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## Overview of the spiny lobster, *Panulirus argus*, commercial fishery in Puerto Rico during 1992-98.

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### ABSTRACT

Puerto Rico's fishery has shown symptoms of overfishing for the last fifteen years. The spiny lobster, *Panulirus argus*, is the most important shellfish in this fishery. Since 1985, *P. argus* has been protected by fishing regulations. The minimum legal size for this species is 89mm (3.50 inches) carapace length (CL). This measure is related with the minimum size of sexual maturation. Landings data indicated that 1.6 million pounds were caught in Puerto Rico during 1992-98. Traps caught 51% of the *P. argus* landings and divers caught 41% during the same period. To evaluate the resource's status it is necessary among other criteria to obtain size frequency data. From 1992-98, 5,354 *P. argus* caught by commercial fishermen in Puerto Rico were measured by personnel of the Fisheries Research Laboratory of the Puerto Rico Department of Natural and Environmental Resources.

The landings, catch per unit of effort (CPUE), and biostatistical data during 1992-98 have been analyzed to evaluate the status of *P. argus*.

**KEY WORDS:** Fishery Management, *Panulirus argus*, Puerto Rico's Commercial Fishery.

### INTRODUCTION

Commercial fishery in Puerto Rico (PR) is artisanal, multispecies and multigear. During the last 15 years this fishery has shown overfishing symptoms. Matos-Caraballo (in press A) mentioned changes in species catch composition, decreasing size of some species and a decrease in landings reported.

The most important shellfish species in PR is the spiny lobster *Panulirus argus*. This species represented 7% of the total catch reported during 1992-98. The average price per pound for this species for the mentioned period of time ranged from of \$4.50-\$9.00. Jarvis (1932) mentioned that in the early 1930's fishermen caught *P. argus* but did not have a good market for them. This fact occurred probably because this species spoiled faster than other type of fish and shellfish. Valuable marketing for *P. argus* started approximately in 1947 (Feliciano, 1958). Many old commercial fishermen interviewed by the author mentioned that in early 1950's, this species was used mostly as bait for traps. Overfishing indications in *P. argus* had been observed since the early 1980's. This fact resulted in the Lobster Fishery Management Plan (LFMP) implemented in 1985 for the waters in the jurisdiction of the Commonwealth of PR (shore to 9 nautical miles) and USA Exclusive Economic Zone (from 9-200 nautical miles).

The LFMP includes a minimum legal size (MLS) of capture of 89mm (3.50 in) of carapace length (CL). The minimum size of sexual maturity in this species is 76mm (3.0 in) CL. The rationalization of the MLS of 89mm, is to give the chance of any lobster to reproduce at least once before is fished. Another important regulation is the prohibition to kill, possess or disturb females with attached eggs.

Matos-Caraballo (in press B) reported that during 1989-91, more than 50% of the *P. argus* were caught before reaching the MLS. He mentioned that LFMP was not enforced, indicating the importance to educate the enforcement officers, commercial fishermen and general public in the need to protect this resource. Since 1995, it was observed that the PR Department of Natural and Environmental Resources (DNER) enforcement officers started to work to force the LFMP. This paper presents an overview of the fishery of the *P. argus* using landings, catch per unit effort (CPUE) and biostatistical data from 1992-98. Also, examines the impact of the recent enforcement efforts of the DNER on the *P. argus* resource.

## PROCEDURES

### Commercial Landings Data

Commercial fishery landings data were collected from PR's fishermen, fish buyers and fishing associations, whom voluntarily cooperate with the Fisheries Statistics Program (FSP). Five port agents visited the 42 coastal municipalities including the islands of Vieques and Culebra, and the 88 identified fishing centers. Port agents worked in the data collection from January 1992-December 1998. Efforts were made to collect the following data: fishing date, name of fish buyer, fisher and/or helper (to avoid data duplication), municipality; fishing center (municipality landing area), number of trips, gear type, fishing effort (hours spent fishing), weight in pounds by species, market value to the fisherman (price in U.S. dollars/pound), maximum and minimum fishing depth and fishing area.

