Portrait of the Fishery of the Spiny Lobster *Panulirus argus* in Puerto Rico during 1988-2001

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ABSTRACT

The Puerto Rico Department of Natural and Environmental Resources (DNER) is responsible to conserve and manage all the Island's natural resources, including the fishery resources. The DNER's Commercial Fisheries Statistics Program (CFSP) collects and analyzes the dependent fisheries data. The CFSP has been collecting data since 1971. During the 1980's decade, it was observed that the Puerto Rico's commercial fishery resources had shown overfishing symptoms (e.g. decrease in landings pounds, change in catch composition, decrease in the size of some important species).

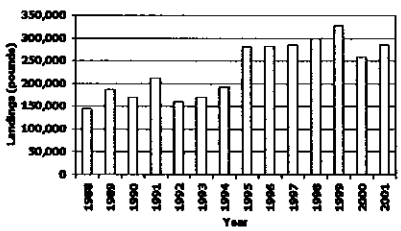
Spiny Lobster *Panulirus argus* is a very valuable exploited marine crustacean in the shallow water of the Caribbean Islands. During the 1950's the fishery and economic of the spiny lobster started to increase. Spiny lobster has been the most important shellfish by landed weight and price per pound in the Puerto Rico's fishery since 1970's to 2001. Spiny lobster shows symptoms of overfishing during the 1980's. Since then the Caribbean Fishery Management Council (CFMC) and the DNER have regulations to protect the spiny lobster. The mentioned regulations includes a minimum legal size (MLS) of 89mm carapace length (CL), forbidden to take egg-bearing females, forbidden the use of gaff to catch, also all spiny lobster they should be landed whole. Although the mentioned fishing regulations CFSP personnel observed that very little or none enforcement occurred until 1995. During 1989-91, more than 50% of the spiny lobster was caught before reaching the MLS. Since 1995, the DNER's rangers started to enforce the spiny lobster regulations, resulting that during for year 1998, only 24% were caught before MLS.

The objective of this study is to describe the fishery of the spiny lobster thru the data collected by the CFSP (landings and biostatistics data) during 1988-2001. Length frequency distributions (LFD) of this species by years, fish traps and SCUBA diving have been analyzed.

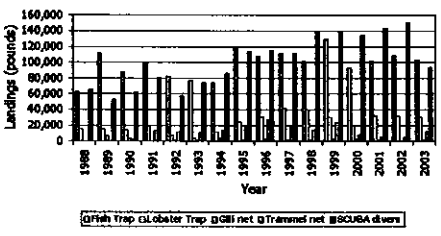
METHODS

- ✓Two types of dependent data were used:
  - *Landings collected by port samplers from fish houses and/or fishers.
  - * Biostatistics
- ✓Landings and biostatistics entered in computers using Microsoft Fox Pro and NMFS Trip Interview Program (TIP).
- ✓The data were analyzed using length frequency distribution (LFD) of this species by year fish and lobster traps and SCUBA divers.
- ✓Kolmogorov-Smirnov Two Sample Test, P<=0.05 (Sokal and Rohlf, 1981) was used to know if there is any significant difference among the comparisons.

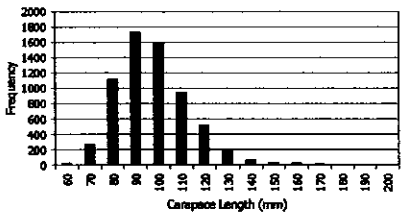
Landings reported of Spiny Lobster in Puerto Rico during 1988-2001.



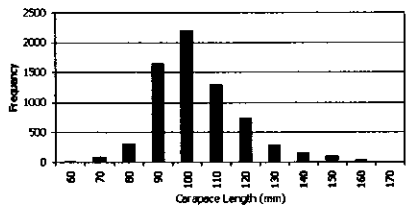
Landings reported of Spiny Lobster by Fish Trap, Lobster Trap, Gill Net, Trammel Net and SCUBA divers in Puerto Rico during 1988-2001.



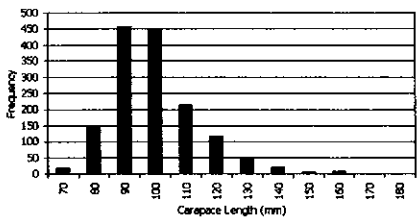
Length Frequency Distribution for Spiny Lobster in Puerto Rico during 1988-1994. (n=6,554)



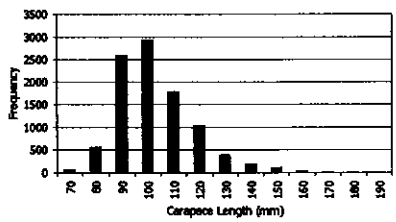
Length Frequency Distribution for Spiny Lobster in Puerto Rico during 1995-2001. (n=6,875)



Length Frequency Distribution for Spiny Lobster caught by Fish Trap in Puerto Rico during 1988-2001. (n=1,492)



Length Frequency Distribution for Spiny Lobster caught by SCUBA divers in Puerto Rico during 1988-2001. (n=9,766)



CONCLUSIONS

- ✓Marketing and demand for spiny lobster continues to be one of the most important fishery resources during the last 15 years.
- ✓Landings data show trends of increase during 1995-2001.
- ✓There are two facts to explain the increase:
  - * More participation of the fishermen in the Fisheries Statistics Program.
  - * Fishers target fish traps to catch spiny lobster.
- ✓SCUBA divers and fish traps were more efficient gears to catch spiny lobster.
- ✓Spiny lobster were caught significantly bigger during 1995-2001.

Job V. Historical Landings and Biostatistical CFSP'Data Analysis for Five Important Species.

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INTRODUCTION

The Puerto Rico Department of Natural and Environmental Resources (DNER) is responsible to conserve and manage all the Island's natural resources, including the fishery resources. The DNER's Commercial Fisheries Statistics Program (CFSP) collects and analyzes the dependent fisheries data. The CFSP has been collecting data since 1971. Matos-Caraballo (in press a and b) mentioned that during the 1980's decade, it was observed that the Puerto Rico's commercial fishery resources had shown over fishing symptoms (e.g. decrease in landings pounds, change in catch composition, decrease in the size of some important species). Species considered in the market as trash during the 1970's, today have been considered a second class market species (Matos-Caraballo, in press a and b).

Spiny Lobster *Panulirus argus* it is a very valuable exploited marine crustacean in the shallow water of the Caribbean Islands (Mateo and Die, 2004). Jarvis (1932) mentioned that in early 1930's fishermen caught frequently spiny lobster although did not have a good market. Old commercial fishers report to CFSP that until early 1950's most lobsters were use as fish trap baits (Matos-Caraballo, 2001). Mattox (1952) and Feliciano (1958) describe how the fishery and economic of the spiny lobster started to increase during the 1950's. Spiny lobster has been the most important shellfish by landed weight and price per pound in the Puerto Rico's fishery since 1970's to 2001 (Suárez-Caabro, 1979; Matos-Caraballo, in press a; b; 2001). Spiny lobster shows symptoms of overfishing during the 1980's. Since the Caribbean Fishery Management Council (CFMC) and the DNER have regulations to protect the spiny lobster. The mentioned regulations includes a minimum legal size (MLS) of 89mm carapace length (CL), forbidden to take egg-bearing females, forbidden the use of gaff to catch, also all spiny lobster they should be landed whole. Although the mentioned fishing regulations CFSP personnel observed that very little or none enforcement occurred until 1995 (Matos-Caraballo, 2001). During 1989-

91,more than 50% of the spiny lobster were caught before reaching the MLS. Since 1995, the DNER's rangers started to enforce the spiny lobster regulations, resulting that during for year 1998, only 24% were caught before MLS.

The objective of this study is to describe the fishery of spiny lobster thru the data collected by the CFSP (landings and biostatistics data) during 1988-2001. Length frequency distributions (LFD) of this species by year, fish traps, and SCUBA divers have been analyzed.

