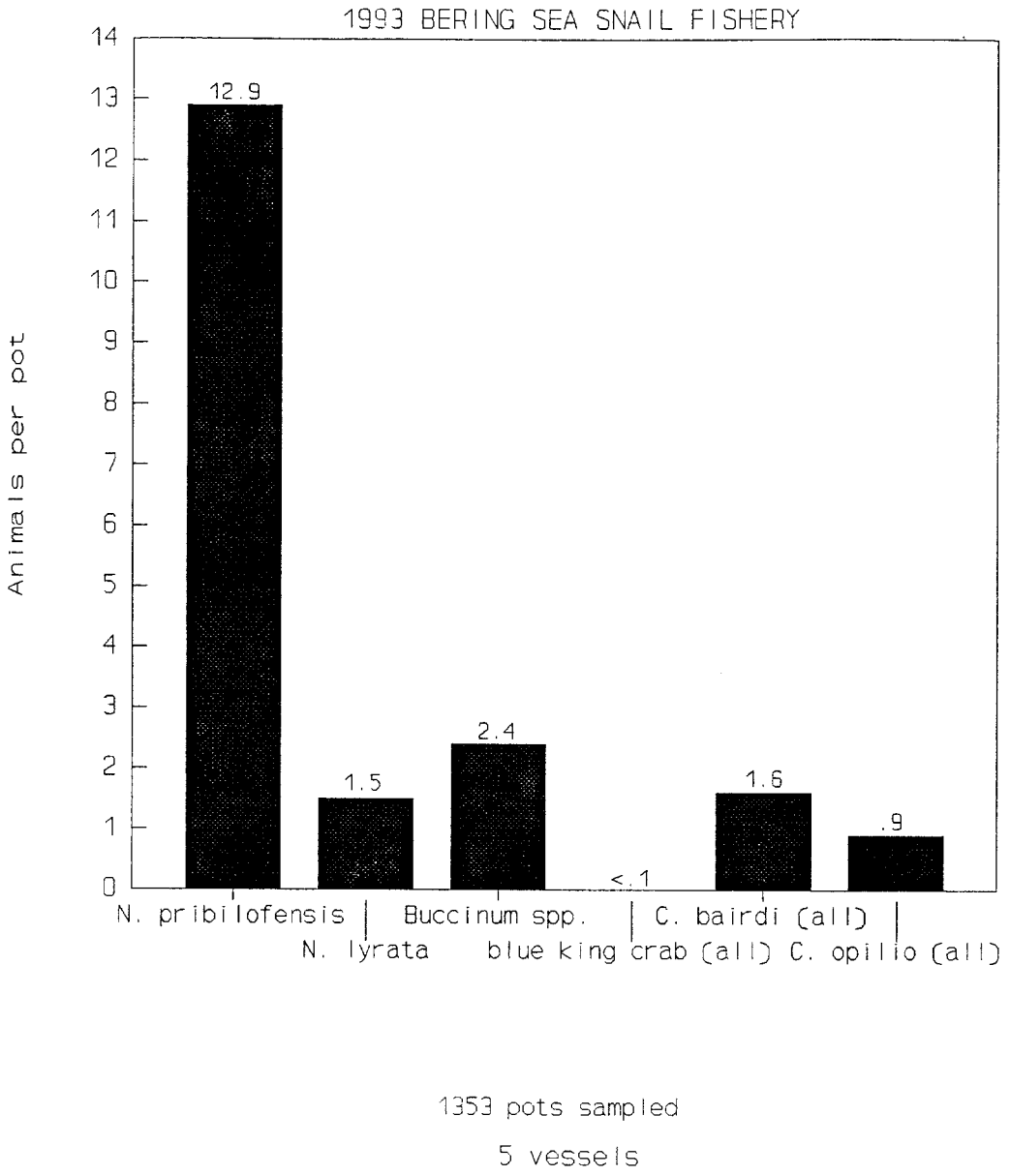

Figure 49. Catch per pot of selected species from the 1993 Bering Sea snail fishery.

