

Summary and Analysis of Onboard Observer Collected Data from the 1996/97 Statewide
Commercial Weathervane Scallop Fishery

By

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Mr. Kelsey Crago mate on the C/P Pursuit presented a lecture to the scallop observer trainee class. Topics included life at sea on a scallop vessel, and insights from a vessel operators perspective.

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INTRODUCTION

Alaskan scallop populations have been evaluated for their commercial potential by both government research and private commercial exploratory cruises since the early 1950's. The Alaska commercial scallop fishery began in 1967 when 2 vessels explored the waters off Kodiak Island. In 1968, the first full year of fishing, 19 vessels (New England type scallop vessels, converted Alaskan crab vessels, salmon seiners, halibut long liners, and shrimp trawlers) entered the fishery (Kaiser 1986). Over time, the character of the fleet has changed to one consisting of highly specialized, very efficient vessels, deriving most, if not all, of their income from the weathervane scallop resource.

An influx of scallop boats from the East Coast of the United States into the weathervane scallop fishery during the early 1990's and corresponding concerns about crab bycatch in the scallop fishery prompted Alaska Department of Fish and Game Commissioner Rosier to declare the scallop fishery a high impact emerging fishery on May 21, 1993. The resulting management plan included an observer program to monitor crab bycatch as well as collect biological and fishery based information on weathervane scallops. The weathervane scallop onboard observer program has been in place for four years, beginning July 1, 1993.

Federal waters in the exclusive economic zone (EEZ) were closed to scallop fishing by emergency rule on February 23, 1995 in response to unanticipated, uncontrolled fishing for scallops in the EEZ by a vessel outside the jurisdiction of Alaska State regulations. The initial emergency rule was in effect through May 30, 1995. Prior to expiration, the initial emergency rule was extended for an additional 90 days through August 28, 1995. The emergency rule closing federal waters was intended to control an unregulated scallop fishery in federal waters until a federal fishery management plan (FMP) could be implemented. Prior to the August 28, 1995 expiration of the emergency rule, the North Pacific Management Council (NPFMC) submitted a proposed FMP which closed scallop fishing in the EEZ for up to one year, until August 28, 1996.

The final rule implementing Amendment 1 to the FMP was filed July 18, 1996 and published in the Federal Register on July 23, 1996. It became effective August 1, 1996 allowing the weathervane scallop fishery to open in federal water on that date. Scallop fishing in state waters of the Westward Region was delayed until August 1, 1996 to coincide with the opening of the EEZ to scallop fishing.

Information contained in this report is from the 1996/97 scallop fishing season (August 1, 1996 through February 15, 1997) in both state and federal (EEZ) waters in the Westward Region as well as the 1996 scallop fishing season (August 1, 1996 through December 31, 1996) in federal (EEZ) waters in Yakutat and District 16. Only federal waters were open in Yakutat and District 16 during this time period because the state water scallop quota was taken in January 1996. Both federal and state waters in Prince William Sound were closed to scallop fishing for the calendar year 1996. There are 9 scallop registration areas in Alaska (Figure 1).

METHODS

Observer Training and Data Collection Procedures

Scallop observer training was conducted at the University of Alaska, Anchorage, North Pacific Fisheries Observer Training Center. A seven day scallop observer training class was held between June 18 and June 26, 1997 for observers that had shellfish trainee permits or current groundfish certifications. A four day class was conducted simultaneously between June 23 and June 26, 1997 for observers holding current shellfish certification status. Course material included: history of the observer program and Alaska scallop fishery, scallop and crab biology and identification, shellfish regulations, vernier calipers and their use, shell aging and sexing crab, safety, finfish and invertebrate identification, forms and sampling procedures, onboard conduct, and documenting violations.

Live scallops were collected by Captain Tom Minio and the crew of the C/P Pursuit in conjunction with department personnel. The live scallops were transported by air to the observer training center for student training. This was the first training class that had an opportunity to examine live scallops in the classroom. Also for the first time since the inception of the scallop observer program, a representative from industry addressed the training class. Mr. Kelsey Crago, mate on the C/P Pursuit presented a lecture on life at sea on a scallop vessel. His insights from a vessel operator's perspective were enlightening to the class.

At-Sea Catch Sampling

Scallop observers were given detailed instructions on collection of a variety of biological data on a daily basis. The daily goal was to sample one dredge from one tow for haul (species) composition and one dredge from six different tows for crab and halibut bycatch and discarded scallop catch. In addition, procedures called for a twice daily scallop meat (adductor muscle) recovery data collection. Observers were instructed to sample the tows randomly. The decision to sample a particular tow was to be made prior to viewing its contents. Examination of the discarded scallop catch and collection of adductor muscle recovery data were added to the observer duties for the first time this season.

Haul composition sampling documented species composition by weight. Dredge contents sampled for haul (species) composition was sorted into baskets by species and weighed. Small quantities were weighed entirely, large amounts were sampled to estimate weight. To estimate the weight of retained scallops, three baskets of scallops retained by the crew were weighed and an average weight was calculated. Total weight of retained scallops per dredge was calculated by multiplying the average weight by the total number of baskets. Scallops not retained by the crew (discarded scallops) were weighed directly. Discarded and retained scallop weights were added together to obtain the total weight of scallops captured in the dredge. The protocol for large volumes of other species encountered was similar to scallops, except the average weight of three baskets was multiplied by the *estimated* volume on deck. Pacific halibut were measured to the nearest centimeter (cm) from the tip of the nose to the end of the central rays of the caudal fin. Halibut weights were determined from a length/weight conversion table. In addition to

vertebrates and invertebrates, wood, rocks, and man-made debris were collected and weighed. Man-made debris was also counted and classified as plastics, fishing gear (including line), cans, and other.

Each day six randomly selected tows were examined for crab and halibut bycatch. One dredge per tow was sampled. Observers identified, counted, and recorded the number of crab and halibut encountered as well as examining the discarded scallop catch. In addition to identifying and counting the crabs, observers were instructed to examine in detail, 100 crabs. Carapace measurements, shell age, sex, injuries and mortality were recorded for each crab. The carapace length (CL) was measured on all king and Korean horsehair crab, carapace width (CW) on all other crab species. Observers were instructed to start at one end of the bycatch pile and collect the first 100 crabs encountered, avoiding size bias. If the dredge contained more than 100 crabs the remaining crabs were counted and speciated only. All Pacific halibut encountered were measured and examined for overall body condition.

The goal was to examine the discarded scallop catch in all six crab and halibut bycatch tows sampled. After the crew sorted and removed the retained scallop catch from the dredge contents on the deck, observers were instructed to collect all remaining scallops (discarded scallop catch). One basket of discarded scallops was further subdivided into two categories, intact scallops and broken/crushed scallops. If a broken/crushed scallop shell had 50% or more of the body tissue attached to it, it was counted as one scallop. The broken/crushed sample was weighed to the nearest pound and the individuals counted. The intact sample was also weighed to the nearest pound and all individuals counted and measured. The scallop shell height (SH) was measured in a straight line distance perpendicular from the umbo to the most distant point on the outer shell margin using a vernier calipers. Any additional baskets of discarded scallops in excess of the single basket sorted into intact and broken/crushed categories were weighed to the nearest pound and recorded.

Twenty scallops from the retained catch in each of the six tows sampled for bycatch and discarded scallops were randomly selected and sampled, recording shell height, sex, and gonad development for each individual. Observers were instructed not to bias the sample by size, shape, or position of the scallop selected for sampling. Scallop sex was determined by gonad coloration; male gonads are white and female gonads are pink or orange. Scallop sex is difficult to determine in gonads without gametes due to the lack of gonad coloration. Unidentifiable sexes were assigned to an unknown category. Observers collected the dorsal (left) valve of every tenth scallop examined, as indicated by the shell sampling protocol contained in the scallop manual. A permanent black marker (sharpie brand) was used to record the haul (tow) number and corresponding shell number from the scallop size frequency form, as well as the statistical area number, vessel ADF&G number, and date on the inside of each shell. Shells were cleaned of mud, flora, and fauna, then dried and stored in muslin bags.

In addition to the shell collection from the retained catch, observers were instructed to collect 10 to 15 dorsal valves from scallops < 100 mm from each statistical area fished to confirm identification of the first and second annuli. Typically, scallopers do not retain scallops < 100 mm in SH. Therefore, this shell collection was taken from the discarded catch. Again, pertinent

collection information similar to that associated with the retained scallop shell collection was recorded on the inside of each shell.

Once per day, conditions permitting, observers were instructed to collect scallop meat (adductor muscle) recovery data. Three to five baskets (typically three) of retained scallops from a given dredge were individually weighed to the nearest one-fourth pound with a 100 pound Chatillon spring scale. For each sample a crew member from the vessel was selected to conduct the shucking. All meats from the sampled baskets were shucked into a single container and weighed to the nearest one-quarter pound using a Normark brand, 50 pound model, digital fish scale.

Data Collection Forms

All the scallop observer data collection forms, except the halibut length and condition form, were changed from those used during the 1994/1995 scallop season (Barnhart et al. 1996), and are contained in appendix A. One new form was added to collect scallop meat (adductor muscle) recovery data. To accommodate vessel operators, a column was added to the fishing log for recording the number of bushels per tow in addition to the weight of whole scallops (Appendix A.1.). The current version of the haul composition form reflects a combination of direct weights and in the case of scallops, an expanded weight of the dredge contents (Appendix A.2.). Subsample methods associated with the 1994/1995 version were deleted. The format of the bycatch and scallop discard form (Appendix A.3.) was changed from the 1994/1995 version. Additional columns to record data collected from the discarded scallop catch were added to the form. The two minor changes in the current version of the crab size and injury form (Appendix A.4.) were the addition of a species code for hair crab and the addition of a crushed category for carapace injury. Changes to the current version of the scallop size frequency form (Appendix A.6.) were the deletion of both observer aging of scallops and collection of scallop shell height measurements to the first ring, as well as condensing the five stages of gonad development into two categories, ripe or not ripe. The scallop meat recovery form (Appendix A.7.) was added beginning with the 1996/1997 season to collect unshucked and shucked scallop weights from the retained catch. Both the weekly summary form (Appendix A.8) and the observer radio report form (Appendix A.9.) are similar to those used during the 1994/1995 season except space was provided to record *C. bairdi* and *C. opilio* separately.

The fishing log was the only form completed by the vessel operator. The log contained information pertaining to fishing location, dredge width, number of dredges fished, gear performance, depth fished, time and speed of tows, and catch information on a tow by tow basis. The haul composition form was used to record the dredge catch composition by weight of all species caught including noncommercial species. It is also used to record the weight and a count of all man-made debris items caught in the dredge as well as the weight of rocks, logs etc.. The bycatch and scallop discard form was used to record the number of crab and halibut caught in sampled dredges, the number and weight of both the intact and broken/crushed scallops in the discarded scallop subsample, and the remainder of the discarded scallop catch. The bycatch and scallop discard form was used in conjunction with the crab size and injury form, the halibut length and condition form, and the scallop size frequency form. Crab recorded on the bycatch and scallop discard form are then measured, sexed, shell aged, assessed for carapace and leg injury by species, and recorded on the crab size and injury form. Halibut recorded on the bycatch

and scallop discard form are then measured and assigned one of six condition codes ranging from excellent to previously dead and recorded on the halibut length and condition form. Measured shell heights from intact scallops collected in the discarded scallop subsample were recorded on the scallop size frequency form. Shell height measurements, sex, and gonad development stages collected from the retained scallop subsample were also recorded on the scallop size frequency form but were assigned a sample type code different from that used for discarded scallops. The scallop meat (adductor muscle) recovery form was used to collect unshucked and shucked scallop weights from the retained catch. The weekly summary form was used by observers for summarizing weekly fishing activity and associated crab bycatch. The observer radio report was used to organize and encode observer data transmitted by radio or mobile satellite communications to ADF&G offices. Other forms used in the scallop observer program include an observer evaluation form completed by the vessel operator, briefing/debriefing form, observer conflict of interest form, and an office radio log form.

Scallop Aging Techniques and Analysis

All shell aging of observer collected shells is conducted by the department scallop biologist. Observer collected weathervane scallop shells were aged by counting the growth rings (annuli) on the exterior surface of the left (upper) valve. The left valve was chosen because the right valve rests on the bottom and is subject to excessive wear. The right valve also lacks the characteristic difference in shell color of summer versus winter growth, an important aspect of aging scallops. Shells collected during the 1994/1995 season have been aged. Shell aging of scallops collected from the 1996/1997 season is in progress. An analysis of the age structure of scallop populations statewide as well as the age composition of the commercial harvest is expected to be available later this year. Utilizing the Geographic Information System (GIS) in conjunction with observer collected data and scallop age and size information, the department will be able to plot distinct scallop beds and overlay each with scallop age and size composition. Appropriate management strategies can then be developed. A separate publication on shell aging techniques and analysis of data will be published at a later date.

Scallop Fishing Location Mapping

Fishing locations were determined based upon the fishing log form completed by the vessel operator. Major fishing areas were plotted by outlining the highest concentration of fishing activity within a management area. Areas with fewer than three participants remain confidential.

Crab and Halibut Bycatch Estimation

Incidental bycatch of Dungeness (*Cancer magister*), king (*Paralithodes spp.*), Tanner (*Chionoecetes bairdi*), and snow (*C. opilio*) crabs, and halibut (*Hippoglossus stenolepis*) was estimated from data collected by onboard observers. The daily goal was to randomly sample one dredge from each of six tows for bycatch per day on each vessel. However, due to constraints

such as weather and observer health, the number of sampled dredges ranged from 0 to 6 per day per vessel. The estimator used to calculate bycatch is described as:

$$(1) \quad B = \sum_{i=1}^n \sum_{j=1}^n \left[\left(\frac{C_{ij}}{t_{ij}} \right) \times (T_{ij} \times D_{ij}) \right]$$

where;

B = total bycatch for a particular species and management area;

t_{ij} = sampled dredge-hours on day_i and vessel_j;

C_{ij} = total number of crab or halibut from sampled dredges on day_i and vessel_j;

T_{ij} = total dredge hours on day_i and vessel_j;

D_{ij} = average number of dredges fished on day_i and vessel_j.

Bycatch for missing samples (vessels with missing sample days) was estimated in one of three ways depending on the size of the data set and the presence or absence of autocorrelation:

1. Missing values for small samples (less than 20 values) were estimated using the overall mean for the vessel.
2. Missing values in larger data sets (greater than 20 values) that demonstrated autocorrelation were estimated using an average of the estimate from the bounding days on either side of the missing sample.
3. Missing values in larger data sets (greater than 20 values) that did not show autocorrelation, or were unbounded (e.g. at the start of a trip), were estimated using a calculated relationship (equation 2) between the average number of captured animals and dredge time:

$$(2) \quad F_j = \frac{\sum_{i=1}^n C_{ij}}{n t_{ij}}$$

where;

F_j = average number of animals caught per dredge hour on vessel_j;

t_{ij} = sampled dredge-hours on day_i and vessel_j;

C_{ij} = total number of crab or halibut from sampled dredge on day_i and vessel_j;

n = sampled fishing days on vessel_j.

In one case the observer weighed the broken scallops, but failed to count the number of broken individuals. For this situation the overall average weight of broken scallop individuals was applied to the sample weight to estimate the number of individual broken scallops. Autocorrelation of data was inspected through the use of lag scatter plots and autocorrelation function plots (a.c.f. plots) (S+ 1995). Confidence intervals for the total bycatch in an area were calculated from bootstrapping estimates by vessel and day (Barnhart et al. 1996).

Analysis of the Discarded Scallop Catch

The daily goal on each vessel was to sample the discarded scallop catch in all six dredges examined for crab and halibut bycatch.

The number of intact and broken scallops in the sampled dredge was estimated by using the relationship between the weight and count of individuals from the sampled basket and applying this proportion to the weight of the remainder:

$$(3) \quad A_{ij} = \frac{I_{ij}}{W_{ij}} \times (R_{ij} + W_{ij})$$

$$(4) \quad M_{ij} = \frac{G_{ij}}{W_{ij}} \times (R_{ij} + W_{ij})$$

where;

A_{ij} = weight of intact scallops in sampled dredges on day_i and vessel_j;

M_{ij} = weight of broken scallops in sampled dredges on day_i and vessel_j;

I_{ij} = sample weight of intact scallops from the subsampled dredges on day_i and vessel_j;

G_{ij} = sample weight of broken scallops from the subsample dredges on day_i and vessel_j;

$W_{ij} = (I + G)$; total sample weight of subsample dredges on day_i and vessel_j;

R_{ij} = weight of remaining unsorted scallops from sampled dredges on day_i and vessel_j.

Weights were converted to numbers of individuals using the average weight, and the following equations:

$$(5) \quad J_{ij} = \frac{I_{ij}}{X_{ij}} \quad (7) \quad Z_{ij} = \frac{A_{ij}}{J_{ij}}$$

$$(6) \quad L_{ij} = \frac{G_{ij}}{Y_{ij}} \quad (8) \quad Q_{ij} = \frac{M_{ij}}{L_{ij}}$$

where;

J_{ij} = average weight of intact scallops on day_i and vessel_j;

X_{ij} = count of intact scallops in subsample on day_i and vessel_j;

Z_{ij} = number of intact scallops in sampled dredges on day_i and vessel_j;

L_{ij} = average weight of broken scallops on day_i and vessel_j;

Y_{ij} = count of broken scallops in subsample on day_i and vessel_j;

Q_{ij} = number of broken scallops in sampled dredges on day_i and vessel_j;

Total scallop discard weight and number was estimated using a modified equation (1):

$$(9) \quad B = \sum_{i=1}^n \sum_{j=1}^n \left[\left(\frac{C_{ij}}{t_{ij}} \right) \times (T_{ij} \times D_{ij}) \right]$$

where:

B = total bycatch for a particular species and area;

t_{ij} = sampled dredge-hours on day_i and vessel_j;

c_{ij} = number of intact scallops (Z) or number of broken scallops (Q) from sampled dredges on day_i and vessel_j;

T_{ij} = total dredge hours on day_i and vessel_j;

D_{ij} = average number of dredges fished on day_i and vessel_j.

Confidence intervals for the number of scallop discards were calculated from a bootstrapping procedure similar to the one used for the crab bycatch (Efron and Tibishirani 1993). Frequency histograms of discarded intact scallops were generated from the sampled intact discards.

Average Weight of Intact and Broken Scallops

The overall average weight for intact and broken scallops for each area was calculated as:

$$(10) \quad E = \frac{\sum_{i=1}^n \sum_{j=1}^n J_{ij}}{n}$$

$$(11) \quad S = \frac{\sum_{i=1}^n \sum_{j=1}^n L_{ij}}{n}$$

where;

E = average weight of intact scallops in an area;

S = average weight of broken scallops in an area;

n = number of sampled days in area.

Sex Composition and Frequency Distributions of the Retained Scallop Catch

Length frequency histograms for the retained catch were generated for males, females, and a combined category that included males, females, and unknowns. Frequency distributions were generated by creating 5 mm incremented size bins and apportioning the samples. Percent sex composition from each area was then determined from the samples by dividing the number encountered for a particular sex by the total number sampled.

Scallop Meat (Adductor Muscle) Recovery

Meat recovery for one haul was calculated by dividing the shucked scallop meat weight by the sum of the weights of the unshucked baskets of scallops:

$$(12) \quad H_j = \frac{w}{\sum_{i=1}^n a_i}$$

where;

H = meat recovery in one haul for a particular vessel_j;

a_i = weight of unshucked basket_i of scallops;

w = weight of basket of shucked scallop meats;

n = number of baskets sampled (3, 4, or 5).

Meat recovery by area was then calculated by taking the average meat recovery by haul for all boats in a particular area:

$$(13) \quad m_k = \frac{\sum_{j=1}^n H_j}{n_k}$$

where;

m_k = meat recovery for an area_k;

n_k = the number of sampled hauls for all boats in area_k.

Area Dredged

Area dredged was calculated from skipper log information using reported fishing duration (minutes), average speed (knots), and dredge width (feet), and the following expression:

$$(14) \quad D = S * T/60$$

where;

D = distance in nautical miles;

S = speed in knots;

T = time in minutes.

Area was then calculated by multiplying distance by the width of the dredge (converted to nautical miles).

RESULTS

Seven different observers were deployed aboard five different vessels during the 1996/97 statewide scallop season. Observer coverage was 100%. Vessel days totaled 466, given that vessel days include all days from observer briefing through debriefing, including weather and travel days. Scallop fishing occurred on 351 of the 460 vessel days. A total of 317 days of fishing were observed (an observed day is a day with at least one sampled tow), from the 351 days on which fishing occurred. Vessel operators recorded 5,856 hauls on their logs, of which approximately 30% were sampled by observers. Over 118,000 scallops and 19,000 Tanner crabs were measured. A total of 32 separate briefings and debriefings, not including mid-trip debriefs, were conducted statewide and included 8 for Yakutat (Area D), 18 for Kodiak (Area K), 4 for the Alaska Peninsula (Area M), and 2 for the Bering Sea (Area Q).

The highly mobile scallop fleet fished 37 different statistical areas statewide extending from the Bering Sea to Yakutat. Figure 2 shows where the majority of fishing occurred in the Kodiak and Yakutat Areas during the 1996\97 scallop fishery.

Commercial Scallop Fishery

Catch and Effort

Total scallop dredging effort by the observed fleet was 22,575 tow-hours per dredge, where a tow-hour is expressed as one dredge towed for 60 minutes (Figure 3). The highest amount of effort occurred in the Kodiak Area with 10,123 tow-hours and combined 1,143 tow-hours from the Northeast District, 6,982 tow-hours from the Shelikof district, and 1,998 tow-hours from the Semidi District. The second highest effort level was recorded in the Yakutat Area with 7,178 tow-hours and combined 1,500 tow-hours from District 16 and 5,678 tow-hours from Yakutat. This was followed by 4,626 tow-hours from the Bering Sea Area and 648 tow-hours from the Alaska Peninsula Area.

Total round weight of retained scallops as reported in vessel fishing logs was 6,575,525 pounds (Figure 4). The Yakutat Area accounted for the largest amount at 2,699,476 pounds and included 336,978 pounds from District 16 and 2,362,498 pounds from Yakutat. The second highest catch was reported from the Kodiak Area with 2,313,654 pounds and combined 147,269 from the Northeast District, 1,878,268 from the Shelikof District, and 288,117 from the Semidi Area. The Bering Sea Area ranked third with 1,432,160 pounds followed by the Alaska Peninsula Area with 130,235.

Shucked meat weights as reported on fish tickets totaled 642,796 pounds. The Kodiak Area harvest of 268,545 pounds was the largest reported harvest in the state and included 11,430 pounds from the Northeast District, 219,305 pounds from the Shelikof District, and 37,810 pounds from the Semidi District. The Yakutat Area harvest of 211,396 pounds was the second highest reported catch and included 185,426 pounds from the Yakutat Area and 25,970 pounds

from District 16. The Bering Sea Area harvest was 150,295 pounds and the Alaska Peninsula Area accounted for 12,560 Pounds.

Scallop catch-per-unit-effort (CPUE), expressed as the round weight of retained scallops per tow-hour per dredge, was highest in Yakutat at 416. Yakutat with its CPUE of 416 combined with a CPUE of 225 from District 16 yielded a combined CPUE for the Yakutat Area of 376 (Figure 5). CPUE in the Bering Sea Area ranked second at 310 pounds/tow-hour/dredge. CPUE in Kodiak Area placed third at 229 pounds/tow-hour/dredge and combined a CPUE of 129 from the Northeast District, 269 from the Shelikof District, and 144 from the Semidi District. The Alaska Peninsula Area had the lowest CPUE at 201 pounds/tow-hour/dredge.

Area dredged, expressed as both tow miles and square miles, was highest in the Kodiak Area with 12,438 tow miles covering 60 square miles (Table 1). The Yakutat Area ranked second with 8,294 tow miles covering 41 square miles. The Bering Sea Area placed third with 5,769 tow-miles covering 28 square miles, while in the Alaska Peninsula 807 tow miles occurred covering 4 square miles.

The average depth fished during the 1996/97 fishing season was 48 fathoms and ranged from a minimum of 18 fathoms in the Semidi District of the Kodiak Area to a maximum of 96 fathoms in District 16 of the Yakutat Area (Table 2). The average depth fished was very similar in the Northeast District of the Kodiak Area, Alaska Peninsula, and Bering Sea Area with average depths of 59, 57, and 56 fathoms respectively. The average depth fished in the Semidi District of the Kodiak Area was slightly less at 52 fathoms. In the Yakutat Area and the Shelikof District of the Kodiak Area the average depth fished was the least at 39 and 37 fathoms respectively.

Discarded Scallop Catch

Observers counted and weighed a large number of discarded scallops; over 93,000 intact and 58,000 broken discarded scallops were sampled during the 1996/97 fishing season (Table 3). Estimates of the statewide discarded scallop catch based on observer samples show the combined intact shell and broken shell discard to be 2,728,333 individual scallops with a combined weight of 690,863 pounds (Table 4). Broken scallops accounted for 1,025,734 individuals with a weight of 310,680 pounds while intact scallops numbered 1,702,599 individuals with a weight of 380,183 pounds.

The combined Yakutat Area accounted for 66% of the statewide discarded scallop weight. It included District 16 with 23% of the discarded weight and Yakutat with 43% of the discarded weight. The Kodiak Area contributed a significant amount to the statewide discarded scallop catch with 31% of the discarded weight. The majority of the discarded scallop weight in the Kodiak Area (28.5%), was from the Shelikof District. The Bering Sea Area accounted for 2.3% of the statewide discarded weight followed by the Alaska Peninsula with 1.1% of the discarded weight.

The average weight of discarded scallops (intact and broken scallops combined) was the lowest (0.21 pounds) in the Alaska Peninsula Area and highest (0.50 pounds) in the Semidi District of the Kodiak Area (Table 5). The weight of the broken scallop component ranged from 0.26

pounds in the Alaska Peninsula Area to 0.54 pounds in the Semidi District of the Kodiak Area. Likewise intact scallop discard weights ranged from 0.15 pounds in the Alaska Peninsula Area to 0.46 pounds in the Semidi District of Kodiak.