METHODS

This report will discuss the spiny lobster fishery using two types of dependent data collected by CFSP thru 1988-2001. First, the landings data were collected by CFSP's port samplers. The commercial fishers and/or fish houses reported their catch in a ticket.

The second type of data used in this study was biostatistics. This data were also collected by CFSP's port samplers. They visited the fishing centers and randomly selected commercial landings. Then they proceed to identify by species all the catch to obtain data about composition. Then port samplers measured CL in mm. If it is possible the whole catch was individually measured and sex is also registered. CFSP's port samplers collect catch per unit effort data (CPUE) in situ when they do the biostatistics sampling. The total landings by trip and by gear, number of traps hauled and nets length in fathoms were recorded.

Port samplers delivered the landings and biostatistics data to CFSP and statistical clerks edited and entered it in computers using Microsoft FoxPro and NMFS Trip Interview Program (TIP). The data were analyzed using length frequency distribution (LFD) of this species by years, fish traps, SCUBA divers and lobster traps. LFD for both species by years and by gears were analyzed. Kolmogorov-Smirnov Two Sample Test, $P <= 0.05$ (Sokal and Rohlf, 1981) was used to know if there is any significant difference among the comparisons.

RESULTS

Landings data show that a total of 3,238,755 pounds of spiny lobster were reported to the CFSP during 1988-2001 (Figure 1). An increase is observed in the spiny lobster reported during the period of 1988-1994 (1,228,856 pounds), compared to 1995-2001 (2,009,899). The spiny lobster landings increase coincides with the higher participation in the number of commercial fishers (Matos-Caraballo, in press b). During 1988-2001, spiny lobster reported represented approximately 8% of the total pounds reported of fish and shellfish. The spiny lobster continues to be the most important shellfish in pounds and traps in Puerto Rico's fishery. Besides spiny lobster is one of the top five species of fish and shellfish in Puerto Rico's landings.

Figure 2 shows the trend of landings reported by fish trap, lobster trap, gill net, trammel net and SCUBA divers during 1988-2001. Landings reported by the mentioned gears show that fish traps caught 42% of the 3,238,755 spiny lobster pounds during 1988-2001. For the same time period lobster trap caught 9.4%, gill net caught 1.0%, trammel net caught 5.1% and SCUBA divers caught 42.4% of the total landed pounds reported. Figure 2 shows that SCUBA divers and fish traps were the most productive gears in this fishery.

Biostatistics data from 1988-2001, shows that a total of 13,418 spiny lobsters were measured by CFSP (Figure 3). The spiny lobster caught during 1988-94, had an average of 93mm CL (Figure 4). On the other hand, the spiny lobster caught during 1995-2001 had an average of 99mm CL (Figure 5). Kolmogorov-Smirnov test shows that the LFD for 1995-2001 were significantly larger than the LFD 1988-1994 (Dmax = 0.1799).

Spiny lobster males caught during 1988-94 had an average of 96mm CL (Figure 6). During 1995-2001 the average was 101mm CL (Figure 7). The trend observed in males was observed also in the females LFD for the same periods of time. Spiny lobster females caught during 1988-94 had an average of 90mm CL (Figure 8) and during 1995-2001 the average was 96mm CL (Figure 9). The females caught during 1988-94 were significant smaller the females caught during 1995-2001 (Dmax =0.1859).

A total of 1,492 individuals of spiny lobsters were caught by fish traps were measured by CFSP's port samplers during 1988-2001 (Figure 10). Length frequency distribution shows that 471 (31%) individuals were caught before reach the MLS of 89mm CL. On the other hand, 9,766 spiny lobster caught by SCUBA divers were sampled by CFSP. From this total 2,434 (25%) were caught before reach the MLS (Figure 11). The lobster trap caught only 18% of the individuals before reach the MLS (Figure 12).

A total of one-hundred biostatistics interviews were randomly selected to obtain spiny lobster CPUE estimates data analysis. Most of the interviews include reports of spiny lobsters, conch and other reef fishes. However the spiny lobster was significant in number of individuals and weight in the landings interviews. CFSP data show that during 1988-94, the fish traps had an average catch of 48 pounds/trip. During this period of time fishing trips had an average of hauling 27.5 fish traps and the average soak time was 4.6 days. It was estimated that every fish trap catch 0.39 pound/trap/day. On the other hand, for the period of 1995-2001, fish traps shows a landings increase obtaining an average of 57 pounds/trip. Fishing trips shown an increase in the average of fish traps hauling to 32.0 and the average soak time increased to 5.3 days. For this period of time it was estimated that every fish trap catch 0.33 pound/trap/day. During 1988-94 SCUBA divers fishing trips had an average of 44 pounds/trip. During this period of time fishing trips had an average of 1.7 divers and the average soak time was 3.6 hours. It was estimated that SCUBA divers catch 7.23 pounds/diver/hour. On the other hand, for the period of 1995-2001, SCUBA divers shows a landings increase obtaining an average of 47 pounds/trip. During this period of time reef fishes fishing trips had an average of 1.33 divers per trip and the average soak time was 4.3 hours. It was estimated that SCUBA divers catch 8.18 pounds/diver/hour.

DISCUSSION

Puerto Rico's commercial fishery of spiny lobster has shown that marketing and demand for this species continues to be one of the most important resources during the last 15 years. The data analyzed in this report show that a high fishing pressure occurred on spiny lobster during 1988-2001. The landings data show trends of increase in spiny lobster during 1995-2001. Two facts would explain the mentioned increase. First, starting in 1995, more fishers participated

in the CFSP (Matos-Caraballo, in press b). Second, many fish traps users mentioned to CFSP's principal investigator that due to the profit they target mostly their gears to catch spiny lobster. This fact it is also supported by the CPUE landings by trip data analysis that shows an increase in the fishing pressure on the spiny lobster for SCUBA divers. Also fish traps increase the average number of fish traps haul by trip and the average number of soak days.

SCUBA divers and fish traps were more efficient gears to catch spiny lobster. Due to regional tradition the lobster trap is use only in three or four south coast municipalities and in the east coast. The trammel net is using to catch spiny lobster during the strong surge wave occurred during November-February in the western coast. Fishers mentioned that spiny lobsters migrate together and trammel nets are able to catch hundreds of pounds of this species in a single day. Unfortunately, a significant part of these catch were not reported to CFSP.

This study shows that the spiny lobsters were caught significantly bigger during 1995-2001 than 1988-1994, for all individuals, for males and females. These results probably indicate that the spiny lobster fishing regulation enforcement has been working to conserve the resource (Matos-Caraballo, 2001).

LFD data shows that fish traps caught a higher percent of spiny lobster before reach LMS, follow by SCUBA divers and lobster trap. However, after 1995, the catch of individuals before reach the MLS, decreased for all gears.

Effort by gear data shows an increase in the effort to catch spiny lobster by fish traps and SCUBA divers. Again these facts reflect an increasing fishing pressure on this resource. The landings, biostatistics and CPUE data shows that spiny lobster received high fishing pressure. Although a spiny lobster landings decreased occurred during the 1970's to the 1980's, since 1988-2001 the landings have been steady (Mateo and Die, 2004). The spiny lobster was caught significantly larger since 1995-2001, probably due to the enforcement of the fishing regulations. Due to the high fishing pressure on this resource it is necessary to continue the enforcement action to diminish or eliminate from the landings the individuals under the MLS. Also it is essential to continue the monitoring of the landings, biostatistics and CPUE data by the CFSP.

ACKNOWLEDGEMENT

We want to express our deep gratitude to all that made possible this research. To NOAA/NMFS Cooperative Fisheries Statistics Program and Puerto Rico's Department of Natural and Environmental Resources (DNER) that provided the funds. To Puerto Rico's Commercial Fisheries Statistics port samplers Walter Irizarry, Jesús León, Héctor Y. López, and Luis A. Rivera, whom collected the data. To Albaliz Mercado and Lucía T. Vargas who edited and entered the data in computers. To Miguel Figuerola who helped in editing the paper. Finally, we want to acknowledge all the commercial fishers that participate in the Commercial Fisheries Statistics Program (CFSP).