Landings data were entered MS-DOS computers, using Microsoft FoxPro for Windows, checked against the original landing trip tickets to validate the information. The data was analyzed using Microsoft Excel. All data presented in this paper are reported data (no correction factor to estimate non-report data was used). Traps category includes fish pot and lobster pot. Diver category includes skin and SCUBA divers.

### Commercial Biostatistical Data

Biostatistical data of spiny lobster were collected by port agents. Spiny lobsters were measured in CL, in millimeters (mm), weighed in grams and identify the sex. Data were recorded on data sheets form. The form was designed to facilitate entry and processing of effort data. Biostatistical data were entered in Trip Interview Program (TIP) developed by NMFS Southeast Fishery Science Center. Later, the data stored in TIP was converted to FoxPro and

analyzed using Microsoft Excel.

## RESULTS

### Commercial Landings Data

Figure 1 shows the total landings reported in PR of *P. argus* during 1992-98. The observed increase of landings for the years 1995-98 occurred mostly because more fishermen participated in the FSP, due to an incentive granted by the DNER. This fact indicates that at least the *P. argus* fishery resource seems to be stable during this period of time. The average price per pound started in \$4.50 in 1992, and increased to \$5.50 in 1998. In the north coast, port agent Héctor Y. López-Pelet, reported that in 1998, some restaurants were paid \$9.00/pound. This is the highest price reported in PR for *P. argus* and occurred due to the scarcity and high demand for this species in this coast.

Traps reported 51% of the *P. argus* total landings reported during 1992-98. Divers reported 41% of the *P. argus* for the same period of time. Figure 2 shows the landings reported by gear of *P. argus* in PR during 1992-98. During the 1970's and early 1980's in PR's fishery the traps were the most productive gear (Matos-Caraballo, A). In the mentioned figure it is observed how the divers increased their landings and in 1998, being very close to the traps, which showed a decrease in landings reported.

A total of 36,139 trip tickets was reported with reliable pounds/trip information during 1992-98. This information was used to obtain the CPUE (pounds reported/trip). Figure 3 shows the average of pounds per trip by gear for *P. argus* in PR during 1992-98. This figure indicates that divers and traps were very similar in their CPUE from 1992-97 (18-21 pounds/trip). In 1998, divers had an average of 33 pounds/ trip and traps had 28 pounds/trip.

### Commercial Biostatistical Data

A total of 5,354 *P. argus* was measured by FSP port agents during 1992-98. From the mentioned total, 2,798 were males and 2,392 were females. Figure 4 shows the mean carapace length for *P. argus* in PR during 1992-98. *P. argus* males were larger than females. This figure shows during 1993-95, a trend to catch bigger *P. argus*. For years 1996-97 the *P. argus* size shows a decreasing trend and finally increased for 1998.

Figure 5 shows the percentage of *P. argus* caught before reaching the legal size (89mm) in PR during 1992-98. The percentage of *P. argus* caught before MLS shows a decreasing trend for males, females and total (both male and female individuals combined). The percentage of *P. argus* males caught below MLS is lower than females.

During 1992-98, port agents of the FSP measured 540 males and 294 females caught by traps. For the same period, they measured a total of 2,059 males and 1,955 females caught by divers. The mean CL of males and females of *P. argus* caught by traps and divers did not show any trend (Figures 6 and 7). The traps caught larger males for years 1992, 94 and 97 (Figure 6). The traps

caught larger females for years 1992, 93, 94 and 97 (Figure 7).

The percentage of *P. argus* males and females caught by traps and divers before reaching the MLS since 1992-98, showed a decreasing trend (Figure 8). Higher percentage of females were caught before reaching MLS than males. Figures 5 and 8 indicate that the work of DNER's enforcement officers organized in 1995, probably had impacted positively the *P. argus* fishery.