Average shell heights of intact discarded scallops ranged from a low of 87.9 mm in the Alaska Peninsula to a high of 120.8 mm in the Semidi District of the Kodiak Area (Figures 6 - 12). Scallops over 100 -110 mm SH are typically targeted for retention in the commercial fishery.

Retained Scallop Catch

Observers measured and sexed over 29,000 scallops from the retained catch. Table 6 contains sex composition and mean shell height data by management area. Some caution should be used interpreting the sex composition data due to the high numbers of scallops in the undetermined sex category. Generally throughout the state there were more males than females identified in the retained scallop samples. The exceptions occurred in the Semidi District of Kodiak and the Alaska Peninsula Area where there were slightly more females than males identified in the samples.

Scallop shell height (SH), as a measurement of scallop size, varied statewide by area as shown in Figures 13 - 26. The average SH of retained scallops ranged from 153.7 mm in the Semidi District of Kodiak to 122.8 mm in the Yakutat Area. Some of the largest differences in shell heights by sex occurred in the Bering Sea Area (Figure 16), District 16 (Figure 22), Alaska Peninsula Area (Figure 24), and the Yakutat Area (Figure 26).

Adductor muscle (meat) recovery from the commercial catch was highest in the Shelikof and Semidi Districts of the Kodiak Area at 12 % (Table 7). Yakutat and District 16 had the lowest percentage meat recovery at 9%. The Northeast District of Kodiak and the Bering Sea both yielded 10% recovery. The Alaska Peninsula had 11% meat recovery.

Scallop Fishery Bycatch

A variety of marine vertebrates, invertebrates, and debris (rocks, kelp, empty shells, etc.) are caught incidentally in scallop dredges however, weathervane scallops predominate catches (Table 8). In the Bering Sea, weathervane scallops comprised the largest percentage of the catch by weight at 87.5% in contrast to the Semidi District of the Kodiak Area where weathervane scallops comprised only 51.8% of the catch by weight. In the Yakutat Area (combined Yakutat and District 16) the percentage of scallops by weight in the catch was 84.7%, similar to the Bering Sea. Both the Shelikof District of Kodiak and the Alaska Peninsula Area had catch compositions of over 70% scallops by weight. The Northeast District ranked only slightly higher than the Semidi District with 54.1% scallops by weight in the catch.

Prohibited species, other commercial species, and miscellaneous noncommercial species and items (including kelp, rocks, man-made debris, etc.) caught incidentally in scallop dredges varied widely by geographic area. The three most frequently caught species or items in Yakutat were starfish (4.5%), empty weathervane shells (3.7%), and skates (1.9%). The three most frequently

caught species or items, by District, in the Kodiak Area were: Northeast District, starfish (32.4%), skates (4.9%), and empty weathervane shells (1.8%); Shelikof District, kelp, rocks, etc. (6.5%), empty weathervane shells (5.5%), and skates (3.1%); Semidi District, starfish (15.7%), kelp, rocks, etc. (9.0%), and empty weathervane shells (8.0%). In the Alaska Peninsula Area starfish accounted for 11.4% of the catch followed by arrowtooth flounder at 4.8% and basket stars at 4.6%. In the Bering Sea snow crab accounted for 3.7% of the catch followed by empty weathervane shells (2.1%), and skates at 1.0%.

Lists of the twenty most frequently caught species by weight by geographic area can be found in Tables 9 -14. In the Semidi District of Kodiak nontarget commercial species accounted for 10.5% of the twenty most frequently caught species (Table 9), followed by the Northeast District with 9.7% (Table 10), Alaska Peninsula 8.6% (Table 11), Bering Sea at 8.0% (Table 12), Shelikof District of Kodiak at 4.9% (Table 13), and the Yakutat Area at 3.9% (Table 14).

Crab Bycatch Estimates

The highest estimated bycatch of Tanner crabs occurred in the Bering Sea with 106,935 *C. opilio* and 16,642 *C. bairdi* taken as bycatch (Table 15). The second highest estimated bycatch of Tanner crabs occurred in the Northeast District of the Kodiak Area where 27,722 *C. bairdi* were taken as bycatch. The Alaska Peninsula Area ranked third with an estimated bycatch of 19,045 *C. bairdi* followed by the Shelikof District of Kodiak with 11,285 *C. bairdi*. The Semidi District had an estimated bycatch of 8,902 *C. bairdi* Tanner crabs followed by Yakutat with 6,872 *C. bairdi*, and District 16 with 669 *C. bairdi*.

The only area in the state where king crab were taken in the scallop fishery was in the Semidi District of Kodiak where 9 king crab were observed in the bycatch. Because only a few king crab are caught on a very infrequent basis, standard estimating procedures are not employed. As a condition of the vessel registration the vessel operator and crew are required to show every king crab caught to the observer for sampling. Failure to do so can result in revocation of the permit.

Incidental Dungeness crab bycatch was highest in the Semidi District of Kodiak where 4,554 crabs were taken as bycatch. The Shelikof District ranked second with 1,008 Dungeness taken as incidental bycatch. Yakutat, Alaska Peninsula, and District 16 had small amounts of incidental bycatch with 38, 10, and 9 crabs respectively. No Dungeness were caught in the Bering Sea or Northeast District of Kodiak.

Tanner Crab Bycatch Mortality. *C. bairdi* Tanner crab mortality observed on deck in the scallop fishery varied from a low of 12.6% in the Bering Sea to a high of 58.9% in Yakutat (Table 16). In the Bering Sea, *C. opilio* mortality at 16.2% was slightly higher than the *C. bairdi* mortality of 12.6%. The overall statewide mortality rate for Tanner crabs was estimated to be 28.9%.

Size Distribution of Tanner Crab Bycatch. Tanner crab bycatch in the Yakutat Area (District 16 and Yakutat combined) was an estimated 7,541 crabs of which 850 were measured and sexed (Figure 27). Observer bycatch samples were predominated by small, immature male and female

Tanner crab which measured less than 30 mm CW and comprised 82% of the total number of crabs measured. The average size of the 449 males measured was 26 mm CW, with a range of 11 mm to 71 mm CW. Males ≤ 30 mm CW comprised 81% of the sampled males. No legal sized (≥ 140 mm CW) Tanners were sampled. The average size of the 401 females measured was 26 mm CW, with a range of 11 mm to 58 mm CW. Females ≤ 30 mm CW comprised 82% of the sampled females.

Tanner crab bycatch in the Northeast District of the Kodiak Area was estimated to be 27,722 crabs of which 2,582 were measured and sexed (Figure 28). Observer bycatch samples were dominated by small, immature male and female Tanner crab. The average size of the 1,273 males measured was 49 mm CW, with a range of 12 mm to 97 mm CW. Males between 30 mm and 70 mm CW comprised 96% of the sampled males. No legal sized (≥ 140 mm CW) Tanners were sampled. The average size of the 1,309 females measured was 46 mm CW, with a range of 13 mm to 96 mm CW. Females between 30 mm and 70 mm CW comprised 97% of the sampled females. The average size of all sampled crab, males and females combined, was 47 mm CW.

Tanner crab bycatch in the Shelikof District of the Kodiak Area was estimated to be 11,285 crabs of which 1,395 were measured and sexed (Figure 29). Observer bycatch samples show a bimodal distribution of both male and female Tanner crabs. Considering the male sample, Tanners between 10 mm and 60 mm CW comprised 80% of the sample, while those between 100 mm and 152 mm CW comprised 19% of the sample. The average size of the 596 males measured was 53 mm CW, with a range of 10 mm to 176 mm CW. Assuming males become sexually mature at 113 mm CW, 16% of the males were sexually mature. The sample contained 26 Males (4.4%) ≥ 140 mm CW (legal size). Forty-four percent of the sampled females were between 10 mm and 60 mm CW while those between 70 mm and 112 mm comprised 54% of the sample. The average size of the 799 females measured was 66 mm CW, with a range of 10 mm to 123 mm CW. Forty-five percent of the sampled females were sexually mature, assuming females mature at 83 mm CW. The average size of all sampled crab, males and females combined, was 60 mm CW.

Estimated Tanner crab bycatch in the Semidi District of the Kodiak Area was 8,902 crabs of which 883 were measured and sexed (Figure 30). Observer bycatch samples show a bimodal distribution of both male and female Tanner crabs. Considering the male sample, Tanners between 16 mm and 62 mm CW comprised 32% of the sample, while those between 67 mm and 151 mm CW comprised 68% of the sample. The average size of the 413 males measured was 89 mm CW, with a range of 16 mm to 151 mm CW. Assuming males become sexually mature at 113 mm CW, 37% of the males were sexually mature. The sample contained 26 males (6.3%) ≥ 140 mm CW (legal size). Considering the female component, Tanners between 21 mm and 62 mm CW comprised 26% of the sample, while those between 68 mm and 117 mm CW comprised 74% of the sample. The average size of the 470 females measured was 77 mm CW, with a range of 21 mm to 117 mm CW. Sixty-five percent of the sampled females were sexually mature, assuming females mature at 83 mm CW. The average size of all sampled crab, males and females combined, was 83 mm CW.

Estimated Tanner crab bycatch in the Alaska Peninsula Area was 19,045 crabs of which 1,917 were measured and sexed (Figure 31). Observer bycatch samples were predominated by small,

immature male and female Tanner crab ≤ 60 mm CW. Males ≤ 60 mm CW comprised 95% of the sampled males. The average size of the 902 measured males was 28 mm CW, with a range of 6 mm to 135 mm CW. Two males (0.2%) were both sexually mature (≥ 113 mm CW) and legal sized (≥ 140 mm CW). Females ≤ 60 mm CW comprised 95% of the sampled females. The average size of the 1,015 females measured was 29 mm CW, with a range of 7 mm to 95 mm CW. Seven females (0.7%) were sexually mature (≥ 83 mm CW). The average size of all sampled crab, males and females combined, was 28 mm CW.

Estimated *C. bairdi* Tanner crab bycatch in the Bering Sea Area was 16,642 crabs of which 1,689 were measured and sexed (Figure 32). Observer bycatch samples were composed of predominately mature crab of both sexes. The average size of the 680 measured males was 124 mm CW, with a range of 42 mm to 170 mm CW. Males ≥ 113 mm CW (sexually mature) accounted for 82% of the sampled males. Males ≥ 140 mm CW (legal size) accounted for 10% of the sampled males. The average size of the 1,009 measured females was 91 mm CW, with a range of 28 mm to 117 mm CW. Females ≥ 83 mm CW (sexually mature) accounted for 84% of the females sampled. Of all females sampled, 99% were in the size range of 70 mm to 110 mm CW. The average size of all sampled crab, males and females combined, was 104 mm CW, with a range of 28 to 170 mm CW.

The *C. opilio*, (snow crab) bycatch estimate in the Bering Sea Area was 106,935 crabs of which 11,631 were measured and sexed (Figure 33). Observer bycatch samples were dominated by mature crabs of both sexes. The average size of the 10,542 measured males was 84 mm CW, with a range of 51 mm to 154 mm CW. Sexually mature males (≥ 77 mm CW) comprised 60% of the male sample. The average size of the 1,089 females measured was 68 mm CW, with a range of 52 mm to 108 mm CW. Assuming females are sexually mature at 50 mm CW, 100% of the sampled females were sexually mature. Most of the female sample (94.5%) occurred between 52 mm and 80 mm CW. The average size of all sampled crab, males and females combined, was 83 mm CW.

Tanner Crab Bycatch Relative to the Commercial Scallop Fishery. The number of Tanner crabs caught per pound of retained scallop meats was the highest in the Northeast District of the Kodiak Area at 2.43 Tanner crab caught for every pound of scallop meats retained (Figure 34). In the Alaska Peninsula Area 1.52 Tanner crabs were caught for every pound of scallops meats retained. In the Bering Sea Area, less than 1 crab (.82) was caught for every pound of scallop meats retained. The Shelikof District of the Kodiak Area, Yakutat and District 16 exhibited very small quantities of Tanner crab caught per pound of retained scallop meats at 0.05, 0.04, and 0.03 respectively.

Halibut Bycatch Estimates and Release Conditions

Estimated Pacific halibut bycatch ranged from a high of 440 individuals in the Shelikof District of the Kodiak Area, to 25 individuals in the Alaska Peninsula Area.

The number of halibut observed in sampled hauls totaled 127, and ranged from 55 in the Shelikof District of Kodiak to 3 in the Alaska Peninsula (Table 17). Of the 130 halibut observed in sampled tows, 45 (35%) were released in excellent condition, 25 (20%) were released in good

condition, 20 (16%) were released in fair condition, 24 (19%) were released in poor condition, 10 (8%) were released dead, and 3 (2%) were previously dead, obviously not killed in the current haul.

SUMMARY

A summary of the 1996/97 statewide weathervane scallop fishing season is presented in Table 18. Statewide, 317 days of fishing were observed. The reported scallop harvest was 6,575,525 pounds (whole weight) or 642,796 pounds of shucked meats, from a total of 22,574 tow-hours per dredge. CPUE ranged from a low of 129 pounds in the Northeast District of the Kodiak Area to a high of 416 pounds in Yakutat. Estimated bycatch of Tanner crabs totaled 198,072 individuals, and ranged from a low of 669 in District 16 to a high of 123,577 in the Bering Sea. Bycatch of halibut totaled 1,088 individuals, and ranged from a low of 25 in the Alaska Peninsula to a high of 440 in the Shelikof District of the Kodiak Area.

Statewide commercial fishery statistics and observer data from the 1993/94 through the 1996/97 seasons are summarized for District 16, Yakutat, and Prince William Sound (Table 19), the Kodiak Area (Table 20), and the Alaska Peninsula, Bering Sea, and Dutch Harbor Areas (Table 21). The tables include information on season dates, effort levels, crab bycatch limits, bycatch estimates, Tanner crab mortality, scallop harvest, percent meat (adductor muscle) recovery, estimated number and weight of the discarded scallop catch, and average size of the retained scallop catch. Notably, statewide fishing effort, as shown by the number of vessels participating and the number of days fished, has decreased following the 17.5 month scallop fishing closure in the EEZ, which extended from February 23, 1995 through July 31, 1996. Tanner crab bycatch composition in the Bering Sea has changed dramatically since 1993. During the 1993/94 and 1994/95 fishery *C. opilio* comprised 5% and 7% respectively of the total Tanner bycatch. When the 1996/97 season opened in August 1996, initial bycatch sampling indicated *C. opilio* comprised the majority of the Tanner bycatch. The trend continued for the entire 1996/97 season. Season totals show *C. opilio* comprised 87% of the Tanner bycatch composition.

The focus of the onboard scallop observer program is two-fold. One is to monitor bycatch, and the second is to collect biological and commercial fishing information relating to the weathervane scallop. Onboard sampling is designed to answer questions necessary for the successful management of the resource. Efforts are underway to use commercial fishing information collected through the observer program to estimate scallop abundance using a fishery based stock assessment model. Aging of scallop shells collected by observers is expected to increase the understanding of age structure and population dynamics. Other data is collected to define the reproductive period, define the time period of highest quality and quantity of product, gain insights into scallop recruitment and maturity, and map scallop bed locations.

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Table 1. Bottom area dredged during the 1996/97 fishing season.

MANAGMENT AREA	AREA DREDGED	
	Tow Miles ^a	Square Miles ^b
Yakutat	6,862	34
District 16	1,432	7
Yakutat Total	8,294	41
Kodiak, Northeast District	1,465	7
Kodiak Shelikof District	8,424	41
Kodiak Semidi District	2,549	12
Kodiak Total	12,438	60
Alaska Peninsula	807	4
Bering Sea	5,769	28
TOTAL	27,308	133

^aTow mile is calculated as speed x duration, regardless of the number of dredges towed.

^bCalculated in nautical miles.

Table 2. Minimum, maximum, and average depth fished during the 1996/97 fishing season.

MANAGEMENT AREA	DEPTH ^a		
	Minimum	Maximum	Average
Yakutat	25	75	37
District 16	29	96	40
Yakutat Average	27	86	39
Kodiak, Northeast District	40	80	59
Kodiak, Shelikof District	22	85	37
Kodiak, Semidi District	18	84	52
Kodiak Average	27	83	49
Alaska Peninsula	42	68	57
Bering Sea	52	61	56
AVERAGE	33	78	48

^aDepth in fathoms.

Table 3. Number and weight of discarded scallops as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallop ^a	
	Intact	Broken	Intact	Broken
Yakutat	35,697	19,595	8,376	7,212
District 16	19,239	2,684	4,031	735
Yakutat Total	54,936	22,279	12,407	7,947
Kodiak, Northeast District	908	982	228	493
Kodiak, Shelikof District	34,398	29,337	7,722	9,314
Kodiak, Semidi District	254	974	126	531
Kodiak Total	35,560	31,293	8,076	10,338
Alaska Peninsula	1,858	2,546	281	711
Bering Sea	1,397	2,174	588	1,097
Total	93,751	58,292	21,352	20,093

^aWeight in pounds.

Table 4. Estimated number and weight of intact and broken scallops in the discarded scallop catch during the 1996/97 scallop fishery.

Management Area	Intact Number		Intact Weight		Broken Number		Broken Weight		Total Number Intact+broken	Total Weight Intact+broken
	Mean	95% CI								
Yakutat	654,403	545,806-772,828	152,144	127,471-179,519	512,019	432,103-597,075	143,789	122,602-166,680	1,166,422	295,933
District 16	594,598	465,351-716,840	124,860	98,939-150,282	112,638	82,188-148,605	35,039	23,600-49,970	707,236	159,899
Yakutat Total	1,249,001		277,004		624,657		178,828		1,873,658	455,832
Kodiak										
Northeast District	9,404	5,921-13,683	2,307	1,339-3,412	12,672	7,728-19,940	6,048	3,767-9,091	22,076	8,355
Shelikof District	412,477	312,151-531,298	91,600	69,853-114,774	340,815	265,836-424,079	105,574	29,444-85,174	753,292	197,174
Semidi District	2,477	1,343-3,772	1,245	637-1,957	8,734	7,263-10,185	4,755	3,930-5,549	11,211	8,000
Kodiak Total	424,358		95,152		362,221		116,377		786,579	211,529
Alaska Peninsula	16,301	9,550-22,795	2,646	1,526-3,856	17,383	9,071-27,292	4,738	2,407-7,636	33,684	7,384
Bering Sea	12,939	11,101-15,009	5,381	4,537-6,390	21,473	18,822-24,331	10,737	9,402-12,077	34,412	16,118
TOTAL	1,702,599		380,183		1,025,734		310,680		2,728,333	690,863

^aWeight in pounds of unshucked scallops

Table 5. Average weight of intact and broken scallops from observer sampled discarded scallop catch during the 1996/97 fishing season.

MANAGEMENT AREA	WEIGHT ^a		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.24	0.29	0.27
District 16	0.21	0.28	0.25
Yakutat Average	0.22	0.28	
Kodiak, Northeast District	0.38	0.52	0.45
Kodiak, Shelikof District	0.25	0.34	0.30
Kodiak, Semidi District	0.46	0.54	0.50
Kodiak Average	0.37	0.46	
Alaska Peninsula	0.15	0.26	0.21
Bering Sea	0.44	0.51	0.47
Overall Average	0.31	0.39	

^aWeight in pounds.

Table 6. Sex composition and mean shell height from observer sampled retained scallop catch during the 1996/97 fishing season.

Management Area	Males	Females	Undetermined
Yakutat			
% in sample	40	29	31
Mean shell height ^a	120	128	122
District 16			
% in sample	56	41	3
Mean shell height ^a	127	140	125
Kodiak, Northeast District			
% in sample	49	42	9
Mean shell height ^a	144	144	151
Kodiak, Shelikof District			
% in sample	50	46	4
Mean shell height ^a	135	137	132
Kodiak, Semidi District			
% in sample	48	51	1
Mean shell height ^a	154	154	149
Alaska Peninsula			
% in sample	43	49	8
Mean shell height ^a	126	127	120
Bering Sea			
% in sample	44	40.5	15.5
Mean shell height ^a	144	151	144
Overall mean shell height ^a	136	140	135

^aShell height in mm

Table 7. Percent scallop meat recovery by management area during the 1996/97 fishing season.

MANAGEMENT AREA	Number of Samples	PERCENT RECOVERY		
		Mean	Median	95% Confidence Interval Mean
Yakutat	52	9.0	9.0	8.8 to 9.3
District 16	17	9.0	9.0	8.4 to 9.8
Kodiak, Northeast District	11	10.0	11.0	9.7 to 10.8
Kodiak, Shelikof District	137	12.0	12.0	11.8 to 12.2
Kodiak, Semidi District	11	12.0	13.0	11.0 to 13.1
Alaska Peninsula	13	11.0	11.0	10.8 to 11.2
Bering Sea	37	10.0	10.0	9.9 to 10.3

Table 8. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1996/97 scallop fishery.

Species Category	Management Area / District					
	Yakutat	Kodiak			Alaska	Bering
		Northeast	Shelikof	Semidi	Peninsula	Sea
weathervane scallops	84.7	54.1	76.8	51.8	70.3	87.5
PROHIBITED SPECIES BYCATCH						
Tanner crab, <i>C. bairdi</i>	<.1	0.9	0.1	0.9	0.5	0.8
Tanner crab, <i>C. opilio</i>	0	0	0	0	0	3.7
king crab	0	0	0	<.1	0	0
Dungeness crab	<.1	0	<.1	0.8	0	0
Pacific halibut	0.2	0.5	0.2	<.1	0	<.1
OTHER COMMERCIAL SPECIES						
skates	1.9	4.9	3.1	2.5	0	1.0
arrowtooth flounder	0.3	0.3	0.4	0.3	4.8	0.8
rock sole	<.1	0.2	<.1	0.5	0.1	0.2
Dover sole	0.2	0.1	<.1	0.1	0	0.1
yellowfin sole	0	0	<.1	0.7	0	<.1
rex sole	0.1	0.6	0	0	0.1	0
flathead sole	0.2	0.5	0.5	1.2	0.3	0.3
butter sole	<.1	0.4	0	0.8	0	<.1
Pacific cod	0.1	1.2	<.1	0.9	0.7	0.4
starry flounder	<.1	0	0	1.6	0	0
walleye pollock	<.1	0	<.1	<.1	0.2	0.4
bay scallops	<.1	0	<.1	<.1	0.2	0
sea urchins	0	0	<.1	<.1	1.6	<.1
octopus	0	0	0.1	0	<.1	<.1
Alaska plaice	0	0	0.6	0.1	0	0
sea cucumber	<.1	0.1	<.1	<.1	0	0.2
MISCELLANEOUS						
starfish	4.5	32.4	2.7	15.7	11.4	0.1
basket star	<.1	<.1	<.1	3.8	4.6	0
weathervane shells	3.7	1.8	5.5	8.0	2.9	2.1
kelp, rocks, etc.	1.2	1.4	6.5	9.0	0.5	0.8
man-made debris	<.1	0.1	0.2	0.2	0.1	0.6
Misc. invertebrates	1.7	0.3	0.8	0.1	1.4	0.8
Mis. fish	0.3	0	0.1	0.2	0.3	<.1

Table 9. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Kodiak Area, Semidi District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	51.8%
2	starfish	<i>Class Stelleroidea</i>	15.7%
3	kelp, rock, etc.		9.0%
4	weathervane shells	<i>P. caurinus</i>	8.0%
5	basket star	<i>Gorgonocephalus caryi</i>	3.8%
6	skates	<i>Family Rajidae</i>	2.5%
7	starry flounder	<i>Platichthys stellatus</i>	1.6%
8	flathead sole	<i>Hippoglossoides elassodon</i>	1.2%
9	Tanner crab	<i>Chionoecetes bairdi</i>	0.9%
10	Pacific cod	<i>Gadus macrocephalus</i>	0.9%
11	Dungeness crab	<i>Cancer magister</i>	0.8%
12	butter sole	<i>Isopsetta isolepis</i>	0.8%
13	yellowfin sole	<i>Limanda aspera</i>	0.7%
14	rock sole	<i>Lepidopsetta bilineata</i>	0.5%
15	sea anemone	Order Actinaria	0.4%
16	arrowtooth flounder	<i>Atheresthes stomias</i>	0.3%
17	man-made debris		0.2%
18	Alaska plaice	<i>Pleuronectes quadrituberculatus</i>	0.2%
19	Dover sole	<i>Microstomus pacificus</i>	0.1%
20	lyre crab	<i>Hyas lyratus</i>	0.1%

^a Commercial species caught in declining order of poundage: skates, starry flounder, flathead sole, *Chionoecetes bairdi*, Pacific cod, Dungeness crab, butter sole, yellowfin sole, rock sole, arrowtooth flounder, Alaska plaice, and Dover sole.

Table 10. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Kodiak Area, Northeast District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	54.1%
2	starfish	Class Stelleroidea	32.4%
3	skates	Family Rajidae	4.9%
4	weathervane shells	<i>P. caurinus</i>	1.8%
5	kelp, rocks, etc.		1.4%
6	Pacific cod	<i>Gadus macrocephalus</i>	1.2%
7	Tanner crab	<i>Chionoecetes bairdi</i>	0.9%
8	rex sole	<i>Glyptocephalus zachirus</i>	0.6%
9	Pacific halibut	<i>Hippoglossus stenolepis</i>	0.5%
10	flathead sole	<i>Hippoglossoides elassodon</i>	0.5%
11	butter sole	<i>Isopsetta isolepis</i>	0.4%
12	arrowtooth flounder	<i>Atheresthes stomias</i>	0.3%
13	sea anemone	Order Actinaria	0.3%
14	rock sole	<i>Lepidopsetta bilineata</i>	0.2%
15	hermit crab	Family Paguridae	0.1%
16	box crab	Genus <i>Lopholithodes</i> .	0.1%
17	man-made debris		0.1%
18	Dover sole	<i>Microstomus pacificus</i>	0.1%
19	sea pen	Order Pennatulacea	0.1%
20	sea cucumber	Class Holothuroidea	0.1%

^a Commercial species caught in declining order of poundage: skates, Pacific cod, *Chionoecetes bairdi*, rex sole, halibut, flathead sole, butter sole, arrowtooth flounder, rock sole, Dover sole, and sea cucumber.