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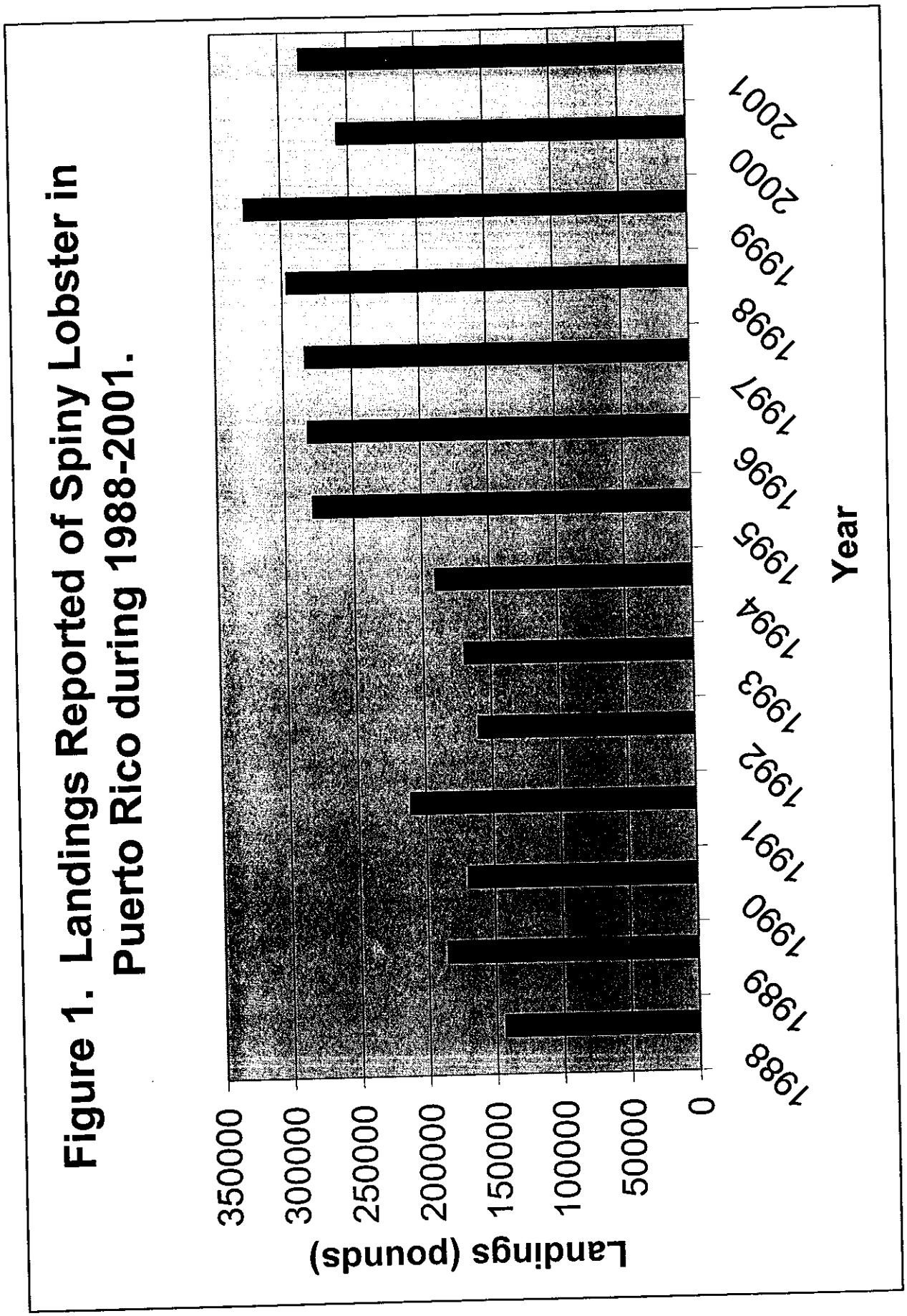


Figure 1. Landings Reported of Spiny Lobster in Puerto Rico during 1988-2001.
Landings (pounds)
350000
300000
250000
200000
150000
100000
50000
0
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year

Figure 2. Landings Reported of Spiny Lobster by Fish Trap, Lobster Trap, Gill Net, Trammel Net and SCUBA Divers in Puerto Rico during 1988-2001.

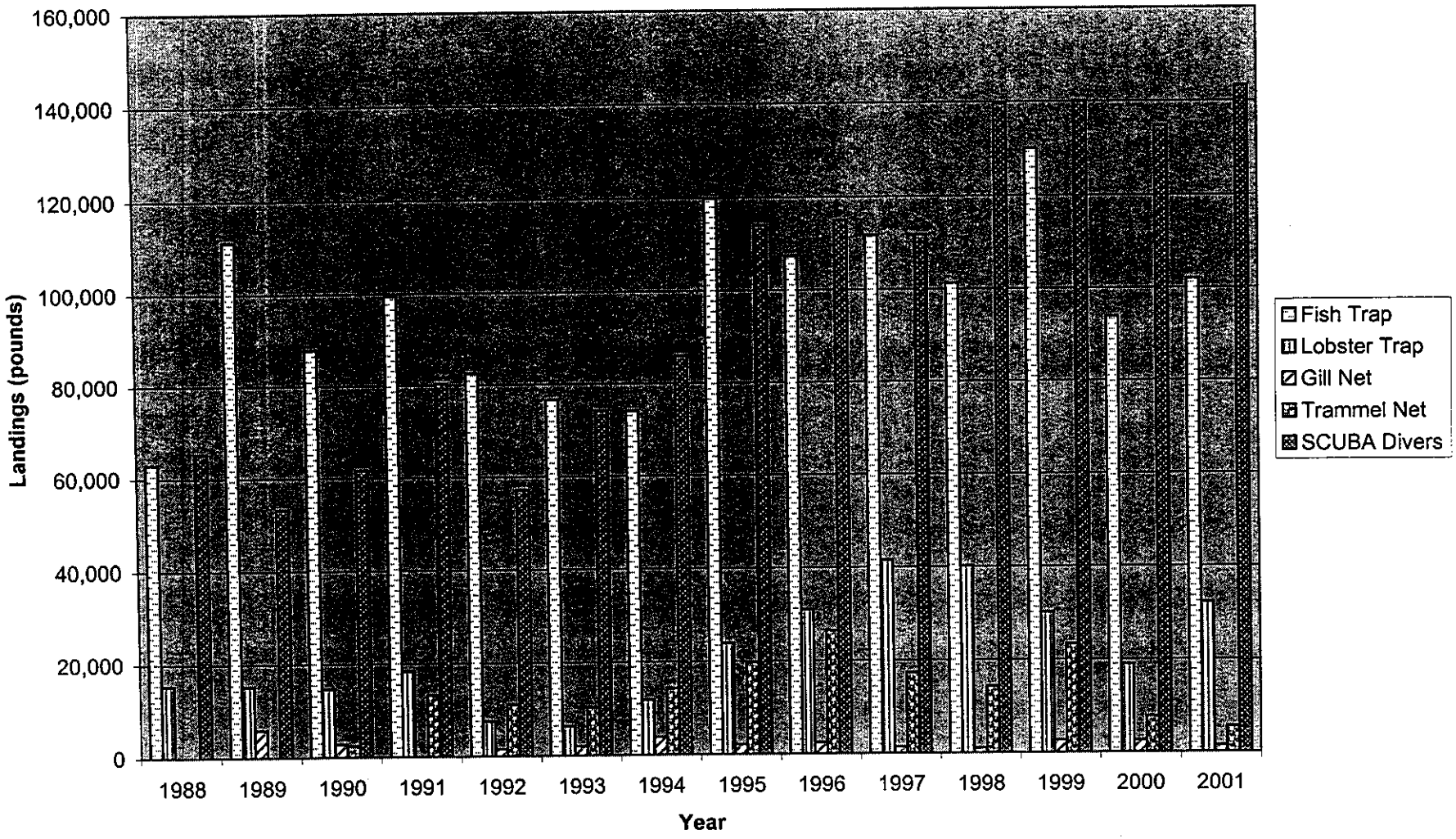


Figure 3. Length frequency distribution for Spiny Lobster caught in Puerto Rico during 1988-2001. n =13,418