## DISCUSSION

### Commercial Landings Data

Mattox (1952) estimated that for 1951 a total of 466,000 pounds of *P. argus* was fished by 466 fishers. Matos-Caraballo (in press B) mentioned that for 1991, 211,941 pounds of lobster were fished by 576 fishers. The landings data reported in PR from 1971-98 indicate that the fishery resource is overfished. For years 1979-82, the peak years in landing reports for PR, the average pounds reported for *P. argus* by year was 456,000 (Collazo and Calderón, 1988). For 1995-98, this average was 276,000 pounds per year by approximately 650 fishers. However the data for 1992-98, show that the decreasing tendency observed in the late 1980's and early 1990's is discontinued. The mean cost per pound of *P. argus* increase from \$4.50 - \$5.50 (in the north coast some restaurants pay \$9.00/pound), indicating that this resource has a great demand and also continue to be overfished.

Traps fished more than 70% of the total landings reported in PR species during the 1970's (Collazo and Calderón, 1988). Matos-Caraballo (in press A), mentioned that due to the overfishing situation the fishermen that used traps showed a tendency to shift to other fishing gears as lines, nets and diving. The data of *P. argus* also evidence that mentioned tendency.

The CPUE observed in this research was very similar for traps and divers. Although most trap's fishermen are lifting their gears once per week this gear fished 51% of this resource during 1992-98. On the other hand, the divers fished 4-5 days per week. This fact probably evidence that the *P. argus* trap fishery is efficient.

### Commercial Biostatistical Data

*P. argus* mean CL decreased from 117mm in 1951 (Mattox, 1952) to 107 mm in 1958 (Feliciano, 1958). The decrease continued during 1989-91, when it was observed that CL mean for *P. argus* was approximately 91mm (Matos-Caraballo, in press B). During the present study the mean of CL for the all *P. argus* was 96mm, 98mm for males and 93mm for females. Bigger individuals were caught for this period of time than for 1989-91. The tendency to caught larger *P. argus* during 1992-98 rather than 1989-91, was also observed by gear. During 1989-91 it was reported that *P. argus* males caught by traps had a mean CL of 92mm and females were 87mm. On the other hand, for 1992-98, for the same gear males mean CL was 96mm and females was 93mm. For 1989-91 was reported that *P. argus* males caught by divers had a mean CL of 94mm and females was 89mm. On the other hand, for 1992-98, divers caught males

with a mean CL of 99mm and females was 93mm. Mattox (1952), Rosario [1987] and this research found that male *P. argus* were caught bigger than females.

During 1989-91, approximately 59% and 50% of *P. argus* fished by traps and divers respectively, were caught before reaching the MLS (Matos-Caraballo, in press B). This results evidence that LFMP was helpless, because no enforcement effort was observed at that time. The implementation of the enforcement effort of the LFMP starting in 1995 was observed immediately, because in 1996, only 31% of the total *P. argus* was caught before reach MLS, in 1997 it was 35% and in 1998 it was 24%.

The results of this research strongly suggest that the enforcement efforts of the DNER's enforcement officers help significantly the LFMP to attain its objectives. Evidently this effort helps to educate more fishermen in the conservation of this resource and they supported the LFMP. If this tendency continues the *P. argus* fishery resource of PR will be available for future generations.

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FIGURE 1. LANDINGS REPORTED OF PANULIRUS ARGUS IN PUERTO RICO DURING 1992-98.