Table 11. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Alaska Peninsula Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	70.3%
2	starfish	Class Stelleroidea	11.4%
3	arrowtooth flounder	<i>Atheresthes stomias</i>	4.8%
4	basket starfish	<i>Gorgonocephalus caryi</i>	4.6%
5	weathervane shells	<i>P. caurinus</i>	2.9%
6	sea urchin	Family Strongyocentrotidae	1.6%
7	Pacific Cod	<i>Gadus macrocephalus</i>	0.7%
8	snails	Class Gastropoda	0.5%
9	Tanner crab	<i>Chionoecetes bairdi</i>	0.5%
10	kelp, rocks, etc.		0.5%
11	flathead sole	<i>Hippoglossoides elassodon</i>	0.3%
12	walleye pollock	<i>Theragra chalcogramma</i>	0.2%
13	hermit crab	Family Paguridae	0.2%
14	Greenland turbot	<i>Reinhardtius hippoglossoides</i>	0.2%
15	bay scallops	<i>Chlamys</i> spp	0.2%
16	brown box crab	<i>Lopholithodes foraminatus</i>	0.1%
17	snail eggs	Class Gastropoda	0.1%
18	man-made debris		0.1%
19	worms unident.	Class Polychaeta	0.1%
20	shrimp	Family <i>Pandalidae</i>	0.1%

^a Commercial species caught in declining order of poundage: arrowtooth flounder, sea urchin, Pacific cod, *Chionoecetes bairdi*, flathead sole, walleye pollock, Greenland turbot, bay scallops, and shrimp.

Table 12. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Bering Sea Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	87.5%
2	Tanner crab	<i>Chionoecetes opilio</i>	3.7%
3	weathervane shells	<i>P. caurinus</i>	2.1%
4	skates	Family Rajidae	1.0%
5	kelp, rocks, etc.		0.8%
6	arrowtooth flounder	<i>Atheresthes stomias</i>	0.8%
7	Tanner crab	<i>Chionoecetes bairdi</i>	0.8%
8	man-made debris		0.6%
9	Pacific cod	<i>Gadus macrocephalus</i>	0.4%
10	walleye pollock	<i>Theragra chalcogramma</i>	0.4%
11	whelk	Genus <i>Neptunea</i>	0.3%
12	flathead sole	<i>Hippoglossoides elassodon</i>	0.3%
13	rock sole	<i>Lepidopsetta bilineata</i>	0.2%
14	hermit crab	Family Paguridae	0.2%
15	sea cucumber	Class Holothuroidea	0.2%
16	jellyfish	Class Scyphozoa	0.2%
17	starfish	Class Stelleroidea	0.1%
18	Greenland turbot	<i>Reinhardtius hippoglossoides</i>	0.1%
19	Dover sole	<i>Microstomus pacificus</i>	0.1%
20	lyre crab	<i>Hyas lyratus</i>	0.1%

^a Commercial species caught in declining order of poundage: *Chionoecetes opilio*, skates, arrowtooth flounder, *C. bairdi*, Pacific cod, pollock, flathead sole, rock sole, sea cucumber, and Greenland turbot.

Table 13. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996/97 Kodiak Area, Shelikof District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	76.8%
2	kelp, rock, etc.		6.5%
3	weathervane shells	<i>P. caurinus</i>	5.5%
4	skates	Family Rajidae	3.1%
5	starfish	Class Stelleroidea	2.7%
6	sea anemone	Order Actinaria	0.9%
7	Alaska plaice	<i>Pleuronectes quadrituberculatus</i>	0.6%
8	flathead sole	<i>Hippoglossoides elassodon</i>	0.5%
9	arrowtooth flounder	<i>Atheresthes stomias</i>	0.4%
10	hermit crab	Family Paguridae	0.3%
11	snails	Class Gastropoda	0.3%
12	Pacific halibut	<i>Hippoglossus stenolepis</i>	0.2%
13	man-made debris		0.2%
14	skate egg case	Family Rajidae	0.2%
15	giant wrymouth	<i>Delolepis gigantea</i>	0.2%
16	Tanner crab	<i>Chionoecetes bairdi</i>	0.1%
17	hairy triton	<i>Fusitriton oregonensis</i>	0.1%
18	snail eggs	Class Gastropoda	0.1%
19	lyre crab	<i>Hyas lyratus</i>	0.1%
20	spiny dogfish	<i>Squalus acanthias</i>	0.1%

^a Commercial species caught in declining order of poundage: skates, Alaska plaice flathead sole, arrowtooth flounder, halibut, and *Chionoecetes bairdi*.

Table 14. Twenty most frequently caught species by weight as recorded by scallop observers during the 1996 Yakutat Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	<i>Patinopecten caurinus</i>	84.7%
2	starfish	Class Stelleroidea	4.5%
3	weathervane shells	<i>P. caurinus</i>	3.7%
4	skates	Family Rajidae	1.9%
5	kelp, rocks, etc.		1.2%
6	skate egg case	Family Rajidea	0.9%
7	sea anemone	Order Actinaria	0.5%
8	lingcod	<i>Ophiodon elongatus</i>	0.4%
9	English sole	<i>Parophrys vetulus</i>	0.3%
10	arrowtooth flounder	<i>Atheresthes stomias</i>	0.3%
11	flathead sole	<i>Hippoglossoides elassodon</i>	0.2%
12	Pacific Halibut	<i>Hippoglossus stenolepis</i>	0.2%
13	octopus	Family Octopodoteuthidae	0.2%
14	Dover sole	<i>Microstomus pacificus</i>	0.2%
15	spiny dogfish	<i>Squalus acanthias</i>	0.1%
16	hermit crab	Family Paguridae	0.1%
17	rex sole	<i>Glyptocephalus zachirus</i>	0.1%
18	Pacific cod	<i>Gadus macrocephalus</i>	0.1%
19	bristle worm	<i>Aphrodita negligens</i>	0.1%
20	wolf eel	<i>Anarrhichthys ocellatus</i>	0.1%

^a Commercial species caught in declining order of poundage: skates, lingcod, English sole, arrowtooth flounder, flathead sole, halibut, octopus, Dover sole, rex sole, and Pacific cod.

Table 15. Estimated bycatch, in numbers of individuals, and confidence intervals for *C. opilio*, *C. bairdi*, Dungeness, and king crab, and halibut from the 1996/97 statewide scallop fishery.

Management Area	n ^b	Bycatch Estimates by Species ^a									
		<i>C. opilio</i>		<i>C. bairdi</i>		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch ^c	95% CI	Bycatch	95% CI
Yakutat	82	0	NA	6,872	4,641-9,588	38	7-77	0	NA	150	91-151
District 16	26	0	NA	669	274-1,123	9	NA	0	NA	68	30-68
Kodiak											
Northeast District	28	0	NA	27,722	10,298-48,407	0	NA	0	NA	202	79-384
Shelikof District	104	0	NA	11,285	9,408-13,257	1,008	584-1,508	0	NA	440	318-569
Semidi District	38	0	NA	8,902	3,798-15,750	4,554	2,504-7,068	9	NA	79	5-176
Alaska Peninsula	13	0	NA	19,045	12,604-26,362	10	NA	0	NA	25	NA
Bering Sea	63	106,935	98,033-116,196	16,642	14,227-19,373	0	NA	0	NA	124	49-229

^aEstimates were calculated as bycatch per hour per boat per day x total hours dredged x number of dredges fished.

^bNumber of vessel days.

^cActual count, not an estimate.

Table 16. Tanner crab bycatch mortality as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	NUMBER OF TANNER CRAB OBSERVED		
	Dead	Alive	Percent Dead
District 16	34	38	47.2
Yakutat	537	373	59
Yakutat Mgmt Area Combined	571	411	58.1
Kodiak, Northeast District	262	1,361	16.1
Kodiak, Shelikof District	587	1,013	36.7
Kodiak, Semidi District	271	464	36.9
Kodiak Mgmt Area Combined	1,120	2,838	28.3
Alaska Peninsula	735	1,541	32.3
Bering Sea <i>C. opilio</i>	1,675	8,674	16.2
Bering Sea <i>C. bairdi</i>	210	1,454	12.6
Bering Sea, Combined Species	1,885	10,128	15.7
All areas Combined	4,311	14,918	22.4

Table 17. Number and Condition of halibut as recorded by scallop observers during the 1996/97 fishing season.

MANAGEMENT AREA	CONDITION OF HALIBUT ^a						Total
	(Number of Halibut)						
	Excellent	Good	Fair	Poor	Dead	Previously Dead	
District 16	4	0	1	1	0	1	7
Yakutat	13	5	2	1	1	0	22
Kodiak, Northeast District	4	2	4	6	2	0	18
Kodiak, Shelikof District	20	10	8	11	4	2	55
Kodiak, Semidi District	1	4	1	3	0	0	9
Alaska Peninsula	1	0	0	1	1	0	3
Bering Sea	2	4	4	1	2	0	13
Total all Areas	45	25	20	24	10	3	127

^aCondition Codes:

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.

Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.

Fair: No body movement; could close operculum tightly; minor external injuries, if any.

Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).

Dead: No body or opercular movement; probably killed in sampled haul.

Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 18. Summary of commercial fishery statistics and scallop observer data from the 1996/97 scallop fishery.

Management Area	Season Dates	Number of Vessels	Number of Days Fishing Observed ^a	Pounds ^b of Retained Scallops (Round Weight)	Pounds of Retained Scallops (Shucked Meats)	Tow Hours per Dredge ^c	CPUE ^d	BYCATCH		% Scallops (by weight) in Catch	Number of Tanners per Pound of Retained Scallop Meats
								Tanner	Halibut		
District 16	1 Aug-29 Nov	2	21	336,978	25,970	1,500	222	669	68	^e	0.03
Yakutat	1 Aug-4 Sep	3	80	2,362,498	185,426	5,678	416	6,872	150	84.7	0.04
Kodiak											
Northeast District	1 Aug 96-15 Feb 97	3	19	147,269	11,430	1,143	129	27,722	202	54.1	2.43
Shelikof District	1 Aug-18 Oct	4	99	1,878,268	219,305	6,982	269	11,285	440	76.8	0.05
Semidi District	1 Aug-15 Feb 97	3	32	288,117	37,810	1,998	144	8,902	79	51.8	0.24
Kodiak Combined	1 Aug-15 Feb 97	5	150	2,313,654	268,545	10,123	229	47,909	721	NA	0.18
Alaska Peninsula	1 Aug-31 Oct	2	12	130,235	12,560	647	201	19,045	25	70.3	1.52
Bering Sea	1 Aug 96-15 Feb 97	1	54	1,432,160	150,295	4,626	309	123,577	124	87.5	0.82
Statewide Combined	-	5	317	6,575,525	642,796	32,697	291	198,027	1,088	79.6	0.31

^aAn observed day is a day with at least one sampled tow.

^bVessel operator estimates.

^cTow-hour per dredge = one dredge towed for 60 minutes.

^dCPUE = pounds (round weight) of retained scallops per tow-hour per dredge.

^eIncluded in Yakutat data.

Table 19. Summary of weathervane scallop commercial fishery statistics and observer data from District 16, Yakutat, and Prince William Sound Areas.

Management Area	Season Dates		Number of Vessels	Number of Vessel Days ^a	Number of Days Fishing Occurred ^b	Number of Days Fishing Observed ^c	Crab Bycatch Limits ^d		Bycatch Estimates			Tanner Crab Mortality %
	Beginning	Ending					Tanner	King Crab	Tanner	King ^e	Halibut	
District 16												
1993	No Observed Trips			NA	NA	NA	NA	NA	NA	NA	NA	NA
1994	20-Jan-94	20-Jan-94	7	NA	7	7	NA	NA	NS	NS	NS	67
1994	01-Jul-94	31-Oct-94	1	NA	4	3	NA	NA	NS	NS	NS	0
1995	10-Jan-95	13-Feb-95	6	NA	42	35	NA	NA	NS	NS	NS	28
1996	10-Jan-96	20-Jan-96	1	NA	6	5	NA	NA	NS	NS	NS	0
1996	01-Aug-96	29-Nov-96	2	NA	23	21	NA	NA	669	0	68	47
Yakutat												
1993	01-Jul-93	11-Jul-93	7	96	77	75	NA	NA	1,700	40	99	54
1994	10-Jan-94	18-Jan-94	10	119	88	83	NA	NA	NS	NS	NS	31
1994	01-Jul-94	12-Jul-94	5	82	60	57	NA	NA	NS	NS	NS	56
1995	10-Jan-95	02-Feb-95	8	235	150	134	NA	NA	NS	NS	NS	28
1996	10-Jan-96	25-Jan-96	3	54	47	43	NA	NA	NS	NS	NS	27
1996	01-Aug-96	04-Sep-96	3	116	82	80	NA	NA	6,872	0	160	59
Prince William Sound												
1993	15-Jul-93	18-Jul-93	7	58	29	27	500	NA	200	0	27	58
1994	Season Closed		NA	NA	NA	NA	NA	NA	NS	NS	NS	NA
1995	10-Jan-95	26-Jan-95	2	29	21	21	500	NA	NS	NS	NS	0
1996	Season Closed		NA	NA	NA	NA	NA	NA	NS	NS	NS	NA

-Continued-

Table 19. (page 2 of 2)

Management Area	Pounds of Retained Scallops (round weight) ^g	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Tow Hours Per Dredge	CPUE ^h	% of Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Average Size Retained Scallops	Number of Tanner Crab Per Pound of Retained Scallop Meats
District 16										
1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1994	150,962	13,301	NA	551	i	NS	NA	NA	NA	NA
1994	i	i	NA	i	i	NS	NA	NA	NA	NA
1995	447,469	33,302	NA	2,190	204	NS	NA	NA	NA	NA
1996	i	i	NA	i	i	NS	NA	NA	NA	NA
1996	336,978	25,970	9.0	1,500	225	i	707,238	158,899	132.0	<0.1
Yakutat										
1993	2,082,824	141,423	NA	3,962	526	NS	NA	NA	117.7	<0.1
1994	2,085,942	158,830	NA	5,071	411	NS	NA	NA	NS	NS
1994	1,713,094	94,400	NA	3,418	501	NS	NA	NA	NS	NS
1995	3,214,958	242,491	NA	8,459	340	NS	NA	NA	NS	NS
1996	908,842	53,310	NA	3,530	257	NS	NA	NA	NS	NS
1996	2,362,498	185,426	9.0	5,878	416	84.7	1,166,422	295,833	122.8	<0.1
Prince William Sound										
1993	850,718	63,068	NA	1,272	669	NS	NA	NA	123.5	<0.1
1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1995	Confidential	108,000 ^j	NA	Confidential		NS	NA	NA	NS	NS
1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aVessel days include all days between observer briefing and debriefing, District 16 vessel days included with Yakutat vessel days.

^bAll days with at least one tow made by the vessel.

^eVessel operator estimates.

^cAn observed day is a day with at least one sampled tow.

^hCPUE expressed as the round weight of retained scallops per tow-hour per dredge.

^dCrab bycatch limits not established for District 16 or Yakutat.

ⁱConfidential, included in Yakutat data.

^eActual count, not an estimated, beginning with the 1995/96 season.

^jIncludes estimated illegal harvest.

^fReopened February 13 (12 Noon) to February 14 (12 Noon).

NA=Not Applicable, NS=Not Summarized

Table 20. Summary of weathervane scallop commercial fishery statistics and observer data from the Kodiak Area.

Management Area	Season Dates		Number of Vessels	Number of Vessel Days ^a	Number of Days Fishing Occurred ^b	Number of Days Fishing Observed ^c	Crab Bycatch Limits		Bycatch Estimates			Tanner Crab Mortality %
	Beginning	Ending					Tanner	King Crab	Tanner	King ^d	Halibut	
Kodiak												
Northeast District												
1993/94	01-Jul-93	24-Nov-93	10	e	272	237	e	e	30,800	9	NS	23
1994/95	01-Jul-94	15-Feb-95	7	e	77	68	143,000	123	2,054	190	577	34
1995/96	Season Closed		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Aug-96	15-Feb-97	3	e	29	19	130,000	66	27,722	0	202	16
Shelikof District												
1993/94	01-Jul-93	05-Aug-93	5	e	83	79	e	e	50,700	0	NS	13
1994/95	01-Jul-94	01-Oct-94	11	e	263	257	98,000	219	64,464	29	851	14
1995/96	Season Closed		NA	e	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Aug-96	18-Oct-96	4	e	103	99	116,100	22	41,285	0	440	37
Semidi District												
1993/94	01-Jul-93	11-Feb-94	7	e	75	70	Not Established		61,000	6	NS	21
1994/95	01-Jul-94	15-Feb-95	2	e	10	10	Not Established		984	22	21	28
1995/96	Season Closed		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Aug-96	15-Feb-97	3	e	37	32	Not Established		8,902	9	99	37
Kodiak Area Combined												
1993/94	01-Jul-93	11-Feb-94	10	597	430	386	199,500	283	142,500	15	NS	18
1994/95	01-Jul-94	15-Feb-95	10	474	350	313	241,000	342	67,482	241	1,449	15
1995/96	Season Closed		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Jul-96	15-Feb-97	5	237	170	150	146,100	88	47,909	9	721	28

-Continued-

Table 20. (page 2 of 2)

Management	Pounds of Retained Scallops (round weight) ^f	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Tow Hours Per Dredge	CPUE ^g	% of Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Average Size Retained Scallops	Number of Tanner Crab Per Pound of Retained Scallop Meats
Kodiak										
Northeast District										
1993/94	2,214,427	155,187	NA	13,719	161	NS	NA	NA	NA	0.2
1994/95	389,202	31,517	NA	1,509	111	43.5	NA	NA	150.9	<0.1
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	147,269	11,430	10.0	1,143	129	54.1	22,076	8,355	148.4	2.4
Shelikof District										
1993/94	1,169,664	105,017	NA	5,007	234	NS	NA	NA	NA	0.5
1994/95	1,522,319	120,111	NA	17,806	198	64.1	NA	NA	131.4	0.2
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	1,878,268	219,305	12.0	6,987	269	76.8	753,292	197,174	135.9	<1.1
Semidi District										
1993/94	579,836	58,157	NA	3,567	163	NS	NA	NA	NA	1.1
1994/95	h	h	NA	h	h	39.3	NA	NA	152.7	h
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	288,117	37,810	12.0	1,998	144	51.8	11,211	6,000	153.7	0.2
Kodiak Area Combined										
1993/94	3,963,927	318,361	NA	22,293	178	NS	NA	NA	142.8	0.5
1994/95	3,911,719	354,498	NA	21,315	184	NS	NA	NA	NS	0.2
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	2,313,654	268,545	NS	10,123	229	88	786,579	211,529	NS	0.2

^aVessel days include all days between observer briefing and debriefing.

NA=Not Applicable

^bAll days with at least one tow made by the vessel.

NS=Not summarized

^cAn observed day is a day with at least one sampled tow.

^dActual count, not an estimate, beginning with the 1995/96 season.

^eIncluded in Kodiak Area combined.

^fVessel operator estimates.

^gCPUE = as the round weight of retained scallops per tow-hour per dredge.

^hConfidential, combined with Shelikof data to protect confidentiality of individual fishing vessels.

Table 21. Summary of weathervane scallop commercial fishery statistics and observer data from the Alaska Peninsula, Bering Sea, Dutch Harbor, and Adak Areas.

Management Area	Season Dates		Number of Vessels	Number of Vessel Days ^a	Number of Days Fishing Occurred ^b	Number of Days Fishing Observed ^c	Crab Bycatch Limits			Bycatch Estimates				Tanner Crab Mortality %
	Beginning	Ending					<i>C. opilio</i>	<i>C. bairdi</i>	King	<i>C. opilio</i>	<i>C. bairdi</i>	King ^d	Halibut	
Alaska Peninsula														
1993/94	01-Jul-93	21-Oct-93	8	136	75	69	NA	52,530	85	NA	150,900	26	327	35
1994/95	01-Jul-94	22-Sep-95	7	137	80	70	NA	44,000	119	NA	25,287	0	157	29
1995/96	SEASON CLOSED		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Aug-96	31-Oct-96	2	34	13	12	NA	22,000	435	NA	19,345	0	25	32
Bering Sea														
1993/94	01-Jul-93	05-Sep-93	9	275	174	168	NA	260,000	17,000	15,000	276,500	212	327	12
1994/95	01-Jul-94	07-Sep-94	8	382	312	309	NA	260,000	17,000	17,000	228,800	20	3,454	28
1995/96	SEASON CLOSED		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	01-Aug-96	15-Feb-97	1	79	63	54	275,000	257,000	500	106,935	16,842	0	124	15
Dutch Harbor														
1993/94	01-Jul-93	18-Sep-93	3	46	36	24	NA	50,500	45	NA	50,800	45	1,497	50
1994/95	1-Jul-94	15-Feb-95	3	21	8	8	NA	87,000	47	NA	767	7	0	14
1995/96	1-Jul-95	15-Feb-96	1	62	38	35	NA	NA	NA	NS	NS	NS	NS	22
1996/97	1-Aug-96	15-Feb-97	No Fishing Effort		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Adak														
1993/94 ^e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1994/95	01-Jul-94	15-Feb-95	No Fishing Effort		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1995/96	01-Jul-95	15-Feb-96	1	7	4	4	NA	NA	NA	NS	NS	NS	NS	NS
1996/97	01-Aug-96	15-Feb-97	No Fishing Effort		NA	NA	NA	10,000	50	NA	NA	NA	NA	NA

-Continued-

Table 21. (page 2 of 2)

Management Area	Pounds of Retained Scallops (round weight) ^f	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Tow Hours Per Dredge ^g	CPUE ^h	% of Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Average Size Retained Scallops	Number of Tanner Crab Per Pound of Retained Scallop Meats
Alaska Peninsula										
1993/94	1,061,925	112,087	NA	3,666	290	NS	NA	NA	121.3	1.3
1994/95	619,473	65,282	NA	2,817	212	73	NA	NA	126.7	0.4
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	130,235	12,560	11.0	647	201	70	33,634.0	7,384.0	126.0	1.5
Bering Sea										
1993/94	3,447,681	284,414	NA	11,470	300	NS	NA	NA	146.3	1.0
1994/95	5,942,312	505,439	NA	22,167	265	77	NA	NA	145.9	0.5
1995/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1996/97	1,432,160	150,295	10.0	4,826	306	83	34,412.0	15,188.0	146.3	0.8
Dutch Harbor										
1993/94	432,970	38,731	NA	1,661	261	NS	NA	NA	128.0	1.3
1994/95	23,590	1,931	NA	153	154	56	NA	NA	157.7	0.4
1995/96	Confidential									
1996/97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Adak										
1993/94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1994/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1995/96	Confidential									
1996/97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aVessel days include all days between observer briefing and debriefing, including weather and travel days.

^bAll days with at least one tow made by the vessel.

^cAn observed day is a day with at least one sampled tow.

^dActual count, not an estimate, beginning with the 1995/96 season.

^eNot a separate area, included in Bering Sea Area

^fVessel operator estimates.

^gTow-hour = one dredge towed for 60 minutes.

^hCPUE expressed as the round weight of retained scallops per tow-hour per dredge.

NA=Not applicable

NS=Not Summarized

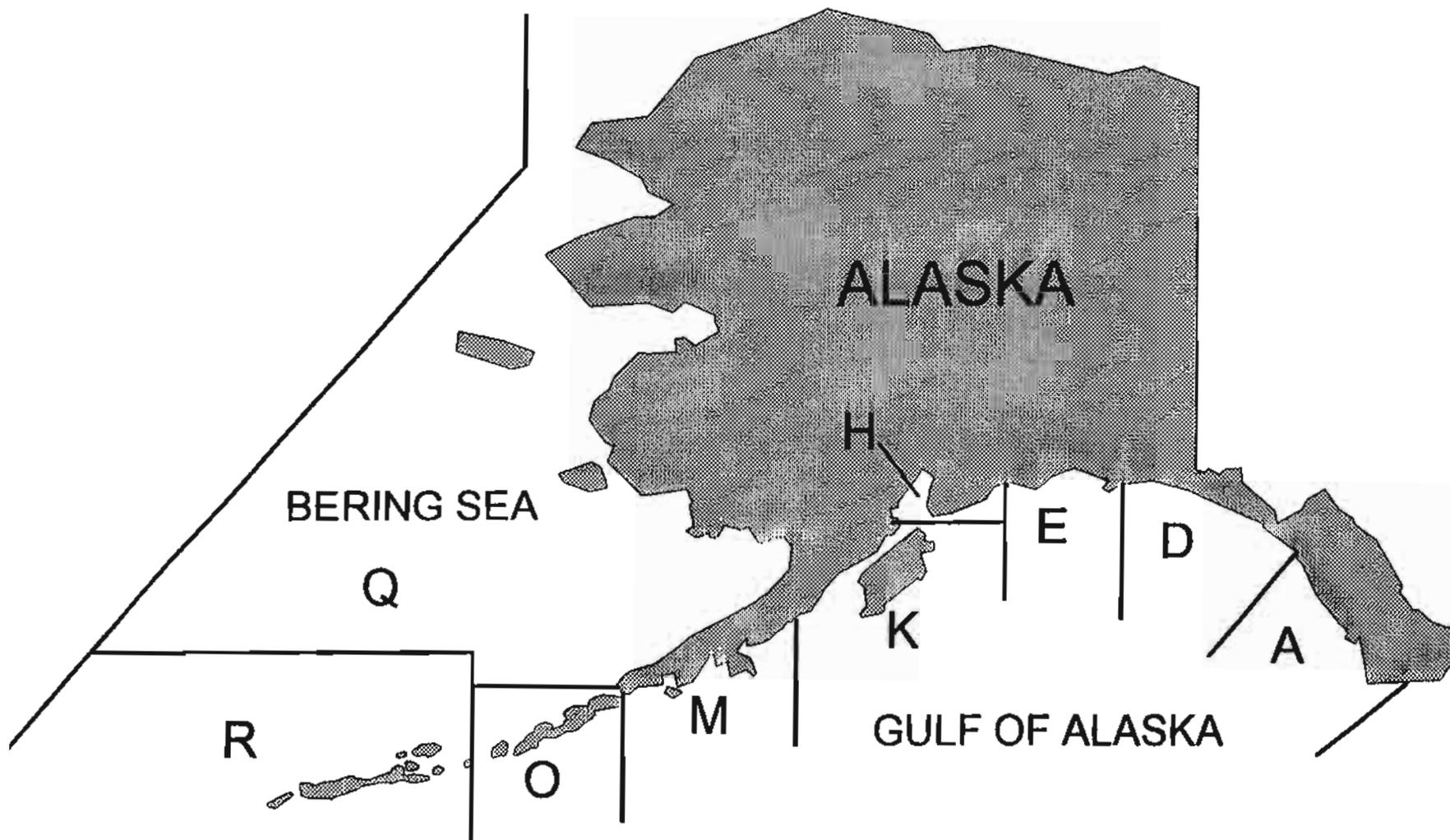


Figure 1. State of Alaska Scallop Fishing Registration Areas.