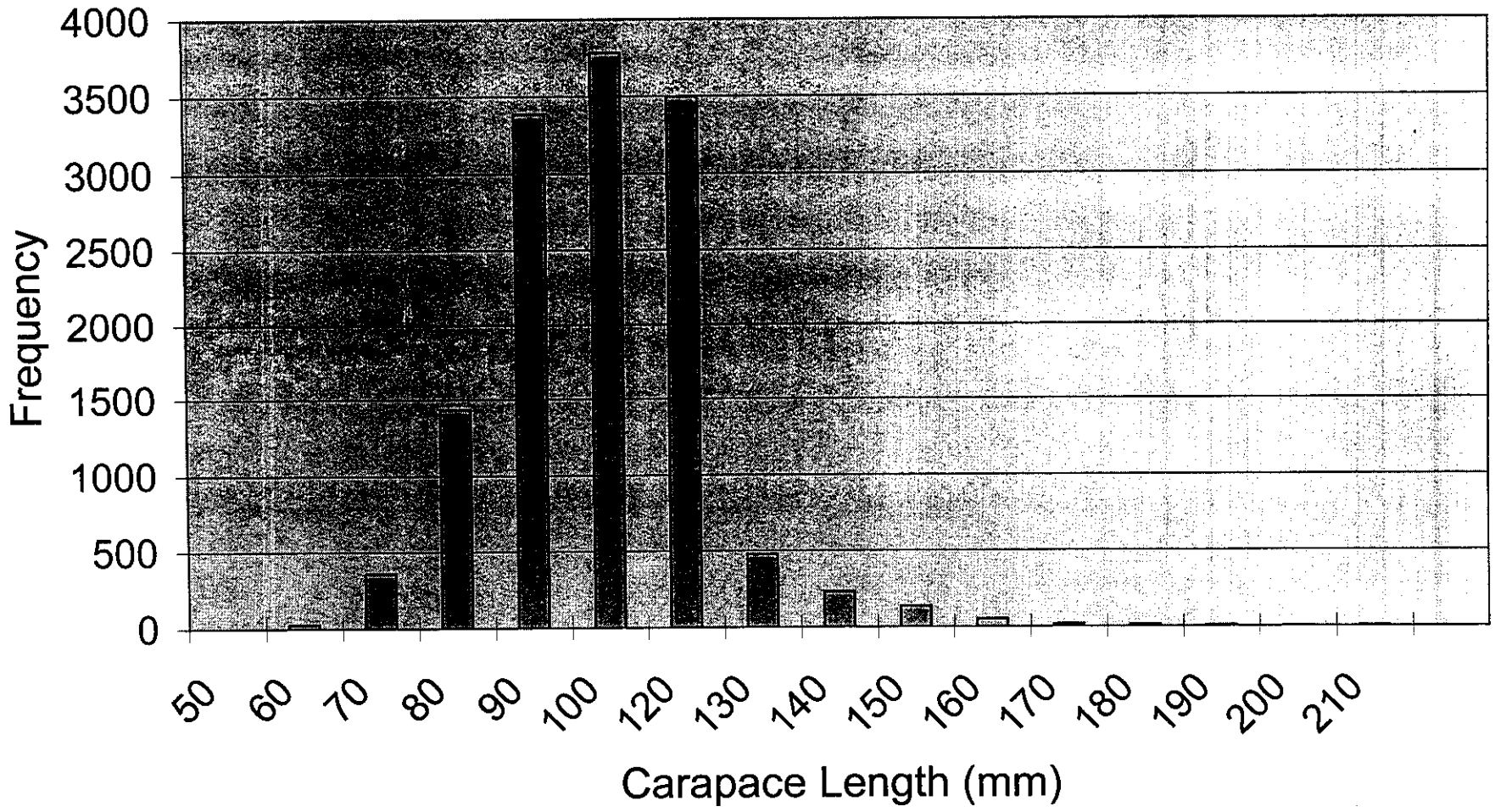


Figure 4. Length Frequency Distribution for Spyny Lobster in Puerto Rico during 1988-94. n = 6,554

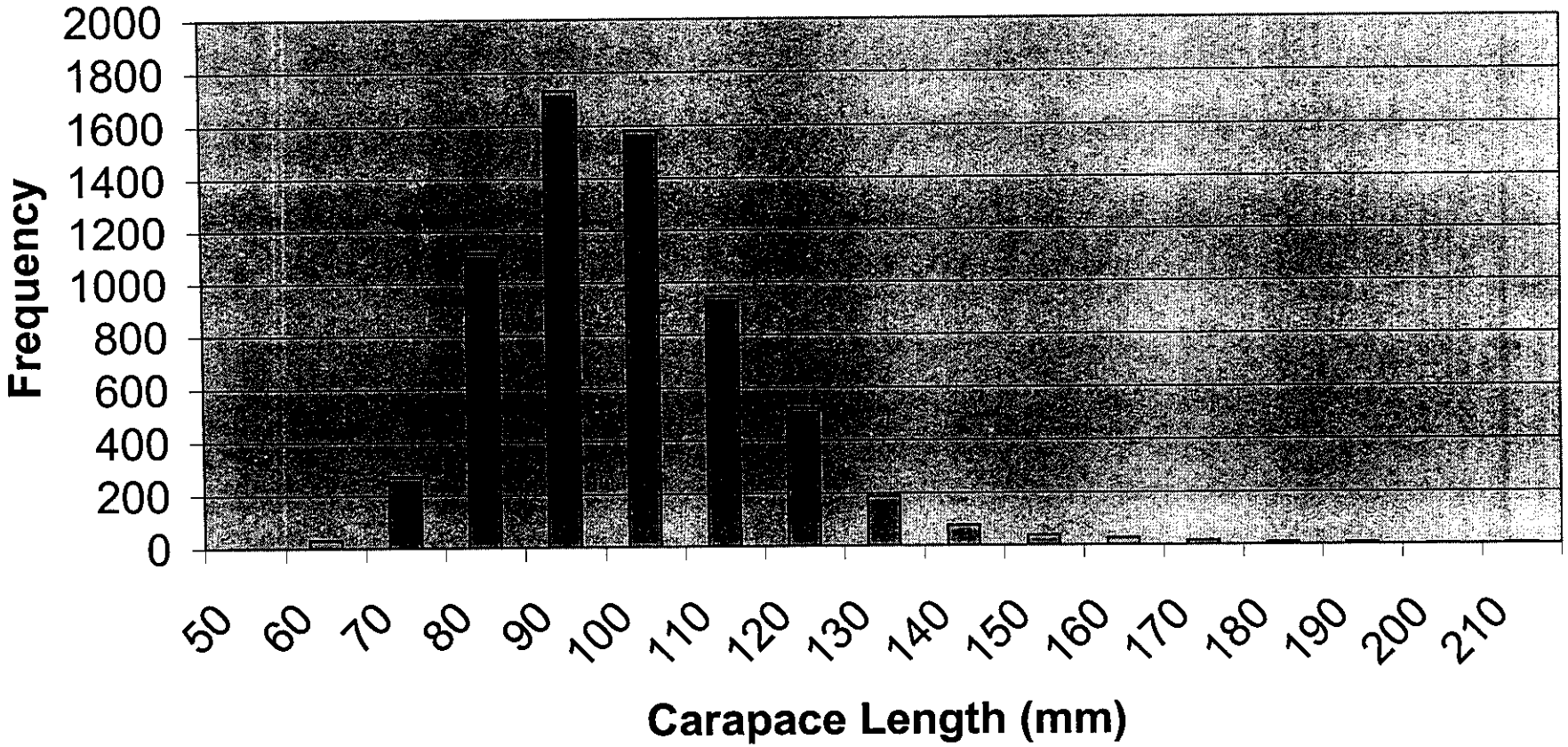


Figure 5. Length Frequency Distribution for Spiny Lobster in Puerto Rico during 1995-2001. n= 6,875