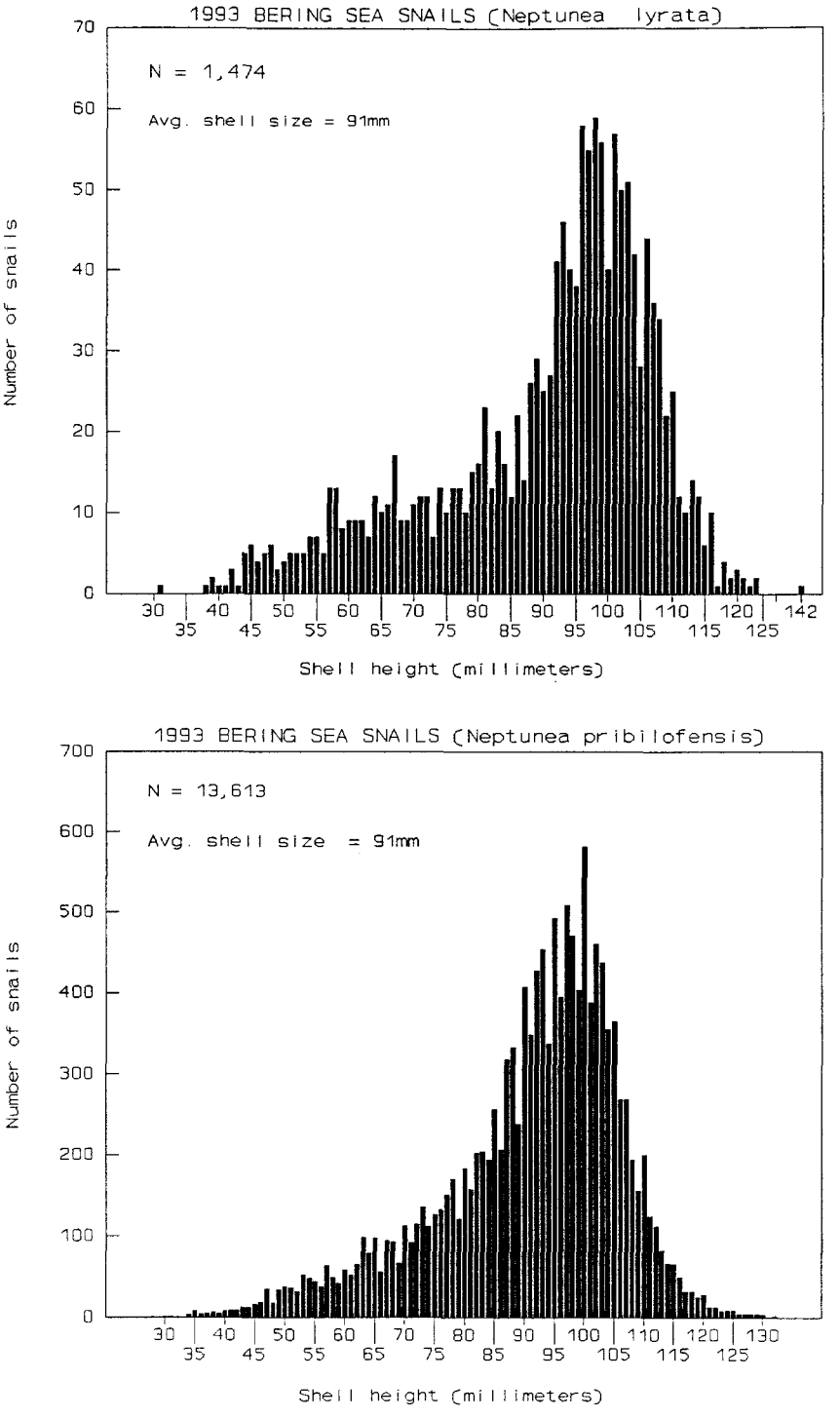

Figure 50. Shell height distributions of *Neptunea spp.* from the 1993 Bering Sea snail fishery.