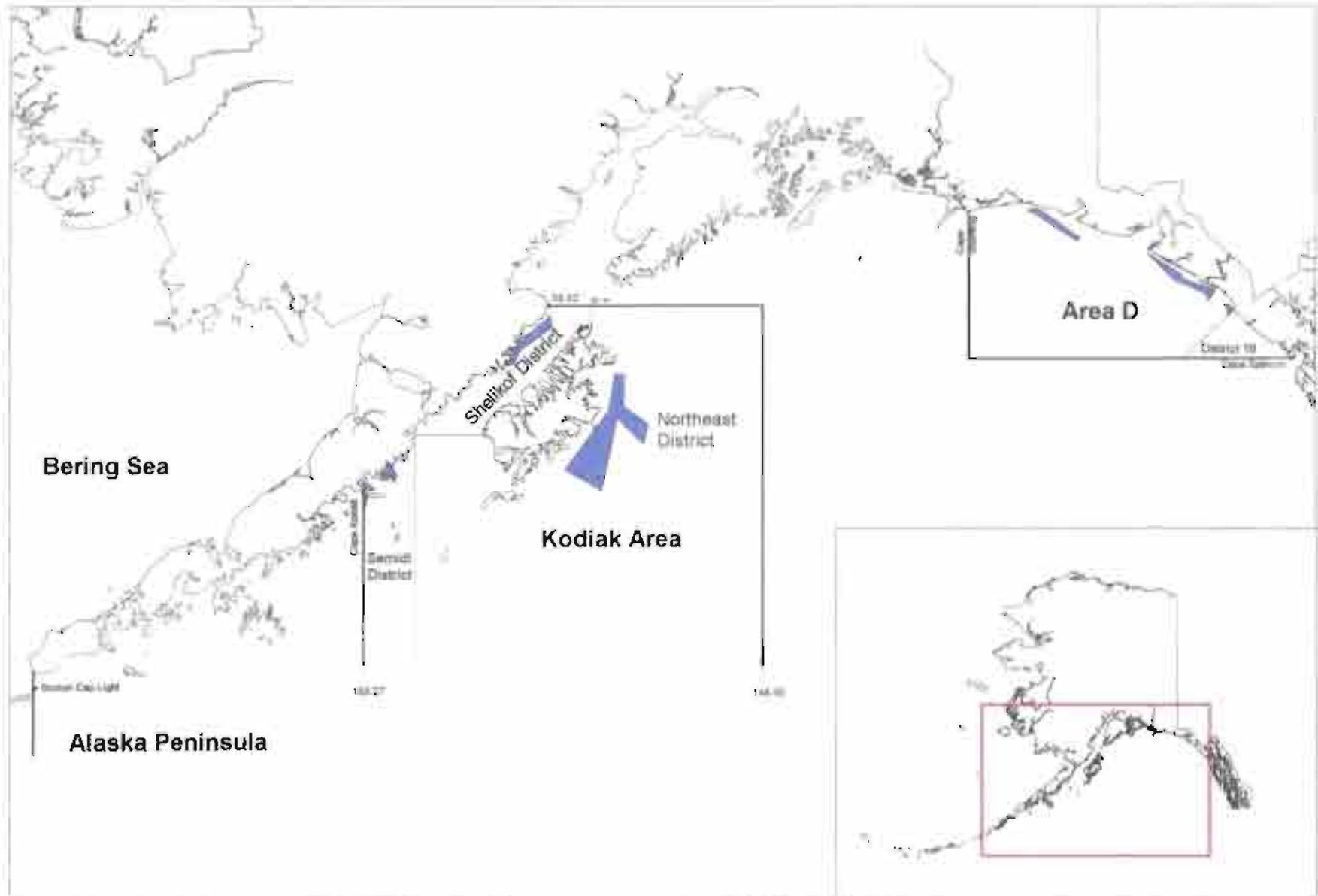


Figure 2. Major fishing areas in the Kodiak and Yakutat areas during the 1996/97 scallop fishery.

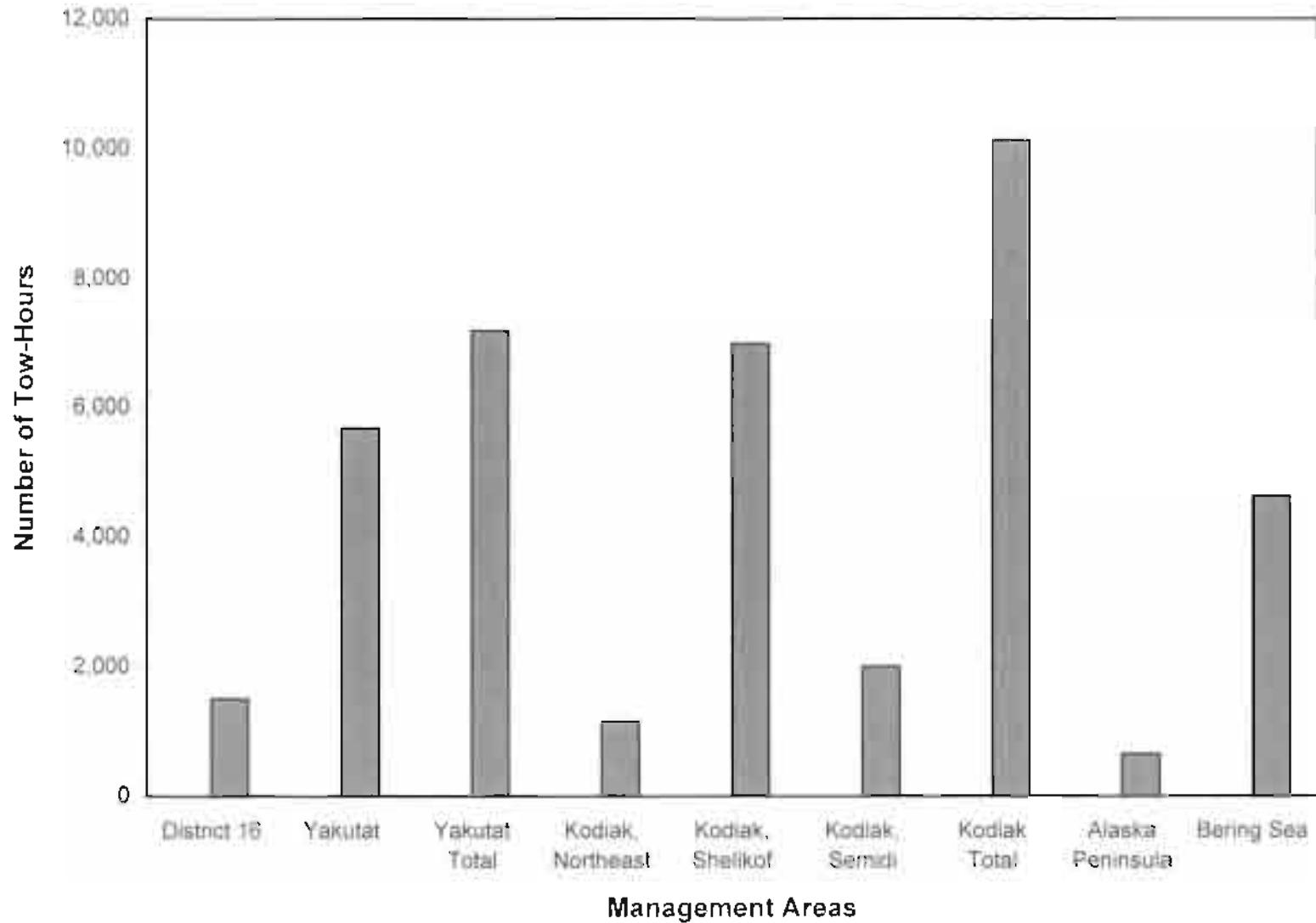


Figure 3. Fishing effort in tow-hours by management area in the 1996/97 scallop fishery.

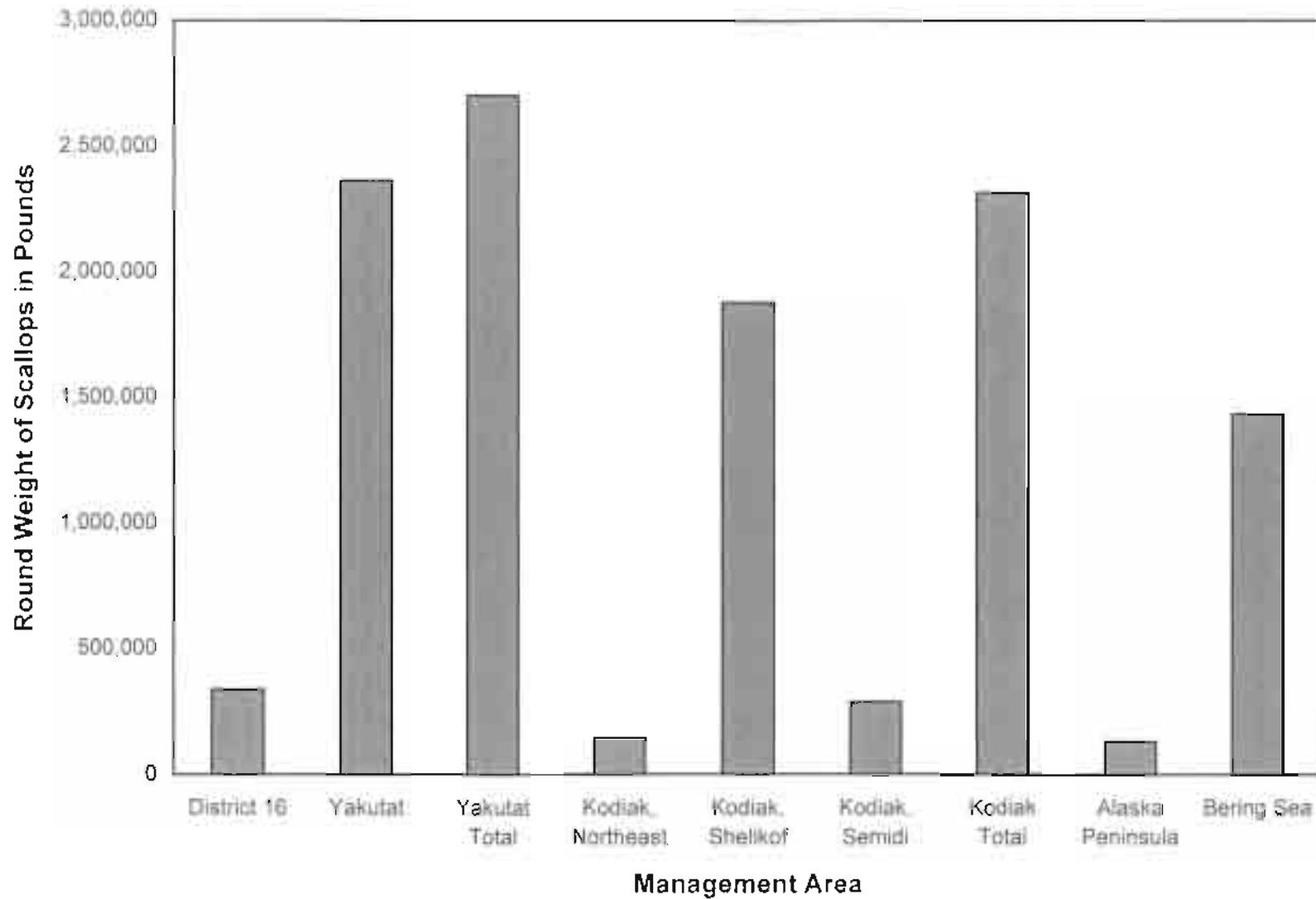


Figure 4. Round weight in pounds of retained scallops by management area in the 1996/97 scallop fishery.

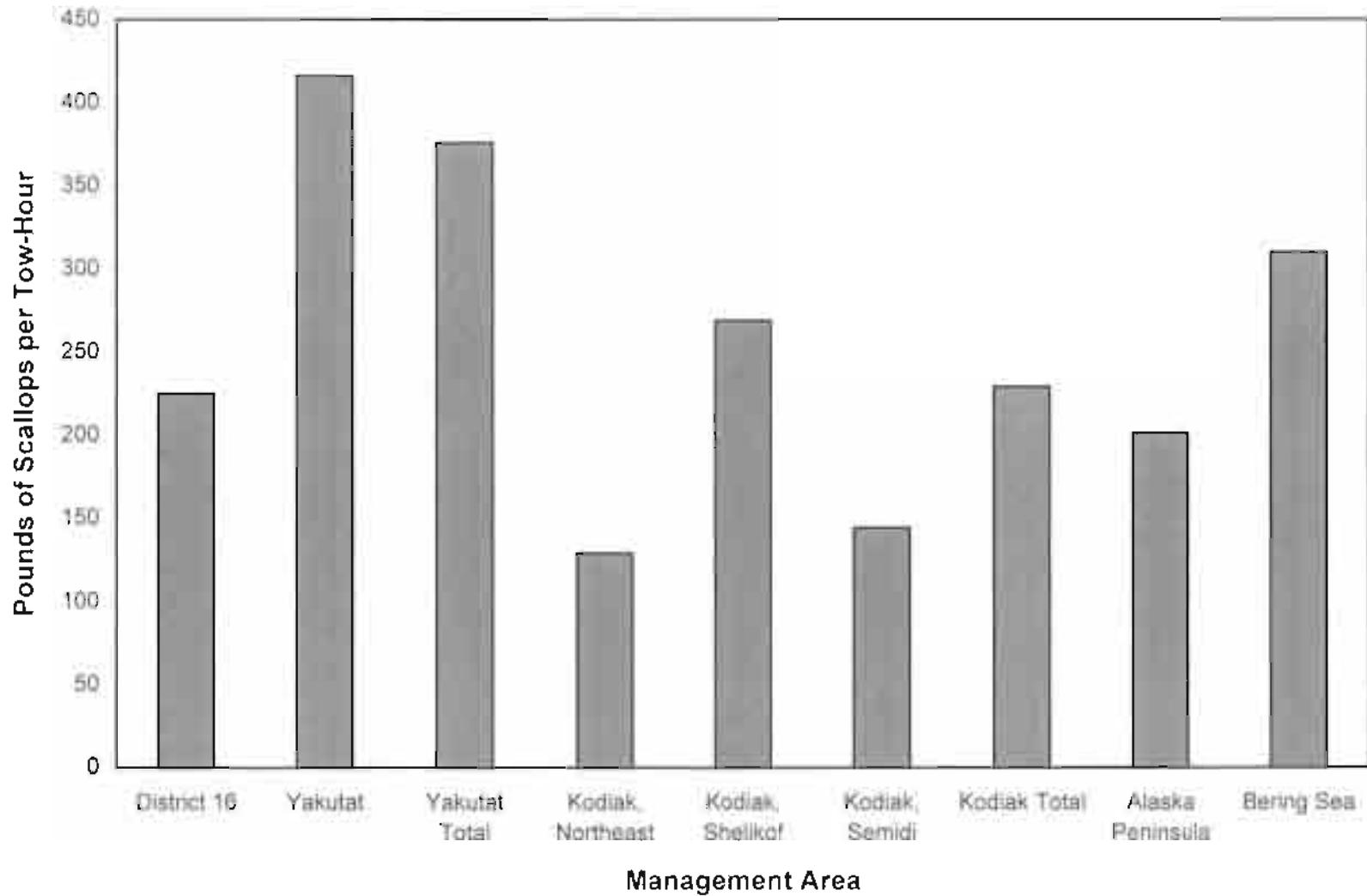


Figure 5. Round weight of retained scallops per tow-hour per dredge by management area in the 1996/97 scallop fishery.

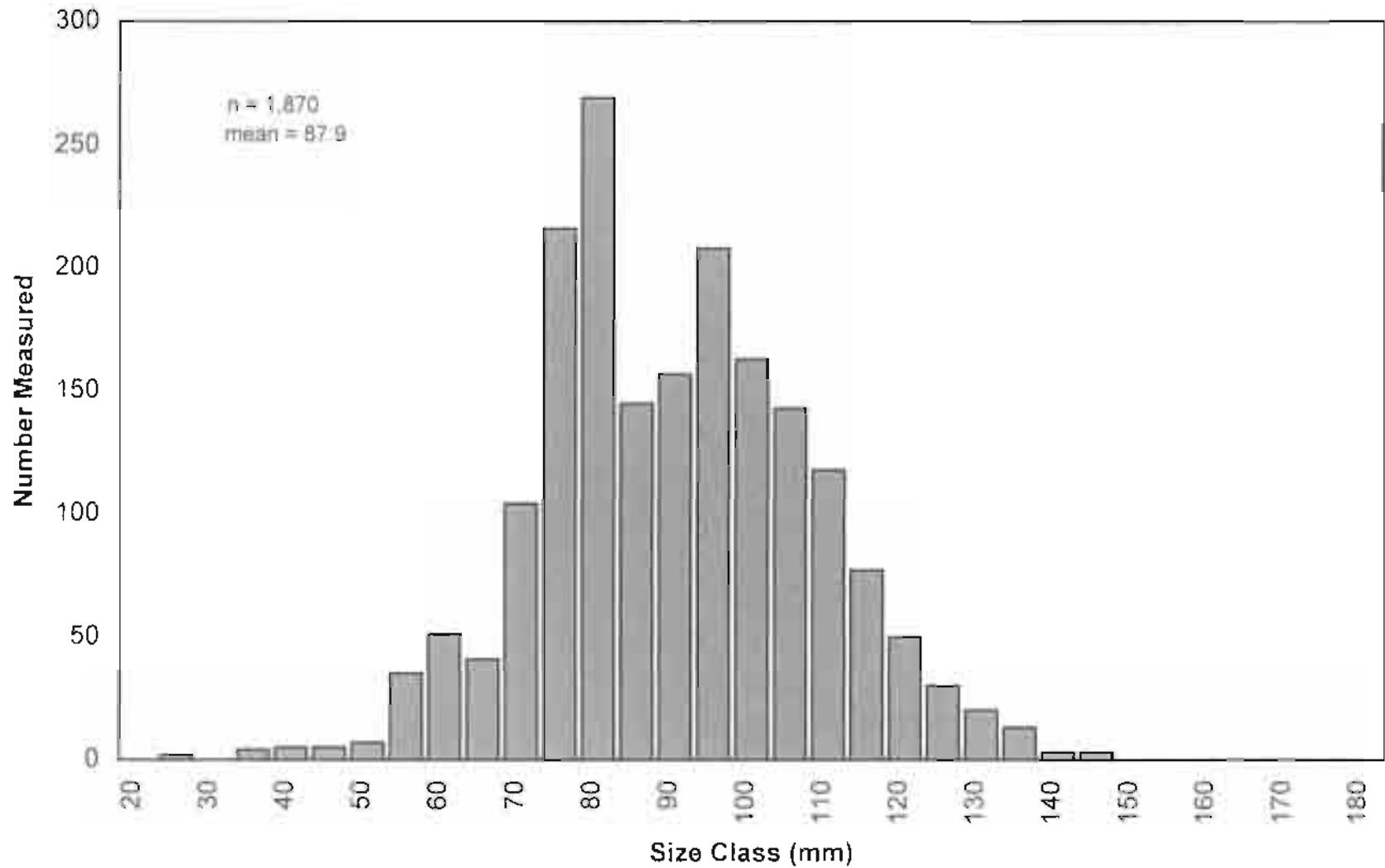


Figure 8. Size distribution of discarded scallops from observer samples, Alaska Peninsula Area, 1996/97.

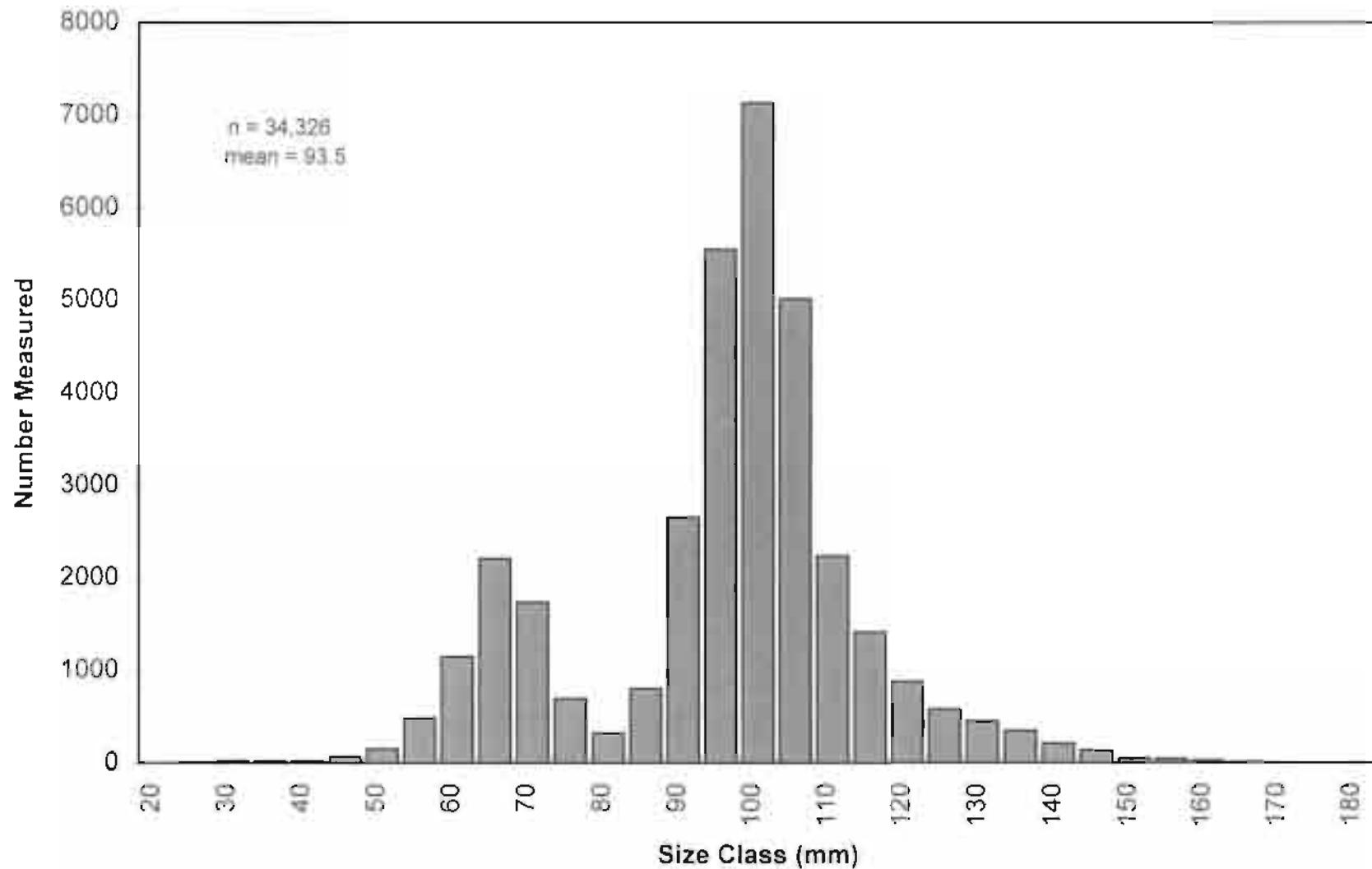


Figure 7. Size distribution of discarded scallops from observer samples, Shelikof District Kodiak Area, 1996/97.

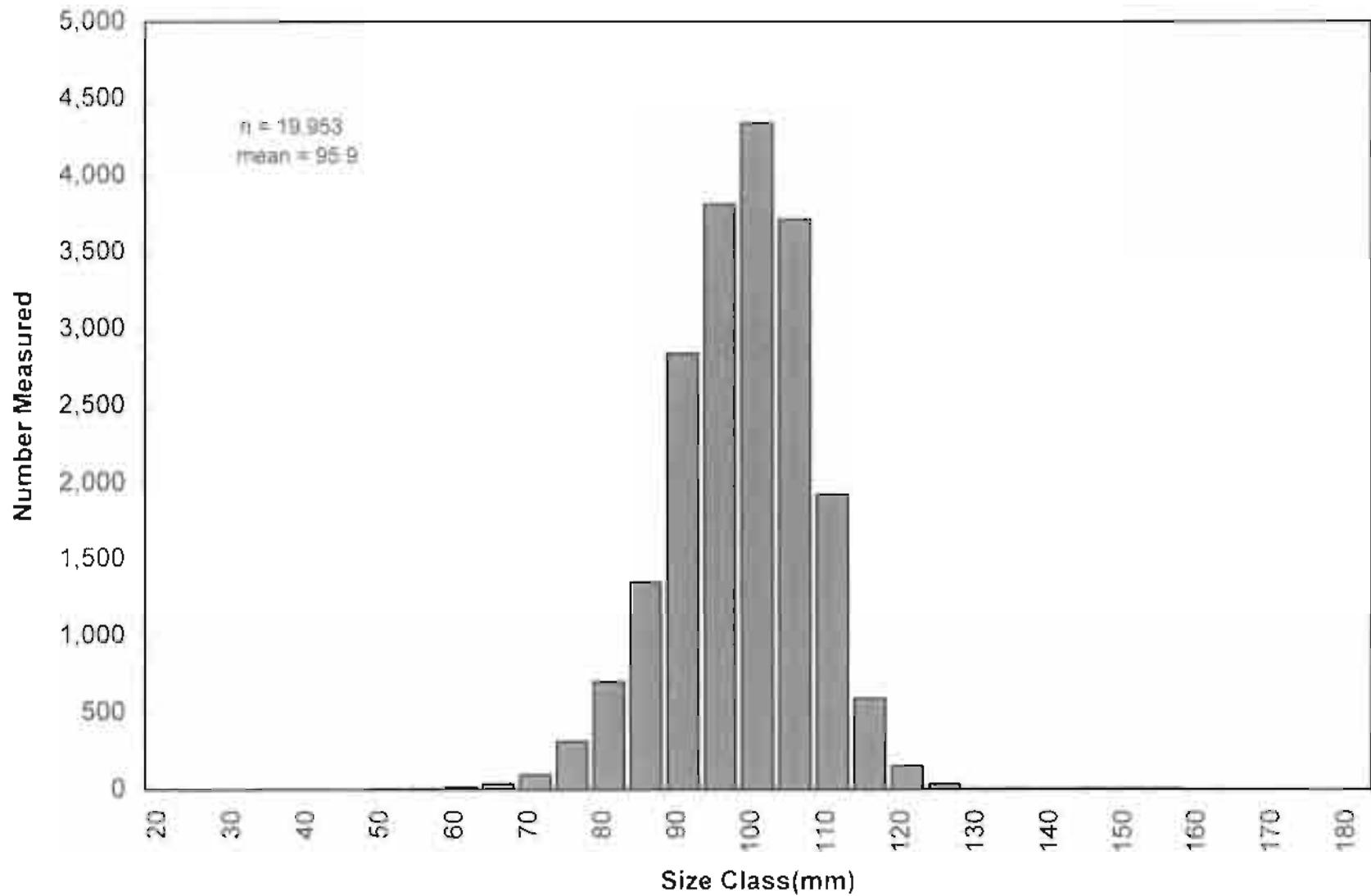


Figure 8. Size distribution of discarded scallops from observer samples, District 16, 1996/97.