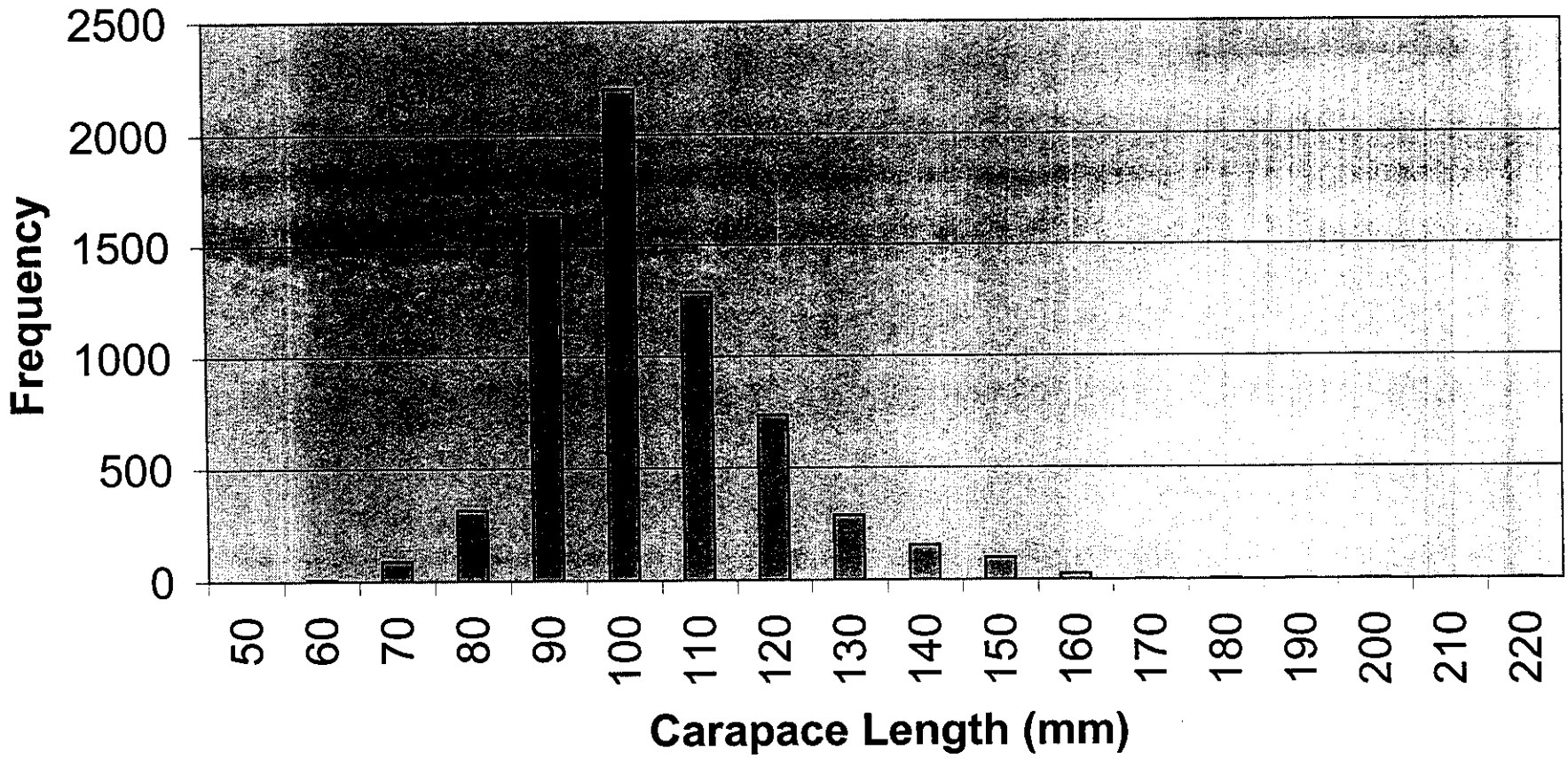


Figure 6. Length Frequency Distribution for Spiny Lobster Males caught in Puerto Rico During 1988-94. n = 3,219

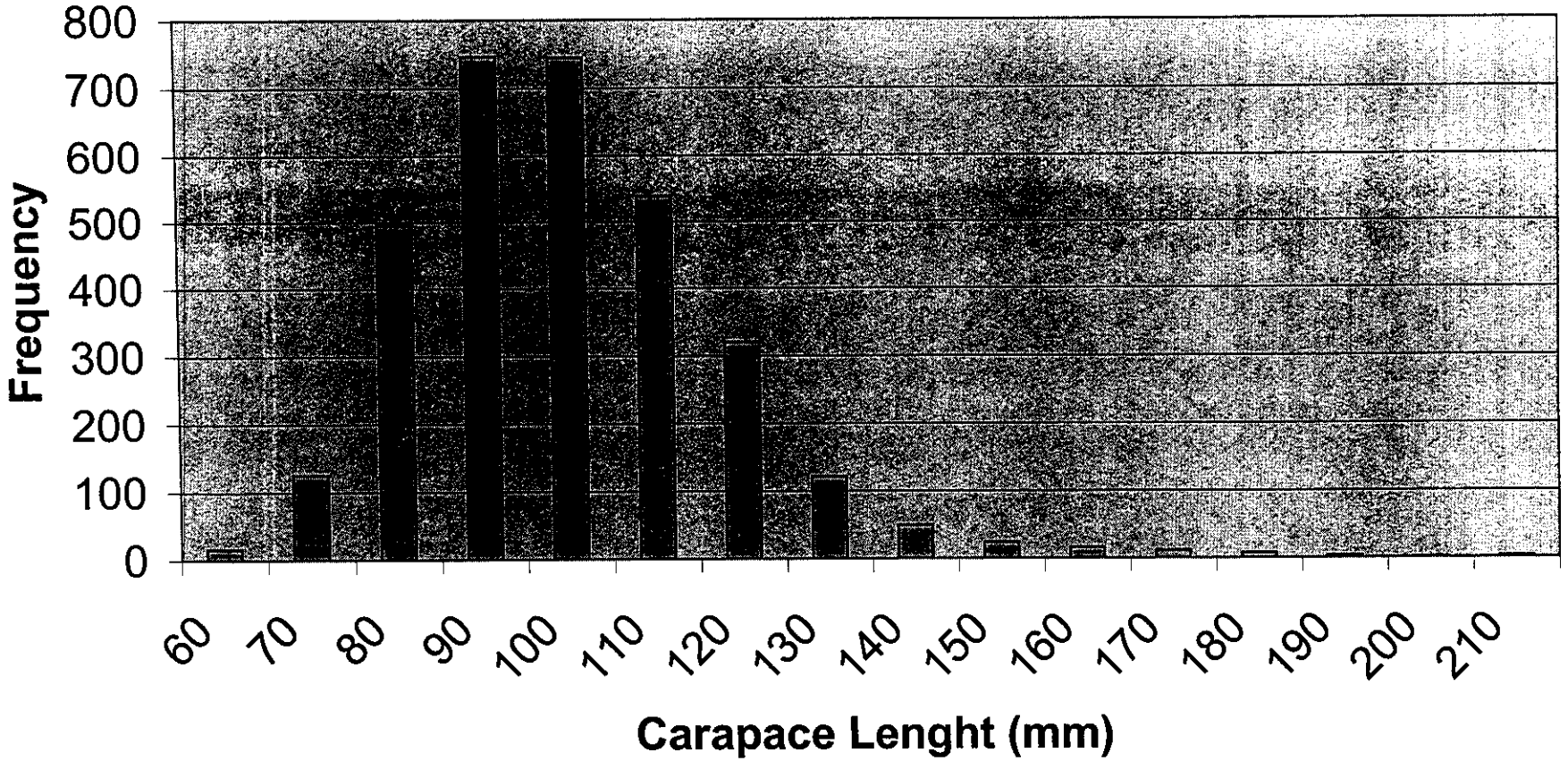


Figure 7. Length Frequency Distribution for Spiny Lobster Males caught in Puerto Rico During 1995-2001. n = 3,188