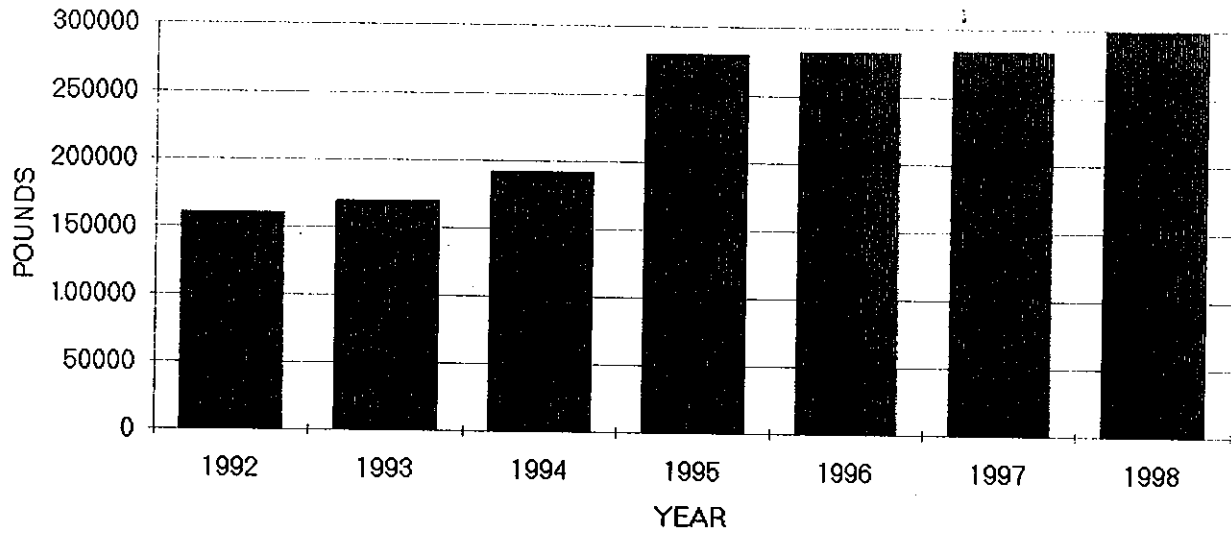


FIGURE 2. LANDINGS REPORTED BY GEAR OF PANULIRUS ARGUS IN PUERTO RICO DURING 1992-98.

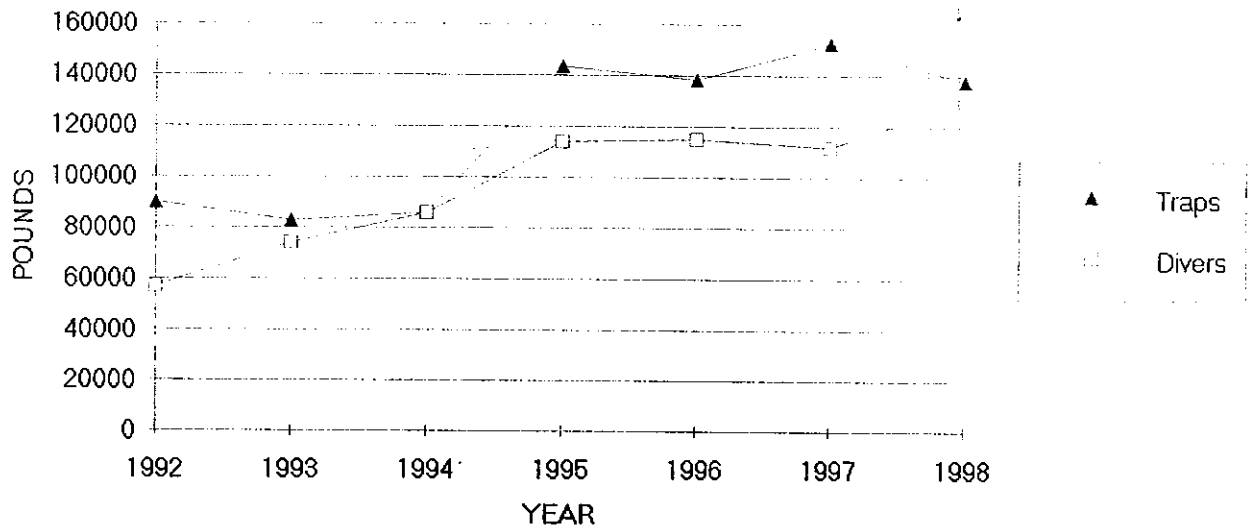


FIGURE 3. AVERAGE OF POUNDS REPORTED PER TRIP BY GEAR FOR PANULIRUS ARGUS IN PUERTO RICO DURING 1992-98.