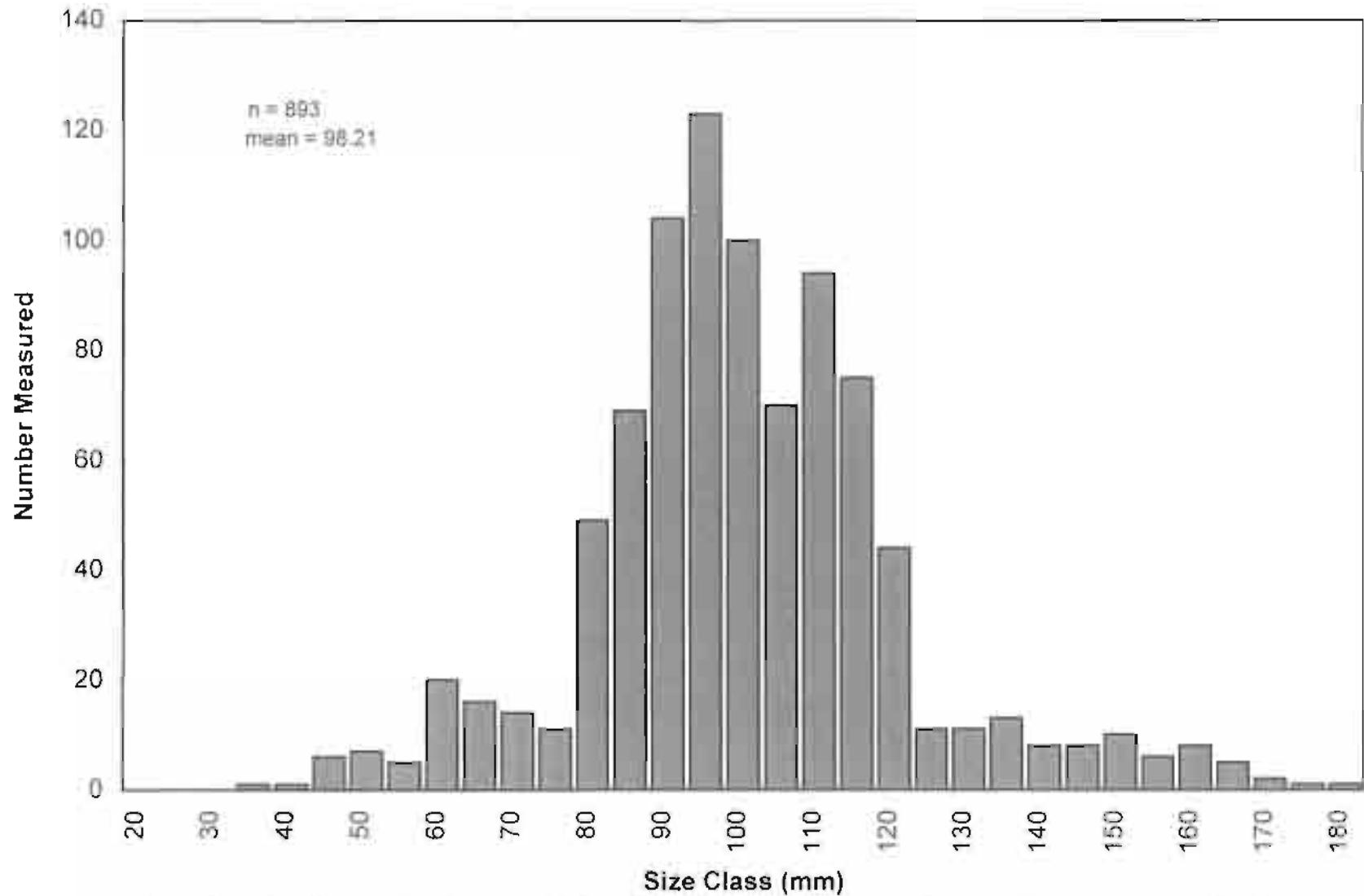


Figure 9. Size distribution of discarded scallops from observer samples, Northeast District, Kodiak Area, 1996/97.

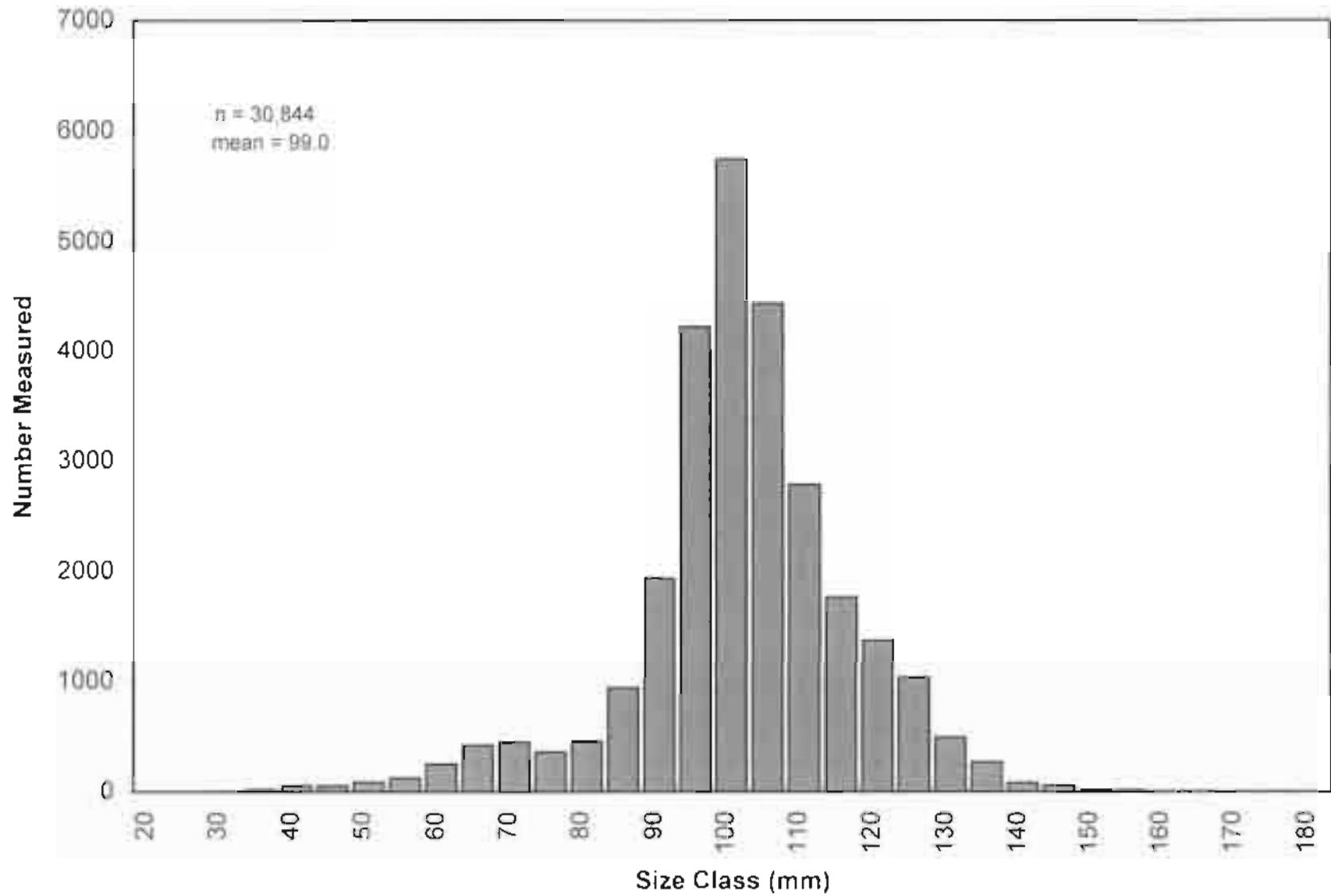


Figure 10: Size distribution of discarded scallops from observer samples, Yakutat Area, 1996/97.

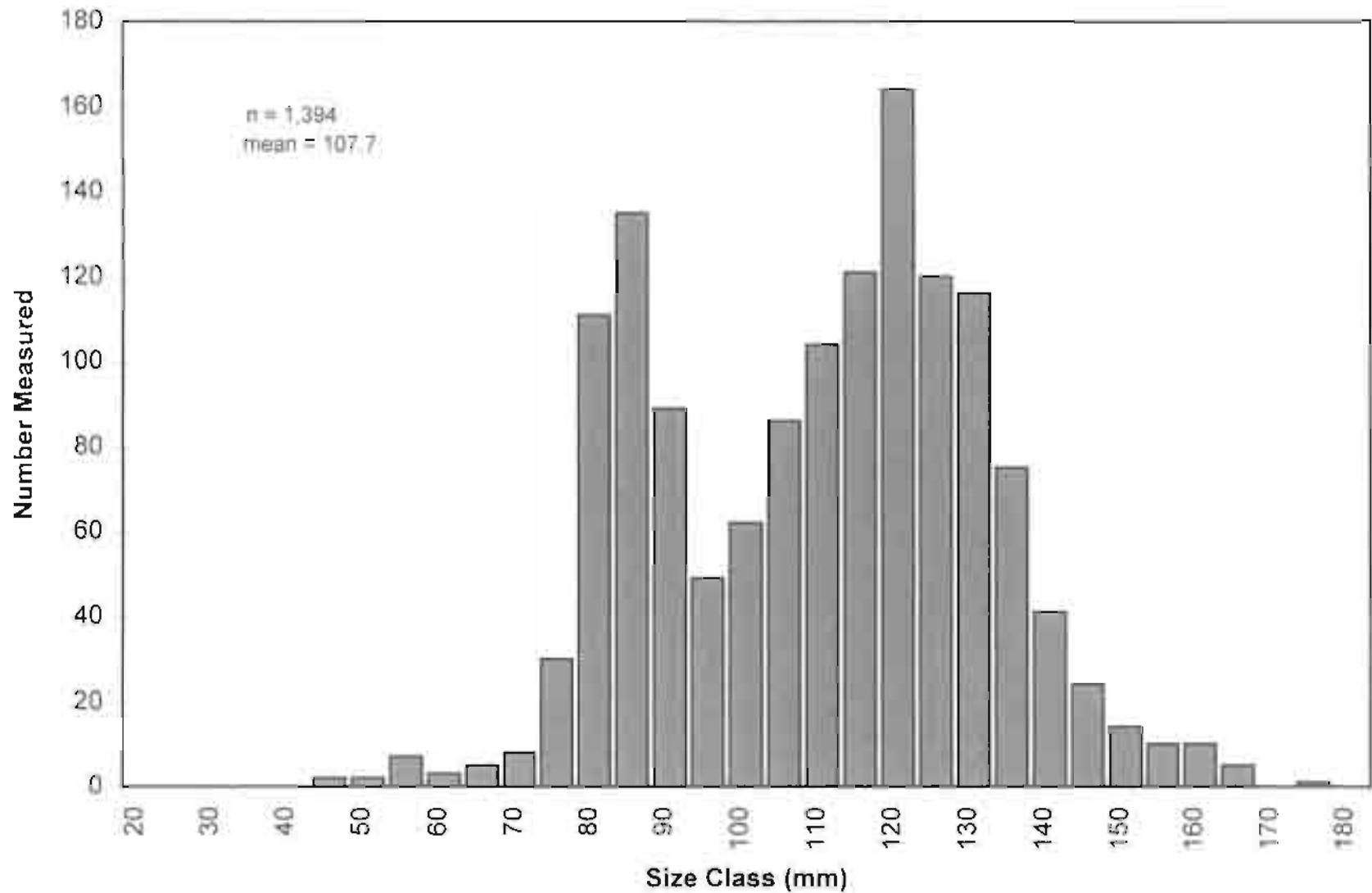


Figure 11. Size distribution of discarded scallops from observer samples, Bering Sea Area, 1996/97.

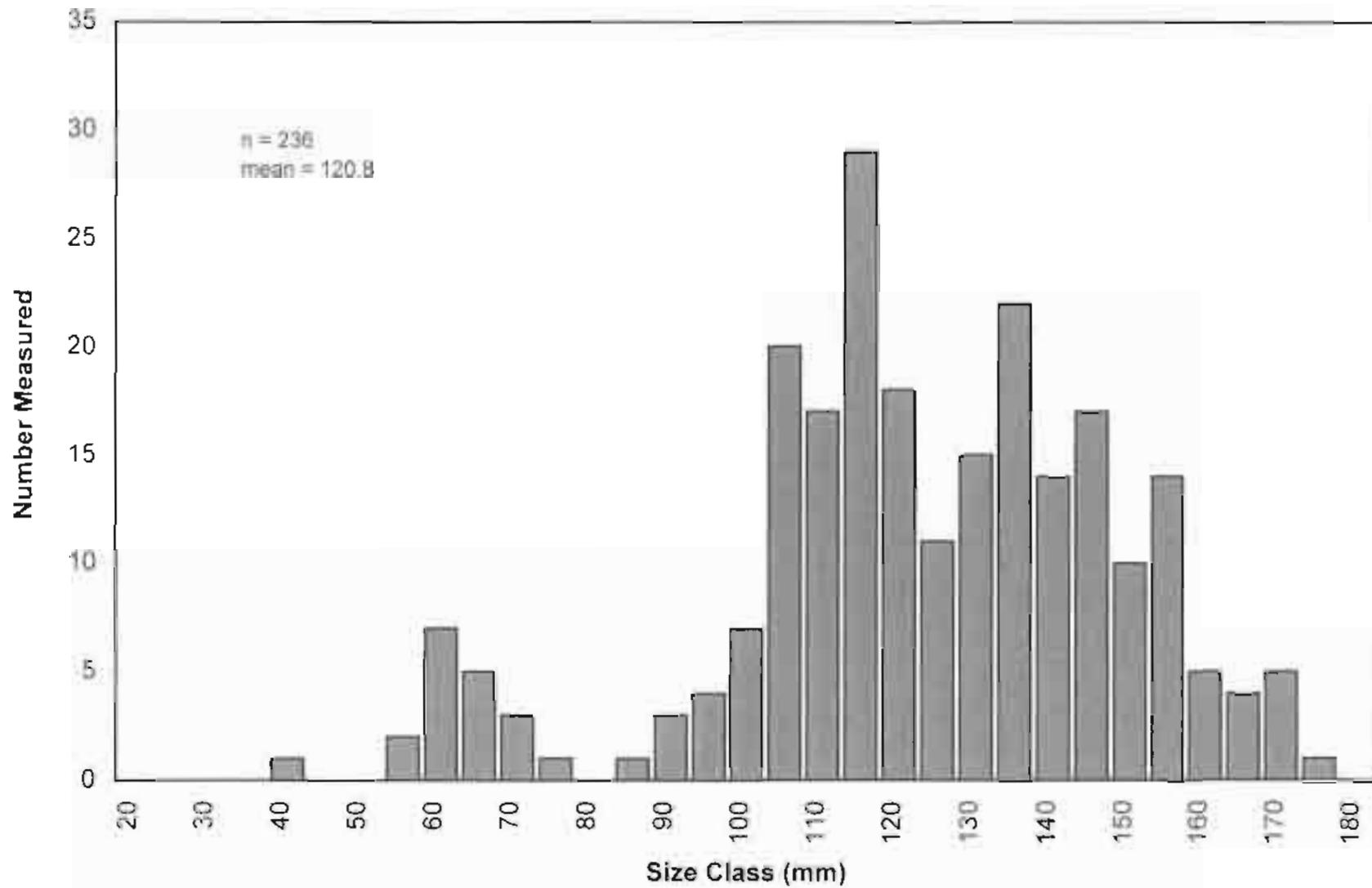


Figure 12. Size distribution of discarded scallops from observer samples, Semidi District, Kodiak Area, 1996/97.

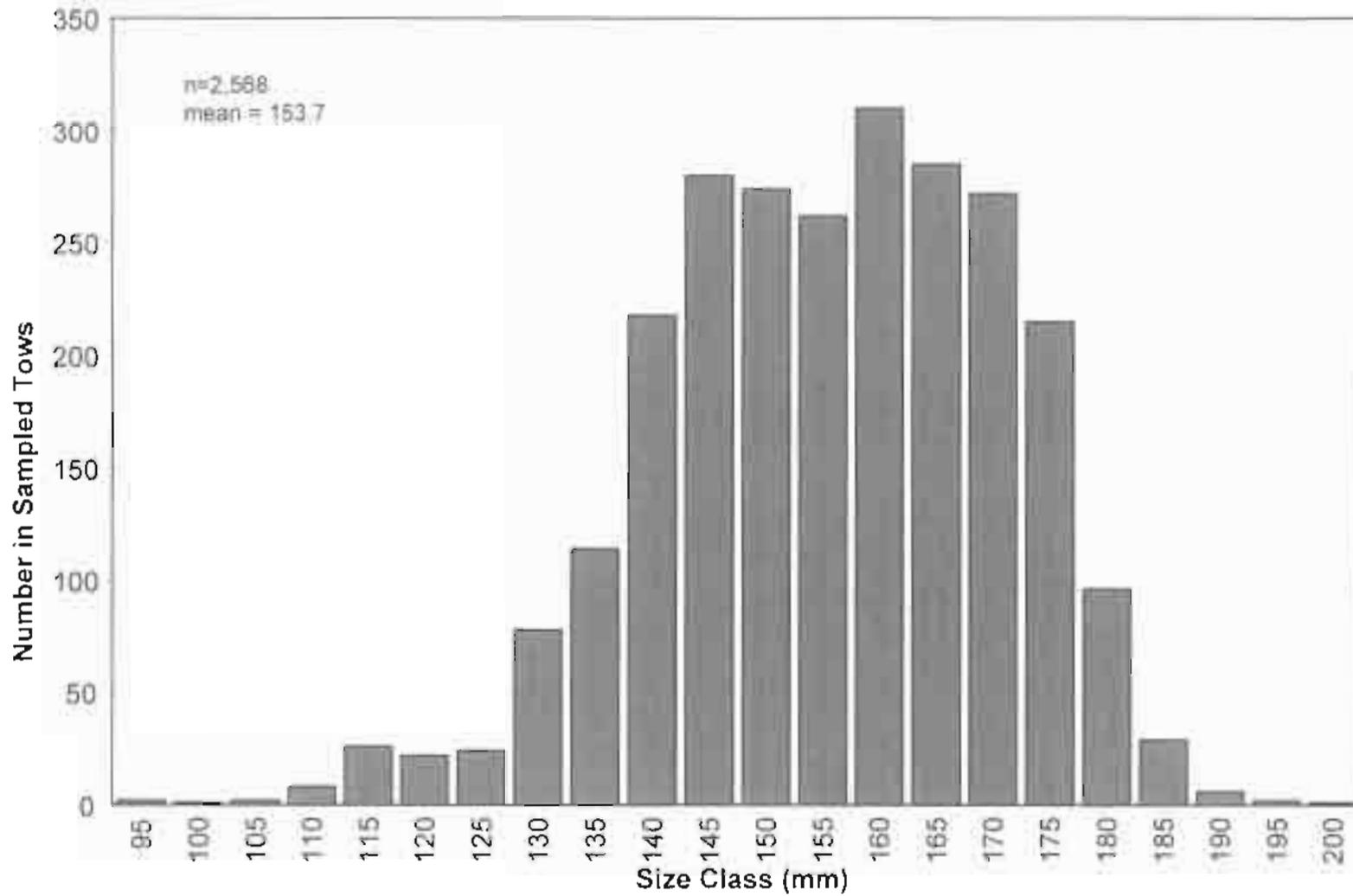


Figure 13. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) Semidi District, Kodiak Area, 1996/97.

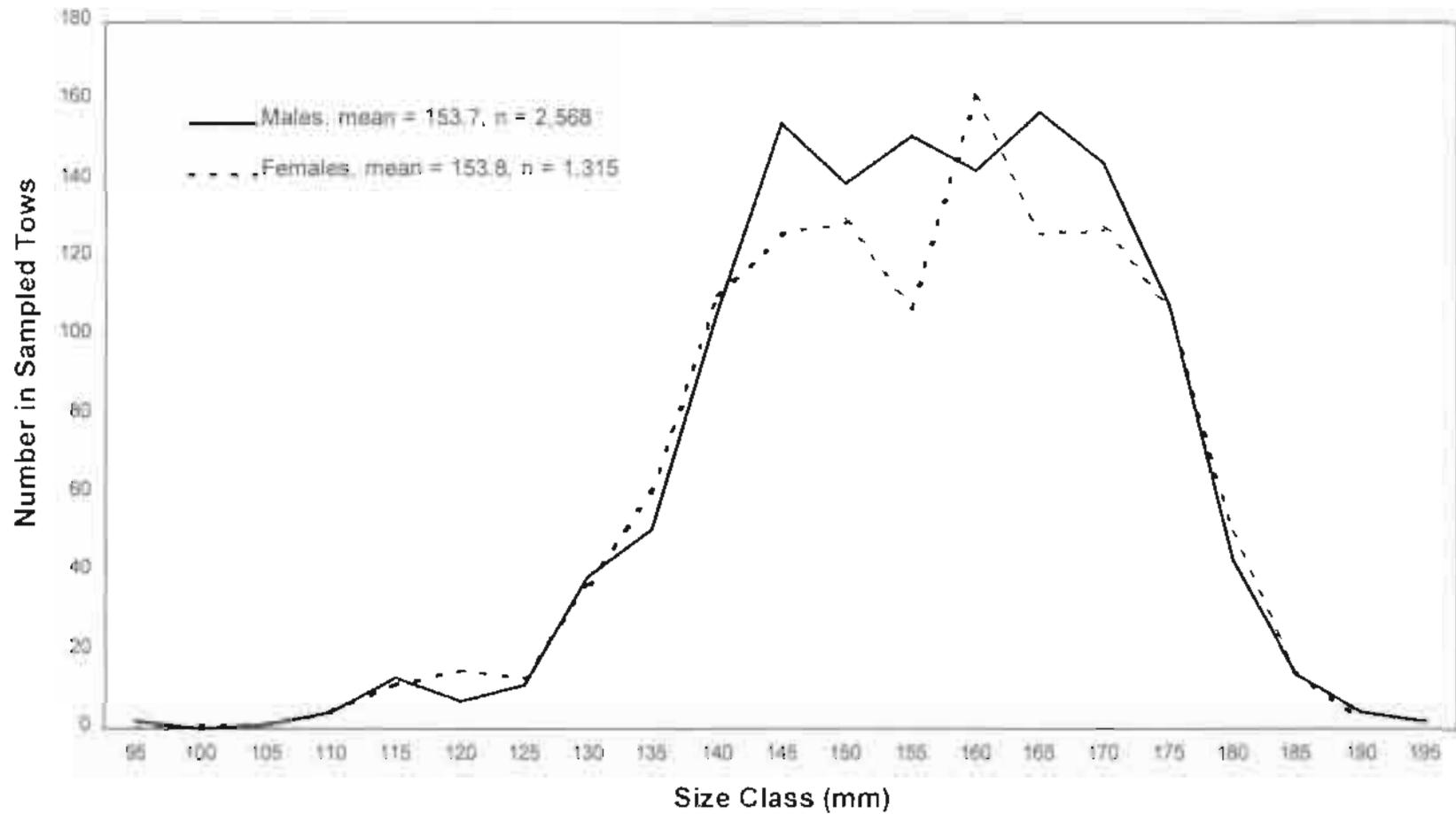


Figure 14. Scallop shell height distribution observed in the retained scallop catch, Semidi District, Kodiak Area, 1996/97.