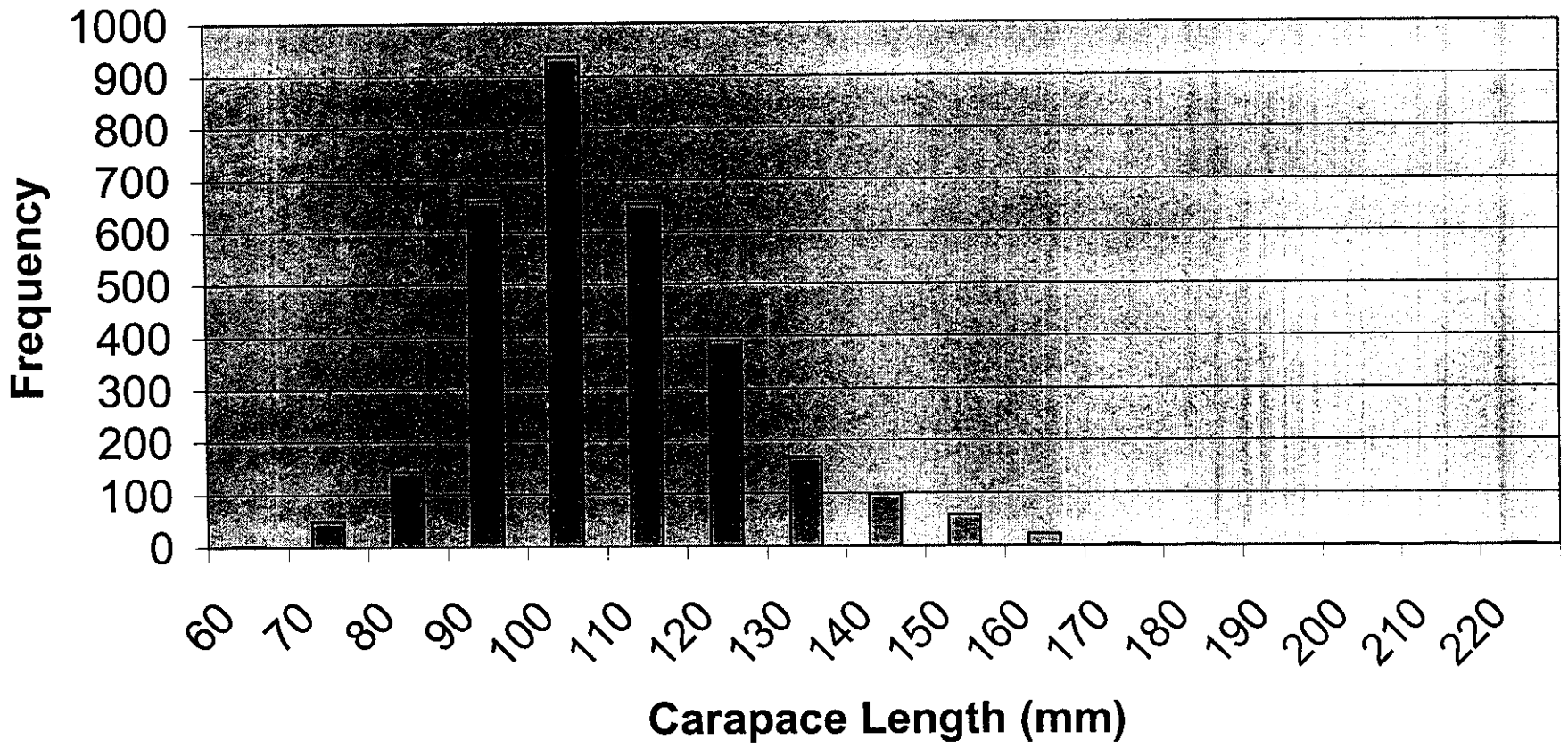


Figure 8. Length Frequency for Spiny Lobster Females caught in Puerto Rico During 1988-94. n = 2,837

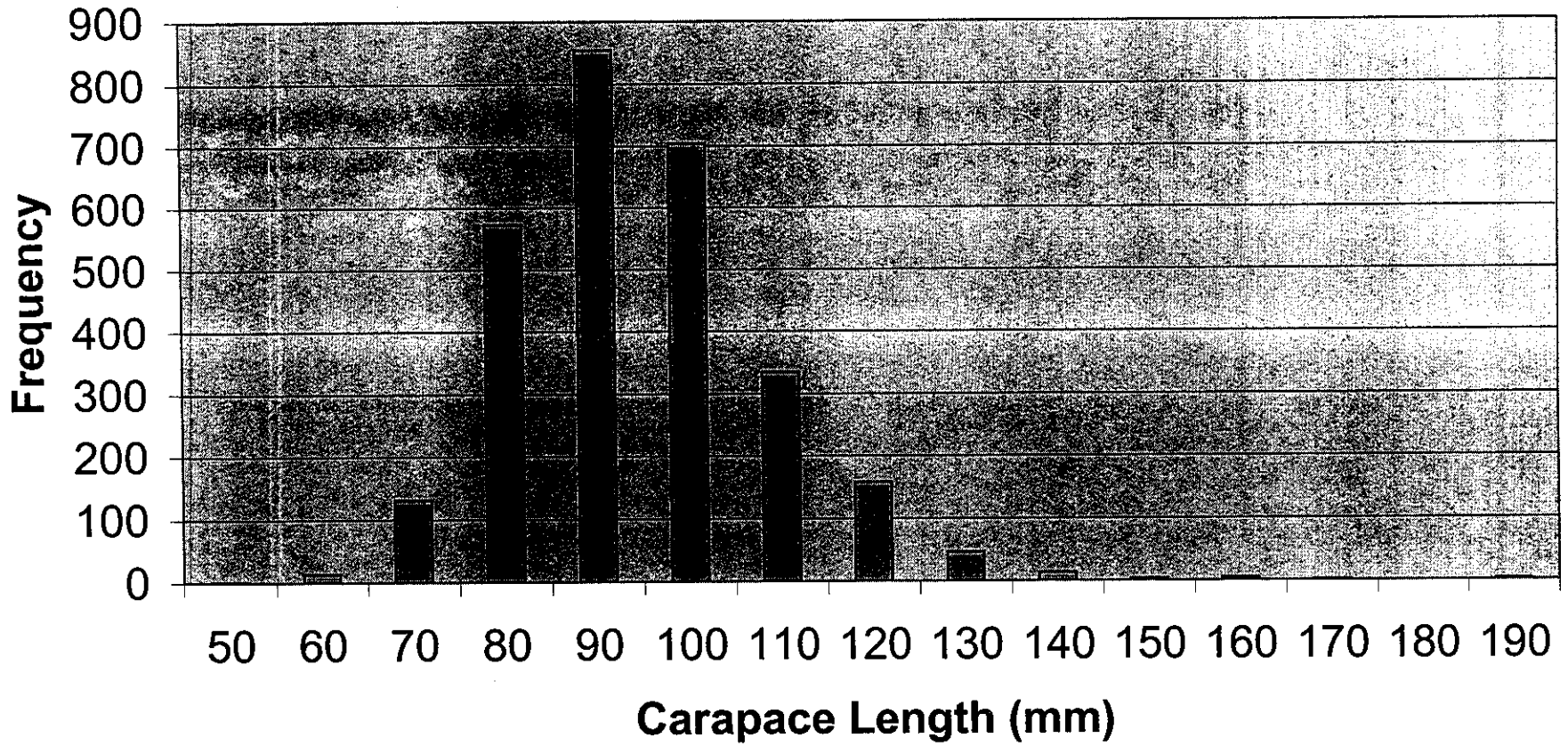


Figure 9. Length Frequency Distribution for Spiny Lobster Females caught in Puerto Rico During 1995-2001. n = 2,865