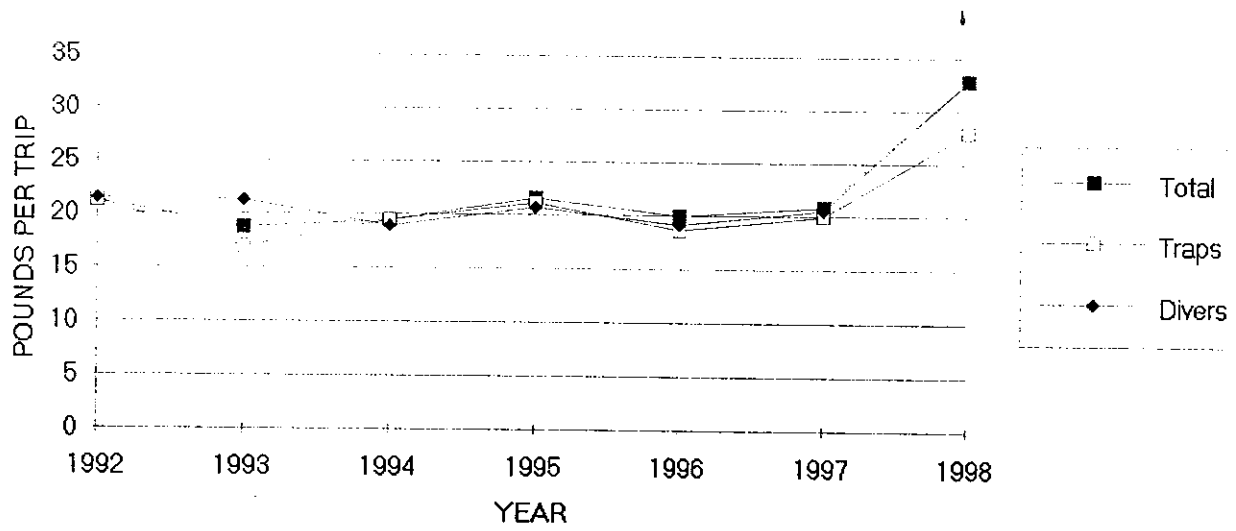




FIGURE 4. MEAN OF CARAPACE LENGTH FOR PANULIRUS ARGUS IN PUERTO RICO DURING 1992-98.