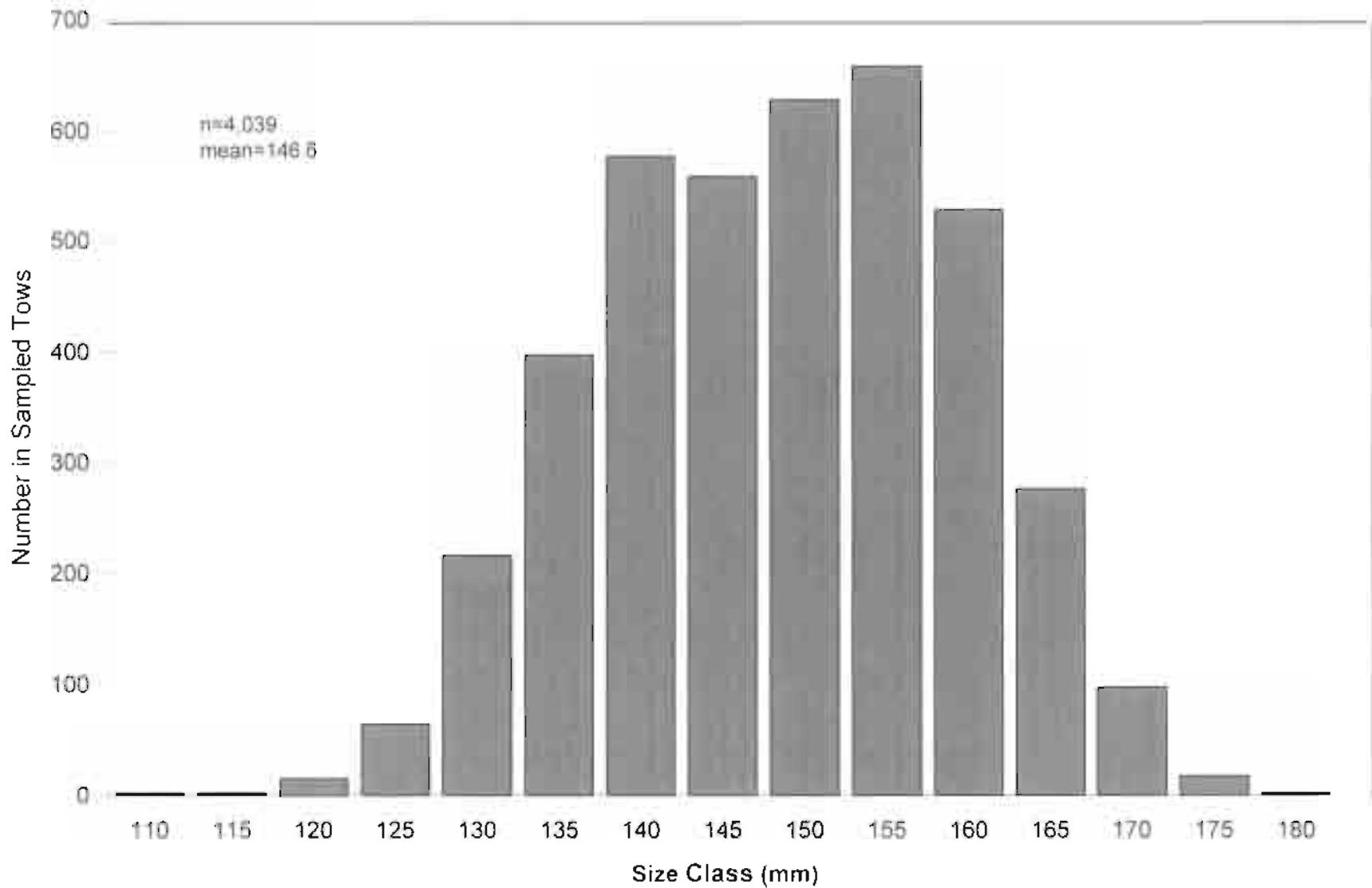


Figure 15. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) in the Bering Sea Area, 1996/97.

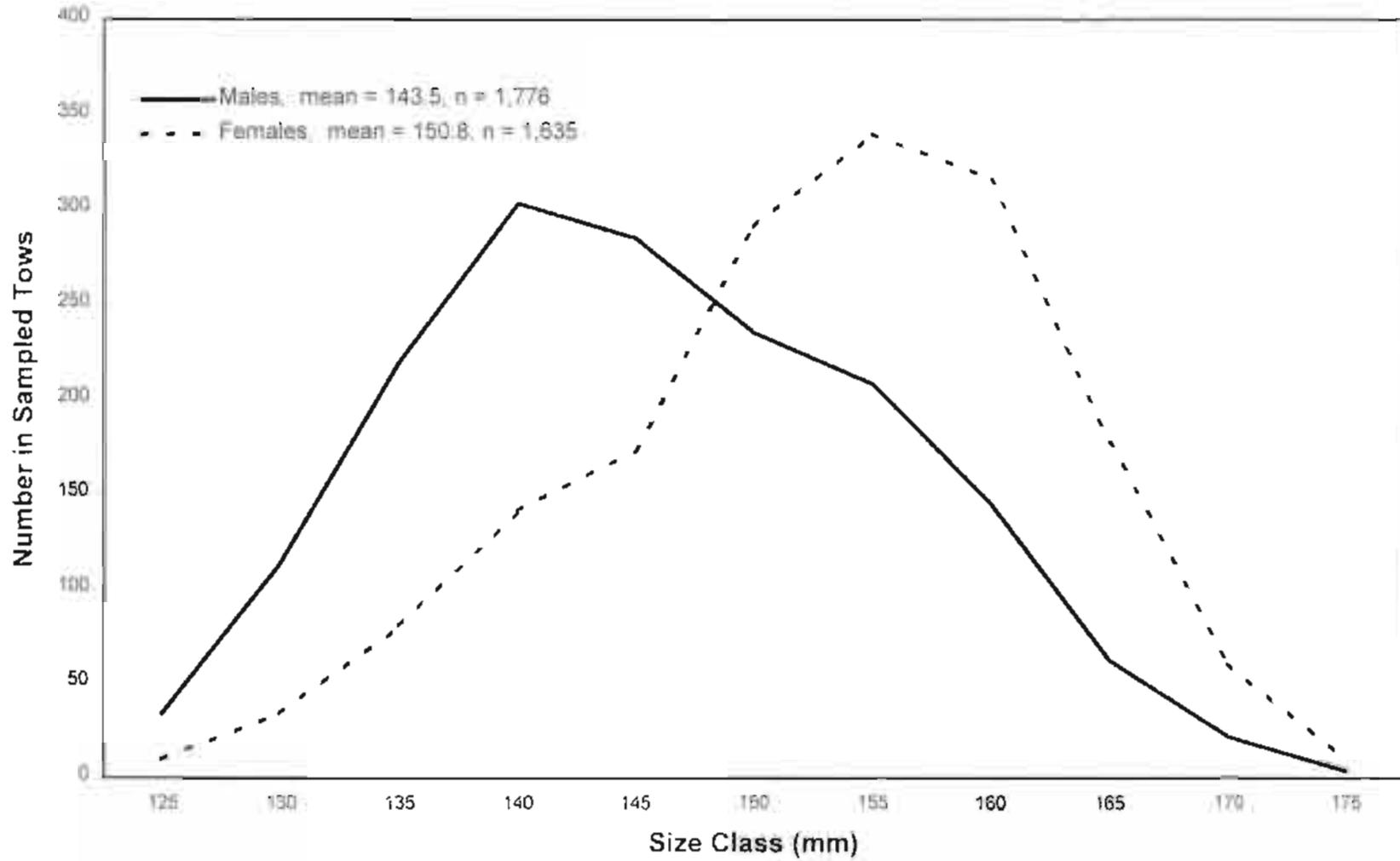


Figure 16. Scallop shell height distribution observed in the retained scallop catch, Bering Sea Area, 1996/97.

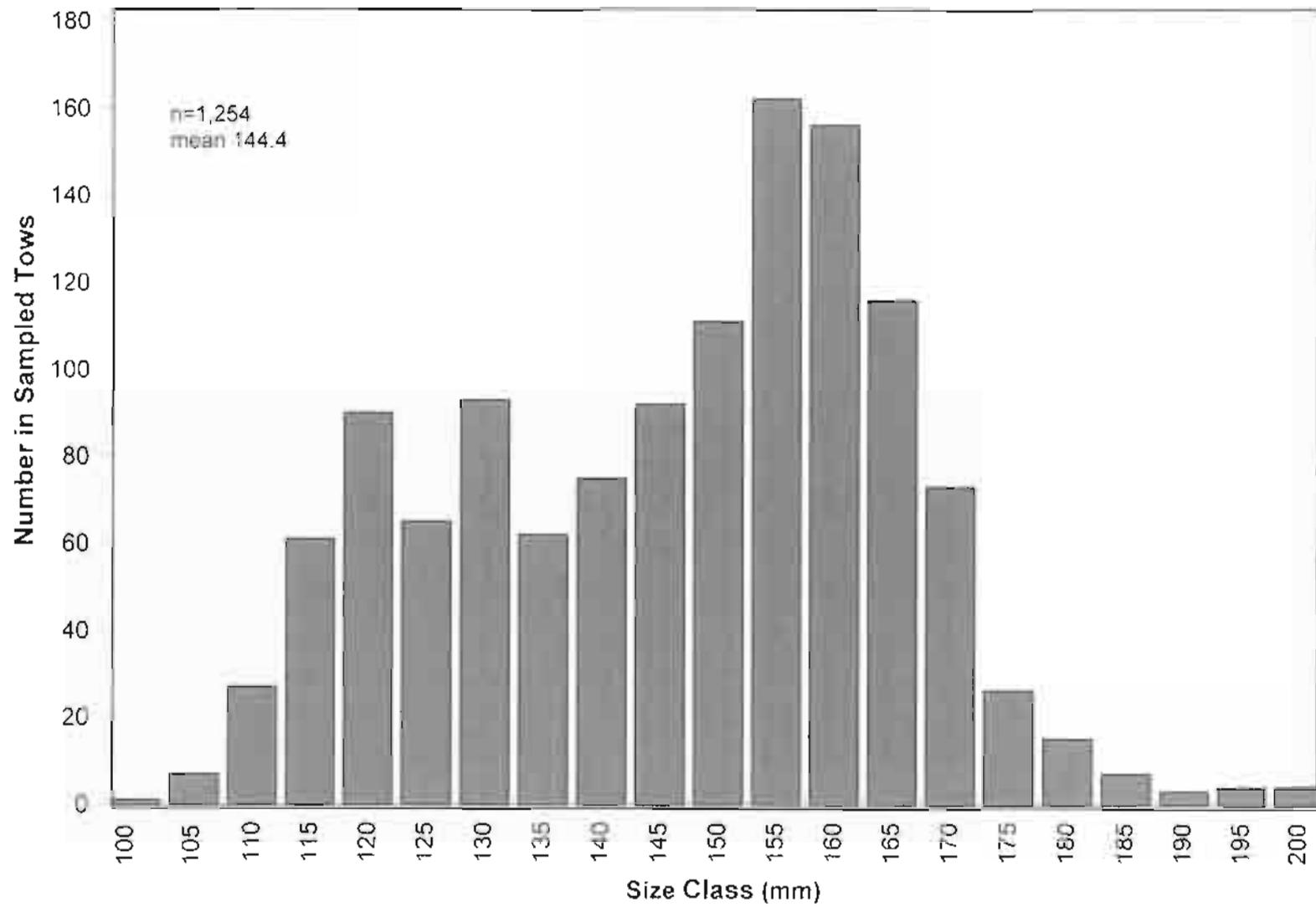


Figure 17. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) Northeast District, Kodiak Area, 1996/97.

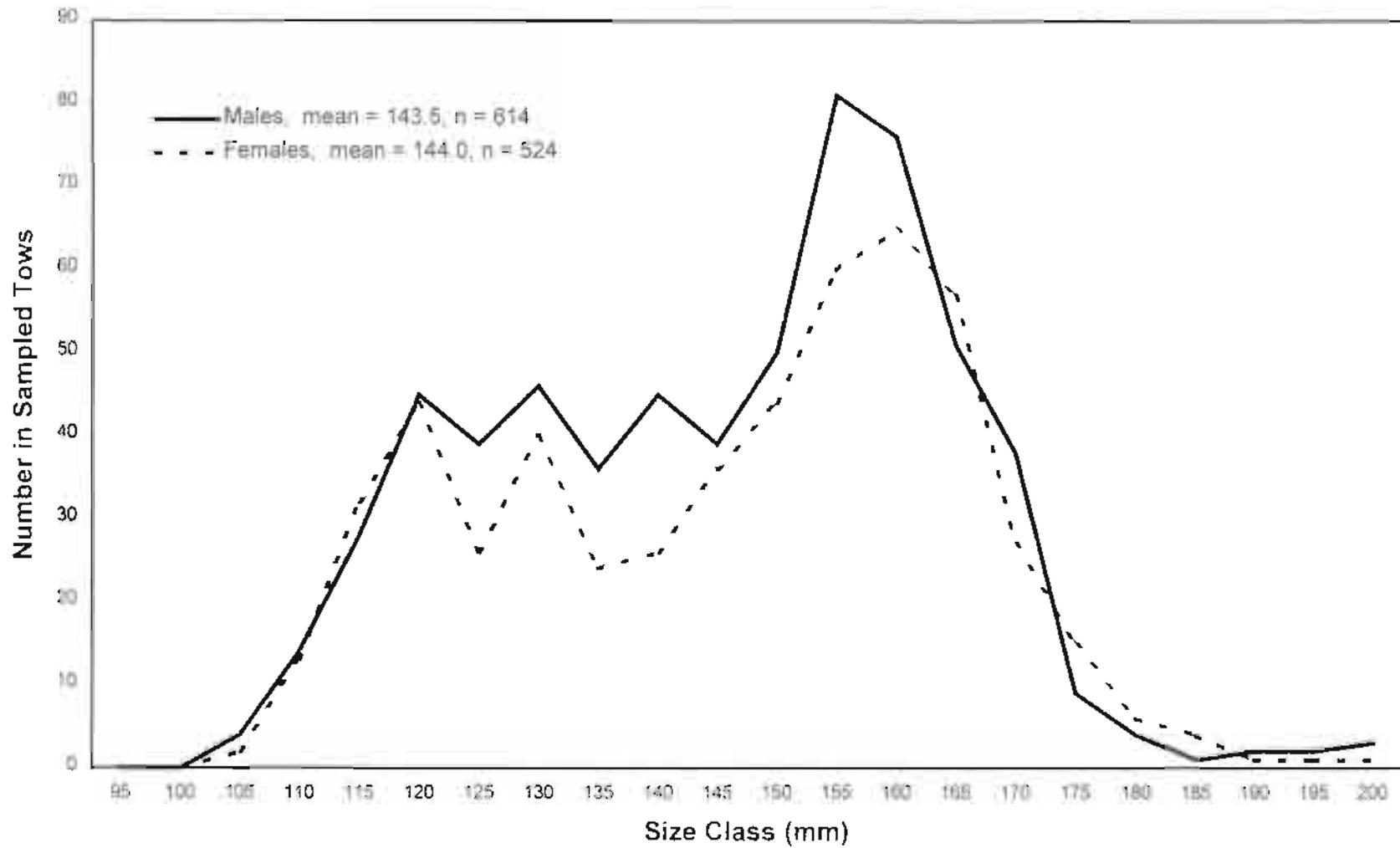


Figure 18. Scallop shell height distribution observed in the retained scallop catch Northeast District, Kodiak Area, 1996/97.

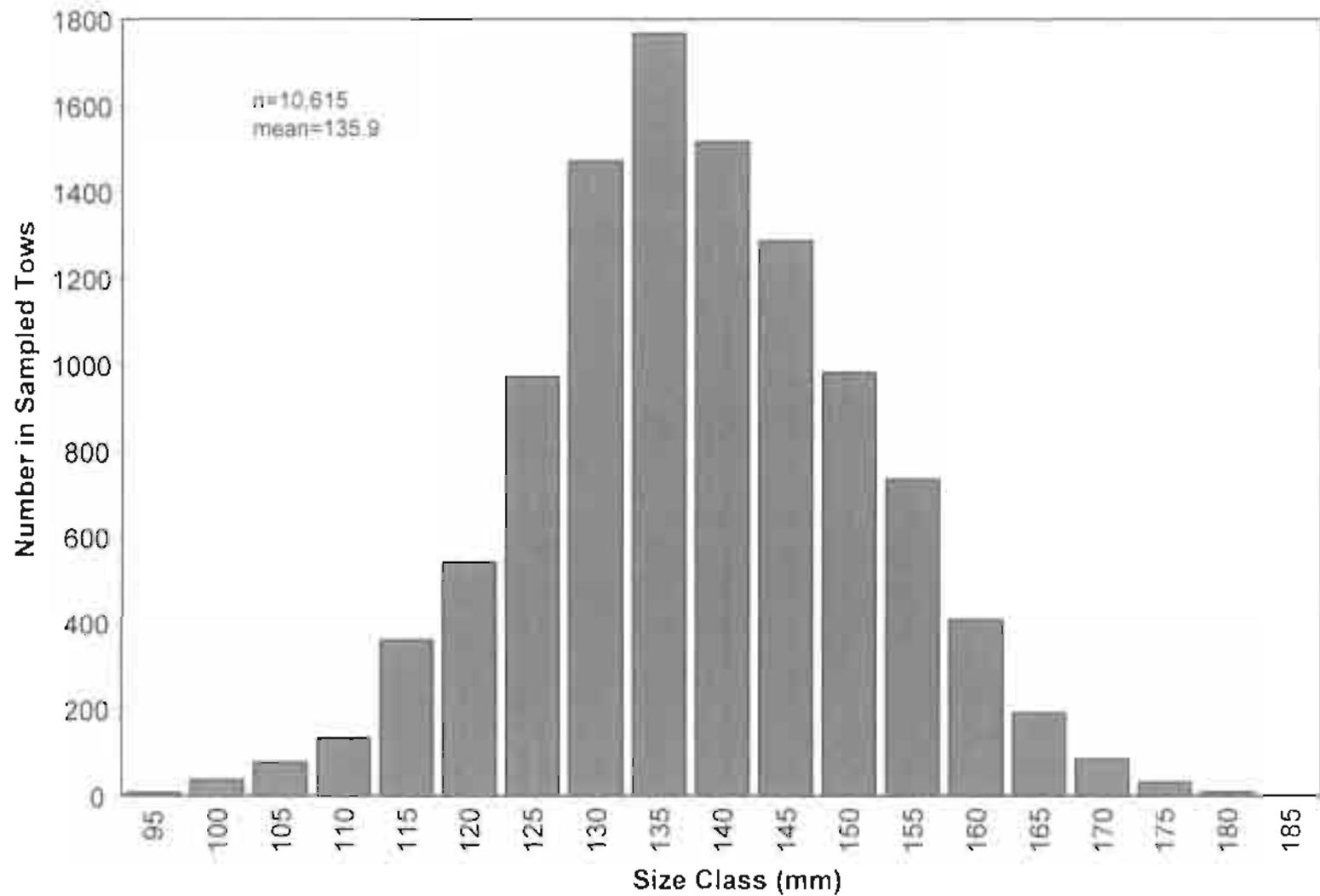


Figure 19. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) Shelikof District, Kodiak Area, 1996/97.

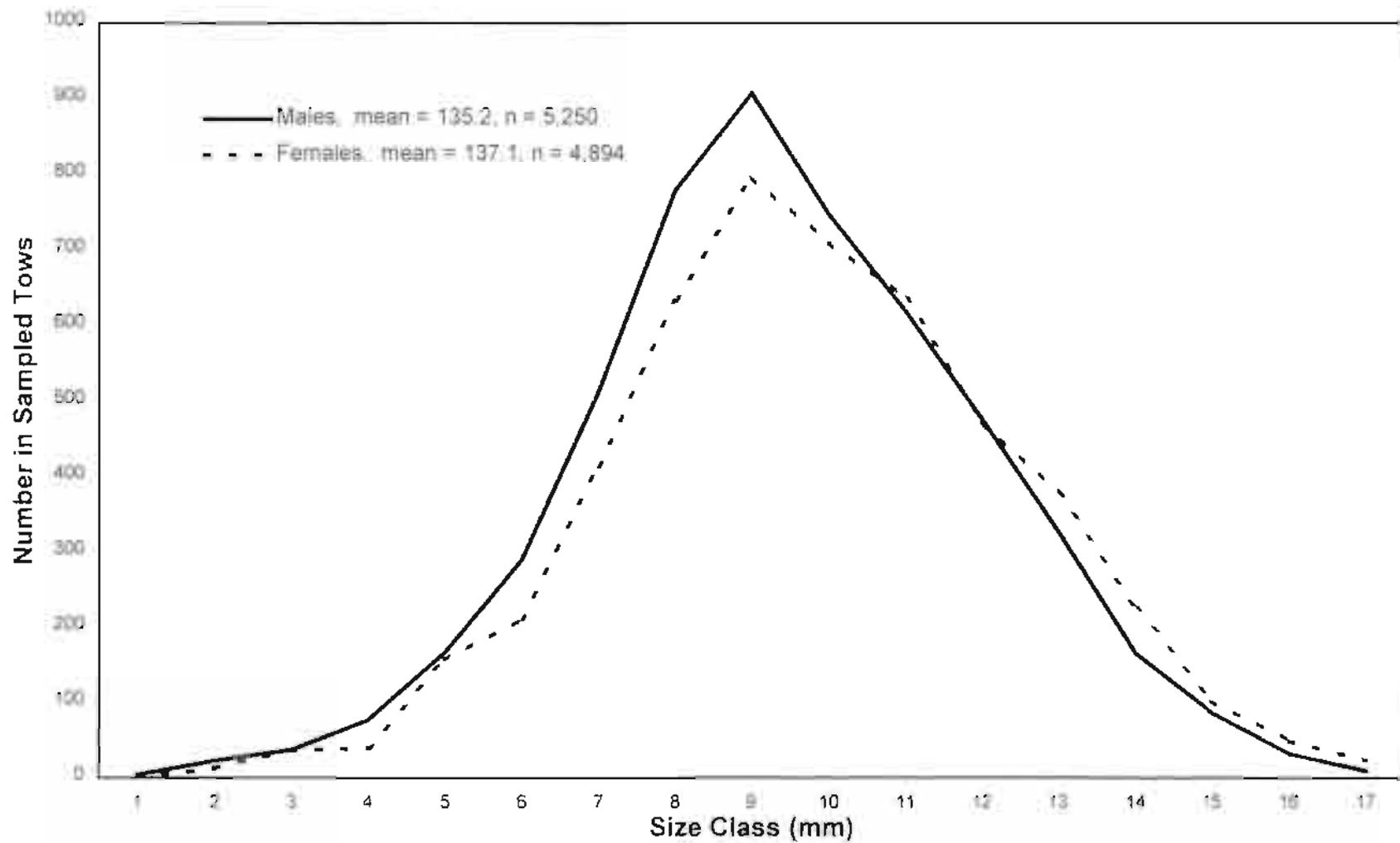


Figure 20. Scallop shell height distribution observed in the retained scallop catch, Shelikof District, Kodiak Area, 1996/97.

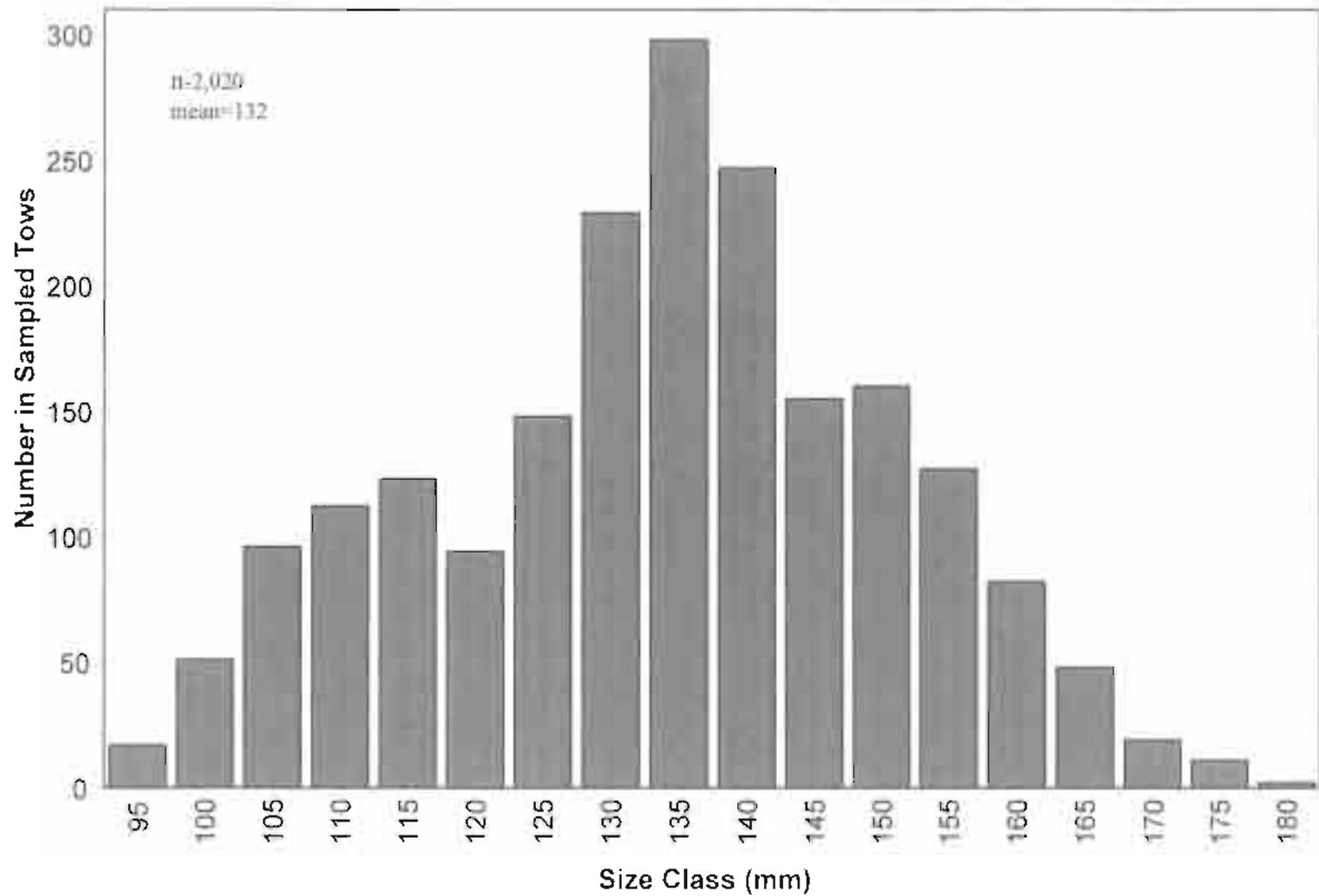


Figure 21. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) District 16, 1996/97.