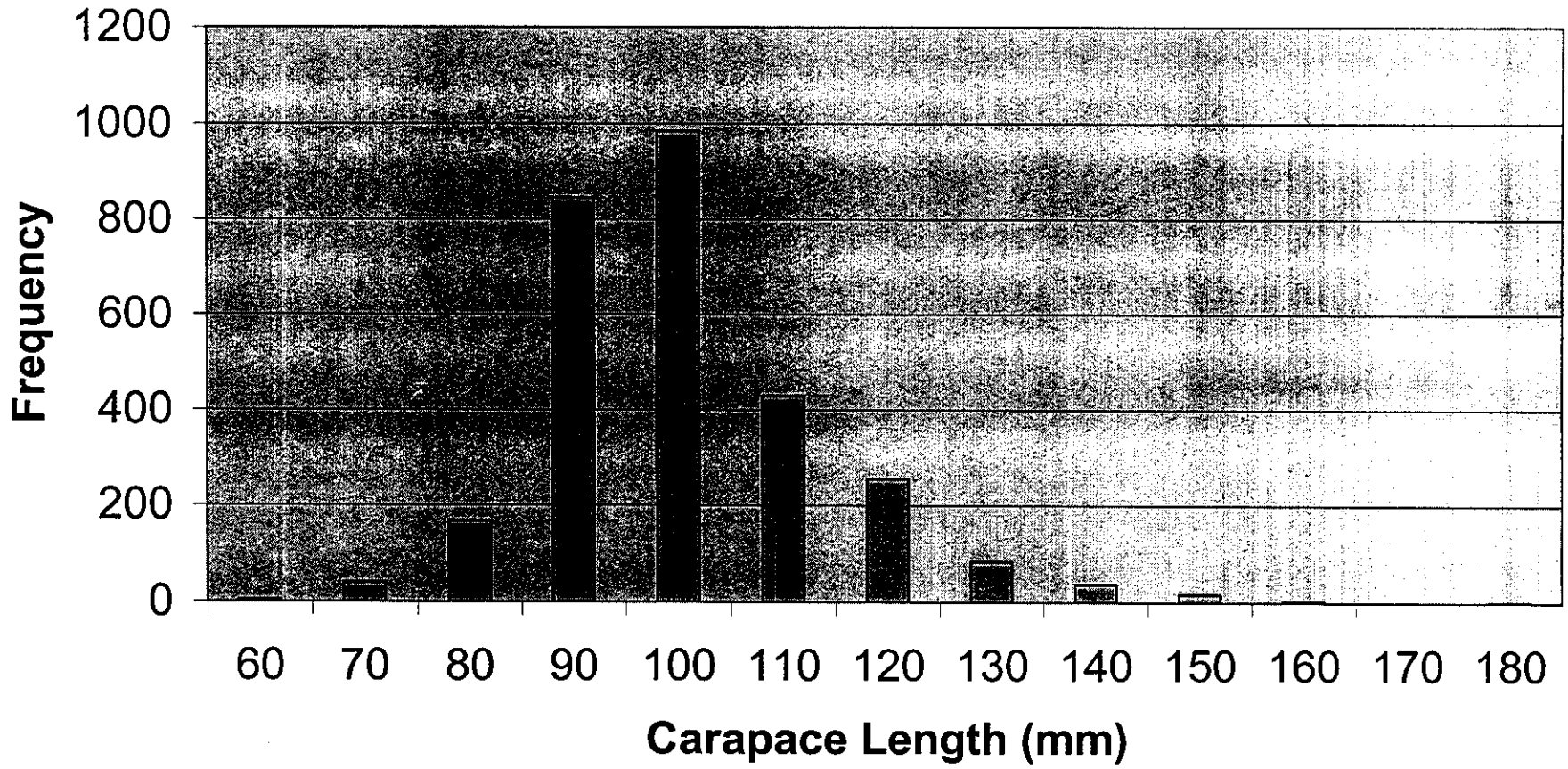


Figure 10. Length Frequency Distribution for Spiny Lobster caught by Fish Traps in Puerto Rico During 1988-2001. n = 1,492

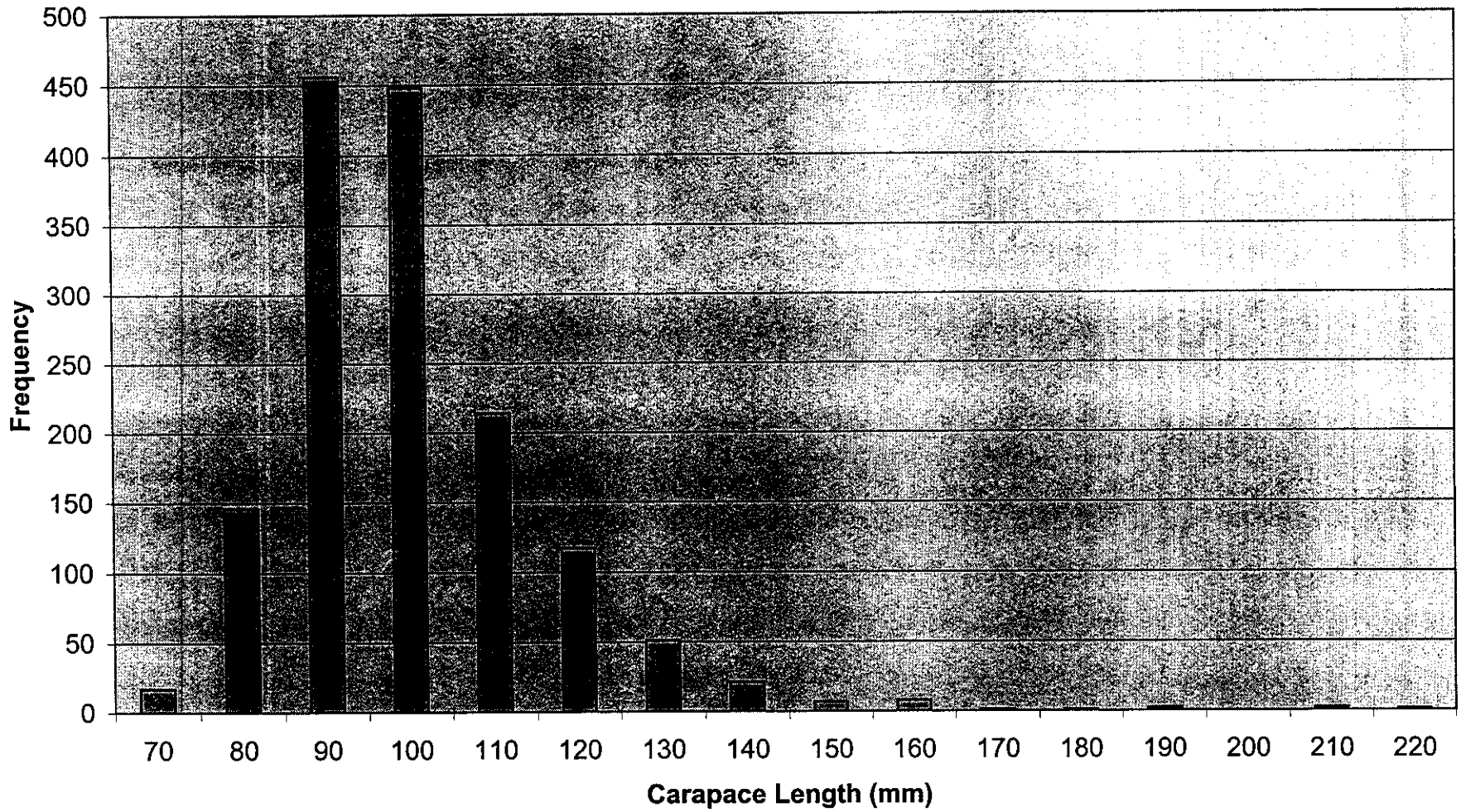


Figure 11. Length Frequency Distribution for Spiny Lobster caught by SCUBA Divers in Puerto Rico during 1988-2001. n = 9,766