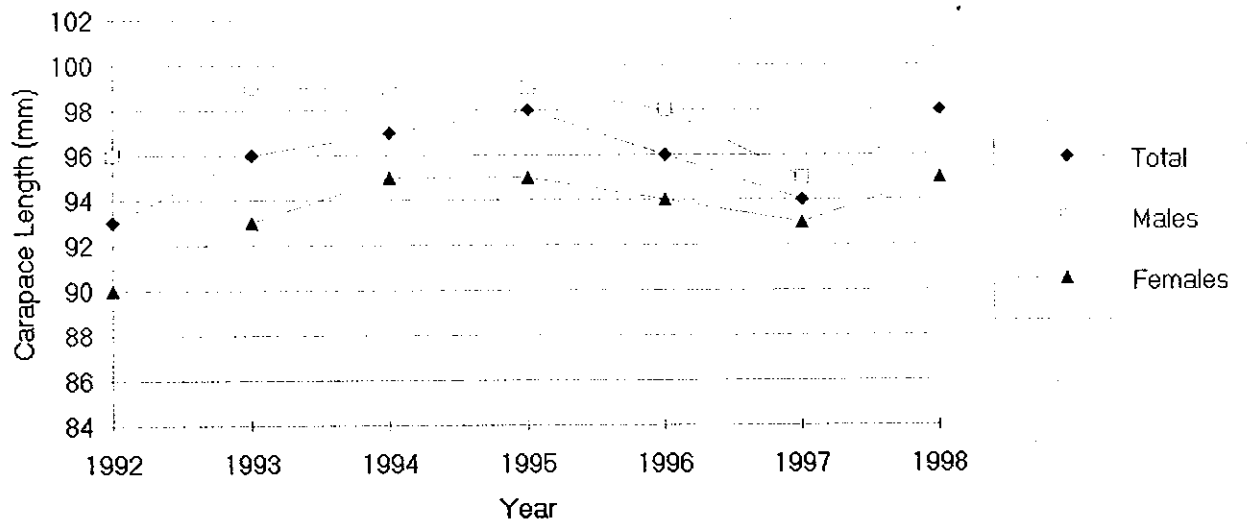


FIGURE 5. PERCENTAGE OF PANULIRUS ARGUS CAUGHT BEFORE REACHING THE LEGAL SIZE (89mm) IN PUERTO RICÓ DURING 1992-98.

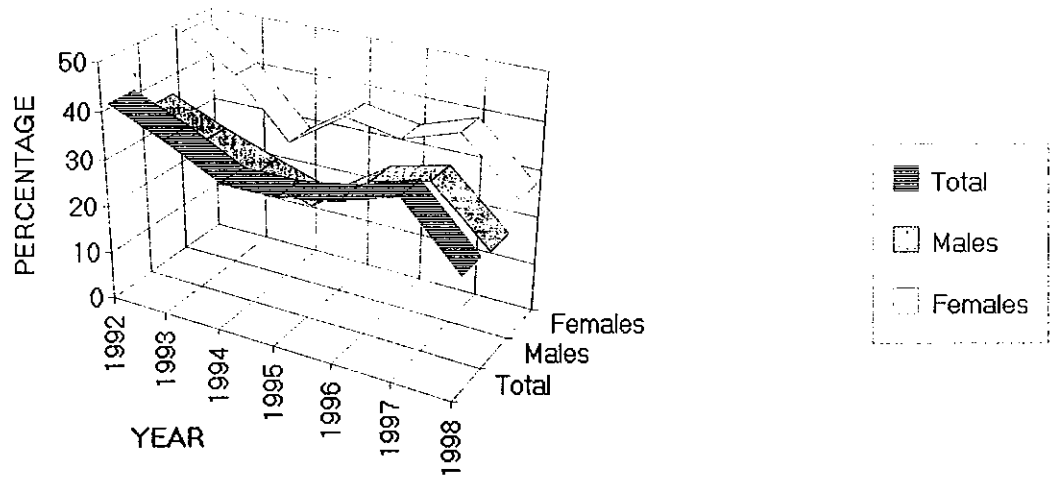


FIGURE 6. MEAN OF CARAPACE LENGTH FOR PANULIRUS ARGUS MALES CAUGHT BY GEAR IN PUERTO RICO DURING 1992-98.