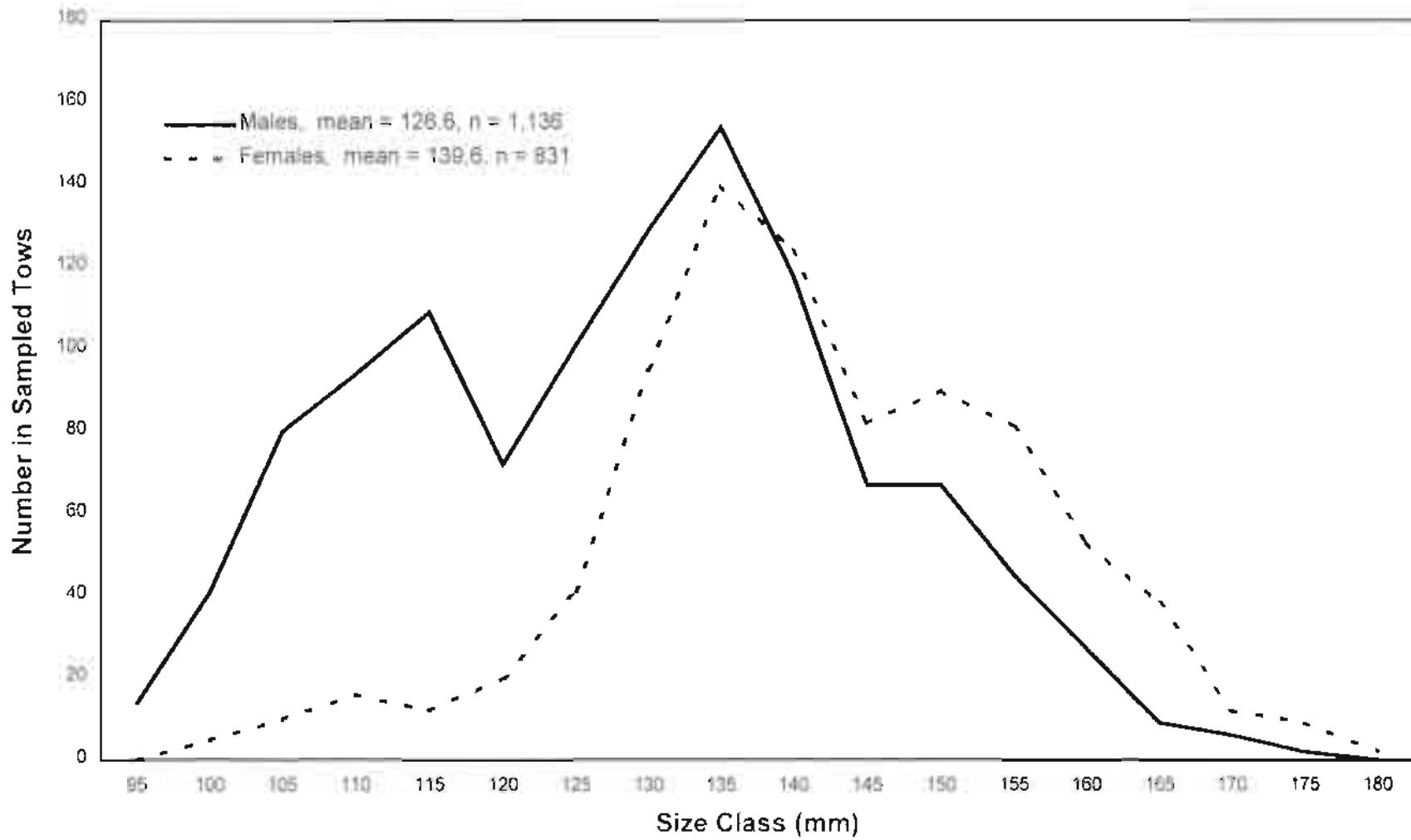


Figure 22. Scallop shell height distribution observed in the retained scallop catch, District 16, 1996/97.

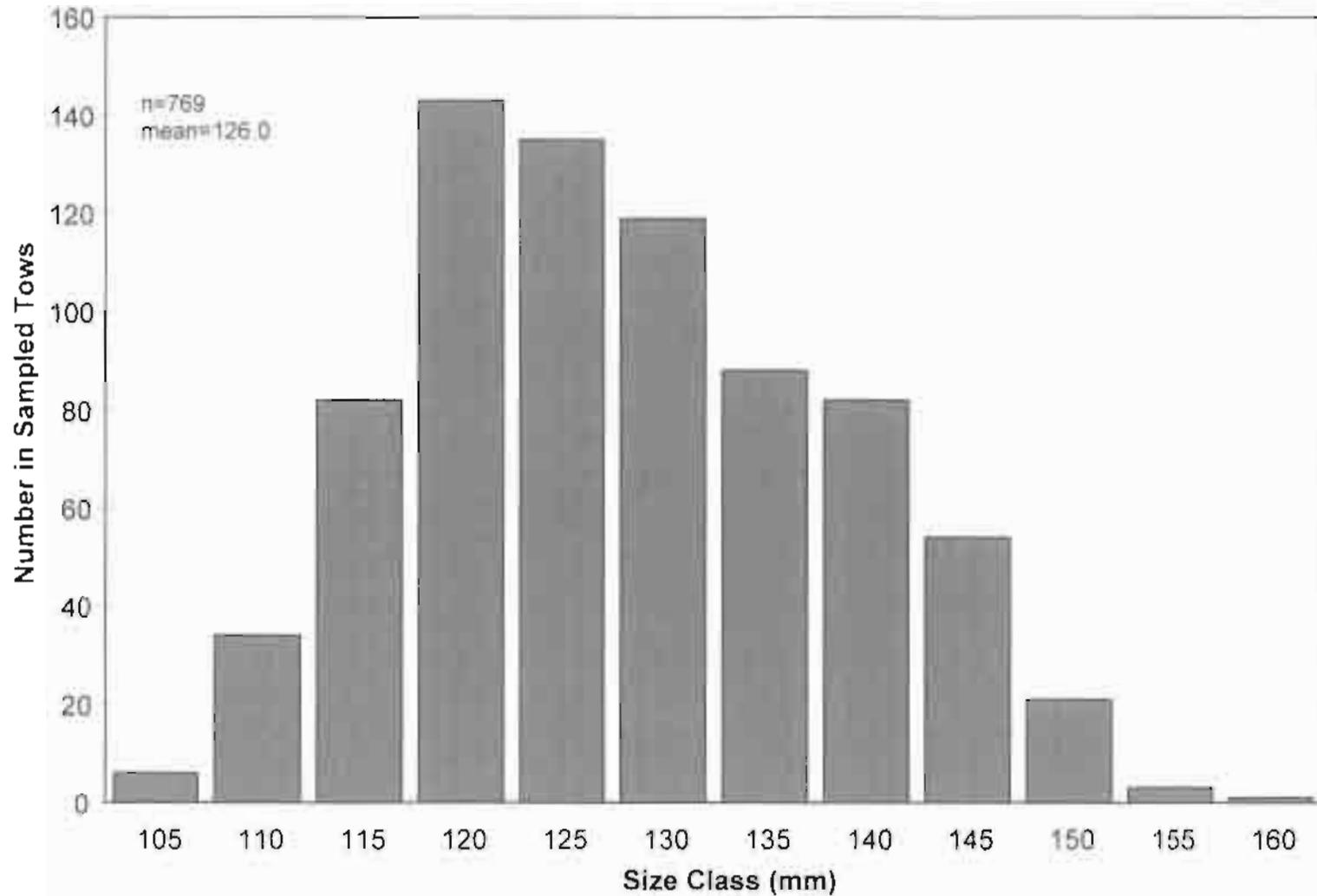


Figure 23. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined), Alaska Peninsula, 1996/97.

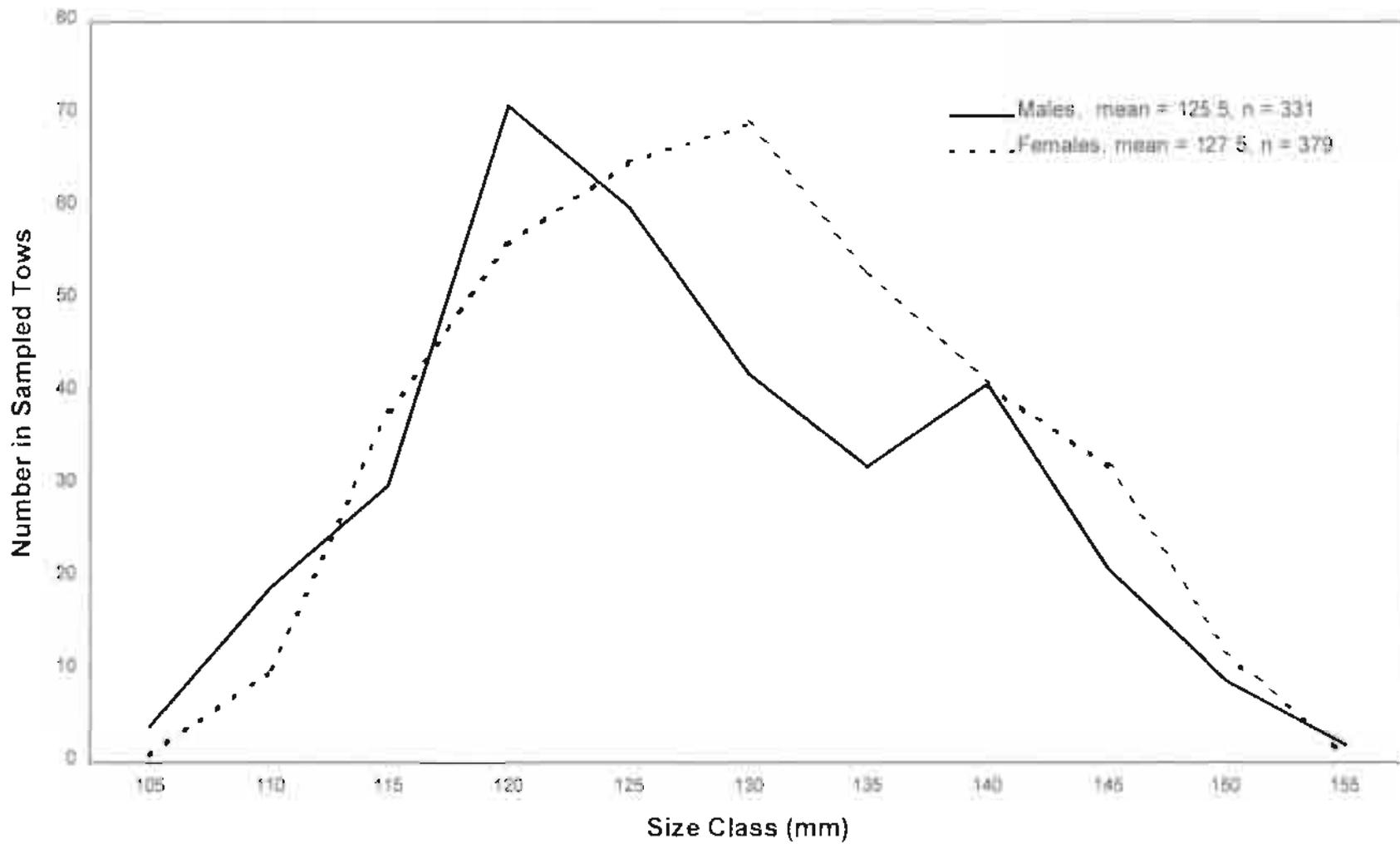


Figure 24. Scallop shell height distribution observed in the retained scallop catch, Alaska Peninsula Area, 1996/97.

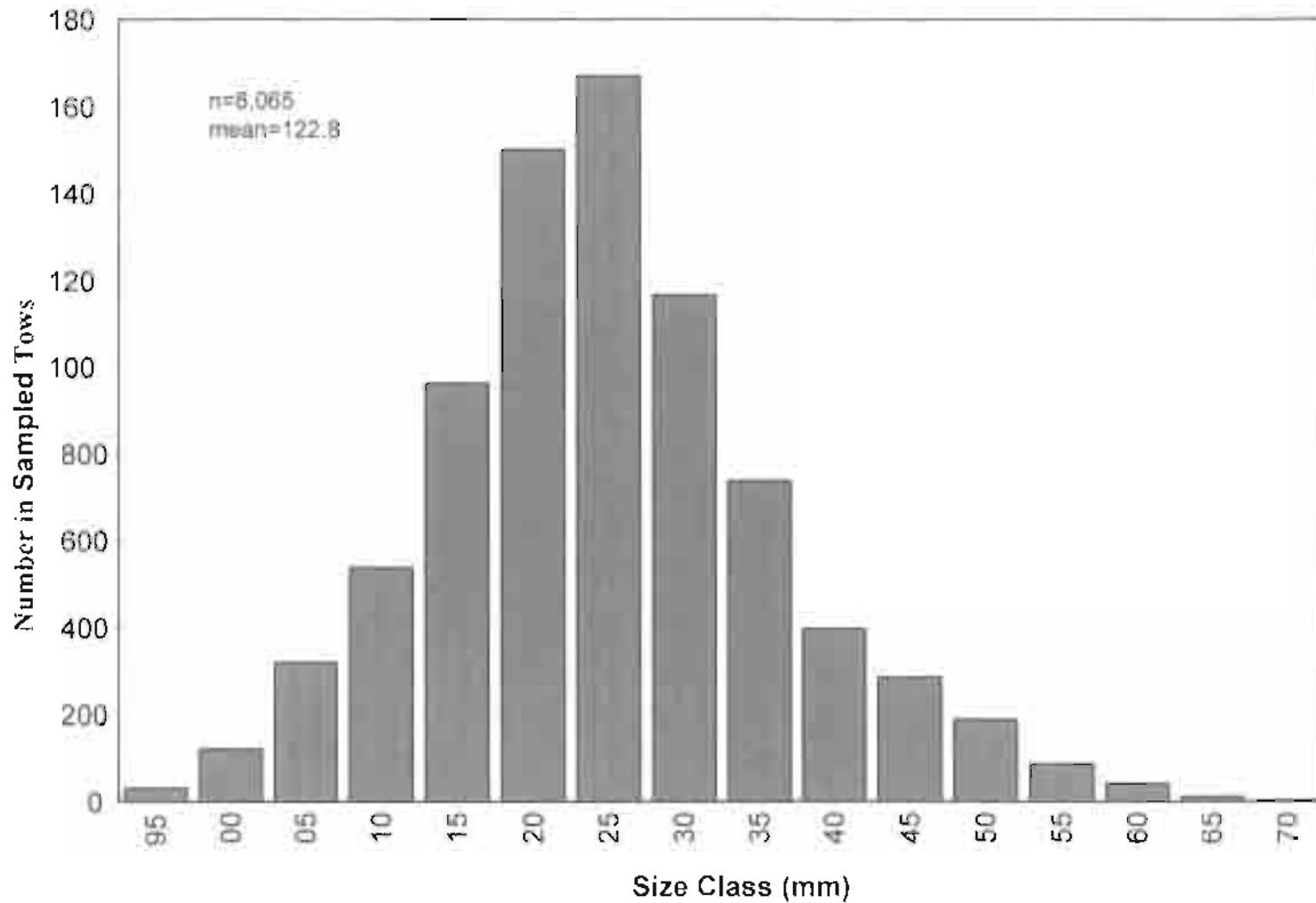


Figure 25. Scallop shell height distribution observed in the retained scallop catch (males, females, and undetermined sex combined) Yakutat, 1996/7.

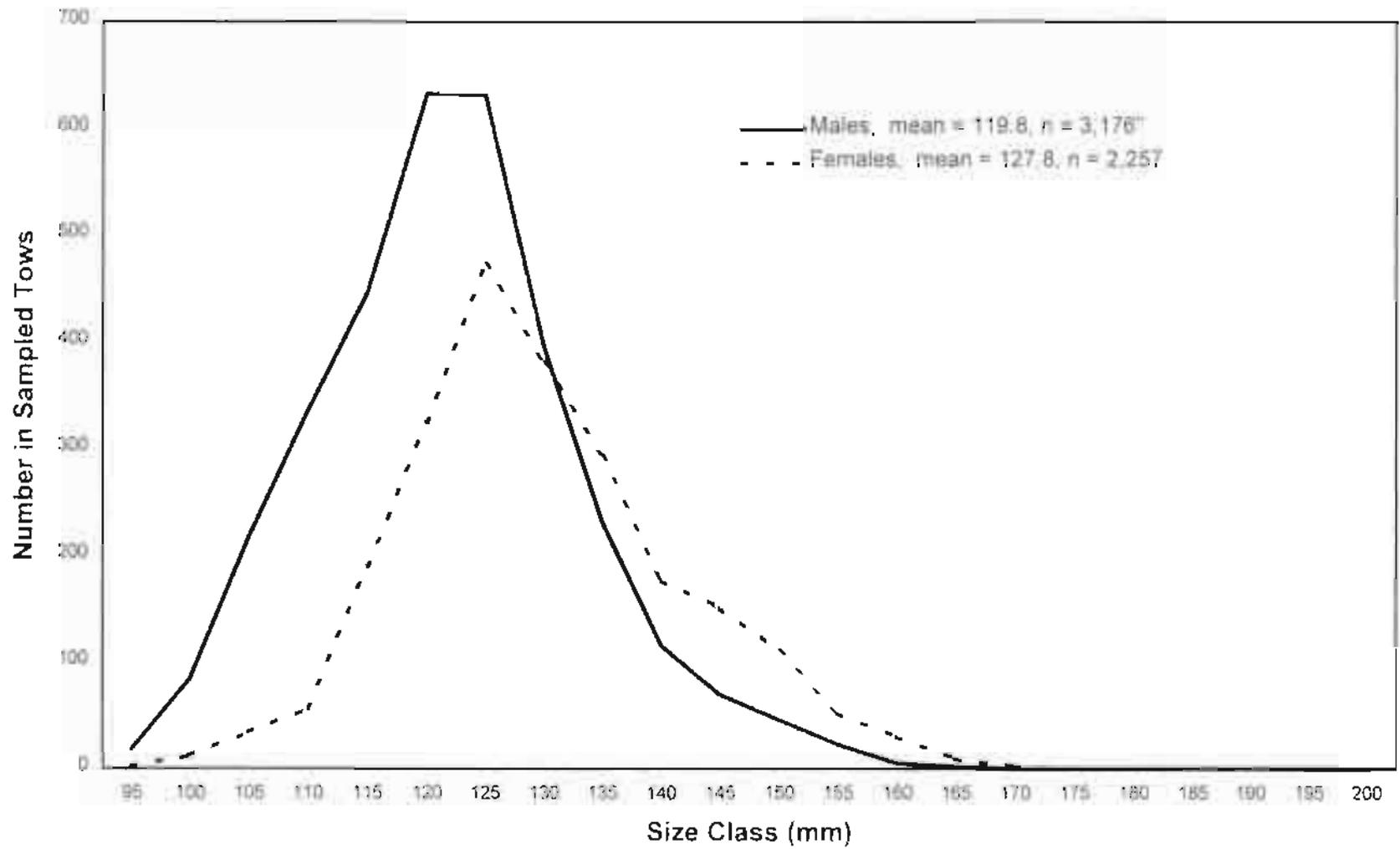


Figure 26. Scallop shell height distribution observed in the retained scallop catch, Yakutat Area, 1996/97.

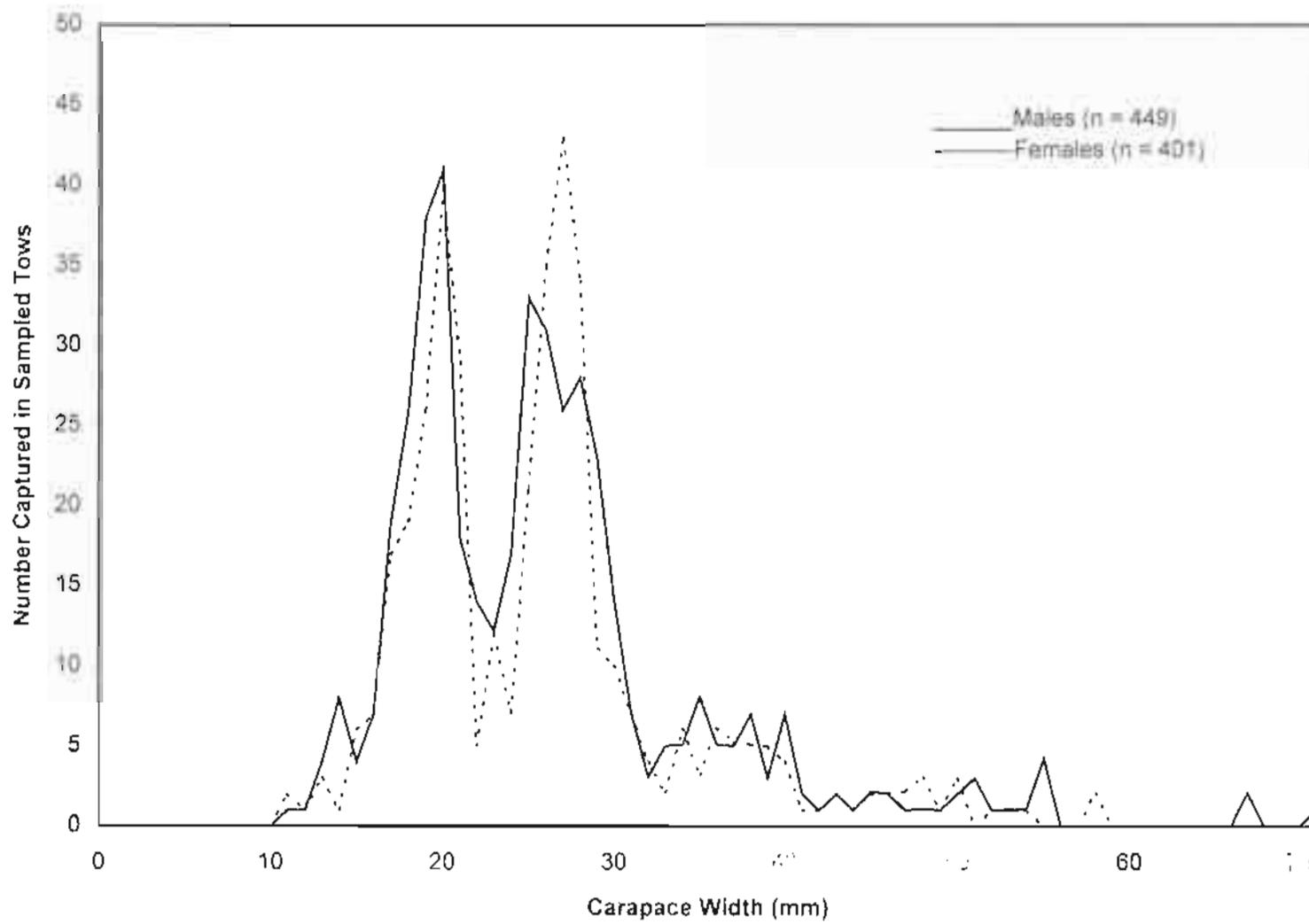


Figure 27. Tanner crab width distribution observed in bycatch sampling, Yakutat Area, 1996/97.

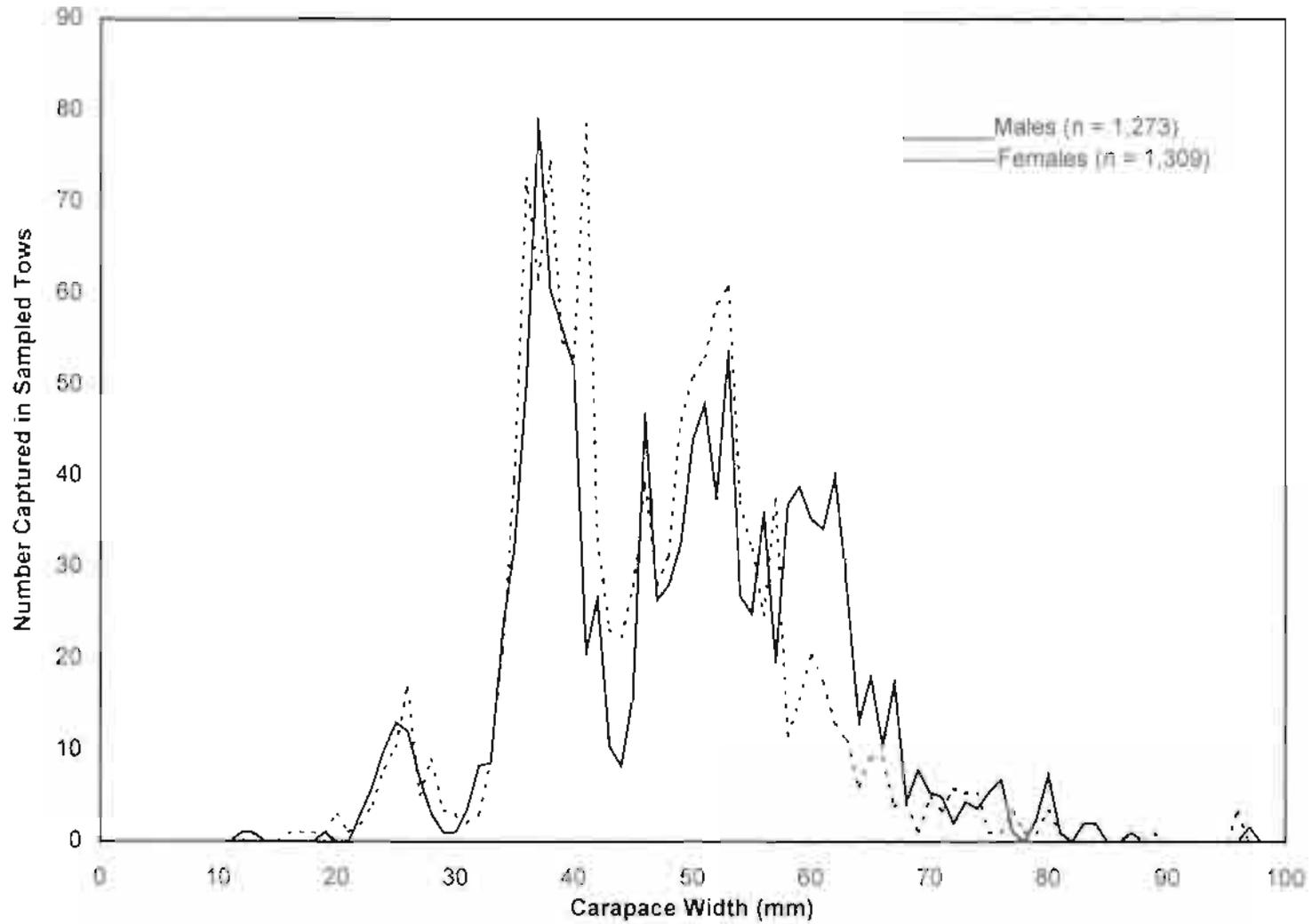


Figure 28. Tanner crab width distribution observed in bycatch sampling, Northeast District, Kodiak Area, 1996/97.