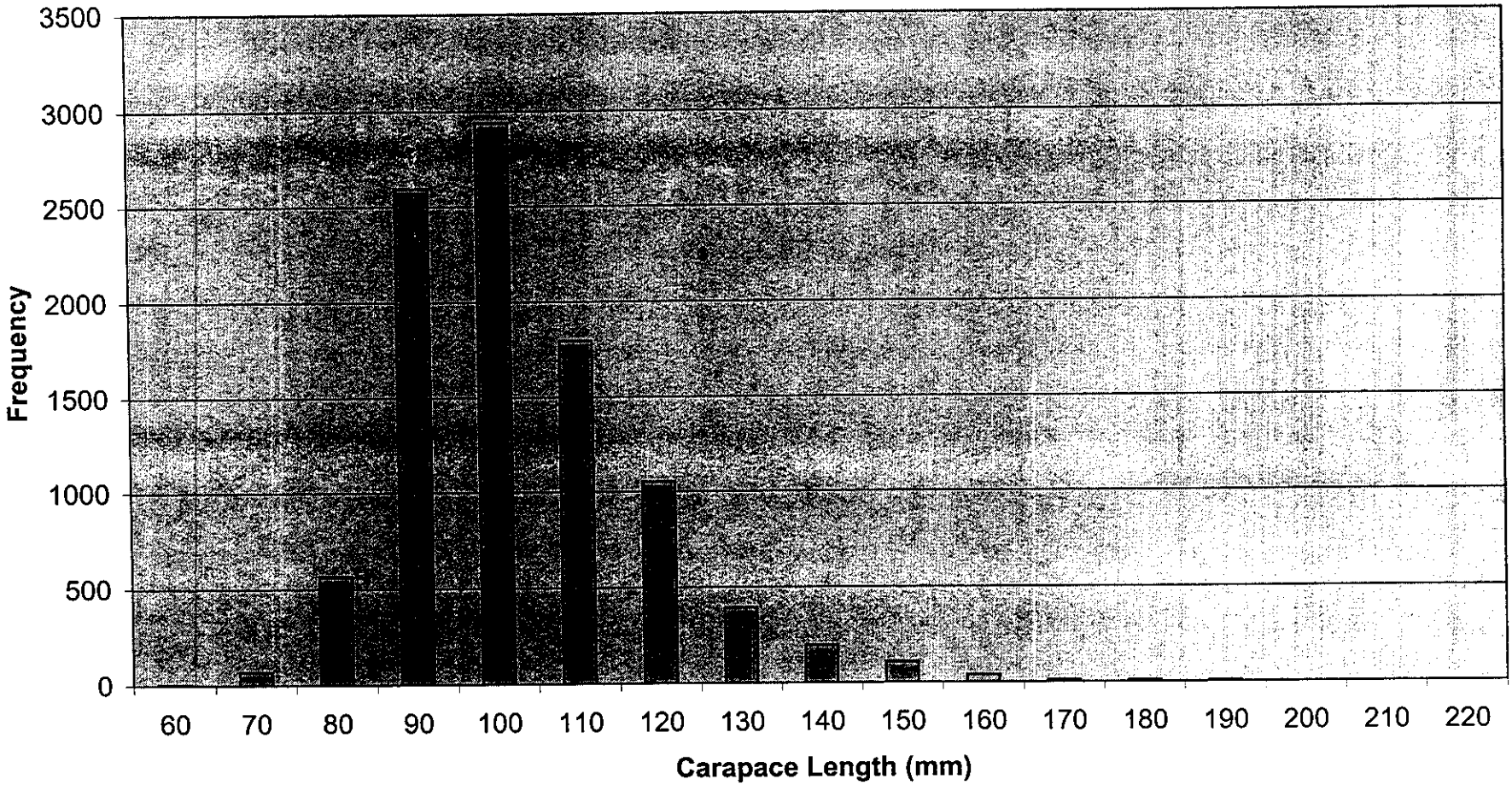
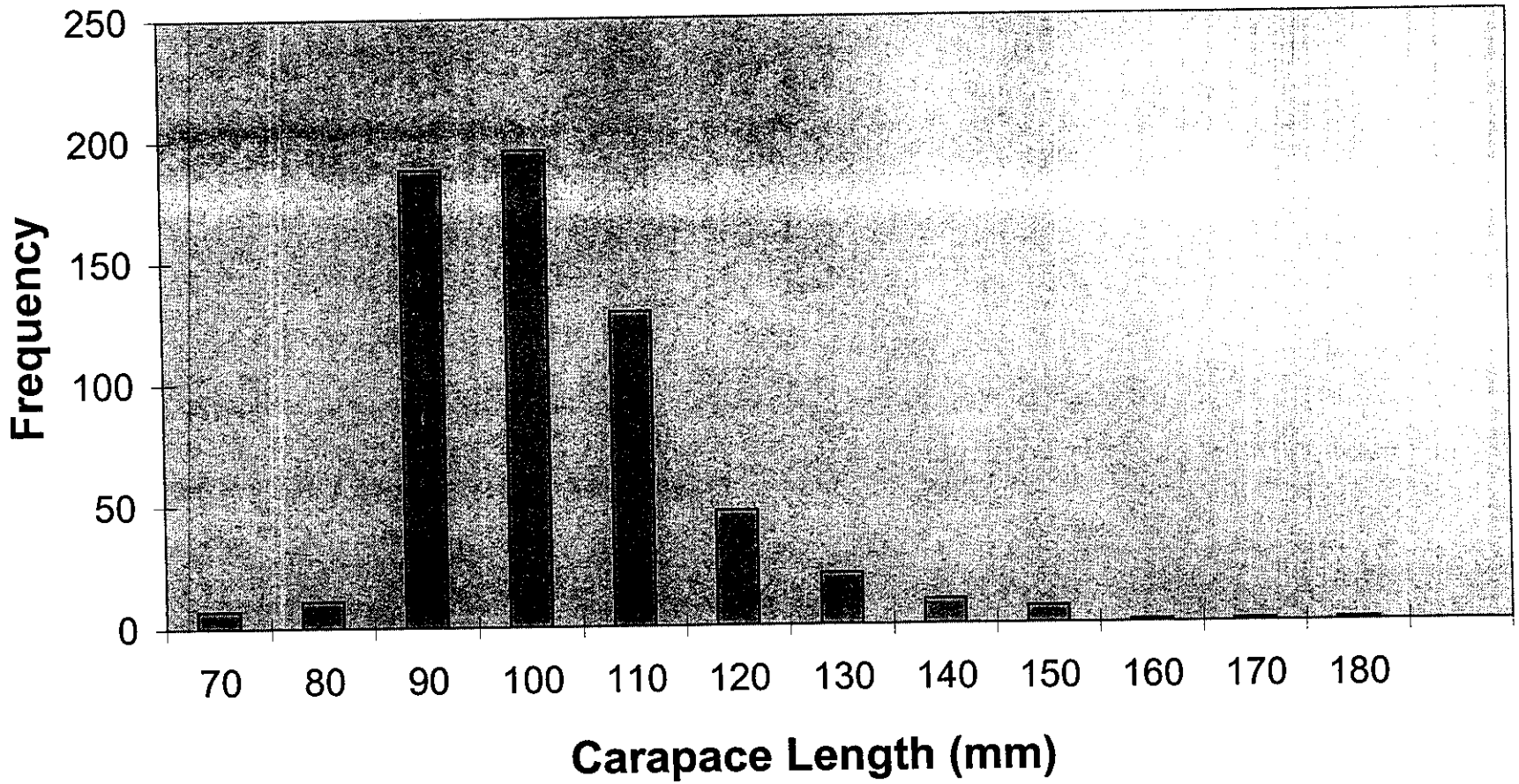


Figure 12. Length Frequency Distribution for Spiny Lobster caught in Puerto Rico by Lobster Traps during 1988-2001. n = 619



Job V. Historical Landings and Biostatistical CFSP'Data Analysis for Five Important Species.

Portrait of the Fishery of *Sparisoma viride* and *Sparisoma Chrysopterum* in Puerto Rico during 1988-2001

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