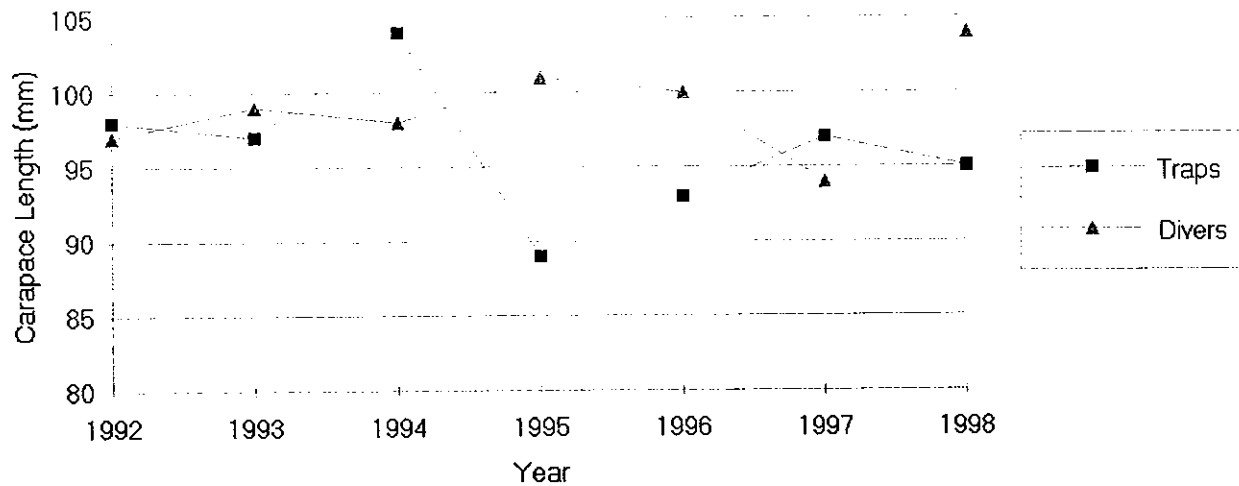


FIGURE 7. MEAN OF CARAPACE LENGTH FOR PANULIRUS ARGUS FEMALES CAUGHT BY GEAR IN PUERTO RICO DURING 1992-98.

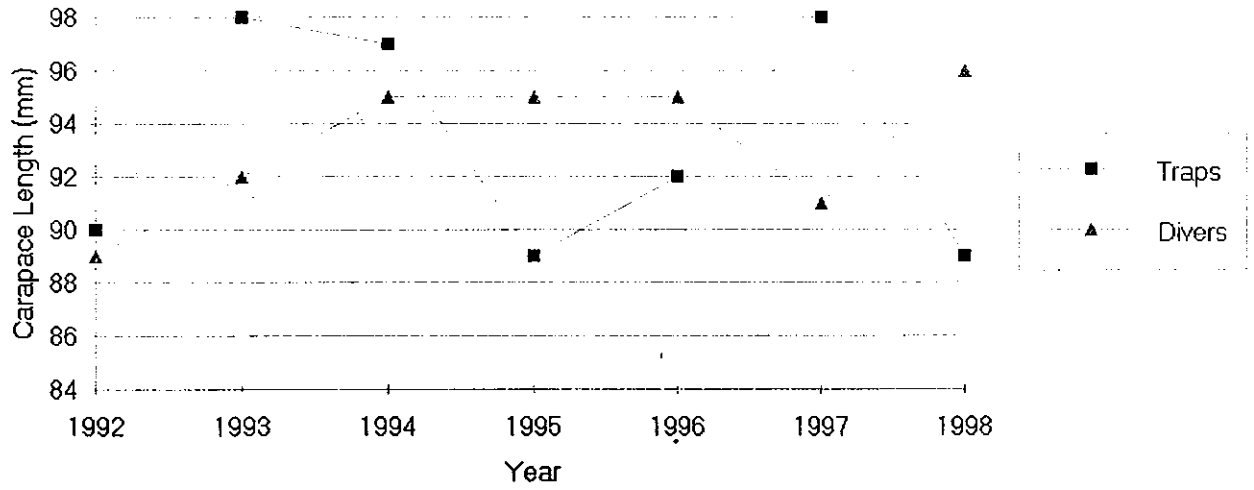


FIGURE 8. PERCENTAGE OF PANULIRUS ARGUS CAUGHT BEFORE REACHING THE LEGAL SIZE IN PUERTO RICO BY GEAR AND BY SEX DURING 1992-98.