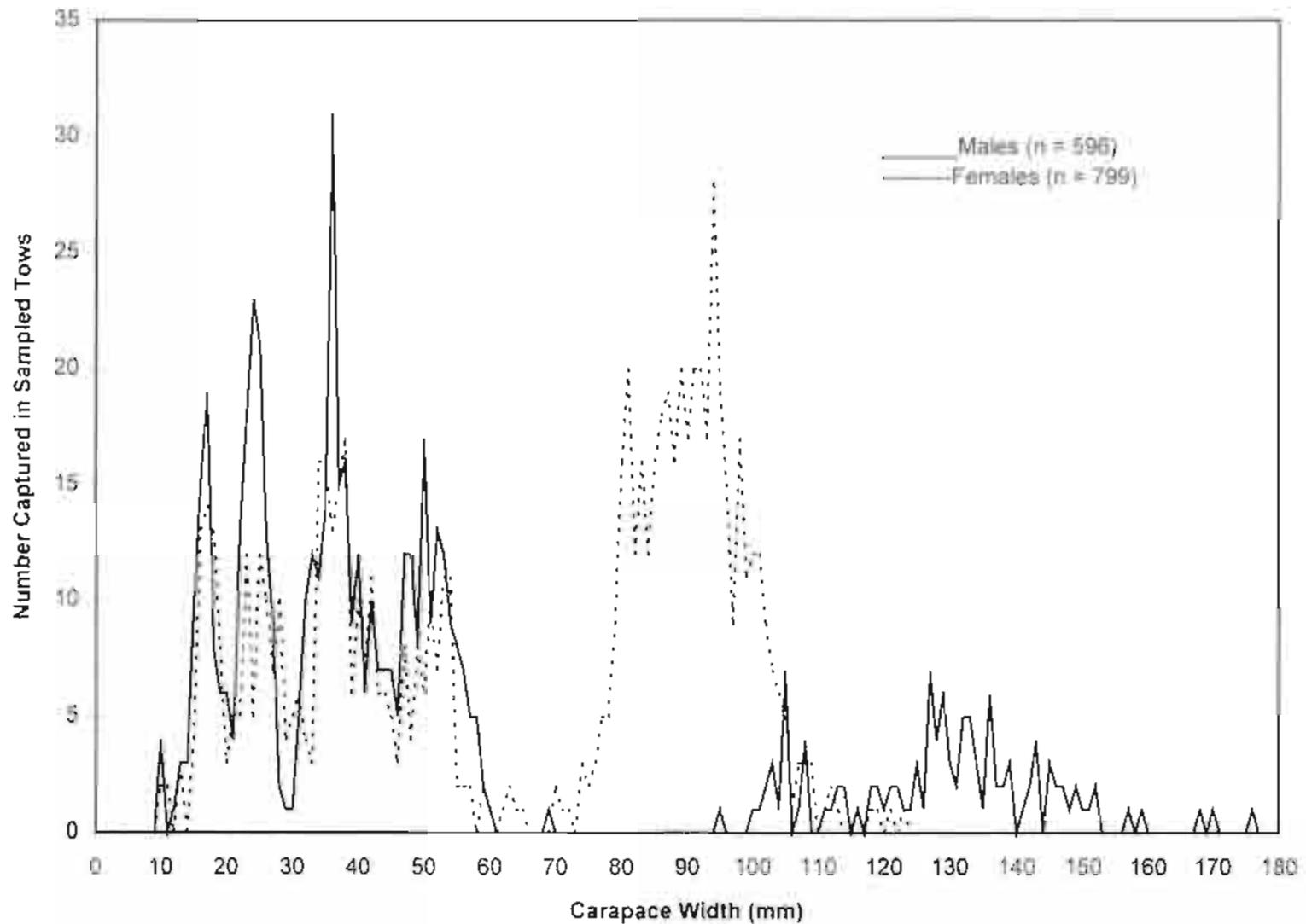


Figure 29. Tanner crab width distribution observed in bycatch sampling, Shelikof District, Kodiak Area, 1996/97.

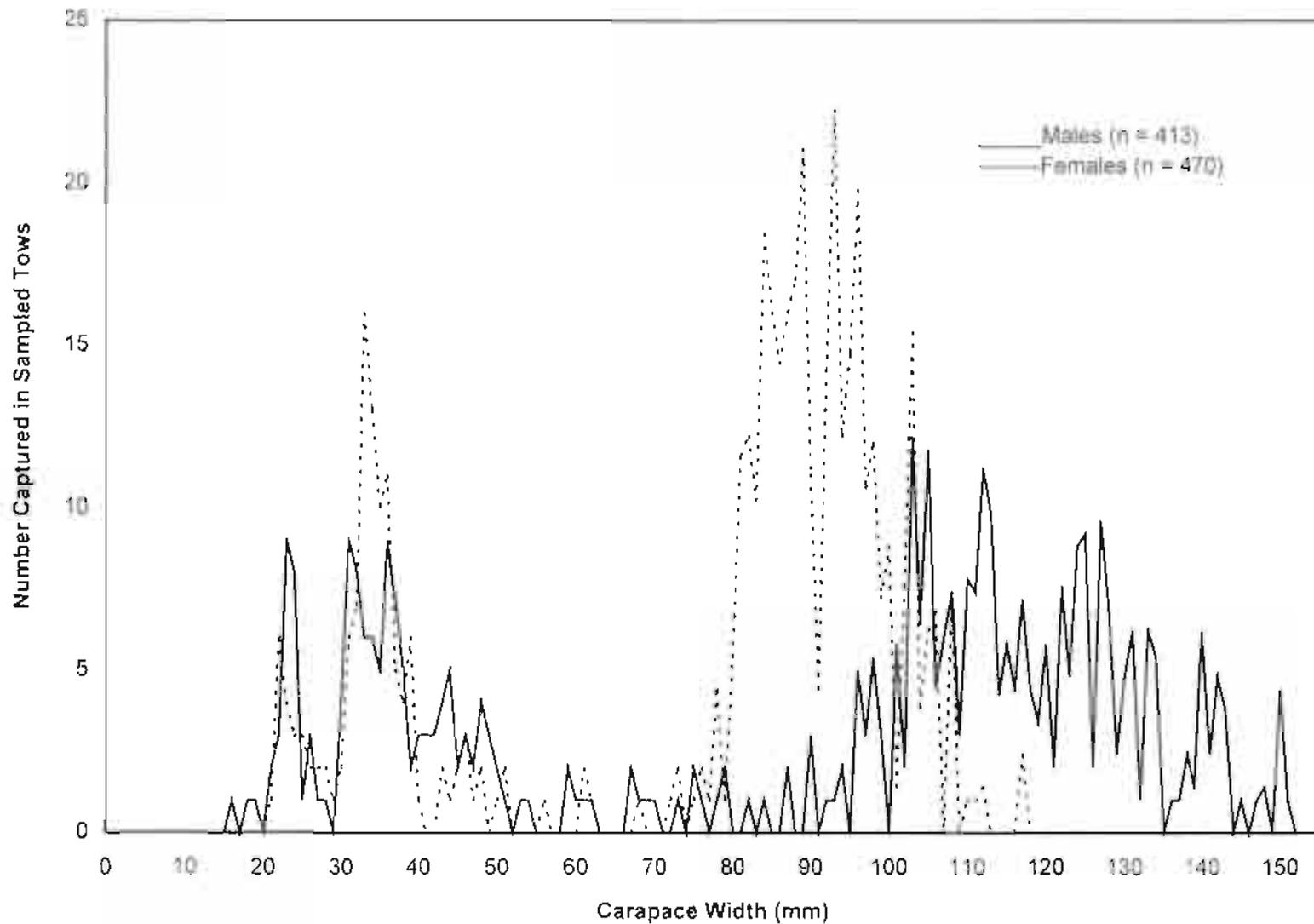


Figure 30. Tanner crab width distribution observed in bycatch sampling, Semidi District, Kodiak Area, 1996/97.

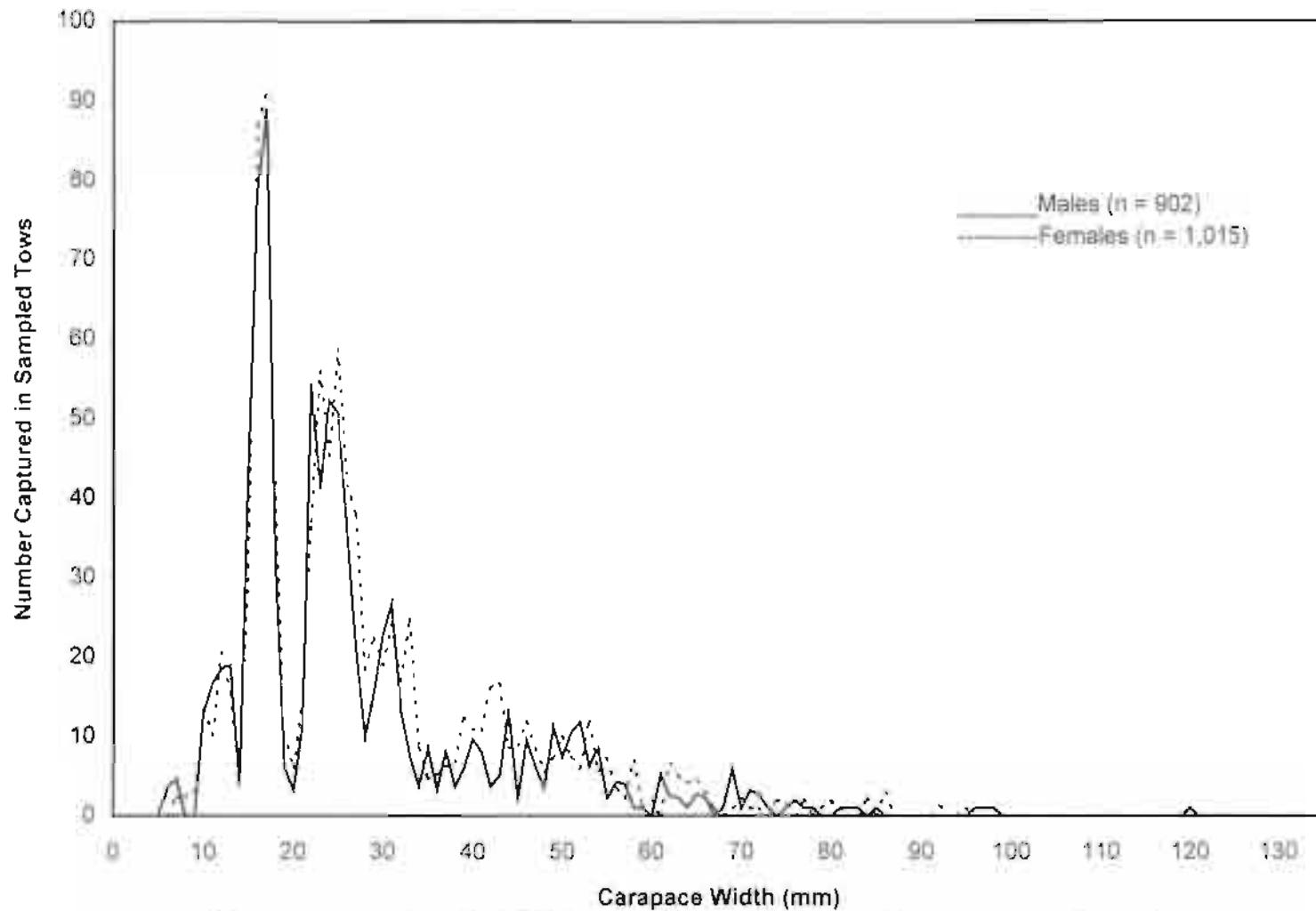


Figure 31. Tanner crab width distribution observed in bycatch sampling, Alaska Peninsula Area, 1996/97.

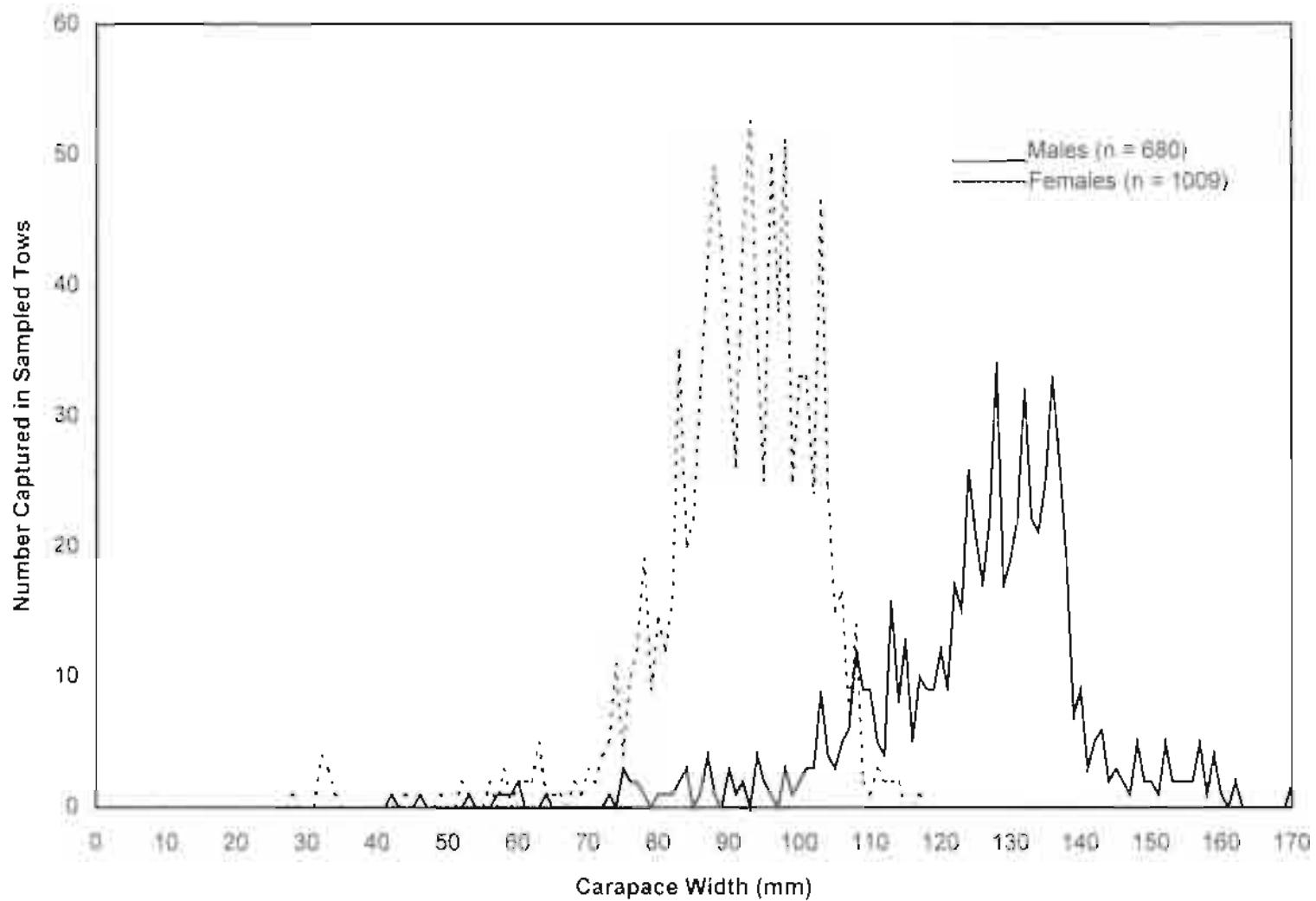


Figure 32. Tanner crab width distribution observed in bycatch sampling, Bering Sea Area, 1996/97.

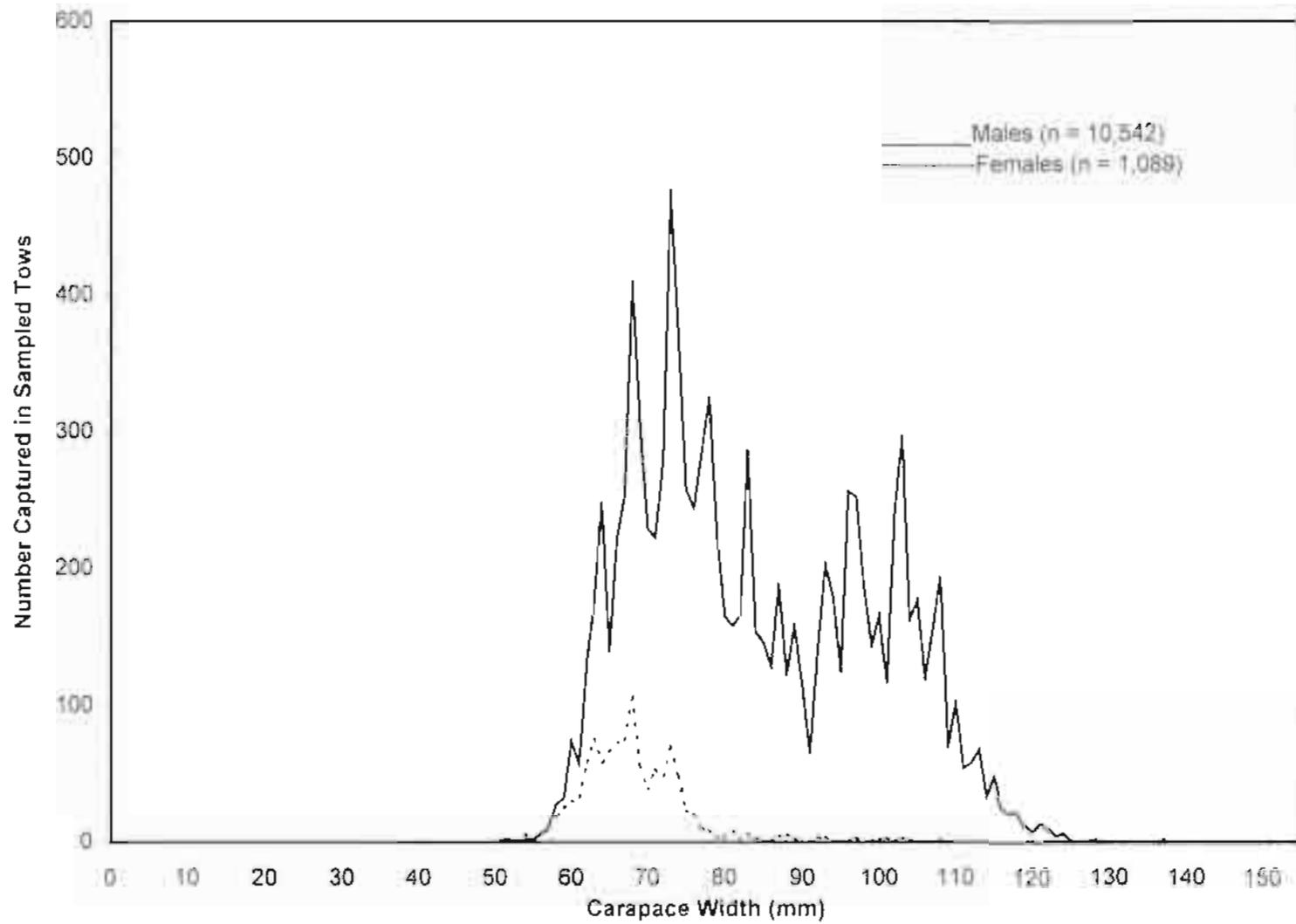


Figure 33. Snow crab width distribution observed in bycatch sampling, Bering Sea Area, 1996/97.

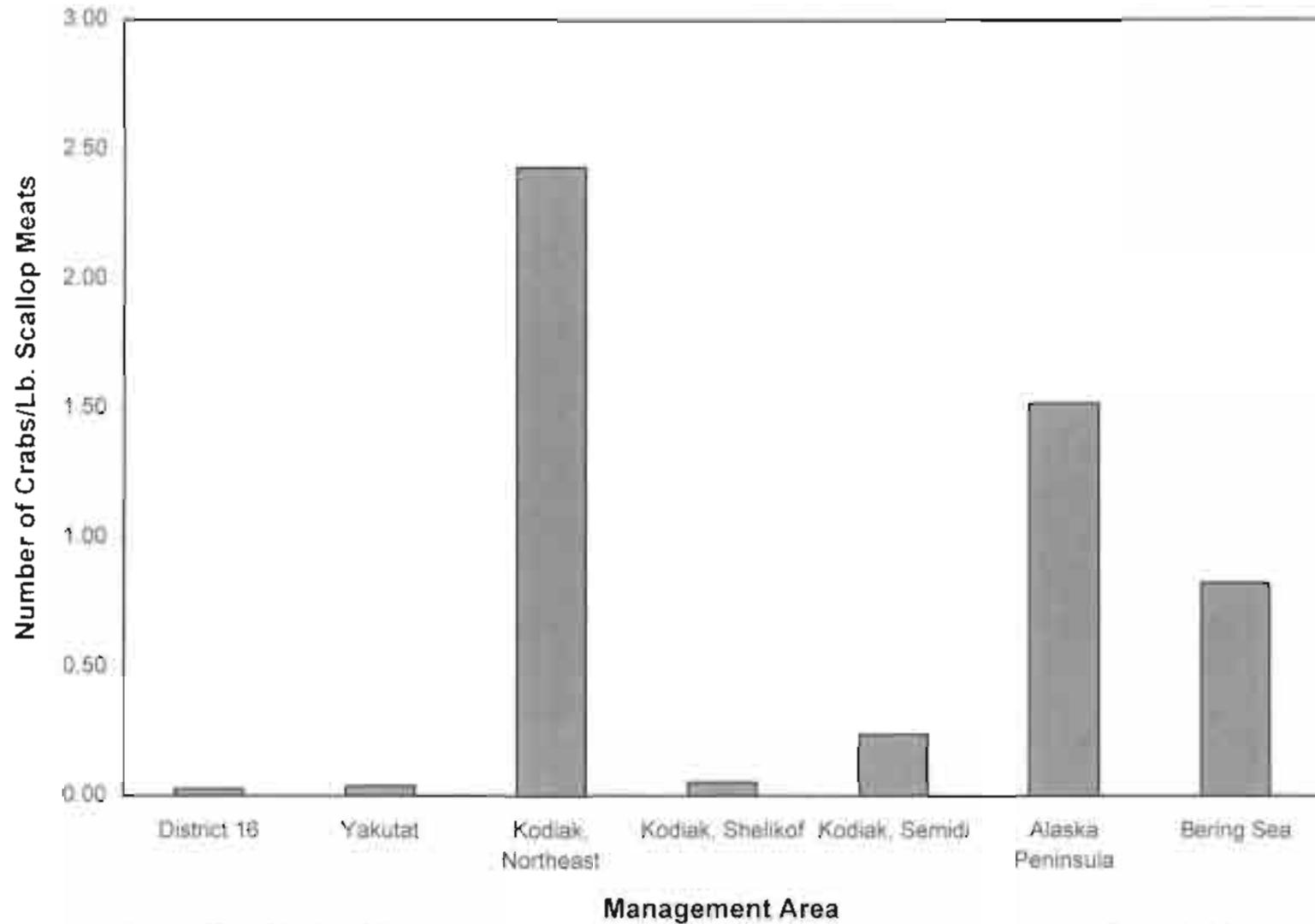


Figure 34. Catch of Tanner crabs per pound of retained scallops by management area in the 1996/97 scallop fishery.

APPENDIX

Appendix A. 6. Scallop size frequency form used by onboard scallop observers for recording shell height, gonad development and sex for both retained and discarded scallop samples.

ALASKA DEPARTMENT OF FISH AND GAME Page ____ of ____
SCALLOP SIZE FREQUENCY FORM

Observer _____
 Vessel _____
 Date _____

Trip #		ADF&G #			Fish Code			Haul #	

Sample type

	Shell height (mm)		Sex	Gonad Develop							Comments	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
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18												
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27												
28												
29												
30												
31												
32												
33												
34												
35												

Sex
 1-Male
 2-Female
 3-can not be determined

Gonad Development
 0-Not Ripe
 2-Full or ripe
 3-Cannot be Determined

Sample type
 1-Unsorted catch
 2-Retained catch
 3-Discarded catch

Appendix A. 9. Radio report form used by onboard scallop observers for summarizing and recording encoded data by statistical area.

SCALLOP OBSERVER RADIO REPORT FORM

AREA: _____
 VESSEL: _____
 OBSERVER: _____

		MONDAY	TUESDAY	MON/TUES TOTALS	WEDNESDAY	THURSDAY	WED/THURS TOTALS	FRIDAY	SATURDAY	SUNDAY	FRI/SAT/SUN TOTALS	WEEKLY TOTAL
DATE												
ITEM 1. Stat-Area	actual code											
ITEM 2. Total number of hauls.	actual code											
ITEM 3. Number of bycatch sampled hauls.	actual code											
ITEM 4. Number of king crab in bycatch sampled hauls.	actual code											
ITEM 5. Sampling Condition	actual code											
ITEM 6. Number of <i>C. bairdi</i> Tanner in bycatch smp'l'd hauls.	actual code											
ITEM 7. Number of <i>C. opilio</i> Tanner in bycatch smp'l'd hauls.	actual code											
ITEM 8. Pounds of scallop meats retained.	actual code											
ITEM 9.	actual code											

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